



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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21ST CENTURY SCIENCE

0608/03

Paper 3

October/November 2009

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

| For Examiner's Use | |
|--------------------|--|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| Total | |

This document consists of **16** printed pages.



1 This question is about the gases in the air.

(a) The table shows three gases.

Finish the table by adding the percentage of each gas in unpolluted air.

Choose each percentage from this list.

1% 21% 78%

| gas | percentage in unpolluted air |
|----------|------------------------------|
| argon | |
| nitrogen | |
| oxygen | |

[2]

(b) Nitrogen dioxide is a pollutant gas.

Scientists measure the concentration of nitrogen dioxide in the air next to a busy highway and a quiet country road.

Their results are shown in the table.

| | nitrogen dioxide concentration (micrograms per cubic metre) | | | | | |
|--------------|---|----------|----------|----------|----------|------|
| location | sample 1 | sample 2 | sample 3 | sample 4 | sample 5 | mean |
| highway | 45 | 43 | 43 | 46 | 48 | 45 |
| country road | 8 | 12 | 9 | 10 | 6 | |

(i) Work out the mean for the nitrogen dioxide concentration next to the country road by calculating the average for the five samples.

mean (average) = micrograms per cubic metre [2]

- (ii) The range of the measurements for the highway is 43 to 48.

What is the range of the measurements for the country road?

range = to micrograms per cubic metre [1]

- (iii) The scientists use the mean (average) values from their results as best estimates of the concentration of nitrogen dioxide in each location.

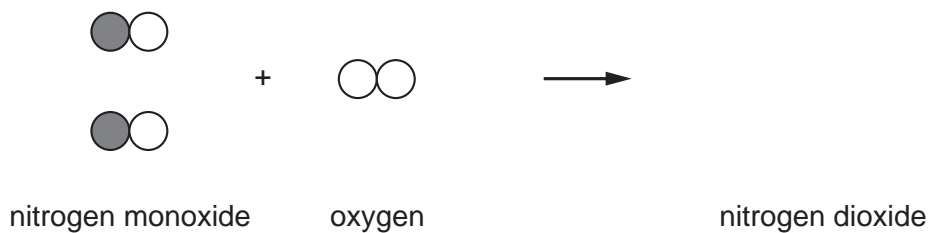
They decide that the best estimate of the nitrogen dioxide concentration from the highway is more reliable than that from the country road

Suggest why this best estimate is more reliable.

.....
..... [1]

- (c) Car exhaust fumes contain nitrogen monoxide. This reacts with oxygen in the air to form nitrogen dioxide.

Complete the diagram below to show the molecules of nitrogen dioxide produced in this reaction.



[2]

[Total: 8]

- 2 Sewage pipes used to be made from ceramic material. This is made by heating clay in an oven. Ceramic material is hard, inflexible and brittle.

Modern sewage pipes may be made from poly(ethene) which is tough and flexible.

- (a) Sewage pipes are laid underground and sometimes crack when the ground moves.

Explain why poly(ethene) is better than ceramic material for sewage pipes.

.....
..... [1]

- (b) Some parts of the Life Cycle Assessment for sewage pipes made from poly(ethene) are different from those for sewage pipes made from ceramic material.

Tick (✓) boxes in the table to show which parts are **different**.

| | |
|--|---|
| | ✓ |
| environmental impact of making the material | |
| environmental impact of using the product | |
| environmental impact of disposing of the product | |

[2]

- (c) Poly(ethene) can be made more flexible by the addition of a chemical.

Name this type of chemical.

..... [1]

- (d) Sewage pipes are an example of a product where a new material has replaced an older material.

- (i) Name **another** example of a product where a new material has replaced an older material.

State the old material and the new material.

product

old material.....

new material.....

[2]

- (ii) Describe **one** advantage of the new material for the product you named in (d)(i).

