

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education  
Foundation Tier  
January 2013

## Science A 2

SCA2FP

### Unit 6

**F**

Thursday 17 January 2013 1.30 pm to 3.00 pm

#### For this paper you must have:

- a ruler
- a calculator
- the Chemistry Data Sheet and Physics Equations Sheet Booklet (enclosed).

#### Time allowed

- 1 hour 30 minutes

#### Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

#### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 15(b) should be answered in continuous prose.  
In this question you will be marked on your ability to:
  - use good English
  - organise information clearly
  - use specialist vocabulary where appropriate.

#### Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
TOTAL	



J A N 1 3 S C A 2 F P O 1

G/K90459

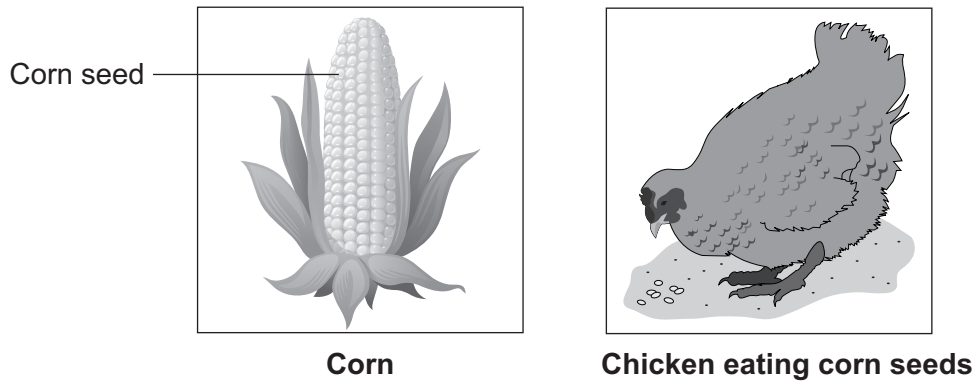
6/6/6/6/6/6

SCA2FP

Answer **all** questions in the spaces provided.

### Biology Questions

- 1 Chickens eat corn seeds.



- 1 (a) When corn plants photosynthesise energy is transferred.

Use words from the box to complete the energy transfer.

**chemical**

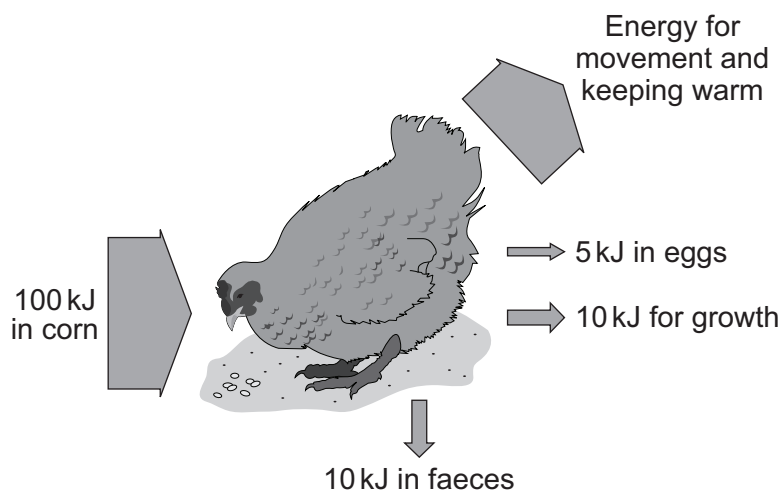
**electrical**

**light**

**movement**

..... energy  $\xrightarrow{\text{Photosynthesis}}$  ..... energy  
(2 marks)

- 1 (b) The diagram below shows what happens to the energy in the corn eaten by a chicken.



- 1 (b) (i)** Calculate the total amount of energy transferred into eggs, growth and faeces.

.....

.....

Energy transferred = ..... kJ  
(1 mark)

- 1 (b) (ii)** How much energy is transferred for movement and keeping warm?

.....

.....

Energy transferred = ..... kJ  
(1 mark)

- 1 (b) (iii)** Draw a ring around the correct answer to complete each sentence.

The energy in the corn is transferred for movement and keeping warm

by	reproduction.
	photosynthesis.
	respiration.

The energy for movement and keeping warm is eventually transferred

to	corn plants.
	humans.
	the surroundings.

