| Centre Number | | | | | | Candidate Number | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Surname | | | | | | | | | | |
| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |

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

General Certificate of Secondary Education
Foundation Tier
June 2012

# Science A 2

# SCA2FP

## Unit 6

# F

**Friday 15 June 2012 1.30 pm to 3.00 pm**

**For this paper you must have:**
- a ruler
- the Chemistry Data Sheet and Physics Equations Sheet Booklet (enclosed).

You may use a calculator.

**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.

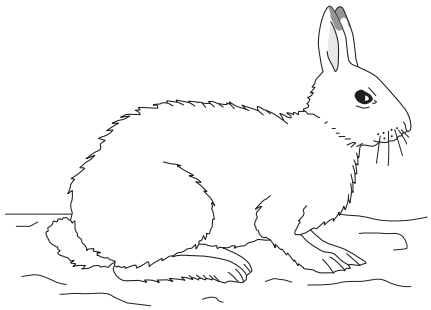
**Information**
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 12 should be answered in continuous prose. 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.

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

## Biology Questions

**1** Arctic hares live in very cold and snowy conditions.



Suggest how each of the following adaptations helps the Arctic hare to survive.

Thick fur: .....

.....

Large feet: .....

.....

White fur: .....

.....

*(3 marks)*

3

**Turn over for the next question**

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

**2** Approximately a third of UK household rubbish is organic matter such as food waste and gardening rubbish.

Many councils have large-scale composting schemes to decompose this rubbish. The products from this process can be sold. This pays for some of the cost of collecting and processing the rubbish.

**2 (a)** Which **two** of the following are reasons to encourage more councils to have large-scale composting schemes?

Tick (✓) **two** boxes.

There will be less household rubbish ☐

They produce substances that help plants grow ☐

They do not cost anything ☐

They reduce landfill ☐

*(2 marks)*

**2 (b)** What conditions are needed to decompose organic waste?

Tick (✓) **two** boxes.

Plenty of carbon dioxide ☐

Dry conditions ☐

Plenty of oxygen ☐

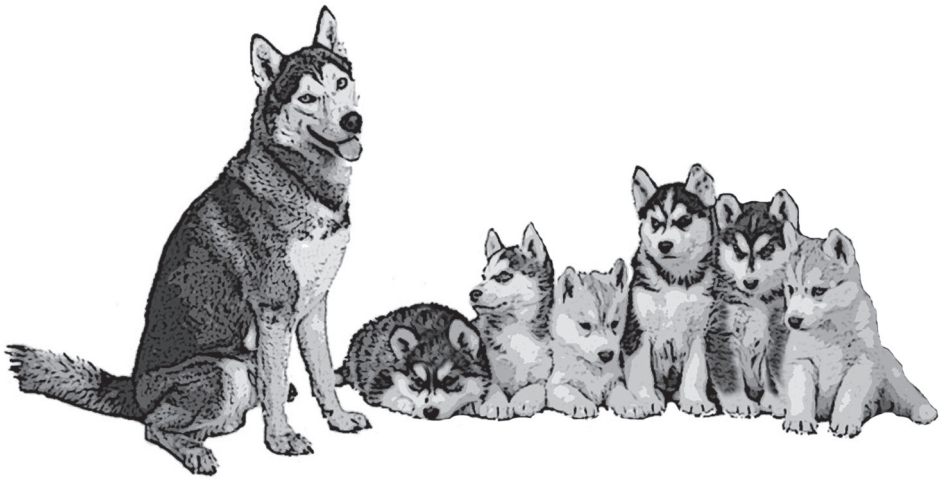
Warm conditions ☐

*(2 marks)*

4

**Turn over for the next question**

**3** The picture shows a mother with her puppies.



**3 (a)** Use words from the box to complete the sentences.

| | | | | |
|---|---|---|---|---|
| **asexual** | **embryos** | **gametes** | **genes** | **sexual** |

The puppies were produced by ..... reproduction.

