Use the three colour pen revision strategy.

1) Black or blue – try each question on your own - black or blue it came from you. You know this, it's not priority to revise again.

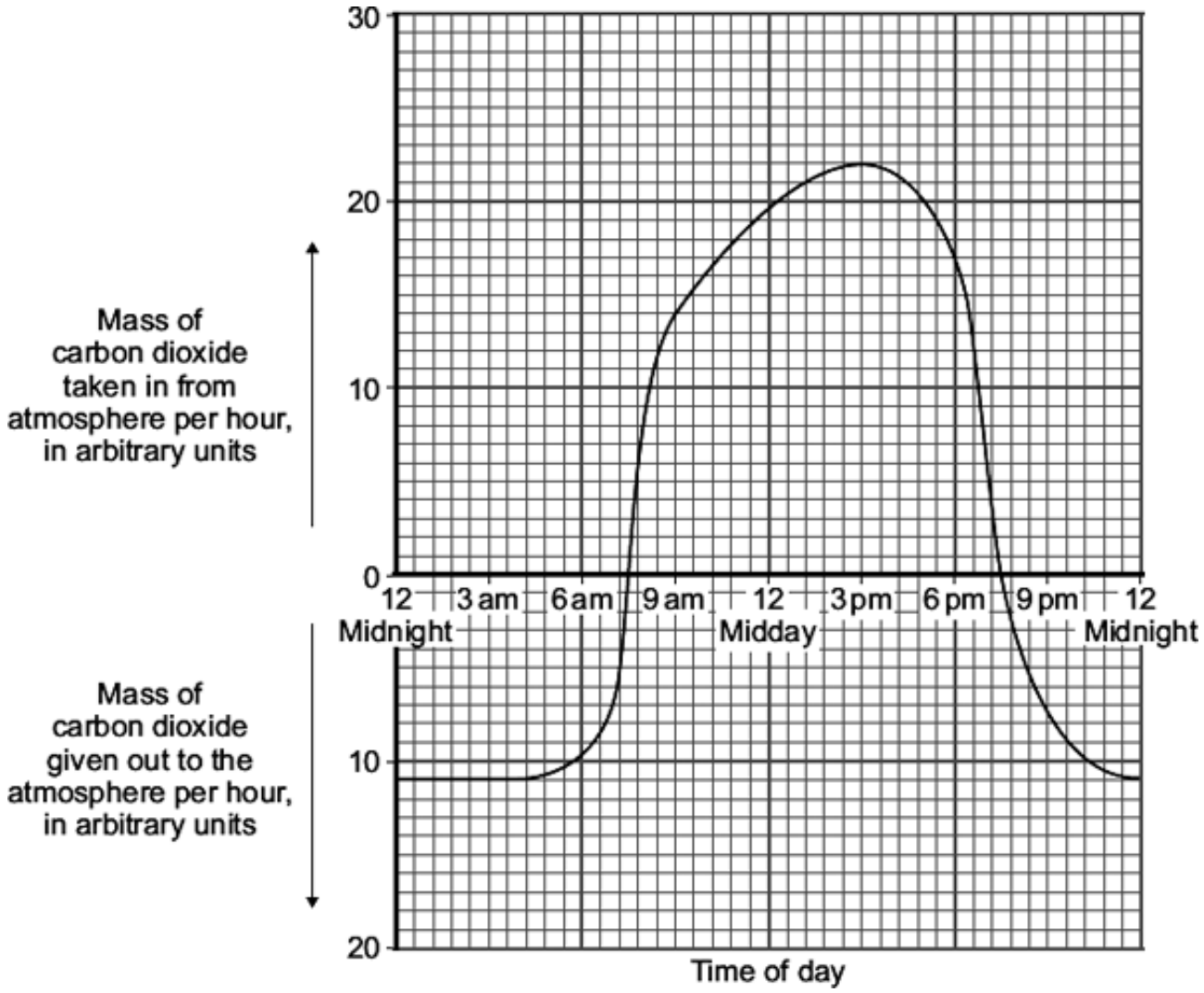
2) Red pen – use your revision guide to check and correct – red for revision, you managed to work it out but you didn't know it off by heart.

3) Green pen – use the mark scheme from the website to mark your work and correct it – green = any corrections are your first point of revision. You didn't know this so revisit it soon.

Mark schemes are on the school website under revision

Hand this booklet in to your first Science Lesson after Easter for checking.

Q1. The graph shows the uptake of carbon dioxide and the release of carbon dioxide by a bean plant on a hot summer's day.



(a) At which **two** times in the day did the rate of photosynthesis exactly match the rate of respiration in the bean plant?

1. _____ **(1)**

(b) The bean plant respires at the same rate all through the 24 hour period.

(i) How much carbon dioxide is released each hour during respiration?

_____ arbitrary units

(1)

(ii) How much carbon dioxide is used by photosynthesis in the hour beginning at 3 pm?

_____

_____

Answer = _____ arbitrary units

(1)

(c) Over the 24 hour period, the total amount of carbon dioxide taken in by the bean plant was greater than the total amount of carbon dioxide given out by the bean plant.

Explain, in detail, why this was important for the bean plant.

_____

_____

_____

_____

_____

_____ **(2)**

(Total 5 marks)

Q2.

Hormones are released from glands.

(a) Which gland produces hormones to control other glands in the endocrine system?

Tick **one** box.

Adrenal ☐

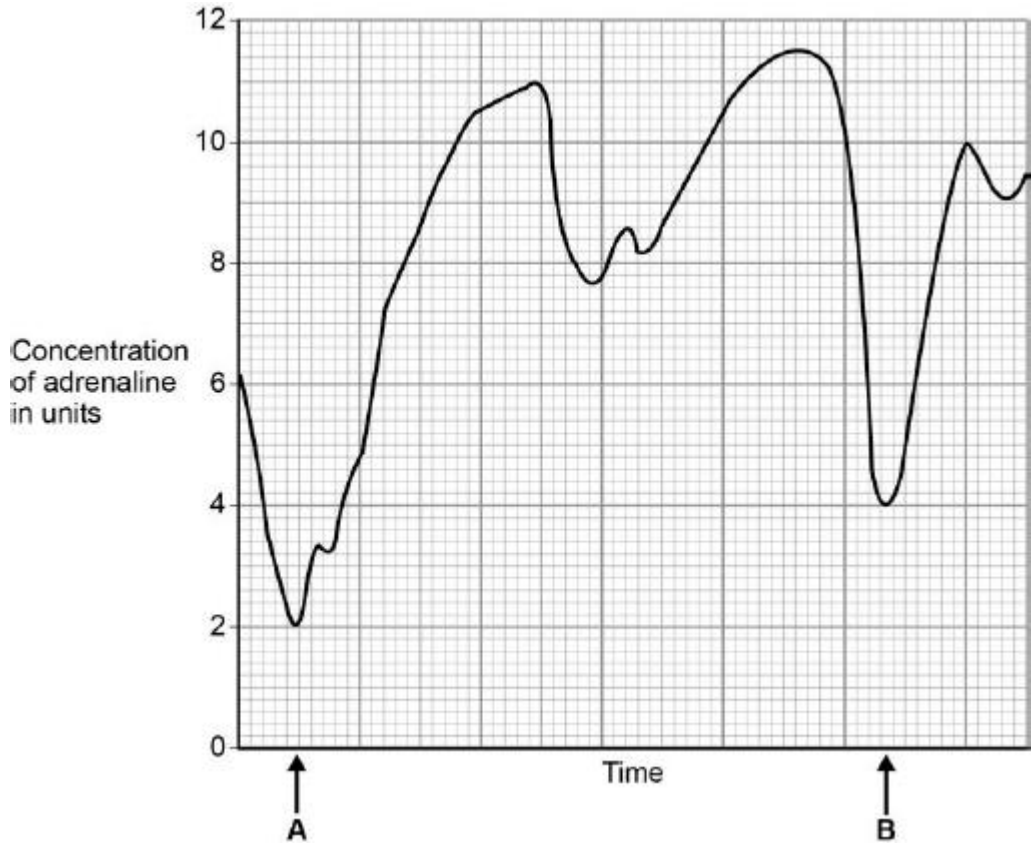
Ovary ☐

Pituitary ☐

Thyroid ☐

(1)

(b) The figure below shows the level of adrenaline in a man's bloodstream while he was watching a 12-minute film.