.....
..... [1]

[Total: 7]

3 This question is about some of the compounds found in plants and animals.

(a) Look at these three chemical formulae: C_2H_6 , $C_6H_{12}O_6$, $C_2H_5O_2N$

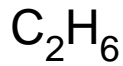
Choose the name of each type of compound from this list.

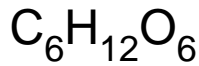
amino acid

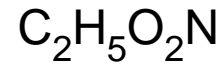
carbohydrate

hydrocarbon

Write the type of compound in the box below each formula.







[2]

(b) Starch is a carbohydrate. It is also a polymer.

During digestion starch is broken down into a simple sugar.

What is the name of this sugar?

Put a **ring** around the correct answer.

cellulose

fructose

glucose

sucrose

[1]

(c) Proteins in food are digested to form amino acids.

Finish the sentence about amino acids.

Use words from this list.

urea

urine

kidneys

liver

Excess amino acids are carried by the blood to the where they

are broken down to form which is excreted by

the in a liquid called

[3]

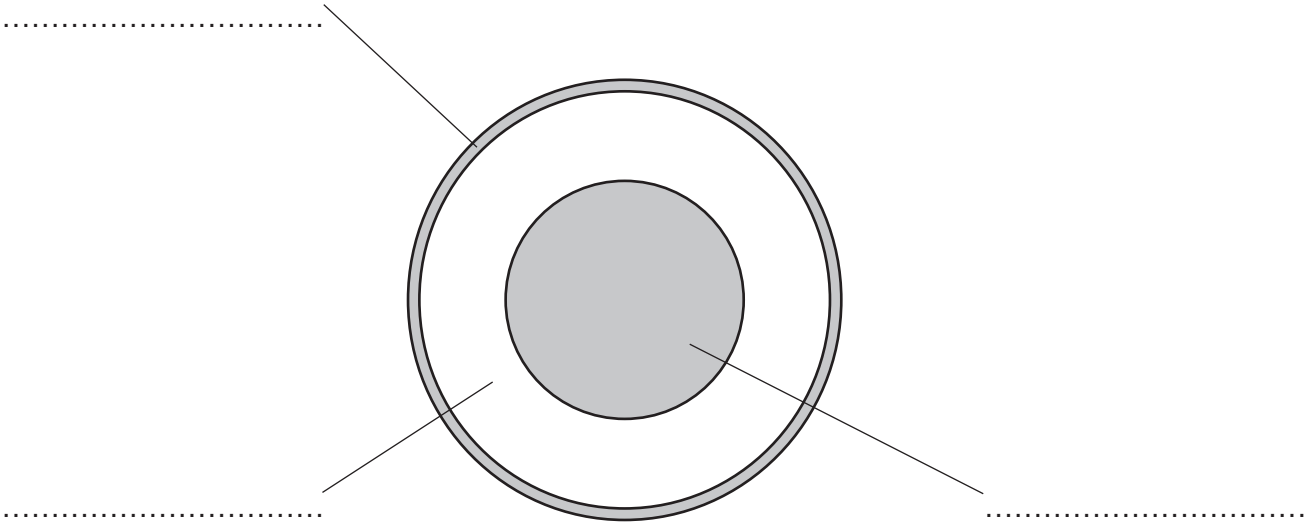
[Total: 6]

4 This question is about the structure of the Earth.

(a) The diagram below is a section through the Earth.

Label the diagram using the words below.

core **crust** **mantle**



[3]

(b) In some parts of the world, movements in the Earth cause serious earthquakes.

Governments may take actions to reduce earthquake damage.

Which of the following actions would help to reduce earthquake damage?

Put ticks (✓) in the boxes next to the **two** correct actions.

action

build stronger buildings

build taller buildings

move everyone to a different country

prepare emergency plans so trained staff can respond quickly

prevent earthquakes from happening

[2]

(c) (i) In 1915, Alfred Wegener suggested his theory of **continental drift**.

He based his theory on a number of observations he and other scientists made.

