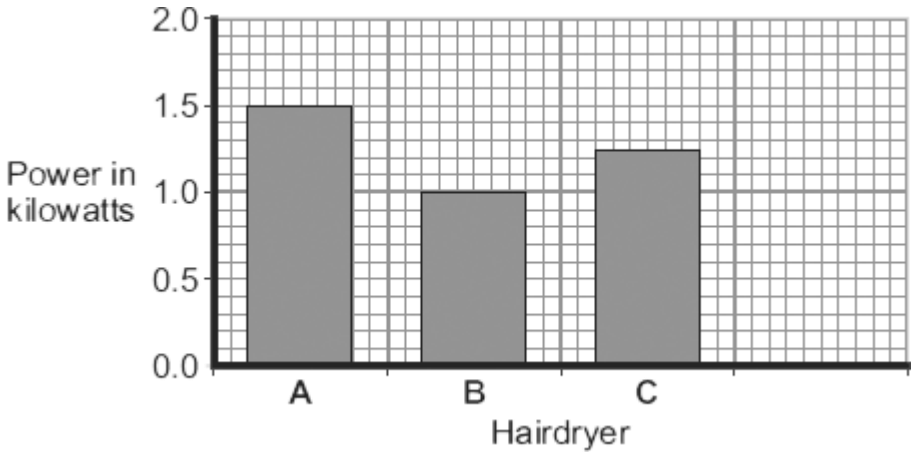
Q1.

(a) The bar chart shows the power of three different electric hairdryers.



(i) Which **one** of the hairdryers, **A**, **B** or **C**, would transfer the most energy in 5 minutes?

Write the correct answer in the box. ☐

(1)

(ii) A small 'travel' hairdryer has a power of 500 watts.

Draw a fourth bar on the bar chart to show the power of the 'travel' hairdryer.

(1)

(b) A family shares the same hairdryer.
The hairdryer has a power of 1.2 kW. The hairdryer is used for a total of 2 hours each week.

(i) Calculate how many kilowatt-hours (kWh) of energy the hairdryer transfers in 2 hours.

Show clearly how you work out your answer.

_____

_____

Energy transferred = _____ kWh

(2)

(ii) Electricity costs 15 pence per kWh.

Calculate the cost of using the hairdryer for 2 hours.

Show clearly how you work out your answer.

_____

_____

Cost = _____ pence

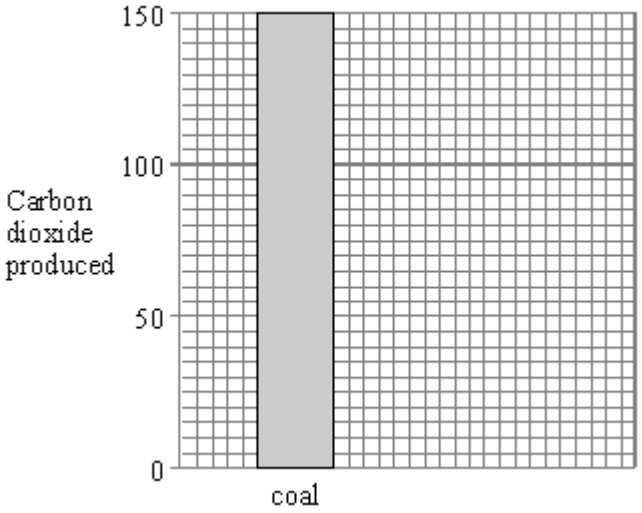
(2)

(Total 6 marks)

Q2.

The table shows how much carbon dioxide is produced when you transfer the same amount of energy by burning coal, gas and oil.

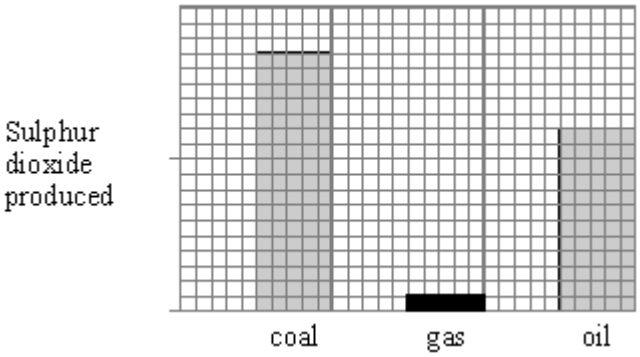
	Carbon dioxide (based on oil = 100)
coal	150
gas	75
oil	100



(a) Use the information from the table to complete the bar-chart.

(2)

(b) The second bar-chart shows how much sulphur dioxide is produced by burning the same three fuels.



Compare the amount of sulphur produced by burning gas with the amount produced by burning coal.

_____

_____

(1)

(c) Burning fuels also produces nitrogen oxides, even though the fuels contain no nitrogen. Explain why this happens.

_____

_____

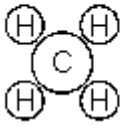
(2)

(d) When you release the same amount of energy from coal, gas and oil, different amounts of carbon dioxide are produced.

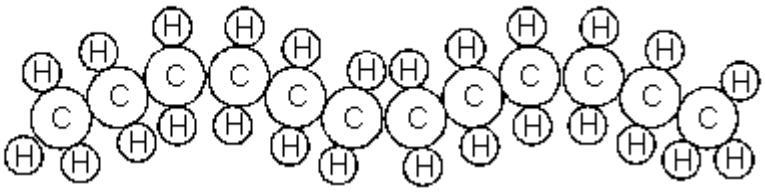
Use the information below to explain why.

Coal is mainly carbon

North Sea gas is mainly methane



Oil is made from molecules similar to the one shown



(3)

(e) What other element do coal and oil usually contain?

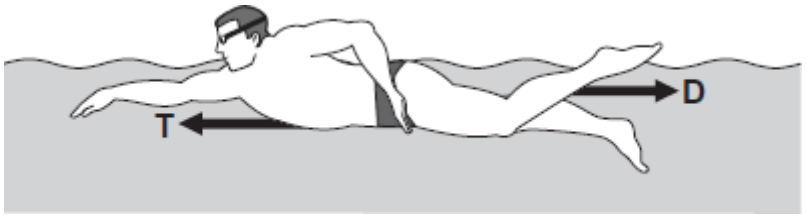
_____

(1)

(Total 9 marks)

Q3.

(a) The diagram shows the horizontal forces acting on a swimmer.



(i) The swimmer is moving at constant speed.
Force **T** is 120 N.

What is the size of force **D**?

_____ N

(1)

(ii) By increasing force **T** to 140 N, the swimmer accelerates to a higher speed.

Calculate the size of the initial resultant force acting on the swimmer.

_____

_____

Initial resultant force = _____ N

(1)

(iii) Even though the swimmer keeps the force **T** constant at 140 N, the resultant force on the swimmer decreases to zero.

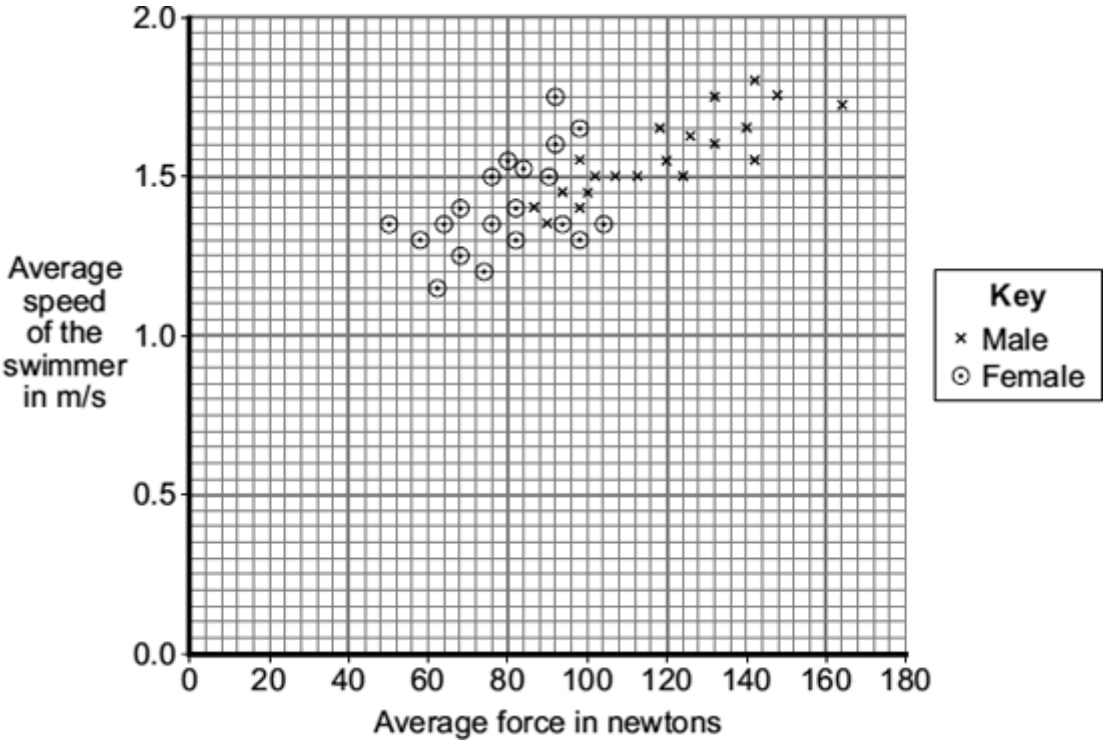
Explain why.

_____

(3)

(b) A sports scientist investigated how the force exerted by a swimmer's hands against the water affects the swimmer's speed.
The investigation involved 20 males and 20 females swimming a fixed distance.
Sensors placed on each swimmer's hands measured the force 85 times every second over the last 10 metres of the swim.
The measurements were used to calculate an average force.
The average speed of each swimmer over the last 10 metres of the swim was also measured.

The data from the investigation is displayed in the graph.



(i) What was the dependent variable in this investigation?

(1)

(ii) Explain **one** advantage of measuring the force 85 times every second rather than just once or twice every second.

(2)

(iii) Give **one** way in which the data for the male swimmers is different from the data for the female swimmers.

_____

_____

(1)

(iv) Considering only the data from this investigation, what advice should a swimming coach give to swimmers who want to increase their average speed?

_____

_____

(1)

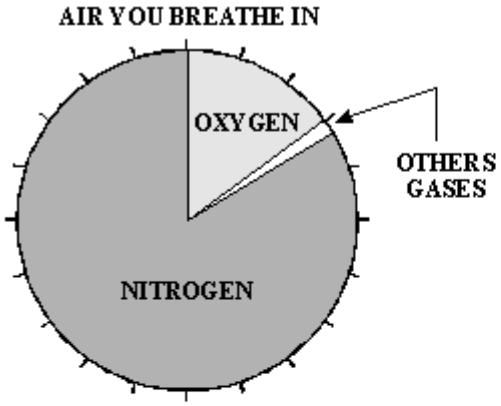
(Total 10 marks)

Q4.

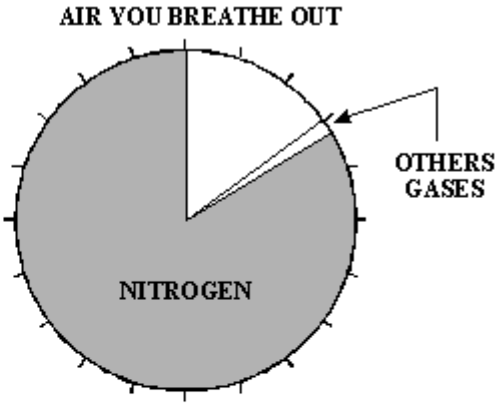
(a) Breathed-out air is different from breathed-in air.

The two pie-charts show the percentages of different gases in each.

Complete the second pie-chart, using the information from the table.



This air contains less than 1% carbon dioxide. (Too little to show)



Gases in breathed–out air	
nitrogen	79%
oxygen	16%
carbon dioxide	4%
other gases	1%

(3)

(b) Use the information above to complete the following sentences.

The air you breathe out contains more _____ than the air you breathe in.

The air you breathe out contains less _____ than the air you breathe in.

(2)

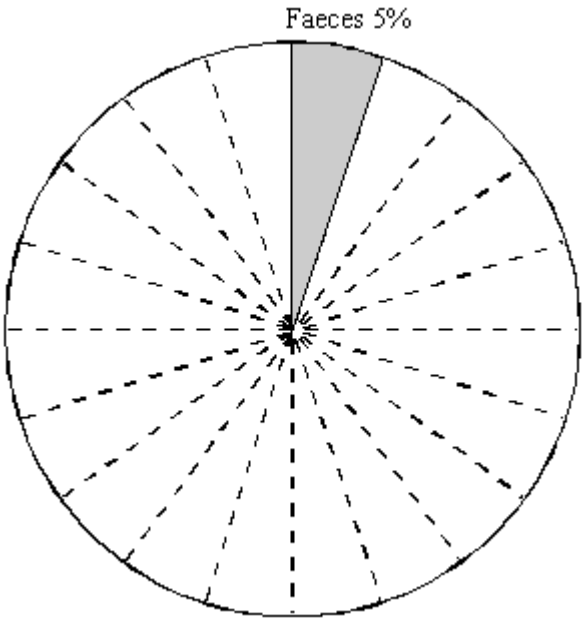
(Total 5 marks)

Q5.

The table below shows how the body loses water.