Calculate the percentage increase in adrenaline after point **B**.

_____

_____

_____

_____

Percentage increase in adrenaline = _____ **(2)**

(c) Suggest why the percentage increase in adrenaline after point **B** is different from the percentage increase after point **A**.

_____

_____

_____

_____ **(2)**

(d) Adrenaline causes changes in the body to prepare for a 'fight or flight' response.

What changes in the man's body are caused by adrenaline?

_____

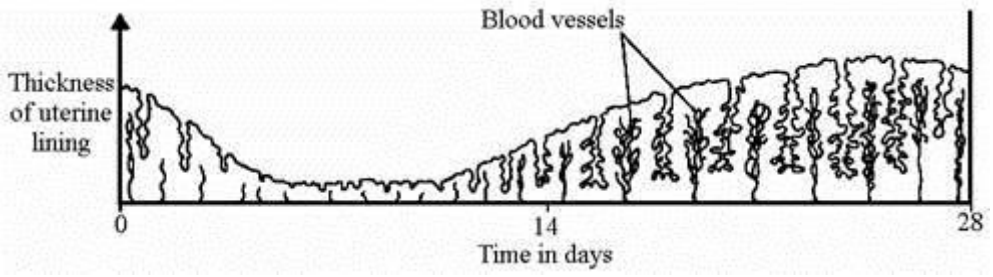
_____

_____

_____ **(2)**

(Total 7 marks)

Q3. (a) The diagram shows changes in the uterus lining during 28 days of a menstrual cycle.



Describe how changes in the lining shown in the diagram adapt it for its function if an egg is fertilised.

_____

_____

_____

_____

_____

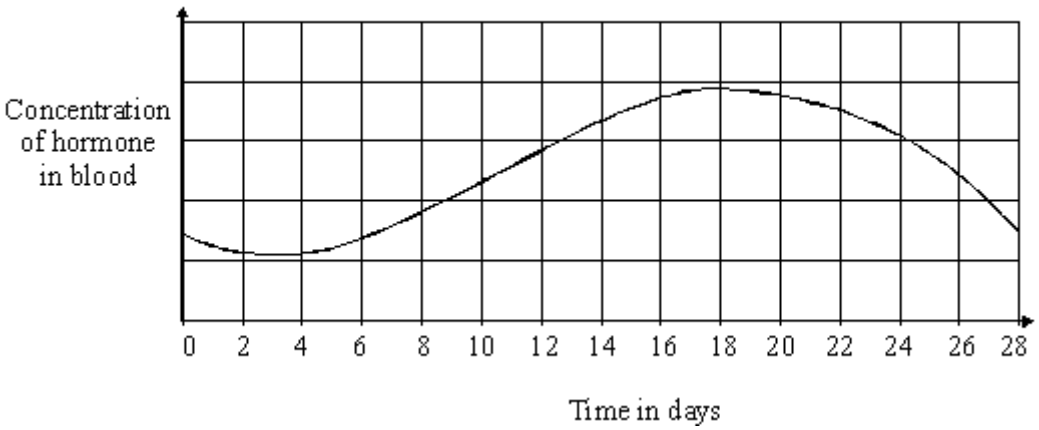
_____ **(3)**

(b) The concentration of a certain hormone in the blood of a woman was measured during her menstrual cycle. The woman's temperature was also measured each day during this cycle.

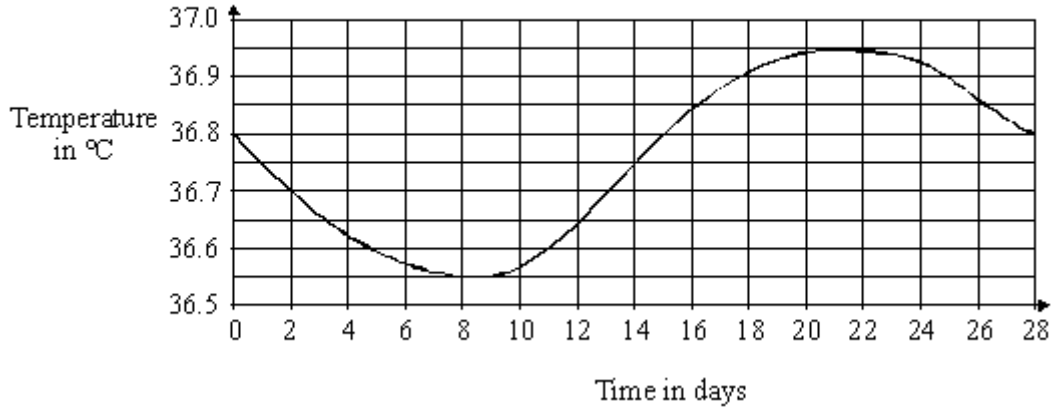
Graph 1 shows the results obtained for the measurement of the concentration of the hormone.

Graph 2 shows the results obtained for the measurement of her body temperature.

Graph 1



Graph 2



(i) What evidence is there that changes in the concentration of the hormone may be connected with changes in body temperature?

_____

_____ **(1)**

(ii) What is the difference between the minimum and maximum temperatures shown by **Graph 2**? Show your working.

