AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
SCIENCE A 2

H

Higher Tier Unit 6

Wednesday 25 May 2016 Afternoon Time allowed: 1 hour 30 minutes

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

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 3(a) 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.

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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

Biology Questions

1 Greenflies are small insects that feed on rose bushes. Ladybirds eat greenflies.

Rose bush ⟶ Greenfly ⟶ Ladybird

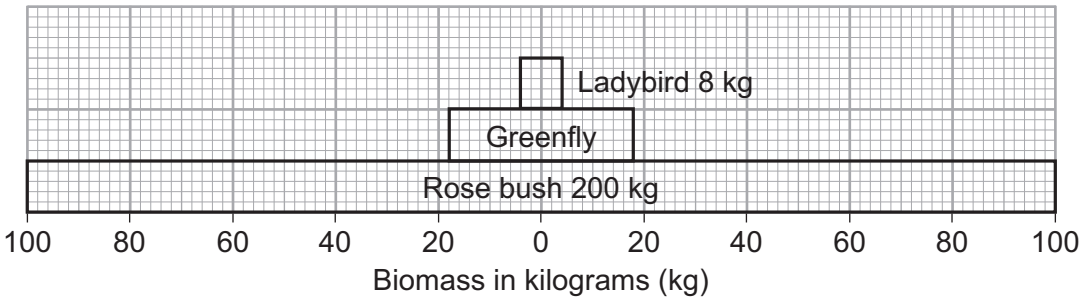
1 (a) What is the source of energy for the food chain?

[1 mark]

_____

1 (b) **Figure 1** shows a pyramid of biomass for this food chain.

Figure 1



1 (b) (i) What is the biomass of the greenfly population shown in **Figure 1**?

[1 mark]

Biomass of greenfly population = _____ kilograms

1 (b) (ii) The biomass of the ladybird population is less than the biomass of the greenfly population.

Give **one** reason for this.

[1 mark]

_____

_____

_____

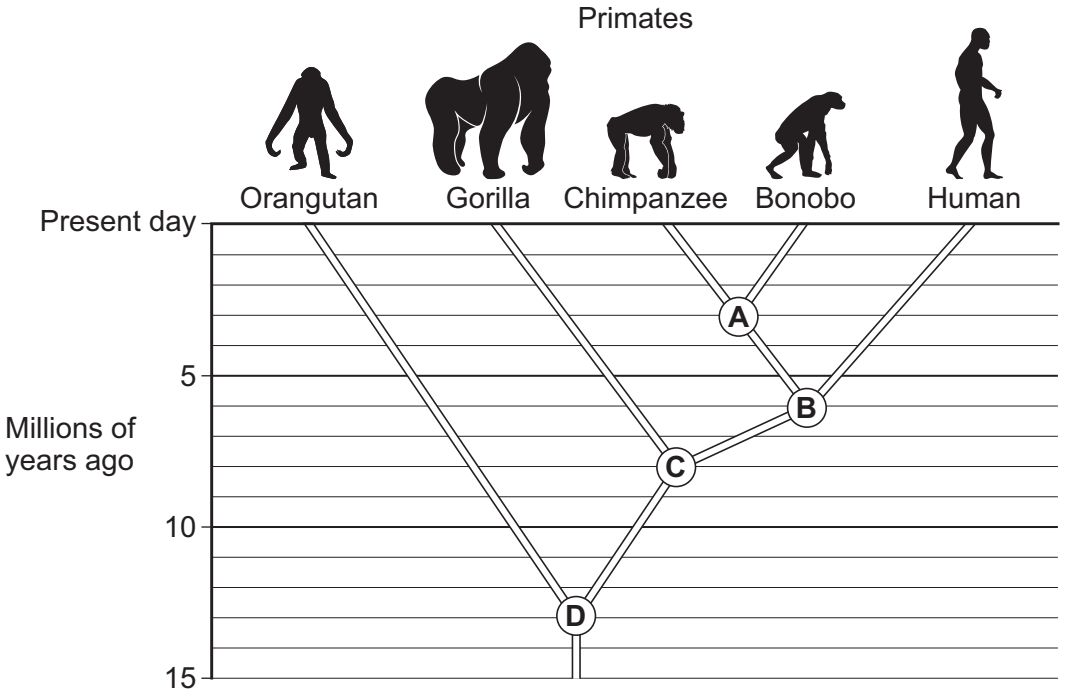
3

2 **Figure 2** shows an evolutionary tree for some primates.

