



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

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**TWENTY FIRST CENTURY SCIENCE**

**5131/01**

Paper 1 Multiple Choice

**October/November 2011**

**1 hour**

Additional Materials: Multiple Choice Answer Sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)



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**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

**Read the instructions on the Answer Sheet very carefully.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

You may use a calculator.

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This document consists of **15** printed pages and **1** blank page.



- 1 Below are two sentences about the role of chromosomes.

Chromosomes are made up of ... 1 ..., which are long sections of ... 2 ....  
The ... 3 ... code for making ... 4 ....

Which row correctly completes the sentences?

	1	2	3	4
<b>A</b>	DNA	genes	proteins	genes
<b>B</b>	DNA	protein	genes	genes
<b>C</b>	genes	DNA	genes	proteins
<b>D</b>	genes	protein	DNA	proteins

- 2 Atlantic salmon swim into rivers to lay their eggs.

Salmon have 58 chromosomes in each of their body cells.

Male salmon produce thousands of sperm to fertilise the eggs.

Which row shows how the chromosomes from each parent combine in the embryo?

	number of chromosomes in sperm	number of chromosomes in each egg cell	number of chromosomes in each salmon embryo
<b>A</b>	58	58	116
<b>B</b>	58	58	58
<b>C</b>	29	58	87
<b>D</b>	29	29	58

The following information should be used for questions 3, 4 and 5.

Lucy is expecting a baby.

- 3 Lucy wants to know the sex of the embryo.

Which sex cells determine the sex of the embryo?

- A** egg cells from the mother
- B** sperm cells from the father
- C** both egg and sperm cells together
- D** neither egg nor sperm cells

4 If the embryo is a normal girl, which sex chromosomes are in each cell?


- A XY                      B XXY                      C XX                      D YY

5 Some pregnant women only want to have a baby if it is a particular sex.

Four people think terminating a pregnancy is wrong.


Which person thinks terminations are ethically wrong?

**A**




Terminating babies because of their sex is wrong because it can lead to an imbalance in the population.

**B**




I think that terminations are wrong because they can lead to physical problems for the mother.

**C**



I think that the tests that are used to provide information for terminations are not very reliable.

**D**



I think that terminations should never be allowed because they are killing a potential life.

6 Jack and John are identical twins.

Jack cannot breathe in as much air per breath as John can.

What is the most likely reason for this?

- A Jack had a lung infection when he was young.  
 B Jack has inherited an allele for this from his mother but John has not.  
 C The cells in Jack's lungs have recently mutated.  
 D This is controlled by a dominant allele and John has two recessive alleles.

- 7 One of the molecules in petrol is heptane. Heptane is a hydrocarbon.

When heptane burns completely in air, it reacts with oxygen.

What forms when heptane burns?

- A carbon dioxide and water
- B nitrogen and carbon dioxide
- C water and hydrogen
- D water and nitrogen dioxide

- 8 Coal burning power stations produce sulfur dioxide,  $\text{SO}_2$ .

Sulfur dioxide reacts with two substances in the air to form acid rain.

What are the names of these two substances?

- A carbon dioxide and oxygen
- B carbon dioxide and water
- C nitrogen and oxygen
- D oxygen and water

The following information should be used to answer questions **9** and **10**.

Some children suffer from asthma. Asthma causes breathing difficulties.

Sulfur dioxide is a pollutant gas.

Joe is a scientist. He measured the average sulfur dioxide concentrations in six towns.

He also investigated the number of children who were being treated for asthma in each town.

town	sulfur dioxide concentration in $\mu\text{g}/\text{m}^3$	children treated for asthma
P	153	33
Q	539	84
R	328	56
S	182	37
T	452	73
U	275	49

Joe thinks there is a correlation in the data.

**9** Which statement describes the **correlation** in the data?

- A** The fewer the number of children treated for asthma, the higher the concentration of sulfur dioxide.
- B** The higher the concentration of sulfur dioxide, the more children were treated for asthma.
- C** The sulfur dioxide concentration has a range of 153-539  $\mu\text{g}/\text{m}^3$  and the children treated for asthma have a range of 33-84.
- D** Town P has the lowest sulfur dioxide concentration and the lowest number of children treated for asthma.