(2 marks)

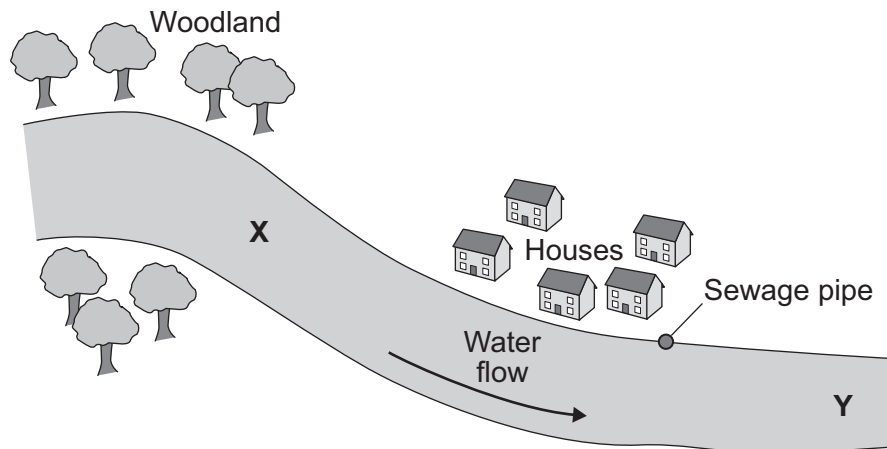
6
---

**Turn over for the next question**

**Turn over ►**



- 2 Scientists investigated the water quality at points **X** and **Y** in a river. The scientists sampled the invertebrate animals living at these points.



The table shows their results.

Invertebrate	Level of oxygen needed for survival	Number of invertebrates sampled	
		Point X	Point Y
Stonefly nymph	High	12	0
Mayfly nymph	High	11	0
Dragonfly nymph	Medium–high	5	0
Freshwater shrimp	Medium–high	14	0
Freshwater louse	Medium–low	5	6
Red-tailed maggot	Low	0	14
Tubifex worm	Low	0	15

- 2 (a) (i) How many different species of invertebrates were found in the river at point **X** and point **Y**?

Number of **different** species of invertebrates at point **X** = .....

Number of **different** species of invertebrates at point **Y** = .....

(1 mark)



**2 (a) (ii)** What does this suggest about the water at points **X** and **Y** in the river?

.....  
.....

(1 mark)

**2 (b)** No Dragonfly nymphs were found at point **Y** in the river.

Use information from the table to suggest why.

.....  
.....

(1 mark)

3
---

**Turn over for the next question**

**Turn over ►**



- 3** One type of soil bacterium produces a poison. The poison kills some insects that feed on cotton plants.

**A cotton plant**



- 3 (a)** Cotton plants can be genetically modified to produce this poison.

Draw a ring around the correct answer to complete each sentence.

The gene that codes for the production of the poison is cut from the

chromosome of 

an insect.
the soil bacterium.
the cotton plant.

This is done using 

an enzyme.
a microorganism.
scissors.

The gene is then transferred to the cells of the 

soil bacterium.
cotton plant.
insect pests.

(3 marks)



**3 (b)** Read the following statements about genetically modified (GM) cotton.

- GM cotton reduces the need to use pesticides.
- GM cotton may kill useful insects.
- GM cotton produces higher yields.
- GM cotton may cause wild plants to produce the poison.
- Some people will not wear clothes made from GM cotton.

Some people do not agree with growing GM cotton plants.  
Other people think it is a good idea to grow GM cotton plants.

Use information given in the statements to answer the following question.

Suggest **one economic advantage** and **two environmental disadvantages** of growing GM cotton plants.

**One** economic advantage: .....

.....  
.....

**Two** environmental disadvantages: .....

.....  
.....  
.....  
.....

(3 marks)

6

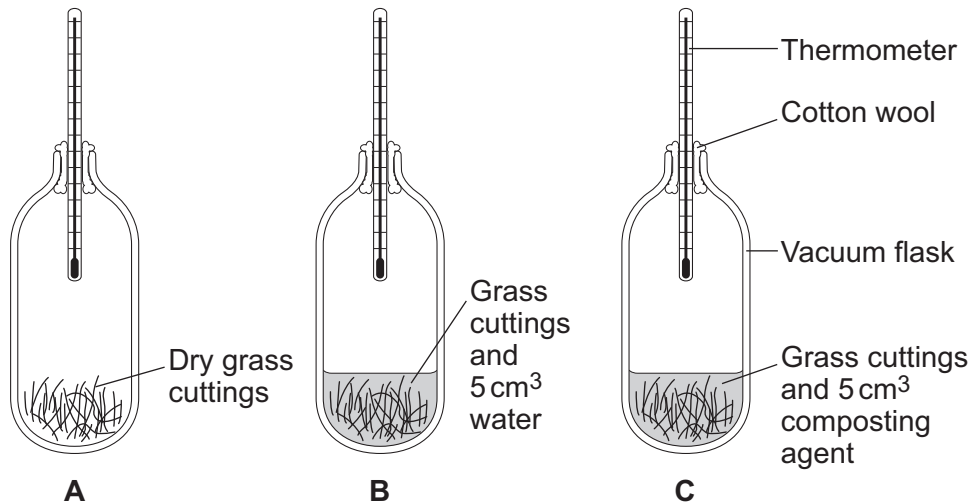
**Turn over for the next question**

**Turn over ►**



**4 (a)** Some students investigated the rate of decay of grass cuttings.

- They set up 3 vacuum flasks, **A**, **B** and **C**, as shown in the diagram.
- They used 5 g of grass cuttings in each flask and left them all for 1 week.
- The students measured the temperature change.
- The bigger the temperature change, the faster the rate of decay.