HOW WATER IS LOST	% (PERCENTAGE)
Breathing	10
Faeces	5
Sweat	45
Urine	40

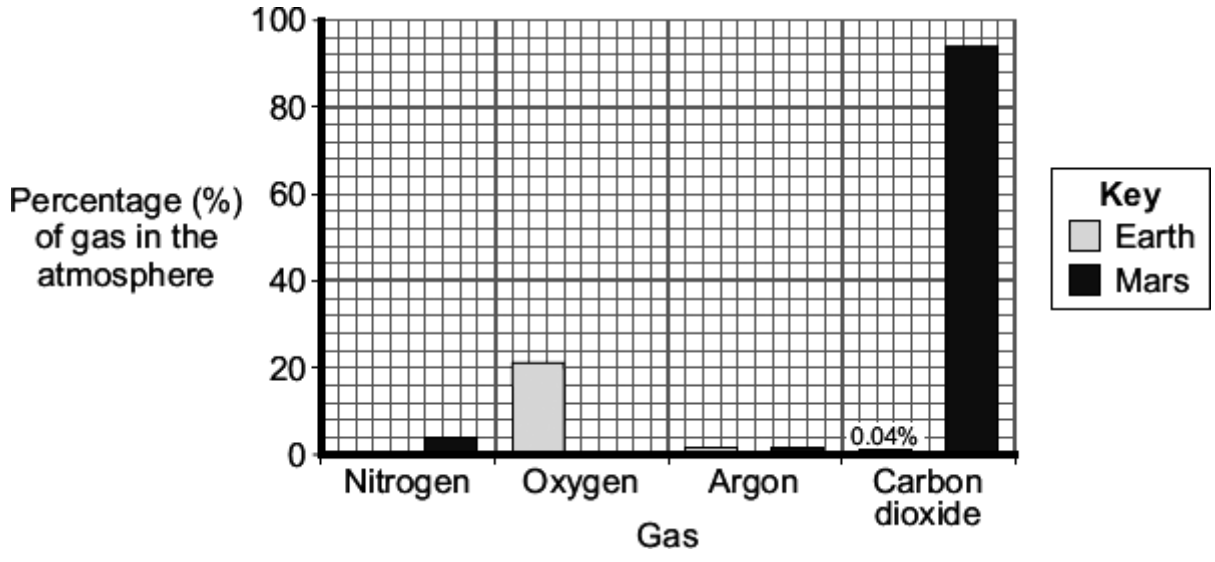
Complete the diagram by showing the water loss for breathing, sweat and urine.



(Total 3 marks)

Q6.

The bar chart shows some of the gases in the atmospheres of Earth today and Mars today.



(a) Complete the bar chart to show the percentage of nitrogen in the Earth's atmosphere

today.

(1)

(b) Some scientists suggest that the Earth's early atmosphere was like the atmosphere of Mars today.

(i) There is **not** much oxygen in the atmosphere of Mars.

Suggest why.

_____

_____

(1)

(ii) The percentage of argon in the Earth's atmosphere today is the same as it was in the Earth's early atmosphere.

Suggest why.

_____

_____

(1)

(c) Compared with the percentage of carbon dioxide in the Earth's early atmosphere there is **not** much carbon dioxide in the Earth's atmosphere today.

Give **one** reason for this change.

_____

_____

(1)

(d) Draw a ring around the correct answer to complete the sentence.

Some theories suggest that the Earth's early atmosphere was

made by

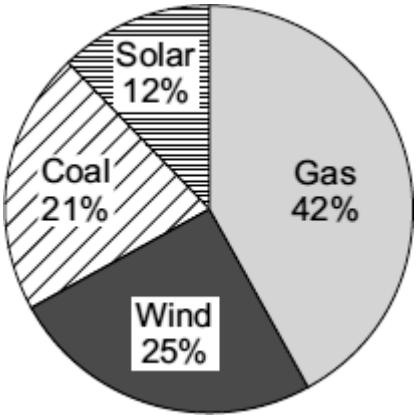
burning fossil fuels.
the formation of oceans.
the eruption of volcanoes.

(1)

(Total 5 marks)

Q7.

(a) The pie chart shows the energy sources used by one company to generate electricity.



(i) Which two energy sources used by the company do **not** produce any polluting gases?

_____ and _____

(1)

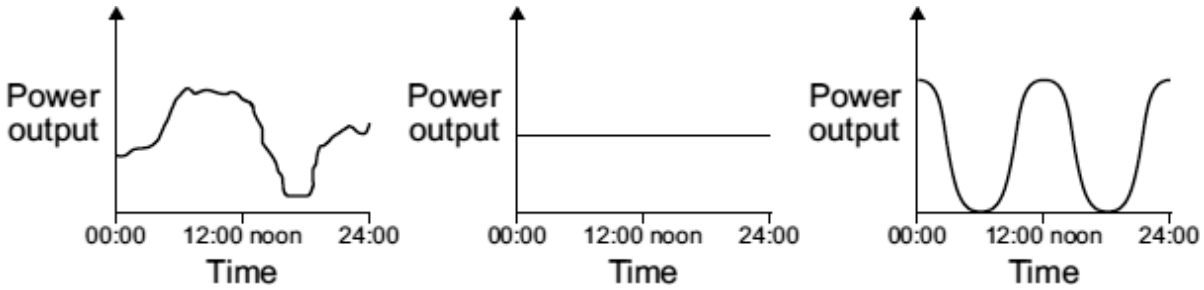
(ii) Calculate the percentage (%) of electricity that is generated using energy sources that do **not** produce any polluting gases.

Percentage = _____

(1)

(b) Which graph, **A**, **B** or **C**, is most likely to show the electrical power output from a wind turbine over one day?

Write your answer, **A**, **B** or **C**, in the box.

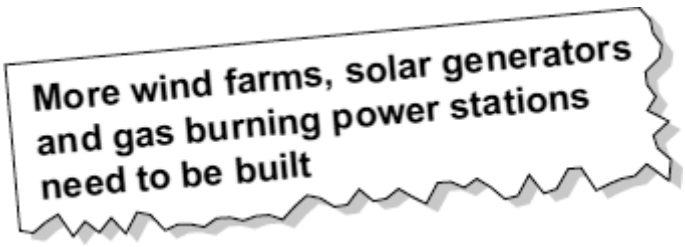


Graph **A** Graph **B** Graph **C**

Graph ☐

(1)

(c) The government has said that more electricity must be generated from renewable energy sources. A newspaper reported that:



Why is the statement in the newspaper incorrect?

_____

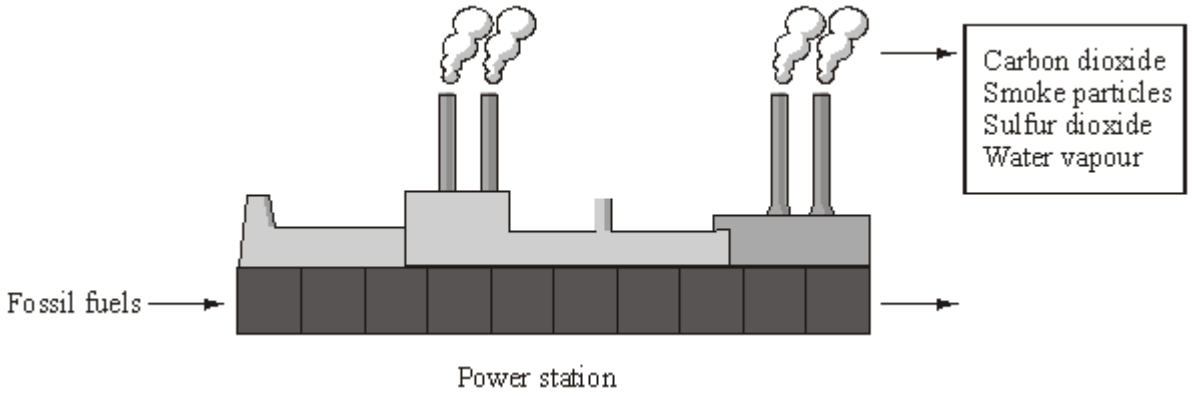
_____

(1)

(Total 4 marks)

Q8.

Most electricity in the UK is generated in power stations that burn fossil fuels. The diagram lists some of the substances released into the air when fossil fuels are burned.



(a) (i) Which **one** of the substances released into the air causes acid rain?

_____

(1)

(ii) In the sentence below, draw a ring around the correct answer.

The type of environmental pollution caused by

smoke particle is

global dimming
global warming
rising sea levels

(1)

(iii) Suggest how the burning of fossil fuels may cause climate change.

_____

_____

_____

_____

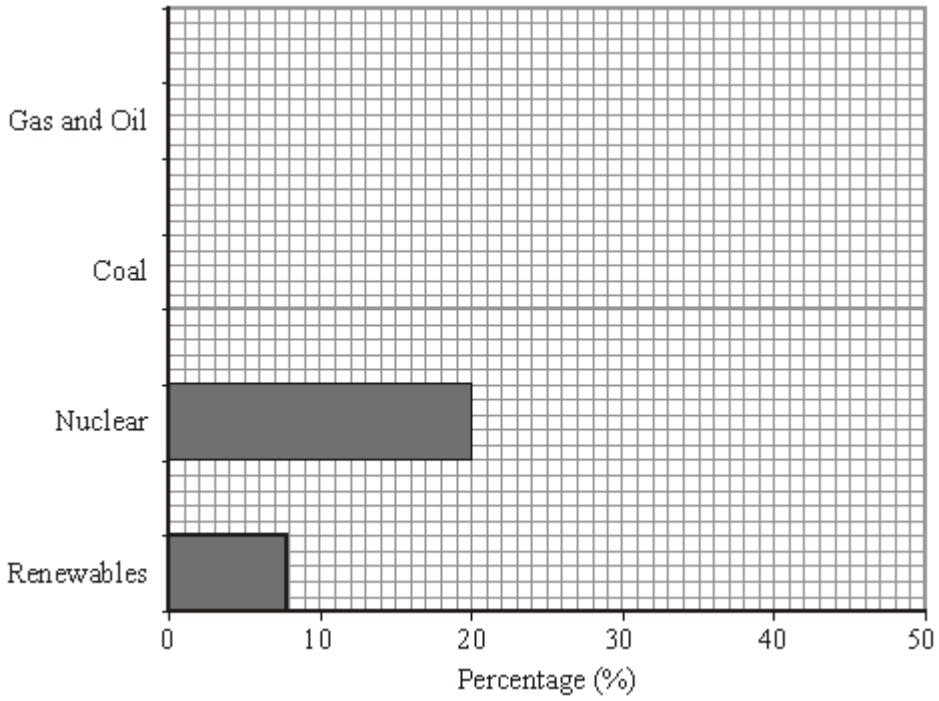
(2)

(b) The table shows the percentage of electricity generated by different energy sources.

Energy sources	Renewables	Nuclear	Coal	Gas and Oil

Percentage (%)	8	20	32	40

Complete the bar chart to show the percentage of electricity generated by coal and by gas and oil.



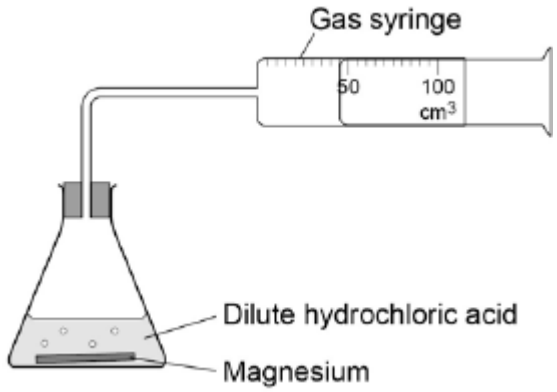
(2)

(Total 6 marks)

Q9.

A student investigated the rate of the reaction between magnesium and dilute hydrochloric acid. The student used the apparatus shown in **Figure 1** to collect the gas produced.

Figure 1



(a) Outline a plan to investigate how the rate of this reaction changed when the concentration of the hydrochloric acid was changed.

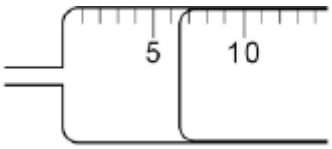
- Describe how you would do the investigation and the measurements you would make.
- Describe how you would make it a fair test.

You do **not** need to write about safety precautions.

(6)

(b) **Figure 2** shows the gas syringe during one of the experiments.

Figure 2



What is the volume of gas collected?

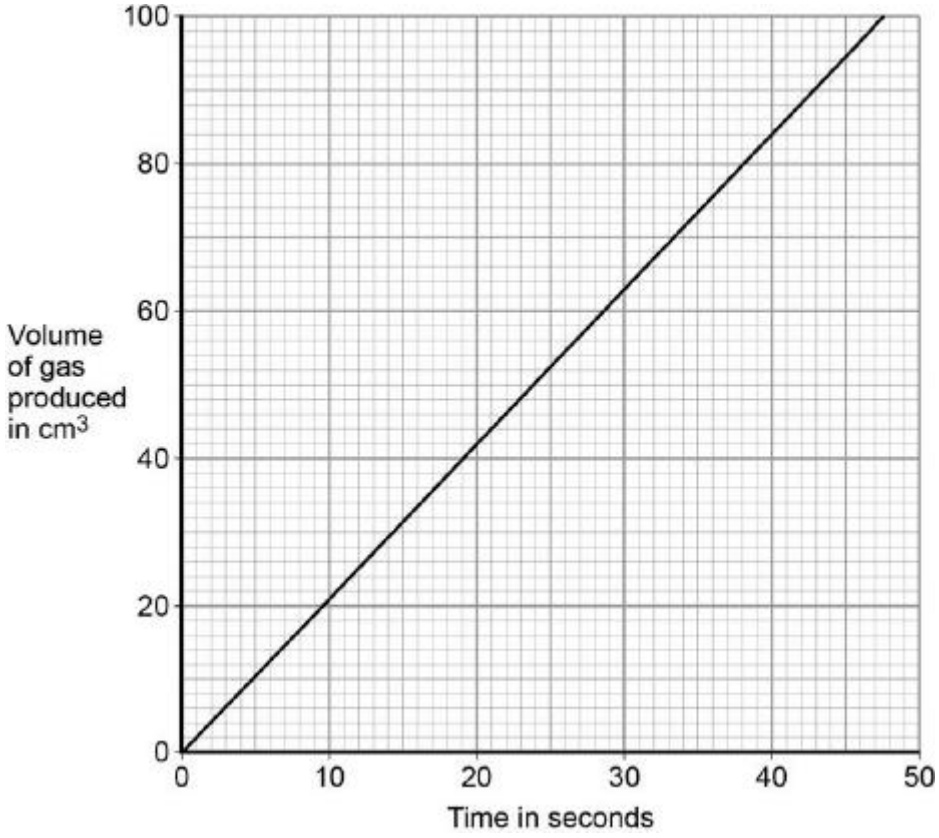
Tick **one** box.

- 5.3 cm^3 ☐
- 6.0 cm^3 ☐
- 6.5 cm^3 ☐
- 7.0 cm^3 ☐

(1)

(c) **Figure 3** shows the student's results for one concentration of hydrochloric acid.

Figure 3



The table below shows the student's results when the concentration was two times greater than the results on **Figure 3**

Time in seconds	Volume of gas produced in cm^3
0	0
10	35
15	52
20	80
30	87

Plot the results in the table above on the grid in **Figure 3**.
Draw a line of best fit.

(3)

(d) Give **one** conclusion about how the rate of reaction changed when the concentration of hydrochloric acid was changed.

_____

_____

(1)

(Total 11 marks)

Q10.

This question is about magnetism.