**10** Joe finds out that another scientist, Eve, has carried out a similar investigation for different towns.

Joe contacts Eve and discusses the results of his investigation with her before he publishes his results.

Why does Joe do this?

- A** If Eve's results are different, it will prove that Joe is wrong.
- B** Joe thinks that if two scientists publish similar results from different studies together, the results will be more likely to be accepted by other scientists.
- C** Joe knows that people are more likely to accept the results of an investigation if only one scientist has been working on it.
- D** Joe wants to find out whose results show the clearest correlation so that only one of them should publish.

- 11** The manager of a factory is worried about the air quality around the factory.

He talks to the workers about travelling to work by bus.

“The air quality near the factory is poor when everyone is travelling to work. If everyone used the bus instead of travelling by car the air quality around the factory would improve.”

Why would travelling by bus improve the air quality?

- A** Everyone would arrive at the same time.
  - B** Many cars are used by people travelling to work.
  - C** One bus produces less pollutants than one car.
  - D** The bus would make more journeys per day than each car.
- 12** How did Wegener’s theory of continental drift explain mountain building?
- A** As the Earth cooled, wrinkles formed on its surface.
  - B** Mountains are formed as volcanoes.
  - C** Mountains are pushed up at the front edge of the moving continent.
  - D** Mountains form at oceanic ridges where molten magma solidifies.
- 13** Which statement about distant galaxies is correct?
- A** The faster a distant galaxy is moving away, the larger it is.
  - B** The bigger the distance to a galaxy, the brighter it appears to us.
  - C** The faster a galaxy is moving away from us, the further away it is.
  - D** The further away a galaxy is, the slower it is moving away from us.

- 14** The table contains a theory and an observation related to the theory.

Which theory is **not** supported by its observation?

	theory	observation
<b>A</b>	The continents of the Earth were once joined together. They have since moved apart.	The seafloor spreads by about 10cm each year as new rock is produced under the seas.
<b>B</b>	Mountain chains were formed by the surface of the Earth 'wrinkling' as it cooled down long ago.	The height of the mountains in the southern Alps is increasing by around 7 mm each year.
<b>C</b>	The Universe started in a 'big bang'.	All distant galaxies are moving away from Earth.
<b>D</b>	Some mountains are formed from rocks that came from the sea floor.	Fossils of shells are found in rocks at the top of mountains.

- 15** The table contains information about different substances that are involved in infections.

Which row contains completely correct information?

	substance	made by	action
<b>A</b>	acid	stomach	makes microorganisms reproduce faster
<b>B</b>	antibiotics	white blood cells	kills microorganisms
<b>C</b>	antibodies	white blood cells	makes blood clot
<b>D</b>	toxins	microorganisms	damages body cells

The following information should be used to answer questions **16** and **17**.

Read this article about the development of a vaccine against HIV (which causes AIDS).

About 60 million people live in Thailand and about 0.6 million people have HIV. 40 % of these people are receiving drug treatment.

A recent trial of a vaccine in Thailand gave a 30 % protection rate from HIV. This would not be high enough to wipe out HIV.

**16** What percentage of people in Thailand have HIV?

- A** 0.01 %      **B** 1 %      **C** 30 %      **D** 70 %

**17** Why is a 30 % success rate for a vaccine unlikely to wipe out AIDS?

- A** Not enough people in the population will be immune.  
**B** Some people have the virus and never develop AIDS.  
**C** The HIV vaccine damages the immune system.  
**D** The virus will always mutate.

**18** Which statement explains why drugs are tested on humans?

- A** The drugs are tested on healthy people to see if they work.  
**B** The drugs are tested on healthy people to see what dose may cause death.  
**C** The drugs are tested on ill people to find out how much the drug should cost.  
**D** The drugs are tested on people with the illness to see if the drug works.

**19** The body has natural barriers that reduce the entry of microorganisms.

Which list contains only natural barriers?

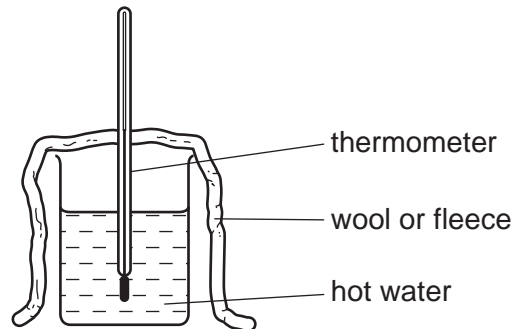
- A** antibiotics, skin and sweat  
**B** bandages, skin and tears  
**C** stomach acid, sweat and white blood cells  
**D** tears, sweat and stomach acid



The following information should be used to answer questions **20** and **21**.