This type of reproduction involves the fusion of male and

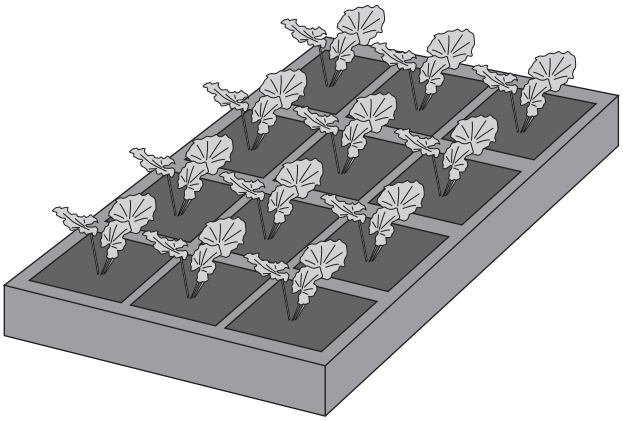
female ..... .

The puppies all look different because their cells contain different mixtures

of ..... .

*(3 marks)*

**3 (b)** A gardener produced some genetically identical geranium plants.



**3 (b) (i)** Complete the following sentences.

Genetically identical organisms are called ..... .

Genetically identical organisms are produced by ..... reproduction.

*(2 marks)*

**3 (b) (ii)** Name a cheap and easy method gardeners can use to produce lots of identical plants.

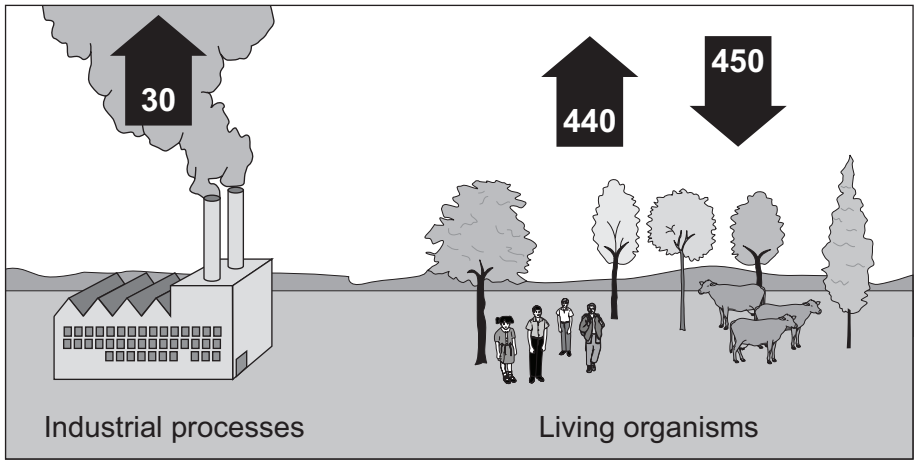
.....

*(1 mark)*

6

**Turn over for the next question**

**4** The diagram shows the mass of carbon dioxide released into and removed from the air each year in billions of tonnes.




**4 (a)** Complete the following sentences.

**4 (a) (i)** Plants remove carbon dioxide from the air by a process

called ..... .

*(1 mark)*

**4 (a) (ii)** All organisms produce carbon dioxide during a process

called ..... .

*(1 mark)*

**4 (b)** Too much carbon dioxide in the atmosphere can harm the environment.

Suggest **two different** ways of reducing the amount of carbon dioxide in the atmosphere.

.....

.....

.....

.....