(a) Which two materials are magnetic?

Tick **two** boxes.

Carbon	☐
Cobalt	☐
Copper	☐
Nickel	☐
Sodium	☐

(2)

(b) Describe how you could find the magnetic field pattern of a permanent bar magnet.

_____

_____

_____

_____

_____

_____

_____

(3)

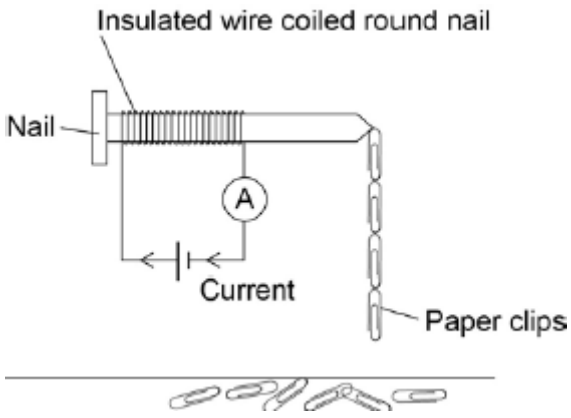
(c) A student investigates how the number of turns of wire on a solenoid affects the strength of the solenoid.

To test the strength of the solenoid she looks at how many paper clips the solenoid could lift.

Figure 1 shows how she sets up the equipment.

She keeps the current through the coil constant throughout the experiment.

Figure 1



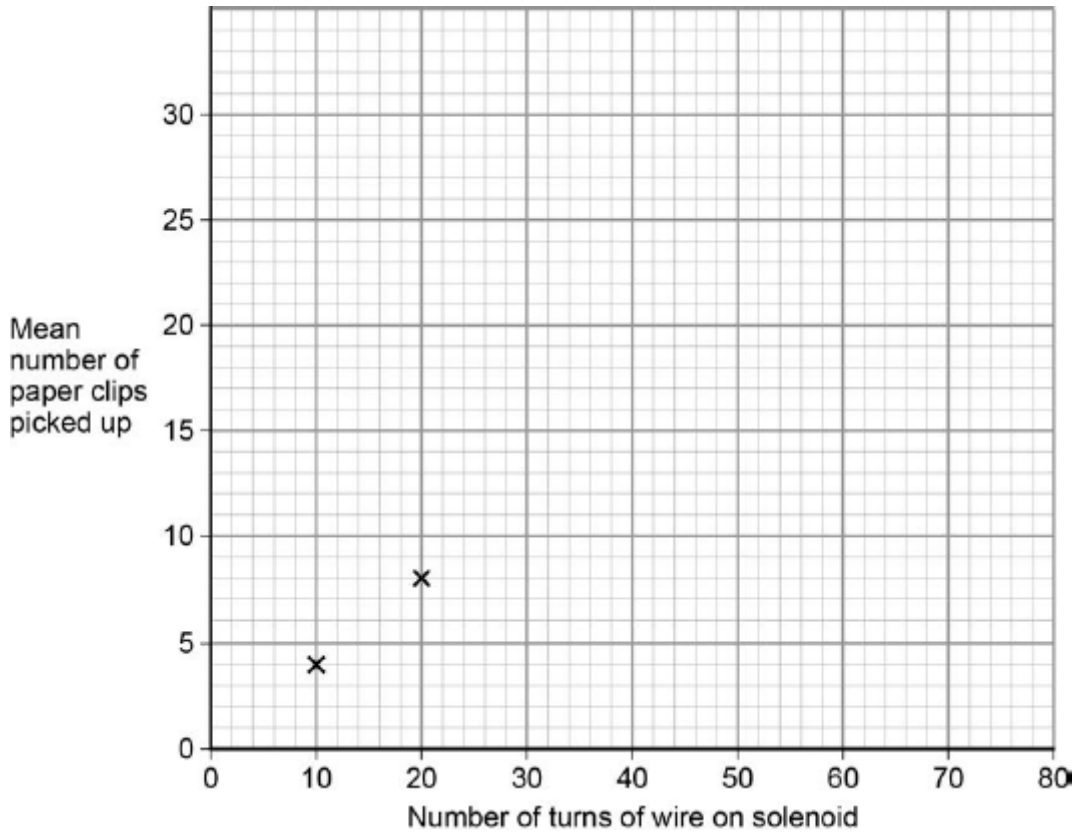
The table below shows the student's results.

Number of turns of wire on solenoid	Number of paper clips picked up by solenoid			
	Test 1	Test 2	Test 3	Mean
0	0	0	0	0
10	4	3	4	4
20	8	8	9	8
30	11	11	13	12
40	15	13	16	15
50	21	24	19	21
60	25	24	26	25

Use the data from the table above to complete the graph in **Figure 2**.

- The first two points have been plotted for you.
- Draw a line of best fit.

Figure 2



(3)

(d) Describe the pattern shown in the graph.

_____

_____

_____

_____

(2)

(e) Use your graph to predict how many paper clips the solenoid will pick up when 80 turns of wire are used.

Number of paper clips picked up = _____

(1)

(Total 11 marks)

Q11.

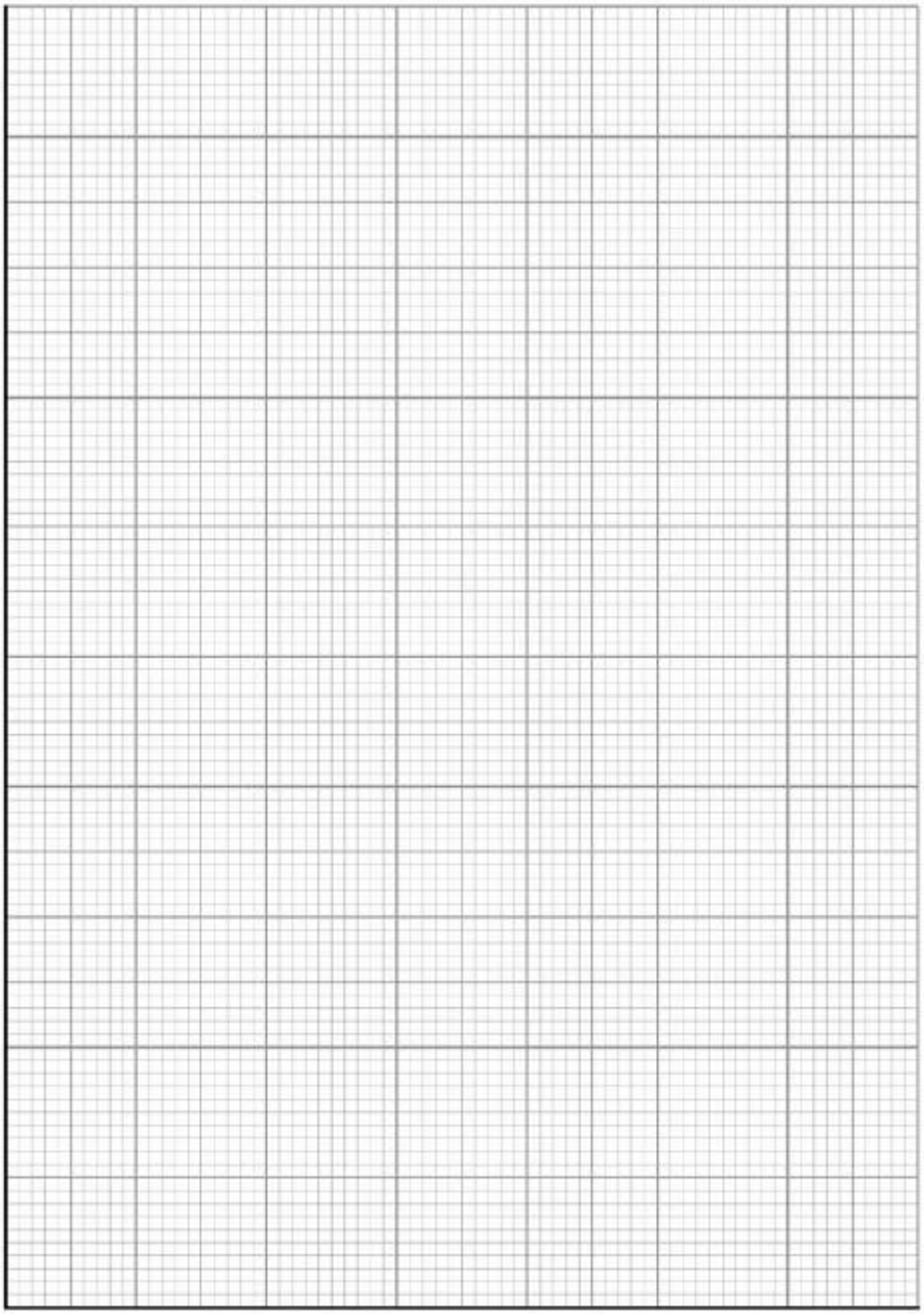
Ammonium nitrate (NH_4NO_3) is produced by reacting ammonia with nitric acid.

A student measured the mass of ammonium nitrate that dissolves in 100 cm^3 of water at different temperatures.

The table below shows the student's results.

Temperature in °C	0	20	40	60	80	100
Mass of ammonium nitrate in g that dissolves in 100 cm^3 water	119	190	286	321	630	1 024

(a) Use the table above to plot a graph of the solubility of ammonium nitrate on the figure below.



(4)

(b) At 20 °C, 190 g of ammonium nitrate dissolves in 100 cm^3 of water.

Calculate the amount of ammonium nitrate (in moles) that dissolves in 1 dm^3 of water at 20 °C.

Relative atomic masses (A_r): H = 1; N = 14; O = 16

_____

_____

_____

_____

Amount of dissolved ammonium nitrate = _____ mol

(3)

(c) Farmers use ammonium nitrate as a fertiliser.

Farmers want to slow down the rate at which ammonium nitrate fertiliser dissolves in the water in the soil.

Suggest why they spread the fertiliser in the form of small beads instead of a fine powder.

_____

_____

_____

_____

(2)

(d) Ammonia is needed to make ammonium nitrate.

The reaction used to make ammonia is:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

At equilibrium, about 35% of the nitrogen and hydrogen are converted to ammonia at 450 °C and 200 atmospheres pressure.

Explain the effects of increasing the temperature, or increasing the pressure, on the amount of ammonia produced at equilibrium.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 13 marks)

Q12.

There is less carbon dioxide in the Earth's atmosphere now than there was in the Earth's early atmosphere.

(a) The amount of carbon dioxide in the Earth's early atmosphere decreased because it was used by plants and algae for photosynthesis, dissolved in the oceans and formed fossil fuels.

Give **one** other way that the amount of carbon dioxide in the Earth's early atmosphere decreased.

(1)

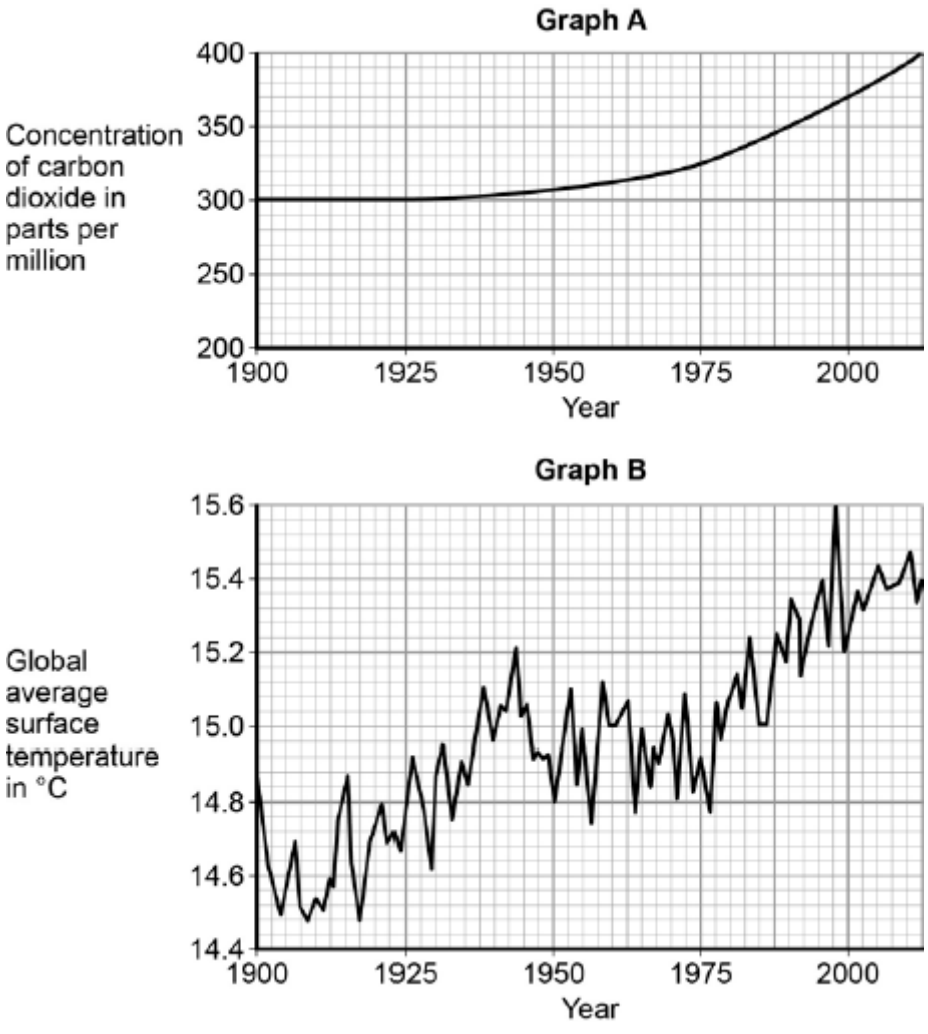
(b) Carbon dioxide is a greenhouse gas.

Describe the greenhouse effect.

(4)

(c) The graphs in **Figure 1** show the concentration of carbon dioxide in the atmosphere and global average surface temperature since 1900.

Figure 1



Calculate the percentage increase in the concentration of carbon dioxide from 1975 to 2000.

_____ %

(1)

(d) What was the global average surface temperature in 1980?

Global average surface temperature = _____ °C

(1)

(e) A student stated: 'The graphs show that increasing the concentration of carbon dioxide in the atmosphere causes global temperature increases.'

