Specimen Paper

AQA

General Certificate of Secondary Education
Higher Tier

Science A 2
Unit 6

H

For this paper you must have:
- a ruler
- the Chemistry Data Sheet (enclosed)
- the Physics Equation Sheet (enclosed).

You may use a calculator.

Time allowed
- 90 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 space 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 4 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   The diagram shows a pyramid of biomass drawn to scale.

Trout

Frogs

Insects
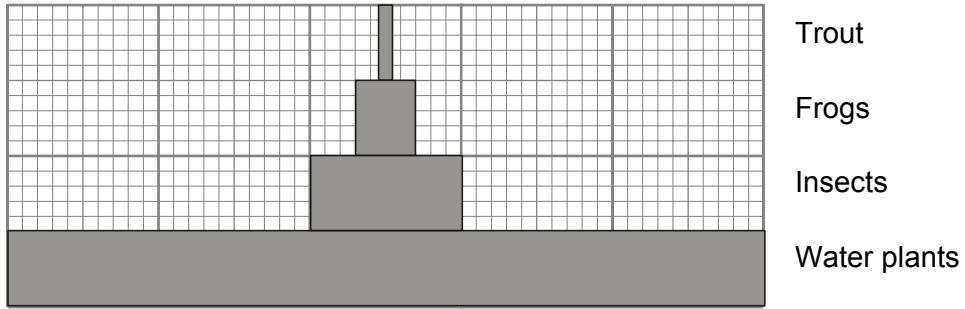
Water plants

1 (a)   Describe how the water plants obtain biomass.

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(2 marks)

1 (b)   The ratio of the biomass of water plants to the biomass of insects is 5 : 1.

Calculate the ratio of the biomass of insects to the biomass of frogs.

Show clearly how you work out your answer.

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Ratio = ... : 1
(2 marks)

1 (c) Frog numbers are falling rapidly.
Suggest how this will affect the biomass of the insects.

Give a reason for your answer.

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(1 mark)

1 (d) Only a small percentage of the energy in the water plants is eventually incorporated into the body tissues of the trout.

Describe, as fully as you can, what happens to the rest of the energy in the water plants.

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(6 marks)

11

Turn over for the next question

Turn over▶

2   The drawings show a dandelion plant and goosegrass plant.

The drawings are not drawn to the same scale.

100 cm

Goosegrass

20 cm

Dandelion

Ground level
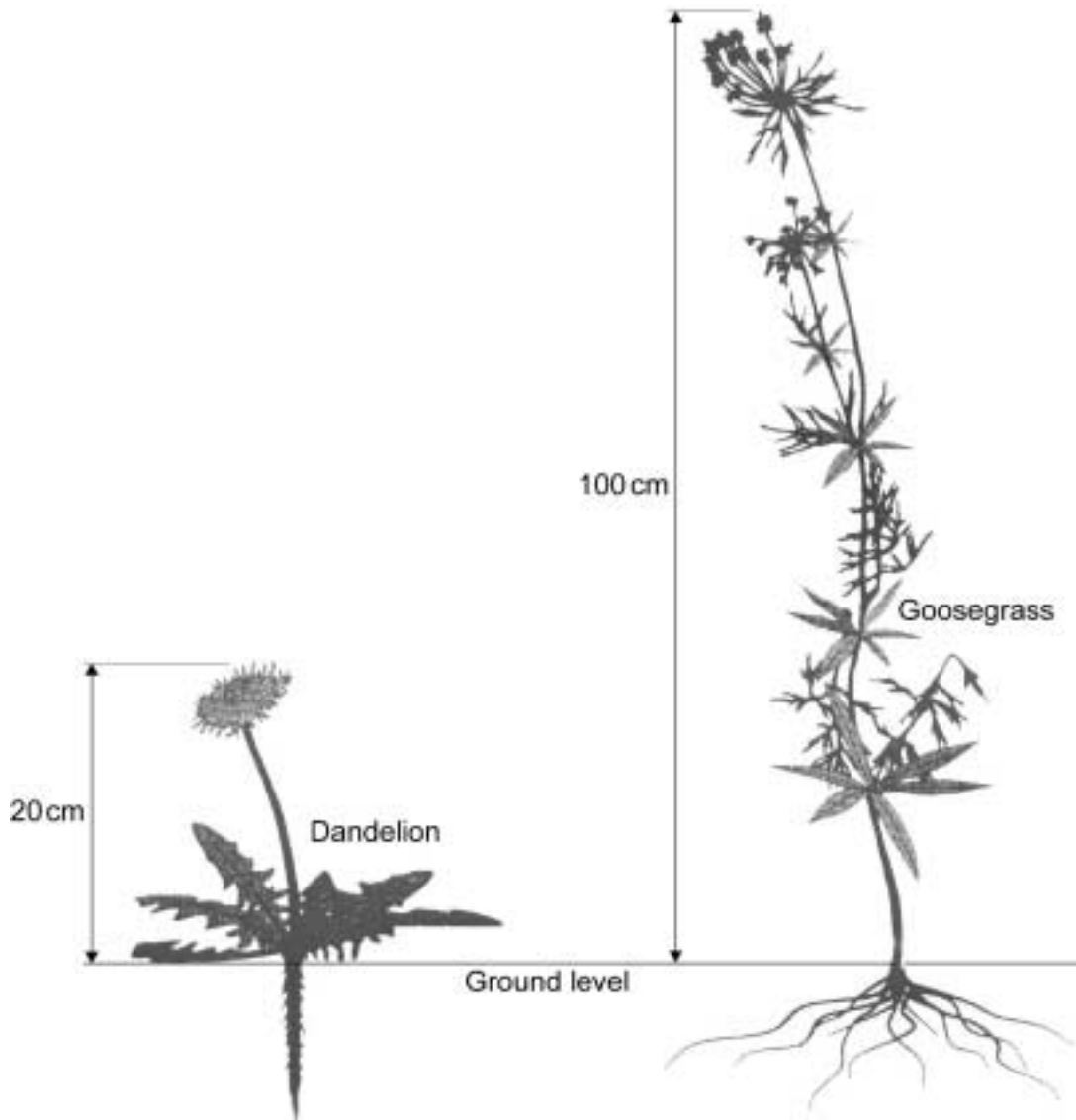
Use the information in the drawings to answer the questions.