Write down two observations which Wegener used to support his theory.

Observation 1

Observation 2 [2]

(ii) In 1915, other scientists did not agree with Wegener's theory of continental drift.

Suggest **one** reason why they did **not** agree with Wegener's theory.

..... [1]

[Total: 8]

5 Microwaves are used in microwave ovens and mobile phones.

(a) Microwaves are part of the electromagnetic spectrum.

The diagram below shows the electromagnetic spectrum, with four regions identified.

| | | | | | | |
|--------------------|----------|-----------------|--------------|----------|----------|-------------------|
| radio waves | A | infrared | light | B | C | gamma rays |
|--------------------|----------|-----------------|--------------|----------|----------|-------------------|

(i) Which region, **A**, **B** or **C**, is microwaves? [1]

(ii) Which region, **A**, **B** or **C**, is X-rays? [1]

(b) Microwaves are used to heat food in a microwave oven.

(i) Which of the following statements explains how this happens?

Put a tick (✓) in the box next to the correct answer.

microwaves are an ionising radiation

microwaves are used in communication

microwaves make particles in the food vibrate

[1]

(ii) A 850W oven will heat food faster than a 650W oven.

Explain the difference between the microwaves in these two ovens.

Use the word **intensity** in your answer.

.....
 [1]

(c) Read these different people's views on mobile phones.

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Aruna
No-one can be certain that mobile phones are safe. I'm not going to have one myself.

Bilal
Microwaves cannot split molecules into bits. The only way they can harm you is by heating. They are too weak to heat you much.

Chen
Everyone I know has a mobile phone, and none of them has any health problems.

David
I need my mobile phone for important calls. I don't use it very much.

(i) Which **two** of these people mention a way to reduce the possible risk from mobile phone radiation?

Put ticks (✓) in the boxes next to the **two** correct names.

Aruna

Bilal

Chen

David

[2]

(ii) Which **one** of these people says that the benefits of having a mobile phone outweigh the risks they might cause?

Put a tick (✓) in the box next to the correct name.

Aruna

Bilal

Chen

David

[1]

[Total: 7]

6 Nuclear waste must be stored somewhere safe.

(a) There are three types of nuclear waste:

- low level waste
- intermediate level waste
- high level waste

Use a straight line to join each **type of waste** to its correct **description**.

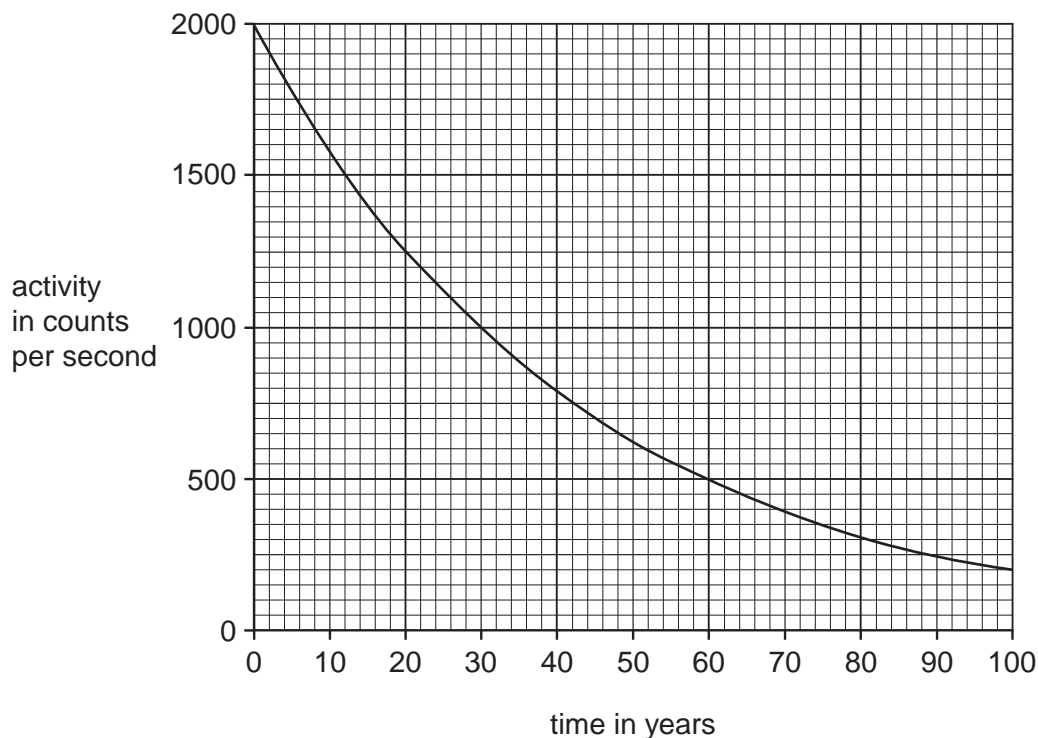
| type of waste | description |
|--------------------|---|
| low level | very long-lived waste which is difficult to store |
| intermediate level | used fuel rods just after they have been taken from a nuclear reactor |
| high level | slightly radioactive protective clothing and medical equipment |