Discuss why this statement is only partially true.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

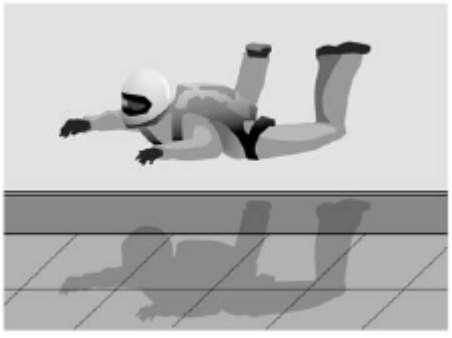
(Total 11 marks)

Q13.

Figure 1 shows a skydiver training in an indoor wind tunnel.

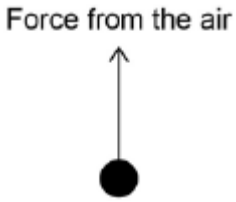
Large fans below the skydiver blow air upwards.

Figure 1



(a) The skydiver is in a stationary position.

Complete the free body diagram for the skydiver.



(2)

(b) The skydiver now straightens his legs to increase his surface area.

This causes the skydiver to accelerate upwards.

Explain why straightening his legs cause the skydiver to accelerate upwards.

_____

_____

_____

_____

(2)

(c) A small aeroplane used for skydiving moves along a runway.

The aeroplane accelerates at 2 m / s^2 from a velocity of 8 m / s.

After a distance of 209 m it reaches its take-off velocity.

Calculate the take-off velocity of the aeroplane.

_____

_____

_____

Take-off velocity = _____ m / s

(3)

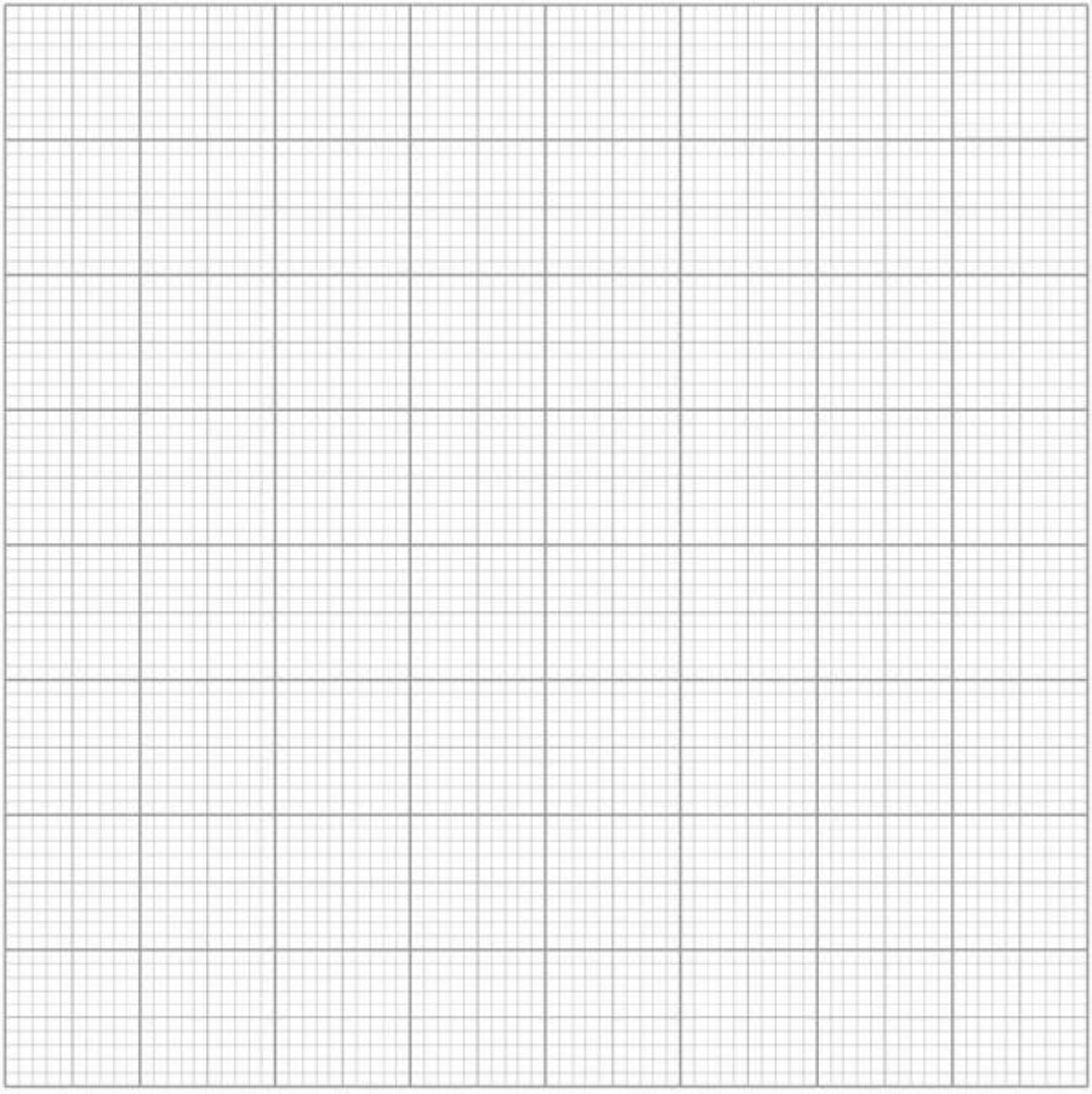
(d) A skydiver jumps from an aeroplane.

There is a resultant vertical force of 300 N on the skydiver.

There is a horizontal force from the wind of 60 N.

Draw a vector diagram on **Figure 2** to determine the magnitude and direction of the resultant force on the skydiver.

Figure 2



Magnitude of resultant force = _____ N

(5)

(Total 12 marks)

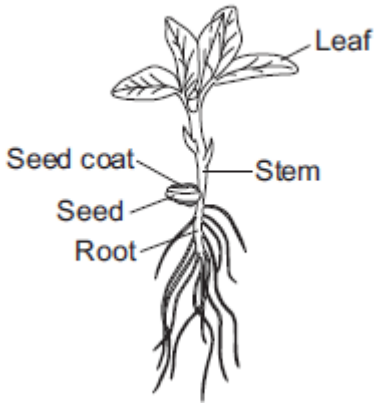
Q14.

Catalase is an enzyme found in many different tissues in plants and animals.It speeds up the rate of the following reaction.

$$\text{hydrogen peroxide} \xrightarrow{\text{catalase}} \text{water + oxygen}$$

Figure 1 shows a 25-day-old broad bean seedling.

Figure 1



Some students investigated whether different parts of bean seedlings contained different amounts of catalase.

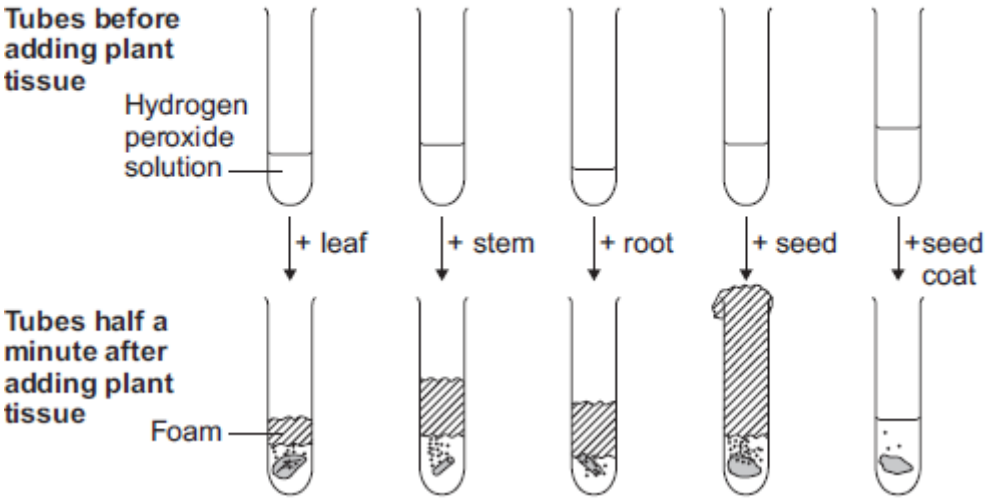
The students:

- put hydrogen peroxide into five test tubes
- added a different part of a bean seedling to each tube
- recorded the results after half a minute.

If there was catalase in part of the seedling, oxygen gas was given off.
When oxygen gas is given off, foam is produced in the tubes.

Figure 2 shows the results.

Figure 2



The students made the following conclusions:

- most parts of a bean seedling contain catalase
- the seed contains a lot of catalase
- stems and roots have quite a lot of catalase
- the leaves have a little bit of catalase
- the seed coat has hardly any catalase.

The students' teacher said that the students needed to improve their investigation in order to

make valid conclusions.

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

Describe how you would carry out an investigation to compare the amounts of catalase in different parts of bean seedlings.

You should include details of how you would make sure your results give a valid comparison of the amounts of catalase.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(b) Scientists investigated the effect of pH on the activity of the enzyme catalase in a fungus.

The table below shows the scientists' results.

pH	Enzyme activity in arbitrary units					
	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**	**Mean**
3.0	0	0	0	0	0	0
4.0	6	5	8	4	7	6
5.0	38	65	41	42	39	
5.5	80	86	82	84	88	84
6.0	100	99	96	103	102	100
6.5	94	92	90	93	91	92
7.0	61	63	61	62	63	62
8.0	22	22	21	24	21	22

(i) Calculate the mean enzyme activity at pH 5.0.

_____

Mean = _____ arbitrary units

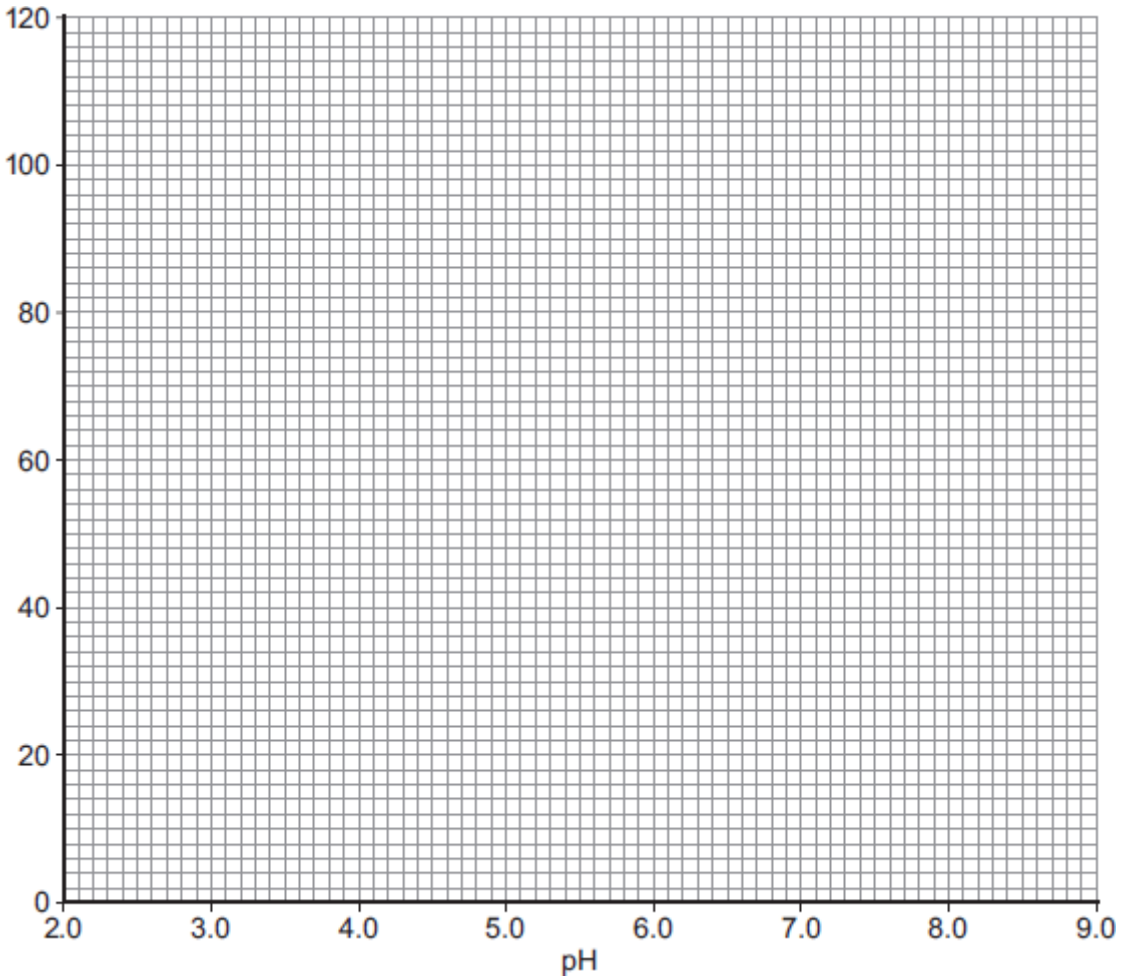
(2)

(ii) On the graph paper in **Figure 3**, draw a graph to show the scientists' results.

Remember to:

- add a label to the vertical axis
- plot the mean values of enzyme activity
- draw a line of best fit.

Figure 3



(4)

(iii) At what pH does the enzyme work best?

_____

(1)

(iv) Predict the activity of the enzyme at pH 9.0.

_____ arbitrary units

(1)

(v) Suggest why the enzyme's activity at pH 3.0 is zero.

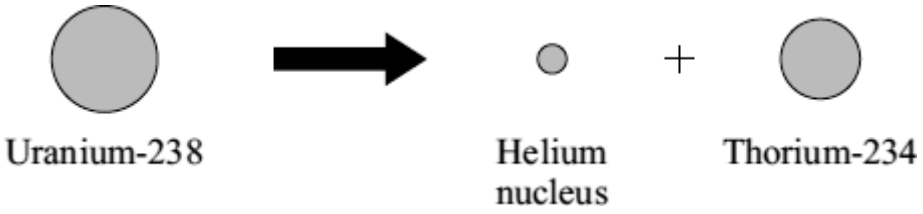
_____

(1)

(Total 15 marks)

Q15.

(a) Some rocks inside the Earth contain uranium-238, a radioactive isotope of uranium. When an atom of uranium-238 decays, it gives out radiation and changes into a thorium-234 atom.



(i) What type of radiation is emitted when a uranium-238 atom decays?

_____

(1)

(ii) From which part of a uranium-238 atom is the radiation emitted?

_____

(1)

(iii) Uranium-235 is another isotope of uranium.