_____

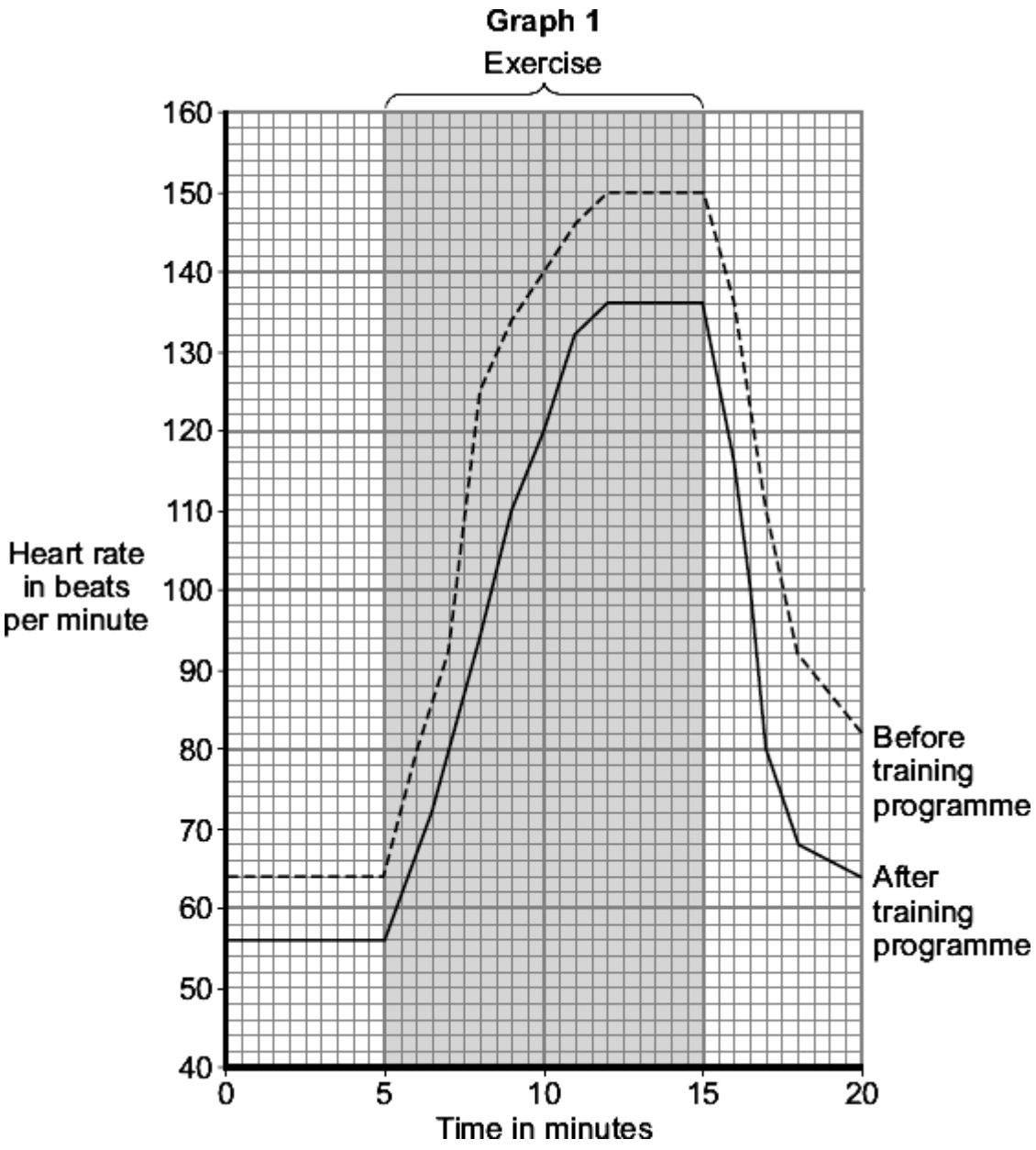
_____ **(2)**

(Total 6 marks)

Q4.

An athlete carried out a 6-month training programme.

Graph 1 shows the effect of the same amount of exercise on his heart rate before and after the training programme.

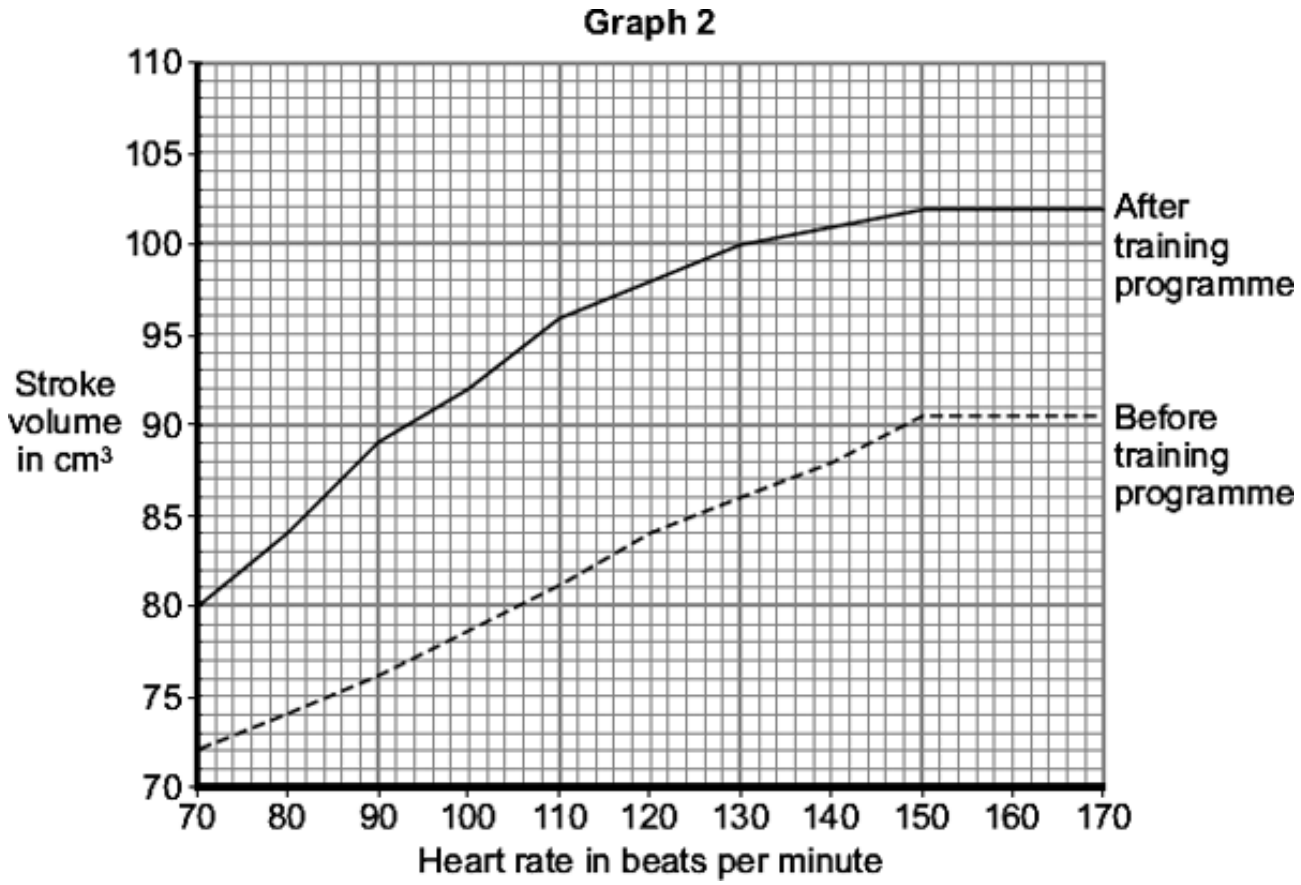


(a) (i) Use **Graph 1** to find the heart rate of the **trained** athlete 5 minutes after the start of the exercise.

Heart rate = _____ beats per minute **(1)**

The stroke volume of the heart is the volume of blood pumped out of the left side of the heart in one heart beat.

Graph 2 shows the relationship between the stroke volume and the heart rate before and after the athlete did the training programme.



(ii) The *cardiac output* is defined as

cardiac output = heart rate × stroke volume

Calculate the cardiac output of the **trained** athlete 5 minutes after the start of the exercise. Use your answer to part (a)(i), and information from **Graph 2**.

Show clearly how you work out your answer.

_____

_____

Cardiac output = _____ cm^3 blood per minute

(2)

(b) **Graph 1** shows that, for the same amount of exercise, the heart of the trained athlete was beating more slowly than it did before the training programme.

Use information from **Graph 2** to explain why.

_____

_____

_____

_____

(2)

(c) An increased cardiac output will provide more oxygen and more glucose to the working muscles.