2 (a)   Explain **one** way in which dandelions are adapted to live in lawns and in fields where animals feed.

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(2 marks)

2 (b) Explain **one** way in which goosegrass is adapted to live alongside hedges.

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(2 marks)

4

Turn over for the next question

Turn over▶

Chemistry questions

3   Evidence shows that the Earth formed from a molten ball of rocks and minerals.

Before 1900 many scientists thought that the Earth's mountains and continents formed in fixed positions when the molten ball of rocks and minerals cooled and wrinkled.

3 (a)   In 1912 Alfred Wegener suggested his hypothesis of continental drift.

The areas of rocks shown on **Map 1** contain fossils of the same type of animals.

Today animals in Africa are different from animals in South America.
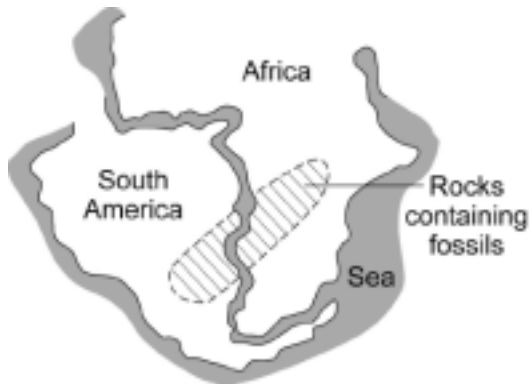
Map 1	**Map 2**
Wegener suggested his hypothesis that all of the continents, including Africa and South America, had been joined together but then drifted slowly apart.	In 1920 other scientists stated that all of the continents were in fixed positions, including Africa and South America, and that they had once been joined together by a land bridge.

3 (a) (i)   Use the information to suggest **two** pieces of evidence that may have led Wegener to propose his hypothesis that continents move.

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(2 marks)

3 (a) (ii) Suggest why, in 1920, other scientists thought that Wegener's hypothesis was wrong.

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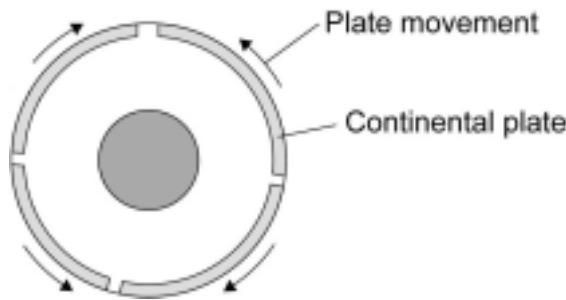
(2 marks)

3 (b) In 1962 scientists produced the theory of plate tectonics.