*(2 marks)*

4

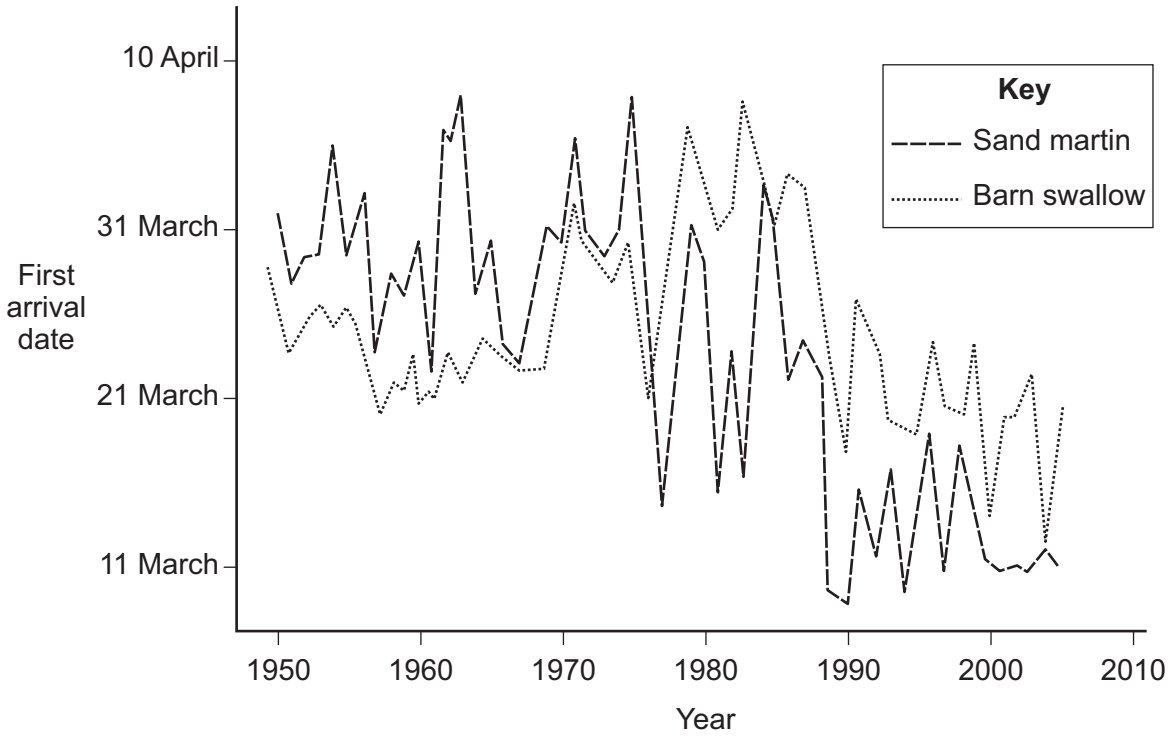
**Turn over for the next question**

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

**5** Scientists have observed changes in the migration patterns of some species of birds.

The graph shows the arrival dates in the UK of two species of birds, the Sand martin and the Barn swallow.

Both birds feed on flying insects.




**5 (a)** What **two** changes in migratory patterns are shown in the data?

Tick (✓) **two** boxes.

Birds fly at faster speeds than they used to ☐

Barn swallows arrive later to the UK than they used to ☐

Sand martins have always arrived in the UK before Barn swallows ☐

Both birds arrive earlier to the UK than they used to ☐

After 1970 the order that the two birds arrive in the UK reversed ☐

*(2 marks)*

**5 (b)** The migratory patterns of the two birds have changed.

Suggest **one** reason why.

.....

.....

*(1 mark)*

3

**Turn over for the next question**

## Chemistry Questions

**6** Sunflower plants can be used to produce vegetable oils.

**6 (a)** From which part of the sunflower plant is vegetable oil extracted?

Draw a ring around the correct answer.

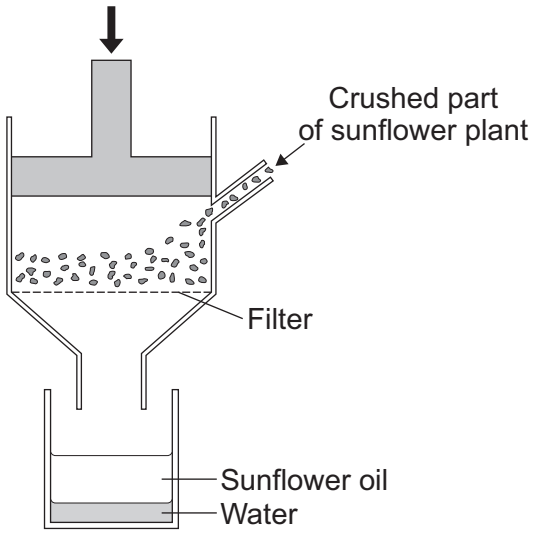
**leaves** **petals** **seeds**

*(1 mark)*

**6 (b)** A student wanted to extract the oil from sunflower plants.

The student crushed part of the plant.