**4 (a) (i)** Give **one** variable the students controlled in this investigation.

.....  
(1 mark)

**4 (a) (ii)** Why was cotton wool used in the neck of the flask rather than a sealed lid?

.....  
.....  
(1 mark)

**4 (a) (iii)** In flask **A**, the rate of decay was slow.

Give a reason for this.

.....  
.....  
(1 mark)





**4 (a) (iv)** Composting agent contains microorganisms.

Suggest how this affects the rate of decay.

.....

.....

(1 mark)

**4 (b)** Many gardeners decompose grass cuttings and other garden waste in a special bin.

Decomposing garden waste is useful to gardeners.

Suggest **two** reasons why.

.....

.....

.....

.....

(2 marks)

6

**Turn over for the next question**

**Turn over ►**

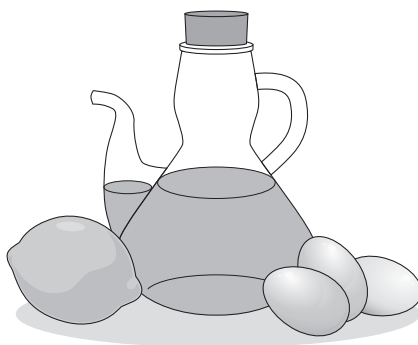


**Chemistry Questions**

**5** Mayonnaise is an emulsion.

A mayonnaise recipe includes:

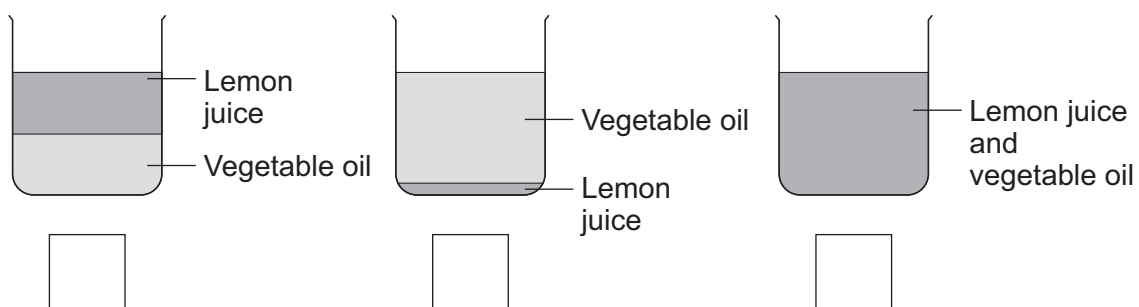
- 3 egg yolks
- $400\text{ cm}^3$  vegetable oil
- $40\text{ cm}^3$  lemon juice (lemon juice dissolved in water).



**5 (a)**  $400\text{ cm}^3$  vegetable oil and  $40\text{ cm}^3$  lemon juice are added together in a beaker.

Which diagram shows what happens when  $400\text{ cm}^3$  vegetable oil and  $40\text{ cm}^3$  lemon juice are added together?

Tick (✓) the box under the correct diagram.



(1 mark)



- 5 (b)** The egg yolks were added to the vegetable oil and lemon juice mixture. The mixture was shaken.  
An emulsion was made.

- 5 (b) (i)** Tick (✓) **two** properties this emulsion has.

Property	Tick (✓)
Better texture than the vegetable oil and lemon juice mixture	
Less stable than the vegetable oil and lemon juice mixture	
Thicker than vegetable oil	
Thinner than lemon juice	

(2 marks)

- 5 (b) (ii)** Which substance in the mayonnaise recipe is the emulsifier?

.....

(1 mark)

4
---

**Turn over for the next question**

**Turn over ►**



- 6** Some people believe that omega-3 oils prevent disease and increase brain performance.  
Omega-3 oils are found in walnuts.



Omega-3 oils are unsaturated vegetable oils.

- 6 (a)** Draw a ring around the correct answer to complete the sentence.

Vegetable oils can be extracted by

fermenting

hydrating

pressing

crushed walnuts.

(1 mark)

- 6 (b)** Vegetable oils are important foods and fuels.

What do the vegetable oils we eat provide us with?

.....

.....

.....

.....

(2 marks)



**6 (c)** Vegetable oils are unsaturated molecules.

Draw a ring around the correct answer to complete the sentence.

Unsaturated molecules contain double

bromine-bromine

carbon-carbon

hydrogen-hydrogen

bonds.