The theory of plate tectonics supported Wegener's hypothesis that continents move.

Tectonic plates move a few centimetres a year.

Complete the sentences about what causes the movement of the Earth's tectonic plates.

Deep inside the Earth .... processes release large amounts of

energy. These processes heat up the substances in the Earth's......................................

producing convection currents.

(2 marks)

Turn over for the next question

6

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

There are millions of plastic bags in use. After use most of these plastic bags are buried in landfill sites. The amount sent to landfill could be reduced if the plastic bags:
- could be reused
- could be recycled by melting and making them into new plastic products
- could be burned to release energy.

Use the information above and your knowledge and understanding to give the positive and negative environmental impacts of using these methods to reduce the amount of plastic bags sent to landfill.

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(6 marks)

6

Physics questions

5   A student listens to the sound waves produced by a car siren. When the car is stationary, the student hears a constant frequency sound.

5 (a) When the car drives away from the student the sound she hears changes.

What name is given to this effect?

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(1 mark)

5 (b) Describe how the wavelength and frequency of the sound waves heard by the student change.

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(2 marks)

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3

Turn over for the next question

Turn over ▶

6 Water waves can be made by vibrating a wooden bar up and down in a tray of water.

The bar moves up and down at a frequency of 5 hertz.
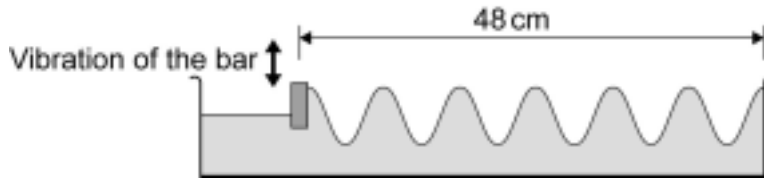
6 (a) Calculate the speed, in cm/s, of the water waves.

Write down the equation you use and then show clearly how you work out your answer.
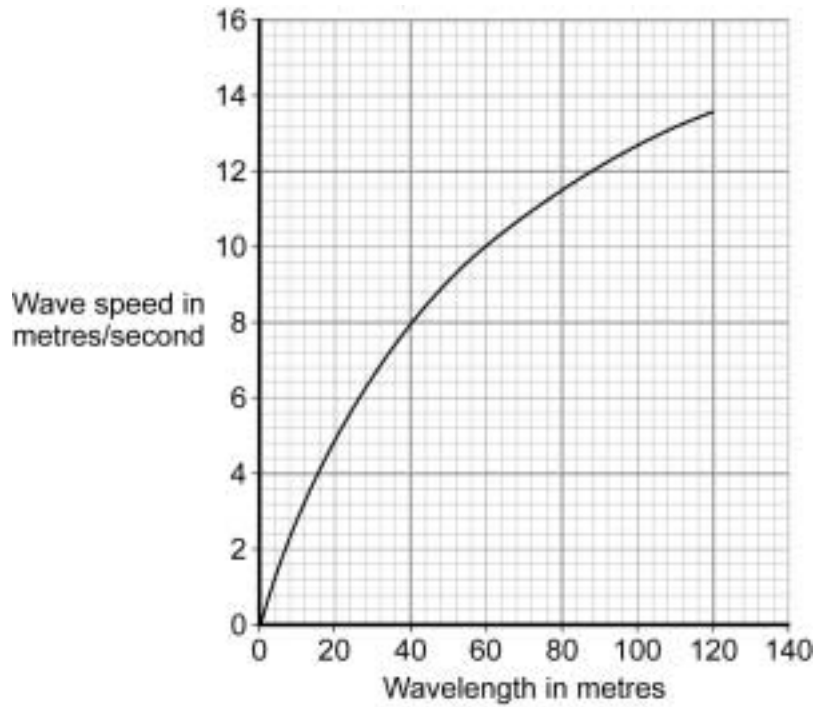
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Wave speed = ... cm/s
(3 marks)

6 (b) The graph shows how the speed of deep ocean waves depends on the wavelength of the waves.

Use the graph to predict a speed for waves with a wavelength of 140 m.

Show clearly how you have used the graph to work out your answer.