The student extracted the sunflower oil using the apparatus shown.



Complete the following sentences.

The oil is obtained from the crushed part of sunflower plants by .....

..... .

An oil layer and a water layer are formed. This is because oil does not .....

..... .

The oil layer is above the water layer because oil .....

..... .

*(3 marks)*

**6 (c)** Sunflower oil is unsaturated.
Bromine water is used to test for unsaturation.
A student added a few drops of bromine water to sunflower oil and shook the mixture.

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

When mixed with sunflower oil, bromine water will change colour

| | | | |
|---|---|---|---|
| from | colourless<br>green<br>orange | to | colourless.<br>green.<br>orange. |

*(2 marks)*

**Question 6 continues on the next page**

**6 (d)** A student added bromine water to equal volumes of different plant oils.
The bromine water was added until there was no further colour change.

The student's results are shown in the table.

| | Volume of bromine water added in $cm^3$ | | | | |
|---|---|---|---|---|---|
| **Oil** | **Test 1** | **Test 2** | **Test 3** | **Test 4** | **Mean** |
| Olive | 9 | 8 | 7 | 8 | 8 |
| Rapeseed | 14 | 16 | 15 | 23 | |
| Sunflower | 24 | 25 | 25 | 26 | 25 |

**6 (d) (i)** Calculate the mean value for rapeseed.

.....

.....

.....

Mean value = ..... $cm^3$

*(2 marks)*

**6 (d) (ii)** Which oil was the most unsaturated?

Give the reason for your answer.

.....

.....

.....

.....

*(2 marks)*

**6 (d) (iii)** Sesame oil is dark brown.
The student did **not** test sesame oil using bromine water.

Suggest why.

.....

.....

*(1 mark)*

11

**7** Active volcanoes give off gases.

The table shows the percentages of gases a volcano gives off.

| Name of gas | Percentage (%) of gas |
|---|---|
| Carbon dioxide | 49 |
| Water vapour | 37 |
| Sulfur dioxide | 12 |
| Carbon monoxide | 2 |

**7 (a)** Scientists use this data to predict what the Earth's early atmosphere was like and how the oceans were formed.

Use information from the table to help you answer the following questions.

**7 (a) (i)** Describe how a gas released from volcanoes caused the oceans to be formed.

.....

.....

.....

.....

*(2 marks)*

**7 (a) (ii)** Gases from volcanoes formed the Earth's early atmosphere.

Which was the main gas in the Earth's atmosphere billions of years ago?

.....

*(1 mark)*

**Question 7 continues on the next page**

**7 (a) (iii)** Which **two** other gases were also present in the Earth's early atmosphere?

Tick (✓) **two** boxes.

| Gas | Tick (✓) |
|---|---|
| Ammonia | |
| Chlorine | |
| Fluorine | |
| Methane | |

*(2 marks)*

**7 (b)** What are the **two** main gases in the Earth's atmosphere today?

Tick (✓) **two** boxes.

| Gas | Tick (✓) |
|---|---|
| Chlorine | |
| Hydrogen | |
| Nitrogen | |
| Oxygen | |

*(2 marks)*

**7 (c) (i)** Draw a ring around the correct answer in the box to complete the sentence.

The amount of carbon dioxide in the atmosphere is increasing.