How is an atom of uranium-235 similar to an atom of uranium-238?

_____

(1)

(b) Uranium-238 has a half-life of 4500 million years.

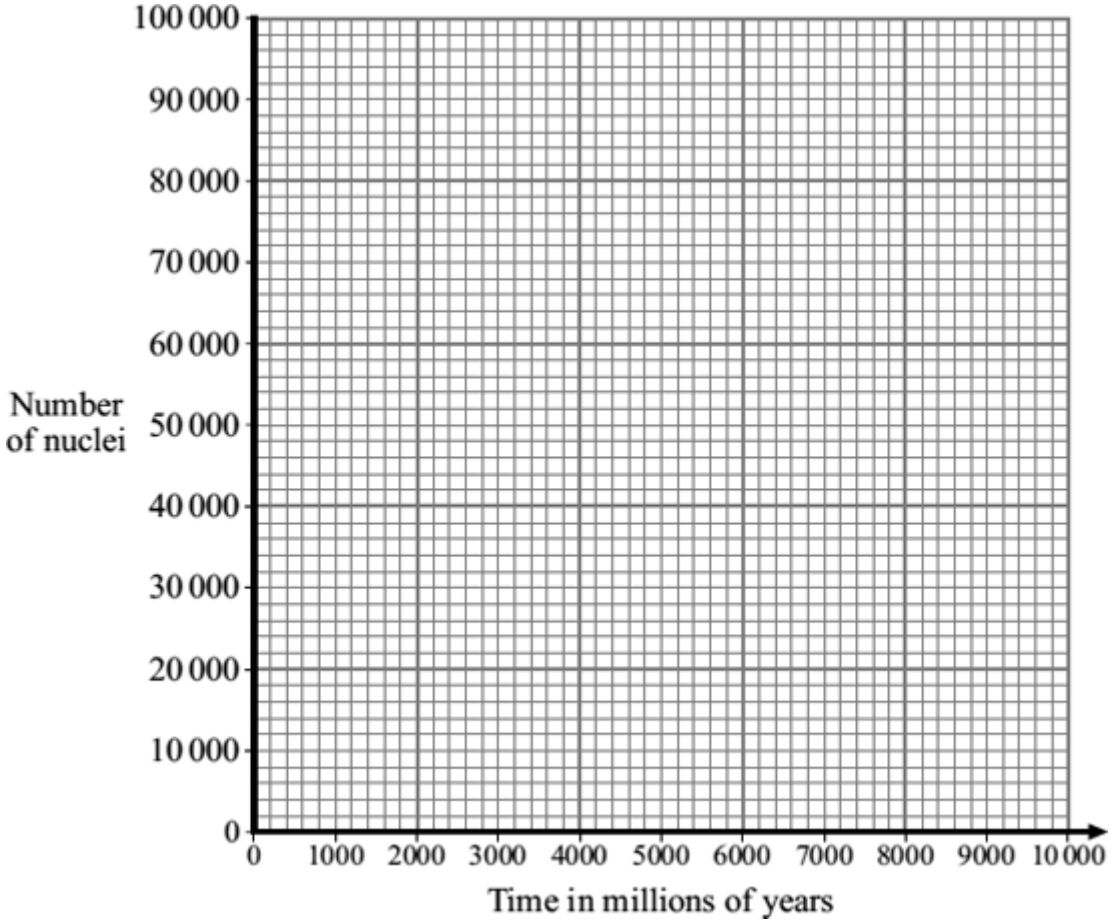
(i) When the Earth was formed, there was twice as much uranium-238 in the rocks as there is now.

What is the age of the Earth?

_____

(1)

(ii) Complete the graph to show how the number of nuclei in a sample of uranium-238 will change with time.
Initially, there were 100 000 nuclei in the sample.



(2)

(Total 6 marks)

Q16.

Amylase is an enzyme that digests starch.

A student investigated the effect of pH on the activity of amylase.

This is the method used.

1. Mix amylase solution and starch suspension in a boiling tube.
2. Put the boiling tube into a water bath at 25 °C.
3. Remove a drop of the mixture every 30 seconds and test it for the presence of starch.
4. Repeat the investigation at different pH values.

The table below shows the students' results.

pH	Time when no starch was detected in minutes
5.0	7.0
5.5	4.5
6.0	3.0
6.5	2.0
7.0	1.5

7.5	1.5
8.0	2.0

(a) The student concluded pH 7.25 was the optimum pH for the amylase enzyme.

This is **not** a valid conclusion.

Suggest **two** reasons why.

1. _____

_____

2. _____

_____

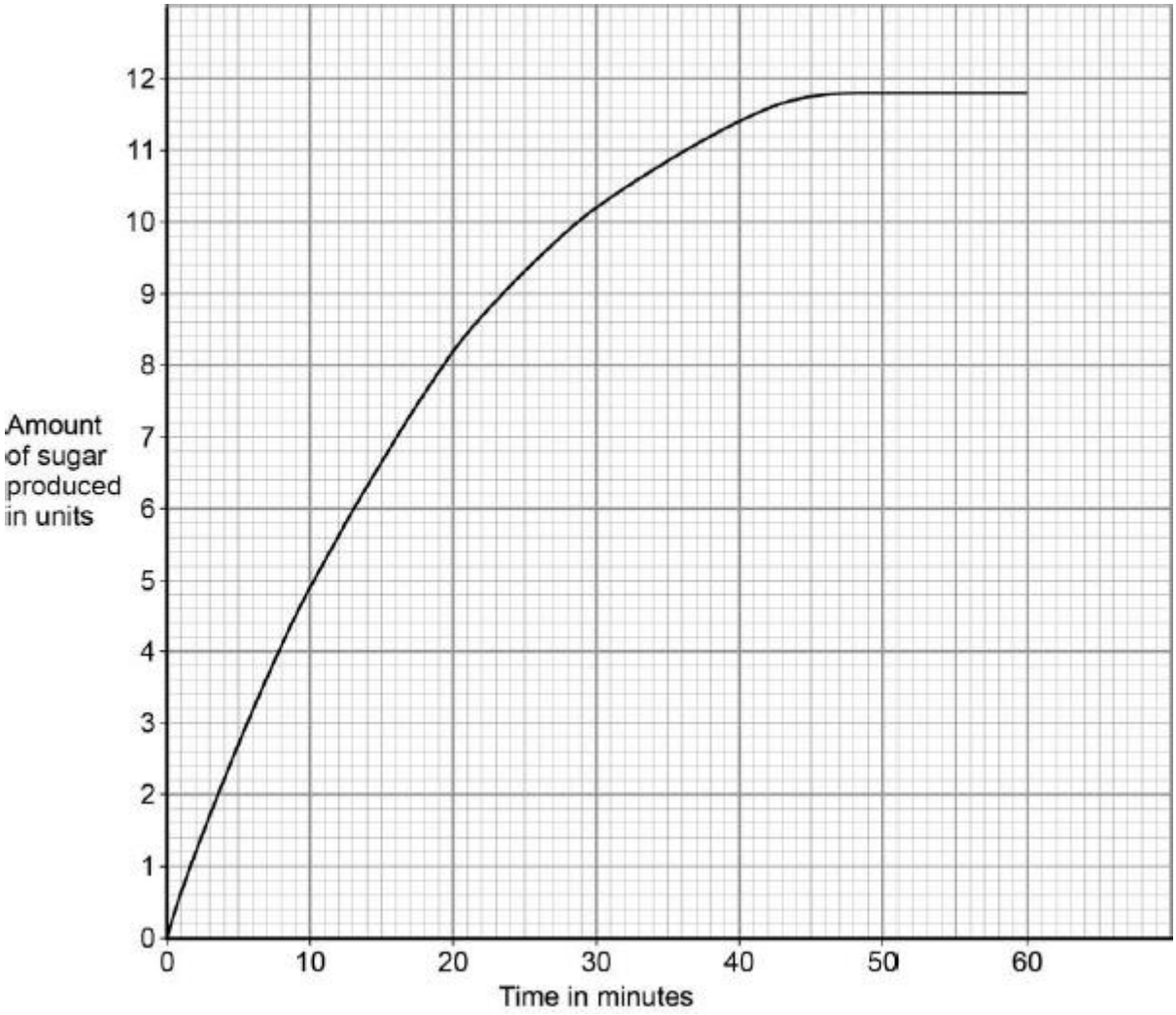
(2)

(b) The student did another investigation.

This is the method used.

1. Put amylase solution and starch suspension into a boiling tube.
2. Make the pH 7.25.
3. Put the boiling tube into a water bath at 25 °C.
4. Measure the amount of sugar produced every 30 seconds.

The results are shown in the figure below.



Calculate the mean rate of sugar produced per minute during the first 5 minutes.

_____

_____

Mean rate = _____ units per minute

(2)

(c) Iodine solution is added to a sample taken from the boiling tube after 10 minutes and 60 minutes.

Suggest what you would see in these samples.

After 10 minutes _____

_____

.After 60 minutes _____

_____

(2)

(d) The scientist repeated the investigation at 37 °C.

Draw a line on the figure above to show the predicted results.

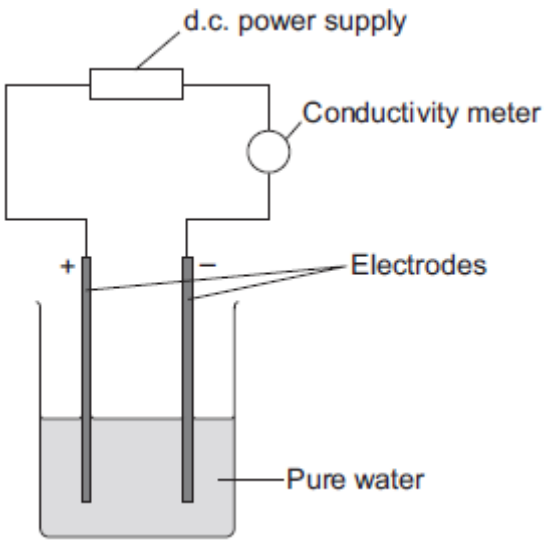
(2)

(Total 8 marks)

Q17.

A student investigated the conductivity of different concentrations of sodium chloride solution.
The student set the apparatus up as shown in **Figure 1**.

Figure 1



The student measured the conductivity of the pure water with a conductivity meter.

The reading on the conductivity meter was zero.

(a) The student:

- added sodium chloride solution one drop at a time
- stirred the solution
- recorded the reading on the conductivity meter.

The student's results are shown in the table below.

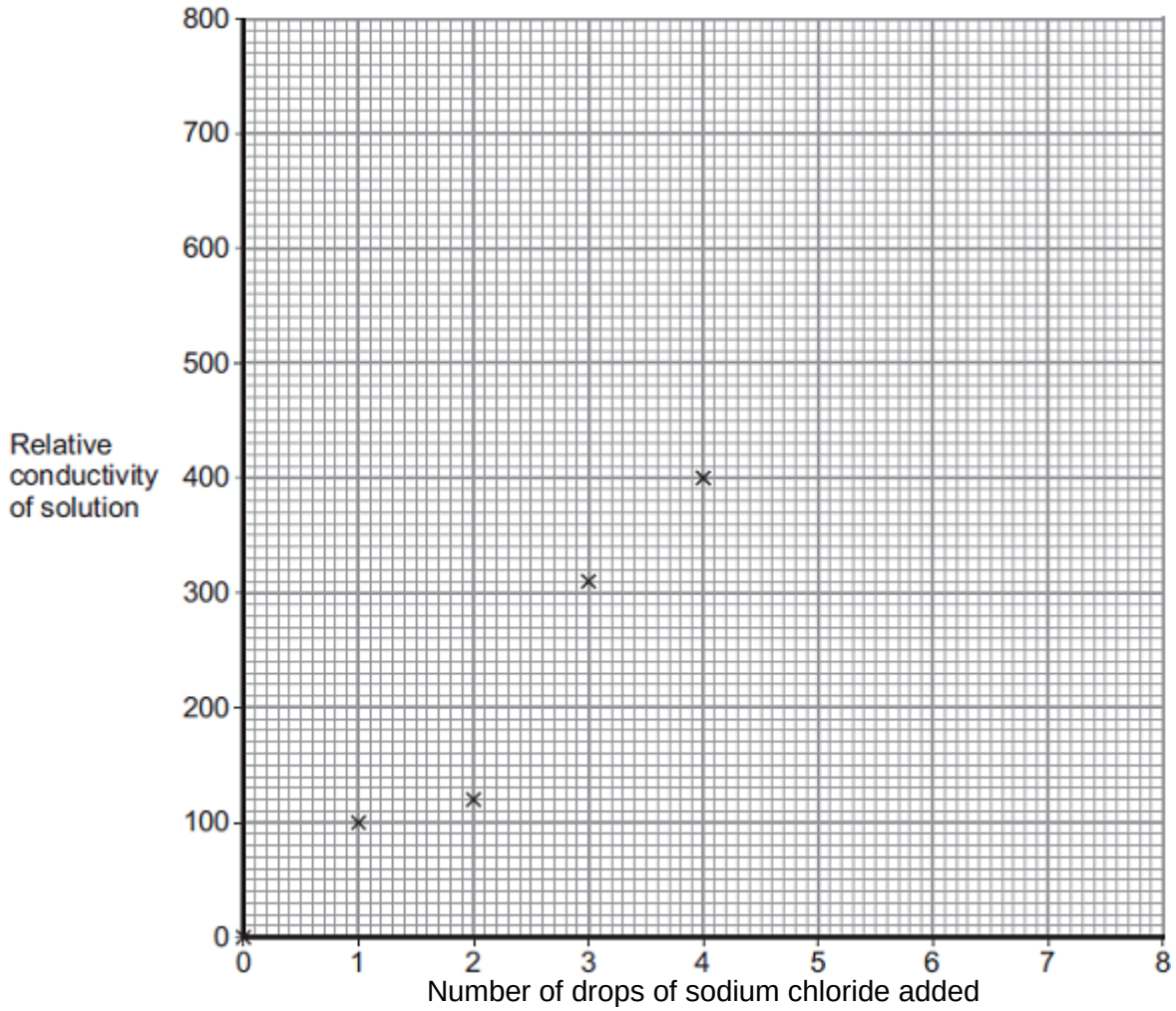
Number of drops of sodium chloride solution added	Relative conductivity of solution
0	0
1	100
2	120
3	310
4	400
5	510
6	590
7	710
8	800

(i) The student plotted the results on the grid shown in **Figure 2**.

Plot the four remaining results.

