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Introduction

Welcome to the Level-A English course custom-made for first-year students in Engineering.

This course has a B1-B2 CEFR level (B2 for reading comprehension and lecturing/listening comprehension). It is essentially an *English for Specific Purposes* (ESP) course consisting of

– scientific articles (analysed for their linguistic features and content),

– debates and presentations,

– exam-format writing exercises (summaries, definitions, descriptions, presenting arguments...) of the IELTS, CFE or TOEFL types, and

– a grammar section (English – Level A Grammar, Self-study Grammar Book with Exercises and Answers) designed for self-learning.

1. Placement test and level groups

The same level-A course is taught (in two-hour weekly sessions) to level groups of 25 to 35 students formed on the basis of the compulsory placement test held in the first week of the year.

The dual purpose of the level-A course is (a) to consolidate and extend the student's general language understanding and use and (b) to introduce the specific features of scientific English (vocabulary and language structures). This is done in the four language skills, i.e. reading, listening, speaking, and writing.

2. Compulsory assignments

The class work mark actually corresponds to continuous assessment of progress through active class participation and various mandatory presentations and papers designed to help students develop their language abilities individually by doing exam-format tasks. In practice, all students will be asked to

– take 3 online tests, each consisting of a listening comprehension and a progress test,

– write a homework essay (on a downloadable template sheet),

– write 2 essays in class,

– do 2 oral presentations (in small groups).

Online tests are compulsory. Like homework essays and oral presentations, these will be marked and students will receive individual feedback.

For each test you will have:

– a **three-week** window to complete it;

– **an hour** to save and submit each part of the test (Listening Comprehension + Progress Test);

– the possibility to download the **audio file** to your own computer before taking the test;

– the possibility to receive online tech support by sending an e-mail to C.Hougardy@uliege.be **at least 4 working days before** the deadline. Past this date, further requests will not be taken into account.

Homework and in-class essays will be assessed according to a number of criteria including their content and internal cohesion, the accuracy of grammar, vocabulary, spelling and punctuation, and the range of vocabulary and structure. Students are expected to act on the feedback they will receive from their lecturer and try to improve their papers.

All written assignments are to be handed in <u>ON TIME</u> (i.e. maximum 2 weeks after the task has been assigned). <u>You will not be allowed to hand them in late or send them by email unless your lecturer has first agreed to it.</u>

While you may not find it possible to do work for this class every single day throughout the year, if you expect to make real progress this year, **<u>you will need to work on your English on a regular basis.</u>**

2. Examination

The final exam is held in June. It is a written exam composed of several papers (vocabulary, grammar, listening and reading comprehension multiple choice tests + writing exercises).

<u>Grading:</u>

Continuous assessment makes up the *class work mark*, which accounts for 20% of the final grade. The *written exam mark* contributes 80% to the final grade. These two marks are subdivided as follows:

Class work mark (= 4 marks out of 20) • in-class essays (2) • oral presentations (2) • online listening and progress tests (3 + 3) and homework essay	 **5%** **10%** **5%**
Written exam mark (16 marks out of 20) • listening – reading – vocabulary – grammar (multiple-choice questions) • writing	 **55%** **25%**

<u>Important:</u> as a function of their grade for the "grammar" section of the placement test, some students will have to take a remedial course. They will be tested again at the end of the remedial course in February. If their February grade is greater than their final grammar grade, and provided they attended the remedial classes on a regular basis (80%), their February grade will account for 20% of the final grammar grade.

3. Self-learning

Given the significant differences in proficiency between first-year students, the limited in-class teaching, and the number of students in each group, supervised self-learning and remedial work should be given due attention by the students who do not need to attend the 30-hour remedial course taught mostly in the first semester.

If necessary, students can also purchase the *Grammaire de base de l'anglais* (with exercises and key), ISLV, written in French. It is available in the <u>Point de Vue</u> copy shop. Students can also train online.

✓ ***<u>Useful links on E-Campus:</u>***

http://www.ulg.ac.be. ***Click on*** **MyULg*, insert your ID and password, then click on*** **Cours *and select*** **Accès à**

ECampus*. In the course list, click on:*

- **Anglais 1 (LANG0038)**

1. For **online progress tests**: click on *Compulsory assignments*.
2. To download the **homework essay template sheet: click on *Tool box.***
3. To **train online**: under the tab *Extra*, you will find additional *listening exercises*, *grammar quizzes* as well as *past exams*.

- ***Grammaire anglaise de base interactive* (*GABi*) (ISLV0000-3.2)** : further tests, exercises and answer keys.

✓ ***To get individual feedback about the placement test and the mock exam held in February:***
http://www.smart.ulg.ac.be, click on *Service Etudiants / Consultez votre feedback personnel* and follow the instructions (teacher's name: select *C. BOUVY*).

Students should never hesitate to ask their lecturers, in person or via e-mail, for additional explanations at any time they feel they need some background filled in. All first-year English teachers will be happy to answer any queries their students have on the English course.

The ISLV teaching team

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Calendar

Quadrimester 1			
Week	**Date**	**Topic**	**Specific assignments***
1	Sept. 17 – 21	**Placement test (compulsory)**	
2	Sept. 24 – 28	No class	
3	Oct. 1 – 5	Unit 1 – The Powers of the Mind	
4	Oct. 8 – 12	Unit 1 – The Powers of the Mind	Homework exercise 1 – Argumentative Essay
5	Oct. 15 – 19	Unit 1 – The Powers of the Mind	Grammar test 1
6	Oct. 22 – 26	Unit 2 – Genetic Engineering **Deadline for Homework Exercise 1 *Argumentative Essay***	
R	Oct. 29 – Nov. 2	*"R" week (catch-up week)*	
7	Nov. 5 – 9	Unit 2 – Genetic Engineering	Grammar test 2 Oral presentation
8	Nov. 12 – 16	Unit 3 – Energy **Feedback on homework exercise** **Oral presentation 1 (a)**	Oral presentation
9	Nov. 19 – 23	Unit 3 – Energy **Oral presentation 1 (b)**	Oral presentation
10	Nov. 26 – 30	Unit 3 – Energy **Oral presentation 1 (c)**	Revise: argumentative essay
11	Dec. 3 – 7	Unit 4 – Living Earth **In-class test 1: argumentative essay**	**Online Test 1** on E-Campus (Dec. 3 – 21)
12	Dec. 10 – 14	Unit 4 – Living Earth	
13	Dec. 17 – 21	Unit 4 – Living Earth **Feedback on in-class test 1**	

*Besides these assignments, students are also requested to prepare exercises from their textbook on a weekly basis, as indicated in class by their teacher.

Quadrimester 2			
Week	**Date**	**Topic**	**Specific assignments**
14	Feb. 4 – 8	Unit 5 – Space	**Online Test 2** on E-Campus (Feb. 4 – 22)
15	Feb. 11 – 15	Unit 5 – Space	Grammar test 3 **Online Test 2** on E-Campus
16	Feb. 18 – 22	Unit 5 – Space	Revise: defining, comparing and contrasting **Online Test 2** on E-Campus
17	Feb. 25 – Mar. 1	Unit 6 – The Future of Science **In-class test 2: defining, comparing and contrasting**	Grammar test 4
18	Mar. 4 – 8	Unit 6 – The Future of Science	Oral presentation
20	Mar. 11 – 15	Unit 6 – The Future of Science **Oral presentation 2 (a)**	Oral presentation
21	Mar. 18 – 22	Unit 7 – Material Science **Oral presentation 2 (b)**	Oral presentation
22	Mar. 25 – 29	Unit 7 – Material Science **Oral presentation 2 (c)**	-
23	Apr. 1 – 5	Unit 7 – Material Science	**Online Test 3** on E-Campus (Apr. 1 – May 3)
	Apr. 8 – 12	*No class (Easter break)*	
	Apr. 15 – 19	*"R" week (catch-up week)*	
24	Apr. 22 – 26	Unit 8 – The Heart of the Matter	Grammar test 5 **Online Test 3** on E-Campus
25	Apr. 29 – May 3	Unit 8 – The Heart of the Matter	**Online Test 3** on E-Campus
26	May 6 – 10	Unit 8 – The Heart of the Matter Q. & A. session	-

Assessment Grids

1) Essays

a. Assessment Grid 1

The grid below will be used to assess the homework exercise (Argumentative Essay) and In-class Test 1.

Syntax, grammar and punctuation	- -			-		+		++		
	0	1	2	3	4	5	6	7	8	9
Organization	- -			-		+		++		
	0	0.5		1	1.5	2	2.5	3		
Vocabulary and spelling	- -			-		+		++		
	0	1		1.5	2.5	3	3.5	4	5	
Ideas	- -			-		+		++		
	0	0.5		1	1.5	2	2.5	3		

b. Assessment Grid 2

The grid below will be used to assess In-class Test 2.

Syntax, grammar and punctuation	- -			-		+		++		
	0	1	2	3	4	5	6	7	8	9
Organization	- -			-		+		++		
	0	1		2	3	3.5	4.5	5	6	
Vocabulary and spelling	- -			-		+		++		
	0	1		1.5	2.5	3	3.5	4	5	

c. Written Assignment Feedback Interpretation

ABBREVIATION/SYMBOL	MEANING	EXAMPLES
I-I	Missing space	
¬L	Next paragraph	
?	I don't understand what you mean.	
COLLocation	Wrong collocation	**to do progress* (vs to make progress), **to take attention to STH* (vs to pay attention to STH), **to throw an eye over STH* (vs to cast an eye over STH), …
CONStruction	Wrong construction	**Among other things**, it can be… • a wrong verb pattern: **to prevent SO to do STH/of doing STH* (vs to prevent SO from doing STH), **to provide STH to SO* (vs to provide SO with STH), … • the overuse of "of phrases": **classes of geography* (vs geography classes), **the classification of venoms of snakes* (vs snake venom classification), … • a dangling modifier: **To improve his results, the experiment was carried out again.* Technically, in this sentence, the subject of "improve" is "the experiment", which doesn't make sense. The sentence should be rephrased: To improve his results, he carried out the experiment again.
False Friend	The word looks like a French word but has a different meaning.	**He realized several experiments* (vs He carried out/performed/ conducted several experiments), …
GRammar	Grammar mistakes other than tense mistakes	**Among other things**, it can be… • Agreement: **Peter leave home at 7; she don't have any breakfast* (vs Peter leaves at 7; he doesn't have any breakfast), … • Articles: **With the time, I realized it was not what I had expected* (vs With time, I realized it was not what I had expected), … • Auxiliaries **He is fallen asleep* (vs He has fallen asleep), **I haven't any money* (vs I don't have/haven't got any money), …

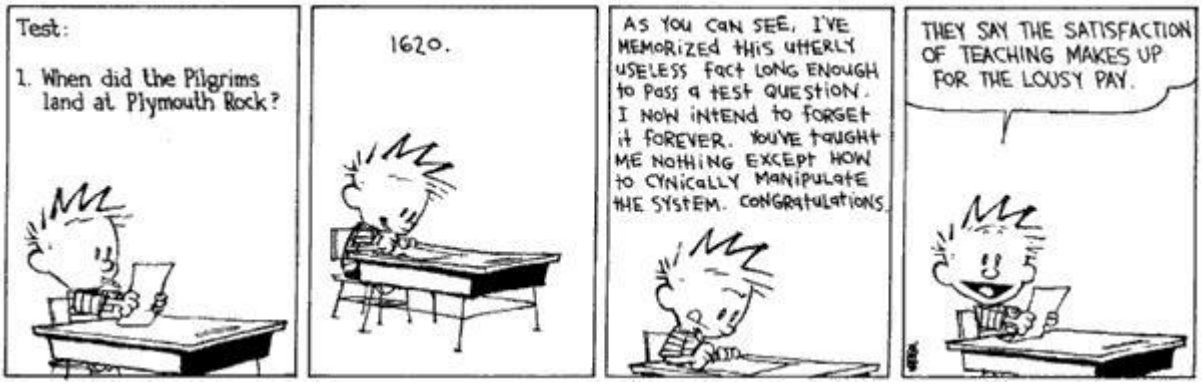
		• Relatives: **The man which lives across the street…* (vs The man who lives across the street…), …
LINKing	Wrong connection	• It can be a wrong linking word: ** I let the cat out despite of the pouring rain* (vs I let the cat out despite/in spite of the pouring rain), … • It can also be a wrong type of connection altogether: **I'd like to become a land surveyor; that's why the course in land market assessment is very interesting this year.* There's no cause-and-effect relationship here (the student's plans don't make the course interesting); this sentence should be completely rephrased: I'd like to become a land surveyor; that's why I find the course in land market assessment very interesting this year.
MODality	Wrong modality	**I don't stay in a room all the time; I want a job where I will spend some time in the field* (vs I can't stay in a room all the time; I want a job where I will spend some time in the field).
Part of Speech	Wrong part of speech	• It can be an adjective-adverb confusion: **It's easy done* (vs It's easily done), … • It can also be an adjective-noun confusion: **I'm interested in geomatic/physics geography/industry engineering* (vs I'm interested in geomatics/physical geography/industrial engineering), …
PREPosition	Wrong preposition	**to be interested by STH* (vs to be interested in STH), **As can be seen on the diagram…* (vs As can be seen in the diagram…), …
PUNctuation	Missing or wrong punctuation	**I have known her for ten years, she is a nice person* (vs I have known her for ten years; she is a nice person), …
REFerence	Absence of reference	**I chose to study geometrology. The advantages of this job are…* (vs I chose to study geometrology. The advantages of the profession of land surveyor are…), …
REGister	Improper register	**I'm gonna tell you guys what my pals and I saw at UCB* (vs This report is a description of our visit of the UCB factory), …
SPELling	Wrong spelling	**wich* (vs which), …
SYNtax	Faulty word order	**a visit factory unforgettable* (vs an unforgettable factory visit), … Remember: In English, you should not separate a transitive verb from its direct object with an adverb: **Geography has modified completely my vision of the landscape* (vs Geography has completely modified my vision of the landscape), …
Tense	Wrong tense, including aspect (simple vs continuous)	**I know her for ten years* (vs I have known her for ten years), **I have seen her two hours ago* (vs I saw her two hours ago), …

VOCabulary	Wrong word	**Every year, millions of tunas are sinned in the Mediterranean* (vs Every year, millions of tunas are fished in the Mediterranean) , …
X(XX)	Missing word(s)	

2) Oral Presentations – Assessment Grid

	Excellent 8 and above	Good 6.5 – 7.5	Satisfactory 5 - 6	Limited 3.5 – 4.5	Very poor 3 and below
CONTENT & STRUCTURE – OVERALL GRADE (30%)					
Knowledge of subject					
Quality of structure and argument					
Ability to field questions					
COMMUNICATION – OVERALL GRADE (30%)					
Audibility and clarity of speech					
Usefulness of visual support					
Rhythm and Length of presentation					
Speaker's conviction and enthusiasm, body language					
LANGUAGE - OVERALL GRADE (40%)					
Correct, varied and appropriate grammar					
Correct, varied and appropriate vocabulary					
Pronunciation and intonation					

UNIT 1: The Powers of the Mind



1. Speaking: Memory and Intelligence

Discuss the following:

- Intelligence vs memory
  - Is intelligence related to memory?
  - What makes human beings intelligent?
  - Can intelligence be measured?
  - What is intelligence? How would you define it? Are there different types of intelligence?
  - Is intelligence innate or can it be learned and improved upon?
  - Do you think memorizing specific dates/facts is important to learn? Do you learn when you memorize or learn something by rote? Explain.
  - Do you think grades are a reliable way to evaluate students' performances and skills? Explain.
  - Is there a limit to how much people remember?
  - Are some people born with a better memory than others?
  - What do we remember best? / Why do we forget?
  - Are there different types of memory?
  - Do you have a good memory for numbers? Faces? Family names?
  - When do we start to remember? What are your earliest memories?

- "Memory is a novelist, not a photographer." What does this mean?

- Freewrite on one of the following quotations: ⇨

- "The word REMEMBER (RE-MEMBER) evokes the coming together of several parts, fragments becoming a whole." (bell hooks[1])
- "To RE-MEMBER something is to perform the act of reassembling its members, thus stressing the importance to the memory process of the creative reconstruction." (Helen Lock, article in "College Literature", Oct. 1995)
- Memories are often recorded in writing; however, Plato "denounced writing not as a tool of remembering, but rather as one of forgetting."

2. Reading: Searching for main and specific ideas

The texts of the different units are based on scientific topics, the level of which is similar to the one tested at the end of the year. Each unit will test your reading skills with various types of exercises, such as Skimming and Scanning, Multiple Choice Questions, True and False exercises, etc.

Before you read a text for detail, it is essential to get a general idea of what will be covered in it.

> ***Reading tip***: Never read whole texts in detail. First look at title and subheadings and then read through them quickly to get an idea of what is discussed. Don't waste time trying to understand every word. When necessary, try to guess the meaning of unknown words and use the vocabulary list at the end of each unit.

Scanning for topic and main ideas

1) In-class brainstorming on the title of the text: what do you think the text will cover?

2) Read the text quickly. Does your reading confirm or correct your guess?

3) Read the following general questions:

   a. What are the two effects of the Internet on our memory?

   b. What is the answer to the question asked in the title?

   c. What type of memory is described in the text?

Is Google Really Wrecking* Our Memory?

By Matt Peckham | July 15, 2011 | Time.com

1. Could Google, the world's largest search engine, be causing our memory banks to atrophy? Maybe, say four Columbia University researchers, who believe Google's instant-**retrieval** search mechanics could be training our brains to jettison* information we're sure of quickly finding again with a few taps on a keyboard.

2. Times certainly have changed. I can still remember having to memorize stuff back in grade school like linking verbs—"is, am, are, was, were, have, has, had, etc."— as if reciting a ritual chant, or the precise sequence of northeastern states, left to right, top to bottom. Nowadays, I just conjure Google Maps if I can't remember whether it's Vermont before New Hampshire, or whether to answer "this is he" or "this is him" when someone asks for me on the phone.

3. But we've heard this tune before, right? I'm looking at a book on my shelf (*The Shallows*) by author Nicholas Carr, whose *The Atlantic* article "Is Google Making Us Stupid" set off all kinds of cultural and scientific klaxons in 2008. *The Shallows* (out last year) expanded on that article and brought in **actual** neurological research (no

[1] Gloria Jean Watkins, born September 25, 1952, Hopkinsville, Kentucky, U.S. (better known by the pen name *bell hooks)*, American scholar whose work examined the varied perceptions of black women and black women writers and the development of feminist identities. (From *Encyclopædia Britannica*, viewed on Mon. 03 August 2009)

slam dunks yet, but the research is suggestive) to buttress* Carr's thesis that the Internet may be dramatically rewiring our brains.

4. And with the Columbia research, the evidence that something's up is growing. In the study, titled "Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips," the Columbia University researchers **claim** that when we're sure of access to information in the future, our ability to summon that information from memory drops. Conversely, our ability to recall *how to access the information* goes up. Thus, the researchers argue, "The Internet has become a primary form of external or transactive memory, where information is stored collectively outside ourselves." Think of it like outsourcing, only from neurons to data bytes.

5. According to Betsy Sparrow, the study's lead, "Since the advent of search engines, we are reorganizing the way we remember things. Our brains **rely on** the internet for memory in much the same way they rely on the memory of a friend, family member or co-worker. We remember less through knowing information itself than by knowing where the information can be found."

6. To answer this story's title-question, then—is Google really wrecking our memory—the answer's "it depends." The Columbia University report doesn't offer evidence of actual memory *atrophying* (as in diminished or impaired memory abilities). Instead, the suggestion's that, influenced by Internet and search engine use, our memories are switching job hats and becoming more transactive. Instead of remembering "ends," we're remembering "means." Search engines like Google are simply becoming extensions of our brains, sort of like wireless cybernetics.

7. And it's not beyond the pale* to consider ways in which such a memory **shift** might actually *benefit* us.

8. "Perhaps those who teach in any context, be they college professors, doctors or business leaders, will become increasingly focused on imparting greater understanding of ideas and ways of thinking, and less focused on memorization," suggests Sparrow.

9. Would that be such a bad thing? After all, I've always thought the **popular** notion that memorizing precisely where something is on a map as a sign of "intelligence" was pretty dumb. I'd rather have an (accurate) working knowledge of the complexities that separate, say, Shia from Sunni interpretations of Islam, than how to point arbitrarily to Qatar or Djibouti on a globe.

Glossary:
Wrecking = to destroy; to shatter
To jettison = to discard
To buttress = to support, to strengthen
To be beyond the pale = être inadmissible

Scanning for specific information:

You will often read a text to find specific information. This coursebook will provide you with different types of exercises to improve this skill. Answer the multiple choice questions below:

1. N. Carr claims that…
    a. neurological research is necessary to understand the impact of Google on intelligence.
    b. although it is sad, the Internet damages our brains and makes us stupid.
    c. the Internet is having a huge impact on how our brains work.
    d. if brain connections worked like wires, their evolution could be explained by neurological research.

2. According to researchers from Columbia University, our capacity to memorize the source of information…
    a. increases when access to information is reliable.
    b. decreases when access to information is easy.
    c. drops when we recall the information too clearly.
    d. increases when we know we can access the information any time in the future.

3. According to Betsy Sparrow, the Internet plays the same role as friends or family members when it comes to memory. True or false? If false, correct the statement.

4. Researchers have now proved that…
    a. human memory is atrophying instead of adapting to search engine use.
    b. search engines are destroying our ability to memorize things.
    c. today's use of search engines influences the development of human memory.
    d. Internet use prevents the development of human memory.
    e. None of the above.

5. Peckham believes that although memorizing is different from being intelligent, it is an accurate sign of intelligence. True or false? If false, correct the statement.

Vocabulary:

Provide a **definition** for "transactive memory":

Find a **synonym** for:

- retrieval: recovery – loss – possession – conservation
- actual: current – real – common – present
- claim: pretend – assume – prove – assert
- rely on : influence – adapt to – depend on – use
- shift : change – influence – impact – consequence

The term "popular" in paragraph 9 means:

a. believed mostly by working-class people
b. the most adequate
c. the most widely accepted
d. trendy

Remembering and describing what happened: a family picture

Discuss: *"Family photographs are supposed to show not so much that we were once there, as how we once were: to evoke memories which might have little or nothing to do with what is actually in the picture. The picture is a prop, a prompt, a pre-text: it sets the scene for recollection. But if a photograph is somewhat contingent in the process of memory-production, what is the status of the memories actually produced?"* (Kuhn)

1. What is usually recorded in family pictures or albums?

2. Why don't we record unhappy events (like funerals...)? How does it relate to memory as a narrative?

3. Storytelling (oral, written and/or visual) plays a major role in the preservation of the past. Now, create your own family narrative. Bring a family picture to class and describe it in a 15-line paragraph (<u>use the past tense, cf. table above</u>). The questions below might help you with the task:

- What happened on that particular day? What event is recorded?
- Who are the main characters in the photograph? What does the picture tell you about the way particular members of the family (for example, the women, young boys, older people, a disabled person...) are positioned in the family?
- What setting is depicted in the photograph?
- Who took the picture? Who was (not) there? Who or what is (not) shown in the photograph?
- Does the picture represent an idealized image of your family, yourself, or particular family members?
- Any anecdote?

4. Language: Providing scientific definitions

During the year, you will be asked to give 2 or 3 scientific presentations in class and write scientific essays. In these exercises, you will have to define unknown terms and to indicate contrast between elements in your presentations.

Defining nouns

To define nouns, express the *class* to which the term to be defined belongs and state specific features and/or the main difference(s) between the term and the other members of the class.

memory

a. A cognitive system that retains information.

b. The act or an instance of remembering.

c. All that a person can remember: e.g. It hasn't happened in my memory. (…)

Biology: Persistent modification of behaviour resulting from an animal's experience.

Computer Science: *a. A unit of a computer that preserves data for retrieval.*

b. Capacity for storing information: e.g. two gigabytes of memory.

Note

a. You can also introduce your definition with
- (can) **be defined as, be called, be termed, be known as, be referred to as, be used to,**
- (have/display) **the capacity to / the property of (…).**

- *Memory can be defined as the set of past events affecting a given event in a stochastic process (statistics).*
- *The capacity of a material, such as plastic or metal, to return to a previous shape after deformation is known as memory (material sciences).*

b. You can add the specific field in which the term is used: *(In) Psychology …*

c. You can give 1 or 2 examples (e.g.), synonyms (*also known as …*), or quote a sentence in which the term is used.

d. Use linking words (see *Appendix B* and your grammar) wherever appropriate.

!! When you define
- an uncountable noun: "*hydropower is …*", "*information is …*"
- a noun in the plural "*scientists are...*"
- a profession "*a geneticist is a scientist* (~~a man~~) *who…*[2]"

Defining verbs

Definitions for verbs are often introduced by a generic verb to which you add specific information, examples, or language use…

remember

1. To recall to the mind with effort; think of again: I finally remembered the address.
2. (…)

Engineering: To return to an original shape or form after being deformed or altered.

[2] Never use 's/he,' 'him/her,' or 'his/her': Use 'he' or 'she' or rewrite as plural to avoid confusion.
See *The Handbook of Nonsexist Writing* (Casey Miller and Kate Swift) for more on nonsexist language.

Note

You can also use the structure with the ing-form: VERB IN THE -ING FORM is an **action** (…) / **means** + **specific features** related to the verb.

You can add the specific field in which the term is used, provide examples, synonyms or antonyms and/or quote a sentence in which the term is used.

! Use linking words (See *Appendix B* and your grammar) wherever appropriate.

Defining adjectives

Definitions for adjectives are often introduced by **relating to, pertaining to**…

scientific
1. relating to science or a particular science: scientific discovery.
2. done in a systematic way, using experiments or tests.

Note

As for noun definitions, you can add the specific field in which the term is used, provide examples of use, antonyms or synonyms and should use linking words (See *Appendix B* and your grammar) wherever appropriate.

5. Language: Indicating contrast

The author of the article above has used some words indicating **contrast**. Consider, for example:

"While it is true that more men than women make up extreme high – and low – scorers in science and math tests, it's absurd to conclude that the difference is primarily because of biology – or environment. For boys, however, the peak comes three years later."

The main linking words of contrast are:

- *while / whereas, though / although / even though (conjunctions of subordination),*
- *despite / in spite of, for, unlike, contrary to (prepositions),*
- *by contrast, however, and yet, nevertheless / nonetheless (adverbs).*

For more details on linking words indicating contrast, see *Appendix B* and your grammar.

REMEMBER the difference in use between the 3 main types of connectors:

Prepositions are always followed by a pronoun/noun (phrase) or gerund.

Subordinating conjunctions are always followed by a sentence with a conjugated verb (which can be partly omitted).

Adverbials serve to link two main clauses. They are used on their own, at the beginning of the sentence followed by a comma or between commas after a first group of words.

Note that some words correspond to two categories of linking words. For example, *as*, *before* and *after* can be prepositions or conjunctions, and *though* can be an adverbial or a conjunction.

Check the meaning of the following linking words using *Appendix B* and complete the text below with appropriate ones:

even though / although / though / however / while / despite / in spite of / unlike

(*Despite – While – Although*) I had had very little chemistry, physics and calculus in secondary school, I decided at 17 I wanted to become a civil engineer. (*Unlike – Despite – While*) many professors really tried to help me, some did their best to flunk me. (*Unlike – Despite – While*) my efforts, some of my professors thought I shouldn't be studying civil engineering. In my second year, two of them even told me I was not cut out to be an engineer (*despite – while – although*) I had not even taken a test for them and they couldn't say how I was going to perform. Their unfair attitude really helped me, (*despite – however – though*). Having people tell me that I was not intelligent enough and that it was a man's job solidified my decision. I was determined to prove them wrong. And I did. Now, (*unlike – despite – while*) my secondary-school classmates, who became mothers and housewives, I am a civil engineer, a problem solver improving the quality of life for people.

6. Grammar in context: Use of articles

Fill the gaps in the text using the correct article: *the – a – an – Ø*, and justify your choice.

GET IT RIGHT

Do not use

- "***the***" with plural and uncountable nouns to talk about things in general.
  Physics is my favourite subject. / Telescopes today are very powerful.

- singular countable nouns **without articles:**
  the computer / a computer But not **computer*.

Use "*a/an*" to say what people's jobs are. *She's an electrical engineer*.

DEFINING INTELLIGENCE

After Goleman

1. There are widespread exceptions to the rule that ____ IQ predicts success, many (or more) exceptions than cases that fit the rule. At best, IQ contributes about 20 percent to ____ factors that determine ____ life success, which leaves 80 percent to other forces. As one observer notes, 'The vast majority of one's ultimate niche in ____ society is determined by non-IQ factors, ranging from social class to luck.'

2. Even Richard Herrnstein and Charles Murray, whose book *The Bell Curve* imputes a primary importance to IQ, acknowledge this. As they point out, 'Perhaps a freshman with an SAT math score of 500 had better not have his heart set on being ____ mathematician, but if instead he wants to run his own business, become a U.S. Senator or make a million dollars, he should not put aside his dreams... The link between test scores and those achievements is dwarfed by the totality of other characteristics that he brings to life.'

3. My concern is with ____ key set of these 'other characteristics' or 'emotional intelligence': ____ abilities such as being able to motivate oneself and persist in ____ face of ____ frustrations, to control impulse and delay gratification, to regulate one's moods and keep distress from swamping ____ ability to think, to empathize and to hope. Unlike IQ, with its nearly one-hundred-year history of research with hundreds of thousands of people, emotional intelligence is ____ new concept. No one can yet say how much of the variability from person to person in life's course it accounts for. But what data exist suggest it can be as powerful, and at times more powerful, than IQ. And while there are those who argue that IQ cannot be changed much by ____ experience or education, the crucial emotional competencies can indeed be learned and improved upon, if we bother to teach them.

4. Of course, there are many paths to ____ success in ____ life, and many domains in which other aptitudes are rewarded. In our increasingly knowledge-based society, ____ technical skill is certainly one. There is a children's joke: 'What do you call a nerd fifteen years from now?' The answer: 'Boss.' But even among 'nerds' ____ emotional intelligence offers ____ **added edge** in the workplace. Much evidence testifies that people who are emotionally adept - who know and manage their own feelings well, and who read and deal effectively with other people's feelings - are at ____ advantage in any domain of life, whether romance and intimate relationships or picking up the unspoken rules that govern success in organizational politics. People with ____ well-developed emotional skills are also more likely to be content and effective in their lives, mastering ____ habits of mind that foster their own productivity; people who cannot marshal some control over their emotional life fight inner battles that sabotage their ability for focused work and clear thought.

Skim and scan the text above and answer the following questions:

1. What types of intelligence are mentioned in the text above?
2. How can they be assessed?
3. Define and compare/contrast both types of intelligence. Use the theory seen above.
4. In his books, Murray points out that emotional intelligence can be as powerful as IQ. True or False? If false, correct the statement.

5. In 80% of cases, social skills are determined by life success. True or false? If false, correct the statement.
6. Social success and IQ test scores are closely related. True or false? If false, correct the statement.
7. The main difference between IQ and emotional intelligence is that IQ can be learned and evolve. True or false? If false correct the statement.
8. Social skills play a major role in both professional and personal life. True or false? If false, correct the statement.
9. Provide a synonym for "added edge":

   a. drawback
   b. advantage
   c. weakness
   d. superfluous feature
   e. flaw

Speaking: Do you think that emotional intelligence might prove to be at least as essential to success as IQ? Justify your answer?

Useful vocabulary to express one's opinion:

Use
- *I think / In my opinion / To me, ...*
- *According to Paul, ...*
- *I agree / disagree with Paul / the idea that …*
- *It is true to say that ...*
- *It is hard to believe that …*

Do not use **according to me*

7. Reading: Identifying main ideas and presenting information

Work in small groups (of 3-4 students). Prepare one section of the text and be ready to explain it to your classmates.

Titles and subheadings can give useful information about the topic of a text. The following text is divided in sections, preceded by a heading summarizing their contents.