Primates all share a common ancestor that lived in forests.

The points labelled **A**, **B**, **C** and **D** show when an ancestor became extinct.

Figure 2



2 (a) (i) Which **two** primates are most closely related?

[1 mark]

_____

_____

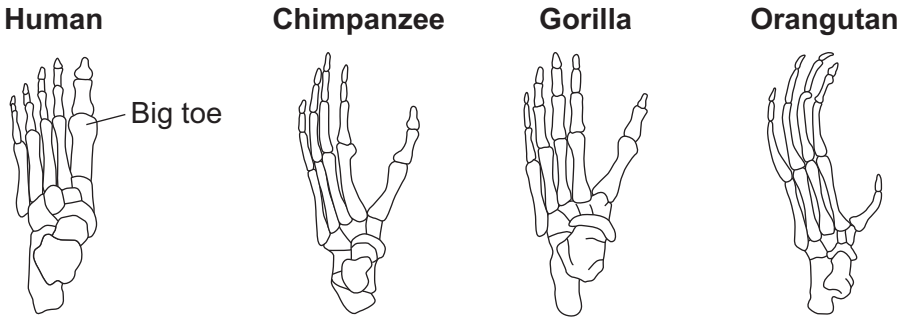
2 (a) (ii) When did the most recent common ancestor of the gorilla, chimpanzee, bonobo and human become extinct?

[1 mark]

_____ million years ago

2 (b) **Figure 3** shows the skeletons of the feet of four primates.

Figure 3



2 (b) (i) What evidence is there in **Figure 3** that primates all share a common ancestor?

[1 mark]

2 (b) (ii) The skeleton of the human foot shows that the big toe is very different from the big toe of the other primates.

Suggest **one** reason for this difference.

[1 mark]

4

Turn over for the next question

3 Polar bears live in the Arctic. Seals are their main food source.

3 (a) **Figure 4** shows some adaptations of polar bears.

Figure 4

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

Explain how the polar bear is adapted to survive in its environment.

Use information in **Figure 4** and your knowledge.

[6 marks]

Extra space

3 (b) Polar bears can only hunt seals when there is ice on top of the sea. During the summer, polar bears may have to survive a long time without food.

The polar bear is a threatened species. The main threat to its survival is global warming.

Explain how global warming can affect the survival of polar bears.

[3 marks]

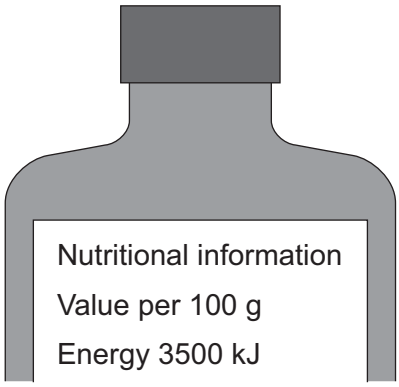
9

Chemistry Questions

4 This question is about vegetable oils.

Figure 5 shows part of the label on a bottle of vegetable oil.

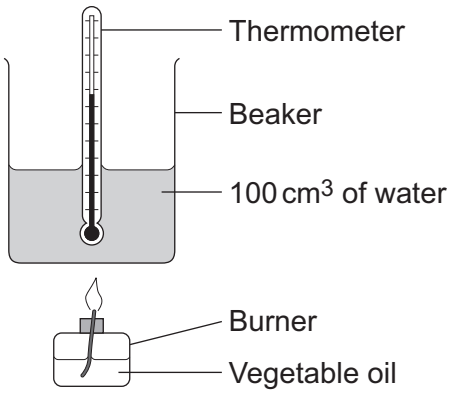
Figure 5



4 (a) A student investigated the energy released by burning the vegetable oil.