Some students wrap a beaker of hot water in wool or fleece.

They time how long it takes for the temperature of the water to fall by  $10^{\circ}\text{C}$ .



The students repeat their experiment four times.

The table shows the results.

	time taken for water temperature to fall by $10^{\circ}\text{C}$ / minutes			
wool	30	31	34	33
fleece	31	29	27	29

**20** Why should the students repeat the experiment?

- A** they can use the values to calculate a best estimate
- B** they need to practise reading the thermometer
- C** to find out if they should vary the starting temperature of the water
- D** to see if there is a correlation

**21** The students write down a mean and a range for each set of results.

material	mean / minutes	range / minutes
wool	32	30 - 34
fleece	29	27 - 31

The students discuss whether or not the results show **a real difference** between the results for wool and fleece.

Which statement is correct?

- A** There is a real difference because one range is higher than the other.
- B** There is a real difference because the means are different.
- C** There is no real difference because the means are close together.
- D** There is no real difference because the ranges overlap.

**22** What is a light year?

- A** The distance light travels in a year.
- B** The speed of light for a year.
- C** The time it takes for light to go around the Sun.
- D** The total light that reaches the Earth in a year.

**23** Natural rubber is a polymer.

Reacting the rubber with sulfur makes it harder.

Which statement gives the most likely explanation for the rubber becoming harder?

- A** Strong bonds form between the polymer chains.
- B** The chains of rubber move apart.
- C** The melting point gets lower.
- D** The polymer chains get shorter.

**24** A scientist does a life cycle assessment for a type of plastic packaging.

The assessment shows that the waste plastic packaging should be burned rather than buried in a landfill site.

Some people do not agree with the scientist.

Which statement gives the best argument in favour of burying waste in a landfill site?

- A** Gases from burning the plastics may be toxic.
- B** Space to build new landfill sites is in short supply.
- C** The energy from burning the plastic can be used to generate electricity.
- D** The plastic packaging does not rot away.

**25** Some shops now use paper carrier bags instead of plastic carrier bags.

The life cycle assessments for a plastic carrier bag and a paper carrier bag are different.

Which statement gives the best explanation for why the life cycle assessments are different?

- A** Different shops use different types of bag.
- B** Some people prefer to use plastic carrier bags.
- C** The bags have different appearances.
- D** The energy use and environmental impact of using the bags are different.

26 The table shows the properties of three different materials.

material	cost	heat insulation	melting point / °C	strength
low density poly(ethene) (LDPE)	low	poor	80	low
high density poly(ethene) (HDPE)	high	poor	180	high
polystyrene	medium	good	240	low

The manager of a fast food restaurant wants to use one of the materials to make boxes for hot food.

He chooses to use polystyrene.

Why is polystyrene the best choice?

- A It has a high melting point and is very strong.
- B It is the cheapest and the strongest.
- C It is the best heat insulator and has the highest melting point.
- D It is the most expensive and it has a low strength.

27 Which type of electromagnetic radiation is an ionising radiation?

- A infra red
- B microwave
- C ultraviolet
- D visible light

28 Which statement about carbon dioxide is **not** correct?

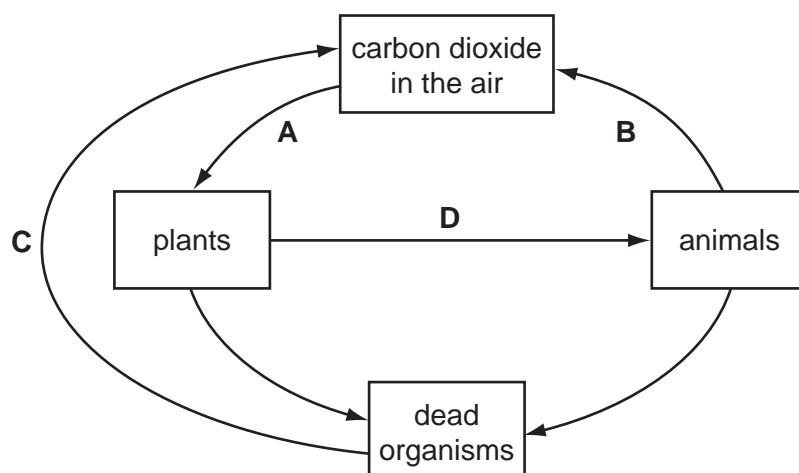
- A Carbon dioxide absorbs visible light.
- B Carbon dioxide is a greenhouse gas.
- C Carbon dioxide is present in very small amounts in the atmosphere.
- D Carbon dioxide is removed from the atmosphere by photosynthesis.