Explain how this helps the athlete during exercise.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 9 marks)

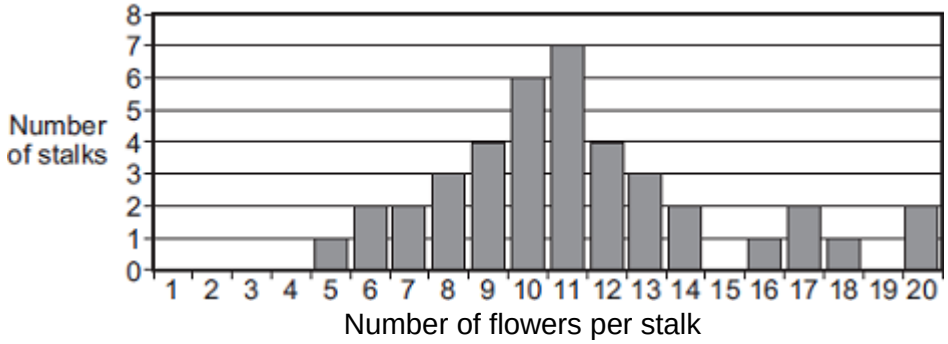
Q5.

Some students studied bluebell plants growing in two different habitats.

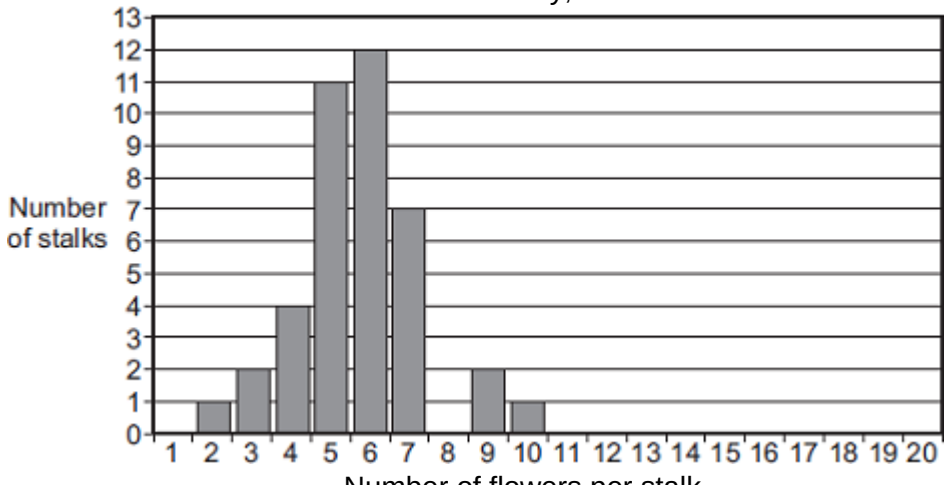
Habitat **A** was a sunny field next to woodland.
Habitat **B** was a shady, moist woodland.

A bluebell plant can have several flowers on one flower stalk. The students counted the number of flowers on each of 40 bluebell flower stalks growing in each habitat.
The bar charts show the results.

Habitat A: Sunny field next to woodland



Habitat B: Shady, moist woodland



(a) The students wanted to collect valid data.
Describe how the students should have sampled the bluebell plants at each habitat to collect valid data.

_____

_____

_____

_____

_____

(2)

(b) (i) The students used the bar charts to find the mode for the number of flowers per stalk in the two habitats.

The mode for the number of flowers per stalk in habitat **A** was 11.

What was the mode for the number of flowers per stalk in habitat **B**?

Mode = _____

(1)

(ii) The students suggested the following hypothesis:

'The difference in the modes is due to the plants receiving different amounts of sunlight.'

Suggest why.

_____

_____

_____

_____

(2)

(iii) Suggest how the students could test their hypothesis for the two habitats.

_____

_____

_____

_____

(2)

(c) Suggest how receiving more sunlight could result in the plants producing more flowers per stalk.

_____

_____

_____

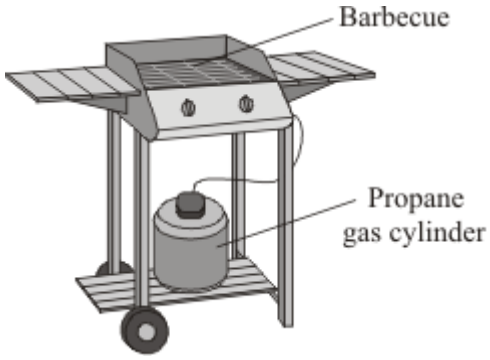
_____

(2)

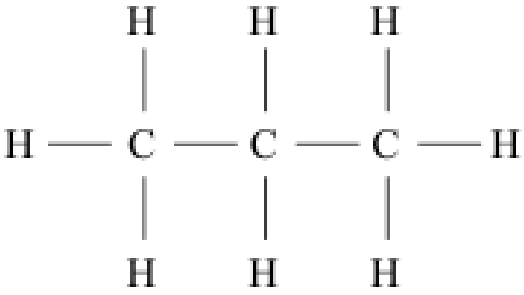
(Total 9 marks)

Q6.

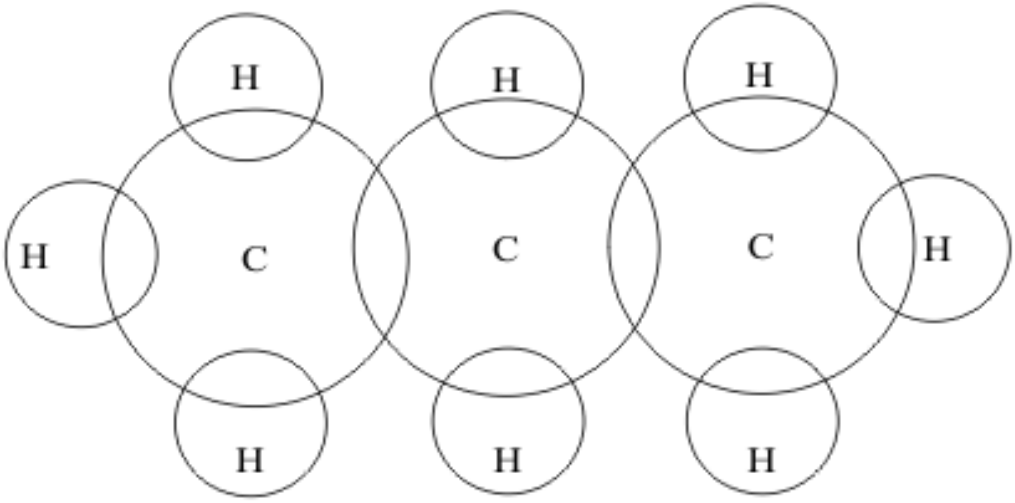
This barbecue burns propane gas.



The structure of propane is shown below.