Figure 6 shows the apparatus the student used.

Figure 6



The student:

- recorded the starting temperature of the water
- burned 1 g of the vegetable oil
- recorded the temperature of the water after burning the vegetable oil.

Table 1 shows the student's results for the investigation.

Table 1

Starting temperature of water in °C	Temperature of water after burning 1 g of vegetable oil in °C
19	34

4 (a) (i) Calculate the energy released when 1 g of the vegetable oil was burned.

Use the equation: Energy released in joules = 100 × 4.2 × temperature change

[2 marks]

Energy released when 1 g of vegetable oil was burned = _____ J

4 (a) (ii) Use your answer to part **(a)(i)** to calculate the energy released by 100 g of vegetable oil.

Convert your answer to kilojoules.

[1 mark]

Energy released when 100 g of vegetable oil was burned = _____ kJ

4 (a) (iii) The student did **not** get an accurate value for the energy released by 100 g of the vegetable oil. Suggest **two** reasons why.

[2 marks]

Question 4 continues on the next page

4 (b) The student compared the cooking of potatoes in vegetable oil and in water.

The potatoes cooked in vegetable oil were a different colour and texture to the potatoes cooked in water.

Give **two** other differences between the potatoes cooked in vegetable oil and those cooked in water.

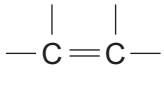
[2 marks]

4 (c) The student added bromine water to the vegetable oil.

Which structure turns bromine water from orange to colourless?

[1 mark]

Tick (✓) **one** box.



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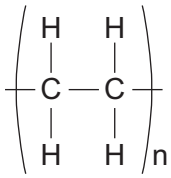

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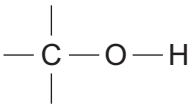

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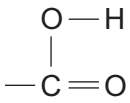


☐

4 (d) Suggest **one** reason why information about energy is shown on food labels.

[1 mark]

9

5 Polymers are used to make plastic bags.

5 (a) Most plastic bags are made from a polymer produced from ethene.

What is the name of the polymer produced from ethene?

[1 mark]

_____

5 (b) Ethene is produced by cracking hydrocarbons obtained from crude oil.

5 (b) (i) Complete the symbol equation for the reaction to produce ethene and octane from decane.

[1 mark]

$C_{10}H_{22} \longrightarrow C_2H_4 +$ _____

5 (b) (ii) Give **one** use for octane.

[1 mark]

_____

_____

5 (c) Plastic bags in supermarkets used to be free. Supermarkets now make a charge. It is estimated that the number of plastic bags used has dropped by 75%.

5 (c) (i) When they were free, 8 billion plastic bags a year were used.

Estimate the number of plastic bags that are now used each year.

[1 mark]

_____

_____

Number of plastic bags used each year = _____

5 (c) (ii) Suggest **two** reasons why the government made a law to charge for plastic bags.

[2 marks]

_____

_____

_____

_____

6

Physics Questions

6 Sound travels through the air as a wave.

6 (a) A sound wave has a frequency of 250 Hz and a wavelength of 1.32 m.

Calculate the speed of sound in air.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

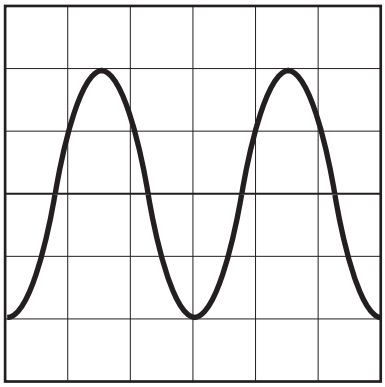
Speed of sound in air = _____ m/s

6 (b) **Figure 7** shows the traces produced on an oscilloscope by two sound waves, **A** and **B**.