(1 mark)

4

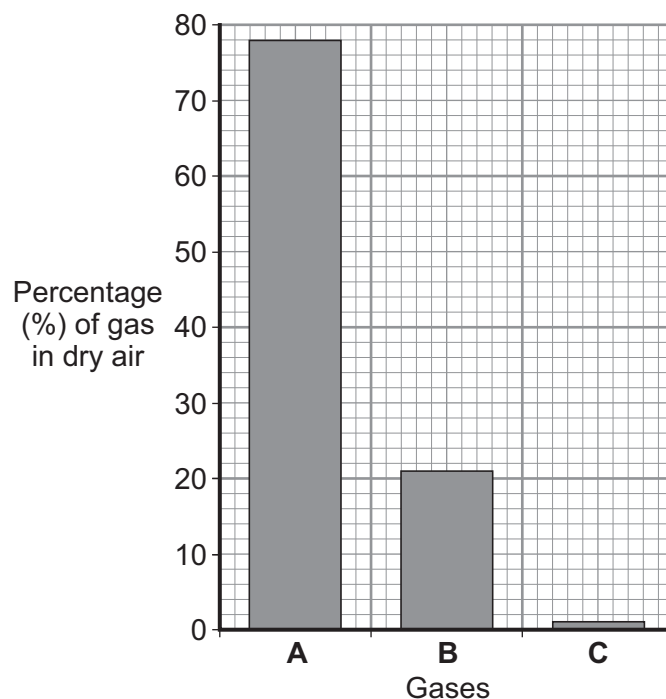
**Turn over for the next question**

**Turn over ►**



**7** This question is about the Earth's atmosphere today.

**7 (a)** The bar chart shows the percentage by mass of the gases in dry air from the atmosphere.



**7 (a) (i)** What percentage of the atmosphere is gas **A**?

..... %  
(1 mark)

**7 (a) (ii)** Use gases from the box to answer this question.

bromine	hydrogen	nitrogen	oxygen
---------	----------	----------	--------

Name gas **A** and gas **B** shown on the bar chart.

Gas **A**: .....

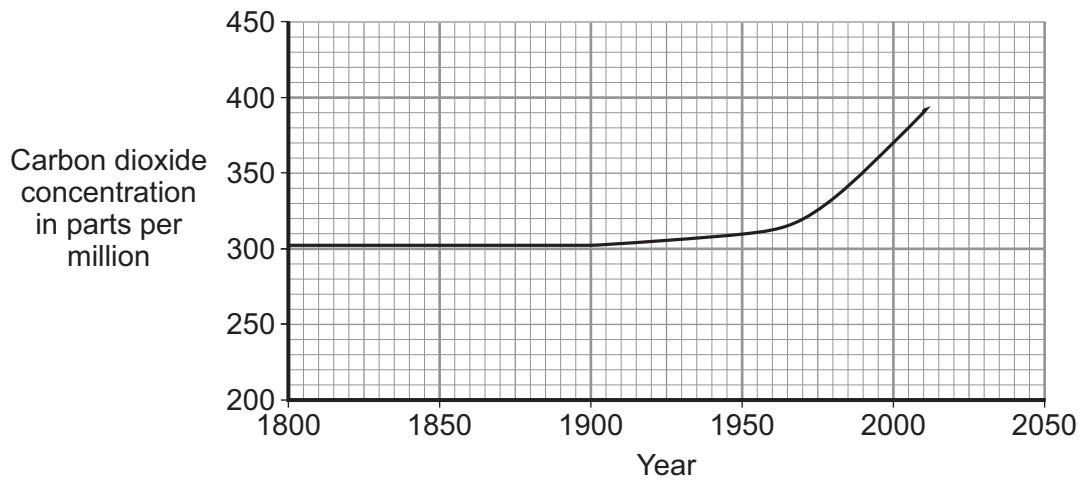
Gas **B**: .....

(2 marks)



**7 (b)** The concentration of carbon dioxide in the atmosphere has changed.

The graph shows how the concentration of carbon dioxide has changed since 1800.



**7 (b) (i)** Describe how the concentration of carbon dioxide has changed since 1800.

.....

.....

.....

.....

(2 marks)

**7 (b) (ii)** Complete the following sentence.

The main process that has caused the change in carbon dioxide is the burning  
of .....