[2]

- (b) Two of the commonest radioactive isotopes in nuclear waste are strontium-90 and caesium-137. These have very similar half-lives.

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The activity of caesium-137 is shown in this graph.



- (i) Use the graph to describe what happens to the activity of caesium-137 with time.

.....

 [2]

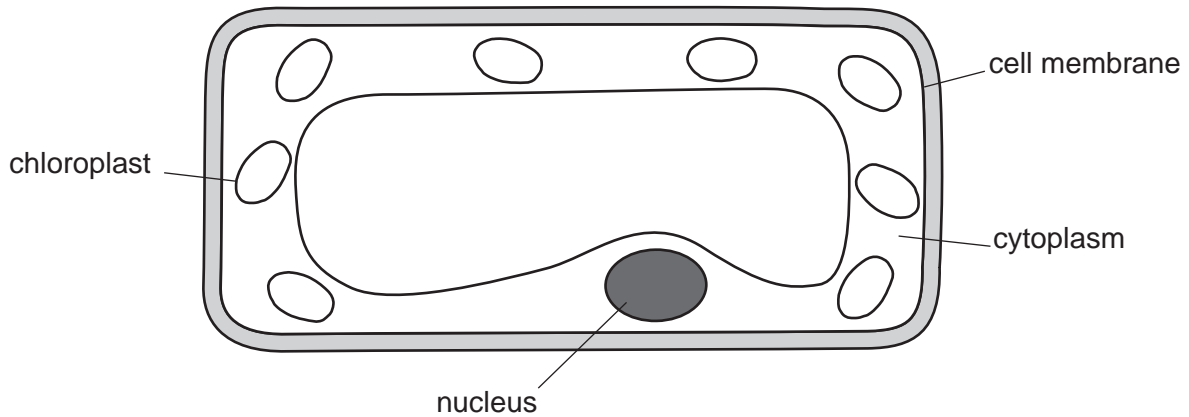
- (ii) Use the graph to find the half-life of caesium-137.

Show your working on the graph or in this space.

half-life of caesium-137 = years [1]

[Total: 5]

7 Look at the diagram of a plant cell.



(a) Which structure **labelled on the diagram** contains instructions for how the plant develops?

.....[1]

(b) Stem cell research is a rapidly advancing field of science.

It uses cells taken from embryos that are only a few days old.

The stem cells can be used to treat illnesses such as Parkinson's Disease.

What are embryonic stem cells? Put a tick (✓) in the box next to the correct answer.

specialised cells that can develop into any type of cell

unspecialised cells that can develop into any type of cell

specialised cells that can develop into one type of cell

unspecialised cells that can develop into one type of cell

[1]

(c) Read these statements, made by five different people.