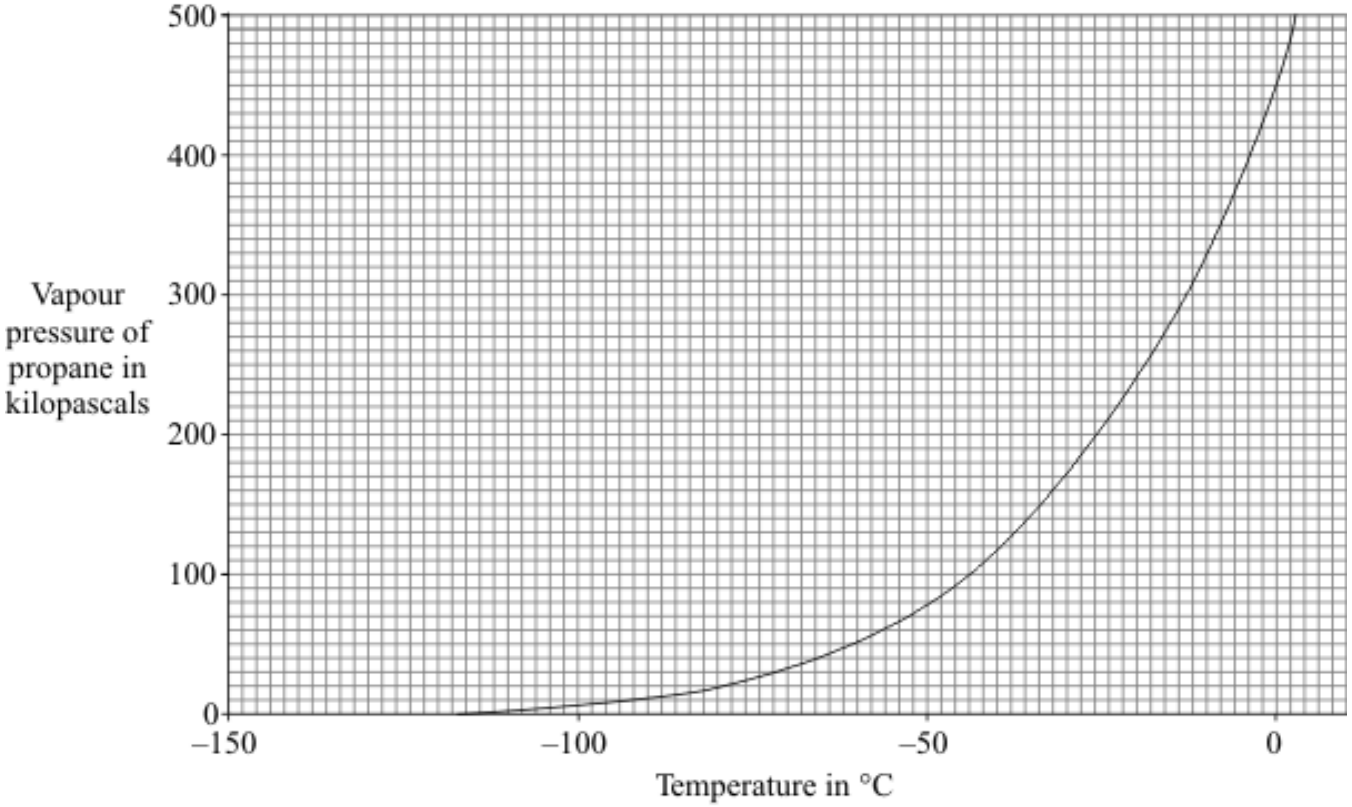
(a) Complete the diagram to show how the outer energy level (shell) electrons of hydrogen and carbon are arranged in a molecule of propane.



(1)

(b) The graph shows how the vapour pressure of propane changes with temperature.

The vapour pressure of a liquid is the pressure of the vapour above the liquid.



(i) Describe, as fully as you can, how the vapour pressure of propane changes with temperature.

_____

_____

_____

_____

_____ **(2)**

(ii) The boiling point of a liquid is the temperature at which its vapour pressure is equal to the air pressure above the liquid.

Use the graph to find the boiling point of propane when the air pressure is 100 kilopascals.

Boiling point _____ °C

(1)

(c) Explain, in terms of molecules, why propane has a low boiling point.

_____

_____

_____

_____

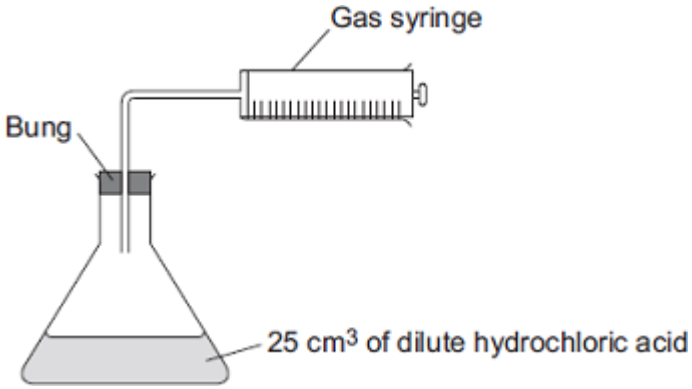
_____ **(2)**

(Total 6 marks)

Q7.

A student investigated the reaction between magnesium metal and dilute hydrochloric acid.

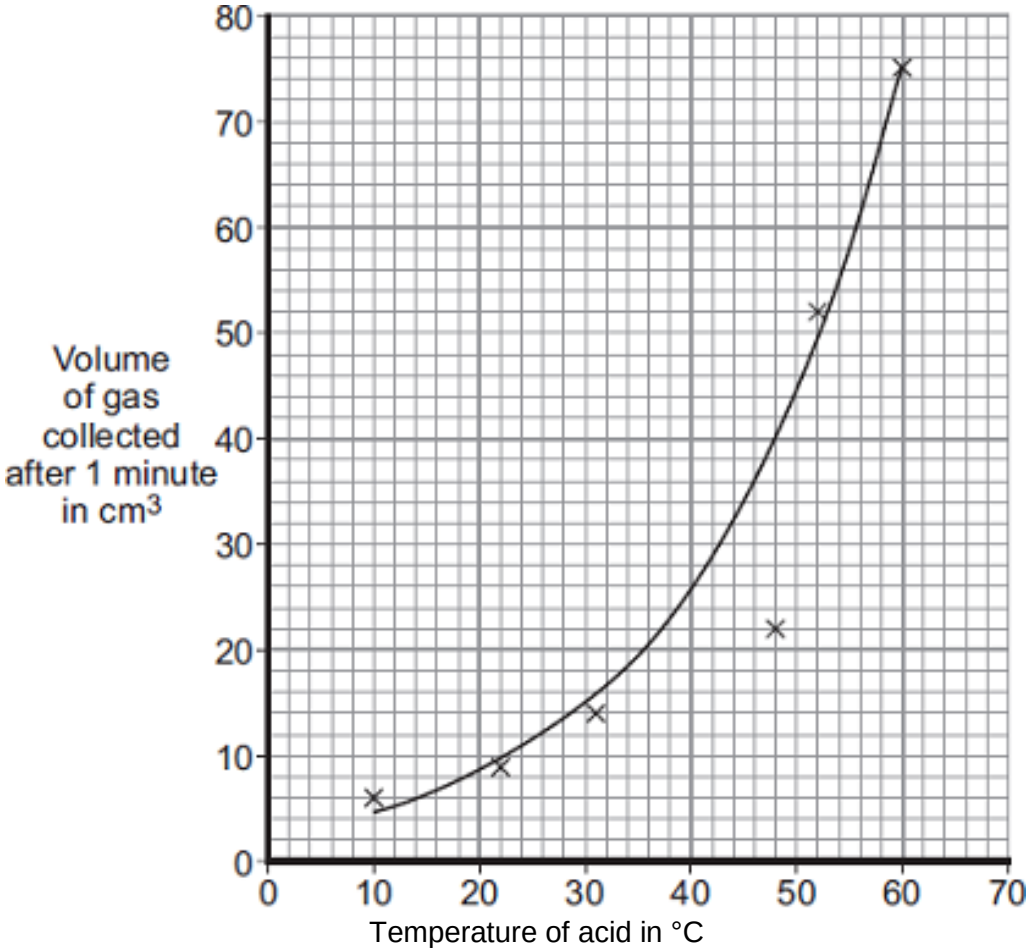
The student placed 25 cm^3 of dilute hydrochloric acid in a conical flask and set up the apparatus as shown in the diagram.