The main process causing this is

| |
|---|
| combustion. |
| condensation. |
| photosynthesis. |

*(1 mark)*

**7 (c) (ii)** How is carbon from carbon dioxide locked up in sedimentary rocks?

Tick (✓) **two** boxes.

| | **Tick** (✓) |
|---|---|
| In calcium carbonate | |
| In the mantle | |
| In fossil fuels | |
| In the Earth's core | |

*(2 marks)*

10

**Turn over for the next question**

## Physics Questions

**8** The different parts of the electromagnetic spectrum are shown below.

| | | | | | | |
|---|---|---|---|---|---|---|
| Gamma rays | X-rays | Ultraviolet | Visible light | Infrared | Microwaves | Radio waves |

**8 (a)** Name a part of the electromagnetic spectrum with:

**8 (a) (i)** a longer wavelength than microwaves: .....

*(1 mark)*

**8 (a) (ii)** greater energy than X-rays: .....

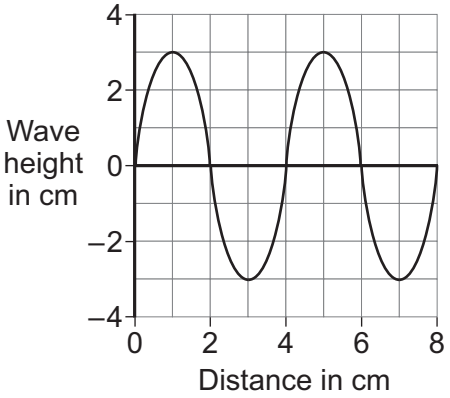
*(1 mark)*

**8 (a) (iii)** a higher frequency than ultraviolet: .....

*(1 mark)*

**8 (b)** The properties of water waves can be measured easily in a school lab.

The diagram shows information about waves.




**8 (b) (i)** How many complete waves are shown in the diagram?

.....

*(1 mark)*

**8 (b) (ii)** What is the wavelength of each wave in the diagram?

..... cm

*(1 mark)*

**8 (b) (iii)** What is the amplitude of the waves?

..... cm
*(1 mark)*

**8 (b) (iv)** Complete the sentence below.

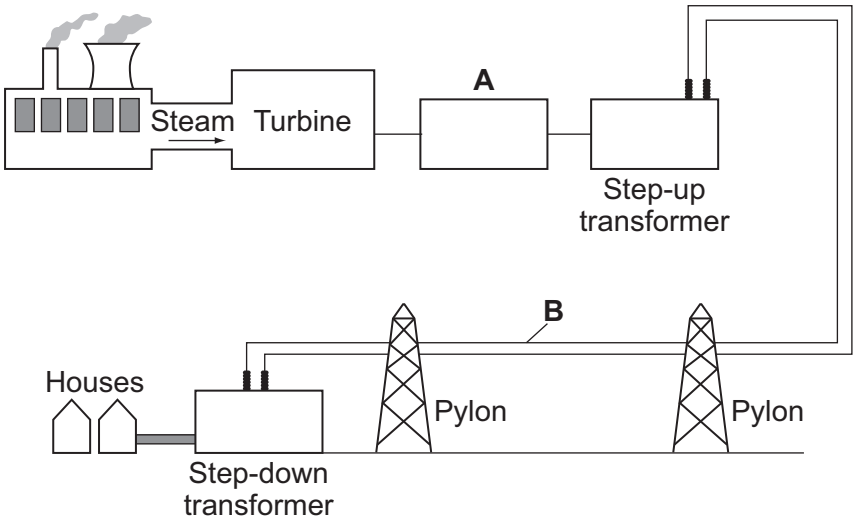
The oscillations of the waves in the diagram are perpendicular to the direction of energy transfer. They are called ..... waves.

*(1 mark)*

7

**Turn over for the next question**

**9** The diagram shows how electricity is generated, and transmitted by the National Grid.




**9 (a)** Name the parts labelled **A** and **B**.

**9 (a) (i)** Part **A** .....

*(1 mark)*

**9 (a) (ii)** Part **B** .....

*(1 mark)*

**9 (b)** The step-up transformer makes changes to the electricity supplied by the power station.

Use words from the box to complete each sentence.

| | | | |
|---|---|---|---|
| **current** | **energy** | **power** | **voltage** |

The step-up transformer increases the ..... of the supply.

The step-up transformer decreases the ..... of the supply.