1. Read the text below section by section and do the content and language exercises as they occur.
2. Read through the article again and choose the best suiting subtitle for each of the 3 'lessons':

- Lesson …: Behaviour changes according to sex
- Lesson …: Function over form
- Lesson …: Never underestimate the brain
- Lesson …: Parts of the brain
- Lesson …: The segregation of the senses

ADAPTED FROM: WHO SAYS A WOMAN CAN'T BE EINSTEIN?

Time, March 7, 2005

1. Thanks to the new brain-imaging technology, we know there are indeed real differences between the male and the female brain, more differences than we would have imagined a decade ago. "The brain is a sex organ", says Sandra Witelson, a neuroscientist who became famous in the 1990s for her study of Albert Einstein's brain.

LESSON ONE: _____

2. Most studies agree that men's brains are about 10% bigger than women's brains overall. Even when the comparison is adjusted for the fact that men are, on average, 8% taller than women, men's brains are still bigger. But size does not predict intellectual performance, as was once thought. Men and women perform similarly on IQ tests. And most scientists still cannot tell male and female brains apart by just looking at them.

3. Recently, scientists have begun to move away from the obsession with size. Thanks to new brain-imaging technology, researchers can get a good look at the living brain as it functions and grows. Earlier studies **relied on** autopsies or X-rays – and no one wanted to expose children or women, who might be pregnant, to regular doses of radiation.

4. The deeper you **probe**, the more interesting the differences. Women appear to have more connections between the two brain hemispheres. In certain regions, the brain is more densely packed with neurons. And women tend to use more parts of their brain to accomplish certain tasks. That might explain why they often **recover** better from a stroke, since the healthy parts of their mind compensate for the injured regions. Men do their thinking in more focused regions of the brain, whether they are solving a math problem, reading a book or feeling a wave of anger or sadness.

5. Indeed, men and women seem to handle emotions quite differently. While both sexes use a part of their brain called the amygdala (*=amygdale cérébelleuse. Part of the grey matter associated with the senses*), which is located deep within the organ, women seem to have stronger connections between the amygdala and regions of the brain that handle language and other higher-level functions. That may explain why women are, on average, more likely to talk about their emotions and men tend to compartmentalize their worries and carry on. Of course, it may not.

Are the following statements True or False?

a) The bigger your brain is, the more intelligent you are.

b) In a female brain, the two hemispheres are more closely connected.

c) Women are less susceptible to strokes than men.

d) Men are more concentrated than women when they think.

Provide a synonym for:

- *relied on (§5): depended on – avoided – examined – developed*
- *probe (§6): explore – work out – evolve – connect*
- *recover (§6): suffer – recuperate – go through – bear*

6. By administering IQ tests to a group of university students and then analyzing scans of their brain structure, Haier's team recently discovered that the parts of the brain that are related to intelligence are different in men and women. This is a major observation, because one of the **assumptions** of psychology has been that all human brains pretty much work the same way. Now that we know they don't, we can try to understand why some brains react differently to, say, Alzheimer's, many medications and even teaching techniques.

7. Even more interesting than the brain's adult anatomy might be the journey it takes to get there. Among girls, brain size **peaks** around age $11^{1/2}$. For boys, however, the peak comes three years later. Most parts of the brain mature faster in girls but some areas mature faster in boys. Specifically, some of the regions involved in

mechanical reasoning, visual targeting and spatial reasoning appeared to mature four to eight years earlier in boys. The parts that handle verbal fluency, handwriting and recognizing familiar faces matured several years earlier in girls.

Go back to paragraphs 4-9, and decide whether the following statements are presented as (1) facts or (2) hypotheses. Be prepared to justify your answer.

a) *Some regions of the female brain are more densely packed with neurons than others.*

b) *Men and women handle emotions differently.*

c) *The presence of stronger connections in the female brain between the amygdala and the regions that handle language and other higher-level functions is why women talk more often about their emotions.*

d) *In girls, brain size reaches its maximum at the age of 11 or so.*

e) *Human brains do not work exactly in the same way.*

Provide a synonym for:

assumptions (§8): evidence – hypotheses – bases – difficulties

What is the singular form of "hypotheses" and "bases"?

Now list the major differences in the functioning and development of the male and female brains mentioned above. Write full sentences and use linking words (comparison/contrast).

1)

2)

3)

4)

LESSON TWO: _____

8. So how do we explain why, in study after study, boys and men are still on average better at rotating 3-D objects in their minds? As for girls and women, how do we explain why they tend to have better **verbal skills** and **social sensitivities**?

9. In rats, for example, we know that the male retina has more cells designed to detect motion. In females, the retina has more cells built to gather information on color and texture. If the same is true in humans, as can be suspected, that may explain why, in an experiment in England four years ago, newborn boys were much more likely than girls to stare at a mobile turning above their cribs. It may also explain why boys prefer to play with moving toys like trucks while girls favour richly textured dolls and tend to draw with a wider range of colors.

10. Likewise, women's ears are more **sensitive to** some noises. Baby girls hear certain ranges of sound better. And the divergence gets even bigger in adults. As for smell, a study published in the journal *Nature Neuroscience* in 2002 showed that women of childbearing age were many times more sensitive than men to several smells upon exposure.

11. None of that means that women are, overall, better than men at perception. It just means the species is internally diverse, making it more likely to survive. The female will remember the color and texture of a particular plant and be able to warn people if it's poisonous. A man looking at the same thing will be more alert to what is moving in the periphery. Which is better? You need both.

What is a man most likely to perceive in his environment?

Boys and girls don't play with the same toys because parents usually raise them differently. True or false? If false, correct the statement.

According to the article, mothers and pregnant women are more sensitive to smell than fathers. True or false? If false, correct the statement.

Go back to §10-14 and explain in your own words why men and women see, hear and smell differently.

12. LESSON THREE: _____

Very young boys and girls would be **better off** in separate classrooms altogether. **Coed** schools do more harm than good, when they teach boys and girls as if their brains mature at the same time. If you ask a child to do something not developmentally appropriate for him, he will, N° 1, fail. N° 2, he will develop an aversion for the subject. By age 12, you will have girls who don't like science and boys who don't like reading. And they won't ever go back. The reason women are under-represented in computer science and engineering is not because they can't do it. It's because of the way they have been taught.

13. So far, studies about girls' and boys' achievements in same-sex grammar schools are **inconclusive**. But if it turns out that **targeting** sex differences through education is helpful, there are certainly many ways to carry it out. The ability of change is phenomenal. That's what the brain does best: it adapts. A 2004 study published in *Nature* found that people who learned how to juggle increased the gray matter in their brains in certain locations. When they stopped juggling, the new gray matter **vanished**. A similar structural change appears to occur in people who learn a second language. In a recent experiment with humans, women showed substantial progress in spatial reasoning after spending a couple of hours a week for 10 weeks playing *Tetris.* But the males improved with weeks of practice too, and so the gap remained. But the improvement for both sexes was massively greater than the gender difference. This means that if the males didn't train, the females would outstrip them.

14. One solution to **overcome** biological tendencies is to consciously **override** them, to say to yourself, OK, I may have a hard time with this task, but I'm going to will myself to conquer it. Some experiments show that girls, when faced with failure, tend to give up relatively quickly, while baby boys get angry and persist.

What's the problem with coed schools?

Recent studies have shown that the effect of same-sex schools on education is undeniable. True or false? If false, correct the statement.

According to the author, how can you manage to get better at something you don't really like?

The article comes from Time Magazine, an American weekly; find a spelling clue in §11 and another in §13.

Despite training, girls will always be biologically inferior to boys. True or false? If false, correct the statement.

How does the brain adapt? Explain the example provided in §13.

Provide a synonym for:

- "vanished" (§13): developed – increased – disappeared – appeared
- "overcome" (§14): undergo – defeat – outnumber – overlook

Speaking: "Very young boys and girls would be better off in separate classrooms altogether." What do you think?

8. Reading: grammar in context

"THE SIMPSONS" (season 17, episode 19), *Girls Just Want To Have Sums*

Watch the Simpsons episode. Take notes while watching in order to be able to answer the questions below.

<u>Episode summary</u>:

Springfield is in an uproar after Principal Skinner makes a sexist comment about women's math skills at the end of an Itchy and Scratchy musical (which was written by a former female Springfield Elementary school student who was a math whiz). Principal Skinner is replaced by Melanie Upfoot, a women's education expert, who segregates the school by gender. At first, Lisa loves the arrangement, but when she discovers that the girls' classes are more about self-esteem boosting than actual learning, Lisa decides to dress up as a boy named Jake Boyman and attends the boys' classes. While Bart teaches her the ropes of boyhood, Lisa wins the math award at the Student Achievement Awards and learns what it's really like to be part of the "boys' club".*

**whiz = expert, champion*

1) Compare the girls' and the boys' schools. What stereotypes are used? (For example, think about what the boys play.)

2) Compare the girls' math class and the boys' math class. What stereotypes are used? (For example, think about what Lisa says on her first day in the boys' math class: *"Oh my God, I was wrong and I was corrected! I learned and no one cared about my feelings!"*; or the moment when Lisa and Nelson are about to fight and Lisa tries to "talk her way out" of the situation.)

3) Lisa tells her math teacher: *"Confidence building cannot replace real learning."* What do you think? Do you agree with Lisa? Explain.

4) Final scene:
"The Award for Outstanding Achievement in the field of mathematics goes to Jake Boyman."
"That's right! The best math student in the whole school is a girl!"
"Do you know why you did good at math?"
[...]
"The only reason Lisa won is because she learned to think like a boy. I turned her into a burping, farting, bullying, math machine."

The text below is about the significant role of confidence and stereotypes in performance in school. Read it quickly, answer the grammar, vocabulary and content questions as they occur and then we will discuss it.

Gender Differences in Math Intelligence: Is it a gift or a matter of personality?

PsychTests AIM Inc. reveals interesting gender results from their intelligence test and ponders the potential relationship between personality and IQ.

MONTREAL, CANADA -- June 1, 2010

1. Much like research studies in the past, PsychTests' IQ Test results reveal a gap in **(men's and women's – men and women's – men's and women – man's and woman's)** performance on several scales, but most notably arithmetic. However, like many theorists, PsychTests believes that there's more to this gap **(that – than – as – whereas)** the "you either got it, or you don't" belief. **(Researchs have – Researches have – Research has)** revealed that stereotypes and confidence may play a significant role on how men and women perform on intelligence tests, and how they view their abilities in general.

2. In a recent episode of "The Simpsons", Springfield Elementary is split **(between – into – by)** a boys-only and girls-only school. This **compels** Lisa to dress like a boy (with the ironic name of Jack Boyman), in order to benefit **(of – on – from)** the math lessons that the girls have been denied. **After** being rewarded for being the best math student in the school, Lisa proudly reveals her true identity, but Bart trumps her with a humorous although hauntingly **significant** quote: "The only reason Lisa won is because she learned to think **(like – such as – as)** a boy! I turned her into a burping, farting, bullying, math machine!"

1. According to PsychTests, the gender gap in performance may be due to stereotypes. True or false?

2. Spot the odd one out: compels = forces – makes – causes – tends

3. Provide a synonym for "significant": aggressive – intelligent – meaningful – trivial

4. What is the difference between "after" – "afterwards" – "then" – "later"?

3. Many girls and boys have been **(teach – teached – teaching – taught)** to believe, whether consciously or not, that there **(is – are)** certain areas where they are meant to excel, and other areas where they are not. Math has been **a thorn in the side of** many girls. On PsychTests' IQ assessment, men **outperformed** women on nearly every scale by a few points, but the most prominent gap was the Arithmetic scale, where women were **outscored** by over ten points (average for men 113, average for women 102; population average 105). **(While – However – Despite – But)** scores were age-dependent (older test-takers outscored younger ones), women still performed below the population average. Even in the area of verbal skill, where women are thought to excel, PsychTests' statistics reveal that men lead in the scoring as well, **albeit** by 2 points.

5. What does "a thorn in the side of/in somebody's side" mean? Define and then use the expression in a sentence.

6. The text suggests that society has different expectations for men and women in terms of education. True or false? Explain.

7. Guess the meaning of "outperformed" and "outscored". What does the prefix *out*- mean?

8. As expected, women did as well as boys in arithmetic. True or false?

9. Circle the right synonym for "albeit": though – in fact – only – whereas

4. "Arithmetic is a form of what is called "crystallized" intelligence, which refers to knowledge that we accumulate with education, time, and **(experiment – experience)**," explains Dr. Jerabek, president of the company. **"(Although – If – Therefore – However)**, it can improve as we accumulate more knowledge or skills in an area. The question is: why is it that girls are struggling? What's holding them back **(in – of – against – from)** absorbing and retaining this knowledge? Research seems to point to the impact of stereotypes, which can impact girls' confidence and sense of self-efficacy in this subject area."

5. Research by Carol Dweck (2007) indicates that the belief that intelligence in math is a "gift" can be extremely counterproductive for women. In her past research, students (**Ø – who – , that – whose – which)** believed that intellectual ability is a gift and fixed, rather than something that can improve with practice and experience, tended to struggle when encountering academic challenges. Research has also shown that teachers can **inadvertently** "sabotage" their students' performance based on their own expectations and **(believes – beliefs – believings).** Stevenson et al.'s (1993) research on school performance of Japanese and American students **alludes** to the fact that this could explain why Japanese students **consistently** outperform their American counterparts. Japanese teachers tend to expect all students to excel in all subjects, while American teachers may fly on the assumption that intelligence is mostly innate. Stereotypes may be why, in a study by Rammstedt & Rammsayer (2000) where men and women were asked **to provide** estimates of their intellectual capacity, men provided higher estimates than women of their mathematical, spatial, and reasoning ability, areas which men are thought (and perhaps expected) to excel in.

10. Although C. Dweck's conclusions were inconclusive, her research shows that most women think that intelligence in mathematics is biologically determined, which does not prevent them from succeeding in that field. True or false?

11. Like their Japanese counterparts, American teachers tend to deny the idea that intelligence is fixed. True or false?

12. The impact of stereotypes and gender-oriented expectations was most visible in men's and women's evaluations of their own intelligence. True or false?

13. Circle the right synonym:

a. inadvertently: willingly – involuntarily – readily – consciously
b. alludes: hints – proves – proposes – examines
c. consistently: constantly – obviously – never – strongly
d. to provide: to examine – to give – to rate – to achieve

6. "We are now contemplating a study that will allow us **to assess** personality characteristics and attitudes like confidence and self-efficacy, intellectual capacity, and personal beliefs all in one," says Dr. Jerabek. "The recent results of our test on Gender Roles reveal that there are still some traditional beliefs that seem **to die hard**, like men's and women's place in the modern world, and the type of careers they are "suited" to. Some of these gender stereotypes, even those regarding intelligence, can go deep - and affect our decisions and behavior whether we **realize** it or not."

14. Now the next step is to examine how intelligence affects personality. True or false?

15. Give as many synonyms as possible for "to assess":

16. What does "To die hard" mean?

17. "To realize" means: to achieve – to account for – to be aware of – to accomplish

18. Discuss gender stereotypes. In your opinion, how do stereotypes and social expectations regarding intelligence affect men's and women's behaviours, choices (career,…) and performance?

Retrieved from: http://www.psychtests.com/

9. Vocabulary: Mind – memory – souvenir, to remember vs remind

The word "memory" has several meanings[3]

- the power of the mind to remember things
- the mind regarded as a store of things remembered
- something remembered from the past

Explain the difference between (1) remember and remind, (2) mind, memory, and souvenir.
Make a sentence with 3 of them using linking words of contrast. (See Appendix B, Main conjunctions.)

[3] See basic structure for scientific definitions later in this unit.

10. Listening comprehension:

I. True and false memories

You are going to hear an interview twice. Listen carefully and answer the questions below.

1) Most people think of memory as a tool to store things. True or false? If false, correct the statement.

2) There is no agreed upon definition of memory. True or false? If false, correct the statement.

3) The "video player" analogy is said to be popular because:

   a. It is mostly believed by working-class people.
   b. It is simplistic.
   c. It is the clearest explanation given by scientists.
   d. It has been the most appropriate explanation up to now.

4) Memory always works as a reconstructive process. True or false? If false, correct the statement.

5) No one has been able to explain the difference between true and false recalls so far because…

   a. there is no difference between true and false recalls.
   b. psychologists and neurologists do not collaborate.
   c. reconstructed or false memories tend to disappear quickly.
   d. there is no difference at the cellular level, so psychologists cannot establish any clear marker.
   e. differences between both types of memories do not last long enough to be observed.

6) When was the term "false memory" coined?

7) Interest in the concept of "false memory" came about …

   a. in 1920-25.
   b. when the term was first coined.
   c. in the last couple of decades.
   d. None of the above.

8) a. In your own words, explain how "false memories" sometimes occur.

   b. Explain the experiment the speaker is talking about.

9) The notion of "false memories" is also an important issue in criminal proceedings because…

   a. eyewitnesses are the most reliable sources to the jury.
   b. thanks to DNA evidence, it has now been proved that most eyewitness testimonies are not reliable.
   c. dishonest eyewitnesses use "false memories" when DNA fails to exonerate the alleged culprit.
   d. None of the above.

10) Explain the relationship between memory as a (re)constructive process and art/creativity/ creation. You may want to go back to Spiegelman's *MAUS* (beginning of the unit) if needed.

II. “60-Minute Science”

Here is a list of short podcasts from the “60-minute Science” series. Your teacher will select a few of them. Listen carefully and be ready to 1) sum up the content of the podcast to the class and 2) answer the questions.

A) “Barbie limits girls' career choices”

B) “Studying languages can grow the brain”

C) “Bigger brains come at a cost”

D) “Animals can be given false memories”

E) “Too many old memories can make it hard to make new memories”

F) “Anxiety impedes memory during high-pressure exams”

G) “Teachers' racial biases have different effect for high versus low performers”

A) “Barbie limits girls' career choices”

1) Explain the experiment.

2) What does “ girls who play with Barbie may have their ambition stunted” mean?

3) What are jobs such as teacher or flight attendant called?

4) How do researchers explain their findings?

5) Do you find the results of the experiment surprising? Do you believe toys can influence a child's career choices later in life?

B) “Studying languages can grow the brain”

1) Who were the participants in this experiment?

2) Why were these participants specifically chosen?

3) What were the findings of the experiment?

4) The better language skills participants had, the bigger the brain growth. True or false ?

C) <u>"Bigger brains come at a cost"</u>

**A guppy (pl.: guppies) is a small freshwater fish of the Caribbean often kept in aquariums.*

1) Sum up the experiment: who, what, how,...?

2) Former studies that compared various species concluded that the bigger the brain, the smarter the animal. True or false?

3) Try to summarize the findings of the experiments in one single sentence.

4) How can the difference between big- and small-brained female fish be accounted for?

5) What are these figures referring to?

- 9:

- 48:

- 20:

- 8:

- 19:

5) Give a synonym for "downside":

6) "The egghead fish made sacrifices that may be evolutionary disadvantages." What does this sentence mean? What does "egghead" mean?

D) <u>"Animals can be given false memories"</u>

1) Sum up the report in one or two sentences.

2) The speaker uses two informal synonyms for "animals", what are they?

3) Sum up the experiment with bees.

4) Sum up the experiment with mice. What are "place cells"?

E) <u>"Too many old memories can make it hard to make new memories"</u>

1) Vocabulary. Provide synonyms or translations for the words below.

to sort =

farfetched =

to clutter =

to store =

to sprout =

to spring up =

2) Compare what was already known and what this new experiment has showed.

3) From the information you get from the report, how would you define "working memory"?

F) <u>"Anxiety impedes memory during high-pressure exams"</u>

1) Fill in the gaps: Listen carefully and fill in the gaps.

Have you ever had a nightmare about taking a math test? Math anxiety is so common that researchers use it to study _____ performance. At _____ AAAS meeting in San Francisco, a _____ discussed math anxiety. One researcher said her studies showed that the best students were the ones most likely to _____ under a high-pressure test situation. That's because normally they use their higher memory capacity to _____ _____ a problem. But when the pressure's on, the good students _____ the same _____the poor students use all the time. Another researchers _____ this with his study showing that anxiety actually occupies working memory, _____ to the task _____. And just being able to _____ these emotions doesn't seem to help. In fact, people with higher intelligence actually _____ more _____ to keep their anxiety in check. They say their _____ suggest that high-pressure tests _____ _____ what they're _____, and schools might want to try _____ their importance.

2) In your own words, summarize the report you've just heard. Avoid using the exact same vocabumary or sentences as above. (One or two sentences is enough)

G) <u>"Teachers' racial biases have different effect for high versus low performers"</u>

1) a) Compare how teachers rated low-performing students VS. high-performing students.

Use at least one linking word of contrast.

b) What does/could this mean?

2) How teachers perceive their students may actually influence... (3 things)

3) How teachers view their students based on racial prejudices influences what they expect from them in terms of capabilities and performance. True or false? If false, correct the statement.

4) How many first graders'test scores did Irizzary compared?

5) What did Irizzary do?

6) What about average students?

7) Who do minority students include?

8) The teacher's racial background also affects his/her perception of his/her students. True or false? If false, correct the statement.

9) Provide a synonym for "biased":

10) What are the 2 ways in which the teacher's preconceptions might be detrimental to his/her students?

11. Exercise : false friends

Complete the sentences below with suitable words from the second column of the table in *Appendix C* ("incorrect translation").

1. As soon as we _____ something was wrong, we moved the children away.
2. _____ your child will leave home to lead his own life as an adult.
3. He _____ his troops to attack.
4. No one _____ saw the shark.
5. The boys, if my eyes were not _____ me, were sleeping.
6. The most _____ thing to do is to leave this place as soon as possible.
7. The public is urgently requested to _____ the police in tracing this man.
8. The Queen declared that she fully _____ the government's reforms.
9. The search is expected to _____ early today.
10. This is sure to be an item on the _____ next week.

⚠ *Homework exercise: Argumentative essay*

> To download the homework essay template sheet: **http://www.ulg.ac.be**. Click on *MyULg*, insert your ID and password, then click on *Cours* and select *Accès à WebCT*. In the course list, click on *Anglais 1 (LANG0038)*, and then on *Boîte à outils*.

In about 200 words (+/- 10% allowed) and 3 paragraphs, you are expected to comment on one of the following sentences:

1) Memory and intelligence are two sides of the same coin.

2) Male versus female intelligence. Does gender matter?

3) "Anyone who conducts an argument by appealing to authority is not using his intelligence; he is just using his memory." – Leonardo da Vinci

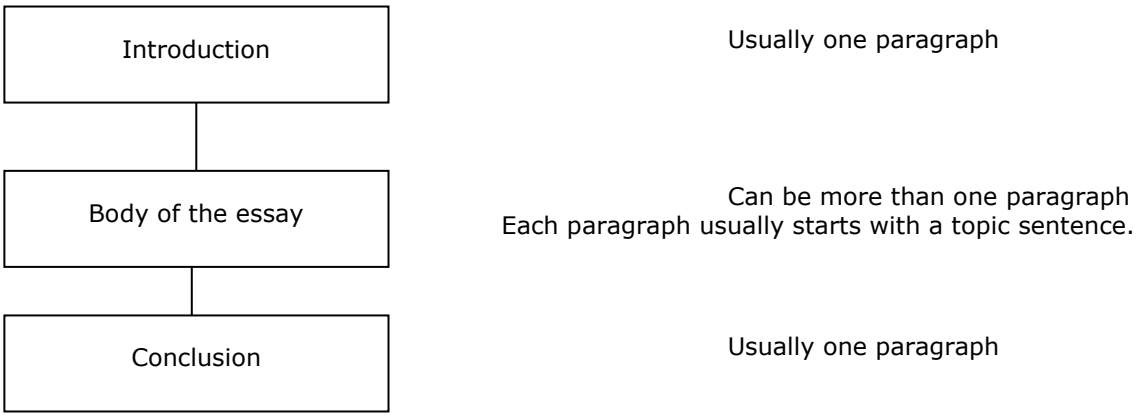
4) "Education is no substitute for intelligence." – Frank Herbert

5) "The sign of an intelligent people is their ability to control their emotions by the application of reason" – Marya Mannes

See *Appendix G* for recommendations on how to write your homework exercise.

Basic structure of an essay

The structure of a basic advantages and disadvantages essay is quite straightforward:



Unit Vocabulary

ability (> cognitive abilities)	*aptitude*
according to X	*selon X*
accordingly	*par conséquent*
account for	*expliquer, représenter (un %)*
accuracy = precision	*précision*
accurate (> accuracy)	*précis (> précision)*
achieve (a goal)	*atteindre (un but), réussir à faire qch*
acknowledge	*reconnaître, admettre*
affluent	*aisé, riche*
as for	*en ce qui concerne*
assess	*évaluer*
assumption = hypothesis (pl. hypotheses)	*hypothèse*
bear out = confirm = corroborate	*confirmer, corroborer (une théorie)*
belong (to sth)	*appartenir à*
bold	*hardi, audacieux*
bottom (>< top)	*inférieur, du bas (>< supérieur)*
bound	*obligé, tenu*
brain	*cerveau*
business (> to run one's business)	*affaire, entreprise (diriger son entreprise)*
business (U[4]) (> business is business)	*affaires (Les affaires sont les affaires)*
characteristic	*caractéristique*
chart	*diagramme*
chemist	*chimiste, pharmacien*
claim	*affirmer, déclarer, prétendre*
collapse	*s'effondrer*
concern	*préoccupation*
convey (goods / ideas)	*transporter (marchandises / transmettre, communiquer)*
cope with (a problem)	*faire face à, venir à bout de*
criterion (pl. criteria)	*critère*
data (pl. or sg.)	*données*
determined	*déterminé, décidé*
dramatic (>< tragic)	*spectaculaire (>< tragique, dramatique)*
educated (>well educated)	*instruit (> qui a un niveau d'instruction élevé)*
eg, e.g. (exempli gratia)	*par exemple*
enhance	*accroître, améliorer*
etch	*graver*
evidence (U)	*preuves*
extent (> to a certain/large extent)	*degré, mesure (jusqu'à un certain point /en grande partie)*
field (> magnetic field)	*champ (> champ magnétique)*
figure out	*comprendre*
figure	*chiffre, illustration, silhouette*
finding	*découverte*
focus	*concentrer*
for example	*par exemple*
geographer	*géographe*
geologist	*géologue*
however	*cependant*
i.e. (id est)	*c'est-à-dire*
large (>< wide)	*grand (>< large)*
likewise = similarly	*de même*

[4] C = countable, U = uncountable

map	*carte, plan*
matter	*compter, avoir de l'importance*
memory	*mémoire, souvenir*
mind	*esprit*
minute = tiny	*minuscule*
nevertheless = nonetheless	*néanmoins*
novel (> novelist)	*roman (> romancier)*
outperform	*surpasser*
outscore	*battre, dominer*
overcome	*surmonter ; vaincre*
override (overrode, overridden)	*outrepasser, ne pas tenir compte de*
pattern	*motif, dessin*
persist (>< give up)	*persister, s'obstiner (>< abandonner)*
photo = picture	*photo*
photograph	*photographie, cliché*
photographer	*photographe*
physicist (>< physician)	*physicien (>< médecin)*
power	*pouvoir, puissance*
pressure (> under pressure)	*pression (> sous pression)*
probe	*sonder, explorer ; faire des recherches*
process (> word processor)	*traiter (> traitement de texte)*
provide sb with sth	*fournir qqch à qqn*
range from A to B	*aller de A à B*
recover <u>from</u>	*récupérer, se remettre de*
reliable (> reliability)	*fiable (> fiabilité)*
rely on	*se fier à, dépendre de*
remember	***SE** rappeler*
retrieval	*récupération, recherche (d'information, de données)*
retrieve	*récupérer*
remind	*rappeler*
reward	*récompenser*
series (pl. series)	*série*
set	*ensemble*
shift	*changer ; se modifier*
significant	*important ; significatif ; considérable ; lourd de sens*
skill	*aptitude*
solve	*résoudre*
spend (time doing/ on sth) (money on)	*passer (du temps à), dépenser (de l'argent à)*
survival	*survie*
take sth for granted	*considérer qch comme acquis*
train	*entraîner, s'entraîner*
turn out	*s'avérer*
tweak	*manipuler*
unlike	*contrairement à*
upgrade	*améliorer, moderniser, valoriser, augmenter en puissance*
vanish = disappear	*disparaître*
widespread	*répandu*
wreck	*détruire; dévaster*

UNIT 2: Genetic Engineering

1. Lead-in: Bio-engineering

Search the web and find all the necessary information to be able to answer the following questions in class.

– What is genetic engineering?

– How does the technology work?

– How old is it?

– What are the potential risks/benefits of GMOs?

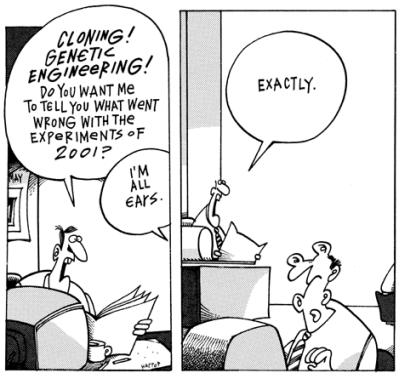
2. Speaking: Giving your opinion

1. Think about your everyday diet. Do you think you eat GM food? If yes, give examples.
How do you feel about it?

2. Imagine you are a group of scientists who have just succeeded in moving genes from one species to another (animals or plants). Explain what your discovery consists in and what the advantages and disadvantages are.

3. Have you ever thought about the enhancement of humans via genetic engineering? Do you think it could have a positive impact on our lives? Explain and give possible examples.

4. Do you think cloning will be more and more common? Why or why not?



GET IT RIGHT: Do not use the future in time clauses.

I'll be happy when I'm back home. → present simple = future

I'll do it after you have left. → present perfect = future perfect

3. Reading: Retrieving specific information

THE POWER OF GENES

Dr. D. Whitehouse, BBC News Online Science Editor.

1. It is difficult to think of another technology that has caused as much debate or concern as that of genetic engineering and its application to food - **nuclear power apart**. Our ability to alter the genetic blueprint* of animals and plants is in the process of changing many aspects of science and medicine. Many people see this as beneficial. But what about genetically-modified (GM) food? Do we want to eat such food? **And is it really such a big deal?**

2. When considering genetic engineering, it should be remembered that almost every living thing that man exploits has been genetically-modified in a major way. The crops* we use for food, the animals we eat, our pets and the plants in our gardens are radically different from those that existed in the so-called "natural" state. Thousands of years of selective breeding* have improved the yields* of crops, the milk production of cows, the quantity of meat on cattle and the sizes and colours of our flowers and dogs.

3. Without this programme of genetic modification, modern life would be impossible as we know it. Mankind's ingenuity* and scientific knowledge feed the world. To this extent, it is curious that many should regard as dangerous the more efficient and knowledgeable* way to breed animals and plants offered by the modern techniques of genetic engineering. It has been said that we are at the start of a new age of "Frankenfood". Is that right?

Yes and no

4. The technological developments of recent years - the ability to isolate, move and modify genes - represent a true revolution. For the first time in our history, we have the ability to manipulate in a very precise and detailed way the very blueprint of any living organism. **We can take the genes from fish that make them resistant to cold and insert them into a strawberry that will then grow better in cold conditions. We can make wheat* with more gluten* so that it will make better bread, and we can make tomatoes that keep their fresh-picked* texture longer.**

5. Critics of this work say that modern genetic engineering is not an extension of the "traditional" methods of breeding. Never in the past, they say, have we had the ability to transplant genes between widely different species - **human genes into pigs for example.**

Few would deny the benefits of modern genetic engineering in medicine. The use of genetically-modified bacteria to produce drugs **such as insulin** has been a revolution in medicine and saved the lives of millions. But many argue that genetically-modified food is simply unnecessary.

6. It is, however, already here. The chances are that today you have already eaten a genetically-modified foodstuff or a food that was made with a modified organism. **Much soya, found in many foods, is modified and much bread is nowadays produced with a genetically-modified yeast*.** All the indications are that these foods are harmless*.

God's plan

7. Most of the worries about engineered foods are misplaced. Concerns about interfering with God's plan are a vague and ill-focused objection. God's plan - if you believe in such a thing - has been interfered with continuously since the beginnings of agriculture and medicine thousands of years ago. But the question remains, do we need genetically-modified food?