The student:

- took the bung out of the flask and added a single piece of magnesium ribbon 8 cm long
- put the bung back in the flask and started a stopwatch
- recorded the volume of gas collected after 1 minute
- repeated the experiment using different temperatures of acid.

The student plotted his results on a graph.



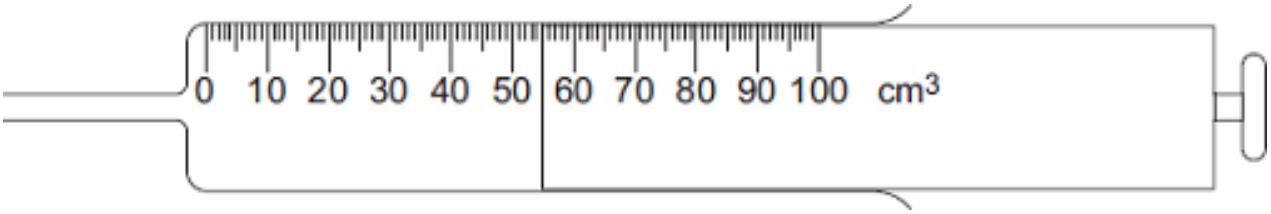
(a) Write the correct state symbols in the equation.

Choose from (s) for solid, (l) for liquid, (g) for gas and (aq) for aqueous.

$$Mg\ (\ldots.) + 2\ HCl\ (\ldots.) \longrightarrow MgCl_2\ (\ldots.) + H_2\ (\ldots.)$$

(2)

(b) The diagram shows a gas syringe after 1 minute.



(i) What volume of gas has been collected in the gas syringe after 1 minute?

Volume = _____ cm^3

(1)

(ii) Use the graph to determine the temperature of the acid used in this experiment.

Temperature = _____ °C

(1)

(iii) Calculate the average rate of reaction, in cm^3 of hydrogen made per second (cm^3/s), for this experiment.

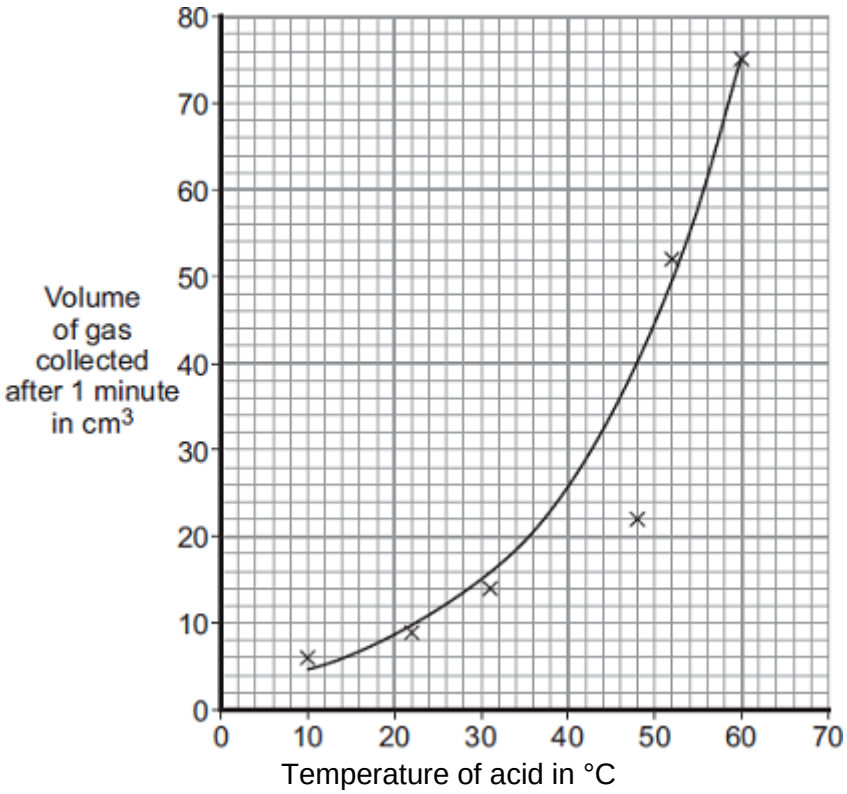
_____

_____

Rate of reaction = _____ cm^3/s

(2)

(c) The student's graph has been reprinted to help you answer this question.



One of the results on the graph is anomalous.

(i) Draw a circle on the graph around the anomalous point.

(1)

(ii) Suggest what may have happened to cause this anomalous result.

Explain your answer.

_____

_____

_____

_____

_____

_____

(2)

(d) Explain how the student could improve the accuracy of the volume of gas recorded at each temperature.

_____

_____

_____

_____

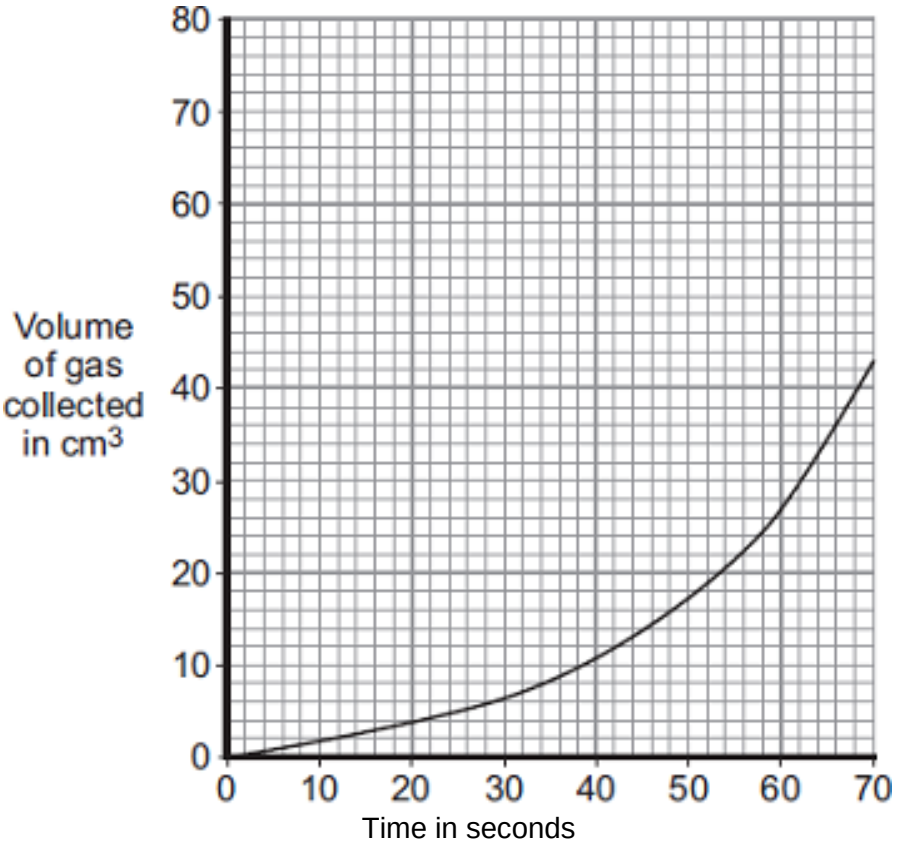
_____

_____

(3)

(e) The student then used the same apparatus to measure the volume of gas produced every 10 seconds at 40 °C.

The student's results are shown on the graph.