(1 mark)

6

Turn over for the next question

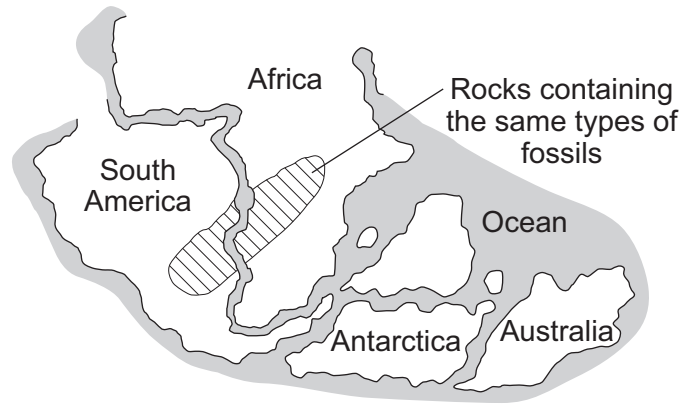
Turn over ►



- 8 In 1915, Wegener suggested the theory of continental drift.

Wegener said the continents were once joined together. The continents then split and slowly drifted apart.

The diagram shows the positions of the continents 250 million years ago.



- 8 (a) (i) Look at the shapes of Africa and South America on the diagram.

Wegener thought Africa and South America had been joined.

Suggest why.

.....

.....

(1 mark)

- 8 (a) (ii) Give **one** more piece of evidence from the diagram that Wegener could use to support his theory.

.....

.....

(1 mark)

- 8 (b) Other scientists did **not** believe Wegener's theory.

Suggest why.

.....

.....

(1 mark)





**8 (c)** In 1912, Captain Scott led a scientific expedition to Antarctica.

The scientists found fossils of *Glossopteris*, a tree-like plant.  
*Glossopteris* fossils had already been found in Australia and Africa.



*Glossopteris*



Fossil of part of  
*Glossopteris*  
(not to scale)

The discovery of *Glossopteris* fossils in Antarctica provided evidence for Wegener's theory.

Suggest how.

.....

.....

(1 mark)

**Question 8 continues on the next page**

**Turn over ►**



**8 (d)** In 1962, scientists produced the theory of plate tectonics.

The theory of plate tectonics supported Wegener's theory of continental drift.

Draw a ring around the correct answer to complete each sentence.

**8 (d) (i)** Tectonic plates move because of convection currents in the Earth's

atmosphere.

core.

mantle.

(1 mark)

**8 (d) (ii)** Tectonic plates move a few

centimetres

kilometres

metres

each year.

(1 mark)

**8 (e)** Some natural processes can cause disasters.

Name **two** types of natural processes that can occur at the boundaries between tectonic plates.

.....

.....

(2 marks)

8



### Physics Questions

- 9** The electromagnetic spectrum is made up of electromagnetic waves.  
The electromagnetic waves form a continuous spectrum of different wavelengths.

- 9 (a)** Draw a ring around the correct answer to complete the sentence.

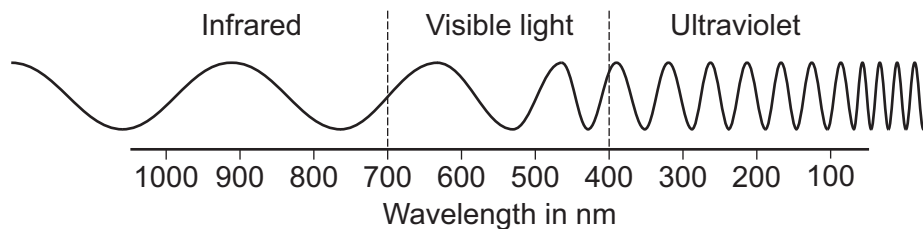
All electromagnetic waves are 

longitudinal
mechanical
transverse

 waves.

(1 mark)

- 9 (b)** Part of the electromagnetic spectrum is shown in the diagram.



- 9 (b) (i)** What is the range of wavelengths the human eye can detect?

The range is from ..... nm to ..... nm.

(2 marks)

- 9 (b) (ii)** Draw a ring around the correct answer to complete the sentence.

As the frequency of the waves in the electromagnetic spectrum increases,

the wave speed 

decreases.
increases.
stays the same.

(1 mark)

4

Turn over ►

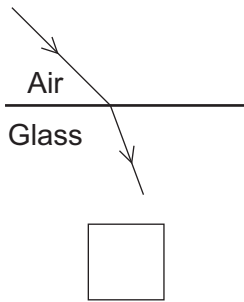


**10** This question is about the properties of light.

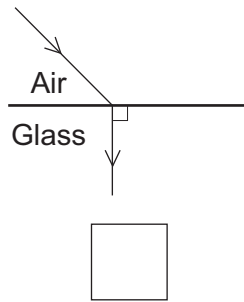
**10 (a)** Which diagram, **1**, **2** or **3**, shows the path a ray of light takes when travelling from air **into** glass?

Tick (✓) the box under the correct diagram.