*(2 marks)*

**9 (c)** Information about five different types of power stations is given in the table.

| Power station | Start-up time | Power output in MW |
|---|---|---|
| Biomass | Medium | 20 |
| Geothermal | Medium | 30 |
| Nuclear | Long | 1200 |
| Hydroelectric | Short | 2000 |
| Wind turbine | Short | 5 |

**9 (c) (i)** Which power station would be best to meet peak demands for electricity?

.....

*(1 mark)*

**9 (c) (ii)** Name **one** power station that does **not** heat water to make steam turn a turbine.

.....

*(1 mark)*

**9 (c) (iii)** Which power station uses a non-renewable energy resource?

.....

*(1 mark)*

**9 (c) (iv)** Wind turbines are used to generate electricity.

Give **one** advantage and **one** disadvantage of using wind turbines to generate electricity.

Advantage: .....

.....

Disadvantage: .....

.....

*(2 marks)*

9

**Turn over for the next question**

**10** Scientists have studied light from distant galaxies. The scientists found that light from distant galaxies seemed to have increased in wavelength. Scientists have used these observations to support the Big Bang theory.

**10 (a)** Draw a ring around the correct answer in each box to complete each sentence.

**10 (a) (i)** The increase in wavelength of light suggests the Universe is

| |
|---|
| contracting. |
| expanding. |
| staying the same size. |

*(1 mark)*

**10 (a) (ii)** The increase in wavelength of light suggests the Universe started

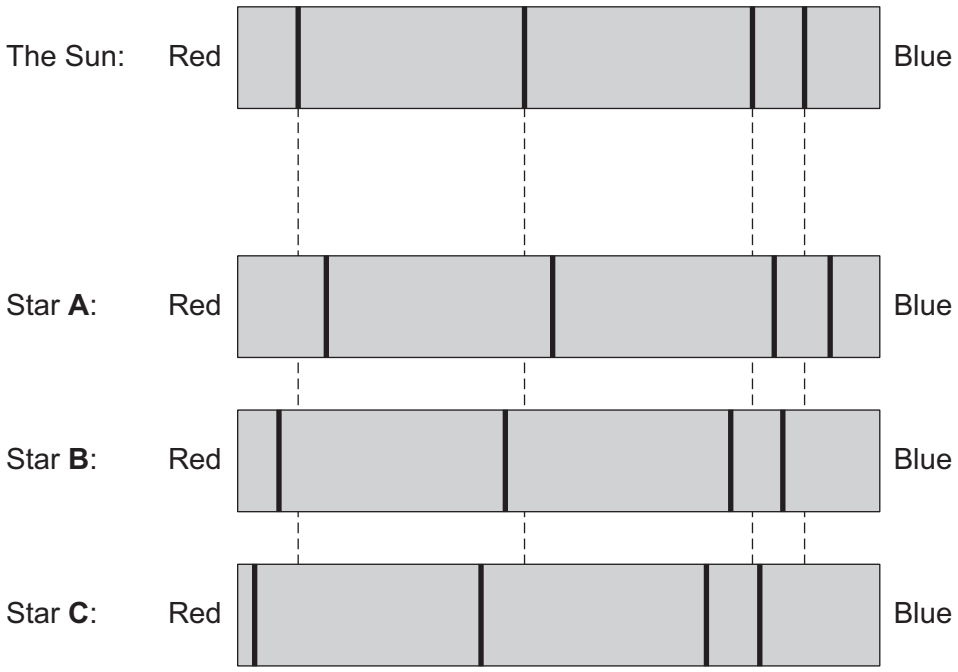
from

| |
|---|
| different points. |
| a very small point. |
| collisions between galaxies. |

*(1 mark)*

**10 (b)** Light from stars can be analysed to find out if the star is moving towards us, away from us or is stationary relative to the Earth.
Our Sun is stationary relative to the Earth.

The spectral lines from our Sun and three other stars are shown below.




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

**10 (b) (i)** Star **A** is

moving away from the Earth.

moving towards the Earth.

stationary relative to the Earth.

*(1 mark)*

**10 (b) (ii)** Star **B** is

moving away from the Earth.

moving towards the Earth.

stationary relative to the Earth.