The rate at which the gas was produced got faster over the first 60 seconds.

The student's teacher gave two possible explanations of why the reaction got faster.

Explanation 1
There was a layer of magnesium oxide on the surface of the magnesium.
The layer of magnesium oxide prevented the magnesium reacting with the acid.
As the magnesium oxide reacted slowly with the acid, the magnesium was exposed to the acid and hydrogen gas was produced.

Explanation 2
The reaction is exothermic, and so the temperature of the acid increased during the reaction.

(i) Describe further experimental work the student could do to see if **Explanation 1** is correct.

_____

_____

_____

_____

_____

(2)

(ii) Describe further experimental work the student could do to see if **Explanation 2** is correct.

_____

_____

_____

_____

_____ **(2)**

(Total 16 marks)

Q8. Since 2000 there has been a lot more research into alternative, environmentally-friendly fuels for road transport.

Several pollutants are found in the exhaust emissions produced when fossil fuels are used for road transport.

Carbon monoxide (CO) interferes with the way that red blood cells carry oxygen. Carbon dioxide (CO_2) increases the level of carbon dioxide in the atmosphere and causes global warming.

Oxides of nitrogen (NO_x) are produced at high temperatures when nitrogen and oxygen from the atmosphere combine.

Sulfur dioxide (SO_2) is produced when sulfur impurities in the fuel combine with oxygen in the atmosphere.

Tiny particles of solids are produced when the fuel does not burn completely.

This increases the level of particulates (PM10) in the atmosphere.

(a) Name the environmental effect caused by:

(i) oxides of nitrogen (NO_x) and sulfur dioxide (SO_2)

_____

(1)

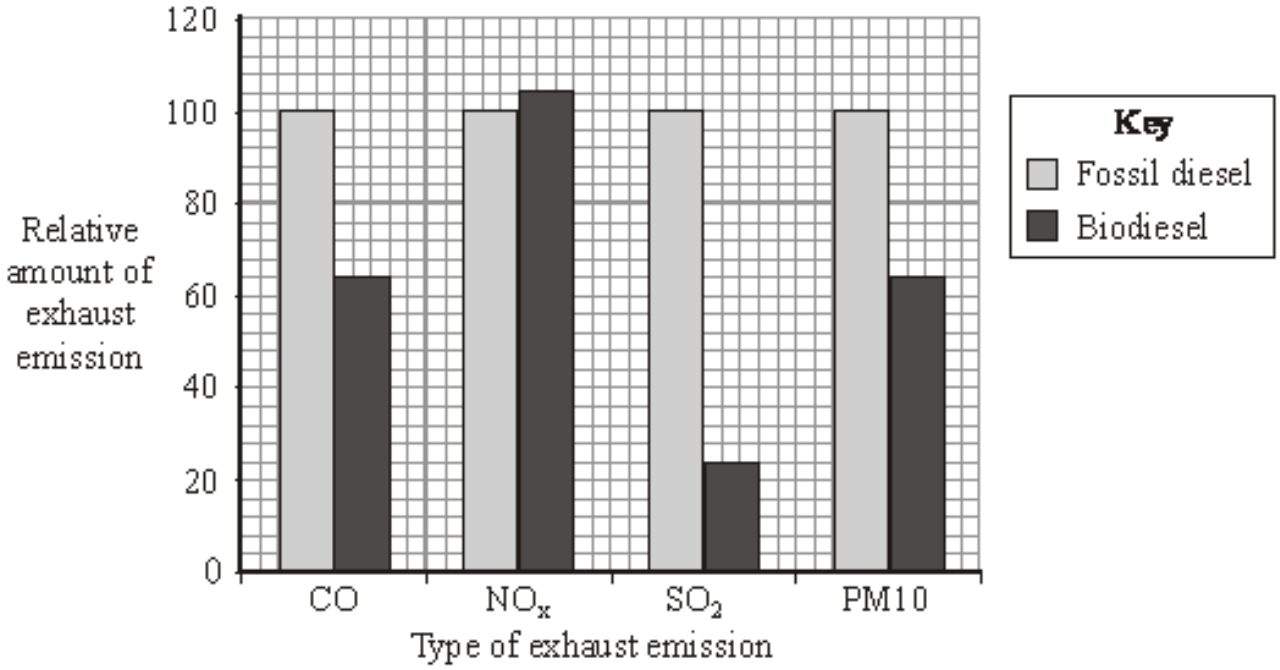
(ii) the increased level of particulates (PM10).

_____

(1)

(b) Diesel obtained from crude oil is often called fossil diesel. Biodiesel can be made from many vegetable oils. One research project compared the exhaust emissions when fossil diesel or biodiesel were used as fuels.

Some of the relative amounts of these exhaust emissions are shown in the bar chart.



(i) Use your knowledge and the information above to explain the environmental benefits of using biodiesel as a sustainable, low pollution fuel.

_____

_____

_____

_____

_____

_____

(3)

(ii) Biodiesel is called a green fuel.

This is because the life-cycle emission of carbon dioxide from biodiesel is less than that from fossil diesel.

Use your knowledge and the information above to explain why biodiesel's contribution to global warming is considered to be much less than that of fossil diesel.

_____

_____

_____

_____

_____

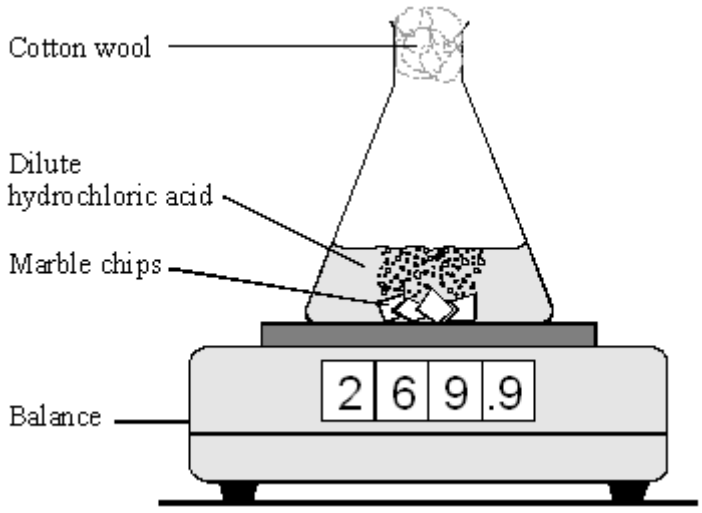
_____

(3)

(Total 8 marks)

Q9.

The apparatus shown in the diagram was used to investigate the rate of reaction of excess marble chips with dilute hydrochloric acid, HCl. Marble is calcium carbonate, formula $CaCO_3$. The salt formed is calcium chloride, $CaCl_2$.



(a) Write a balanced equation for the reaction.