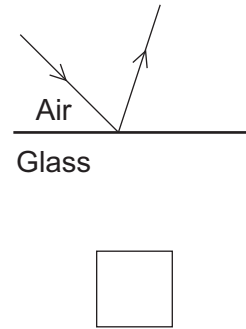
**Diagram 1**



**Diagram 2**



**Diagram 3**

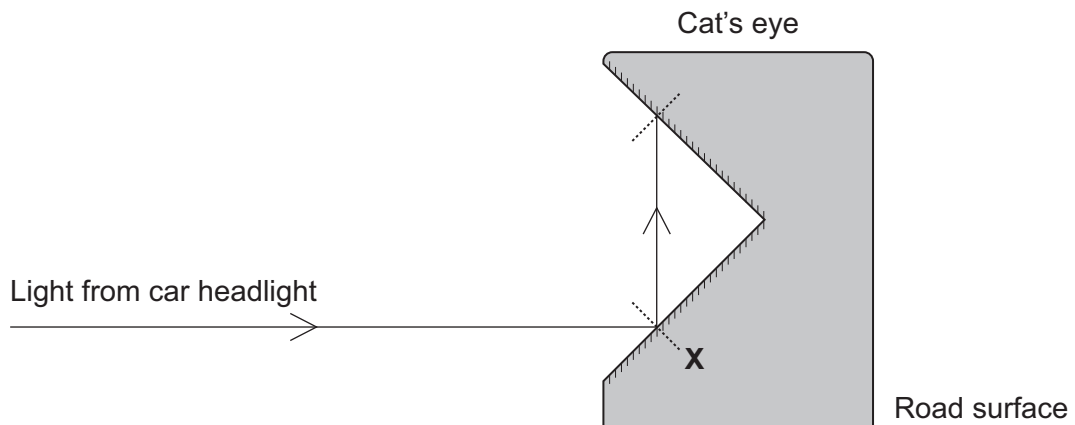


(1 mark)

**10 (b)** 'Cat's eyes' are used on roads as markers. They reflect light from car headlights.

**Diagram 4** shows the path of a ray of light entering a 'cat's eye'.

**Diagram 4**



**10 (b) (i)** Continue the path of the ray of light on **Diagram 4**.

Show the direction of the ray.

(2 marks)

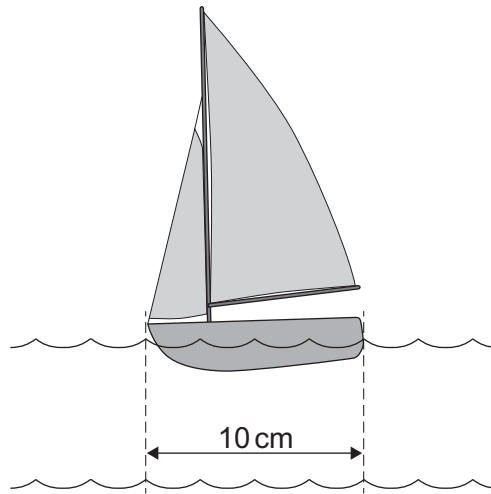
**10 (b) (ii)** What is the name given to the dotted line on **Diagram 4** labelled **X**?

.....

(1 mark)



- 11** A scientist tests a design for a sailing boat using a scale model in a tank of water.



- 11 (a)** Waves are produced on the surface of the water.

Use the diagram to calculate the wavelength of one wave.

.....  
 .....

Wavelength = ..... cm  
 (2 marks)

- 11 (b)** After testing the scale model, a full-size boat is built. This boat is tested at sea.

- 11 (b) (i)** The waves at sea have a wavelength of 6 m. The frequency of the waves is 0.5 Hz.

Calculate the speed of the water waves.

Use the correct equation from the Physics Equations Sheet.

.....  
 .....

Speed = ..... m/s  
 (2 marks)

- 11 (b) (ii)** Suggest why a scale-model is tested before a full-size boat is built.

.....  
 .....

(1 mark)