29 Which statement best describes the greenhouse effect?

- A The Earth reflects some of the Sun's radiation back into space.
- B The Earth's atmosphere emits radiation into space.
- C The Earth emits electromagnetic radiation which is absorbed by some gases in the atmosphere.
- D The Sun emits radiation which is absorbed by the Earth's atmosphere.

The following information should be used to answer questions 30 and 31.

The diagram shows part of the carbon cycle with some of the processes labelled **A**, **B**, **C** and **D**.



30 Which process, **A**, **B**, **C** or **D**, is respiration?

31 Which process, **A**, **B**, **C** or **D**, is only carried out by microorganisms?

32 The table shows some information about variation.

Which row shows the correct information?

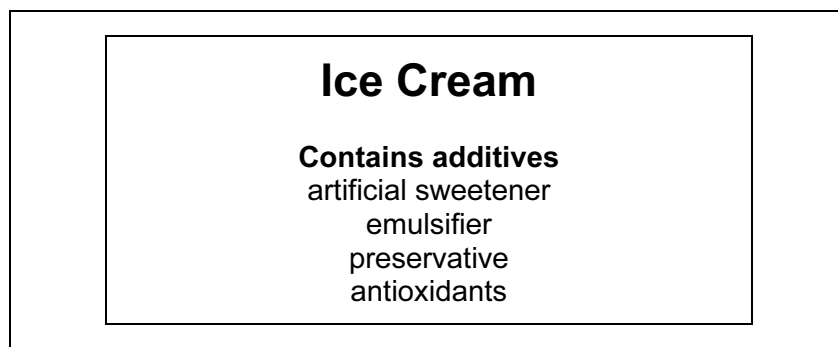
	environment		genes	
	Can it produce variation?	Can this variation be passed on?	Can it produce variation?	Can this variation be passed on?
<b>A</b>	yes	yes	yes	no
<b>B</b>	yes	no	yes	yes
<b>C</b>	no	no	yes	yes
<b>D</b>	no	no	no	no

33 Multi-cellular organisms use both nervous and hormonal communication.

Which row shows the correct features of hormonal communication?

	messages travel in	responses are
<b>A</b>	blood	long-lasting
<b>B</b>	blood	short-lived
<b>C</b>	neurones	long-lasting
<b>D</b>	neurones	short-lived

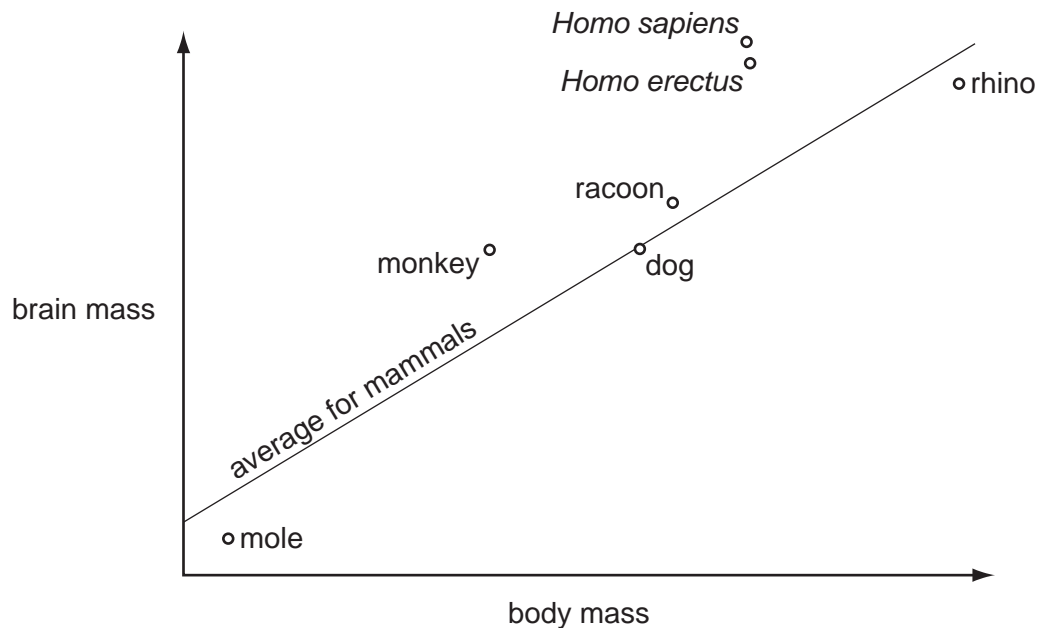
34 The diagram shows a label from a tub of ice cream.