Draw a line of best fit, ignoring the anomalous result.

Figure 2



(3)

(ii) One of the points is anomalous.

Suggest **one** error that the student may have made to cause the anomalous result.

_____

_____

(1)

(iii) The student wanted to compare the conductivity of sodium chloride solution with the conductivity of potassium chloride solution.

State **one** variable he should keep constant when measuring the conductivity of the two solutions.

_____

(1)

(b) (i) Explain, in terms of bonding, why pure water does **not** conduct electricity.

_____

_____

_____

_____

(2)

(ii) Explain why sodium chloride solution conducts electricity.

_____

_____

_____

_____

(2)

(iii) After he had added sodium chloride solution, the student noticed bubbles of gas at the negative electrode.

Complete the sentence.

The gas produced at the negative electrode is _____

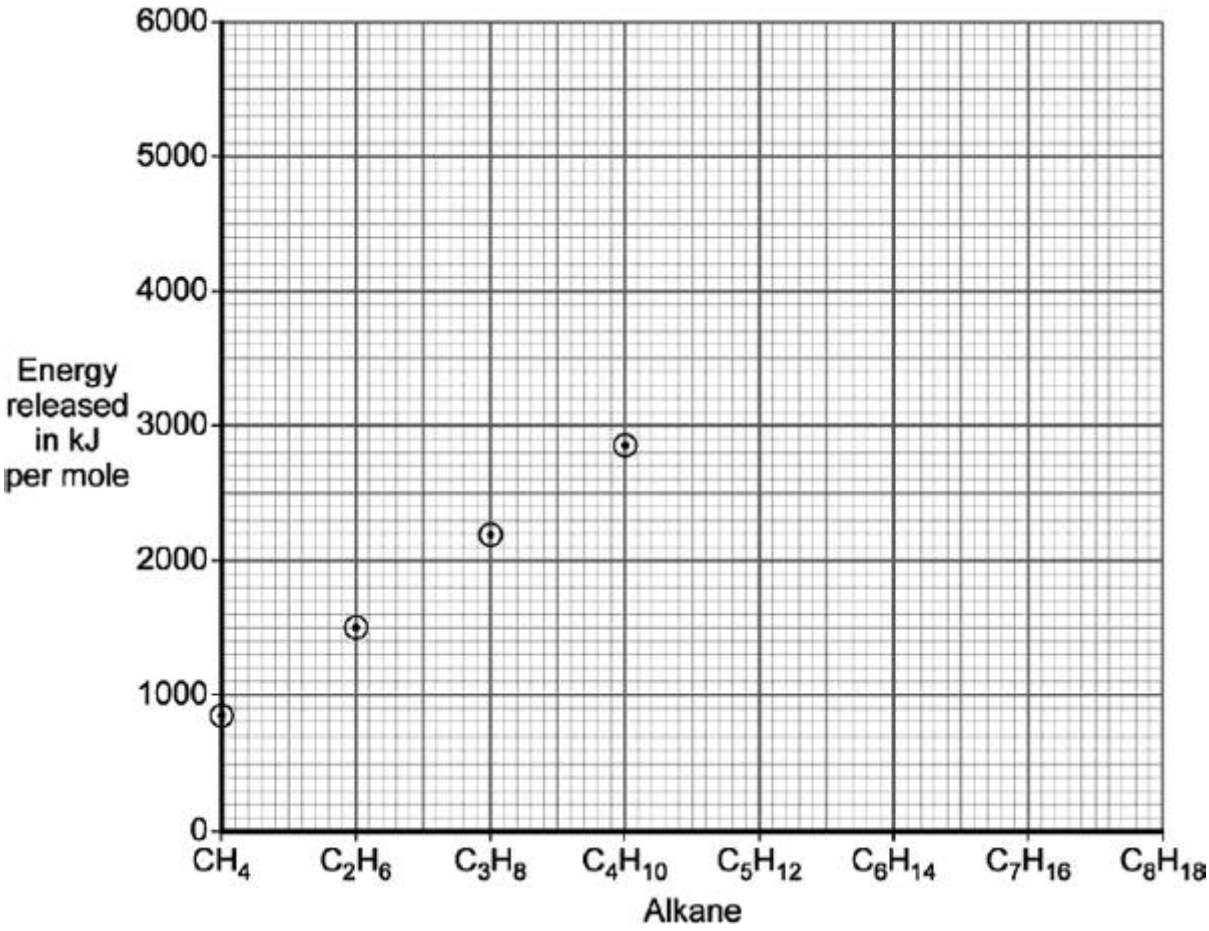
(1)

(Total 10 marks)

Q18.

(a) Alkanes are important hydrocarbon fuels. They have the general formula C_nH_{2n+2}

The points on the graph show the amount of energy released when 1 mole of methane (CH_4), ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}) are burned separately.



(i) Draw a line through the points and extend your line to the right-hand edge of the graph.

(1)

(ii) Use the graph to estimate the amount of energy released when 1 mole of octane (C_8H_{18}) is burned.

Energy released = _____ kJ

(1)

(iii) Suggest why we can make a good estimate for the energy released by 1 mole of pentane (C_5H_{12}).

_____

_____

(1)

(iv) A student noticed that octane (C_8H_{18}) has twice as many carbon atoms as butane (C_4H_{10}), and made the following prediction:

"When burned, 1 mole of octane releases twice as much energy as 1 mole of butane."

Use the graph to decide if the student's prediction is correct. You **must** show your working to gain credit.

_____

_____

_____

_____

(2)

(b) Some information about four fuels is given in the table.

			Combustion products			
Fuel	**Type**	**Heat released in kJ per g**	**CO_2**	**SO_2**	**H_2O**	**Type of flame**
Bio-ethanol	Renewable	29	✓		✓	Not smoky
Coal	Non-renewable	31	✓	✓	✓	Smoky
Hydrogen	Renewable	142			✓	Not smoky
Natural gas	Non-renewable	56	✓		✓	Not smoky

From this information a student made two conclusions.

For each conclusion, state if it is correct **and** explain your answer.

(i) "Renewable fuels release more heat per gram than non-renewable fuels."

(2)

(ii) "Non-renewable fuels are better for the environment than renewable fuels."

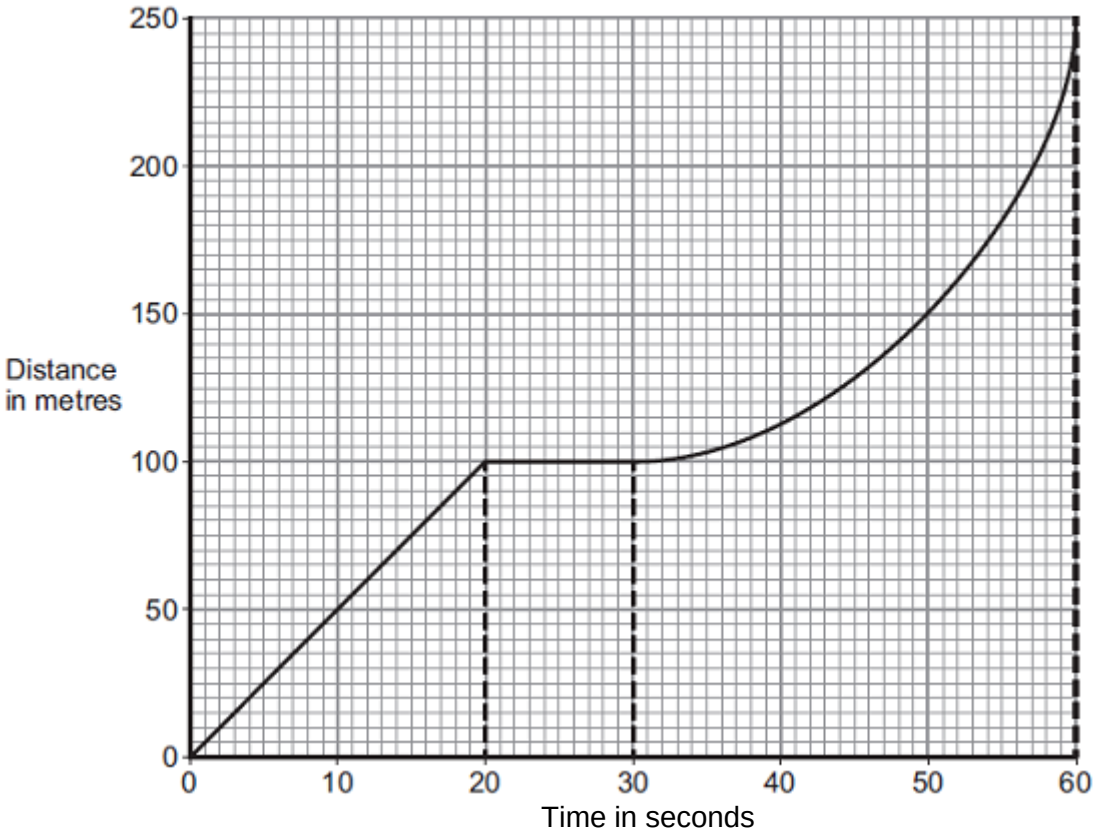
(2)

(Total 9 marks)

Q19.

A bus is taking some children to school.

(a) The bus has to stop a few times. The figure below shows the distance–time graph for part of the journey.



(i) How far has the bus travelled in the first 20 seconds?

Distance travelled = _____ m

(1)

(ii) Describe the motion of the bus between 20 seconds and 30 seconds.

_____

_____

(1)

(iii) Describe the motion of the bus between 30 seconds and 60 seconds.

Tick (✓) **one** box.

	Tick (✓)
Accelerating	
Reversing	
Travelling at constant speed	

(1)

(iv) What is the speed of the bus at 45 seconds?

Show clearly on the figure above how you obtained your answer.

_____

_____

_____

Speed = _____ m / s

(3)

(b) Later in the journey, the bus is moving and has 500 000 J of kinetic energy.

The brakes are applied and the bus stops.

(i) How much work is needed to stop the bus?

_____

Work = _____ J

(1)

(ii) The bus stopped in a distance of 25 m.

Calculate the force that was needed to stop the bus.

_____

_____

Force = _____ N

(2)

(iii) What happens to the kinetic energy of the bus as it is braking?

_____

_____

_____

_____

(2)

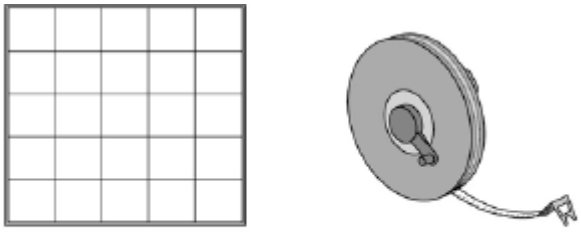
(Total 11 marks)

Q20.

A student investigated the number of ribwort plants in a field.

The student used the apparatus shown in **Figure 1**.

Figure 1



Quadrat

Tape measure

Not drawn to scale

This is the method used.

1. Place the quadrat in an area where there are lots of ribwort plants in the field.
2. Count the number of ribwort plants inside a quadrat.
3. Repeat steps 1 and 2 four more times.

(a) How could the student improve his method so that he can collect valid results?

Tick **two** boxes.

Count the leaves of each ribwort plant	☐
Place more quadrats in the field	☐
Place the quadrats randomly	☐
Use a smaller quadrat	☐
Weigh the ribwort plants	☐

(2)

(b) The student calculated that the mean number of ribwort plants per m^2 was 3.2

The area of the field was 8250 m^2.

Calculate the total number of ribwort plants in the field.

_____

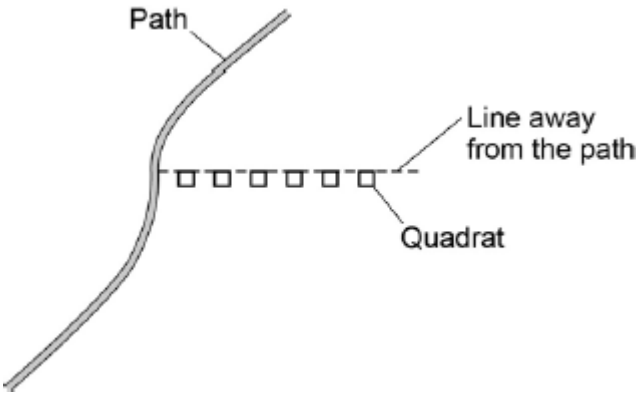
Total number of ribwort plants = _____

(1)

(c) Another group of students did an investigation in the field.

Figure 2 shows how the students placed their quadrats in this investigation.

Figure 2



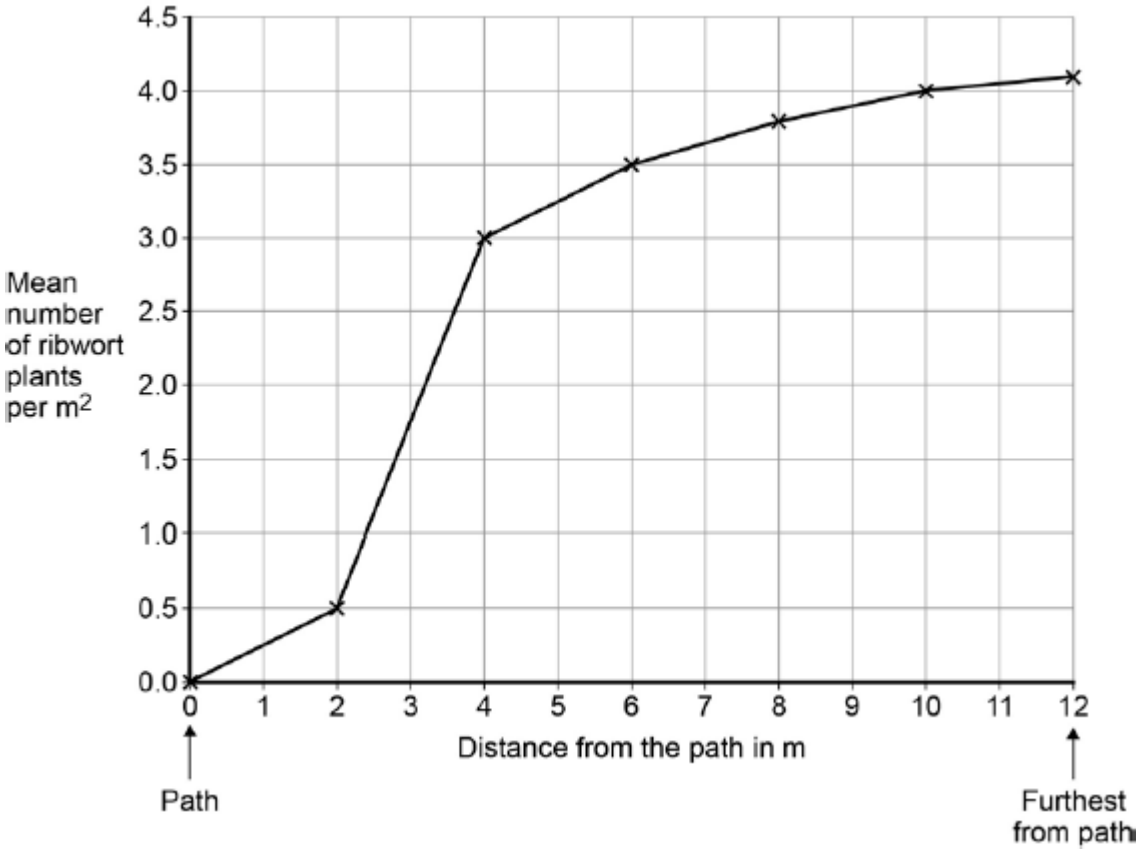
What is the name given to the line in **Figure 2**?