8. Some crops, **such as soya,** have had a gene added to them to increase their tolerance to pesticides so that farmers can use those chemicals more efficiently. Many studies have shown that soya that has been genetically-altered in this way is no different in composition or nutritional quality than other commercially available soya varieties, and that it is suitable for food use.

9. But the fact that in some cases the same company produces both the modified soya seed* and also the pesticide has led to allegations of corporate* manipulation of food markets. It is at this level that the criticisms of GM foods become more focused; with the accusation that they are a market-driven juggernaut* oblivious* to concerns wider than profit. You might raise the issue here also of whether it is right for these companies, at

the end of the 20th century, to be allowed patent* genes - chemical codes that have existed in nature for millions of years.

Confused issue

10. Many believe that the genetic-engineering lobby has been just a bit too complacent about safety. But are these political points saying anything about the inherent safety of the technology? Might we be confusing one with the other? The key question is: when we change the genetic structure of a plant or an animal, do we know enough about what we are doing to be sure of safety? Life is complex and has an unfailing capacity to surprise.

11. It is clear that GM foods have a lot they could offer the world if they were introduced in an open and fair way without the suspicion of big business bullying*. But there is a correct pace in which to introduce GM foods and many feel that the current pace is too fast. What's the hurry, they say.

12. Above all we must not become intoxicated by our power to manipulate genes. We have only just learned to do it in a very crude* and simple way. Nature has been doing it for billions of years. We have a lot to thank the genetic revolution for but we must remember evolution's ability to frustrate human desires. We must remember that our past is full of man-made disasters. Will the new genetic agricultural revolution mimic the disasters of the industrial age?

Vocabulary

breeding: *élevage*
bullying: harassment
corporate: by big companies
crop: *culture*
crude: *rudimentaire*
fresh-picked: *fraîchement cueilli*
genetic blueprint: *patrimoine génétique*
gluten: *gluten*
harmless: inoffensive
ingenuity: *intelligence*
juggernaut: *force*
knowledgeable: knowing a lot
oblivious: forgetful
patent: *brevet*
seed: *semence*
wheat: *blé*
yeast: *levure*
yield: *production*

Answer the following questions.

1) Say whether the following statements are True or False. Correct those you think are False.

a. Genetic modification has existed for thousands of years.	
b. Scientists are now able to crossbreed species as different as man and the pig.	
c. All of us may already have eaten genetically-modified food without realizing it.	
d. It has been proved that genetically-modified food is harmless.	
e. Thanks to modern genetic engineering, crops are more resistant to chemicals.	
f. Companies which produce pesticides are not allowed to produce genetically-modified seeds.	
g. Some companies hold patents for genes they didn't create.	
h. Modern genetic engineering might lead to disasters if scientists don't think enough about safety issues.	

2) In his article, Dr. Whitehouse mentions two different kinds of genetic modification. What are they? In what are they different?

3) What are the criticisms about GM foods that are relayed in the article?

4) What's Dr. Whitehouse's main feeling towards GM foods?

5) Explain, with your own words, the meaning the words below have in the context they have been extracted from:

- genetic blueprint (§ 1):

- patent genes (§ 9):

4. Listening: Retrieving specific information

Listen to Dr Patrick Dixon's talk about genetic engineering and try to answer the following questions:

1. What is, according to Dr Dixon, the most amazing staggering fact about life?

2. How many transgenic animals are made in England every year?

3. What use can we already make of the spider web gene?

4. Can you name another achievement of genetic engineering?

5. Do you necessarily need to understand what genes do to use them?

6. Genetics can be used in law courts. What is the example of this use that is given by Dr Dixon?

7. According to Dr Dixon, genes seem to determine much of our personality and characteristics. Can you give examples?

8. Dr Dixon mentions genetic prophecy; can you explain what it is?

9. Why is genetic prophecy hair-raising?

5. Speaking: Debating and confronting ideas

Topic 1:

GMOs are extremely controversial. Some people think they represent the future of agriculture while others believe they should be forbidden because they are dangerous.

Work with a partner. You are either in favour or against the use of GMOs in agriculture and you have to defend your opinion by using valid arguments.

Here are some questions to help you:

-What are the advantages/disadvantages of GMOs?

-Who produces GMOs?

-Are GMOs dangerous?

…

Topic 2:

Genetic profiling is now possible. Should it be used by insurance companies and employers?

Work with a partner. One of you has to give a positive answer to the question above while the other takes the opposite stance on the issue. Confront your views and provide arguments for the opinion that you are defending.

Here are some questions to help you:

-Are there any benefits to using genetic profiling? What are they?

-Is genetic profiling reliable?

-What are the ethical implications of genetic profiling?

…

6. Reading: Retrieving specific information

Skinny genes – how GM food may help you stave off obesity

Scientists are experimenting with modifying foods as a low-cost answer to health problems, including obesity and zinc deficiency.

Fiona Harvey, environment correspondent, guardian.co.uk, March 2012.

1. Fond of a full English breakfast? Perhaps you should have a glass of blood orange juice on the side – it might help to reduce the harm from all the fat you are ingesting, and make you less likely to become obese.

2. But as blood oranges are among the least favoured fruits for consumers, scientists in the UK are hoping to find ways to genetically modify standard oranges to incorporate the beneficial effects of their less popular cousins.

3. The project is one of several aimed at improving health through the genetic modification of plants – a process that scientists say could be a low-cost answer to harmful nutritional deficiencies.

4. Another project involves incorporating algae genes into oilseed rape, in order to produce nutritionally vital fish oils without having to kill fish; and grains modified to take up more zinc from the environment, to alleviate the zinc deficiency that blights millions.

5. The scientists involved believe that the public will be more accepting of GM plants that plug common nutritional gaps, than those crops that benefit big companies. "This isn't about increasing the profits from multinationals – there are big gains to be had," said Prof Dale Sanders, director of the John Innes Centre, an independent centre for plant science and microbiology research.
Although only a handful of GM experiments are licensed in the UK at present, some lab research continues, although scientists are concerned that the science is moving elsewhere. Cathie Martin, also of the John Innes Centre, who is leading the research on blood oranges, said: "There are enormous problems in creating something that can be grown in Europe, and big problems in public funding, because of the regulation."

6. Unpublished research has suggested that compounds found within blood oranges could help to cut obesity by reducing the accumulation of fats, and so avoid some of the harm from fatty foods. In one human

study, people fed a full English breakfast along with the juice of three blood oranges experienced less accumulation of fat, possibly because of substances known as anthocyanins, found in abundance in blood oranges.
The results should be taken with caution – they are unpublished and have not yet been peer-reviewed. Studies on mice have shown a similar effect, preventing obesity in mice fed a high-fat diet, compared to mice given ordinary orange juice, or water, but the human effects are still uncertain.

7. Overfishing is a severe problem in the world's oceans, but eating fish is one of the few ways in which we can gain enough omega oils to keep the cardiovascular system and the brain in good health. Fish produce these long chain fatty acids by feeding on algae and other sources. Prof Johnathan Napier at Rothamsted Research, an agricultural research organisation, has been working for about a decade on ways to take genes from algae and introduce them into land-based plants such as oilseed rape. In this way, the genetically modified seed can be harvested and turned into oil that will contain the same acids, which are easily absorbed by the body.
Cultivating algae for food will not work, according to Dr Napier, because of the vast quantities of water and space in order to make enough algae. But if the same genes can be expressed in oil-bearing plants, it should be possible to mimic the processes that occur within fishes' bodies, and make an edible form of the long chain Omega 3 fatty acids on a large scale.
Zinc deficiency can cause mental retardation in its extreme forms, but even mild deficiencies can impair the immune system, reducing the body's resistance to common diseases including malaria, pneumonia and diarrhoea. The World Health Organisation estimates that one-third of the world may be suffering from some zinc deficiency, and that it contributes to at least 800,000 deaths a year globally.

8. By changing the genes in certain grains, it may be possible to induce them to take up more zinc from the ground, in a form that is more easily digestible to human beings.

9. Prof Sanders said the research could open ways to improve people's diets to remove nutritional deficiencies in key areas, with massive benefits to human health.

Answer the following questions.

1) The only possible purpose of GM food is to increase profits for the people who produce it. T/F

2) Blood oranges...

-are the only source of anthocyanins.
-prevent humans from becoming fat.
-are not very popular among consumers.
-are part of the typical English breakfast.

3) Why would the public be more tolerant of the GM products described in the article than of the already existing GM products?

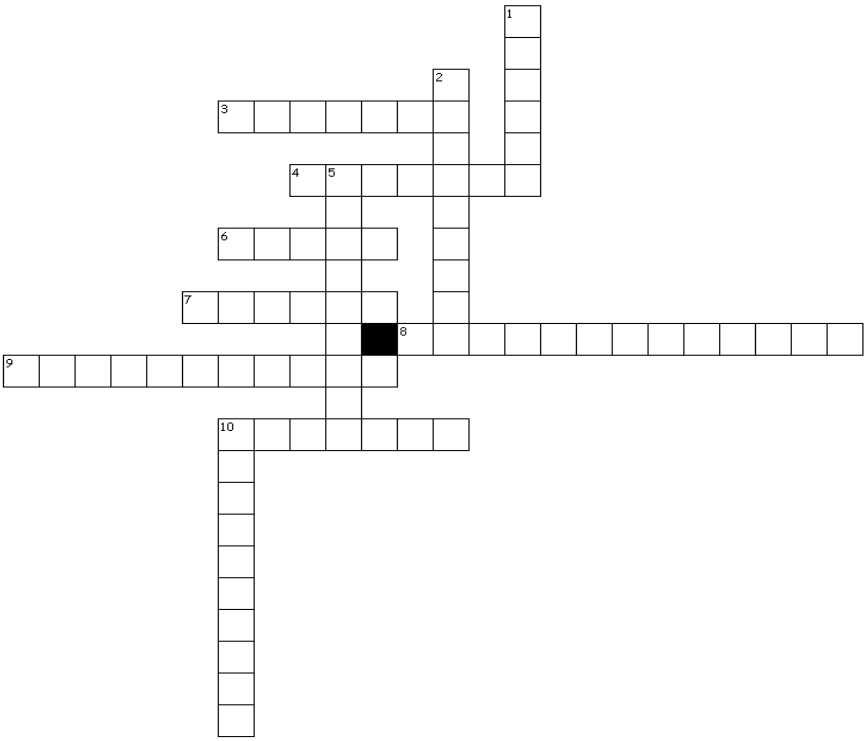
4) Incorporating algae genes into oilseed rape...

-could be a way to combat overfishing.
-could help us producing omega oils on a larger scale.
-is something that scientists have been working on for 10 years.
-All of the above.

5) Can a lack of Zinc in your nutrition have serious consequences on your health? Explain.

7. Language : Vocabulary and asking questions

1) Use words from the text you have just read to fill in the following crossword puzzle. Try not to go back to the text, the definitions next to the puzzle should be sufficient.



Across
3. A small number of people or things
4. To cut and gather a crop; to catch a number of animals or fish to eat
6. To happen
7. A period of ten years
8. Said of a creative work that has been evaluated by other people in the same field in order to maintain or enhance the quality of the work or performance in that field
9. Producing or containing oil
10. An illness affecting humans, animals or plants, often caused by infection

Down
1. To spoil or damage something, especially by causing a lot of problems
2. To make something less severe
5. A large quantity that is more than enough
10. The fact of not having, or not having enough of, something that is essential

2) Asking questions. Here are a series of sentences in connection with the text you have read. Imagine questions that could have triggered them.

a. _____ ?

Because it might make you less likely to become obese.

b. _____?

About ten years ago.

c. _____?

Yes, or at least that is what research on mice seems to indicate.

d. _____?

By introducing genes from algae into land-based plants such as oilseed rape.

e. _____?

No, I think it is too fat!

f. _____?

A zinc deficiency, for example.

GET IT RIGHT: The structure of a question

The basic structure of a question in English is very simple:

auxiliary verb + subject + main verb

Examples:

Do you like Mary?

Will Anthony go to Tokyo?

Have you seen ET?

If there is a question word, just add it in front of your sentence.

Examples:

Why do you like Mary?

When will Anthony go to Tokyo?

Where did you see the last Harry Potter movie?

Exception! To be

For the verb *be* in the simple present and simple past, we do not use an auxiliary verb. We simply reverse the positions of *be* and subject.

Example: *Are you sick?*

8. Language: Exemplification / illustration

Look at the sentences or phrases **in bold** in the first text. Those sentences or phrases are there to illustrate the author's main idea, to support his thesis or opinion. They are **examples**. An example is "one that is representative of a group as a whole." The word "illustration" is a synonym for "example" and is defined as "material used to clarify or explain." Examples are usually introduced by one of the following expressions:

- **such as ...**
- **for instance,**
- **namely ...**
- **including ...**
- take, as an example,
- consider, for example,
- as examples of …, consider …
- as an illustration of this / by way of illustration, consider …

- **especially ...**
- **notably ...**
- **mainly ...**
- **a case in point ...**
- **that is to say,**
- **to take a typical case,**
- take, for example,
- an example/illustration/instance of this is …
- a brief example will serve to illustrate this.
- a brief example will illustrate this point.
- some examples will indicate how …
- this can be simply illustrated from …
- it can be illustrated clearly with …
- I can illustrate this with …

Exercises

1. Using expressions from the list above, provide examples of the following.

e.g. *Genetic modification has existed for thousands of years.*

> The animals we eat, notably, are radically different from those that existed in the so-called 'natural' state.

a) Scientists are now able to manipulate the genetic blueprint of a living organism.

b) We may already have eaten genetically-modified food without realizing it.

c) Thanks to modern genetic engineering, crops are more resistant to chemicals.

d) Genetically-modified food could be used to solve important health issues.

2. Explain, with your own words, the meaning the words below and provide examples.

– Land-based plants (§ 7):

– Mental retardation (§ 7):

– Nutritional deficiencies (§ 9):

9. Speaking: Retrieving and presenting information

Retrieve sufficient information to be able to present and discuss the following questions in class.

1) What's a clone?

2) How do you feel towards the latest discoveries in cloning?

Comment on one of the statements below.

a) *Six per cent of Americans like the idea of cloning themselves.*
b) *The fact that new technologies feel scary or strange should not be enough to rule them out.*
c) *The ability to clone adult mammals opens up lots of exciting possibilities, from propagating endangered species to producing replacement organs for transplants.*
d) *A survey found that 53% of Americans opposed cloning animals for research, but 71% were prepared to abandon their principles if it meant life-saving breakthroughs.*

Decide under what circumstances cloning should be banned or allowed to go ahead.

Should be given the go-ahead	**Should be made illegal**

10. Reading: Identifying information

Read the text below and do the exercises.

Will the woolly mammoth be lumbering back? Japanese scientists 'to resurrect extinct giant from frozen DNA within five years'

By Fiona MacRae, 4 February 2011

1. It **died out - has died out - had been dying out** around **8,000 years ago - since 8,000 years - for 8,000 years**...but in just five years the woolly mammoth could soon be walking the Earth again. Japanese scientists are behind an ambitious project to bring the long-extinct mammal back from the dead.

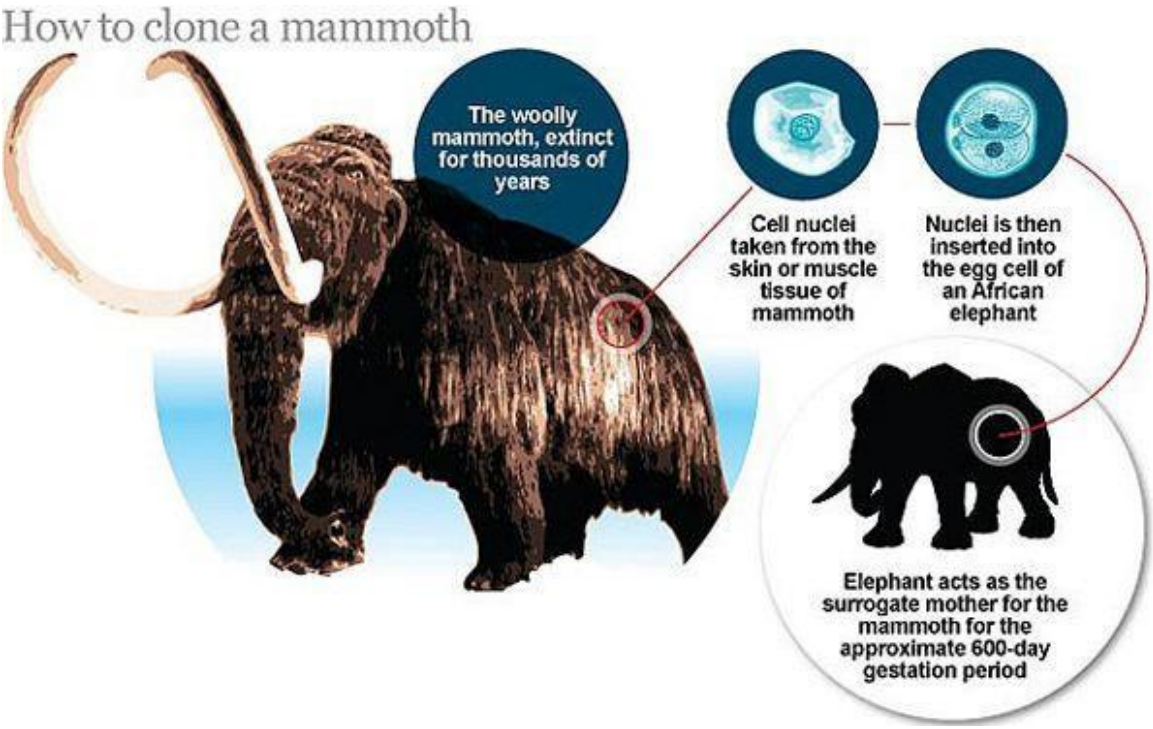
2. The revival requires a sample of intact DNA for cloning purposes and an elephant to act as surrogate mother, donating an egg and her womb. Taking into account the 600 or so days needed for the pregnancy, the first baby mammoths of the modern age could be born in four to five years.

3. In recent years, scientists **used - have used - were using** samples of hair frozen in the Siberian ice **since - during - for** thousands of years to piece together the mammoth's genetic code. And DNA preserved in bone has been used to recreate the prehistoric giant's blood. **--GAP 1--** the latest project is far more ambitious. The Kyoto University researchers are planning an expedition to the Siberian permafrost this summer in search of a flash-frozen specimen still rich in DNA.

4. Other options include taking a sample of skin or tissue from a carcass already in a research collection, Japanese newspaper Yomiuri Shimbun reports. A sample just over an inch square could provide all the genetic information needed.

5. DNA from the mammoth's cells will be injected into an empty egg, taken from an elephant, its closest living relative. The egg is then zapped with electricity to trick it into growing and dividing, like a normal embryo. It will **--GAP 2--** be allowed to mature in the lab **while - during - for** a few days, before being inserted into the womb of an elephant that will act as a surrogate mother, in the hope that she will eventually give birth to a baby mammoth.

6. The project will build on the success of other Japanese scientists who two years ago **had created - created - have created** clones of a mouse that **had been - was being - has been** dead and frozen for 16 years.



But it will not be plain sailing, with the intricate process fraught with the possibilities of failure, miscarriage and animal

suffering. **--GAP 3--** resurrecting the mouse, more than 1,100 attempts produced just seven healthy clones.

7. **--GAP 4--** the scientists are successful, the problems don't end with the birth. Project leader Professor Akira Iritani said: 'If a cloned embryo can be created, we need to discuss, before transplanting it into the womb, how to breed (the mammoth) and **--GAP 5--** to display it to the public.'

8. Study of the baby mammoth may shed light on why the huge creatures that once strode in large herds across Eurasia and North America died out 8,000 years ago at the end of the last Ice Age. Some experts hold that mammoths were hunted to extinction by the species that was to become the planet's dominant predator – humans.

9. Others argue that climate change was more to blame, leaving a species adapted for frozen climes ill- equipped to cope with a warming world. Cloning dinosaurs would be a much more complex task, because their DNA would be at least 65million years old and likely to have broken down.

Exercises:

1) Fill in the gaps in the text with the correct word:

GAP 1: But - Despite - Unlike - In spite of

GAP 2: therefore - thus - then - moreover

GAP 3: Whenever - When - During - Since

GAP 4: Even if - While - Nevertheless - Although

GAP 5: whether - unless - provided - whereas

2) Provide a synonym for:

- ***purpose (§2)****: aim - experiment - project*
- ***eventually (§5)****: perhaps - hopefully - in the end*
- ***fraught with (§6)****: filled with - made of - defined as*
- ***to cope (with) (§9)****: to manage - to support - to adapt*

3) Define the following terms:

- sample (§2):

- surrogate mother (§2):

- womb (§2):

- miscarriage (§6):

- to breed (§7):

- ill-equipped (§9):

4) True or false?

a. The odds are that the cloning of the mammoth will fail only because the length of the mammoth's pregnancy is unknown.
b. Scientists were able to recreate the mammoth's blood from an elephant bone.
c. Frozen DNA has never been used to clone an animal.
d. The cloning of the mammoth entails various problems which are not necessarily connected to the technical/scientific aspect of the process.

5) Answer the following questions:

- Explain the process that scientists are planning to use to try to resurrect the woolly mammoth.
- Resurrecting animals is playing God and there are many ethical issues that should be taken into account before making a decision. Discuss.

11. Listening

Watch the video "Genetic engineering will change everything forever" and answer the questions:

LINK: https://www.youtube.com/watch?v=WZi-lMpZ52U

1. Selective breeding is a process that has always been clearly understood and done in a fully controlled way by humans. True or false? If false, correct the statement.

2. Name the various purposes of DNA mentioned by the speaker:

   •
   •
   •
   •

3. Why did scientists bombard plants with radiation in the 1960s?

4. Give some key information about what happened in the 1970s, 1980s and 1990s.

5. Name the genetically modified animals that we can find today which are mentioned by the speaker:

   •
   •
   •
   •

6. What were the disadvantages of gene editing before CRISPR?

7. CAS 9 is a protein that acts very accurately. True or false? If false, correct the statement.

8. What is CRISPR compared to? Why?

9. What are the advantages of CRISPR? What does it allow to do?

10. Explain how CRISPR works.

⚠ *Online test 1*

This is the first online test you will be asked to do in the course of the year (See *Introduction* for further instructions and *Calendar* for deadlines).

> **Online tests** are **compulsory**. They will be marked, students will receive individual feedback, and they will be taken into account in the final grade (See *Introduction*).

Unit Vocabulary

above all	*par-dessus tout*
achievement	*réussite, accomplissement, exploit*
allegation	*allégation, accusation*
alleviate	*soulager, apaiser*
alter	*modifier*
as much (+ U)/many (+C) **as**	*autant de … que*
attempt	*tentative, essai*
bacterium (pl. bacteria)	*bactérie*
be likely to	*être susceptible de*
beneficial to	*bénéfique à*
benefit ≠profit (financial)	*bienfait ≠ profit, bénéfice (financier)*
blame	*tenir pour responsable, rejeter la faute sur*
blight	*anéantir, détruire, nieller*
boost	*stimuler, améliorer, augmenter*
break down	*se décomposer*
breakthrough	*avancée, progrès majeur*
breed	*élever (animaux) / cultiver (plantes)*
breeding	*élevage (animaux) / culture (plantes)*
bring sb back from the dead = resuscitate	*ramener qqun à la vie*
bullying = harassment	*brimades, harcèlement*
cattle (plural noun !) → the cattle **are** in the field	*bétail → le bétail est dans le pré*
chemical = chemical product	*produit chimique*
cloning	*clonage*
company ≠ society	*société commerciale* ≠ société (sociologie)
complacent	*content soi, suffisant*
concern	*inquiétude*
consumer	*consommateur*
cope with	*faire face à*
corporate	*d'entreprise*
crop	*culture (=plante cultivée)*
crossbreed (tr.) = interbreed (tr. and intr.)	*croiser*
crude	*rudimentaire*
cut (out)	*réduire*
decade	*décennie*
deficiency	*carence, manque*
die out	*disparaitre, s'éteindre (espèce)*
disease	*maladie*
display	*montrer, exhiber*
DNA	*ADN*
egg = ovum	*ovule*
enhancement (<enhance)	*amélioration, mise en valeur (<améliorer)*
failure	*échec*
few (>< a few)	*peu (>< quelques)*
feed (pret.: fed ; p. part.: fed)	*nourrir*
fond of sth (be fond of sth)	*aimer beaucoup qqch*
fraught with = filled with	*rempli de, plein de*
gene	*gène*
genetic blueprint	*patrimoine génétique, génome*
genetic engineering	*génie génétique*
GMO=Genetically modified organism	*OGM*
hair-raising	*Effrayant, qui fait dresser les cheveux sur la tête*
handful of	*poignée de*
harmless (>< harmful)	*inoffensif (>< nocif, dangereux)*

harvest	*récolter, prélever*
health	*santé*
healthy	*En bonne santé*
herd	*troupeau*
immune system	*système immunitaire*
impair	*détériorer, diminuer, affaiblir*
improve (<improvement)	*améliorer (<amélioration)*
in this way	*de cette façon*
induce sb to do sth	*inciter, persuader qqun de faire qqch*
intricate	*complexe*
issue = problem	*problème*
it is plain sailing	*ça marche comme sur des roulettes*
latest = newest (>< last)	*dernier (dans le temps) >< dernier (dans l'ordre)*
license	*donner une licence à, permettre*
lobby	*groupe de pression, lobby*
mammal	*mammifère*
mankind	*le genre humain, l'humanité, les hommes*
mature	*se développer*
meat (> beef meat)	*viande (> viande de boeuf)*
mimic	*imiter*
nucleus (pl. nuclei)	*noyau (d'une cellule)*
occur = happen	*se produire*
oblivious to	*oublieux de, inconscient de*
offspring (U) = progeny	*progéniture*
oil-bearing	*qui contient de l'huile*
organ	*organe*
patent (n. and v.)	*brevet, breveter*
peer-reviewed	*évalué par les pairs*
pet	*animal de compagnie*
piece together	*assembler, reconstituer*
plug nutritional gaps	*mettre fin aux problèmes nutritionnels*
pregnant (>pregnancy)	*enceinte (>grossesse)*
rape	*colza*
relative	*parent(e)*
rule sth out	*écarter, exclure (une possibilité etc.)*
safety	*sécurité*
sample	*échantillon*
scary	*effrayant*
seed	*graine, semence*
severe	*grave*
shed light on sth	*éclairer qqch, éclaircir (un mystère,…)*
skin	*peau*
so-called	*soit-disant, prétendu (adj.)*
specie**s** (pl. species)	*espèce*
spider web	*toile d'araignée*
staggering	*stupéfiant, ahurissant*
stride (pret.: strode ; p. part.: stridden)	*marcher à grands pas, arpenter*
suffer **from**	*souffrir de*
suitable	*approprié, qui convient*
surrogate	*de remplacement, porteuse*
tissue	*tissu (organique)*
transplant = transplantation	*transplantation*
trick sb into doing sth	*amener qqun à faire qqch (par la ruse)*
turn sth into sth	*transformer qqch en qqch*

weed	*mauvaise herbe*
wheat	*blé, froment*
womb = uterus	*utérus*
woolly mammoth	*mammouth laineux*
yeast	*levure*
yield	*rendement*

UNIT 3: Energy

1. Lead-in: Energy

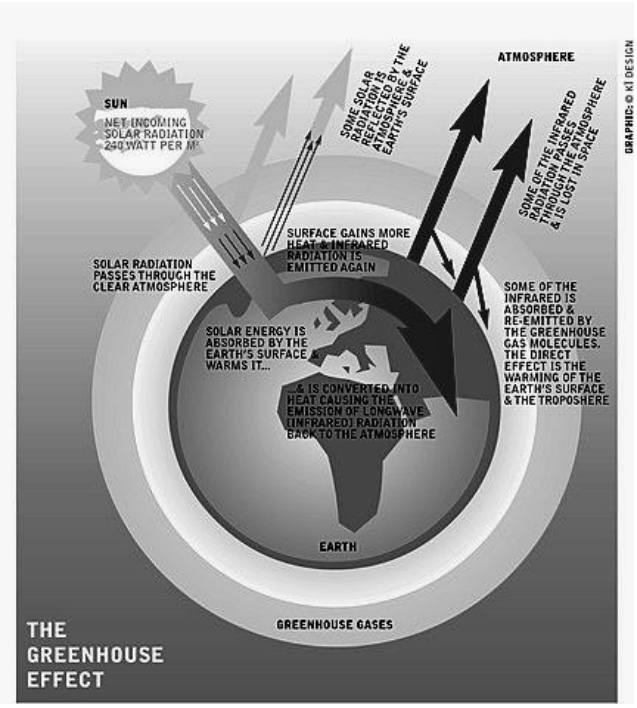
Discuss the following questions in pairs.

- What's a fossil fuel? Give examples.
- We've come to rely a great deal on fossil fuels in our everyday lives. Provide as many examples as you can.
- What's the link between fossil fuels and the greenhouse effect?
- In your opinion, how long will it take for fossil fuels to run out completely?

2. Language: Describing processes and sequences of events[5]

THE GREENHOUSE EFFECT

Very often, a process can be illustrated with a diagram. The diagram below[6] illustrates the greenhouse effect. Study it and make sure you understand how the process works.



Process descriptions usually start with an **introductory sentence** that summarises the process as a whole. Which of the following sentences would serve as the best introduction to a description of the greenhouse effect? Why?

- *The greenhouse effect is a naturally occurring process that aids in heating the Earth's surface and atmosphere*.
- *The portion of the Sun's radiation that reaches the Earth's surface is used in a number of processes, including plant photosynthesis.*
- *Only a small portion of the outgoing infrared radiation actually makes it back to space.*

[5] Section adapted from Sue O'Connell, Focus on IELTS, Pearson Education Limited, Harlow, 2002 (reprinted 2006).
[6] Source: www.greenpeace.org (retrieved on April 28, 2008).

In process descriptions, the information is generally organised in **logical stages**. The following connectors are often used to that aim: *after*, *afterwards*, *at this stage*, *during this process*, *eventually*, *finally*, *first*, *later*, *meanwhile*, *next*, *second*, *subsequently*, *then*, *when*.

– Which expressions mark stages which happen at the same time?

– Which one marks a stage which happens after a long time?

– Which two would not be used in describing a cycle, like the water cycle, for example? Why?

– Most of the sentences below contain errors. Identify and correct them.

At first, the machine must be switched on.

News of the event didn't reach the city until several hours after.

The report has taken a year to complete, but it's available at last.

Firstly, I enjoyed the course, but gradually I began to lose interest.

There was thunder and after it began to rain.

GET IT RIGHT

1. **at first/firstly/first**

   First, *firstly*, *first of all* introduce the first item in a list or a sequence. The next item in a sequence is normally introduced by *then* or *next*, and in a list by *second/secondly*, ...

   At first means at the beginning of an event or period, especially when the situation changes. *We liked living abroad at first, but we got homesick later.*

2. **at last/lastly**

   Use *lastly* like finally to introduce the last element in a sequence or list.

   Use *at last* when something good happens after a long period of waiting.
   At last the government is doing something about unemployment.

3. **after/afterwards/later**

   When you mention a time in the past that is measured from an earlier time in the past, don't use *after*. Use *later* instead. *They met in July and married two years later.*

!! Do **not** use *after* on its own as an adverb. Use *afterwards*, *later*, etc. instead.
After can be used in informal styles in phrases like *immediately after* or *not long after*.

Most often, descriptions of natural processes and sequences are written <u>in the present</u>. Moreover, the <u>passive form</u> of the verb is used a lot. This is because in this type of writing, we are usually more interested in the process than in who/what is doing the work.

3. Grammar: Passive voice

The structure of the passive voice is very simple:

subject + auxiliary verb (be) + main verb (past participle)

The main verb is always in its past participle form.

> **GRAMMAR**
>
> As opposed to the construction of the French "passé composé", where you have to choose between auxiliaries "être" and "avoir", the construction of the English "present perfect" (active voice) ALWAYS requires the auxiliary *to have*.
>
> *To be* is the auxiliary used to build the passive voice.