Speed of waves = ... m/s

(2 marks)

5

Turn over for the next question

Turn over ▶

7 (a) Scientific research carried out in 13 countries has tried to find out if there are any links between using a mobile phone and developing different types of cancer.

About 13 000 people, half with cancer and half in good health, were interviewed about their mobile phone use.

7 (a) (i) Suggest why people in good health were interviewed.

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(1 mark)

7 (a) (ii) Interviewing 13 000 people gave the researchers a large sample size.

Give **one** advantage, in any research project, of having a large sample size rather than a small sample size.

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(1 mark)

7 (b) The following information was included in a newspaper article about the research project.

- It may be difficult to prove there is a link simply by asking people how much they use a mobile phone. People's memories are not always accurate.
- Scientists in Israel found that people who use a mobile phone a lot are 50 % more likely to develop a cancer on the salivary gland just in front of the ears.
- The cost of the research, £20 million, has been partly paid for by mobile phone companies.
- No children were included in the research.

7 (b) (i) Draw a ring around the correct answer to complete the following sentence.

Using children in scientific research raises

| environmental |
| ethical |
| social |

issues.

(1 mark)

7 (b) (ii) Suggest **two** reasons why some people are concerned that the research was partly paid for by mobile phone companies.

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(2 marks)

7 (b) (iii) In Germany, mobile phones that emit very low levels of radiation are marked with a special symbol.

Explain why low emission mobile phones should be marked in this way.

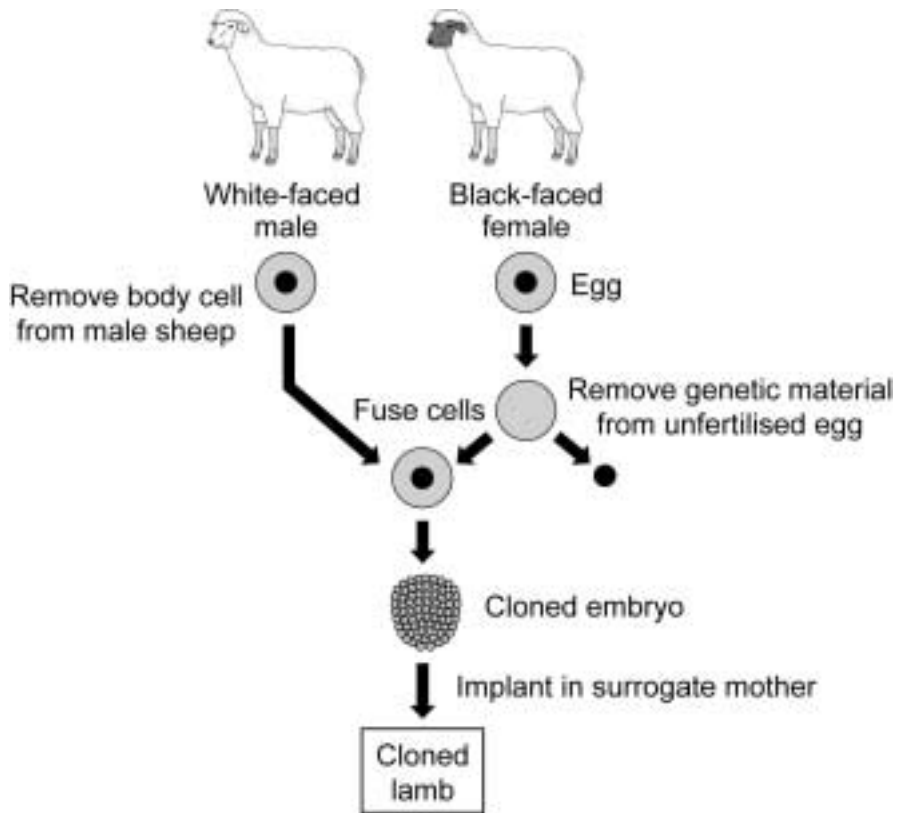...

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(2 marks)

7

Turn over for the next question

Turn over ▶

Biology questions

8 The diagram shows one method of cloning sheep.

8 (a) The fusion of the body cell from the male sheep and the egg from the female sheep is an example of asexual reproduction.

Explain why.

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(2 marks)

8 (b) (i) Give the gender and face colour of the cloned lamb.

Gender ....

Face colour ....

(1 mark)

8 (b) (ii) Give the reasons for your choice.