*(1 mark)*

**10 (b) (iii)** Star **C** is

moving at the same speed as star **B**.

moving faster than star **B**.

moving slower than star **B**.

*(1 mark)*

5

## Biology Questions

**11** The biomass of different organisms in a food chain is shown below.

| Grass | → | Sheep | → | Man |
|---|---|---|---|---|
| 14 000 kg | | 700 kg | | 70 kg |

**11 (a)** Sketch and label a pyramid of biomass for this food chain.

*(2 marks)*

**11 (b)** The amount of biomass decreases along the food chain.

Suggest **two** reasons why.

.....

.....

.....

.....

.....

*(2 marks)*

4

**12** *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate*.

The drawing shows the shapes of trees growing on their own and inside a forest. The trees are of the same species.

**Tree on its own** **Trees inside a forest**

Describe the differences between the tree growing on its own and the trees inside the forest.

Suggest reasons for the differences you have described.

.....

.....

.....

.....

.....

.....

.....

.....

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.....

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.....

.....

*(6 marks)*

6

## Chemistry Questions

**13** Fuel for cars in Brazil contains 75 % petrol and 25 % ethanol.

Ethanol can be produced by two methods:

- fermentation of sugars
- hydration of ethene obtained from crude oil.

**13 (a)** Write a word equation for the reaction of ethene with steam.

..... + ..... → .....

*(1 mark)*

**13 (b)** Brazil produces ethanol by fermentation rather than by hydration of ethene.

Suggest **one** reason why.

.....

.....

*(1 mark)*

**13 (c)** The table gives details of the two methods used to make ethanol.

| Process 1 | Process 2 |
|---|---|
| Fermentation of sugars using yeast | Hydration of ethene with steam |
| Produces a dilute solution of ethanol after a few days | Produces pure ethanol continuously |

Suggest **two** disadvantages of producing ethanol by fermentation compared with hydration.

.....

.....

.....

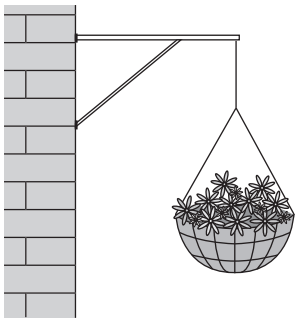
.....

*(2 marks)*

4

**Turn over for the next question**

**14** Some gardeners add hydrogels and compost to the soil used in hanging baskets.



Scientists investigated how much water different mixtures of soil, compost and hydrogel could hold.

The table shows the scientists' results.

| Mixture | Mass of soil in kg | Mass of compost in kg | Mass of hydrogel in g | Water holding capacity as percentage (%) of total mass |
|---|---|---|---|---|
| Soil | 10 | 0 | 0 | 22.96 |
| Soil + compost | 10 | 1 | 0 | 24.18 |
| Soil + compost | 10 | 2 | 0 | 26.12 |
| Soil + hydrogel | 10 | 0 | 2 | 26.09 |
| Soil + hydrogel | 10 | 0 | 4 | 27.00 |
| Soil + compost + hydrogel | 10 | 2 | 2 | 27.86 |

**14 (a)** Describe and compare the effects of adding compost and hydrogels on the water holding capacity of soil.

.....

.....

.....

.....

.....

.....

*(3 marks)*

**14 (b)** Hydrogels are polymers.

Describe what happens to the monomers in the chemical reaction used to produce a polymer.

.....

.....

.....

.....

*(2 marks)*

**5**

**Turn over for the next question**

## Physics Questions

**15 (a)** Sound and light are different types of waves.

Give **two** similarities and **two** differences between sound waves and light waves.

.....

.....

.....

.....

.....

.....