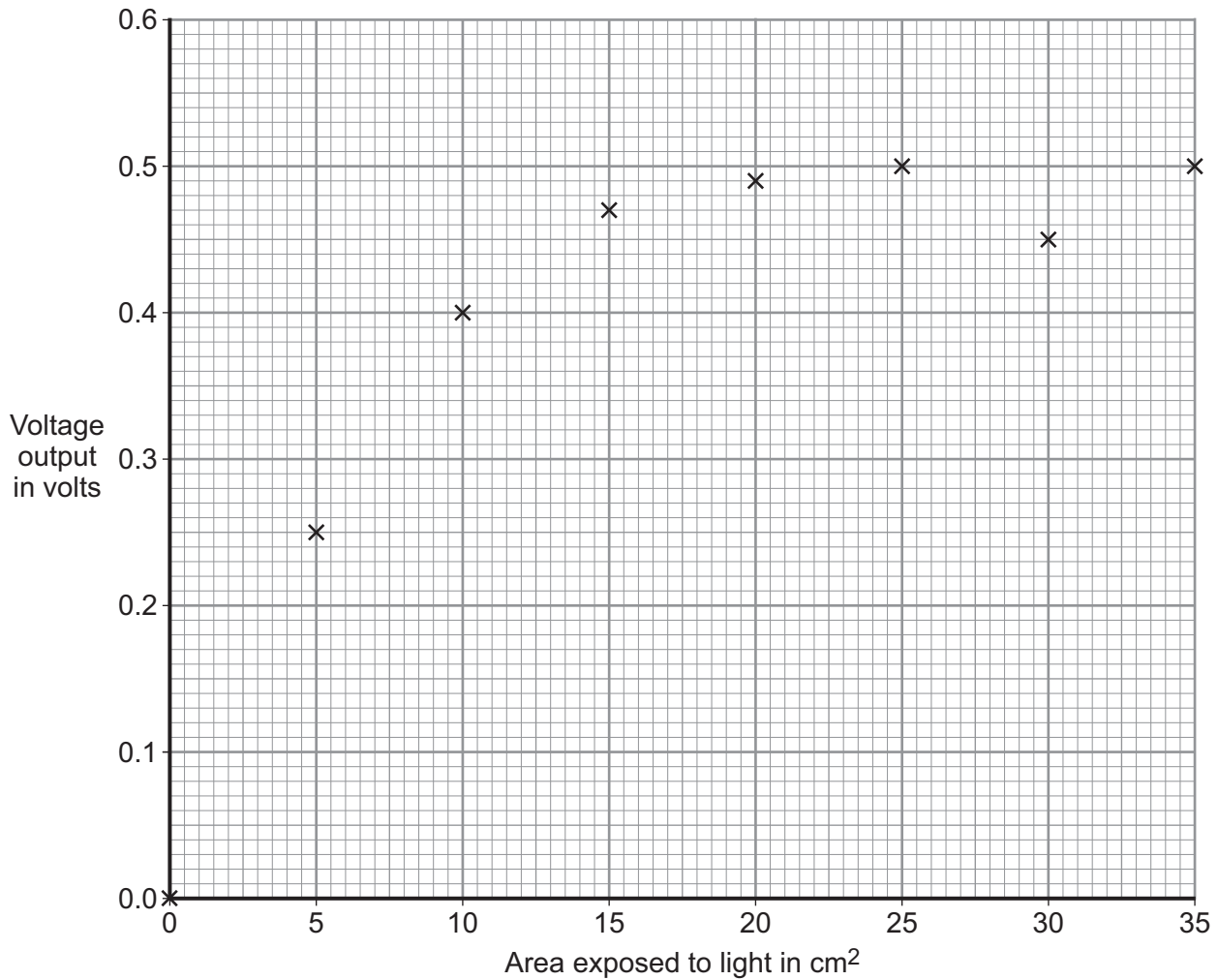


12

A student is investigating how the voltage output of a solar cell depends on the area of the solar cell exposed to light.

He shines a desk light at a solar cell. He varies the area of the solar cell exposed to the light and records the voltage output.

The graph shows the student's results.



12 (a) One of the results on the graph is anomalous.

12 (a) (i) Draw a ring around the anomalous result on the graph.

(1 mark)

12 (a) (ii) Suggest what the student could do about the anomalous result.

.....

.....

(1 mark)



**12 (b)** Give **two** conclusions that can be made from these results.

.....

.....

.....

.....

(2 marks)

**12 (c)** Most houses use electricity from the National Grid.

Some houses have panels made from many solar cells joined together. These panels produce electricity for the house.

**12 (c) (i)** Houses with panels of solar cells remain connected to the National Grid.

Give **two** reasons why.

.....

.....

.....

.....

(2 marks)

**12 (c) (ii)** Producing electricity for a house using solar cells is better for the environment than using electricity from coal-fired power stations.

Give **two** reasons why.

.....

.....

.....

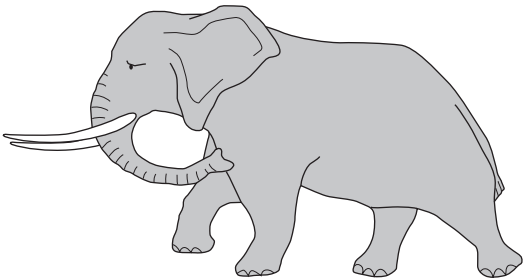
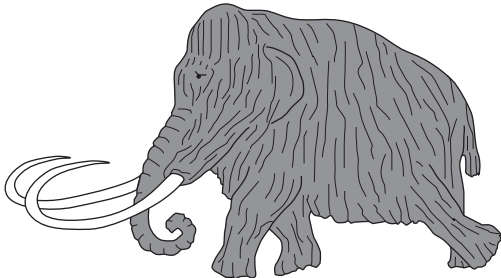
.....

(2 marks)



## Biology Questions

- 13** The table gives some information about the African elephant and the woolly mammoth.