Study the diagram of the greenhouse effect and complete the gapped description below. Use the verbs in the box in active or passive forms, as appropriate. The numbers between brackets indicate that some of them are used more than once.

absorb (3) – cause (3) – emit – pass – reach – reflect (2) – result

The greenhouse effect _____ from the fact that certain atmospheric gases, such as carbon dioxide, water vapor, and methane, are able to change the energy balance of the planet by absorbing longwave radiation that _____ from the Earth's surface. Without the greenhouse effect, life on this planet would probably not exist as the average temperature of the Earth would be a chilly -18° Celsius, rather than the present 15° Celsius.

As energy from the Sun _____ the atmosphere, a number of things take place. A portion of the energy (26% globally) _____ or scattered back to space by clouds and other atmospheric particles. About 19% of the energy available _____ by clouds, gases (like ozone), and particles in the atmosphere. Of the remaining 55% of the solar energy passing through the Earth's atmosphere, 4% _____ from the surface back to space. On average, about 51% of the Sun's radiation _____ the surface. This energy is then used in a number of processes, including the heating of the ground surface; the melting of ice and snow and the evaporation of water; and plant photosynthesis.

The heating of the ground by sunlight _____ the Earth's surface to become a radiator of energy in the longwave band (infrared radiation). This emission of energy is generally directed to space. However, only a small portion of this energy actually makes it back to space. The majority of the outgoing infrared radiation _____ by the greenhouse gases.

Absorption of longwave radiation by the atmosphere _____ additional heat energy to be added to the Earth's atmospheric system. The now warmer atmospheric greenhouse gas molecules begin radiating longwave energy in all directions. Over 90% of this emission of longwave energy is directed back to the Earth's surface where it once again _____ by the surface. The heating of the ground by the longwave radiation _____ the ground surface to once again radiate, repeating the cycle described above, again and again, until no more longwave is available for absorption.[7]

[7] Source: http://www.physicalgeography.net (retrieved on April 28, 2008)

4. Reading: Skimming and scanning

Skim the article below and answer the following questions.

- Why is fossil energy bound to become too expensive in a not-so-distant future?

- Could technological progress help solve this problem? Provide examples.

- Why isn't the use of low-grade fossil fuels a suitable alternative? And what about synthetic fuels?

THE END OF FOSSIL FUELS

Humans are using fossil fuels about a million times faster than it took nature to create them. This means that they will run out one day. The big question is: Will fossil fuels run out before an alternative is found?

What does "run out" mean?

- As coal, oil and gas supplies become scarcer, more money will be spent to find new supplies in more out of the way places - such as Alaska's Arctic North Slope* or in deeper seas than at present.
- These new supplies are likely to be deeper and more expensive **to mine** or pump. Barely 150 years ago, oil was found within a few metres of the surface. Today new drilling* goes down over 10 kilometres.
- These new sources are also likely to be in smaller deposits than today's huge fields - making profits smaller given the cost of exploration and development.
- Some older sources of lower quality fuel might start to be used.

All of this will cause the price of fossil energy to rise, until eventually it becomes too expensive. High prices of fossil fuels could lead to

- new technologies that use less fuel: already, the internal combustion engine that powers almost all the world's cars is about twice as fuel-efficient as it was in 1974 - when the oil price suddenly doubled.
- people cutting back on the amount of energy that they use by, for example, turning down the thermostats on central heating systems.
- the development of alternative sources of energy, such as solar power.
- the discovery and development of completely new sources of energy, such as thermo-nuclear fusion.

This will all be counter-balanced by the rising demand for power in the less economically developed countries - the LEDCs. Some of these countries, like China, are experiencing rapid economic growth. So even with major advances in technology and new discoveries of fossil fuels, there is likely to be a rise in energy costs as these fuels run out.

The oil industry argues that it will continue to be able to supply affordable fossil fuels for centuries into the future. Environmentalists and alternative energy companies argue that the "oil crunch*" could come much sooner. The very high oil prices of 2000 are seen as a warning sign of things to come. (These were due to OPEC controlling supply, rather than a shortage of available oil.) All the big oil companies are developing expertise in alternative fuels, especially solar power, in preparation for the day when oil, gas and coal become too expensive for everyday use.

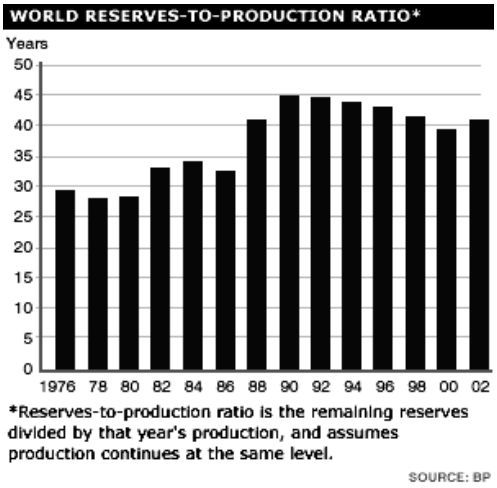
Low-grade fuels

If the reserves of low quality coal and oil are taken into account, then the people who say that there is enough fossil fuel to last for hundreds of years are probably right - but there are problems with these fuels.

- Low-grade coal produces a lot of sulphur and **ash** when it is burnt in a power station. While a lot of the ash is removed from the smoke before it leaves the chimneys, millions of tonnes of ash are still ejected into the air. Removing the ash is an expensive process.
- Power stations do little to remove the sulphur dioxide and nothing to remove the carbon dioxide that is produced by burning these fuels.
- Many governments have passed laws limiting the use of low-grade fuels because of pollution problems.

Synthetic oil

Petrol and gas, as well as a wide variety of other products normally made from natural gas and oil, can also be made from coal and tar*. The problem with synthetic fuels is that their manufacture uses a lot of energy. For example, making one tonne of petrol may require two or three times as much energy as that petrol will produce when it is used in a motor car. This means that synthetic fuel can only be made if very cheap coal or tar is available. Only one country, South Africa, makes a significant amount of petrol from coal. They are able to do this because South Africa has some of the cheapest coal in the world and the chemical by-products - not to mention the jobs created - make it worthwhile.



How long will last?

The short answer is no-one knows, but even the oil industry suspects the world "peak" is now approaching.

It says it has 40 years of proven reserves at the moment - but it also said that 30 years ago.

In fact, the estimate has actually increased in recent years as production has fallen. Cutting consumption would prolong oil's life.

Glossary

crunch: crisis drilling: *forage* slope: *versant, flanc* tar: *goudron*

Vocabulary

1. Match the following adjectives (underlined in the text above) with a suitable definition.

1. scarce	a. of inferior quality
2. fuel-efficient	b. having a cost that is not too high
3. affordable	c. available in small quantities
4. low-grade	d. working in a way that does not waste fuel

2. Define the following words (**in bold** in the text above).

- To mine:
- Ash:

3. What's the difference between "profits" (in a box in the text above) and "benefits"?

5. Discussion: Advantages / disadvantages of alternative sources of energy

1. In pairs, fill in the table below in note form.

Alternative energy sources	Advantages	Disadvantages

2. In groups of 4-5, discuss and present to your friends...

   – advantages and disadvantages of alternative sources of energy (Choose 1 or 2).

- which source of energy you think is most likely to be used in the future.
- what you think of nuclear energy, geothermal energy, biomass.

Useful words and phrases (See also *Appendix F*)

To express advantages:	**To express disadvantages:**	**To introduce /continue an idea:**
One advantage is… A positive factor is… On the one hand… On the positive side… The advantages (of…) are… …	A disadvantage is… A negative factor is… On the other hand… On the negative side… The disadvantages (of…) are… Against this… But… However… Yet… …	Some people argue that… It can be said that… Moreover… A further point is… Also… Similarly… … **To conclude:** To sum up… To conclude… In conclusion… All in all… In short/brief… (…)

6. Reading: A case in point: Geothermal energy

1. Read the text below to check your ideas on geothermal energy and complete your answer with information of the text.

2. Explain the words in boxes in the text.

- To take sth for granted:
- Byproduct:
- To melt:
- To be piped in:
- Cost-effective:
- Consistently:

3. Find synonyms for the words **in bold** in the text.

- Convenience:
- To tap:
- To spin:

4. What's the basic principle of a heat exchanger? Explain using a diagram of your own.

5. Compare and contrast geothermal energy and oil. Start by filling the table below in note form, then write a paragraph based on your notes.

Similarities	Differences

HOW GEOTHERMAL ENERGY WORKS

Source : http://science.howstuffworks.com - retrieved June 20, 2017

1. We depend on our cars to take us to work and get our children to school. We rely on our home heating systems to keep us warm in the winter. We take it for granted that we can easily switch on our computer, vacuum cleaner or oven.

2. Yet scientists say the sources of energy we need to power all these modern **conveniences** are running dangerously low. We could run out of oil in as little as 40 years and out of natural gas soon after that. These fossil fuels have been percolating beneath the Earth for hundreds of millions of years, and once they're gone, they're going to take millions more years to replenish. Not only are we running out of fossil fuels, but they're adding to our environmental woes* by releasing nasty byproducts that increase pollution and contribute to global warming.

3. Scientists are running a race against time to find cleaner, more efficient, renewable sources of energy. One potential source that we've barely **tapped** is right underneath our feet. Deep inside the Earth lies hot water and steam that can be used to heat our homes and businesses and generate electricity cleanly and efficiently. It's called geothermal energy -- from the Greek words *geo*, or "earth," and *therme*, meaning "heat."

4. There is plenty of heat in the center of the Earth. The deeper you dig, the hotter it gets. The core, about 4,000 miles (6,437 kilometers) beneath the surface, can reach temperatures of 7,600 degrees Fahrenheit (4,204 degrees Celsius). Part of that heat is left over from the Earth's formation, about 4 billion years ago. The rest comes from the constant decay* of radioactive isotopes inside the Earth.

5. The heat inside the Earth is intense enough to melt rocks. Those molten rocks are known as magma. Because magma is less dense than the rocks surrounding it, it rises to the surface. Sometimes magma escapes through cracks in the Earth's crust, erupting out of volcanoes as part of lava. But most of the time magma stays beneath the surface, heating surrounding rocks and the water that has become

trapped within those rocks. Sometimes that water escapes through cracks in the Earth to form pools of hot water (hot springs) or bursts of hot water and steam (geysers). The rest of the heated water remains in pools under the Earth's surface, called geothermal reservoirs.

How Can We Use Geothermal Energy?

6. Heat is sitting under the Earth -- we just need to tap it. Geothermal energy can be used in three ways:

7. **Direct geothermal energy**. In areas where hot springs or geothermal reservoirs are near the Earth's surface, hot water can be piped in directly to heat homes or office buildings. Geothermal water is pumped through a heat exchanger, which transfers the heat from the water into the building's heating system. The used water is injected back down a well* into the reservoir to be reheated and used again.

8. **Geothermal heat pump**. A few feet under the ground, the soil or water remain a constant 50 to 60 degrees Fahrenheit (10-15 degrees Celsius) year-round. Just that little bit of warmth can be used to heat or cool homes and offices. Fluid circulates through a series of pipes (called a loop) under the ground or beneath the water of a pond* or lake and into a building. An electric compressor and heat exchanger pull the heat from the pipes and send it via a duct system throughout the building. In the summer the process is reversed. The pipes draw heat away from the house and carry it to the ground or water outside, where it is absorbed.

9. **Geothermal power plant**. Hot water and steam from deep underground can be piped up through underground wells and used to generate electricity in a power plant. Three different types of geothermal power plants exist:

- **Dry steam plants**. Hot steam is piped directly from geothermal reservoirs into generators in the power plant. The steam **spins** turbines, which generate electricity.
- **Flash steam plants**. Water that's between 300 and 700 degrees Fahrenheit (148 and 371 degrees Celsius) is brought up through a well. Some of the water turns to steam, which drives the turbines. When the steam cools it condenses back into water and is returned to the ground.
- **Binary cycle plants**. Moderately hot geothermal water is passed through a heat exchanger, where its heat is transferred to a liquid that boils at a lower temperature than water. When that fluid is heated it turns to steam, which spins the turbines.

How Does Geothermal Energy Compare to Other Energy Sources?

10. Experts say geothermal energy is cleaner, more efficient, and more cost-effective than burning fossil fuels, and it can reduce our dependence on foreign oil.

11. Geothermal energy is clean because it can be generated without burning fossil fuels. Geothermal plants release a fraction of the carbon dioxide produced by fossil fuel plants, and they create very little nitrous oxide or sulfur gases. Reykjavik, Iceland, which heats 95 percent of its buildings using geothermal energy, is considered one of the cleanest cities in the world.

12. Because the energy is generated right near the plant, it saves on processing and transportation costs compared to other types of fuel. Geothermal plants are also considered to be more reliable than coal or nuclear plants because they can run consistently, 24 hours a day, 365 days a year.

13. The initial costs of geothermal energy are high -- wells can cost $1 to $4 million each to drill, and installation of a home geothermal pump system can run as much as $30,000. However, a home geothermal energy pump can cut energy bills by 30 to 40 percent and will pay for itself within 5 to 10 years.

14. Geothermal energy is considered renewable because the heat is continually replaced. The water that is removed is put right back into the ground after its heat is used.

15. The world uses about 7,000 megawatts of geothermal energy, about 2,700 megawatts of which is produced in the United States (the equivalent of burning 60 million barrels of oil each year). Still, we're not using nearly as much geothermal energy as is available. That has to do with the limited geographic availability of geothermal energy, and the difficulty and expense of drilling down far enough to reach that

energy. More advanced techniques being developed could allow for deeper drilling, potentially bringing geothermal energy to more people in more places.

16. For right now, geothermal heat pumps are the most viable option. They can be used just about anywhere in the world because the temperature beneath the ground always remains constant.

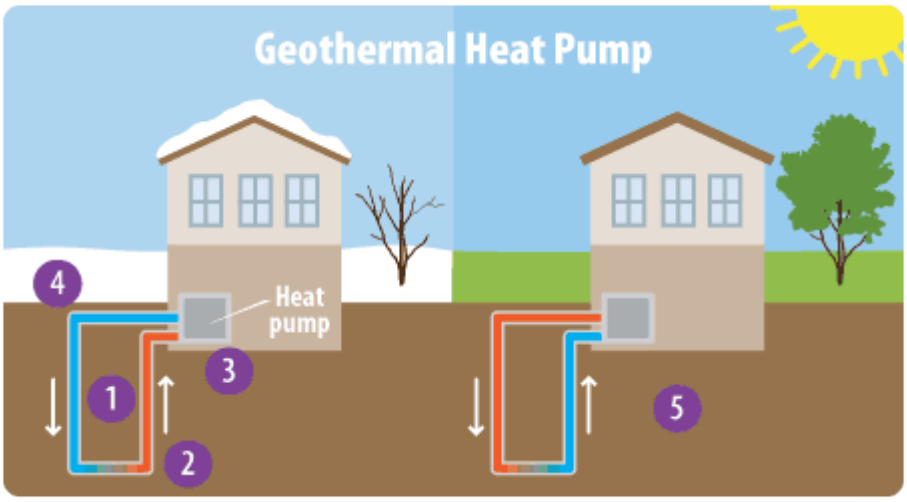
Glossary

woe: *malheur* decay: degeneration well: *puits* pond: *étang*

7. Speaking: Describing processes

In pairs, try to figure out how the heat pump below works and get ready to explain it to the rest of the group.

Refer to Section 2 of this unit for useful language tips.



8. Listening: How does a fuel cell work?

Watch the Naked Science Scrapbook video (https://www.youtube.com/watch?v=Tk_iIzOUjTU) and try to answer the following questions:

1) How do coal-fired power stations and nuclear power stations produce electricity?
2) How efficient is a good car engine?
3) How does a fuel cell produce electricity?
4) How does the hydrogen fuel cell make it possible to control the way energy is released when hydrogen reacts with oxygen to produce water?
5) "Fuel cells work like a battery." Explain.
6) What is electrolysis?
7) What are the advantages of solid oxide fuel cells?
8) What's complicated about using a hydrogen fuel cell in a car?

In-class test 1: argumentative essay

Unit Vocabulary

affordable	*abordable*
be bound to do	*aller sûrement, inévitablement faire*
be likely to do	*avoir de fortes chances de, risquer de faire*
by-product	*dérivé, sous-produit*
clean (= non-polluting)	*propre (= non-polluant)*
coal	*charbon*
consume (> consumption)	*consommer (> consommation)*
cut back **on**	*faire des économies de, réduire sa consommation de*
dam	*digue, barrage*
deep	*profond*
demand >< supply	*demande >< offre*
dioxide (> carbon/sulphur dioxide)	*dioxyde (de soufre/de carbone)*
dispose **of**	*se débarrasser de qqch*
drilling	*forage*
dump	*décharge publique*
engine	*moteur*
environmentally-friendly	*qui respecte l'environnement*
experience	*vivre, connaître*
fossil fuel	*combustible fossile*
fuel	*combustible, carburant*
generate (electricity)	*produire (de l'électricité)*
greenhouse effect	*effet de serre*
greenhouse gas	*gaz à effet de serre*
growth	*croissance*
harness = exploit	*exploiter*
heating (> central heating)	*chauffage (> chauffage central)*
inexhaustible (= endless)	*inépuisable (= sans fin)*
low-grade >< high-grade	*de qualité médiocre >< de bonne qualité*
nuclear waste (U)	*déchets nucléaires*
oil (> crude oil)	*pétrole (> pétrole brut)*
outlast	*durer plus longtemps que*
petrol (GB) / gasoline (US)	*essence*
petroleum	*pétrole*
power = energy	*énergie*
power station/plant (>nuclear power station/plant)	*centrale (électrique) (> centrale nucléaire)*
recycle (>< retrain)	*recycler (des déchets) >< recycler (des travailleurs)*
rely **on**	*compter sur*
remains	*restes*
renewable	*renouvelable*
round the clock	*24 heures sur 24*
run out	*s'épuiser, venir à manquer*
set up	*implanter, installer*
shortage	*pénurie*
solar panels	*panneaux solaires*
store	*stocker*
substitute (= replacement)	*produit de substitution*
supplies	*réserves*

supply sb **with** sth (provide sb **with** sth)	*fournir qqch à qqn*
sustainable	*durable*
switch **to**	*passer à*
take into account	*prendre en compte*
warmth (≈ heat)	*chaleur*
waste product	*déchet de fabrication*
well (> oil well)	*puits (> puits de pétrole)*
wind farm	*champ d'éoliennes*
wind turbine	*éolienne*
worthwhile	*intéressant, qui vaut la peine*

UNIT 4: Living Earth

1. Lead-in[8]: Water issues

Find out how much you know about water issues. Work with a partner to answer as many of the following questions as possible: be ready to defend your opinion in front of the class.

1. Which of the following accounts for most of the world's water use?

   a) agriculture *b) industry* *c) domestic uses*

2. How many litres of water does one person require each day (for all domestic purposes) in order to enjoy a reasonable quality of life?

3. Which two of the following countries have the highest consumption of water per person per day, and which country has the lowest?

   a) Austria *d) Italy* *g) Switzerland*
   b) Germany *e) Japan* *h) UK*
   c) India *f) Spain* *i) USA*

4. What percentage of the Earth's surface is covered with water?

5. Name three other water resources in addition to the sea.

6. What percentage of the Earth's total water resources can be transformed into usable water?

   a) 1% *b) 10%* *c) 25%*

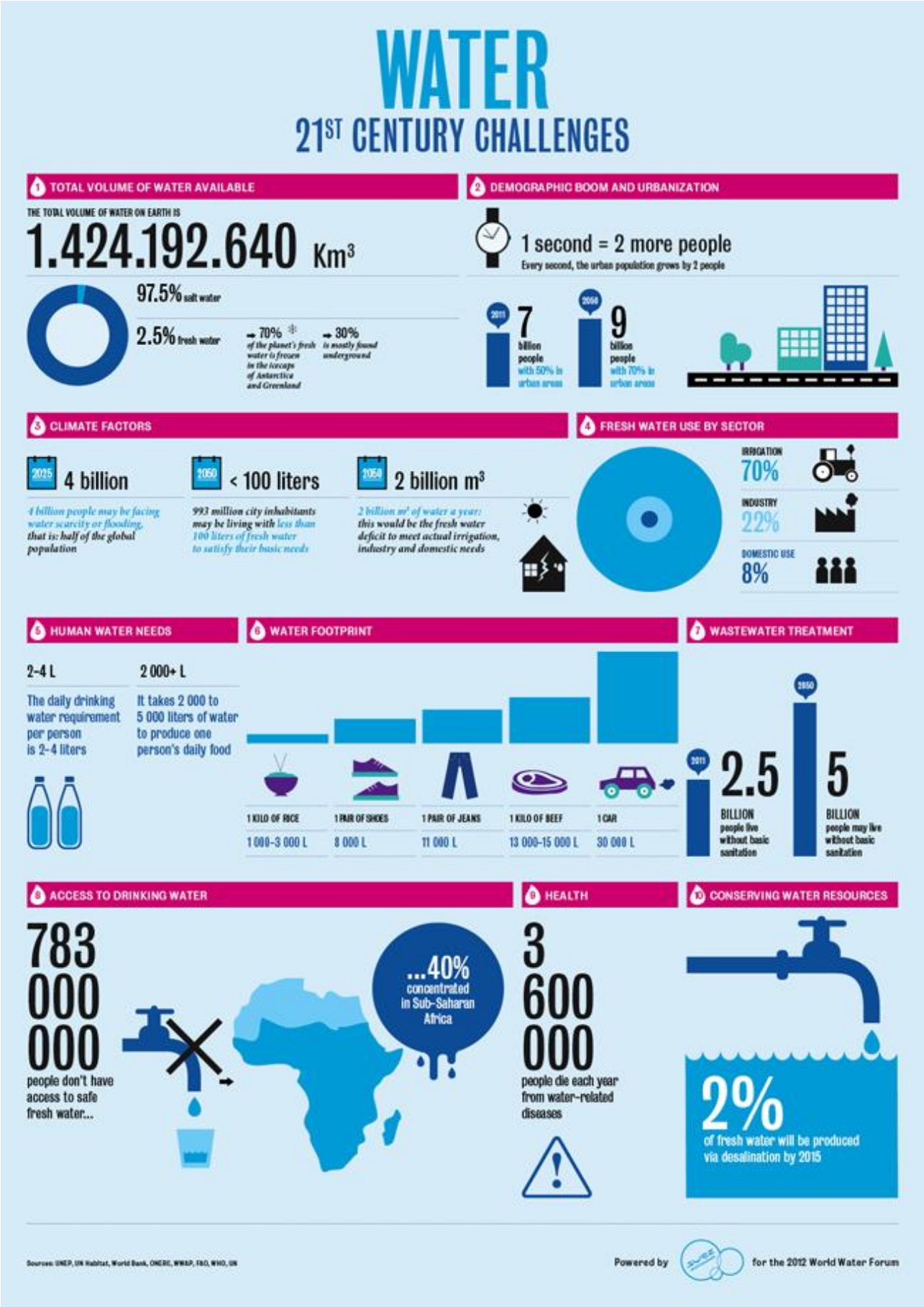
7. What percentage of disease could be prevented in developing countries if safe, clean water was available?

   a) 20% *b) 50%* *c) 80%*

8. Which of these countries has the most available drinking water, and which has the least?

   a) India *b) Kenya* *c) Mexico* *d) Peru*

[8] Section adapted from Sue O'Connell, Focus on IELTS, Pearson Education Limited, Harlow, 2002 (reprinted 2006).


WATER
21ST CENTURY CHALLENGES
1 TOTAL VOLUME OF WATER AVAILABLE
THE TOTAL VOLUME OF WATER ON EARTH IS
1.424.192.640 Km3
97.5% salt water
2.5% fresh water
→ 70% of the planet's fresh water is frozen in the icecaps of Antarctica and Greenland
→ 30% is mostly found underground
2 DEMOGRAPHIC BOOM AND URBANIZATION
1 second = 2 more people
Every second, the urban population grows by 2 people
2011 7 billion people with 50% in urban areas
2050 9 billion people with 70% in urban areas
3 CLIMATE FACTORS
2025 4 billion
4 billion people may be facing water scarcity or flooding, that is: half of the global population
2050 < 100 liters
993 million city inhabitants may be living with less than 100 liters of fresh water to satisfy their basic needs
2050 2 billion m3
2 billion m3 of water a year: this would be the fresh water deficit to meet actual irrigation, industry and domestic needs
4 FRESH WATER USE BY SECTOR
IRRIGATION 70%
INDUSTRY 22%
DOMESTIC USE 8%
5 HUMAN WATER NEEDS
2-4 L
The daily drinking water requirement per person is 2-4 liters
2 000+ L
It takes 2 000 to 5 000 liters of water to produce one person's daily food
6 WATER FOOTPRINT
1 KILO OF RICE 1 000-3 000 L
1 PAIR OF SHOES 8 000 L
1 PAIR OF JEANS 11 000 L
1 KILO OF BEEF 13 000-15 000 L
1 CAR 30 000 L
7 WASTEWATER TREATMENT
2011 2.5 BILLION people live without basic sanitation
2050 5 BILLION people may live without basic sanitation
8 ACCESS TO DRINKING WATER
783 000 000 people don't have access to safe fresh water...
...40% concentrated in Sub-Saharan Africa
9 HEALTH
3 600 000 people die each year from water-related diseases
10 CONSERVING WATER RESOURCES
2% of fresh water will be produced via desalination by 2015
Sources: UNEP, UN Habitat, World Bank, ONERC, WWAP, FAO, WHO, UN
Powered by
for the 2012 World Water Forum

Going further:

1) Speaking: Before coming to class, search for information on ONE specific water issue and be ready to present it to the class.

2) Based on the statistics presented on the previous page, discuss some of the 21st – century water challenges in pairs or in small groups.

- What figures do you find most surprising ? Why ?
- Do you think water will be a major global challenge in the coming years ? Explain.
- Do you think it is important to try and decrease our own water footprint ?
- How could Western or developed countries in general reduce their water footprint ?

3) Now, discuss the following questions in pairs.

1. Do you generally use water carefully or do you use it without thinking?
2. Are there ever any restrictions on water use in your country?
3. What are some of the ways of saving water in the home?

4) Listening comprehension

a) Water conservation tips. Watch the video taken from the National Geographic's website called "The Green Guide" and answer the questions below.

1. What percentage of domestic water do we actually use in the bathroom?

2. What are the two ways in which a low-flow showerhead can help you to save money?

3. How does an aerator work?

4. List the different ways of conserving water without changing anything to your house equipment.

5. What percentage of domestic water is used outdoors?

6. How much water is necessary for a car-wash done by a professional?

7. According to this video, is it better to have your car washed by a professional or to wash it yourself in your garden? Why?

8. What is a "waterless car-wash"?

b) "Will the world ever run out of water?". Watch the video twice and answer the questions below.

1) Which statement is correct?

1) On a global level, 85% of people don't have access to drinking water because they live in the driest regions in the world.

2) More than 4 fifths of the world's population live in the driest areas of the globe where there is no access to clean drinking water.

3) 85% of the people who live in the driest regions of the planet don't have access to clean drinking water.

4) Half of the world's population lives in driest regions of the planet, where hundreds of millions of people lack access to drinking water.

5) None of the above.

2) How is the world expected to change over the next few decades?

1) Some regions around the globe will undergo more extreme weather patterns.

2) As the global population keeps growing in a dramatic way, water may become scarcer and scarcer.

3) The high increase in population will go hand in hand with an increasing water demand.

4) As countries are predicted to become more populated and developed, the need for water will increase by more than 50%.

5) All are correct

3) According to the report, …

1) a worldwide drought will never happen because the water cycle is a closed system, constantly renewing itself.

2) although a worldwide drought might not be the real issue, more and more areas around the planet will be affected by more and more severe droughts.

3) as fertile areas around the globe become larger and drier, water won't be able to penetrate the soil, disrupting the water cycle as we know it today.

4) Areas of land where water used to flow will become dry and water will not flow into the oceans as it used to.

4) Where can the 1% of the Earth's water available as potential drinking water be found? (name 3)

5) Only 1% of the Earth's water can be used … (name 4)

6) Thanks to Hetch Hetchy, California's drought has been able to cope with the severe drougth that other regions like Brazil or China have been facing. True or false? Correct if the statement is false.

7) According to recent research, …

1) the lack of snowfall in the Northern Hemisphere is likely to cause droughts.

2) the accumulation of winter snowfall worldwide has been decreasing, and is likely to affect more than 2 billion people over the next century.

3) More than two-thirds of the world's population are likely to suffer from a serious lack of snowfall in the future.

4) the decreasing amount of snowfall, which provides people with freshwater, is likely to affect more than one billion people over the next century.

8) The authors of the study published in the journalEnvironmental Research Letters fear that the Hetch Hetchy reservoir will disappear. True or false? If false, correct the statement.

9) Fill in the gaps: **(2:44 – 3:14)**

And it's not just a lack of water from above. Water _____ from below are _____ too. In June 2015, NASA announced that the water table _____ all over the world. Of the 37 _____ aquifers on Earth, 21 have passed their _____. That means more water _____ than is finding its way back in. And the thing about aquifers, _____ water is old, really old, and it takes a while for it to refill. Some aquifers could take anywhere _____ years to refill.

10) Over the last 15 years, the shortage of water has increased by 40%. True or false? If false, correct the statement.

11) According to the United Nations, two main issues relating to water shortage are....

-

-

12) What measures has California taken to decrease water consumption?

13) As 70% of the planet's water is used for agricultural purposes, ….

1) food availibity itself is being threatened in case of drought because lots of countries cannot afford to pay several billion dollars to make up for the losses.

2) a water shortage might mean a major food crisis, with increasing prices and growing famine around the world.

3) if we start running out of water, governments might have to invest several billion dollars in agriculture in order to avoid another food crisis.

4) None of the above.

14) The United Nations hopes that by 2050, we will have found solutions to reduce our water consumption. Explain those solutions :

a) agriculture:

b) energy production:

c) cities:

15) Conclusion: At the beginning of the report, it is said that we tend to think that water is a renewable infinite resource. But is it really? Explain.

****Bonus question: vocabulary**** Provide synonyms for the following words:

plagued by (0:04) :

widespread (2:16):

account for (2:28):

highlighted (3:22):

upheaval (3:57):

drive up (4:15):

staples (4:22):

soared (4:26):

strain (4:44):

2. Reading: Skimming and scanning

Read the following questions and answer them as quickly as possible.
Do not worry if you don't understand every word of the text.

1. The text contains much information of the "Facts and Figures" type. Give examples.

2. How could water use in agriculture be better managed?

3. Does the future lie in desalination? Why?

WHY WORLD'S TAPS ARE RUNNING DRY

By Alex Kirby, BBC News Online environment correspondent

1. Two-fifths of the world's people already face serious shortages, and water-borne diseases fill half its hospital beds. People in rich countries use 10 times more water than those in poor ones.

2. The world cannot increase its supply of fresh water: all it can do is change the way it uses it. Its population is going to go on increasing for some time before there is any prospect it will stabilize. And water-borne diseases already kill one child every eight seconds. Water is not running out: it is simply that there are steadily more of us to share it.

3. Climate change will also have an effect on water - just what effect, though, nobody can really say. Some regions will become drier, some wetter. Deserts may well spread and rivers shrink, but floods will also become more frequent. Most of the world's water is already inaccessible, or comes in the form of storms and hurricanes to the wrong places at the wrong times.

4. But there is certainly room for better management of water in agriculture - which currently takes up 70% of the water we use. Drip irrigation, for example, minimizes waste, as do low-pressure sprinklers and even simple earth walls to trap rainfall instead of letting it drain away too fast to be used.

5. Industry will usually make savings and cut costs wherever it can, and if it can spend less on water it will. And us? One way to make consumers more responsible about water is to charge them for consuming it.

6. It works - up to a point. If water is expensive, those who can will economize on its use. But not everyone can.

7. Privatising the water supply in South Africa means many people would receive 6,000 litres a month free, then pay for whatever they use beyond that. A monthly 6,000 litres means 50 litres a day for a family of four. Fifty litres is the recommended basic domestic water requirement, and by no means every South African family has only four members. That is one reason why the anti-privatisation movement has been so strong in South Africa.