_____

(1)

(d) **Figure 3** shows the students' results.

Figure 3



Describe the relationship shown in **Figure 3**.

_____

_____

_____

_____

(2)

(e) What is one reason why there are no ribwort plants next to the path?

Tick **one** box.

There is less light near the path ☐

The ribwort plants get walked on ☐

There are more nutrients in the soil near the path ☐

There are fewer animals near the path ☐

(1)

(Total 7 marks)

Mark schemes

Q1.

(a) (i) A

1

(ii) bar drawn with correct height

ignore width of bar

1

(b) (i) $E = P \times t$

2.4

*allow **1** mark for correct substitution*

ie 1.2 × 2

provided no subsequent step shown

2

(ii) 36 or their (b)(i) × 15 correctly calculated

or

their (b)(i) × 0.15 correctly calculated with an answer given in £

*allow **1** mark for correct substitution*
ie 2.4 × 15

or
their (b)(i) × 15
*allow **1** mark for correct substitution*
provided no subsequent step shown
an answer £0.36 gains both marks

2

[6]

Q2.

(a) both bars correct height (to better than half a square)

1 mark for both

both bars correctly labelled
(w.r.t. relative heights if these incorrect)

for 1 mark

2

(b) a lot less / much less / 18 times less (converse must specify coal)

gains 1 mark

1

(c) *ideas that*

- at high temperatures (produced when fuels burn)
- nitrogen and oxygen from air / atmosphere combine / react
  or nitrogen from air / atmosphere oxidises

for 1 mark each

2

(d) *ideas that*

- coal produces most carbon dioxide / more CO_2 than gas / oil
- because coal is (mostly) carbon
- gas produces less carbon dioxide than coal / oil
- oil and gas also contain hydrogen / contain more hydrogen atoms than carbon atoms / also produce water

any three for 1 mark each

3

(e) sulphur

for 1 mark

2

[9]

Q3.

(a) (i) 120

1

(ii) 20

accept 140–their (a)(i) provided answer is not negative

1

(iii) as speed increases

1

drag force / water resistance / friction / **D** increases

1

(until) **D** = 140 N or (until) **D** = **T**

forces balance is insufficient

1

(b) (i) (average) speed (of swimmer)

1

(ii) any **two** from:

- more data

  accept results for data

  *do **not** accept more accurate data*
- force may vary (a lot) / change
- give more <u>reliable average</u>

  ignore references to anomalies

  ignore accurate / precise

2

(iii) examples of acceptable responses:

- most / some females produce smaller forces

  *do **not** accept <u>all</u> females produce smaller forces*
- most / some males produce larger forces

*do **not** accept <u>all</u> males produce larger forces*

- some females swim as fast as males but use a smaller force
- most of the faster swimmers are male
  *do **not** accept <u>all</u> males swim faster*
- most of the slower swimmers are female
  *do **not** accept <u>all</u> females swim slower*
- range of the (average) speed of males is smaller than the range of the (average) speed of females
- range of the (average) force of the males is greater than the range of the (average) force of the females

1

(iv) exert maximum (hand) force (throughout the swim / stroke)

accept (any method to) increase (hand) force

practise more is insufficient

1

[10]

Q4.

(a) carbon dioxide in range 2.5-5%

gains 1 mark

but

carbon dioxide closer to 4% than to 3% or 5%

gains 2 marks

OR

oxygen in range 15-17.5%

gains 1 mark

but

If 3 sectors drawn and two correctly labelled, award marks and ignore remaining sector

Oxygen <u>and</u> carbon dioxide sector<u>s</u> labelled

for 1 mark

3

(b) carbon dioxide
oxygen

for 1 mark each

Do not allow water vapour.
(Allow correct symbols/formulae)

2

[5]

Q5.

1 sector correct

gains 1 mark

but all sectors correct B = 2 S = 9 U = 8

gains 2 marks

all sections labelled correctly (w.r.t. sector size)
for 1 mark

[3]

Q6.

(a) bar drawn correctly 78 – 80 (%)

1

(b) (i) (Mars has) no (green / living) plants / trees

1

(ii) (argon) is unreactive / inert
accept argon is a noble gas
ignore it is in Group 0

1

(c) (the amount of carbon dioxide has decreased because it has been) absorbed / used by (green / living) plants / trees **or** used for photosynthesis
accept dissolved / absorbed by oceans or locked up in fossil fuels / carbonate rocks

1

(d) the eruption of volcanoes

1

[5]

Q7.

(a) (i) solar and wind
both required for mark either order

1

(ii) 37(%)
*accept their **two** sources in a(i)*
correctly added as an error carried forward (ecf)

1

(b) **A**

1

(c) gas is non-renewable
*do **not** accept they are not all renewable*
statements such as gas produces CO_2 is neutral

1

[4]

Q8.

(a) (i) sulfur dioxide / SO_2

1

(ii) global dimming

1

(iii) carbon dioxide / CO_2

ignore ozone

1

increases the levels (of carbon dioxide)

*accept it is a greenhouse gas **or** causes global warming / greenhouse effect*

1

(b) gas / oil bar correct length

1

coal bar correct length

1

[6]

Q9.

(a) **Level 3 (5–6 marks):**
A coherent method is described with relevant detail, which demonstrates a broad understanding of the relevant scientific techniques and procedures. The steps in the method are logically ordered with the dependent and control variables correctly identified. The method would lead to the production of valid results.

Level 2 (3–4 marks):
The bulk of a method is described with mostly relevant detail, which demonstrates a reasonable understanding of the relevant scientific techniques and procedures. The method may not be in a completely logical sequence and may be missing some detail.

Level 1 (1–2 marks):
Simple statements are made which demonstrate some understanding of some of the relevant scientific techniques and procedures. The response may lack a logical structure and would not lead to the production of valid results.

0 marks:
No relevant content

Indicative content

- remove bung and add magnesium
- start stopclock / timer
- measure volume of gas at fixed time intervals
- repeat with different concentrations of acid
- control volume of acid
- control initial temperature of acid
- control amount / mass / length / particle size of magnesium

6

(b) 6.5 cm^3

1

(c) all points plotted correctly

*allow **1** mark for 4 points plotted correctly*

2

best fit straight line drawn

1

(d) when the concentration of acid increased the rate of reaction increased or vice versa

answer must use the terms 'rate of reaction' linked to

'concentration'

1

[11]

Q10.

(a) Cobalt

1

Nickel

1

(b) **Either**

- put iron filings

1

- on a piece of paper

1

- over the magnet

1

or

- use (plotting) compass(es) (1)
- around the magnet (1)
- with the needle showing the direction (1)

(c) all points plotted correctly

*2 points plotted correctly for **1** mark*

2

correctly drawn line of best fit

allow ecf from incorrectly drawn points

1

(d) as the number of turns increases so does the amount of paper clips picked up

1

linear / directly proportional

allow doubling the number of turns doubles the number of paper clips picked up

1

(e) 32

allow number correctly extrapolated from student's graph

1

[11]

Q11.

(a) *x* axis scale correct

1

y axis scale correct

1

all points plotted correctly

± ½ small square

1

curve correct, omitting the anomalous point

1

(b) relative formula mass of NH_4NO_3 = 14 + (4 × 1) + 14 + (3 × 16) = 80

1

mass of ammonium nitrate in 1 dm^3 at 20 °C = 190 × 10 = 1 900 g

1

number of moles of ammonium nitrate in 1 900 g = 1 900 / 80 = 23.75 mol

1

(c) small beads would dissolve slower than fine powder

1

because the surface area of the bead is less than fine powder

1

(d) increasing the temperature at equilibrium will reduce the amount of ammonia produced

1

because the reaction is exothermic

1

increasing the pressure at equilibrium will increase the amount of ammonia produced

1

because the equilibrium will shift towards the smaller number of molecules in the equation (which is ammonia)

1

[13]

Q12.

(a) sediment / limestone formation from carbonates

1

(b) short wavelength radiation

1

passes through atmosphere to Earth's surface

1

Earth's surface radiates different wavelengths

1

which are absorbed by greenhouse gases to produce temperature increase

allow CH_4 H_2O or CO_2

1

(c) 13.8 %

allow values in the range 13.0 to 15.0

1

(d) 15.08 (°C)

allow values in the range 15.05 – 15.10

1

(e) correlation between CO_2 levels and temperature

1

despite short-term variations of temperature

1

supported by values from graph which show correlation

1

cannot determine causality from this data or possible causality as increasing use of fossil fuels since 1900 has caused accelerated temperature increase

1

[11]

Q13.

(a) arrow of equal size pointing vertically downwards

judged by eye

1

labelled 'weight'

1

(b) the upwards force is greater than the downwards force

1

because air resistance increases

1

(c) $v^2 = (2 \times 2 \times 209) + 8^2$

1

$v = \sqrt{900}$

1

v = 30 (m / s)

1

*allow 30 (m / s) without working shown for **3** calculation marks*

(d) vertical force (300 N) drawn with a suitable scale

1

horizontal force (60 N) drawn to the same scale

1

resultant force drawn in correct direction

1

value of resultant in the range 304 N – 308 N

1

[11]

Q14.

(a) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1−2 marks)

The method described is weak and could not be used to collect valid results, however does show some understanding of the sequence of an investigation.

Level 2 (3−4 marks)
The method described could be followed and would enable some valid results to be collected, but lacks detail.

Level 3 (5−6 marks)
The method described could be easily followed and would enable valid results to be collected.

Examples of the points made in the response:

- bean seedlings of same age
- cut material from same part of each organ (for repeats) e.g. top 1 cm of stem / a whole cotyledon / seed
- equal mass of each organ

  accept weight for mass
- grind / homogenise
- in equal amounts of water / buffer
- equal volumes of hydrogen peroxide solution
- equal concentrations of hydrogen peroxide solution
- same temperature
- temperature maintained in water bath
- quantitative measure of gas production eg height of foam in mm / collect gas in graduated syringe in cm^3
- for same time period
- repetitions (3+ times)
- calculate mean for each.

6

(b) (i) correct answer: 40

1 *mark for 45 as the anomalous result has been included in the calculation*

or

$$\frac{(38 + 41 + 42 + 39)}{4}$$

1 *mark for*

$$\frac{160}{4}$$

or

2

(ii) vertical axis correctly labelled:
'Enzyme activity in arbitrary units'

allow ecf from (b)(i)

1

points plotted correctly ±1 mm

*deduct **1** mark for each incorrect plot*

2

suitable line of best fit

not feathery, not point to point

1

(iii) 6.0 / 6

allow ± 0.1

if 6.0 not given, allow correct for candidate's graph ± 0.1

1

(iv) in range 0 to 14 units

allow correct for candidate's graph

1

(v) enzyme denatured / enzyme (active site) shape changed

allow substrate no longer fits (active site)

ignore reference to temperature

do not allow enzyme dies

1

[15]

Q15.

(a) (i) alpha (particle)

1

(ii) (unstable) nucleus

accept (unstable) nuclei

*do **not** accept middle*

*do **not** accept helium nucleus*

1

(iii) same number of protons

accept same number of electrons

accept same atomic / proton number

accept they both have 92 protons

same number of neutrons negates answer

1

(b) (i) 4500 million years

*do **not** accept 4500 years*

1

(ii) curve starting at 100 000 with a correct general shape

1

passing through (4500, 50 000) and (9000, 25 000)

*allow **1** mark for points plotted*

or

line passing through (4500, 50 000) and (9000, 25 000)

1

[6]

Q16.

(a) any **two** from:

- same result at pH 7 and 7.5
  or
  could be any pH between 7 and 7.5
  or
  not tested at pH 7.25
  or
  need to test at smaller pH intervals (between 7 and 7.5)
- accuracy of result only to nearest 0.5 minutes
- no repeats
- difficult to determine end point (colour)

2

(b) 2.7 / 5

1

0.54 (units per minute)

*allow 0.52 with no working shown for **2** marks*

1

*allow **1** mark for 0.52 **or** 0.56*

(c) (after 10 minutes) solution goes black

1

(after 60 minutes) solution stays the same
or
does not go black
or
goes slightly orange

1

(d) steeper curve

1

levels off at 11.8 units **and** before 45 minutes

1

[8]

Q17.

(a) (i) points correctly plotted (± ½ small square)

*four points = **2** marks*

*three points = **1** mark*

Max 2

straight line of best fit using full range of points from 0,0

1

(ii) any **one** from:

must explain why the point is below the line

- the solution may not have been properly stirred
- the electrodes may have been a larger distance apart
- the drop of sodium chloride may have been a smaller volume / smaller

allow not enough sodium chloride added

allow smaller amount of sodium chloride

*do **not** allow too few drops added*

ignore the student may have misread the conductivity meter

1

(iii) any **one** from:

- the volume of pure water

  allow amount
- the concentration (of the solutions added)
- the volume (of the drops) of solution added

  ignore number of drops
- the distance between the electrodes
- the same electrodes **or** electrodes made of the same material

- same depth **or** surface area of electrodes in the water
- constant power supply

  ignore current
- stirred

1

(b) (i) because (pure) water is covalent / molecular (simple) **or** contains molecules

1

therefore (pure) water has no free / mobile electrons **or** ions

*molecules do not have a charge **or** molecules do not contain ions gains **2** marks*

1

(ii) because there are ions in sodium chloride

*allow Na^+ and / or Cl^-(ions) **or** ionic bonding.*

Ignore particles other than ions for MP1.