African elephant	Woolly mammoth
	
Mass of male: 6000 kg	Mass of male: 8000 kg
Habitat: near the equator	Habitat: northern Europe
An endangered species	Extinct

- 13 (a)** Use information from the table to help you to answer the following questions.

- 13 (a) (i)** The diagrams show that both animals have tusks. Tusks help animals to compete.

Suggest **two** things animals may compete for.

1 .....

2 .....

(2 marks)





**13 (a) (ii)** The woolly mammoth was adapted to survive during the ice age.

Use information from the table to suggest **two** ways the woolly mammoth was adapted to survive in the cold.

Adaptation 1: .....

How this helped the woolly mammoth survive: .....

.....

.....

Adaptation 2: .....

How this helped the woolly mammoth survive: .....

.....

.....

(4 marks)

**13 (b)** Darwin's theory of evolution says that elephants developed a trunk because animals with a longer nose had an advantage over animals with a shorter nose.

The elephants with a longer nose survived to breed and pass on the gene for a longer nose to their offspring.

**13 (b) (i)** Name the process by which evolution happens.

.....

(1 mark)

**13 (b) (ii)** Describe how Lamarck's theory would explain how elephants developed a trunk.

.....

.....

.....

.....

(2 marks)



**Chemistry Questions**

**14** Ethene is an alkene.

**14 (a)** The general formula of alkenes is  $C_nH_{2n}$

An ethene molecule has two carbon atoms.

What is the molecular formula of ethene?

.....

(1 mark)

**14 (b)** Ethene is produced in industry from hydrocarbons.

**14 (b) (i)** Use words from the box to complete the sentence.

**bromine**

**catalyst**

**fuel**

**polymer**

**steam**

Hydrocarbons are obtained from the fractional distillation of crude oil.

To produce ethene, the hydrocarbons are vaporised.

The vapours are then passed over a hot ..... or mixed with

..... and heated to a very high temperature.

(2 marks)

**14 (b) (ii)** Complete the following sentence.

The industrial process used to make ethene is called .....

(1 mark)



**14 (c)** 8 billion plastic bags are used each year in the UK.

Most plastic bags are made from poly(ethene), but some modern plastic bags are made from polylactic acid (PLA).

PLA is a polymer made from cornstarch.

Cornstarch comes from maize, a plant crop.

**14 (c) (i)** PLA causes fewer problems with waste disposal compared with poly(ethene).

Explain why.

.....

.....

.....

.....

(2 marks)

**14 (c) (ii)** PLA and poly(ethene) are made from different raw materials.

Besides waste disposal, suggest **one** other environmental advantage of using PLA rather than poly(ethene) to make plastic bags.

.....

.....

(1 mark)

**14 (c) (iii)** Suggest **one** disadvantage of using cornstarch to make PLA.

.....

.....

(1 mark)

8
---

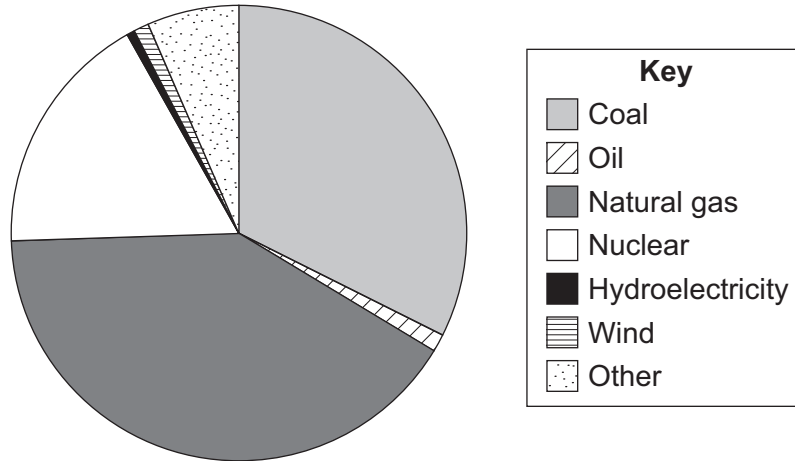
Turn over for the next question

Turn over ►



### Physics Questions

- 15 (a)** The pie chart shows how the electricity generated in the UK is produced using different energy resources.



- 15 (a) (i)** Which energy resource is used to generate approximately one third of the UK's electricity?

.....  
(1 mark)

- 15 (a) (ii)** Name **two** energy resources that could be part of the 'Other' energy resources used to generate electricity in the UK.

1 .....

2 .....

(2 marks)



9



**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**



**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**



**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

ACKNOWLEDGEMENT OF COPYRIGHT-HOLDERS AND PUBLISHERS

Question 3: Cotton plant photo © Thinkstock

Question 6: Walnut photo © Thinkstock

Copyright © 2013 AQA and its licensors. All rights reserved.