8. There is no one-size-fits-all prescription for the harsh business of bringing water demand into line with supply. Nor is there an off-the-peg way of engineering our way out of the crisis.

9. Desalination may play a part, but it is energy-hungry and leaves a brine mountain for disposal. Dams will impound more water, but can easily bring more problems in their train. One of the disappointments of the World Water Forum in Japan in March 2002 was its focus on mega-engineering solutions like dams and pipelines, rather than using natural systems like forests and wetlands to conserve water.

10. There is some good news. Clean water and sanitation are getting to more and more people. But you may not have noticed, because the number of people benefiting was outstripped by the growth in human numbers.

11. Because the world's water supply is finite, most of life's other necessities are finite as well. In China it takes 1,000 tonnes of water to grow one tonne of wheat. If we do not learn to live within our aqueous means, we shall go hungry as well as thirsty. A world where consumption was a means to survival, not an economic end in itself, would have enough water to go round. And polluted, inadequate water might kill its children a little more slowly.

3. Task focus: Analyzing and completing diagrams, tables and graphs

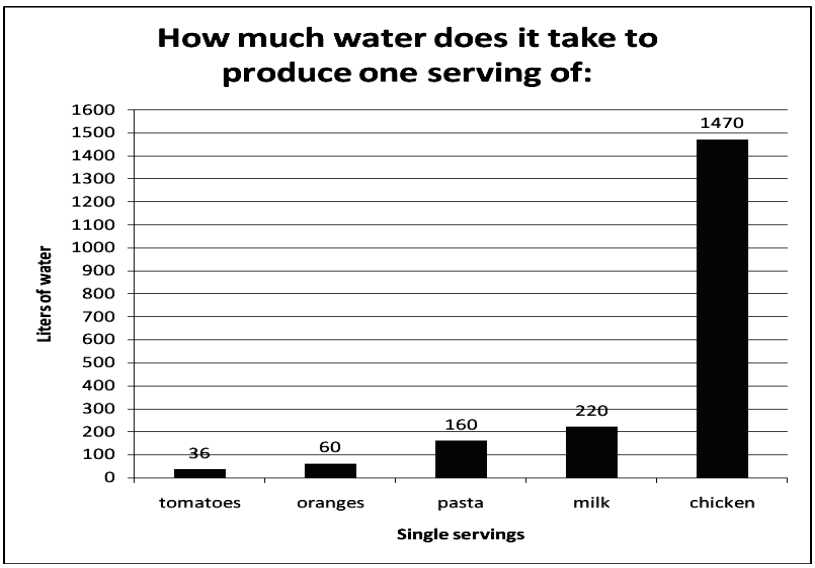
The bar graph below shows how much water (in litres) is needed to produce various foods. Use the information provided in the graph to answer the following questions (pay special attention to the **structures in bold**):

1) What takes nearly **50% more** water to produce **than** a serving of pasta?

2) What takes over **six times as much** water to produce **as** a glass of milk?

3) What takes **less** to produce **than a quarter** of the water needed to produce a serving of pasta?

4) What takes nearly **twice as much** water to produce **as** a serving of tomatoes?



GET IT RIGHT: reference to visual aids

When referring to visual aids, French-speaking learners of English very often make the following mistakes:

- *As can be seen on the graph,...**
  ➔ IN the graph/diagram/map/picture/table/...

- *There has been an increase of prices.**
  ➔ an increase/rise/decrease/drop/... IN prices/temperatures/the number of...

- *Prices have risen of 20%.**
  ➔ to increase/rise/decrease/drop/... (BY) 20%/10,000 units/$500/...

- *Prices rise in function of demand.**
  ➔ to increase/rise/decrease/drop/... AS A function of demand/time/...

Most of the sentences below contain errors. Identify and correct them.

a) *It takes twice as much more time to cook potatoes in a pressure cooker than in the microwave.*

b) *The shadow of the plane could clearly be seen on all the pictures taken at that angle.*

c) *The number of students who choose to study chemistry has dropped of about 50% in the last ten years.*

d) *Your car is three times as heavy as mine!*

e) *It can be seen on the graph that temperature increases in function of time.*

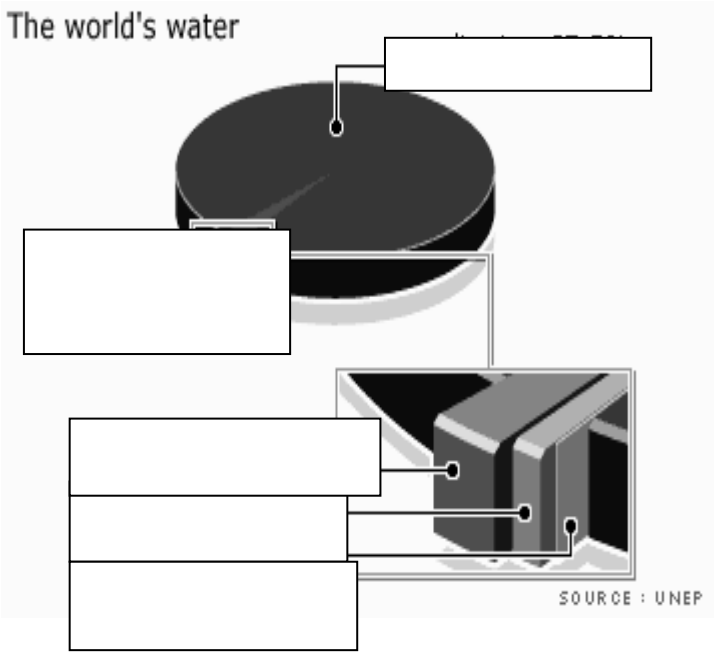
Tip

When you have to complete a diagram, a table or a graph using information from a text, you should:

1. **Study the instructions** and the diagram, table or graph.
Read any headings or labels and make sure you understand the organization.
Notice what kind of information is needed.

2. Scan the text until you find the first key topic, highlight it and read the information carefully.

Complete the graph[9] below, using information from the short paragraphs in boxes.

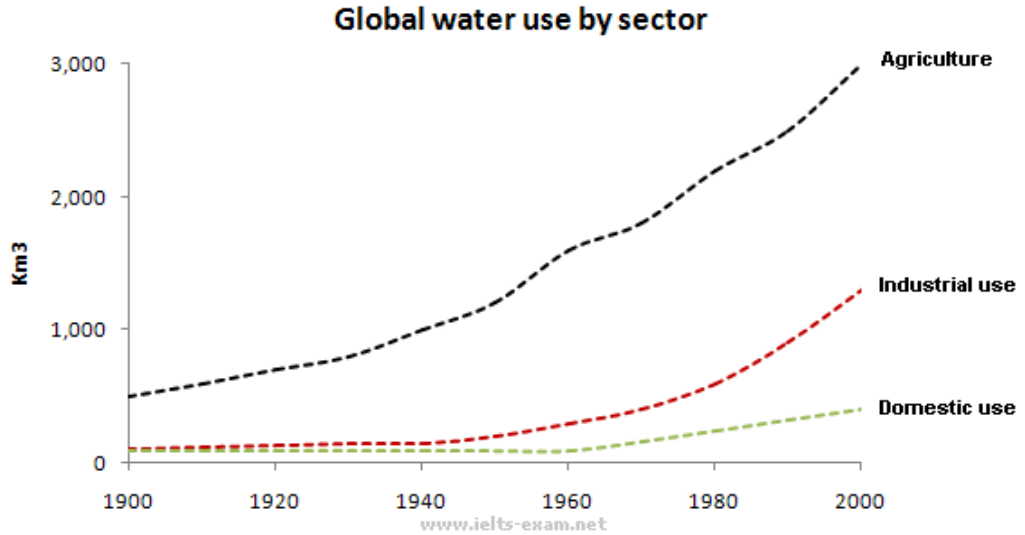


97.5% of water on the Earth is salt water, leaving only 2.5% as fresh water of which over two thirds is frozen in glaciers and polar ice caps. The remaining unfrozen freshwater is mainly found as groundwater, with only a small fraction present above ground or in the air.

[9] Source: http://news.bbc.co.uk/2/hi/science/nature/2943946.stm# (retrieved on May 5, 2008)

Look at the graph and the table and answer the questions below.[10]

The graph and table below give information about water use worldwide and water consumption in two different countries.



Water consumption in Brazil and Congo in 2000

Country	Population	Irrigated land	Water consumption per person
Brazil	176 million	26,500 km^2	359 m^3
Democratic Republic of Congo	5.2 million	100 km^2	8 m^3

1. Fill in the gaps in the following graph description with relevant prepositions.

The graph shows how the amount _____ water used worldwide changed _____ 1900 _____ 2000.

Throughout the century, the largest quantity of water was used _____ agricultural purposes, and this increased dramatically _____ about 500 km³ _____ around 3,000 km³ in the year 2000. Water used _____ the industrial and domestic sectors also increased, but consumption was minimal until mid-century. _____ 1950 onwards, industrial use grew steadily _____ just over 1,000 km³, while domestic use rose more slowly _____ only 300 km³, both far below the levels of consumption by agriculture.

The table illustrates the differences in agriculture consumption _____ some areas of the world _____ contrasting the amount _____ irrigated land in Brazil (26,500 km³) _____ that in the D.R.C. (100 km²). This means that a huge amount of water is used in agriculture in Brazil, and this is reflected _____ the figures _____ water consumption per person: 359 m³ compared with only 8 m³ in the Congo. With a population of 176 million, the figures for Brazil indicate how high agriculture water consumption can be in some countries.

2. Write further sentences describing the information contained in the graph and in the table using the following expressions:

a. population

b. an increase

c. water - more than 40 times

[10] Adapted from IELTS Sample section in http://www.ielts-exam.net (retrieved on May, 28, 2012)

4. Reading: Retrieving and classifying information

Read the text below and tick the boxes where appropriate:

	Budgerigars	Chinchillas	Gerbils	Goldfish	Guinea pigs	Hamsters	Rabbits	Spiders	Terrapins
Are nocturnal									
Can become embarassed when eating									
Can pass on disease									
Live long									
Need to bathe									
Should be kept in groups of the same origin									
Should not be separated from their life partner									
Suffer from being stroked									
Tend to bite									

TAKE ONE HOME FOR THE KIDDIES?

guardian.co.uk – June 22, 2000

Mice don't like cheese and hamsters are antisocial.

1. German researchers have established that pet hamsters are anti-social, uninquisitive animals so frightened of humans that they almost have a seizure when one comes near. After being stroked* hamsters are so stressed that they need 20 minutes to calm down. Hammy does not like to live in a cage. Hammy would prefer to live down a hole. Alone.

2. Welcome to the pet paradox. About 18m British households* own pets. They keep 7.3 m cats, 7m dogs, 1m rabbits and hundreds of thousands of small mammals and fish. The pet industry is worth $4.5bn a year, and manuals claim that pets teach children about sex, death and responsibility. So how do you explain to your children that by giving Hammy some nice fresh bedding* they are forcing him out of his environment, increasing his heart rate by 150 beats a minute and pushing him close to a coronary*?

3. Parents should start from the assumption that children do not need pets, and pets do not need children. In some cases, where a child is unhappy and lonely, pets can be an excellent help, but it is not a significant factor for child development in general. If you want a pet, plan your choice extremely carefully.

4. It is increasingly hard to find an animal up to the job in a world in which your innocent caresses are actually driving slowly your pets mad. Goldfish recognise their owners and feeders but they have hearing* so acute that a slight greeting tap on their bowl is like taking them to a rave where the bass is up full volume and then standing them next to a pneumatic drill*. Keeping goldfish in a bowl or a circular tank is just cruel. They should not swim round in circles but in a straight line at a constant speed. If they are in an empty bowl they will be unstimulated and depressed: put them in a long, rectangular tank with playthings and algae for amusement and to hide behind. Buy them in pairs and never introduce fish from a different background.

5. Likewise, chinchillas don't like sugary food, and will become diabetic if given a dog treat; they also mate for life, and if separated from their mate they will die of a broken heart. Pet spiders dread being picked up, and when caressed will shed* all the hair on their back.

6. The natural habits of common pets are often very different from what we imagine. Guinea pigs* are terribly shy and prone to die of shock if touched. Unlike hamsters, guinea pigs do like company and will feel depressed if alone. You should always pair them with another guinea pig of the same sex, or a rabbit. But they are too worried even to let their pen-mates see them eating. To place a guinea pig on a lawn, uncamouflaged, and give it a piece of apple is nerve-racking.

7. Rabbits are another minefield. They hate being handled by children. Female rabbits are prone to terrible pre-menstrual tension and will become incredibly aggressive and bite children. So you should always opt for males and buy two, as they are incredibly sociable. Rabbits need fresh air and you are doing them no favour to keep them in a shed or in the house after litter-training them. If they are kept too warm they have breathing difficulties.

8. Surprisingly, mice don't like cheese and shouldn't be fed it, because it makes them smell. Parrots crave cheese, but must not be kept in a cage or left alone as they need company. Female budgies don't sing; males do. Both get depressed when separated and should be kept in an aviary. Budgies must have a bath in their cage and be let out twice a day to fly around. The sound of a dog barking in the distance can send them mad with fear.

9. The best pets are gerbils*. They live longer lifespans than other small rodents and are active in the day. They also need very little maintenance. But gerbils are burrowers*; they must be placed in a tank with a peat* substitute and a sand mix packed tightly, so it doesn't collapse. Then create tunnels for them using clay pipes and old bricks, and children can watch them dig. The tank needs to be changed only once every few months, and gerbils should be bought in groups of four of the same litter*. Never introduce outside gerbils, even if one dies.

10. The worst pets are terrapins* and tortoises*. Terrapins grow to the size of a dinner plate and may live 30 years. They don't like being handled, they tend to bite, and they need a 2m-long tank with water changed every day. They are also notorious for passing salmonella to children. Apart from being a protected endangered species, tortoises, believe it or not, have a habit of speeding off when you are not looking.

Vocabulary

bedding: *litière*
burrower: *animal qui creuse un terrier*
coronary: heart attack
gerbil: *gerbille*
guinea pig: *cobaye*
hearing: *ouie*
household: family
litter: *portée*
peat*: tourbe*
pneumatic drill: *marteau piqueur*
shed: *abri, cabane, remis*
shed: *perdre (poils, feuilles,...)*
stroke: caress
terrapin: *tortue d'eau douce*
tortoise: *tortue (de terre)*

Vocabulary Tips

Species, *series* and *means* have the same singular and plural forms while *people*, *police* and *cattle* are always regarded plural.

Sheep does never take –s in the plural. The normal plural form of fish is *fish*. Finally, *foot*, *tooth* and *goose* do *feet*, *teeth* and *geese* respectively while *mouse* and *louse* do *mice* and *lice*.

Except for *lamb*, which is the word both for a young sheep and for its meat, there is a special word for the flesh of an animal regarded as food, which is different from the name of that animal when it is alive:

living animal	dead animal / meat
calf	*veal*
ox	*beef*
pig	*pork*
sheep	*mutton*

5. Language: Expressing advice and instructions

Rewrite the following sentences using suitable modal verbs. Use a passive form whenever possible.

Example: *Never give chinchillas sugary food.* → *Chinchillas must never be given sugary food.*

1. It is essential to keep goldfish in a large rectangular tank.
2. It's not a good idea to take guinea pigs for a walk.
3. Never put gerbils of different litters in the same tank.
4. The advice is that only unhappy children keep pets.
5. It is not a good idea to buy your little daughter a pet spider.
6. Remember to reinforce your dog's good behaviour with attention and praise.
7. Never force a cat to interact - they like to feel in control.
8. It is essential to provide guinea pigs with a log to gnaw to help keep their teeth short.

6. Listening (note-taking) and writing (expanding a definition)

1. In pairs, think of how you could define the term "biodiversity" and write down your draft definition.

2. Watch the short movie on biodiversity[11] and take notes so as to have enough material to possibly correct your definition. Be ready to explain it orally.

Going further: take notes so as to expand your own definition in writing.

3. Going further: rephrase and expand your initial definition with the information given in the video. Organize your writing in paragraphs. Don't forget to use linking words!

⚠ *Online test 2*

See *Introduction* for further instructions and *Calendar* for deadlines.

> **Online tests** are **compulsory**. They will be marked, students will receive individual feedback, and they will be taken into account in the final grade (See *Introduction*).

[11] available at http://www.thewildclassroom.com/home/ecogeeksvideos/biodiversity.html (retrieved on May, 28th, 2012)

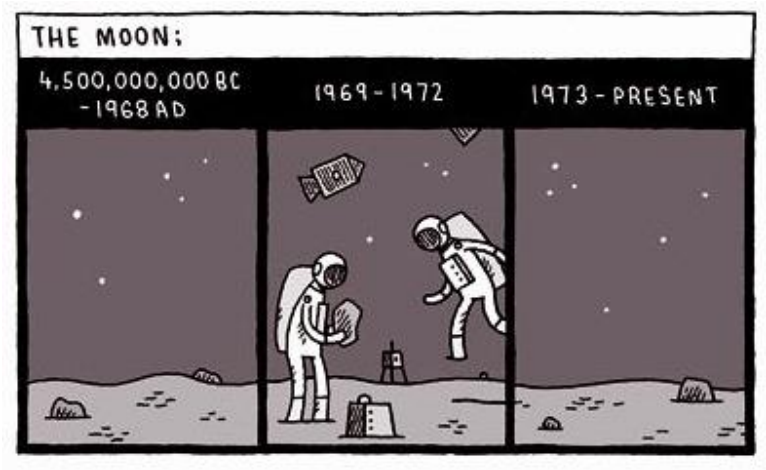
Unit Vocabulary

acute	*aigu*
all the same	*tout de même, néanmoins*
ape	*singe (grand singe)*
assumption	*supposition*
at constant speed	*à vitesse constante*
aviary	*volière*
awareness	*conscience*
be born	*naître*
bee	*abeille*
belong to	*appartenir à*
bite	*piqûre, morsure, bouchée*
-borne (eg *water-borne, mosquito-borne*)	*transporté par ….*
budgerigar = budgie	*perruche*
burrow	*terrier*
calf (>< veal)	*veau (vivant) >< (viande de) veau*
consumption	*consommation*
cow (> mad-cow disease)	*vache (> maladie de la vache folle)*
cure = remedy	*remède*
disease	*maladie*
donate (*blood* …)	*donner (du sang …), faire don de*
drinking (water)	*potable (eau)*
drop	*chuter, laisser tomber*
edible	*comestible*
explain **TO** sb	*expliquer **à** qn*
eyesight (< eye)	*vue (< oeil)*
fancier	*amateur*
feed (> to feed on)	*nourrir (> se nourrir de)*
finite	*limité*
fit	*en pleine forme*
forerunner = pioneer	*précurseur = pionnier*
full-grown = adult = mature	*adulte*
halt = stop	*arrêter*
hearing (< ear)	*ouïe (< oreille)*
household	*ménage*
huge	*énorme*
hurricane	*ouragan*
inquisitive	*curieux*
issue	*problem, question*
mammal	*mammifère*
mankind = humankind	*humanité*
millennium (pl. Millennia)	*millénaire*
mind (> to my mind)	*esprit (> à mon avis)*
misconception	*idée fausse*
mouse (pl. mice)	*souris*
nest	*nid*
on average	*en moyenne*
outperform (cf. *outplay, outscore* …)	*faire mieux (cf. jouer mieux, marquer plus …)*
own *(> dog owners*)	*Posséder (> propiétaires de chiens)*
ox (>< beef)	*bœuf (vivant) >< (viande de) boeuf*

parrot	*perroquet*
pay attention to	*faire attention à*
prone to (do) sth	*prédisposé, enclin à*
pet (household pet)	*animal domestique*
pregnant	*enceinte, pleine*
prospect	*perspective*
raise = rear (*animals, children)*	*élever*
rate (> birth rate)	*taux (> taux de natalité)*
relinquish	*abandonner*
requirement	*besoin*
responsible FOR sth	*responsable de qch*
rodent (e.g. *hamster, guinea pig* …)	*rongeur (ex. hamster, cobaye …)*
roughly = approximately	*environ*
scheme	*1. plan, projet - 2. classification, arrangement*
seizure	*crise, attaque*
shortage	*manque*
skill	*compétence, savoir-faire*
smell (< nose)	*odorat (< nez)*
so-called	*prétendu, soi-disant*
spinal cord	*moelle épinière*
stroke = caress	*caresser*
surrogate (> surrogate mother)	*de remplacement (> mère porteuse)*
tank (> fish tank)	*réservoir, cuve (> aquarium)*
tap	*robinet*
target	*cible*
taste (< tongue)	*goût (< langue)*
terrapin (>< tortoise)	*tortue d'eau douce (>< tortue de terre)*
touch (< skin)	*toucher (< peau)*
waste	*déchet, gaspillage*
wetlands	*marécages*
worm	*ver*

UNIT 5: Space – The Final Frontier

1. Lead-in: Space and space exploration



Explain the political context of the above cartoon (political background vs. scientific breakthrough).

How do you understand this metaphor? Share your personal opinion with the class.

Name the 8 planets of our solar system. What happened to the ninth planet?

Do this quiz in pairs.

– Of the eight planets of the solar system, which is the largest, Jupiter, Uranus or Saturn?

– Which is closer to the Sun, Venus or Mercury?

– Which country sent the first man to space, the USA, the Soviet Union or China?

– Which event was watched on television by one-third of the world's population?

– Unmanned spacecraft have landed on two planets. Which ones?

– What is the longest anyone has ever been in space without returning to Earth?
Is it a bit more than 220, 430 or 800 days?

– When and on which space mission was the first untethered spacewalk successfully completed? In 1969 on Apollo 11, in 1984 on Shuttle Challenger, or in 1995 on Mir?

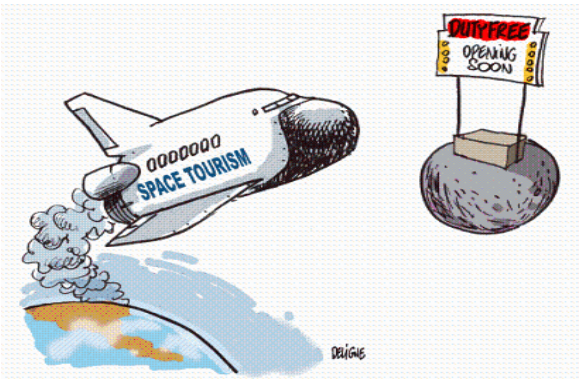
– What is a light-year?

– Have you ever heard of the term "space junk"? What does it mean?

<u>Discuss the following questions in pairs.</u>

– Some people say that space exploration is a waste of money which could be spent on more immediately useful projects on earth. Do you agree or not? If so, how do you think the money should be spent?

– How do you feel about the idea that people may soon be living in colonies in space? Would you like to be one of the pioneers? Why/Why not?



2. Reading: Close reading

The future of Nasa: what's next for the agency, its robots and its plans to get to Mars

By **Martin Rees** – www.wired.co.uk - 2016

1. I was born in 1942 and my generation followed the heroic exploits of space exploration. The first orbital flight, the first spacewalk, the iconic picture Earthrise taken by William Anders from Apollo 8, and of course the Moon landings. And the near-disaster of Apollo 13 reminded us how great the risks were - and the dependence on technology that was primitive by today's standards.

I. Connect the events from paragraph 1 with the pictures in the table below:

1) 	
2) 	
3) 	
4) 	
5) 	

2. Only 12 years elapsed between the first Sputnik and Neil Armstrong's "one small step". And this **was – had been – has been - is** a long time ago - in 1969. Had that momentum been maintained, there would surely be footprints on Mars by now: that's what our generation expected. **Despite - But – Although- Whenever** the Apollo programme was a "space race" against the Russians. Once that race was won, there was no motive for continuing massive expenditure.

3. It's nearly 45 years since Apollo 17, the last lunar mission, **returned – has returned – had returned – has been returning** to Earth. **Today young people - Today's young people – The young people of today – Today's youngs** know the Americans landed men on the Moon. They know the Egyptians built pyramids. But both seem ancient history, motivated by almost equally bizarre national goals.

4. Hundreds more **ventured – venture - have ventured - had ventured** into space in the ensuing decades - but, anticlimactically, they have done no more than circle the Earth in a space station. The International Space Station (ISS) is probably **the more expensive** - **the most expensive – the expensivest –most expensive** artefact ever constructed. Its cost, plus that of the shuttles that until recently serviced it, ran well into 12 figures.

5.The scientific and technical pay-off hasn't been negligible, but it's been immensely less cost-effective than unmanned missions. Nor are these voyages inspiring in the way that the pioneering Russian and US space exploits were. The ISS only makes news when something goes wrong - when the loo fails, for instance - or when astronauts perform "stunts", **- i.e. - such as – by example – that is to say** the Canadian Chris Hadfield's guitar-playing and singing.

II. Are the following statements true or false?

a) The reason why nobody has walked on Mars so far is because the government had to cut the funding. Space programs were simply too expensive.

b) Hundreds of people have walked the Moon since 1969.

c) The shuttles that travel to the ISS are more expensive than the space station itself.

d) Unmanned missions are more cost-effective than missions with a human crew.

e) It can be inferred that the ISS has been rather useless in terms of scientific pay-off.

f) The author claims that the only news we get from the ISS is about frivolous anecdotes.

III. What is considered anticlimactic? Why has that term been used?

6. Space technology has of course burgeoned: we depend **to – about – on - of** satellites for communication, satnav, environmental monitoring, and weather forecasting - some of these satellites are large, but there is a growing market for cheap miniaturised ones. Telescopes have beamed back data from the remotest parts of the cosmos; **spacecrafts – spacecraft – spacecraft's - spacecraftes** have journeyed to all the planets of our solar system.

7. Nasa's New Horizons probe beamed back amazing pictures from Pluto, 10,000 times **more far - farther – farthest – more** farther away than the Moon. And the European Space Agency's Rosetta has landed a robot on a comet. These spacecraft took five years to design and build, and then ten years journeying to their remote targets. We're aware how mobile phones **–are changing – changed - have changed - change** in the last 15 years - so imagine how much more sophisticated today's follow-ups to these missions could be.

8. During this century, the entire Solar System - planets, moons and asteroids – **will be exploring –will have explored - will be explored – will explore** and mapped by flotillas of tiny robotic craft. The next step would be space mining and fabrication. (And fabrication in space will be a better use of materials mined from asteroids than bringing them back to Earth). **All – Every – Some - Most** man-made object currently in orbit has had to be launched from Earth. But later this century, giant robotic fabricators will be able to construct, in space, huge solar-energy collectors and other artefacts. The Hubble Space Telescope's successors, with huge gossamer-thin mirrors assembled under zero gravity, will further expand our vision of stars, galaxies and the wider cosmos.

9. It is robots, and not humans, that will build giant artefacts in space, and explore the outer planets. Moreover, these robots won't be humanoid in size and shape. Humans are adapted to the Earth's environment. Something more spider-like would be better suited to the **weakest - weaker - more weak – more weaker** gravity of Pluto or the asteroids. But what role will humans play? There's no denying that Nasa's Curiosity, now trundling across Martian craters, may miss startling discoveries that no human geologist could overlook. But machine learning is advancing fast, as is sensor technology, **despite -whereas – however – because** the cost gap between manned and unmanned missions remains huge. The practical need for manned space flight gets ever weaker with each advance made in robots and miniaturization.

IV. Find synonyms for the following words in the paragraphs above:

a) to increase, multiply, proliferate:

b) to watch, keep track of something:

c) distant, far away:

d) to create, conceive, plan out:

e) to travel:

f) man-made or artificial object:

g) to roll:

h) to miss, to ignore:

i) device that responds to a physical stimulus:

V. What are the author's predictions for this century? Do you agree with him?

VI. According to the article, will robots similar to C-3PO one day build giant artefacts in space? Explain.

VII. What is the author's position towards the need for manned missions in the future? Will geologists still be essential? Explain and discuss.

10. **Nonetheless – Although – Despite – Whereas**, I hope that some people now living will walk on Mars - as an adventure, and as a step towards the stars. But Nasa will confront political obstacles in achieving this goal within budget. The American public is risk-averse. The Shuttle's two catastrophic accidents (out of nearly 140 launches) were national traumas in the US - each **lead – leads - led – leaded** to a three-year stalling of the programme as near-futile attempts **have made - were made - been made – were making** to ensure even greater safety. The US public regarded a two per cent risk as unacceptable.

11. That's why I think the best future for Nasa is to share expertise and collaborate with outfits like SpaceX and Blue Origin - indeed, to let the private sector "front" the missions. These private ventures can tolerate higher risks than a western government could impose on publicly funded civilians; they can thereby cut costs compared to Nasa (or the ESA). There would, **nonetheless even though – despite - furthermore**, be many volunteers - accepting high risks and perhaps even "one-way tickets" - driven by the same motives as early explorers, mountaineers and the like. These opportunities should be promoted as adventures or extreme sports - the phrase "space tourism" should be avoided. It lulls people into unrealistic confidence.

VIII. Should space missions be financed by the government or by private companies? What is the author's position? Do you agree with him?

12. By 2100, courageous pioneers in the mould of (say) Felix Baumgartner, who broke the sound barrier in free fall from a high-altitude balloon (or Sir Ranulph Fiennes, who, among many feats, dragged a sledge to the South Pole in the Antarctic winter), may have established "bases" independent from the Earth - on Mars, or maybe on asteroids. Elon Musk (aged 45) says he wants to die on Mars - but not on impact. Development of self-sustaining communities remote from the Earth would also ensure that advanced life would survive, even if the worst conceivable catastrophe befell our planet. But don't expect mass emigration from Earth. Nowhere offers an environment even as clement as the Antarctic or the top of Everest. It's a dangerous delusion to think that space offers an escape from Earth's problems. There's no "Planet B".

IX. What kind of space projects are expected in a medium term future? Do you think they are feasible and worthwhile? Why doesn't the author expect any mass emigration from earth?

13. Indeed, space is an inherently hostile environment to which humans are ill-adapted. For that reason, even though we may wish to regulate genetic and cyborg technology on Earth, we should surely wish the space pioneers good luck in using all such techniques to adapt to different atmospheres, different g forces, and so forth. This might be the first step towards divergence into a new species: the beginning of the post-human era.

X. What is the author's view on genetic and cyborg technology?

14. To find an environment as clement as our Earth, we need to look far beyond the solar system to the exoplanets orbiting other stars. But the transit time to other stars, using known technology, exceeds a human lifetime. And it will remain so even if futuristic forms of propulsion can be developed and deployed - involving nuclear power, matter-antimatter annihilation, or pressure from giant laser beams.

15. Interstellar travel (except for unmanned probes, DNA samples, and so on) is therefore an enterprise for post-humans. They could be organic creatures (or cyborgs) which had won the battle with death, or perfected the techniques of hibernation or suspended animation. A journey lasting thousands of years is a doddle if you are near-immortal and are not constrained to a human lifespan.

16. There must be chemical and metabolic limits to the size and processing power of "wet" organic brains. Maybe we're close to these already. But fewer limits constrain electronic computers (still less, perhaps, quantum computers). And there's no limit to how widely such machines could spread. Earth's biosphere, in which organic life has symbiotically evolved, is not essential sustenance for advanced AI. Indeed, it is far from optimal: interplanetary and interstellar space, a hostile environment for humans, will be the preferred arena where non-biological "brains" may, in the distant future, far surpass human capabilities.

XI. Explain the concept of "post-humans". What are concrete examples mentioned in the article? How do you feel about it?

XII. Find the words corresponding to the definitions below (§12-16)

a) pleasant, not severe:

b) difficult or not suitable for living or growing:

c) something difficult needing a lot of skill, strength, courage, etc. to achieve it:

d) belief in something that is not true:

e) a planet of a star that is outside the solar system:

f) complete destruction or obliteration:

g) an act of travelling from one place to another:

h) a very easy task:

i) the length of time for which a person or animal lives or a thing functions:

j) to restrict the activity or extent of something:

k) to become distributed over a large or larger area:

l) the maintaining of someone or something in life or existence:

3. Speaking

1. Make **groups of six** plus an adjudicator.
2. Each group chooses one **topic** (see topics below).
3. Each group divides into **two teams of three.**
4. Each sub-team chooses **a side** (in favor or against the chosen topic).
5. In teams, **brainstorm arguments** that support your position.
6. Divide these arguments between the **speakers**.
7. Each speaker has a **time limit** of two minutes.
8. Start the debate with the **first speaker in favor of the chosen topic.**
9. **Alternate** between the two teams.
10. The adjudicator **sums up** the main ideas at the end of the debate.