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- A. An embryo has the same human rights as any person.
- B. Stem cell research could provide valuable treatments for millions of people with incurable diseases.
- C. Stem cell research is a very interesting area of science.
- D. The embryos used are those left over from fertility treatments so they would be discarded anyway.
- E. Most human embryos do not develop beyond two weeks.

Which of the statements **A, B, C, D** or **E**, suggests that,

- (i) the right decision is the one which leads to the best outcome for the majority of people involved.

..... [1]

- (ii) certain actions are never justified because they are wrong.

..... [1]

- (d) Scientists are now able to clone embryos so that large numbers of stem cells can be produced.

Some organisms, e.g. bacteria, can produce clones of themselves using asexual reproduction.

Which of the following statements describe asexual reproduction? Put ticks (✓) in the boxes next to the **three** correct answers.

- | | |
|--|--------------------------|
| all the offspring produced are genetically identical to each other | <input type="checkbox"/> |
| does not involve the production of sex cells | <input type="checkbox"/> |
| involves the production of sex cells | <input type="checkbox"/> |
| one parent is involved | <input type="checkbox"/> |
| the offspring produced are genetically different from each other | <input type="checkbox"/> |
| two parents are involved | <input type="checkbox"/> |

[2]

[Total: 6 marks]

8 Microorganisms may enter the body and cause illness.

(a) The body has natural barriers to reduce the risk of harmful microorganisms entering.

Which of the following are examples of these natural barriers? Put a tick (✓) in the boxes next to the **two** correct answers.

- skin
- teeth
- sweat
- urine
- bone

[2]

(b) Vaccinations provide protection against these microorganisms.

A vaccination is when a safe form of the disease-causing microorganism is put into someone's body.

Describe how vaccinations provide protection from microorganisms in the body.

.....

.....

..... [2]

(c) Read this article:

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Number of measles cases soars due to fears over MMR jab

The number of new cases of measles in the UK has risen to almost 20 times higher than ten years ago. Measles is a highly infectious illness which can cause severe disability or death.

This rise is thought to be due to the relatively low uptake of the combined measles, mumps and rubella (MMR) vaccine over the last ten years. A large number of children are not fully vaccinated against these diseases and measles is spreading easily amongst these children. There is now the real risk of a measles epidemic.

Earlier research had suggested a link between the MMR jab and the developmental disability autism amongst children.

Use the article to help you answer the following questions.

(i) What has happened to the number of people getting measles over the last ten years?

..... [1]

(ii) What **factor** does the article suggest is the cause of this change? Put a tick (✓) in the box next to the correct answer.

more people are having the MMR jab

fewer people are having the MMR jab

no-one is having the MMR jab

the same number of people are having the MMR jab

[1]

(iii) Suggest one reason **for** and one reason **against** having your child immunised with the MMR jab.

.....

 [1]

(iv) The article says:

“Earlier research had suggested a link between the MMR jab and autism...”

Put a (ring) around the word in the sentence which represents the **outcome**. [1]

[Total: 8 marks]

9 Scientists are interested in how life on Earth began and how it has changed over the years.

(a) Complete the following sentences using the correct words from the list below.

You may use each word once, more than once or not at all.

fossils evolved species reproduced plants died

The many different of living things on Earth
from very simple living things.

Evidence for this is provided by [3]

(b) In 1831, Charles Darwin sailed around the world on the ship HMS Beagle. The journey took 5 years.

During this time, he looked at many different plants and animals.

Darwin later proposed ideas to explain his observations.

Read the following statements. Suggest which are data, **D**, and which are explanations, **E**.

Write the correct letter, **D** or **E**, in the box next to each statement.

| | D or E |
|---|---------------|
| All living things change over time by a process called evolution. | |
| Fossils in older rocks are different from those in younger ones. | |
| Individuals of the same species are all different. | |
| Some species become extinct. | |

[2]

[Total: 5 marks]

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