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(2 marks)

5

Turn over for the next question

Turn over ▶

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ANSWER IN THE SPACES PROVIDED**

9 Puffins are birds which live along coastal regions from southern Spain to Iceland.

Scientists investigated whether wing length is related to temperature by collecting data on five adult puffins from each of Spain, France, the British Isles and Iceland.

The results are shown in the table.

Country	Latitude in ° North	Mean daily temperature range in °C	Range of wing length in cm
Spain	36 to 43	10 to 28	13.3 to 14.8
France	42 to 50	3 to 25	14.1 to 15.8
the British Isles	50 to 58	2 to 18	15.2 to 16.8
Iceland	63 to 66	–10 to 10	15.9 to 17.5

9 (a) Describe **two** patterns shown by the data in the table.

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2 ....

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(2 marks)

9 (b) Suggest an explanation for the patterns you have described in part 9(a).
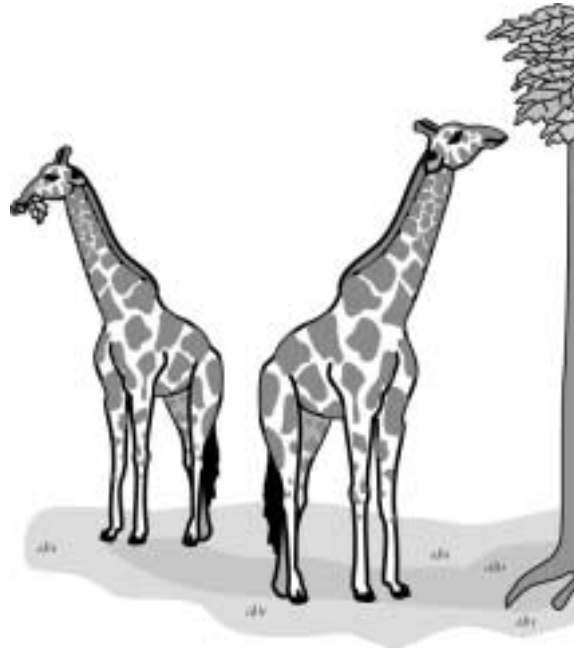
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(2 marks)

Turn over for the next question

4

Turn over▶

10 (a) What is meant by natural selection?

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(1 mark)

Giraffes feed on the leaves of trees and other plants in areas of Africa.

Darwin explained the evolution of the long neck in terms of getting leaves from the tall trees.

Recently, scientists have tried to explain how the long neck of the giraffe might have evolved.

These are some of the scientists' observations.

- Giraffes spend almost all the dry season, when there is not much food, feeding from low bushes.

- Only in the wet season do they feed from tall trees when there are plenty of new leaves.

- Females spend over 50 % of their time feeding with their necks horizontal.

- Both sexes feed faster and most often with their necks bent.

- Long giraffe necks are very important in male-to-male combat. Males fight each other with their long, powerful necks.

10 (b) Do the observations support or reject the explanation that the long neck of the giraffe evolved to get leaves from tall trees?

Draw a ring around your answer. **Support / Reject**

Explain the reason for your answer.

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(3 marks)

10 (c) Use the scientists' recent observations to give another explanation for the evolution of the long neck of the male giraffe.

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(3 marks)

7

Turn over▶

Chemistry questions

11 An advert for crisps claimed that they are healthier because they are cooked in sunflower oil.

11 (a) A student found the following information about four oils that are used to make crisps.

	Rapeseed oil	Sunflower oil	Olive oil	Corn oil
Saturated fat (%)	6.6	12.0	14.3	14.4
Polyunsaturated fat (%)	29.3	63.3	8.2	51.3
Melting point (°C)	+5	−18	−12	−15

One hypothesis is that oils are thought to be healthier if they are:
- low in saturated fat
- high in polyunsaturated fat.

11 (a) (i) Use the table to decide which oil should be healthiest. Explain your decision by comparing this oil with other oils from the table that you think are less healthy.

Healthiest oil is ....

Explanation ....

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(2 marks)

11 (a) (ii) These oils can be hardened by reacting them with hydrogen.
A student said that hardening would make sunflower oil healthier.