Topics:

- *Manned missions to the moon were a waste of money.*

- *Colonizing other planets will never be possible.*

- *We had better preserve and improve our planet rather than spending huge amounts of money on useless space exploration. There isn't anything interesting out there.*

4. Language: Comparing & contrasting

Comparing and contrasting are means of describing the similarities and differences between ideas, systems or components. They are often used together. Here are the main markers.

Comparison	Contrast
Adverbials Likewise, … Similarly, … In the same way, … also as well both … and … In / By comparison, … Equally important, …	**Adverbials** Alternatively, … Instead, … All the same, … Even so, … On the contrary, … By contrast, … On the other hand, … Otherwise, … Conversely, … However, … Nevertheless, …
Prepositions In comparison with … Compared / Comparing with … Like … As … in common with … (n)either …(n)or …	**Prepositions** In spite of / despite … For all … Unlike … In opposition to … In contrast to … Contrary to …
Conjunctions As … Like … As if / As though …	**Conjunctions** Though / Although / Even though … While / Whereas … No matter what/where/when/ etc. Yet / and yet, …

1. Look at the connectors used and, if necessary, correct the following sentences.

a) Despite they had a set of rules to follow, most students were not able to balance their REDOX equations.

b) Even though following the guidelines, most students failed to balance the REDOX equations.

c) The students had paid attention in class. And yet, most of them were not able to balance the REDOX equations.

d) The students were taught the accounting method to keep track of electrons during a chemical reaction. After, they had to balance a series of REDOX equations.

2. Complete with words from the table above.

a) _____ Mars is much smaller than Earth, its surface area is about the same as the land surface area of Earth.

b) _____ Venus being Earth's near twin in terms of its mass and radius, the planet's surface is far from friendly and perhaps represents "the most hostile planetary environment ever explored by robotic spacecraft."

c) _____ Saturn's, Jupiter's rings are dark and seem to contain no ice.

d) _____ what a lot of people think, some experiments show that water can exist in liquid form on the surface of Mars.

e) _____ Earth, Venus looks like a word out of a horror movie, with a dense atmosphere composed mostly of carbon dioxide and sulfuric acid that create a runaway green house effect, which heats up the surface to more than 475 degrees Celsius.

f) _____ it is one and a half times further away from the Sun than Uranus, Neptune is practically the same temperature. But _____ Uranus, which doesn't have any real weather, Neptune has clouds and storms.

g) There is no solid surface on Jupiter; _____, the surface consists of a dense atmosphere topped with a layer of colourful clouds about 100 kilometres thick.

h) The Martian year lasts 687 days _____ that on earth only lasts 365 days.

i) Mars is famous for its reddish colour. _____, Saturn is probably best known for its planetary rings, which make it one of the most visually remarkable objects in the solar system.

j) _____ Mercury and Venus have orbits that lie within that of the Earth, and as a consequence they are known as the 'inferior' planets.

3. Make 3 sentences using different connectors (adverbials, prepositions and conjunctions)

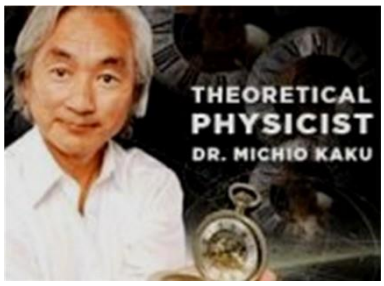
-

-

-

5. Listening and note-taking

You are about to see a video (http://www.youtube.com/watch?v=sYYdh84pFng) with Michio Kaku, a renowned American theoretical physicist who speaks about the space elevator project.



What do you imagine under the term "space elevator"?

Have you ever heard of it?

Do you think it is feasible or rather a science fiction dream?

In your opinion, what is the main problem with "traditional" space travel?

Share your opinion with the class and check if you were right by listening to the documentary.

Listen to the recording (2x) and answer the questions or fill in the gaps with the missing words.

1) The main problem with space travel _____. To put you into orbit _____ _____.

2) What happens once you are outside the first 100 miles?

_____

3) Explain the concept of "space elevator" in your own words.

_____

4) What makes this project achievable in a near future? Explain.

_____

5) What is graphene? What are its properties?

_____

_____

6) What is the practical problem engineers have to face with graphene?

_____

7) How does Kaku concretely intend to put up a space elevator?

_____

_____

What do you think of this project? Would you invest in it if you had a lot of money? Why?/Why not?

Read the article about the space elevator on http://science.howstuffworks.com/space-elevator.htm at home and take some notes about further technical details and concrete advantages of the space elevator in order to share them with the class next week.

Complete the following description of how a space elevator works with the correct forms of the verbs below.

allow - attach - carry - consist of - keep - make of - place - prevent - use

A space elevator is a device _____ for transporting payloads into space. It _____ a sea platform, a long cable _____ carbon nanotubes and a small counterweight approximately 62,000 miles into space. Mechanical lifters then climb the cable, _____ cargo and humans into space at a price of only about $100 to $400 per pound. The counterweight spins around the Earth, _____ the cable straight and _____ the robotic lifters to ride up and down the ribbon.

To better understand the concept of a space elevator, we can think of the game tetherball in which a rope _____ at one end to a pole and at the other to a ball. In this analogy, the rope is the carbon nanotubes composite ribbon, the pole is the Earth and the ball is the counterweight. Now, let's imagine the ball _____ in perpetual spin around the pole, so fast that it _____ it from slackening. This is the general idea of the space elevator.

USEFUL LANGUAGE

Function

A tool	*which allows / enables … to + infinitive*
A device	*(which is) used for + -ing*
A system	*which prevents / stops … from + -ing*

Structure

It consists of …
It (is) shaped like … / (is) made of … / (is) divided into …
The … is / are connected to … by…

Choose <u>three</u> of the following words and define them properly:

- *probe*
- *heliocentric*
- *water*
- *meteorite*
- *space suit*
- *atmosphere*

1. _____
_____
_____

2. _____
_____
_____

3. _____
_____
_____

6. Reading

***Pre-reading activity**: Read the title of the article and discuss the issue of space property. Is it possible to own/buy property in space? What regulations should apply?*

Space property: who owns it?

By SEAN BLAIR – sciencefocus.com – 2012

Technological advances mean the vast resources in space will soon be within our grasp. But who will get the rights to the resources and, as Sean Blair asks, can you even own a piece of outer space?

1. This August, a mission to the Moon will set off – by balloon. A team of Romanian space enthusiasts plans to lift a three-stage rocket to 18km (11 miles) off the ground before it fires, blasting an unmanned spacecraft towards the lunar surface in a bid to win the Google Lunar X Prize. And they're not alone. Worldwide, 25 teams are registered in this competition to be the first to send a craft to the Moon to send back images and other data.

2. Amateur clubs, university departments and multi-million pound companies have all signed up to take part in the Lunar X Prize, hoping to claim a share of the $30 million prize fund. But ultimately, their goal is to check out the resources on the Moon; a goal that would pave the way for those resources to be exploited.

Official involvement

3. Governments are joining in too. China's Chang'e-3 rover will touch down in the Bay of Rainbows in 2013, in a likely neck-and-neck race with India's Chandrayaan-2 rover. As for the 1960s Moon race rivals, the US is dispatching a lunar orbiter in 2013 and Russia is assisting India with a lunar landing. Next year it will send its own lander too. The European Space Agency is also planning on sending its own lunar lander to the Moon's South Pole in 2020.

4. So the second Moon race is under way. But this time, resources are the reward: reaching them, claiming them and making money from them. There's only one problem: right now, no one is sure if it's legally possible to own anything in space.

Stake your claim

5. Lawyers have been debating the concept of space property ownership for 40 years. But now, as new technology means that exploiting the Solar System's resources is becoming a distinct possibility, this once purely academic issue begins to have real-world implications.

6. "If you were writing a space law textbook it'd have 20 pages of facts and 180 pages of question marks," says Chris Newman, senior law lecturer at Sunderland University. "So many issues haven't even been considered – it's like the internet 25 years ago. That's bound to change however, because commercial companies entering space will require a legal framework."

7. What framework there is today comes mainly from the Outer Space Treaty drawn up by the United Nations in 1967. "It's the Magna Carta of space, from which all future laws are likely to develop," says Newman. Negotiated during the race to the Moon, the Treaty headed off territorial disputes by excluding outer space and celestial bodies from all 'national appropriation'. But, reflecting its time, no mention was made of individuals or private companies.

8. This loophole permits private property in space: so goes the argument of US entrepreneur Dennis Hope. He filed a claim for the entire Solar System in 1980, going on to earn millions by selling lots on the Moon, Mars and Venus online. Hope's claim is contested by many, however, including businessman Greg Nimitz, who asserted ownership of asteroid 433 Eros in advance of a NASA probe landing on it in 2001. "Individuals have the inherent right to claim un-owned things, without the interference of governments," says Nimitz.

9. "Ownership is part of human nature. Even more, it's part of life; even some birds want to own coloured and glittering pebbles," agrees space-law specialist Virgiliu Pop, author of Unreal Estate and Who Owns the Moon? "But claiming doesn't mean owning: I can claim to be Angelina Jolie's boyfriend. A claim is just that, nothing more. Registering the claim does nothing more than certify it being made."

10. In 2002, Romanian-born Pop claimed ownership of the Sun with an online register, jokingly threatening to bill Hope, Nimitz and other extraterrestrial property 'owners' for using his sunlight.

11. Typically, to legally own something, simply expressing the intention to own it, or 'animus', is not enough; 'corpus', or actual possession, is also required. It's where the phrase 'possession is nine tenths of the law' comes from. "Land a probe there, with the intention to claim property, and one has both," says Pop. Here on Earth, the idea of placing some of your stuff over what you want to claim has already proved its worth. In 1989 a remote-controlled robot established a claim in international waters on behalf of a US firm. There was no flag-planting and no human presence on the ocean floor was required, the District Court in Virginia ruled.

Your own acre

12. Hawaii-based publisher Steve Durst would like to do something similar in space. Durst is marshaling Silicon Valley tycoons to back a private Moon lander called the International Lunar Observatory (ILO). Its target will be the lunar south pole and its aim is to earn revenue from science observations and communications relays for other landers. "The ILO will also advance the cause of multi-world property rights," says Durst. "Its four landing legs will have people's initials etched onto their bases, so that each person can claim a lunar acre. We're still deciding how many initials to include – one set per leg for simplicity, or divide each leg into quadrants, or even split them 360 ways. We chose acres as our unit because there are about 10 million acres on the Moon, not counting crater slopes – enough, theoretically, for everyone to get their own."

13. Durst aims to kick-start debate. Many in the emerging commercial spaceflight community believe private property rights are essential for space development. "Investors want to know they won't be kicked off something they invest in," says Brad Blair of the Space Studies Institute, a group researching space colonisation techniques with a base in Mojave, California.

14. While the deep-sea property claims here on Earth appears to show that possession will be sufficient, we're still to discover exactly what will happen when someone lands a craft on a celestial body with the intention of claiming it, or at least part of it. There are some who believe that regardless of what's happened on Earth, you simply can't own something in space. "For us it is clear that private property rights over parts of outer space are not permitted," says Tanja Masson-Zwaan, President of the International Institute of Space Law. "There is no consensus on property rights in space, as there will always be people who continue to challenge what the law says."

15. Right now, the only private individual with undisputed lunar property is the UK-born videogame developer and space tourist Richard Garriott. He bought Russia's Lunokhod-2 rover at auction in 1993. The Outer Space Treaty specifies that man-made objects retain ownership status and, as Garriott wrote last year: "At the least I might be able to make some claim to the land beneath it, if not even more territory."

Off-world ownership

16. In 1979, the UN passed the Moon Treaty, which closed all loopholes in the Outer Space Treaty by banning private property claims altogether. But this was a step too far for most nations. "None of the space-going powers ratified this treaty and few other countries did either. It's basically ignored today," says Newman.

17. But, there's one fundamental question: is there anything worth owning in space anyway? One space resource already contributes billions to the terrestrial economy: geostationary orbit. It's the point in

space directly above the equator where a satellite orbits at the same rate as the Earth turns, so it appears fixed in one position.

18. It allows a fixed antenna to maintain a link with a satellite. Access to this highly sought after bit of space is regulated by the International Telecommunication Union (ITU). No one owns an area of space, they're simply assigned separate 0.1° 'slots' (about 70km wide). The system has worked well for decades, illustrating one point emphasised by Masson-Zwaan: "Ownership isn't needed to carry out activities in outer space, just as mining rights can be exercised without owning the land in question."

19. But ownership has been claimed for geostationary orbit. In 1976, a declaration made by various equatorial nations, known as the Bogotá Declaration, stated that the orbit was an extension of their national airspace. Non-equatorial countries were sceptical, however.

20. Further out, the Moon has the equivalent area of North and South America combined, with concentrations of precious metals including aluminium, titanium, platinum and rare earth elements. Apollo 17 astronaut Harrison Schmitt champions mining for Helium-3, a rare isotope enabling clean nuclear fusion. On Earth, Helium-3 can only be acquired by dismantling nuclear weapons. But a Shuttle bay filled with the stuff could power the US for a year. "In the short term, the main market for these resources will be people already in space," says Professor John S Lewis of the University of Arizona's Lunar and Planetary Laboratory, author of Mining The Sky.

Reading comprehension activities on the text

1. What is the "Lunar X" project? What is the prize (≠price) and what is its ultimate goal?

2. Decide whether the following statements are true or false:

   - The first law on space property was edicted 40 years ago.
   - Nations and private companies cannot own celestial bodies in space.
   - A 200-page space law textbook already exists.

3. Why is space compared to the Internet in §6?

4. What is a "loophole" (§8)?

5. Can we say that Dennis Hope is the legal owner of the entire solar system? Explain and discuss the information presented in the article.

6. Read paragraphs 12 and 13 and explain Steve Durst's project in your own words. Do you think what he does is legitimate?

7. Sum up the main idea of §14.

8. "Richard Garriot claims to own some land on the moon but his property is not legitimate." Is that statement true or false?

9. Skim paragraphs 16 to 20 and be prepared to answer your teacher's questions about the keywords below.

   - The Moon Treaty
   - Geostationary orbit
   - Space resources

7. Writing

"Ownership is part of human nature. Even more, it's part of life; even some birds want to own coloured and glittering pebbles." Virgiliu Pop, space law specialist

"Private property rights are essential for space development." Steve Durst

Discuss one of these quotes in 100 to 150 words. Organise and structure your ideas into paragraphs and use the linking words from section 4.

⚠ *In-class test 2: Defining, comparing and contrasting.*

Unit Vocabulary

glimpse (n.)	*aperçu*
tantalizing (adj.)	*séduisant, tentant*
hospitable (adj.)	*accueillant, favorable, hospitalier*
eventually (adv.)	*finally, in the end*
probe (n./v.)	*sonde/ sonder*
evidence (n. UC)	*des preuves*
drill (v.)	*forer*
payload (n.)	*charge, cargo*
glitch (n.)	*problème, bug*
dwarf (v.)	*to cause to appear smaller or to seem inferior*
hazy (adj.)	*brumeux, trouble*
setback (n.)	*revers, contretemps, recul passager*
kick off (v.)	*démarrer, commencer*
sufficient (adj.)	*suffisant*
celestial body (n.)	*corps céleste*
challenge (n./v.)	*défi, défier*
sustaining (adj.)	*durable*
emphasize (v.)	*accentuer, souligner*
lair (n.)	*tanière*
solar flare (n.)	*éruption solaire*
payload (n.)	*charge/ capacité de charge*
assume (v.)	*supposer*
wonder (v.)	*se demander*
astronaut (n.)	*astronaute*
spacecraft (n./ pl. : spacecraft)	*vaisseau spatial*
geosynchronous (adj.)	*géosynchrone*
counterweight (n.)	*contrepoids*
pole (n.)	*pylône, poteau*
prevent sth/sb from –ing sth (v.)	*empêcher qqch/qqun de faire qqch*
bid (n.)	*offre, enchère*
rover (n.)	*astromobile*
reward (n. / v.)	*récompense, récompenser*
assert (v.)	*affirmer, soutenir*
outer space (n.)	*l'espace extra atmosphérique*

target (n./v.)	*cible, cibler*
issue (n.)	*problème, question*
affordable (adj.)	*abordable (financièrement)*
beam (n.)	*rayon, faisceau*
information (n. U)	*information(s)*
propel (v.)	*propulser*
spot (n.)	*endroit*
stay (n.)	*séjour*
unmanned (adj.)	*sans équipage*
vacuum (n.)	*le vide*
vessel (n.)	*vaisseau*
weigh (v.)	*peser*
weight (n.)	*poids*
research (to do/carry out research into/on sth)	*recherche(s) (faire des recherches sur qqch)*
researcher (n.)	*chercheur*
so far (adv.)	*jusqu'à présent*
foreseeable (adj.)	*prévisible*
fuel (n.)	*carburant*
vehicle (n.)	*véhicule*
waste (n.)	*gaspillage*
release (v.)	*libérer, dégager*

UNIT 6: The Future of Science

1. Lead-in: Categorizing/describing inventions

1. Have a look at the cartoons below. Describe them and discuss the issues that are presented.

"Uh-oh, Darling, I think we've really overslept."

2. Now discuss the following questions:

a) Do you think there are any limits to technological advances?

b) Do you think the human species will keep evolving? In what ways? Can you think of some possible new features that could appear or current features that could disappear?

c) Do you think technological evolution has brought only positive aspects? Can you think of some negative aspects or potential dangers?

3. List some inventions from the 20th century. Put them in categories and say how they have been evolving up to now.

4. Take the same categories and say whether the evolution will continue or not. Can you think up some other possible inventions that do not exist yet and that could match these categories?

2. Language: Describing an object

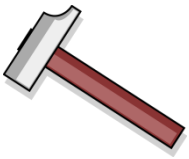
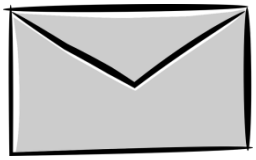
When describing an object or a material, think about its key aspects: not only its size, shape or colour, but also *what it's made of* or *how it's used*.

> **Tip**: Use the pattern: CLASS WORD + specific features. (See also Unit 1.)
>
> *- A battery is a device consisting of one or more cells, in which chemical energy is converted into electricity and used as a source of power.*
>
> *- A brake is a device for slowing down or stopping a vehicle, typically by applying pressure on the wheels.*
>
> *- An engine is a machine with moving parts that converts power into motion.*

1. Complete the definitions below with suitable words.

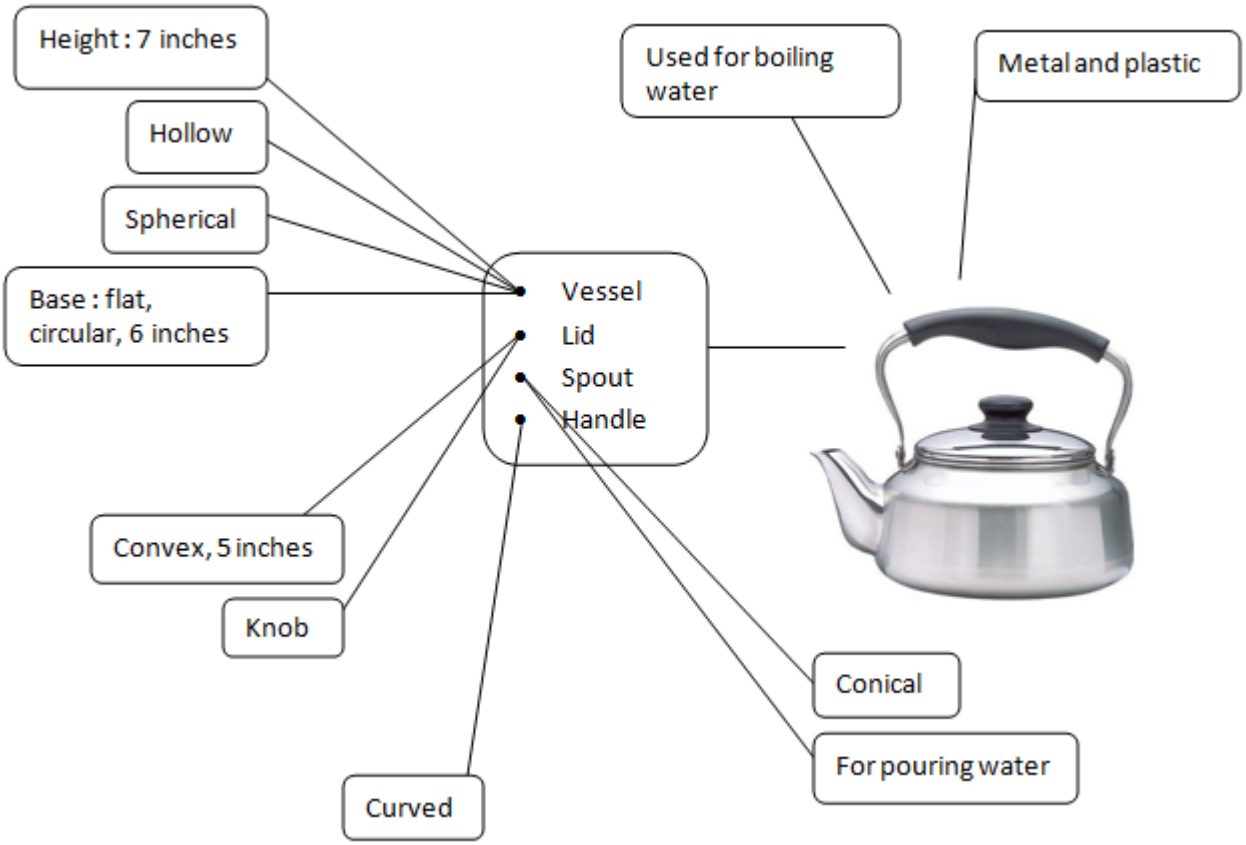
- A mirror is a reflective _____, now typically of _____ coated with metal, which reflects a clear _____.
- Glue: adhesive _____ used for sticking objects or _____ together.
- A car is a road _____ with an _____ and four _____ that is used to carry a small number of _____.
- A computer is an electronic _____ that can _____, organize and find _____, do calculations and control other _____.
- A television is a piece of electrical _____ with a _____ on which you can _____ programmes with moving _____ and sounds.
- A pressure cooker is a strong _____ pot with a tight _____, that _____ food quickly by _____ under high _____.

2. Describe the objects below using the words in brackets.

-  (break – hammer – handle – head – heavy – hit nails – metal – tool – wood)
-  (container – envelope – flat – paper – send letters)

-  (button – clothing – fasten two parts together – metal – plastic – round – sewn – wood)

3. Write a complete description of a kettle using the mind map below.



4. In pairs, describe a number of objects and see if your partner can identify them.

3. Speaking: Predicting and speculating

Here are some useful structures to talk about the future.

Predicting[12]

Do you think anyone will ever invent a robot that can do all the housework?

Yes, I think it's very likely that they will.

When we make predictions about the future, we use ***think + will.***

How do you think this would affect people's lives?

Well, I think it would give people a lot of extra time to do other

When making predictions about an unreal situation (sth that may or may not happen), we use ***would.***

Speculating

How do you think people would feel about having a robot in their home?

I think they would feel uneasy.

I think they could feel uneasy.

I think they might feel threatened bv it.

If we are not certain, we can speculate using ***could*** or ***might.***

1. In pairs, ask questions about the future and see what your partner thinks.

Eg : A) -Do you think computers will become superior to man?

-No, I think they won't. / Yes, I think they will because…

B) -Do you think people would like computers to be superior to man?

-Yes/No, I think people would/could/might feel…

2. Read the following text and answer the questions below, using the outlined structures.

[12] Section adapted from V. Jakeman and C. McDowell, Step up to IELTS, CUP, Cambridge,2004 (reprinted 2007)

IS THERE ANYTHING IN THIS UNIVERSE THAT IS STRANGER THAN THE BRIGHT CUTTING EDGE* OF SCIENCE?

Adapted from TIME's 100 questions for the 21st century, April 10, 2000

1. Let's focus on the great unsolved riddles of space and time and human consciousness. Our journey will necessarily be brief – we don't have enough fuel to travel more than 25 years or so in the future. But we'll come back excited by how much can be foretold – about cloning, evolution and space travel – and humbled by how much is yet unknown.

2. Here are some of the questions we asked ourselves: Will we live on Mars? Will we travel to the stars? Will we travel back (or forward) in time? Will someone build a perpetual motion machine? Will a killer asteroid hit the earth? How will the universe end? Will we discover another universe? Will the mind figure out how the brain works? Will we have a final theory of everything? Will we figure out how life began? Will we clone a dinosaur? Will we keep evolving? Will we control the weather? Will we ever travel at the speed of light? … reach absolute zero? … Will Frankenfood feed the world? Will our PCs be smarter than we are? Will we plug computers into our brain? What will replace silicon? Is technology moving too fast? Will there be anything left to discover?

Vocabulary :

cutting edge: latest, most advanced stage

1. Provide some possible answers to the questions asked in the text.

2. Now try to predict some possible scientific breakthroughs of the 21st century.

4. Reading: Expressing ideas

FUTURE OF SCIENCE: 'WE WILL HAVE THE POWER OF THE GODS'

Adapted from R. Highfield - Telegraph.co.uk – Oct.23, 2007

1. A leading theoretical physicist has tapped the best scientific brains of the age to provide a startling vision of the future. Roger Highfield reports

2. Just before Sir Isaac Newton died, he described how humbled he felt by the thought that he had glimpsed only a fraction of the potential of the great scientific revolution he had helped to launch: "I seem to have been only like a boy playing on the seashore and diverting myself in now and then finding a smoother pebble or prettier shell than ordinary, while the great ocean of truth lay all undiscovered before me."

3. Three centuries later, that great ocean of truth is not so mysterious. According to the theoretical physicist Professor Michio Kaku of the City College of New York, we are entering an empowered new era: "We have unlocked the secrets of matter. We have unravelled the molecule of life, DNA. And we have created a form of artificial intelligence, the computer. We are making the historic transition from the age of scientific discovery to the age of scientific mastery in which we will be able to manipulate and mould nature almost to our wishes."

4. Among the technologies he believes will change our lives in the coming decades are cars that drive themselves, lab-grown human organs, 3D television, robots that can perform household tasks, eye glasses that double as home-entertainment centres, the exploitation of genes that alter human ageing and the possibility of invisibility and forms of teleportation.

5. "We will have the power to animate the inanimate, the power to create life itself," says Prof Kaku. "We will have the power of gods. But will we also have the wisdom of Solomon?"

6. Here are some remarkable speculations about how the scientific and technological revolution will transform life and society in the 21st century.

1. Answer the following questions :

- Could you explain in your own words what the author says about Isaac Newton? Paraphrase Newton's quote.

- What does Prof. Kaku mean when he says: "We will have the power of gods. But will we also have the wisdom of Solomon" (par. 5)? Explain.

- What do you think of the ideas for the future expressed in paragraph 4?

- Do you think “the power of gods” described in the text might be dangerous?

7. The future of physics:

Teleportation
(Prof Anton Zeilinger, University of Vienna)
"We achieved quantum teleportation 10 years ago, and we're using it on a regular basis on the information carried by a system. This information is teleported over to another system, which assumes exactly that information; therefore it becomes identical with the original.
"If you dream about teleportation of humans – well, we can dream – then all kinds of questions arise, such as: what does it mean to be me? When someone teleports me and I know that what is being teleported is information – not matter, not the stuff I'm made of – who is it that ends up over there?"

Electricity from plant life
(Dr Andreas Mershin, Centre for Biomedical Engineering, MIT)
"Plants have developed this amazing ability to capture sunlight and create chemical energy and store it. Now we can grab the machine – the protein inside the plant called photosystem, which is responsible for generating energy for the plant – and hijack its function to create solar electrical power. Our goal is to provide an alternative to regular silicon-based solar panels. What we're trying to do is produce a material that you can paint on a metallic surface, expose to light and have some electricity."

8. The future of biology:

Control over human evolution
(Joel Garreau, author of Radical Evolution)
"For the first time, our technologies are not so much aimed outward at modifying our environment in the fashion of agriculture or space travel; increasingly, technologies are aimed inward, at modifying our minds, our memories, our metabolisms, our personalities and our kids. And this is not in some distant, science-fiction future – this is now. What's shocking about this is that if you can do all that, you're talking about humans becoming the first species to take control of their own evolution."

9. The future of computing:

The virtual family
(Jaron Lanier, virtual-reality pioneer)
"One notion is that virtual-reality interfaces might simply be integrated into the human body. We could have a display built into any of a number of layers within the eye, or into the optic track – or, indeed, into the brain itself.
"But these possibilities raise disturbing questions. What happens if we assume so many different identities that we begin to lose our own sense of identity? What happens if we begin to prefer virtual social networks to our real social networks? And will the family suffer if we spend more time with our virtual family than our real one?"

Artificial intelligence
(Eliezer Yudkowsky, Singularity Institute for Artificial Intelligence, California)
"We have a choice in how we create artificial intelligence. And you've got to be very sure that a created mind is never going to want to self-improve and that it's never going to want to do anything that destroys intelligent life. You've got to treat that gun as if it's loaded."

2. For each topic, explain the main idea in one or two sentences. Write down some key words for each category.

- The future of physics:

- The future of biology:

- The future of computing:

5. Reading: Understanding the writer's view

> **When you first read a text**, you should quickly form an overview of the main ideas/arguments. After that, you need to use appropriate reading strategies to understand the writer's view more in-depth.

1. Read the title and the first paragraph of the text.

   What answer do you predict the writer will give to the question asked in the title?

2. Now read the whole text and decide whether the following statements agree (1) or not (2) *with the views of the writer*.

   Don't forget to mention where you have found evidence to support your answer (paragraph number).

   a) If we consider human evolution so far, we might be tempted to believe that it will continue in the same way in the future, making us more and more perfect.

   b) The cave dwellers had much smaller brains but larger muscles than us.

   c) Man's brain will keep growing as it is increasingly used.

   d) In two million years the odds are that humans will be big-headed, frail creatures with hardly any teeth left.

   e) Humans will also get taller and less hairy over generations.

   f) Computers will affect the way humans evolve, depriving them of good eyesight for example.

   g) A gradual improvement of our species is a very tempting idea, but it doesn't take into account the fact that organisms are more than a simple sum of their parts.

   h) New species can only appear in small and scattered populations.

   i) Communications and mobility are such that no significant evolutionary change will take place in the future.

   j) The disappearance of the boundaries between the different variants of our species will eventually create favourable conditions for human evolution.

3. According to the writer, what might possibly re-establish the conditions needed for human evolution?

WILL WE KEEP EVOLVING?

Adapted from Time, April 10, 2000

1. Over the past 5 million years, as many as 17 distinct human species have walked the earth. Barring* nuclear or environmental disaster, human evolution may have stopped. As we spend more time online, our brains will get bigger and our eyes weaker, right? Wrong. That's not how evolution works.

2. We take for granted* that human beings are the pinnacle* of the living world, that Homo sapiens is nature's most advanced product. And since many lines of evidence testify that our species is the result of a long evolutionary history, we tend to assume that in the future there will be more perfecting change along essentially the same lines.

3. Two million years ago, our predecessors had brains barely* half as large as ours today. So it would seem to follow that in another couple of million years, our brains will be twice again as large, housed in the huge globular heads familiar from sci-fi images. Conversely, our immediate forebears* were robustly boned and, we think, more heavily muscled than we are today. What could be more natural than to conclude that supported by increasingly complex labor-saving technologies, our bodies in future will be frailer and shorn of such frivolities as the little toe?

