UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

TWENTY FIRST CENTURY SCIENCE **0608/04**

Paper 4 **May/June 2012**

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 **15** printed pages and **1** blank page.

1 The table shows some chemicals commonly used to colour processed foods.

For Examiner's Use

name	colour	source
beta-carotene	orange	carrots
carmoisine	red	synthesised
lycopene	red	tomatoes
sunset yellow	yellow	synthesised
tartrazine	yellow	synthesised
xanthophyll	yellow	plant leaves

(a) Some data suggest that carmoisine, sunset yellow and tartrazine may cause hyperactivity in children.

There is no evidence to suggest that beta-carotene, lycopene or xanthophyll cause hyperactivity.

Use information in the table to suggest which sort of food colourings may cause hyperactivity and which do not.

.....

.....

..... [2]

(b) A pressure group wants a government to ban the use of carmoisine, sunset yellow and tartrazine in processed food.

(i) Explain how the government would be applying the precautionary principle if they did this.

.....

.....

..... [2]

(ii) A government spokesman says that a ban is not necessary. He says that work carried out by a scientific advisory committee means that use of these additives in food is safe.

Suggest what scientific advisory committees do to make sure that the use of food additives is safe.

.....

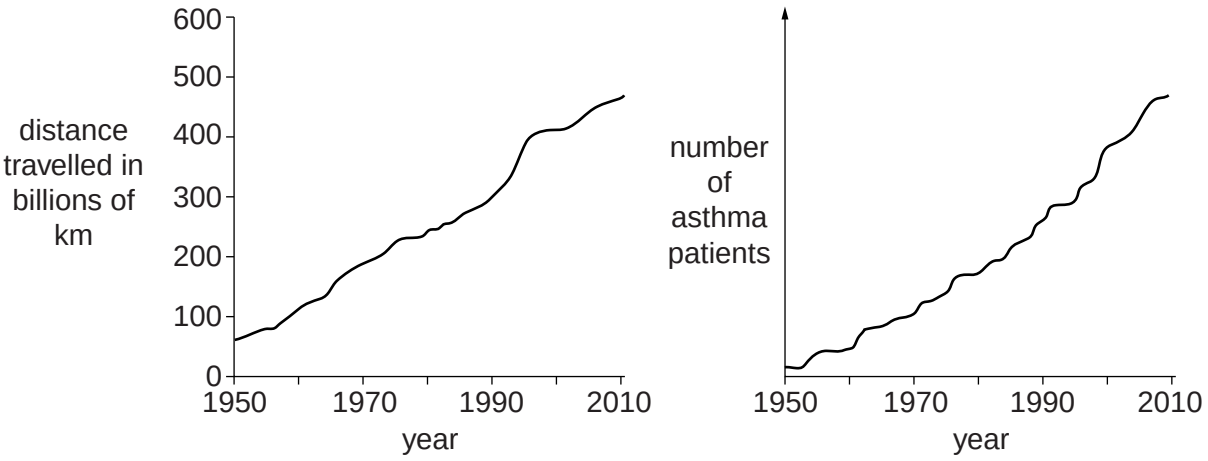
.....

..... [2]

[Total: 6]

2 Scientists look at data from an industrialised country.

They compare the distance travelled by motor vehicles and the number of asthma patients.



(a) Describe the connection between the data shown in the two graphs.

.....

.....

.....[2]

(b) The scientists think that particulates produced by vehicle engines can cause asthma.

Explain why the data does **not** prove this idea and suggest what further information would support the idea.

.....

.....

.....

.....[2]

(c) Suggest **two** ways that the amount of particulates produced by motor vehicles in this country could be reduced.

.....

.....

.....

.....[2]

[Total: 6]

3 Scientists test the tensile strength of low density poly(ethene), LDPE, and high density poly(ethene), HDPE. Tensile strength is a measurement of how much the material can be pulled before it breaks.

For Examiner's Use

	tensile strength / kPa	
	LDPE	HDPE
sample 1	112	285
sample 2	106	279
sample 3	108	298
sample 4	111	282
sample 5	107	289
sample 6	110	284
best estimate	109	
range	106 to 112	

(a) (i) Work out the best estimate for the tensile strength of HDPE.

Give your answer to the nearest kPa.

Show your working.

tensile strength of HDPE = ... kPa [2]

(ii) The scientists decide that there is a real difference between the tensile strength of LDPE and the tensile strength of HDPE.

How does the data show this?

.....

..... [1]

(b) Suggest which of the two types of poly(ethene) would be more suitable for making rope.

Explain your choice.

.....

.....

..... [2]

(c) HDPE has higher crystallinity than LDPE.

For Examiner's Use

(i) Suggest another difference in structure that could explain the difference in properties of these two polymers.