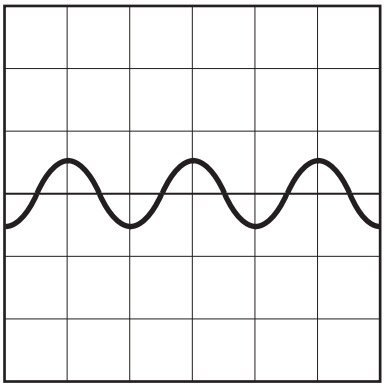
The oscilloscope settings are the same for each trace.

Figure 7

Sound wave **A**



Sound wave **B**



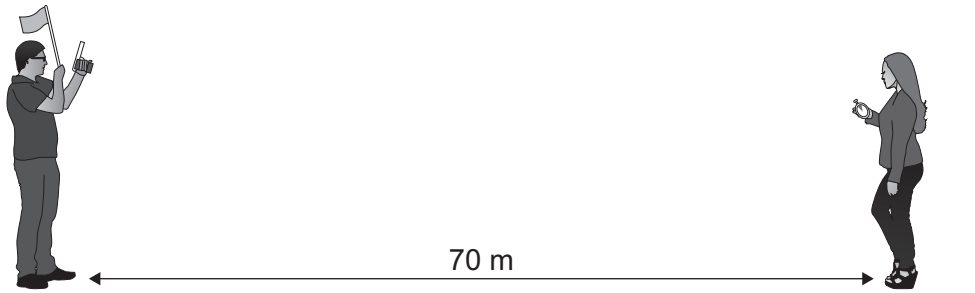
How do the sounds produced by sound waves **A** and **B** differ?

Use information from **Figure 7** to give reasons for your answers.

[4 marks]

6 (c) **Figure 8** shows two students measuring the time it takes a sound wave to travel a known distance. They use their measurements to calculate the speed of sound through air.

Figure 8



(Not to scale)

The students use the following method:

- Student 1 has a starting gun and a flag.
- When Student 1 fires the starting gun, he moves the flag.
- When Student 2 sees the flag move, she starts a stopwatch.
- When Student 2 hears the sound, she stops the stopwatch.

Question 6 continues on the next page

6 (c) (i) The time recorded on the stopwatch is 0.29 seconds.

What is the resolution of the stopwatch?

[1 mark]

Draw a ring around the correct answer.

0.1 s **0.01 s** **0.001 s**

6 (c) (ii) Suggest **two** ways to obtain a more accurate result.

[2 marks]

_____

_____

_____

_____

9

7 Microwaves are a type of electromagnetic wave. Microwaves are used by mobile phones.

7 (a) (i) Give **two** properties of all electromagnetic waves.

[2 marks]

_____

_____

_____

_____

7 (a) (ii) Complete the sentences about electromagnetic waves.

[2 marks]

Radiowaves have the longest _____ and lowest

_____ of all electromagnetic waves.

7 (b) Some scientists are investigating if brain cancer is linked to the use of mobile phones.

In one study the scientists analysed information from phone companies from more than 358 000 people who used mobile phones.

The study looked for a link between the amount of time people use their mobile phones and the number of people who developed brain cancer. The scientists could not come to a definite conclusion.

7 (b) (i) Give **one** advantage of using phone company records to look for a link, instead of asking people about their mobile phone use.

[1 mark]

_____

_____

7 (b) (ii) Suggest **one** reason why the scientists could not come to a definite conclusion.

[1 mark]

_____

_____

6

Biology Questions

8 Living organisms can be used as indicators of pollution.

8 (a) (i) Which group of organisms can be used to indicate the concentration of dissolved oxygen in water?

[1 mark]

_____

8 (a) (ii) Lichen species are indicators of a pollutant gas.

Name the pollutant gas.

[1 mark]

_____

8 (b) Scientists investigated the distribution of lichens at different distances to the north and south of a power station.