4. Back in the 1930s, my predecessor at the American Museum of Natural History, Harry Shapiro wondered what humans might become in a half-million years hence. His predictions included such features* as a rounder skull, a smoothing of the area above the brows, a reduction in the size and number of teeth, and a shrinking of the face in general. Shapiro also predicted that we would get taller and even balder and that body hair would continue to diminish.

5. When he revisited the subject three decades later, his vision of the future was essentially unchanged except that he had become increasingly worried about the potential effects of technology. Many today share similar beliefs assuming, for example, that lives spent in front of computers will rob humans of fully functional arms and legs or proper eyesight. Well, not to worry. As seductive as such extrapolations may be, they overlook what we know about how evolution works. In particular, they buy into the idea that evolution consists of a sort of generation-to-generation fine-tuning in each population as time passes. Under the guidance of natural selection, this process of gradual change inexorably leads to improvement in the species and ultimately to new species as those improvements accumulate.

6. Superficially persuasive as this view is, it ignores certain basic realities. It assumes, for instance, that organisms are little more than agglomerations of special-purpose mechanisms, each of which can be tracked independently of the "packages" of which they form part. We speak of "evolution of upright walking" or "evolution of the hand", often without realizing that legs and hands can only be parts of the story.

7. The reality is that natural selection can vote up or down only on entire organisms, warts and all. Individual organisms are mind-boggingly complex and integrated mechanisms; they succeed or fail, economically and reproductively, as the sum of their parts. It's the same with populations and species.

8. Finally, we have to bear in mind how distinctive new species originate. We don't understand everything about how this happens, but we do know that in large interbreeding populations it is extremely difficult, if not impossible, for new genetic variants to become established.

9. You can guess where this argument is heading. During the Ice Ages, when our own species emerged, human populations were small and scattered and were continuously disrupted by climatic fluctuations. Conditions were ideal for genetic innovation. Today, however, the human population is 6 billion and mushrooming and increasingly densely distributed. At the same time, individual humans are incomparatively more mobile than ever before. Efficient communication means that, for example, American males can advertise for wives in journals distributed halfway around the globe.

10. The upshot* is that after a period of diversification, Homo sapiens is in a mode of reintegration, as witness the fact that the boundaries between the former geographical variants of our species are becoming increasingly blurred. As present trends continue, those boundaries will become blurrier still. Amid all this, the conditions for incorporating meaningful new innovations into human populations have all but disappeared – and with them the prospects for significant evolutionary change.

11. Of course, anything that would serve to fragment the current huge population might help re-establish the conditions necessary for future human change. Unfortunately, we would undoubtedly perceive such an event as a terrible disaster, since it would necessarily entail the disappearance of billions of human beings. For

example, an asteroid impact of the kind that finished off the dinosaurs might do the trick, as might the appearance of a supervirulent and highly contagious virus. More probable, perhaps, is a man-made catastrophe – a general environmental collapse provoked by overexploitation of the world's resources, say, or nuclear conflicts.

Vocabulary

barely: *à peine*
barring: except if there is
forebear: ancestor
take for granted: believe that sth is true without making sure that it is
pinnacle: most important or most successful part of sth
feature: trait
upshot: final result

6. Listening: Retrieving information

You are about to listen to Professor Michio Kaku talking about time travel.

-Do you think time travel would be possible for humans?
-If you had the opportunity of travelling back in time, which historical event would you like to witness?
-Travelling backwards in time is extremely difficult but it could also be a little risky. Explain.

Listen to Professor Michio Kaku and answer the following questions.
http://www.youtube.com/watch?v=X02WMNoHSm8

- Explain Isaac Newton's theory of time.

- Newton and Einstein both compared time to objects. What are they?

- What did Kurt Gödel find and when? Who was he?

- Einstein said that the universe rotates: True or False?

- What is the explanation Kaku gives for "wormhole"?

- What kind of energy would be necessary to do that?

Unit Vocabulary

account for	*expliquer, représenter (un %)*
achieve	*arriver à, obtenir*
advance	*progrès*
advanced (> advanced civilisations)	*évolué (> civilisations évoluées)*
agree (on sth / with sb)	*être d'accord*
aim (be aimed at sth)	*viser qqch*
arise = appear	*apparaître*
arrow	*flèche*
at the speed of light	*à la vitesse de la lumière*
barely = hardly	*à peine*
being = creature (> human being)	*être= créature (> être humain)*
beyond	*au-delà de, plus loin que*
bless (> blessing)	*bénir (> bénédiction)*
body	*corps*
boundary	*limite*
brain	*cerveau*
brake	*frein*
breakthrough	*progrès, avancée*
cave (> cave dwellers)	*caverne (> les habitants des cavernes)*
cell	*cellule*
century (> in the 21st century)	*siècle (au 21e siècle)*
change	*changement*
chemical	*chimique*
chemistry	*chimie*
clue(> to be clueless about sth)	*indice (> ne pas avoir la moindre idée de qch)*
coat (> coated with)	*couche (> recouvert de)-*
coated with	*recouvert de*
collapse	*effondrement*
conduct = carry out (an experiment)	*faire (une expérience)*
contraption	*machin*
conversely	*inversément*
convert (sth **into** sth)	*transformer*
course (> the course of events)	*cours (> le cours des événements)*
curse	*malédiction*
damage (U) (> to cause damage)	*dégâts, dommages*
deduce = infer (>< deduct = subtract)	*déduire, conclure (>< déduire = soustraire)*
design	*concevoir*
device	*appareil*
display	*écran*
DNA	*ADN*
engine	*moteur*
entail	*entraîner*
evolve	*évoluer*
experience (>*to learn by experience*)	*expérience (de vie)*
experiment (> *to do / conduct / carry out an experiment*)	*expérience scientifique*
extend	*prolonger*
favourite	*préféré*
figure out	*arriver à comprendre*
flow (>< fly, flew, flown)	*couler, s'écouler (>< voler)*
fortunately (>< unfortunately)	*heureusement (>< malheureusement)*
fuel	*carburant, combustible*
future	*avenir*
glass	*verre*

glue	*colle*
happen = occur	*se passer, avoir lieu*
harmful	*nuisible, nocif*
heat	*chaleur*
hit (hit[2])	*frapper, toucher*
improvement	*amélioration*
launch	*lancer*
law (> the laws of physics)	*loi (> les lois de la physique)*
layer (> the ozone layer)	*couche (> la couche d'ozone)*
level	*niveau*
likely (>< unlikely)	*probable (>< improbable)*
mankind = humankind	*humanité*
material	*matériau, matériel*
melt (> molten)	*fondre (> en fusion)*
mirror	*miroir*
motion	*mouvement*
mould	*modeler, façonner*
occur	*se passer, avoir lieu, arriver*
the odds of (doing sth)	*les chances, la probabilité (de faire qch)*
operate	*fonctionner*
particle	*particule*
pass on = transmit (e.g. disease)	*transmettre*
physics	*physique*
prevent sb /sth from doing sth	*empêcher qn / qch de faire*
progress (U) (> to make progress)	*progrès (> faire des progrès)*
raise (a question)	*soulever (une question)*
reach	*atteindre*
reflect (an image)	*réfléchir (une image)*
reluctant = unwilling	*peu disposé, peu enthousiaste*
replace	*remplacer*
require	*nécessiter*
research (> do research)	*recherche(s) (> faire des recherches)*
researcher	*chercheur, chercheuse*
resist = withstand (withstood[2]) sth	*résister à*
re**s**ource	*ressource*
rope (> a length of rope)	*corde (> une corde)*
scarce	*rare*
scattered	*éparpillé*
scientist	*scientifique, chercheur*
skull	*crâne*
smart	*1. intelligent, 2. élégant*
species	*espèce*
speed (> at the speed of light)	*vitesse (à la vitesse de la lumière)*
spread = propagation	*propagation*
spread	*se propager*
stick (stuck, stuck)	*coller*
straight	*droit*
substance	*substance*
take place = occur = happen	*arriver, avoir lieu*
techn**ique**	*technique*
thin (>< thick)	*mince (>< épais)*
threaten	*menacer*
tool	*outil*
trigger = set off	*déclencher*

unravel (a mystery)	*démêler, résoudre (un mystère)*
weak	*faible*
wheel	*roue*
witness	être témoin de, assister à

UNIT 7: Material science

1. Lead-in: Materials

1) In pairs try to find as many names of materials as possible and categorize them.

2) What is "material science"?

3) Why is the study necessary?

4) What properties may certain materials have?

5) Can you think of any material that doesn't exist today and that should be invented?

6) Materials have 6 fundamental types of properties. Match the properties and their definitions below.

Having little or no ability to conduct electricity; insulating.	a. mechanical

Relating to electricity.	b. magnetic
Relating to the physical action of light.	c. electrical
Causing slow, gradual damage or destruction by chemical action.	d. dielectric
Relating to the motion of electric charge, which results in attractive and repulsive forces between objects.	e. optical
Relating to physical forces or motion.	f. corrosive

7) Now watch the youtube video "What is materials science and engineering?" and answer the questions.

   i. What does Bradley say a materials engineer does?

   _____

   _____

   ii. To paraphrase Yushen, a materials engineer looks at materials on a _____ _____ or _____ scale and enhance them to a _____ scale.

   iii. As an example, concrete and steel are the most _____ materials for construction use.

   iv. List the materials Robert gives as examples of materials he works with:

      a) _____

      b) _____

      c) _____

   v. Similiarly, Bradley gives examples of properties we may need in materials:

      a) _____

      b) _____

      c) _____

      d) _____

      e) _____

8) For the remainder of the video, listen carefully and take notes on the examples of where and how material science can be useful.

   _____

   _____

   _____

GET IT RIGHT

1. **Optics** is the branch of science which studies light, or sight and vision.

2. **Optical** is an adjective which means *relating to light, sight and vision*.
   An optical effect/illusion, optical instruments, optical telescope, optical microscope

3. **Optic** is an adjective which means *relating to eye or sight*. Although both *optic* and *optical* are derived from *optics*, the former is mainly used to talk about the eyes, the organ. *The optic nerve, the optic disc.*

- - - - -

1. A **mechanic** is a worker who repairs engines of machines and vehicles.

2. **Mechanics** is the branch of physics that studies the effect of forces acting on stationary or moving objects.

3. The **mechanics** (plural noun) of something is the way it works.
   He knew everything about the mechanics of managing a team.

4. **Mechanical** can have several meanings:
   - automatic (His behaviour when he cooks is really mechanical)
   - relating to machines: I'm not very good at mechanical work. My brother on the contrary is a very mechanical person
   - Relating to physical forces or motion (the mechanical pressure of a strong wind).

- - - - -

Electric/electrical

Although both have a close meaning, the former is more frequently used to describe specific objects that use electricity for power (*electric guitar, toothbrush, blanket, kettle, car*), whereas the latter is more often used with more abstract nouns (*electrical appliances, circuit, device, energy, system, equipment*).

GRAMMAR TIP: noun in plural form + singular verb

Some nouns have a plural form but take a singular verb. That's the case of
- some subjects of study: *optics, physics, mathematics, politics, economics*
- some sports: *gymnastics, athletics*
- some games: *billiards, darts, dominoes*
- some illnesses: *mumps, measles*

2. Reading: Skimming and scanning

Skim the article below and answer the questions.

NON-DRIBBLING GLASSES

The Economist – June 2000

1. Even so rational a subject as science has its myths. And like the more traditional sort, scientific myths are often used to illustrate general truth. One myth which weaves its way from textbook to textbook is that the reason glass in old windows (especially medieval church windows) is thicker at the bottom than at the top is because glass – despite its apparent solidity – is actually a liquid. Given enough time, therefore, it will flow from the top of a window pane to the bottom, accumulating there a perceptible bulge.

2. In the abstruse world of physics, glass is indeed classified as a liquid (**albeit** a supercooled and therefore not very mobile one). The myth of the ancient window pane has therefore been thought of as a good way to show students that the everyday meaning of the word "liquid" is not completely subverted by thinking of glass as a liquid too.

3. Putting the myth to the test, several researchers have recently tried to calculate how fast glass actually flows. Unfortunately for the textbooks, **the latest estimate**, made by Yvonne Stokes of the University of Adelaide is that it would take over 10m years for a window pane to flow perceptibly.

4. Dr Stokes's calculations, which use the equations of fluid dynamics, also show that a **thickening** at the bottom of a pane of glass would not result in a **thinning** at its top, as might naively be expected. Rather, the flow of glass would cause a reduction in the **overall height** of the pane. Even a 5% thickening at the bottom of a window a metre high would result in a shrinkage of the window's height by about a centimetre. In other words, if the original myth were correct, old windows would have gaping holes in them.

5. That does, however, leave the question of what the real reason is that the glass in old windows tends to be thicker at the bottom than at the top. Perhaps it is just that medieval glaziers preferred that way.

1) Decide whether the statements below are True or False. Justify your answers.

- Physicists regard glass as a liquid, not a solid.

- Glass flows, albeit extremely slowly.

- That church window panes are thicker at the bottom than at the top can be taken as evidence that glass actually flows.

- Glass panes in medieval churches are thinner at the bottom.

- It follows from principles of fluid dynamics that a thickening at the bottom of a window pane will go together with a thinning at its tops.

2) In your own words, explain what the "myth" consists in.

3) Speaking exercise: A myth is a story based on unproved belief; in groups, discuss other myths you know and choose the best one to share with the class!

4) Speaking exercise: Similar to myths are 'old wives' tales', so-called because they are pieces of advice and stories that older ladies would tell their family in the olden days. Have a look at the following myths and old wives' tales, and decide whether they are true or not. Be ready to justify your answer!

a) Humans explode in space.

b) Lightning never strikes the same place twice.

c) Gain a child, lose a tooth.

d) Do not drink water from the hot tap.

e) Polaris is the brightest star in the northern hemisphere night sky.

f) A penny dropped from a very high building can kill a pedestrian below.

g) Chicken soup fights a cold.

h) Meteorites are always hot when they impact the earth.

i) Putting hot food in the refrigerator will ruin the food.

j) Drink cranberry juice to fight a bladder infection

k) Reading in dim light will ruin your eyesight.

l) Carrots will make you see in the dark

5) Writing/Speaking/Listening activity:

a. Freewriting: Make a prediction about this myth: "A penny dropped from a very high building can kill a pedestrian below." What do you think will/could/might happen if you drop a penny from a skyscraper? Use a correct modal verb to express your opinion and explain in a 3-5 lines.

b. Speaking: Now, share your opinion with the class.

c. Listening: Watch the "Mythbusters" video twice and take some notes about the experiment and the results of the experiment. Be as precise as you can.
<Youtube: "mythbuster penny drop" https://www.youtube.com/watch?v=PHxvMLoKRWg

d. Writing/Speaking: In pairs or small groups, share your notes and write a summary of the video you have just watched. Explain the goal of the experiment, what they do, and make sure you include a clear conclusion. Was your prediction correct?
Reminder: Use linking words when necessary to connect your ideas and create coherence in your text.

3. Language: Size, dimension, quantity and weight

1) Match the nouns, the adjectives and their opposites.

deep - large - small - high - short – heavy – light / lightweight - thick - thin - wide - big - low - broad - narrow - long - shallow

Noun	Adjective	Opposite
Length		
Width		
Height		
Depth		
Thickness		
Size		
Weight		

2) Complete the following sentences using the following pattern.

Even a 5% thickening at the bottom of a window a metre high would result in a shrinkage of the window's height by about a centimetre.

1. Parts of the Pacific Ocean are over 30,000 feet _____.
2. These trees are almost 20 metres _____.
3. The telescope is 25 metres _____.
4. The crater is 100,000 feet _____.
5. The new laboratory is 25 metres _____ by 12 metres _____.
6. Ice shelves can be up to 1500 metres _____.

Notes:

- when *length, width and/or height* are taken together the word *by* is used as in sentence 5 above.
- instead of *high*, we can say *in height*.
  Similarly, . *deep* can be replaced by *in depth*
  . *long* *in length*
  . *wide* *in width*
  . *broad* *in breadth*
  e.g. *The mountain is roughly 5,000 metres high/in height.*
- Needless to say that when the adjective does not exist, the second construction is the only possible one. e.g. *The moon is some 3,500 kilometres in diameter*.
- for weight, these two constructions are possible
  It is 150 grams in weight and *It weighs 150 grammes.*

4. Language: Describing materials properties

1) Jot down all the words related with materials **properties** or shape in the text below.

SMART MATERIALS

1. Smart materials can change their properties in response to an external stimulus. Materials such as Lycra®, Thinsulate®, carbon fibres, Kevlar®, Teflon® and Gore-Tex® have different special properties that make them suited to particular uses.

Lycra® and Thinsulate®

2. Lycra® and Thinsulate® are commercial materials that have been **designed** to have special properties. Lycra® is a stretchy artificial fibre. It is used to make **sports clothing** such as wetsuits, and with other fibres to make comfortable clothing with a snug fit. Its molecules have a stretchy section that make it soft and rubbery, and a rigid section that makes it tougher than rubber. Lycra® is lightweight but doesn't get damaged by sunlight, sweat or detergents - all of which can make other materials **wear out**.

3. Thinsulate® fibres are much thinner than most other artificial fibres. They form a dense tangled web of fibres that trap a lot of air and reflect heat. This reduces **heat loss**, so clothes containing this material keep you very warm. The fibres also absorb very little water, so they still keep you warm if the clothes get wet. Thinsulate® fibres are much finer than human hairs and normal fibres

Carbon fibres and Kevlar®

4. Carbon in the form of graphite is soft, slippery and easily broken. But very thin filaments of carbon are very stiff. These carbon fibres are useful for reinforcing other materials to make them tougher. They are **embedded** in strong plastics to make composite materials. These are usually very strong but lightweight, so they are used for skateboards, boat hulls and high performance sports equipment.

5. Kevlar® is a very strong artificial fibre. It is woven to make a material that is used for light and flexible body armour. It is strong and tough because its molecules can pack closely together and because there are chemical bonds between adjacent molecules

Teflon® and Gore-Tex®

6. Teflon® is the trade name for a polymer called polytetrafluoroethene or PTFE. It is very slippery so it is used to make **non-stick coatings** for pans. It is also used in clothing to make it difficult for dirt to stick, and it is used in Gore-Tex®. PTFE is also unreactive, so it is used to make pipes and containers for chemicals.

7. Gore-Tex® is a **fabric** that is designed to keep you dry in the rain without getting sweaty. It contains a layer of plastic based on PTFE. This contains very many tiny holes called pores. There are around 14 million pores per square millimetre. Each one is too small for water droplets to pass through, but big enough to let water molecules from sweat go through. This makes a 'breathable' fabric which can also be combined with **insulation** such as Thinsulate® to make outdoor clothing that keeps you dry and warm.

2) Translate the words in bold.

3) Answer the following questions.

a) What are smart materials?

b) What are the advantages of carbon fibres?

c) What is a "breathable fabric"?

STOP

4) Answer the following questions on the text.

a) Which of these materials is known for its stretchiness?
- ☐ Gore-Tex®
- ☐ Lycra®
- ☐ Kevlar®
- ☐ Teflon®

b) Which of these materials is known for its ability to reduce heat losses?
- ☐ Thin-insulate®
- ☐ Kevlar®
- ☐ Lycra®
- ☐ Gore-Tex®

c) Why is Gore-Tex® a "breathable" fabric?
- ☐ It contains a layer that only lets water droplets through it.
- ☐ It allows air to circulate between the fibres.
- ☐ It has large pores to let the wind in to carry sweat away.
- ☐ It has tiny pores that only let water molecules from sweat though.

d) Kevlar® is very strong and tough because its molecules:
- ☐ Pack closely together and have weak bonds between them.
- ☐ Do not pack closely together but have strong bonds between them.
- ☐ Pack closely together and have strong bonds between them.
- ☐ Are loosely connected to one another.

e) Two of the key properties of Teflon® are that it is:
- ☐ Unreactive and slippery
- ☐ Reactive with certain chemicals
- ☐ Reactive and slippery
- ☐ Unreactive with high friction

5) Fill in the table below: the first one has been done for you as an example.

Material	Properties	Advantage(s)	What it is used for
Lycra®	stretchy, soft, rubbery, tough, lightweight	doesn't get damaged/ doesn't wear out	sports clothing snug fit clothing
Thinsulate® fibres			
Carbon fibres			
Kevlar®			
Teflon®			
Gore-Tex®			

Language: forming adjectives[13]

Many adjectives are formed with a suffix (e.g. *–al*, *-ic*). These are called "derived adjectives" and are extremely common, particularly in academic writing. Adjectives formed with *–al* are overwhelmingly more common than adjectives formed with any other suffix.

Use

- ***Economical*** to describe something which is cheaper to buy or use than something similar. *Coach travel is an economical alternative to rail travel*.

- ***Economic*** to talk about the way a country's money is produced, spent and controlled. *The new government is proposing a number of economic reforms.*

- ***Financial*** to talk about the way people and organisations use and control their money, to mean 'connected with money'. *The company got into financial difficulty*.

Compound adjectives of physical or psychlogical description can be formed as follows: ADJECTIVE + NOUN -ED (remember spelling rules)
Consider: *short-haired, broad-shouldered, blue-eyed, warm-hearted, open-minded, bad-tempered, self-centred, left-handed, narrow-minded, tight-fisted, short-sighted*

6) Provide opposites and use some of the adjectives in the sentences below.

transparent:	*hard:*	*conductive:*
lightweight:	*combustible:*	*brittle:*
strong:	*widespread:*	*matt:*
rough:	*rigid:*	*bio-degradable:*

a) Unlike rubber, copper is a very _____ material.

b) Plastic is not environment-friendly because it is _____.

c) Unlike stone, chalk is _____.

d) A piece of rubber has a _____ surface.

e) If unplaned, a piece of wood has a _____ surface.

f) As you know, steel does not bend easily. It's extremely _____.

7) Define

- Maintenance-free
- Waterproof
- Sustainable
- Reinforced concrete
- Stainless steel
- Stained glass

8) Complete the sentences below by adding *–proof* to suitable nouns from the list in the box to make adjectives

- A plus sign (+) means that *proof* is added to the word.

[13] Section adapted from Sue O'Connell, Focus on IELTS, Pearson Education Limited, Harlow, 2002 (reprinted 2006).

- A hyphen (-) means that *proof* is added to the word after a hyphen.
- If there is no hyphen or plus sign, the adjective is formed of two separate words.

bullet+	sound+	child+	fool+	shatter+	oven+	recession-	earthquake

a) To protect youngsters, most medicines are now sold in _____ containers.

b) Transfer the mixture to a(n) _____ dish and bake at 180°C for 45 minutes.

c) By law, all new designed buildings in the city must now be designed to be_____.

d) The officer would have been killed if he hadn't been wearing a _____ vest.

e) We have converted the garage into a _____ recording studio.

f) Even economies based on high-tech industries may not be _____ forever.

g) No system can be entirely _____, but this one was certainly very easy to use.

h) Since the robbery, the bank has been fitted with new _____ glass screens.

9) Find compound adjectives corresponding to the following definitions.

e.g. not susceptible to corrosion by rust = *rustproof*

a) able to resist great heat:

b) that doesn't stick:

c) not easily set on fire:

d) which will not be decomposed by bacteria or other living organisms:

e) able to clean itself:

f) of the same colour as sand:

g) shaped like a bell:

STOP

10) *The usual way to **toughen** glass, developed in the 1920s, is to draw it into fibres that can reinforce other materials.*

– What does "***toughen***" mean?

– Build more of the same for the following adjectives:

long*		strong*		stiff		tight	
Wide		thick		soft		flat	
short		bright		black/red		sharp	
deep		broad		straight		weak	

11) Listening exercise: Watch the 'invisibility cloak' video and answer the following questions.

a) What difference does the presenter mention between an octopus and a lionfish?

b) What has John Pendry come up with?

c) What does "all this techno-trickery" make clear?

d) What is the catch?

e) How should the cloak work?

f) Where else could this technology be used?

1. _____

2. _____

3. _____

12) Speaking exercise: Many other smart materials have been developed in recent times. What others do you know, and what are they used for?

Skimming and scanning

1) Which material/cloth do you like to wear? Why? Under which circumstances?

2) Skim the article below and answer the questions.

SMART CLOTHES – STAYING HEALTHY BY DRESSING SMART

Medical News Today – March 2005

Patients in the near future will use 'smart' fabrics to keep them healthy, thanks to a EU project that recently **completed** initial development of high tech clothing. The Wearable Health Care System (WEALTHY) IST project just completed 30 months of research and development to prototype technologies at the heart of smart fabrics. **Smart fabrics** incorporate functional fibres and yarns into the weave, allowing researchers to develop many useful sensors for a wide variety of applications.

Intelligent use of microelectronics allows scientists and engineers to extract useful data from very simple inputs. For example, the WEALTHY project integrated **temperature sensors** in the armpit and shoulder of their garment to register core and skin temperature.

Towards commercialisation

In the coming months the WEALTHY project will send prototypes of its smart clothing to selected stores around Europe, in part to acquire vital data from users. "It's a validation process," says Dr Rita Paradiso, research director of Italian R&D company Smartex and coordinator of the WEALTHY project. "We have working prototypes and we want to get feedback from potential users." "*I think it will be about three years before full commercialisation is possible*," says Paradiso. "*We are currently working on another project, MyHeart with Philips, that should **develop** a commercial product for heart monitoring in the next three years*."

Once a product is available, there will be plenty of applications. The clothing can monitor vital health data, communicate with remote health centres and present data in a variety of formats for further analysis by doctors and researchers.

Many potential users

So who will **benefit** from such clever clothes? Soldiers under extreme conditions in the field, athletes, personnel in high-risk jobs like firefighting, or the sick and vulnerable, will all benefit from the health data these clothes can provide. Doctors will be able to **remotely monitor** a patient's health statistics and condition, useful for observing at risk populations, such as the elderly or people with cardio-vascular disease, for example. Monitoring the health of newborn babies is another promising application. Athletes' performance and vital data can be captured during exercise or competitions. This information can keep athletes safe, and also help them to improve performance. The system can also be used as part of treatment, for example monitoring people undergoing physical therapy and rehabilitation. Sleep apneas, where people stop breathing in their sleep, is another application, or for people who drive long distances.

"*Really there are a vast number of applications, though the garment would need to be **customised** for each task*," says Paradiso.

Simple properties, advanced tasks

All these applications come from using the simple electrical properties of electrodes and other simple circuits to mine rich data seams. Rather than **overloading** the clothes with weighty gadgets, WEALTHY employed the ingenuity of engineers and scientists to allow lightweight devices do the heavy lifting. For example, in the WEALTHY system one prototype **respiration-sensing device** uses impedance to derive the respiration of the wearer. The device uses four electrodes placed on a thoracic position. The two external are injecting high frequency current (50 KHz) and the other ones are capturing the voltage variation caused by thoracic impedance change. The output signal is modulated by changes in the body impedance accompanying the respiratory cycle.

WEALTHY's prototype contains tiny sensors that can collect information about the wearer's respiration, core and surface skin temperature, position (standing or lying down) and movement. What's more, the garment can take advantage of Europe's extensive mobile phone network to communicate the data with **remote sensors**, thanks to the integration of a miniaturised GPRS transmitter. This transmitter could, in a future version, use

emerging location-based services (LBS) to transmit the exact location of the wearer to emergency services or rescue teams, meaning a faster response to accidents and a better chance of survival for the victim.

"There were some major challenges," says Paradiso. "In the beginning I was really worried that all the different electrodes and sensors would interfere with each other and create noise, interfering with the sensors' signals, but we **overcame** that problem. Now we need to deal with noise created by movement."

The advantage of the WEALTHY prototype is the wide range of data it can capture, it's ability to transmit this information to remote monitoring centres, and its comfort. "It has to be comfortable, like underwear really, if people are going to use it," says Paradiso.

Further developments for the suit are in planning, such as an acoustic wave sensor, which could be used to measure the wearer's pulse, for example.

In future, clothes will have all the more reason to be smart.

3) Answer the following questions.

a) Define "smart clothes"

b) Translate the words in bold characters

c) What are the challenges a company like WEALTHY has to take up when developing applications of smart clothing?

d) Explain the difference between

- Clothes / underwear:
- Wear / carry
- Sensor / monitor
- Device / gadget

e) Fill in the table below

Name the applications of smart clothes mentioned in the article	**Imagine a few other possible applications of smart clothing**

f) Using information from the texts above,…

- Make 2 sentences with special passive patterns. *It is said that …. He is thought to …. I was given…*

- Make 2 sentences with modal verbs expressing probability.

- Complete the sentences below.

  Despite…

  Unlike…

  I wish…

  It's time…

  I'd rather…

  They'd better…

9. Language: Adjectives of colour, shape and material

A. Materials

Except *woollen* and *wooden* (and *metallic*), there are no adjectives of material in English. Simply use the corresponding noun. Consider: *oak benches, aluminium panels, a timber framework, concrete columns, ceramic tiles, steel parts, copper handles, velvet dress.*

B. Colours

The colours of the rainbow are *red, orange, yellow, green, blue, indigo* and *violet*. *Peacock blue* is a widely accepted description of the colour formed by a mixture of blue and green.

It is often necessary to introduce **shades** of colour. A very common way is to add the suffixes *-ish* or *-y* to a colour as in *bluish, reddish, yellowish, greyish, whitish, brownish or silvery.* When two colour adjectives are combined, the first one is usually added a suffix *–ish* or *-y* (*reddish-brown, yellowish-brown, greyish-white, silvery-grey, etc.*)

Noun modifiers can also be used as in *brick red, pitch black, bottle green, sea green, charcoal grey, coffee brown, steel blue, sky blue*, etc. Sometimes, compound adjectives ending in *–coloured* are used (*cream-coloured, flesh-coloured, straw-coloured, multi-coloured, sandy-coloured,etc.)*

Colours can be *light* or *dark, bright* or *pale*. Substances which have no colour (like water) are *colourless*. When an object or substance is dirty, it is said to be *discoloured*.

A material which allows light to pass through it is *transparent*. A material which does not allow light to pass through it is *opaque.* A material like *frosted glass* which allows some light to pass through it is *translucent.*

C. Shapes

Besides adjectives like *round, square, oval, rectangular, triangular*, and *conical, cubic, cylindrical, pyramidal* and *spherical*, there are lots of adjectives ending in *–shaped* (*bell-shaped, E-shaped, cigar-shaped, log-shaped, wedge-shaped …*) and in *–like* (*threadlike, tubelike, canopy-like, etc.*)

Remember also: *corrugated – serrated – curved – tapering – pointed – twisted , etc.*

Exercises

1) Some sophisticated work on the English alphabet. Which word (in capital letters) is described below?

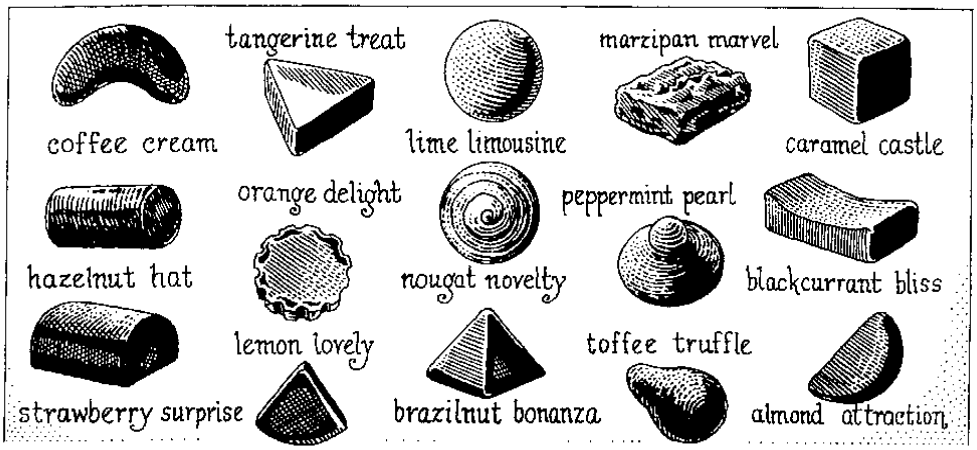
- First letter: One ***full-length perpendicular line*** is joined at the top and at its centre point by two parallel lines, the former being longer than the latter, ***extending*** to the right horizontally.