.....[1]

(ii) Explain how the difference in structure you have suggested in part **(i)** results in the difference in properties.

Use ideas of forces and energy in your answer.

.....

.....

.....

.....[2]

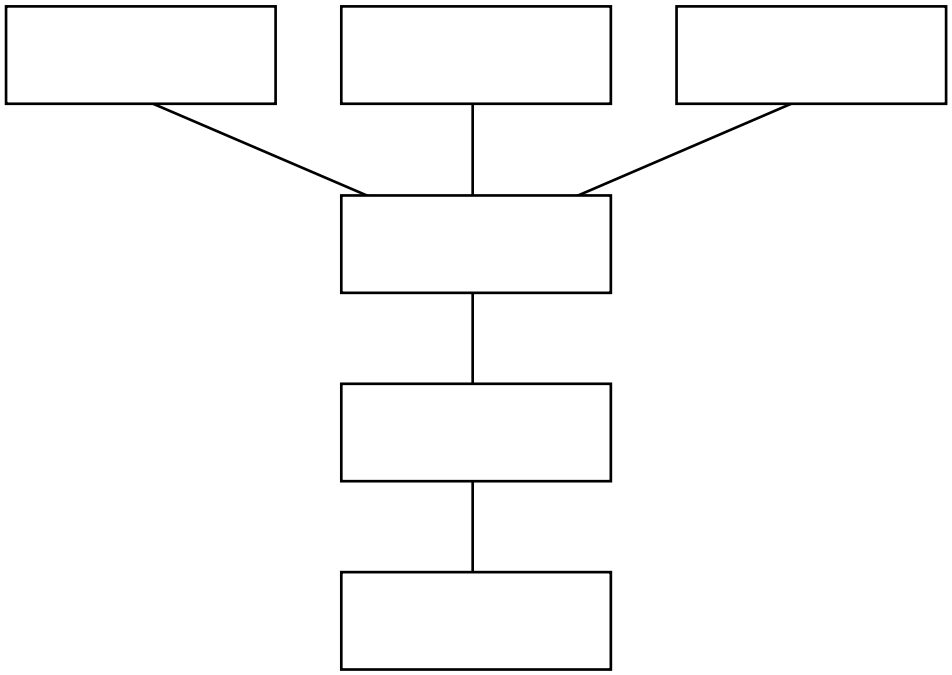
[Total: 8]

4 A puffin is a seabird found living around the coast of the UK.

For Examiner's Use

Puffins eat sand eels (small sea fish) which feed off plankton (small plants found in the sea). Puffins are predated by rats, stoats and seagulls.

(a) Complete the food web using the information above to help you. Add the arrow heads correctly.



[2]

(b) Competition for resources can occur between organisms in a food web.

Interspecific competition occurs between two organisms of **different** species.

Intraspecific competition occurs between two organisms of the **same** species.

Give an example of each type of competition using organisms **from this food web**.

interspecific competition .....

.....

intraspecific competition .....

.....[2]

(c) In recent years, the number of puffins has decreased.

Look at the statements below.

A Oil pollution in the sea increases.

B The number of seagulls decreases.

C Fishing of sand eels increases.

D Hunting puffins for food decreases.

E The number of rats increases.

Complete the table below by writing the letter of each statement, **A** to **E**, in the correct column.

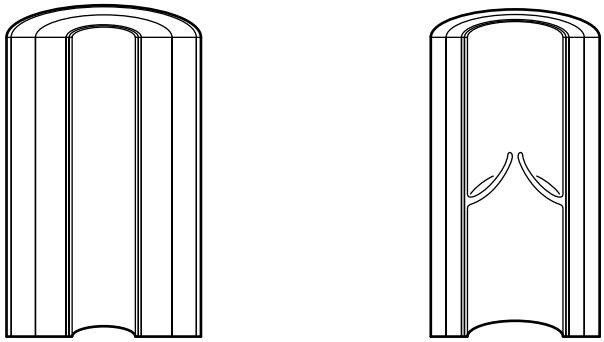
likely to increase the number of puffins	likely to decrease the number of puffins

[2]

[Total: 6]

5 The diagram shows the cross-sections of two different types of blood vessel, **A** and **B**.

For Examiner's Use



A **B**

(a) Describe how the structure of each blood vessel is related to its function.

.....

.....

.....

.....

.....[3]

(b) There are blood vessels that supply blood to the heart muscle. These blood vessels can sometimes become blocked. This can lead to a heart attack.

Explain how this blockage could lead to a heart attack.

.....

.....

.....[2]

(c) Leanne is a smoker. She reads the following information on the side of a cigarette packet.

For Examiner's Use

Smoking increases the risk of heart disease

(i) This suggests there is a correlation between smoking and heart disease.