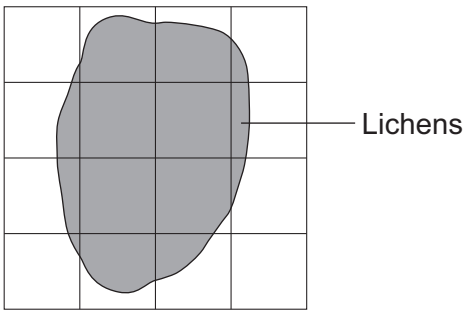
The scientists used a sampling square called a quadrat to estimate the percentage cover of lichens on trees.

Each quadrat was divided into 16 smaller squares.

Only the small squares in which the lichens covered more than half the square were counted. This number of squares was then used to calculate the percentage cover of lichens in the whole quadrat.

Figure 9 shows the lichens growing in one quadrat.

Figure 9



Calculate the percentage cover of lichens in the quadrat shown in **Figure 9**.

[1 mark]

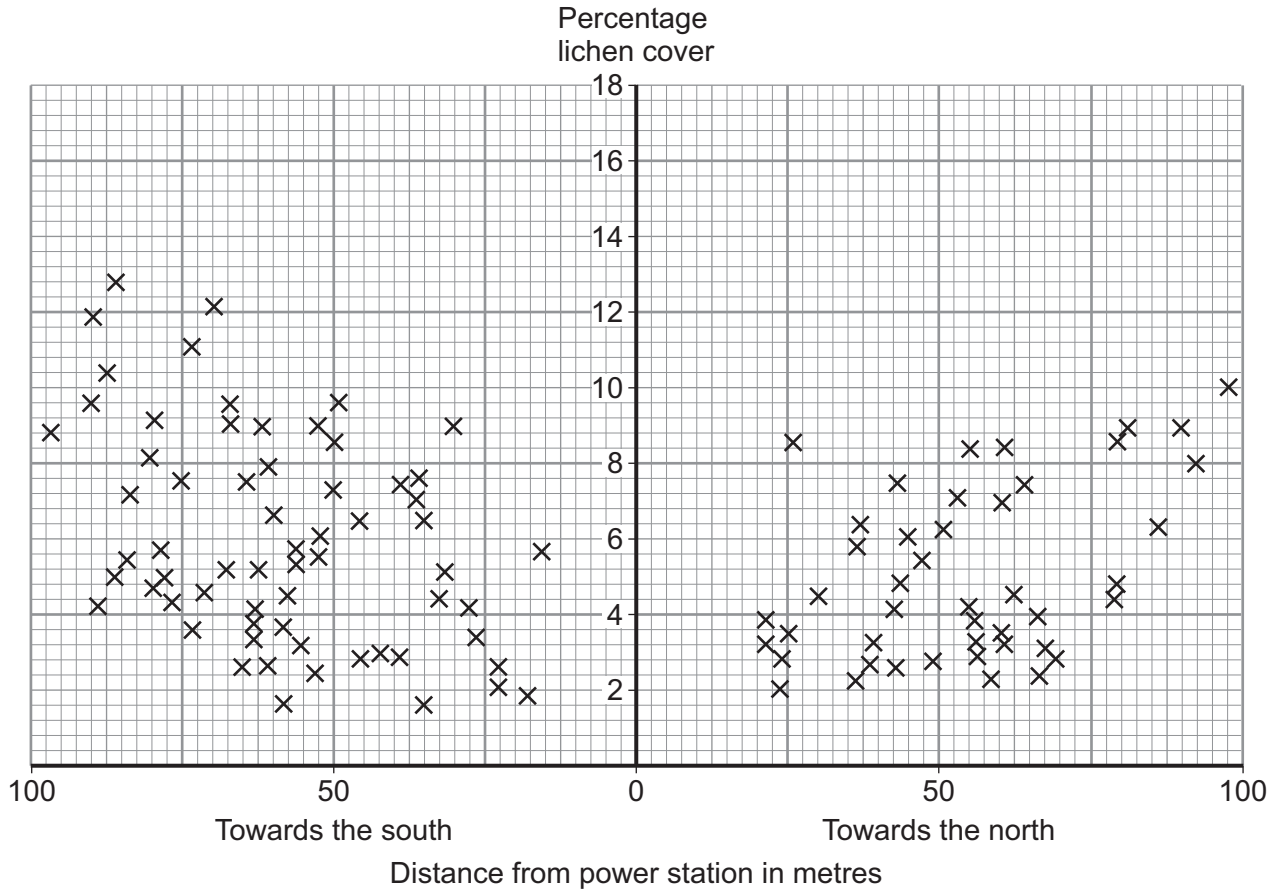
_____

_____

Percentage cover of lichens = _____ %

8 (c) **Figure 10** shows the results of the investigation.

Figure 10



8 (c) (i) What type of graph is shown in **Figure 10**?

[1 mark]

8 (c) (ii) Describe **one** trend shown in **Figure 10**.

[1 mark]

5

9 The materials in organisms are constantly recycled.

Many trees lose their leaves every year, and most animals produce waste at least once a day. All plants and animals eventually die.

Describe the processes that return the chemicals in waste and in dead organisms to the environment.

[4 marks]

4

10 Variation between individuals of the same species can be caused by genes inherited from their parents.

10 (a) State the other cause of variation between individuals of the same species.

Give **one** example of this cause, and describe how it could affect the individual.

[2 marks]

10 (b) Scientists can alter the genetic make-up of organisms so that they develop desired characteristics.

Recently the treatment of cancers has improved. This is partly due to research using genetically engineered mice that develop cancer.

Evaluate the use of mice that develop cancer in medical research.

[3 marks]

5

Turn over for the next question

Chemistry Questions

11 Olive oil is used to make salad dressings and spreads.

11 (a) Olive oil is extracted from olives, a type of fruit.