- Second letter: A symmetrical, ***wedge-shaped figure***: two ***straight*** but oblique lines slanting down to the base from a common point at the top; these are ***bisected*** by a single horizontal line.

- Third letter: A long vertical line is connected at two points – ***at the top and halfway down*** – to a ***curved***, semi-circular line running to the right. From the centre intersection, a ***sloping line*** drops to the baseline ***at an angle of 45 degrees*** to the perpendicular, again to the right.

1) In pairs, describe a letter or number to your partner using similar vocabulary.

3) Decide which of these shapes describes each chocolate (from *The Heinemann English Wordbuilder*).



1. pyramid-shaped	6. conical	11. semi-circular, half-moon shaped
2. spherical	7. oblong, with a convex top	12. square, with an uneven surface
3. a perfect cube	8. rectangular with a concave top	13. cylindrical, log-shaped
4. a spiral	9. crescent-shaped	14. triangular, three-sided
5. pear-shaped	10. round, with a serrated edge	15. nipple-shaped

⚠ *Online test 3*

See *Introduction* for further instructions and *Calendar* for deadlines.

Online tests are **compulsory**. They will be marked, students will receive individual feedback, and they will be taken into account in the final grade (See *Introduction*).

Unit Vocabulary

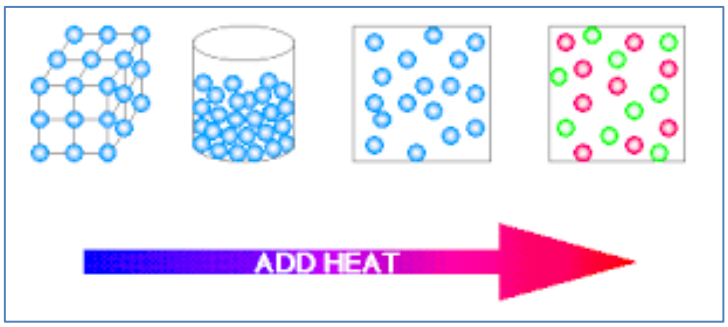
actual (ly)	*vrai (en réalité)*
alloy	*alliage*
albeit	*bien que, quoique*
blend into	*s'intégrer*
brittle	*friable, cassant*
bulge	*bosse*
cave >< basement	*caverne, grotte >< cave*
carve	*tailler, sculpter*
century	*siècle*
chalk	*craie*
charge (electric) >< load (= weight)	*charge*
clean (>< dirty)	*propre (>< sale)*
coat (e.g. *a coat of paint*)	*couche (extérieure) (ex. couche de peinture)*
coating = cladding	*recouvrement*
combination	*combinaison*
compound	*composé (chimique)*
concrete (> reinforced concrete)	*béton (> béton armé)*
copper	*cuivre*
crystal	*cristal*
electric / magnetic field	*champ électrique / magnétique*
eventual(ly)	*final (finalement)*
fabric (of clothes …)	*tissu (de vêtements …)*
framework	*armature, structure*
fulfil (a wish)	*réaliser (un vœu)*
glass	*verre*
hack	*abattre à coups de hache*
heat	*chaleur*
iron (> corrugated iron)	*fer (> tôle ondulée)*
layer	*couche*
lightning	*foudre*
lump	*bosse, gros morceau*
magnet	*aimant*
maintenance	*entretien*
manufacture	*fabriquer*
medicine	*1. médecine - 2. Médicament*
monitor	*surveiller*
narrow (>< rough)	*étroit (>< large)*
patent < patent	*brevet < breveter*
plane *(unplaned wood)*	*aplanir*
pound	*frapper*
remote	*éloigné, isolé*
remote control	*commande à distance*
rough	*rugueux*
roughly	*à peu près*
rust	*rouille*
scale (*on a large / microscopic scale*)	*échelle*
sew	*coudre*

shrinkage	*rétrécissement*
skill	*habileté, don*
slippery	*glissant*
smart	*1. élégant - 2. intelligent*
smooth (>< rough)	*lisse (>< rugueux)*
stain	*tache*
stained glass	*verre teinté*
steel (> stainless steel)	*acier (> acier inoxydable)*
suitable (for)	*qui convient, approprié (pour, à)*
thick (>< thin)	*épais (>< mince)*
tissue	*tissu (organique)*
tough	*résistant*
trade / trade (in, with)	*commerce / faire le commerce de, faire commerce avec*
tremendous = enormous	*énorme*
trial = test	*tester*
trial and error	*essais et erreurs*
wardrobe	*garde-robe*
water drop(let)	*goutte(lette) d'eau*
wavelength	*longueur d'onde*
wax	*cire*
weave (wove, woven)	tisser
wedge (into, between)	*enfoncer, caler*

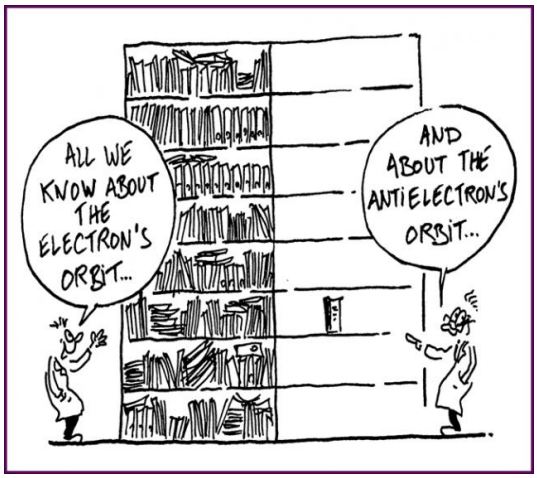
UNIT 8: The Heart of the Matter

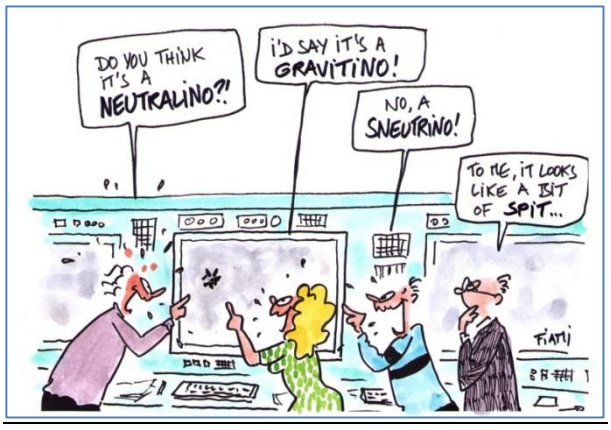
1. Think ahead

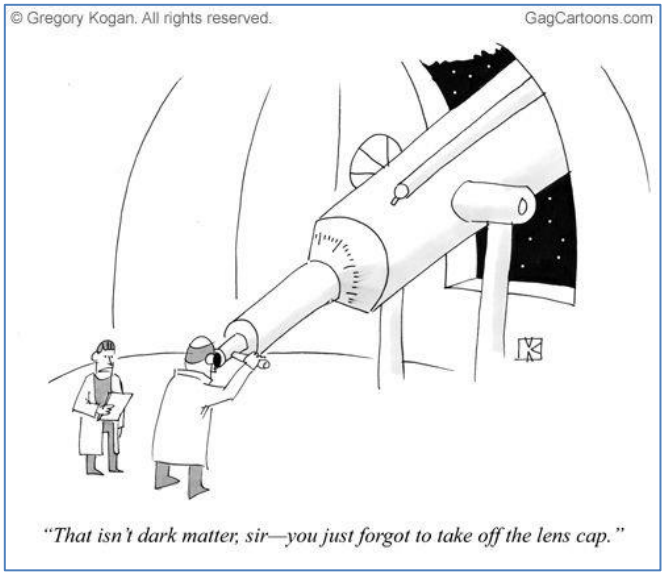
In small groups, (1) explain the diagram below.



(2) Choose one of the cartoons below, describe it and explain what it illustrates.







"That isn't dark matter, sir—you just forgot to take off the lens cap."

2. Listening and retrieving information

1. Read the questions below, then listen to "What is matter?" and answer them:

a) What's the fourth state of matter?

b) How is it different from the third state of matter, i.e. gas?

c) Unlike solids, liquids don't have any...
   - volume. True or false?
   - shape. True or false?

d) Fill in the gaps in the following sentence: "While it's _____ that ice melts, even _____ solids melt when they are _____ to enough energy. Rocks melted by the heat and _____ deep in the earth erupt from volcanoes as liquid _____ and lava."

e) Which element is given as an example of a gas present in the universe?

f) How much of the visible universe is made up of superheated gas?

g) What does the simplest interpretation of Einstein's equation $E = m.c^2$ suggest?

h) What does this theory help explain?

i) Fill in the gaps in the following sentence: "No _____ what state matter is in, it demonstrates the _____ of inertia. This natural law means that matter doesn't change _____ it's made to by some _____ force. Ice may be moved to melt, and an avalanche to slough only when moving _____ such as heat act on them."

2. Here is a basic description of the structure of an atom. Fill in the gaps with the given verbs. For some gaps, there may be more than one good answer.

> **Language**: Describing structures
>
> Describing the structure of something simply means naming its components and, sometimes, explaining how they are connected together. You can use words such as: **be composed of**, **be made (up) of**, **comprise**, **consist of**, **contain**, **have**, **include**, …

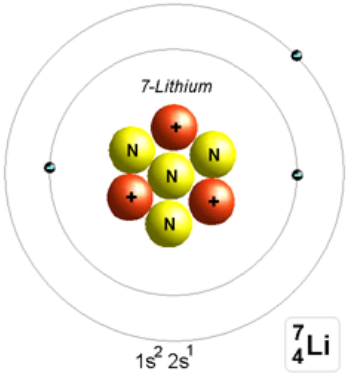
are composed of (2) – bind – carry (3) – cluster – contain (2) – form (2) – have (2) – join – orbit

Atoms are the basic building blocks of ordinary matter. Atoms can _____ together to _____ molecules, which in turn _____ most of the objects around you.

Atoms _____ particles called protons, electrons and neutrons. Protons _____ a positive electrical charge, electrons _____ a negative electrical charge and neutrons _____ no electrical charge at all. The protons and neutrons _____ together in the central part of the atom, called the nucleus, and the electrons _____ the nucleus. A particular atom will _____ the same number of protons and electrons and most atoms _____ at least as many neutrons as protons.

Both protons and neutrons _____ other particles called quarks and gluons. Protons _____ two 'up' quarks and one 'down' quark while neutrons _____ one 'up' quark and two 'down' quarks. The gluons _____ the quarks to one another.

3. Write a short description of the structure of the 7-Lithium atom below.



3. Speaking: anticipating the content of a listening task

In small groups, answer the questions below and be ready to share your ideas with the class.

1. What does the acronym CERN stand for? What type of organization is it? What is their area of research?

2. Which of these instruments is/are generally used to observe fundamental particles?
   a) particle accelerators
   b) Petri dishes
   c) detectors
   d) nuclear reactors

3. What is the Higgs Bosson ?
   a) a theory explaining the origin of the universe
   b) a prize annually awarded to physicists working on particle physics
   c) the latest particle accelerator designed by CERN
   d) an elementary particle whose existence was proven in 2012

4. Listening: The Standard Model of Particle Physics

Read the questions below, then listen to "The Standard Model of Particle Physics" and answer them:

a) Fill in the gaps in the following sentence: "The objective of particle physics is to understand the _____ structures and _____ in nature – all the way from the largest _____ in the universe (formation of galaxies and _____) all the way down to the smallest dimension in the _____ ."

b) Name 3 of the 5 natural elements Dr Strandberg says we knew about historically.

c) Why did particle physics become more complicated at the beginning of the 20th century?

d) How did scientists first try to organize the "zoo" of new particles? Why was it not such a good system?

e) What are the 4 properties according to which they finally decided to organize the particles?

f) How many quarks are there?

g) Fill in the gaps in the following sentence: "In addition to these quarks, there's another set of fundamental _____ of matter, the so-called leptons. They're composed of an electron, the _____ cousins, the muon and the tau, and their _____ partners. In addition to the fundamental building blocks of matter, the Standard Model also _____ the fundamental _____."

h) Fill in the empty cells in the table below:

Force	**Role**	**Force carrier / Exchange particle**
Weak force		W and Z boson
	Is responsible for _____ or for the fact that a magnet can pick up a paperclip.	Photon
Strong force	Literally glues together the quarks in the neutrons and the protons and it _____.	

i) Why is the Higgs Boson said to be "the Holy Grail of particle physics"?

5. Reading: Retrieving and presenting key information

1) Read the text a first time and select the right connectors (a-e).

A. BIG BANGS AND CRUNCHES

1. All the peoples of the world have their stories of how the universe began – even science people. Most physicists now believe that the universe started with an enormous explosion which came from nothing. But this flash of immense energy, called the Big Bang, was not at all like a huge bomb. Time and space themselves were created in this special blast*. Many people have difficulty understanding this, but it's not a new idea. St Augustin in the fifth century first realised that the universe was created with time, not in time. **(a) Although / So / While** asking what happened before the big bang is as meaningless as asking what's north of the north pole, as Stephen Hawking once remarked.

2. Just after the Big Bang, all the material in the universe was packed into a tiny volume. This hideously* distorted how time flowed and how space looked. Things were such a mess that time and space were indistinguishable. As the universe grew older, it grew bigger and cooler. It expanded so quickly at this stage that it went faster than light. **(b) However / Nevertheless / Although** it is true to say that nothing travels faster than light in our universe today, that law had yet to be created.

3. "Hang on!" you may say. "This all sounds very fishy* to me." True, there are some scientists who do not believe in the Big Bang at all. Most of them prefer the idea that the universe always has been and always will be – this is known as the steady state theory. That, after all, is easy to understand and accept. But although the Big Bang theory is not without its problems, it has successfully predicted a lot of facts, certainly more than its competitors.

4. One discovery which fits happily into the idea of a Big Bang is something scientists call "the background radiation". This appears to be a radio echo of a huge explosion. These radio waves are everywhere in space and warm it slightly to about 4 degrees centigrade above the lowest you can go. It appears that the universe is also growing bigger – something which agrees with the Big Bang theory, too. We know this by watching how the distant galaxies are all rapidly moving away from us. Yet another success of the Big Bang theory is the predictions of what the universe is made of: about three quarters hydrogen, a quarter helium and a tiny bit of everything else.

5. Although the Big Bang theory has enjoyed great success, there are still many unanswered questions about the universe which no theory has successfully predicted. **(c) For instance / Furthermore / By contrast** , a few years ago, a satellite called COBE took a picture of the sky with a special camera and saw wrinkles* in the supposedly uniform background radiation. No one knows for sure what causes these wrinkles. **(d) On the contrary / Likewise / As a consequence**, nobody knows for sure why everything is not equally spaced out but clumps together* to form stars and galaxies. "We may be further away from the answers to the universe than when we started," says Dr Simon Mitton, the science director for Cambridge University Press, "but lots of questions have been answered along the way."

6. It is harder to say what the future holds for the universe than to say what happened in the past. It seems that there are one of two possibilities. **(e) Either / Neither / Nor** the universe's own gravity will pull everything back together again in what is called the Big Crunch or it will continue expanding and growing colder forever. It all depends on how heavy the universe is. All observations agree that it is a close run thing between the two, though there is slightly more evidence that it will carry on growing. It all depends on whether or not we find the missing mass, or dark matter as it is known.

7. Whatever happens, nobody alive today will ever find out. If the fate of the universe is to die in a Big Crunch, it is still a long way off. At roughly 15 billion years old, the universe is only middle aged. The future will definitely be longer than the past.

Vocabulary

blast: explosion hideously: terribly fishy: suspicious wrinkle: *pli, ride* to clump together: to gather

2) Read the text again and answer the following questions.

a) What's the Big Bang?

b) Why is it meaningless to ask what happened before?

c) What is the 'steady state theory'?

d) Which elements given in the text seem to support the Big Bang theory?

e) How do we know the universe keeps expanding?

f) What's the Big Crunch?

g) Explain §6 in your own words, using the following keywords:

future – 2 possibilities - most likely – dark matter

B. THE CASE OF THE MISSING MATTER

Read the text and answer the questions below.

1. Out in deep space, things are not what they ought to be: the universe, it would appear, is a cheating weight-watcher. When we put it on a cosmic pair of scales*, the universe seems to have more weight than we can actually see: the universe is sucking its stomach in*!

2. This missing mass – or dark matter as it is called since we can't see it – will affect the future of the universe. If there is far more matter than we can see, one day the universe will start contracting until all things are squashed* in a "big crunch". If what we see is indeed all there is out there, the universe will keep on expanding forever.

3. We know there is some mass missing from the universe by how distant galaxies (whirlpools* of stars) attract each other. In the same way that you know the wind is blowing when you look through a window and see trees bend, so cosmologists can see how much galaxies weigh by the forces of gravity between them. And just as an elephant has more force pulling it to the ground than a mouse, galaxies with lots of mass in them should pull each other together more than galaxies with less mass. Observations seem to indicate there is far more force acting on galaxies than we would expect from the matter we can see within them.

4. There are a number of suspects in the missing mass mystery. Fortunately they fall into two categories: ordinary matter and the slightly more 'exotic' matter. It is possible that the universe has a great deal of ordinary matter that is invisible simply because it's not massive enough to shine. Stars like the Sun must have enough mass for nuclear reactions to start before they can give off light and heat. Stars that don't have quite enough mass don't shine and are called brown dwarfs*. It is possible that there are quite a few of these failed stars in the universe so they could account for quite a bit of the mass that we can't see.

5. The other category – exotic matter – is made up of a collection of rather bizarre particles including neutrinos and WIMPS. Suspect number one is a particle called the neutrino. Its name, given by the Italian physicist Enrico Fermi, means "little neutral one" in Italian. We know that it definitely exists because we have seen evidence for it in nuclear reactions on Earth. But since neutrinos are neutral and have no electric charge, they very rarely interact with the things in our everyday life. This makes them extremely hard to catch and detect and could explain why so much of the missing matter in the universe is invisible. Unfortunately, even if we could detect them easily, we still don't know if neutrinos have any mass – they could be massless. In which case, although there might be billions and billions of neutrinos, they might weigh absolutely nothing!

6. The next suspect is a WIMP (Weakly Interacting Massive Particle). Again, wimps rarely interact with everyday things but they are thought to be so heavy, that they could make up the missing matter. Unfortunately, we've yet to see one. You may think this is a good reason to eliminate them from the inquiry, but many cosmologists – the people who worry about these sorts of things – believe the idea is too good to give up. At this very moment, machines to catch these suspects are being built, usually deep underground in old mines in an attempt to shield* them from the natural showers of cosmic waves which come from space. And to protect them from the natural radiation from rocks deep underground, the detectors are surrounded with lead* and tons of pure water.

7. Some scientists argue there may not be a missing mass mystery at all. They say the scales with which we measure the weight of the universe may be wrong: our laws for gravity may not be precise. There may be a loophole* which lets neutrinos, wimps and all the other suspects go free.

8. However, Dr Richard Ellis of the Institute of Astronomy at Cambridge says "My personal view is that we are looking for particles which interact very rarely with normal material. I believe there is a lot of dark matter around in my room at the moment. Perhaps as much as ninety per cent of the universe is dark matter. This missing mass would have a lot to do with how galaxies are distributed throughout the universe – how they clump together. If we could find the positions of galaxies very accurately we'd be able to say one way or the other if indeed there was a missing mass problem."

Vocabulary

pair of scales: *balance*	to suck one's stomach in: *rentrer le ventre*	squash: *crush*
whirlpool: *tourbillon*	dwarf: *nain*	shield: *protect*

a) How could dark matter affect the future of the universe?

b) How do we know matter is missing?

c) Fill in the table with information from the text.

	Missing Matter	
	ordinary matter	_____ matter
Example(s) + characteristics	(1)_____	(1)_____ (2)_____

d) Do all scientists agree with the hypothesis of dark matter? Why/why not?

e) What is Dr Ellis' view?

6. Language reminder: Types of questions

A. Yes/No questions (Answer: Yes or No)

Yes/No questions begin with an **auxiliary verb** or a form of **do** followed by the subject

e.g. *Is it time to go?* *Have you done the washing up?* *Can you swim?* *Do you know Peter ?*

B. Wh-questions (beginning with who, what, which, whose, where, when, why and how)

If the question word is the subject > Question word + verb form

e.g. *Who is driving the car?* *What are you doing?* *Whose book is this?*

If the question word is NOT the subject >

Question word + **AUXILIARY** or **DO** + subject + remainder of the verb form

e.g. *How does this machine work?*

!: the question word can also be the ***object of a preposition***.

e.g. *What are you looking at?* *Who are we waiting for?*

How many people do you work with? *Where do you come from?*

Write questions to which the underlined words are the answers.
e.g. *She's twenty. > How old is she?*

1. *She had to drive for four hours to get there.*

2. *Jenny washes her hair every other day.*

3. *The house was her uncle's.*

4. *The farm is six miles from Lancaster.*

5. *Johnny went to the prep ball with Daisy.*

6. *My coat cost me fifty pounds.*

7. *I prefer the blue jumper.*

8. *He married her because he loved her.*

9. *She bought a mobile phone so that he could call her.*

10. *We have known them for over ten years.*

11. *Mary told him.*

12. *The letter arrived last week.*

7. Speaking: Informally presenting key information

In pairs, choose one of the 2 texts below. Make notes while reading it, then decide with your partner what information should be selected. Together, get ready to present it to the group IN YOUR OWN WORDS.

ANTIMATTER CERN – IDEAS - © 2000

Is there an anti-universe or an anti-you?

1. Antimatter found its way into the popular imagination soon after its discovery in the early 1930s. "Star Trek" fans know antimatter as the high-energy fuel of the Enterprise, the stuff that sends the starship faster than the speed of light. That kind of space travel isn't likely to materialize. But the theoretical possibilities of antimatter have long seduced science fiction aficionados and scientists with promises of amazing revelations about the nature of distant galaxies and the origins of the universe.

2. Perhaps the most amazing thing about antimatter is that it was conceived of at all. In 1928, British physicist Paul Dirac set out to solve a problem: how to reconcile the laws of quantum theory with Einstein's special theory of relativity. Through complex mathematical calculations, Dirac managed to integrate these disparate theories. He explained how things both very small and very fast -- in this case, electrons near the speed of light -- behave. This was a remarkable achievement in its own right, but Dirac didn't stop there. He realized that his calculations would work for an electron with negative charge, but also for an electron with positive charge -- an unanticipated result.

3. Dirac argued that this anomaly was in fact the electron's "antiparticle," the subatomic equivalent of the "evil twin." In fact, he asserted, every particle has an "antiparticle" with nearly identical properties, except for an opposite electric charge. And just as protons, neutrons, and electrons combine to form atoms and matter, antiprotons, antineutrons, and antielectrons (called positrons) combine to form antiatoms and antimatter. His findings led him to speculate that there may even be a mirror universe made entirely of antimatter.

4. Dirac's equations marked the first time something never before seen in nature was "predicted" - that is, assumed to exist based on theoretical rather than empirical evidence - solely on the basis of theory guided by the human imagination. His prediction would be confirmed in experiments by Carl Anderson in 1932. Both men won Nobel prizes for their efforts.

5. Physicists have learned a great deal about antimatter since Anderson's discovery. One of the more dramatic findings (custom-made for many a science fiction adventure) is that antimatter and matter explode on contact. Like lovers caught in a doomed relationship, matter and antimatter initially attract (thanks to their opposite

charges) and then destroy each other. Because these annihilations produce radiation, scientists can use instruments to measure the "wreckage" of their fatal collisions. No experiments have yet been able to detect the antigalaxies or vast stretches of antimatter in space that Dirac imagined. Scientists still send observatories into space to look for them, though, just in case.

6. But the question that really confounds physicists today springs from the same fountain that captured the imagination of the public: that matter and antimatter annihilate when they meet. All the theories of physics say that when the universe burst into existence some fifteen billion years ago with the Big Bang, matter and antimatter existed in equal amounts. Erupting from a celestial cauldron of unfathomable temperatures, matter and antimatter materialized and then annihilated repeatedly, finally disappearing back into energy, known as the cosmic background radiation. The laws of nature require that matter and antimatter be created in pairs. But within a millifraction of a second of the Big Bang, matter somehow outnumbered its particulate opposite by a hair, so that for every billion antiparticles, there were a billion and one particles. Within a second of the creation of the universe, all the antimatter was destroyed, leaving behind only matter. So far, physicists have not been able to identify the exact mechanism that would produce this apparent "asymmetry," or difference, between matter and antimatter to explain why all the matter wasn't also destroyed.

7. Today, antimatter appears to exist primarily in cosmic rays -- extraterrestrial high-energy particles that form new particles as they penetrate the earth's atmosphere. And it appears in accelerators like CERN's, where scientists create high-energy collisions to produce particles and their antiparticles. Physicists study the properties and behavior of manufactured antiparticles, and the antimatter they form when they combine, hoping to find clues to this asymmetry mechanism.

8. Most scientists believe that a subtle difference in the way matter and antimatter interact with the forces of nature may account for a universe that prefers matter, but they haven't been able to definitely confirm that difference in experiments. Theories suggest that even if equal amounts of matter and antimatter were created with the Big Bang, disparities in their physical properties -- such as decay rate or life span -- might favor a matter-filled world. In 1967, Russian theoretical physicist Andrei Sakharov postulated several (rather complex) conditions necessary for the prevalence of matter. One required something called "charge-parity" violation, which is an example of a kind of asymmetry between particles and their antiparticles that describes the way they decay. By comparing the way particles and antiparticles move, interact, and decay, physicists have been trying to find evidence of that asymmetry ever since.

9. To find that evidence, physicists conduct two types of extremely difficult experiments, in an effort to observe matter and antimatter directly. One produces antiparticles and antimatter from high-energy collisions in particle accelerators, and then makes precision measurements of them; these measurements are then compared with everything we know about their matter opposites to identify any detectable differences.

10. Whatever the outcome of such experiments, physicists will continue to push the limits of human imagination trying to fix this little hole (albeit not the only one) in their beautiful theory. While theoretical physics manages to explain with extreme precision a good part of what we know about the laws of nature -- as experiments confirm -- so far, asymmetry doesn't quite fit into the framework. But who knows? In their search for that elusive mechanism that would help explain the mystery of why we're here, physicists might uncover something totally unexpected, opening the door to an amazing new discovery no one has yet imagined.

WATCHING THE DETECTORS

Physics can tell us why we're here, if we know how to look

Frank Close - guardian.co.uk, Thursday July 25 2002

It is some 15 billion years since the Big Bang, 4bn since life began on Earth, yet only in the past hundred years have we discovered what our universe is made of. But as the 21st century begins, our questions are turning from "what" to "why". Why is there anything? Why do the fundamental particles have the masses they have? Why do the forces have their special strengths and properties?

The form and state of matter today on the cool Earth is the frozen end-product of creation: the early universe, we now know, was a cauldron of heat and ephemeral varieties of matter, now long gone.

None the less, there remain hints of this profound history, hidden from our immediate senses. Matter today is made of atoms so small that up to a million could fit into the width of a single human hair. Once thought to be the ultimate seeds of everything, today we know that atoms are made of yet smaller pieces. Their basic constituents were created within the first seconds of the Big Bang.

The inner labyrinths of an atom are as remote from daily experience as the hearts of stars, but to watch the atomic constituents we have to reproduce in the laboratory the intense heat of stars. This is the world of high-energy particle accelerators, which create feeble imitations of the Big Bang in small volumes of a few atomic dimensions.

Years ago, particle accelerators were known as "atom smashers". At the turn of the 21st century, the idea of an "atom smasher" is passé. Today, particle accelerators such as those at Cern, Fermilab, and similar laboratories around the world might be better termed chronoscopes - time machines that are using pieces of atoms to mimic the condition of the new-born Universe. From such experiments we are on the threshold of discovering how matter came to be, and even set to answer profound questions such as why there is any material universe at all.

Creating such extreme conditions is only part of the challenge. It would be useless if we were unable to see what happens and record the results. The particles formed in today's high-energy collisions can be smaller than a millionth of a billionth of a centimetre across - smaller, relative to a grain of sand, than a grain of sand is to our distance from the sun. And not only are these particles triflingly small, they live for only a few hundredths of millionths of a second, or less.

Recording these tiny and ephemeral pieces of matter is the job of the detectors. Detectors come in a variety of types and sizes, but all rely on the same basic principles. They never "see" the particles at all; what they see are the effects of the particles on their surroundings - much as an animal leaves tracks in the snow, or a jet plane forms trails of condensation across the sky.

Electrically charged particles leave trails as they gradually lose energy when they travel through a material, be it a gas, a liquid, or a solid. The art of particle detection is to sense this deposited energy in some manner that can be recorded.

Then, in the way that measurements of the footprints of our ancestors can reveal something about their size and the way they walked, the information recorded can reveal details of a particle's nature, such as its mass and its electric charge.

All the techniques for detecting particles rely on this same principle, from the simple photographic emulsions of the 1930s and 40s to the metre-long, gas-filled chambers, criss-crossed by thousands of wires, of the 1980s, and the barrels of silicon wafers of the 21st century.

In earlier days, much of the data was recorded in photographic form - in pictures of tracks through cloud chambers and bubble chambers, or even directly in the emulsion of special photographic film. Many of these images have a peculiar aesthetic appeal, resembling abstract art. Even at the subatomic level, nature presents images of itself that reflect our own imaginings.

The essential clue to understanding the images is that they show the tracks of the particles, not the particles themselves. Particle physicists have become as adept at interpreting the types of track left by different particles as early hunters were at interpreting the tracks of animals.

Most of the subatomic zoo of particles have brief lives, less than a billionth of a second. But this is often long enough for a particle to leave a measurable track. Relatively long-lived particles leave long tracks, which can pass right through a detector. Shorter-lived particles usually decay visibly, giving birth to two or more new particles. These decays are often easily identified in images: a single track turns into several tracks.

Relativity plays a vital role in studying these ephemeral particles. Thanks to an effect in Einstein's relativity called time dilation, (the faster a particle is travelling through space, the slower time elapses for it), even the most ephemeral particles can be revealed. For a particle travelling at nearly the speed of light, time almost stands still. In this way, short-lived particles can be produced in high-speed beams that survive long enough to be useful in experiments.

Unit Vocabulary

albeit	*encore que, bien que*
attract	*attirer*
be the size of	*avoir la taille de*
behave	*se comporter*
blast (= explosion)	*explosion*
break down **into**	*décomposer en*
building block	*élément de base*
carry on doing sth (= to keep (on) doing sth)	*continuer à faire qqch*
catch (caught[2])	*attraper*
cheat	*tricher*
collide (> collision)	*se heurter (> collision)*
component	*composant*
compress = squeeze	*comprimer*
core	*cœur, noyau*
current	*actuel*
density	*densité*
distribute	*répartir*
electric charge (positive or negative)	*charge électrique (positive ou négative)*
empty	*vide*
exert a force	*exercer une force*
expand	*s'étendre, s'agrandir*
explode (> explosion)	*exploser (> explosion)*
failed	*raté*
fall apart	*se désagréger*
fate	*destin*
freezing point >< melting point	*point de congélation >< point de fusion*
give off (light/heat)	*émettre (de la lumière/chaleur)*
gravity	*gravité*
have difficulty doing sth	*avoir du mal à faire qqch*
interact	*agir l'un sur l'autre*
In the making	*en gestation*
know for sure	*savoir avec certitude*
lead	*plomb*
make sense of sth = to figure sth out	*arriver à comprendre qqch*
mass	*masse*
matter	*matière*
meaningless	*qui n'a pas de sens*
missing	*manquant*
orbit	*graviter autour de*
overcome	*surmonter, triompher de*
path = track	*trajectoire*
property	*propriété*
repel (> repulsion)	*repousser (> répulsion)*
(a pair of) scales	*balance*
shine (shone[2])	*rayonner, briller*

steady	*constant*
surround	*entourer*
underground	*sous terre*
vapour (> vaporization)	*vapeur (> vaporisation)*
warp	*distortion*