Describe the correlation between smoking and heart disease.

.....

..... [1]

(ii) A pressure group suggests that the label on the cigarette packet should be changed to

Smoking will give you heart disease

Suggest why this would be misleading.

.....

.....

..... [2]

[Total: 8]

[Turn over

For Examiner's Use

6 Some people may choose to undergo the process of pre-implantation genetic diagnosis (PGD).

(a) Describe the process of PGD.

.....

.....

.....[2]

(b) Lee and Margaret want a baby.

They are **both** carriers of cystic fibrosis. Cystic fibrosis is caused by a recessive allele.

They are advised to have their embryos tested using PGD.

Explain why.

.....

.....

.....[2]

(c) **(i)** It is possible to use PGD to make sure that a baby is a boy.

In some countries, this is not allowed. Suggest **one** reason why.

.....

.....[1]

(ii) Some people believe that PGD should not be carried out under any circumstances.

Suggest **one** reason why.

.....

.....[1]

[Total: 6]

7 Microwave ovens use microwaves to heat food.

For Examiner's Use

(a) A microwave oven cooks food quickly. The microwaves do not harm the person using the oven.

(i) Explain, using the correct scientific terms, how a microwave oven cooks food.

.....

.....

.....[2]

(ii) State how a microwave oven is constructed to protect the user from microwave radiation.

.....

.....[1]

(b) Mobile phones also use microwaves.

Many people are concerned about the possible damage to the brain caused by the microwaves.

Some people do not let their children have mobile phones until they are older.

Other people think that young children are safer if they have mobile phones.

Suggest one reason supporting each point of view.

- reason for **not** having a mobile phone until the child is older

.....

.....

- reason for young children having a mobile phone

.....

.....[2]

[Total: 5]

8 This question is about tectonic plates and earthquakes.

For Examiner's Use

(a) The idea that the continents moved on the surface of the Earth was first suggested by Alfred Wegener.

Scientists at the time did not accept these ideas.

(i) Write down **one** piece of evidence supporting Wegener's theory.

.....

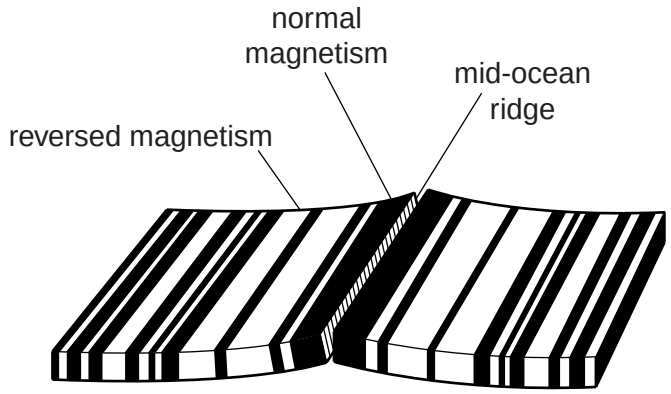
.....[1]

(ii) Give **one** reason why scientists in Wegener's time did not accept his ideas.

.....

.....[1]

(b) Magnetic measurements taken in the Atlantic Ocean in the 1950s showed a pattern of magnetic stripes on the seafloor, as shown below.



(i) Explain how this pattern was produced.

.....

.....

.....[2]

(ii) These results show that the seafloor is spreading.

Explain how this finding supports Wegener's theory that the continents are moving.

.....

.....

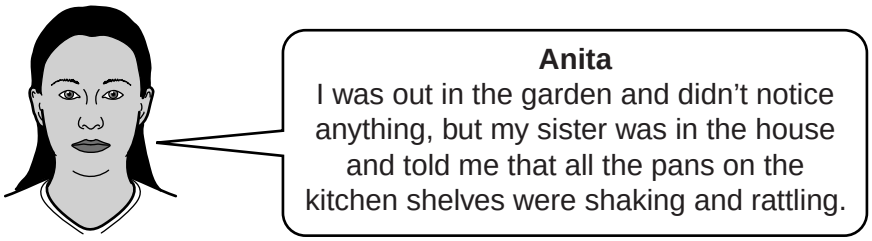
.....[1]

(c) The table shows the effect of different magnitude earthquakes and how often they happen.

For Examiner's Use

magnitude	effect	how often they happen in a typical year
under 3	detected only by special equipment	1 300 000
3.0 – 3.9	just noticeable indoors	130 000
4.0 – 4.9	most people notice them – windows rattle	13 000
5.0 – 5.9	everyone notices them – slight damage to buildings	1 300
6.0 – 6.9	serious damage – bridges are twisted and walls break	130
7.0 – 7.9	great damage – most buildings collapse	13
greater than 8.0	total damage – widespread destruction	1

(i) Anita is describing an earthquake.