Describe the **two** main steps used to extract the oil from the fruit.

[2 marks]

11 (b) Salad dressings are made by adding together olive oil, vinegar and mustard.

11 (b) (i) Olive oil and vinegar are shaken together.

Why does the mixture quickly separate?

[1 mark]

11 (b) (ii) When mustard is added to olive oil and vinegar, an emulsion is formed.

Explain how mustard molecules act as an emulsifier to produce a stable emulsion.

[3 marks]

11 (c) How is olive oil hardened to form a spread?

[2 marks]

8

Turn over for the next question

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12 This question is about gases in the atmosphere.

12 (a) The atmosphere is a mixture of gases. The gases can be separated to provide raw materials for industrial processes.

Table 2 shows the melting and boiling points of some gases in the atmosphere.

Table 2

Gas	Melting point in °C	Boiling point in °C
Carbon dioxide	–78	–78
Neon	–249	–246
Nitrogen	–210	–196
Oxygen	–219	–183

The gases in the atmosphere are separated by the following method:

- water vapour and carbon dioxide are removed
- the remaining gases are cooled to –200 °C
- gases that do not condense at –200 °C are removed
- the liquid mixture is separated.

12 (a) (i) Give the full name of the process used to separate the liquid mixture.

[1 mark]

_____

12 (a) (ii) Which gas does **not** condense at –200 °C?

[1 mark]

Draw a ring around the correct answer.

carbon dioxide **neon** **nitrogen** **oxygen**

12 (a) (iii) Suggest why carbon dioxide and water are removed before the gases are cooled to –200 °C.

[1 mark]

_____

_____

12 (b) Scientists think Earth's early atmosphere was like the atmosphere of Mars today.

Table 3 shows the percentages of some of the gases in the atmosphere of Mars.

Table 3

Gas	Percentage (%) of total
Carbon dioxide	95.3
Nitrogen	2.7
Oxygen	0.13

Describe how the percentages of oxygen and carbon dioxide in the Earth's atmosphere today have changed from those in the early atmosphere.