1

which can move **or** carry the current / charge

MP2 must be linked to ions only.

1

(iii) Hydrogen

allow H_2 / H

1

[10]

Q18.

(a) (i) straight line through the 'points' and extended to C_8H_{18}

*do **not** accept multiple lines*

1

(ii) 5500

range 5400 to 5600

accept ecf from their graph

1

(iii) it is a straight line graph

allow directly proportional

accept constant difference between (energy) values

accept C_5H_{12} close to values on the graph

***or** C_5H_{12} comes in middle of the graph*

ignore 'fits the pattern' unqualified

ignore 'line of best fit'

ignore 'positive correlation'

1

(iv) expected ranges for working are:

accept correct numerical answer as evidence of working

(5400 to 5600) – (2800 to 2900) = (2500 to 2800)

or

their value from (a)(ii) – a value from 2800 to 2900

or

(5400 to 5600) / their (a)(ii) divided by 2

or

a value from 2800 to 2900 - 2

1

no / not quite / almost / yes

this mark is only awarded on evidence from their correct working

1

(b) (i) incorrect / no **or** partially correct

ignore references to hydrogen

1

bio-ethanol produces least energy

mark independently

or

bio-ethanol produces 29 kJ

1

(ii) *ignore incorrect / correct*

any **two** from:

- hydrogen produces <u>only</u> H_2O
  accept hydrogen does not produce harmful gases / CO_2 / SO_2
- coal produces SO_2
  allow coal causes acid rain / respiratory problems
- coal produces smoke
  allow coal causes global dimming
- both renewable <u>and</u> non-renewable fuels produce CO_2
  accept bio-ethanol <u>and</u> natural gas / coal produce CO_2 / global warming
- (both) the non-renewable fuels produce CO_2
  accept coal <u>and</u> natural gas produce CO_2 / global warming
- (both) renewable fuel<u>s</u> produce no smoke
  accept hydrogen <u>and</u> bio-ethanol do not produce smoke / global dimming
- (both) renewable fuel<u>s</u> produce no SO_2
  accept hydrogen <u>and</u> bio-ethanol
  do not produce SO_2 / acid rain

2

[9]

Q19.

(a) (i) 100 (m)

1

(ii) stationary

1

(iii) accelerating

1

(iv) tangent drawn at t = 45 s

1

attempt to determine slope

1

speed in the range 3.2 – 4.2 (m / s)

dependent on 1st marking point

1

(b) (i) 500 000 (J)

ignore negative sign

1

(ii) 20 000 (N)

ignore negative sign

*allow **1** mark for correct substitution, ie*

500 000 = F × 25

***or** their part (b)(i) = F × 25*

provided no subsequent step

2

(iii) *(kinetic) energy* transferred by heating

1

to the brakes

ignore references to sound energy

*if no other marks scored allow k.e. decreases for **1** mark*

1

[11]

Q20.

(a) Place more quadrats in the field

1

Place quadrats randomly

1

(b) 26 400

1

(c) transect

1

(d) as distance from the path increases the number of (ribwort) plants increases

1

steep rise from 0.5 to 3.0 between 2 and 4 m from path **or** numbers level off to about 4 plants from 10 m from the path

1

(e) The ribwort plants get walked on

1

[7]

Examiner reports

Q1.

(a) (i) Nearly all students correctly identified hairdryer A.

(ii) The great majority of students could correctly complete the bar chart.

(b) (i) Surprisingly, less than two-thirds of students were able to calculate the correct answer. Of those that gave an incorrect answer, only a tiny proportion showed a correct substitution to score one mark.

(ii) Only the better students correctly completed this calculation. Many simply multiplied the time in hours by the cost in pence, as these were the two numbers that appeared in the stem of this part of the question.

Q3.

(a) (i) Most candidates recognised that the constant speed of the swimmer was due to the forces being equal.

(ii) This part question was not answered well. A simple subtraction of the two forces would produce the correct resultant force but unfortunately, many candidates opted to add, multiply or divide the values of the two forces or simply copy the value of one of the forces.

(iii) The majority of candidates either scored zero on this part question or opted to leave it blank. The majority of the incorrect responses involved a decrease in the amount of drag, leading to the swimmer becoming stationary. There were also many answers involving upthrust, gravity, currents in the water and suggestions that the swimmer may, by altering his swimming technique, reduce the resultant force to zero.

(b) (i) It was surprising that only one-fifth of candidates were able to identify the dependent variable from information in the stem of the question and from the axes of the graph, the most common error being to state the gender of the swimmers or the distance over which the readings were taken.

(ii) Although some candidates were aware that the collection of more data would be advantageous, their explanations were couched in terms of this extra data being in some way more precise or accurate than data collected less frequently. Few candidates noted that the extra data would provide information regarding the variation of force values in the swimmers dynamic situation or provide a more reliable average. It was clear that to most candidates reliability, accuracy and precision are the same thing.

(iii) Although many responses were over-generalised, just under two-thirds of candidates scored the mark. Incorrect responses, apart from where the relationship between the variables had been misunderstood, were mostly in terms of factors for which there was no data provided, such as the swimmers mass, muscular strength, size of hands or swimming technique.

(iv) Just over half of the candidates provided a correct answer to this question. Those failing to gain credit gave responses which ignored the request in the stem to consider only the data supplied, and referred to issues such as body mass or shape, improved exercise and training regimes, etc.

Q4.

Paper F2

Accurate plots to 16% oxygen and 4% carbon dioxide were given by more able candidates. A few candidates missed the instruction to “complete the piechart”.

Paper I4

Nearly all candidates got carbon dioxide and oxygen in the correct order in (a). Most candidates realised that there was still oxygen left in the expired air. However, only a few candidates noted that most/nearly all the oxygen was left.

Q5.

Paper 2 Option P

The pie chart was almost invariably correct, both in accurate completion of the sectors and full labelling. The amount of time that some candidates spent in decorating the pie chart could perhaps have been put to better use.

Paper 4 Option Q

This question was well answered.

Q6.

(a) Students should use a ruler to draw straight lines. Far too many students lost the mark because their lines were drawn free-hand and touched 76% or were above 80%. However, a few students did manage to get the mark. The most common mistake was to draw a line at 20%. Several students did not attempt this question.

(b) (i) The most common mark awarded was for ‘there are no trees on Mars’. There were many incorrect ideas, such as, ‘Mars has too much carbon dioxide so not enough space for oxygen’, ‘no humans to use oxygen’ and ‘Mars has no gravity so there is no atmosphere’.

(ii) There were very few correct responses indicating that argon is unreactive or that argon is a noble gas. Many stated that argon stays the same because it has no uses.

(c) Few students stated that the percentage of carbon dioxide had decreased because of ‘photosynthesis by plants’ or ‘absorption by oceans’ or ‘locked up in fossil fuels’ or ‘locked up in carbonate rocks’. Many students appeared to have failed to notice the word **not** in the question and answered as if carbon dioxide was increasing. The more common incorrect answers were ‘because we burn more fuels’ and ‘there are more humans breathing out carbon dioxide’.

(d) The majority of students knew that theories suggest that the Earth’s early atmosphere was made by the eruption of volcanoes.

Q7.

(a) (i) The majority of candidates correctly identified wind and solar as being the two energy sources that do not produce any polluting gases.

(ii) Most candidates correctly worked the percentage as 37%.

(b) About two-thirds of candidates correctly identified graph A as the one most likely to represent the output from a wind turbine.

(c) Almost half of the candidates were able to state that gas is not a renewable energy source. The other half missed the point that there was an incorrect statement in the report, and instead offered their opinion as to why any or all of these power stations should not be built. Often such arguments were based on the pollution from gas burning power stations.

Q8.

For part (a)(i) most candidates knew that it is sulfur dioxide that causes acid rain. Most candidates did not know that smoke particles could cause global dimming in part (a)(ii).

In part (a)(iii) many candidates gained one mark for stating that it was the greenhouse effect or global warming that may cause climate change. However, candidates are confused between the greenhouse effect and the hole in the ozone layer. Only better candidates made reference to carbon dioxide.

Both bars were usually well drawn in part (b). The coal bar was sometimes drawn incorrectly, usually at 31 or 34 instead of 32.

Q14.

(a) In this section, students were provided with a description of a less-than-perfect method for assessing the relative amounts of catalase in the leaf, stem, root, seed and seed coat of a bean seedling, as supposedly performed by a group of students. They then had to suggest how the investigation could be improved in order to give a valid comparison of the amounts of catalase in the different parts of the seedling.

In this question, students were tested on their ability to use good English, organise information clearly and use specialist terms where appropriate.

The question discriminated well across the entire ability range, with a little over half of the students scoring 3 or 4 marks and less than one-tenth scoring either 1 or 6 marks out of the 6 available. Students gave varying amounts of detail in their accounts, the most basic points being the need for equal volumes of hydrogen peroxide and equal masses of the different parts of the bean seedling. Further appropriate details included some numerical means of determining the amount of oxygen released (e.g. measuring the height of the foam produced with a ruler or collecting the oxygen in a gas syringe or upturned measuring cylinder) over a set time period, controlling other variables, such as the temperature, repeating the procedure several times and calculating the mean amount of oxygen produced by each part of the seedling. It was surprising how many students forgot to include a description of how they would measure the volume of oxygen released (‘find the results’ being a totally inadequate phrase), or forgot to mention repetitions.

(b) This section involved data handling from a set of results obtained in an investigation of the effect of pH on the activity of catalase.

In part (i), students had to calculate the mean enzyme activity from the five measurements given for one of the pH values. It should have struck students that one of the results was anomalous (it was approximately 50% greater than each of the other four values) and so this value should not have been included in the calculation of the mean, giving an answer of 40 arbitrary units; just under half of the students calculated this value. However, just over half the students included the anomaly and thus calculated a mean value of 45.

In part (ii), students were required to plot a graph of the results. Any error occurring in part (i) was allowed for in this section. Nearly two-thirds of students scored full marks for their graph plotting. Occasionally there was a plotting error (as would be anticipated with one small square on the graph paper representing 2 units), or the

student forgot to label the y-axis, or joined point-to-point with straight lines instead of drawing a line of best fit as instructed. The most remarkable error, however, was to rule a single straight line of positive gradient somewhere through the points instead of constructing a bell-shaped curve.

In part (iii), nearly all students correctly selected the optimum pH value as pH6, although allowance was made for a slightly different value if the student's graph warranted this (e.g. 6.1 or 6.2).

In part (iv), again nearly all students were successful in predicting the activity of the enzyme at pH9.0. Since this involved extrapolation beyond the data, a wide range of what seemed to be sensible values was allowed by examiners, between 0 and 14 arbitrary units.

In part (v), only half the students realised that the enzyme had zero activity at pH3.0 because it had been denatured.

Q15.

(a) (i) Just over half of the answers were correct, as well as answers of beta and gamma there were a few 'thermal' and 'electromagneti' answers.

(ii) Most candidates gave the correct answer.

(iii) Many candidates seem to have mis-read this question and referred to the difference in the number of neutrons.

(b) (i) This proved to be a difficult question for many candidates, the most common answers being 9000 million years and 9000 years.

(ii) Not many candidates scored both marks on this question. Some drew a correct general shape, but didn't think about the number of nuclei after 4500 million years and 9000 million years. Other candidates correctly identified these two points and then drew two straight lines.

Q17.

(a) (i) The majority of students gained full marks. The most common errors were not drawing a line covering the full range, especially to the origin, incorrect plotting and not drawing straight lines.

(ii) Only just over half of the students scored the mark here. Many gave only vague suggestions. Students did not always appreciate the reason why the value was lower than expected, so instead of suggesting that too little sodium hydroxide had been added, they often stated only that the quantity of sodium hydroxide added was incorrect. Many gained credit by reference to the lack of stirring. The most commonly seen incorrect answer was an error in reading or recording data.

(iii) Most students gained the mark in this question, and a wide range of responses was seen. The most common answers involved the volume of water, volume of solution added and the concentration of solutions added.

(b) (i) The idea being tested appeared to be well understood, with over half of the students scoring full marks. Most correct responses identified that water was covalently bonded and therefore contains no free or delocalised electrons, or did not have ions. Many of the better students had responses that could have gained two marks in more than one way. Some students did not express their ideas very well and included comments that supported the evidence along

with one that had the counter argument.

(ii) Students had a good knowledge of the chemistry being tested in this question. About half of the students gained two marks for a clear and concise answer that sodium chloride solution contains ions that can move. Some students clouded the issue with electrons being involved in the transfer of the charge.

(iii) The majority of students correctly identified hydrogen as the gas produced at the negative electrode.

Q18.

(a) (i) Some candidates drew a curve while others produced multiple lines.

(ii) The majority of the candidates were able to read off the correct value from the graph. However, there were some candidates who got the scale wrong, 5500 was read as 5050.

(iii) A lot of candidates gave quite vague answers here, eg because you follow the line up and across, because of the line of best fit and it fits the pattern.

(iv) A large number of candidates read off the value for butane as 2850, multiplied by 2, got the answer as 5700 and then went back to part (ii) and changed their answer to 5700 so that they could say yes, the student's prediction is correct. In doing so, many of them lost the mark in part (ii) as 5700 did not correspond to the value from their graph. Candidates need to know that the answer does not always have to be yes.

Some candidates just showed the working and lost the second mark while others showed no working and just wrote yes or no.

Here again, there were some candidates who got the scale wrong and misread the value for butane.

(b) (i) Some candidates misinterpreted the question. They added the values for coal and natural gas to get 87, then added the values for hydrogen and bio-ethanol to get 171 and came up with yes as their answer.

(ii) Some candidates answered the question in terms of the number of products formed by each fuel while others wrote in terms of the amount of heat released by each fuel. A few candidates wrote sulfur instead of sulfur dioxide while a small number of candidates wrote that non-renewable fuels will run out.

Q19.

(a) (i) Almost all students answered this question correctly.

(ii) Almost all students answered this question correctly.

(iii) Almost all students answered this question correctly.

(iv) Just over a fifth of students drew a tangent and correctly calculated its gradient. Nearly two-thirds scored no marks, with the most common incorrect answer being to find the average speed by dividing total distance travelled by time.

(b) (i) The vast majoriy of students answered this questiion correctly.

(ii) Almost all students scored full marks for this question.

(iii) Whilst the majority of students correctly identified the transfer of energy taking place, only about a fifth stated the effect that this would have on heating up the brakes. The most common response was to indicate that the energy was transferred ‘to the surroundings’.