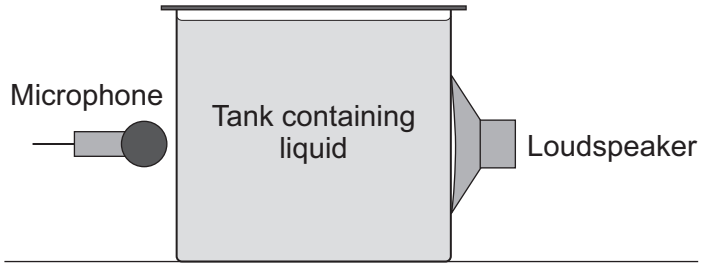
.....

.....

*(4 marks)*

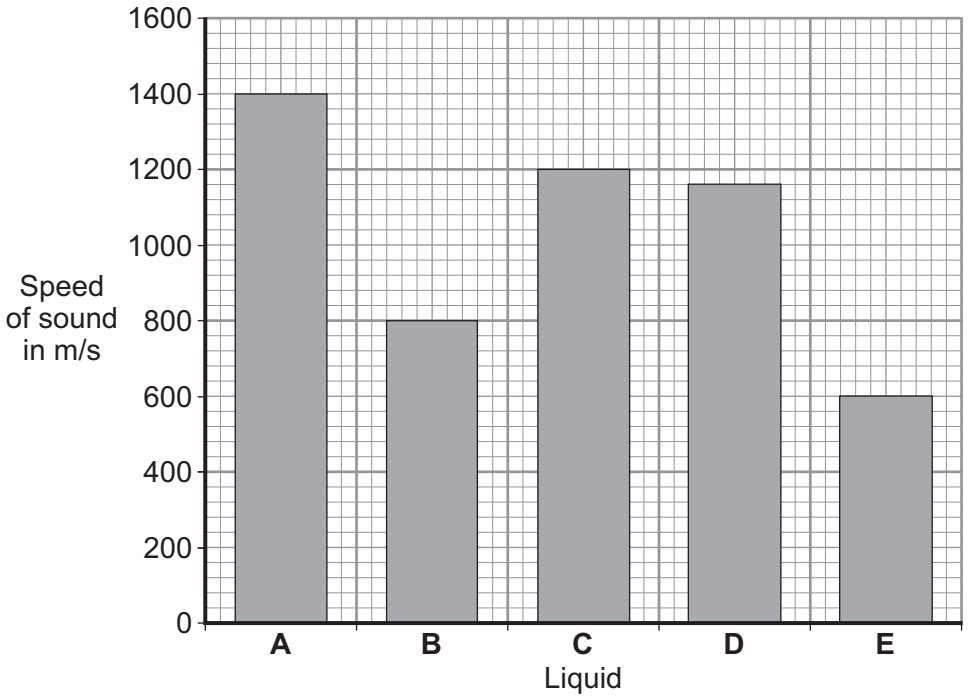
**15 (b)** A student does an experiment to investigate the speed of sound in different liquids.

The student uses the apparatus shown.




A loudspeaker makes a sound wave. The sound wave travels through the liquid in the tank. The time it takes to travel this distance is used to calculate the speed of sound.

The bar chart shows the student's results.




**15 (b) (i)** When a sound wave with a frequency of 4800 hertz passes through one of the liquids, it has a wavelength of 0.25 m.

Calculate the speed of the wave and identify the liquid used.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

.....

.....

Speed = ..... m/s

The liquid used was .....

*(3 marks)*

**Question 15 continues on the next page**

**15 (b) (ii)** The student's hypothesis was:
'There is a link between the density of a liquid and the speed of sound in the same liquid.'

| Liquid | Density in g/cm$^3$ | Speed of sound in m/s |
|---|---|---|
| Ethoxyethane | 0.71 | 985 |
| Ethanol | 0.80 | 1150 |
| Kerosene | 0.82 | 1300 |
| Water | 1.00 | 1500 |
| Mercury | 13.50 | 1450 |

Use the information in the table to decide whether the student's hypothesis was completely correct or not.

Was the student's hypothesis completely correct?

Draw a ring around your answer. **Yes / No**

Give reasons for your answer.

.....

.....

.....

.....

*(2 marks)*

9

**END OF QUESTIONS**

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Question 7: Volcano photo © Thinkstock
Question 13: Fuel pump photo © Thinkstock