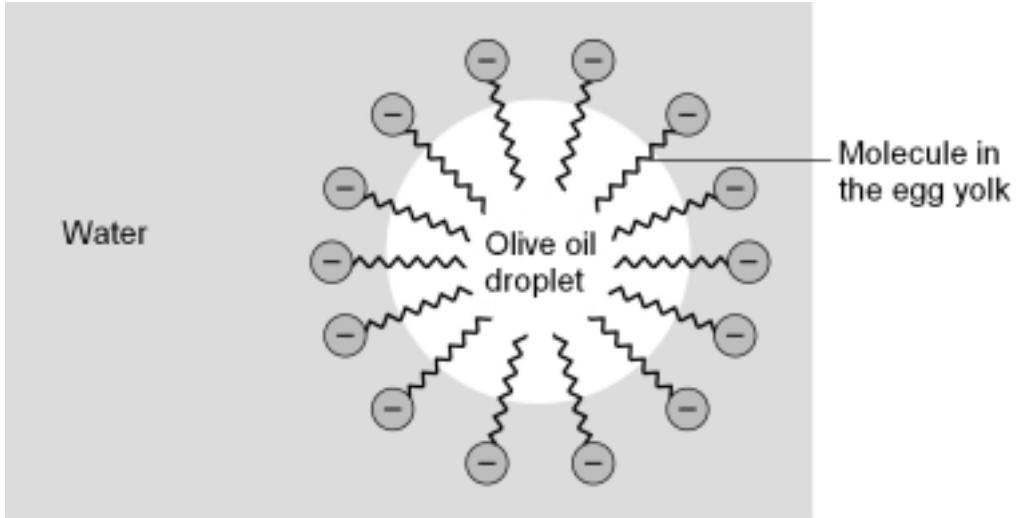Is this student's hypothesis correct?

Explain your answer.

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(2 marks)

11 (b)   A mixture of the olive oil, water and egg yolk was shaken and left to stand. The olive oil and water do not separate.

The diagram shows a simple model of how a stable mixture of olive oil and water is produced by the addition of egg yolk.

Use this simple model to explain how the molecules in the egg yolk are able to produce a stable mixture of olive oil and water.
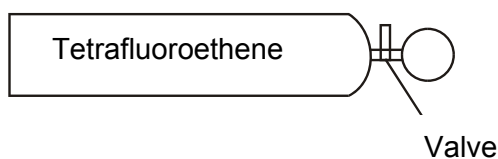
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(3 marks)

7

Turn over for the next question

Turn over▶

12   In 1939 a scientist opened the valve on a new cylinder of tetrafluoroethene gas. No gas
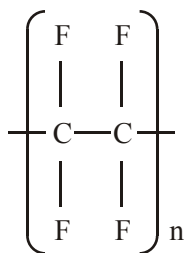came out.

Tetrafluoroethene

Valve

He cut the cylinder open and found that the gas had changed into a white solid. This
solid was an addition polymer.

12 (a)   Give the name of the addition polymer that formed inside the cylinder.

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(1 mark)

12 (b)   The structure of this polymer can be represented by the diagram below.

Draw the structure of the monomer, tetrafluoroethene, from which it is formed.

(2 marks)

GCSE Science A 2 Unit 6 Specimen Paper Higher Tier V1.0

12 (c)   Describe how this addition polymer forms from monomers.

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(3 marks)

6

Turn over for the next question

Turn over▶

13   There was little or no nitrogen in Earth's early atmosphere, but a gaseous compound of nitrogen was present in small amounts.

13 (a)   Name this gaseous compound.

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(1 mark)

13 (b)   In 1892, Lord Rayleigh compared nitrogen from the air with very pure nitrogen obtained from nitrogen compounds. The density of the nitrogen was:

nitrogen from the air   =   1.2572 grams per litre

nitrogen from nitrogen compounds   =   1.2511 grams per litre.

Rayleigh and Sir William Ramsay proved that atmospheric nitrogen was not pure but contained five other gases, which together made up about 1 % of the Earth's atmosphere.

The gases were argon (0.94 %) and traces of helium, neon, krypton and xenon.
The five gases are similar in that they show no chemical reactions but have different physical properties, eg density, melting point, boiling point.

13 (b) (i)   Suggest **one** reason why scientists did **not** find these five gases in the atmosphere at an earlier date.

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(1 mark)

13 (b) (ii)   Give **one** way of separating the five gases from each other.

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(1 mark)

13 (b) (iii)   From the information given in the question, which prediction can be safely made?

Tick **(✓) one** box.