Why are emulsifiers added to food?

- A** to mix oil and water in the food together
- B** to prevent oxygen in the air reacting with the food
- C** to reduce the need for adding sugar
- D** to stop the growth of microbes

- 35 The graph shows the brain mass and the body mass of a number of different mammals. It includes modern man (*Homo sapiens*). It also includes *Homo erectus*, an ancestor of modern man.



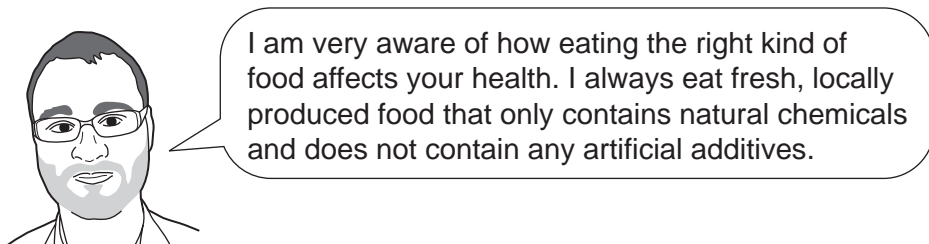
Which conclusion can be made from the graph?

- A A rhino has a larger brain than expected for its size.
  - B It proves that *Homo sapiens* evolved from *Homo erectus*.
  - C It proves that *Homo sapiens* is more intelligent than other mammals.
  - D Monkeys and man have a higher brain mass to body mass ratio than other mammals.
- 36 A gardener has grown vegetables on the same piece of land for many years. Over time, her vegetables do not grow as well.

What is the most likely explanation for this?

- A Bacteria in the soil have converted all of the nitrates into ammonia.
- B Over time, the levels of nitrates and phosphate have built up in the soil.
- C The soil has become low in nitrogen, phosphorus and potassium.
- D There are no proteins left in the soil.

37 Ben is discussing the type of food that he eats.



Which statement about the type of food Ben eats is **not** correct?

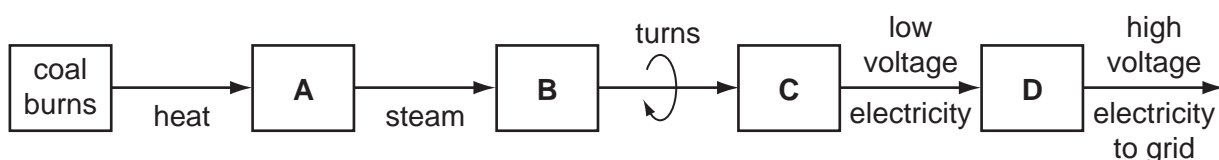
- A Food grown and bought locally is less likely to contain artificial additives.
- B Food without artificial additives may have a shorter shelf life.
- C Natural chemicals in food are never harmful or toxic.
- D Some naturally produced food causes allergies in some people.

38 What is the meaning of 'half-life'?

- A half the time until a radioactive source is safe
- B the time until a radioactive source loses half its activity
- C the time until half a radioactivity experiment is finished
- D the time until there are half the number of protons in the nucleus

The following information should be used to answer questions 39 and 40.

The block diagram shows how electricity is generated in a coal burning power station.



39 Which part, **A**, **B**, **C** or **D**, is the **generator**?

40 Which part, **A**, **B**, **C** or **D**, is the **turbine**?

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