Estimate the magnitude of the earthquake described by Anita.

estimated magnitude = ... [1]

(ii) The following table shows how many earthquakes of magnitude greater than 7.0 happened in the first ten years of the 21st century.

year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
number of earthquakes of magnitude >7.0	16	13	15	16	11	11	18	12	17	22

Discuss whether this shows that serious earthquakes are becoming more common.

.....

.....

..... [1]

[Total: 7]

9 This question is about radioactive decay.

(a) Raoul tests the radiation given out by a radioactive material.
He uses a radiation detector and sheets of paper, aluminium and thick lead.
He shows that the radiation given out is **beta** radiation.
Describe how he does this.

.....

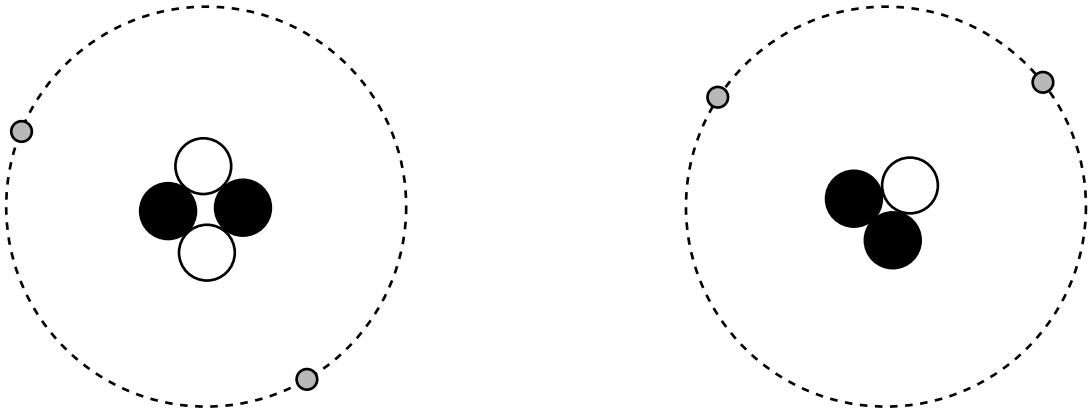
.....

..... [2]

(b) The diagram shows two different atoms. They are both atoms of the element helium.

Each atom is made of three different particles.

Complete the key to identify these particles.



Key

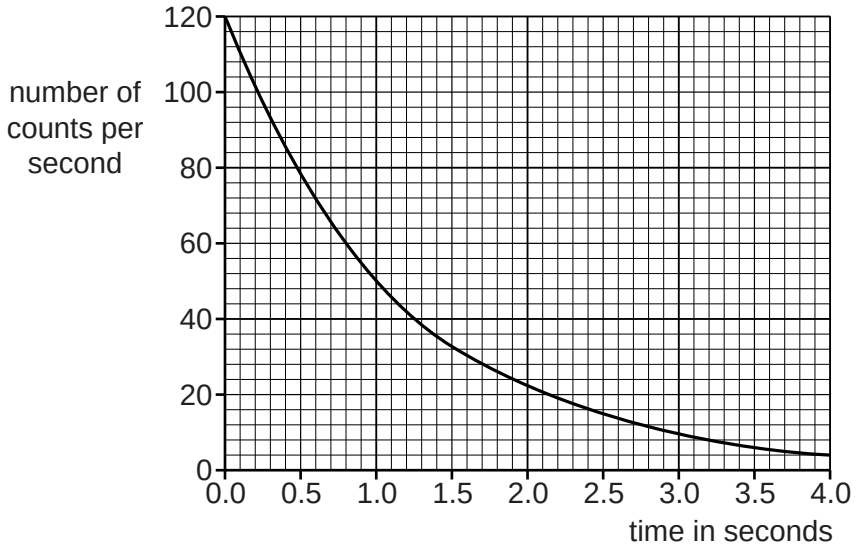
particle	name
○	.....
●	.....
•	.....

[1]

(c) The two different forms of helium shown in **(b)** are both stable.

Another form of helium, helium-6, is radioactive.

The graph below shows how the radiation given out from a sample of helium-6 changes with time.



(i) Before the graph was plotted, the background radiation count was removed from the readings so that the graph shows only the radiation from the helium-6.

State where the background radiation comes from.

.....[1]

(ii) Use the graph above to find the half life of helium-6.

Show your working clearly on the graph.

half life = ... seconds [2]

(iii) Another sample of helium-6 has an activity of 12 000 counts per second.

Use the data above to estimate its activity after 4 seconds and explain how you get your answer.

activity after 4 seconds = ... counts per second

explanation

.....

.....[2]

[Total: 8]

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