Nitrogen makes up about 78 % of the atmosphere.   ☐

Argon has a density greater than the density of nitrogen.   ☐

Neon, krypton and xenon have a density lower than the density of nitrogen.   ☐

Nitrogen from nitrogen compounds must contain a very light gas such as hydrogen. ☐
(1 mark)

4

Physics Questions

14   In 2005 a space telescope detected a star that exploded 13 billion years ago. The light from the star shows the biggest red-shift ever measured.

14 (a)   What information can scientists gain from measuring the red-shift of stars or galaxies?

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(3 marks)

14 (b)   Scientists have measured the presence of Cosmic Microwave Background Radiation (CMBR).

Explain the significance of CMBR.

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(2 marks)

14 (c)   The Andromeda galaxy is not moving away from Earth. It is actually moving towards the Earth. This means that the light from Andromeda shows a blue-shift.

How do the wavelength and frequency of the light from Andromeda seem to have changed when viewed from the Earth?
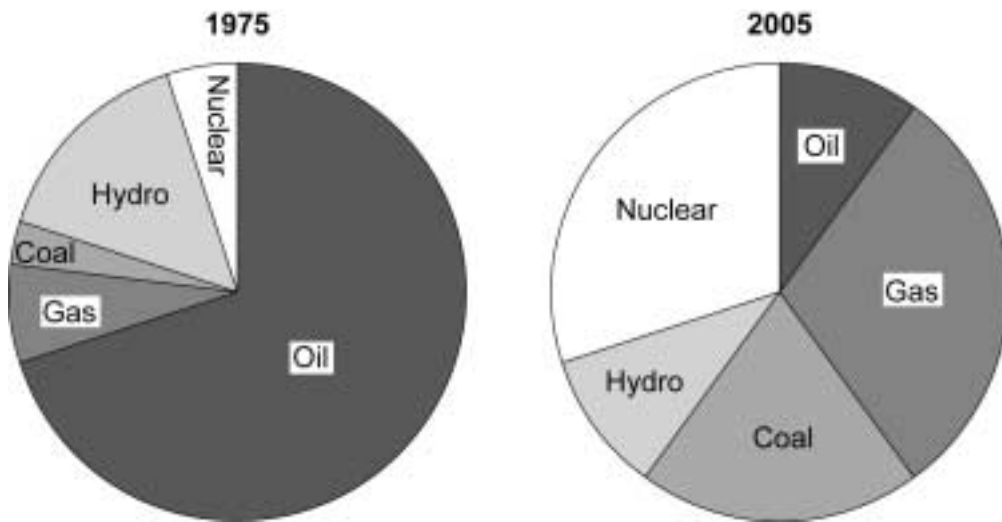
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(1 mark)

6

Turn over▶

15 The pie charts show the relative proportions of electricity generated in Japan from different energy sources in 1975 and 2005.

15 (a) Describe and suggest a reason for **two** differences in the energy sources used in 2005 compared with 1975.

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(2 marks)

15 (b) Mining for coal often releases large amounts of methane gas. Methane is both explosive and a greenhouse gas. At the Sihe coal mine in China the methane is diverted to a gas burning power station where it is used to generate electricity.

15 (b) (i) A newspaper reported a scientist as saying:

> If the concentration of greenhouse gases in the atmosphere doubles, the average temperature of the Earth will increase by up to 5 °C over the next 100 years.

What has been stated in the newspaper?

Draw a ring a round your answer.

a fact   **a guess**   **a prediction**

Give a reason for your answer.

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(2 marks)

15 (b) (ii) Explain an environmental advantage of taking the methane gas from coal mines and using it to generate electricity.

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(2 marks)

15 (c) The average person in Britain uses 1930 kWh of electricity each year. Many people in the world's poorest countries do not have access to electricity.

Giving examples, explain why electricity is essential for both improving public health and for modern communications.

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(3 marks)

END OF QUESTIONS

9

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ANSWER IN THE SPACES PROVIDED

GCSE Physics Equations Sheet

Unit 6

$E = m \times c \times \theta$	E energy transferred m mass θ temperature change c specific heat capacity
$\text{efficiency} = \dfrac{\text{useful energy out}}{\text{total energy in}} \ (\times \ 100\%)$	
$\text{efficiency} = \dfrac{\text{useful power out}}{\text{total power in}} \ (\times \ 100\%)$	
$E = P \times t$	E energy transferred P power t time
$v = f \times \lambda$	v speed f frequency λ wavelength