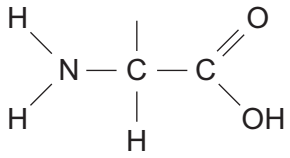
Give reasons for these changes.

[3 marks]

12 (c) Some scientists believe life started after gases in Earth's early atmosphere reacted with each other to produce amino acids. Two scientists, Miller and Urey, modelled the early atmosphere and produced amino acids in an experiment.

Figure 11 shows the basic structure of an amino acid.

Figure 11



Suggest **one** other gas, in addition to those shown in **Table 3**, that must have been present in the early atmosphere for amino acids to be produced.

[1 mark]

_____

7

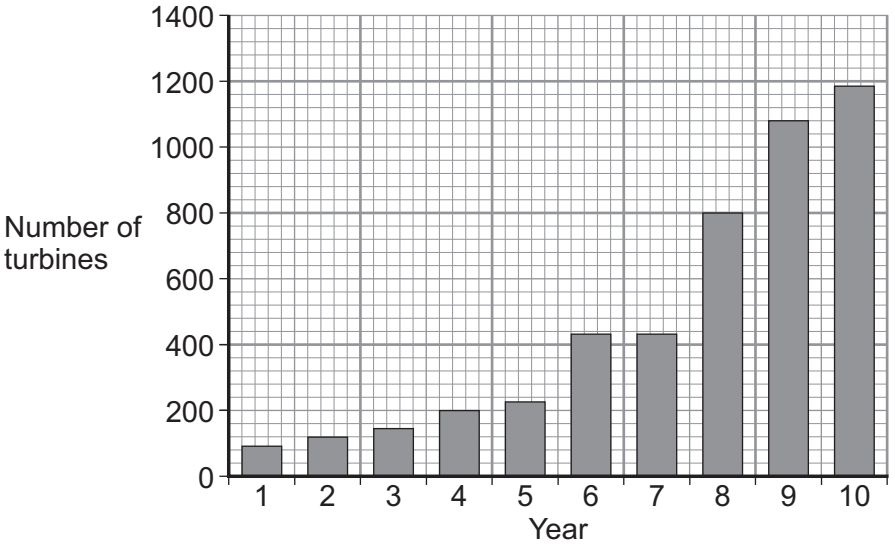
Turn over for the next question

Physics Questions

13 The wind is a renewable energy source. Wind turbines may be located on land or out at sea.

Figure 12 shows the number of wind turbines out at sea around the UK over a 10 year period.

Figure 12



13 (a) Many people do not like wind turbines on land because of visual and noise pollution.

Suggest **two** other reasons for the increased use of wind turbines out at sea.

[2 marks]

13 (b) A disadvantage of wind turbines is that the wind is an unreliable energy source. Geothermal power stations and hydroelectric power stations use more reliable energy sources.

In Iceland almost all of the electricity is generated in geothermal and hydroelectric power stations.

Suggest reasons why.

[3 marks]

5

Turn over for the next question

14 Some scientists study cosmic microwave background radiation (CMBR) and the speed of galaxies at different distances from the Earth.

14 (a) (i) What is CMBR?

[2 marks]

14 (a) (ii) How did the discovery of CMBR support the 'Big Bang' theory?

[1 mark]

14 (b) (i) A student collected data about the speed of galaxies at different distances from the Earth. Some of the data that the student collected is shown in **Table 4**.

Table 4

Distance of galaxy from Earth in million light years	Speed of galaxy in km/s
1.63	200
2.61	300
3.26	920
6.52	1090

The student concluded that the distance of a galaxy from Earth is directly proportional to the speed of the galaxy.

Explain whether the data in **Table 4** supports this conclusion.

Your answer should include appropriate calculations.

[3 marks]

14 (b) (ii) Red-shift is the observed increase in wavelength of light received from distant galaxies.

Red-shift gives evidence for the 'Big Bang' theory.

Explain how red-shift gives evidence for the 'Big Bang' theory.

[4 marks]

10

END OF QUESTIONS

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