_____

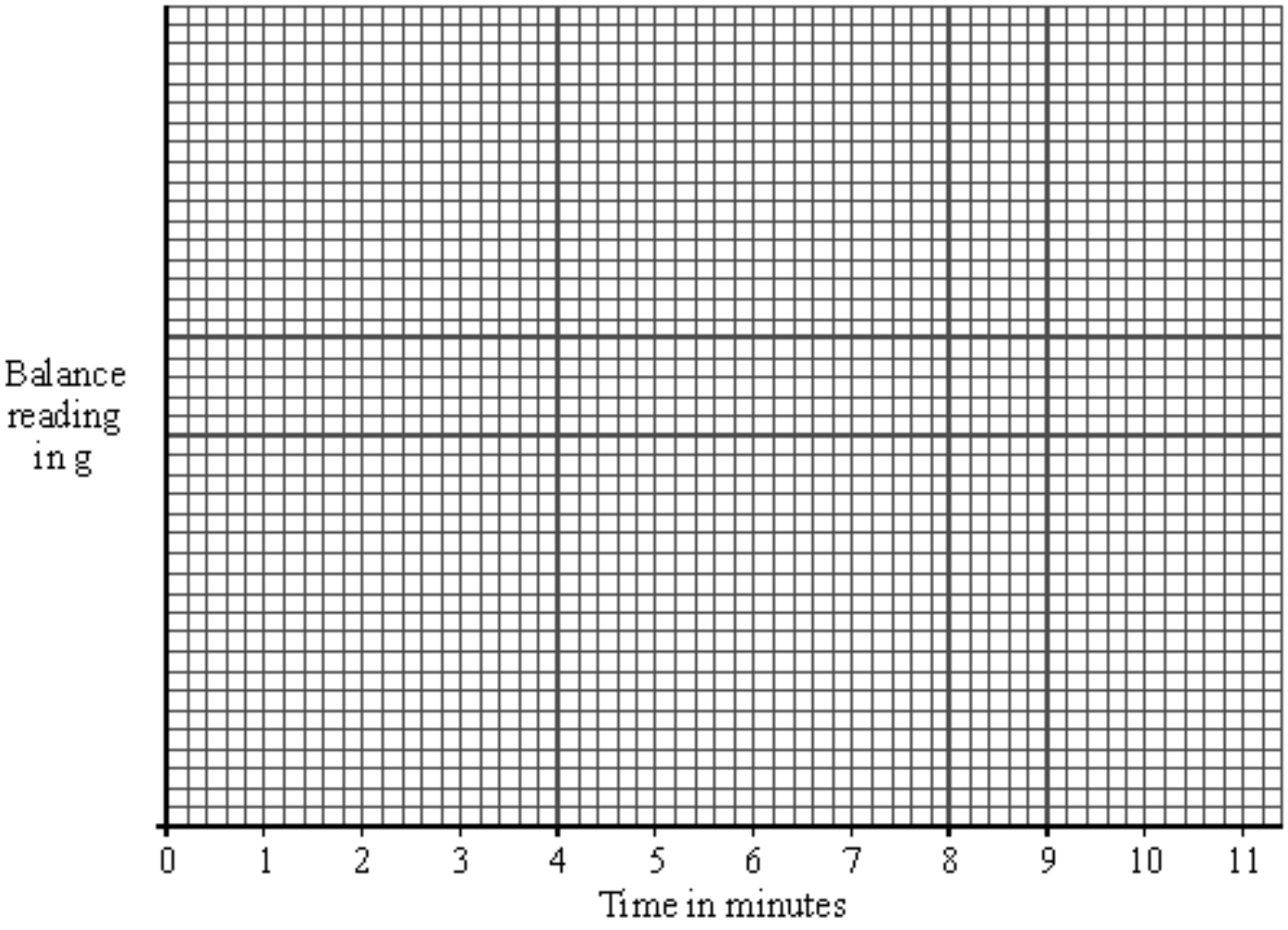
_____

(2)

The following results were obtained from the experiment.

Time in minutes	Reading on balance in g
0.5	269.6
1.0	269.3
2.0	269.0
3.0	268.8
5.0	268.7
9.0	268.6

(b) (i) Plot the results and draw a graph on the axes below.



(3)

(ii) Continue the graph you have drawn to show the expected reading after11 minutes.

(1)

(iii) On the axes above, sketch a graph of the result which would be obtained if in a similar experiment the same mass of powdered marble was used instead of marble chips.

(2)

(Total 8 marks)

Q10.

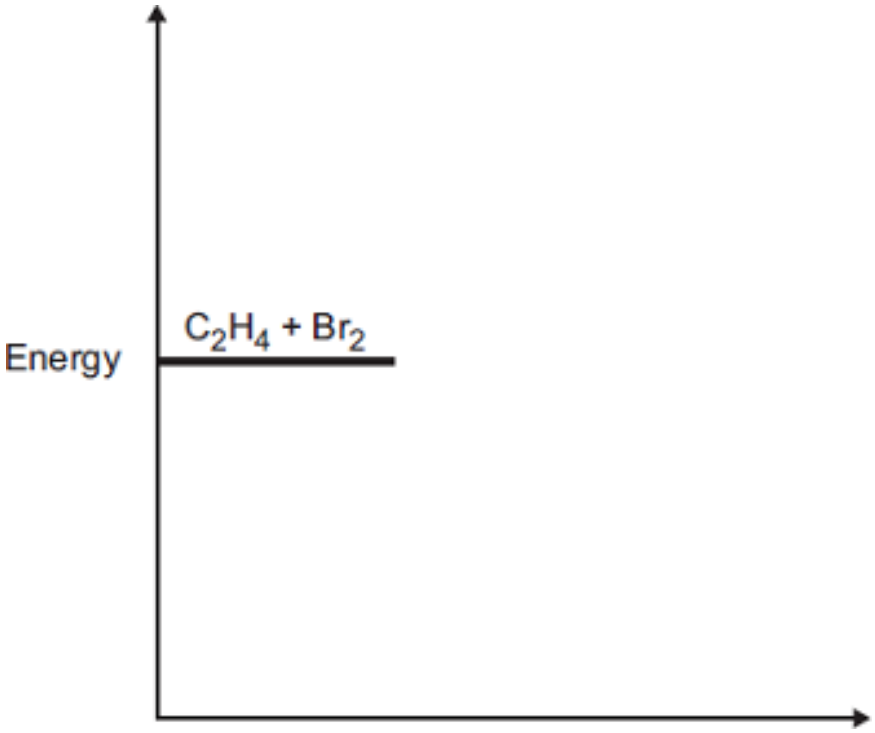
The equation for the reaction of ethene and bromine is:

$$C_2H_4(g) + Br_2(l) \longrightarrow C_2H_4Br_2(l)$$

The reaction is exothermic.

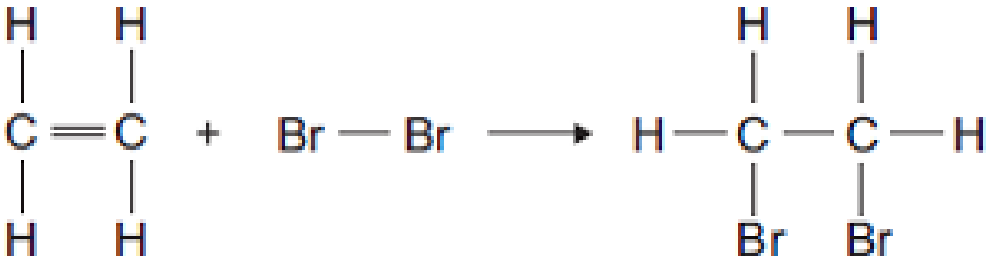
(a) Complete the energy level diagram.

You should label:
- the activation energy
- the enthalpy change (ΔH).



(3)

(b) (i) The equation for the reaction can be represented as:



Bond	Bond dissociation energy in kJ per mole
C—H	413
C = C	614
Br—Br	193
C—C	348
C—Br	276

Use the bond dissociation energies in the table to calculate the enthalpy change (ΔH) for this reaction.

Enthalpy change (ΔH) = _____ kJ per mole

(3)

(ii) The reaction is exothermic.

Explain why, in terms of bonds broken and bonds formed.

(2)

(Total 8 marks)

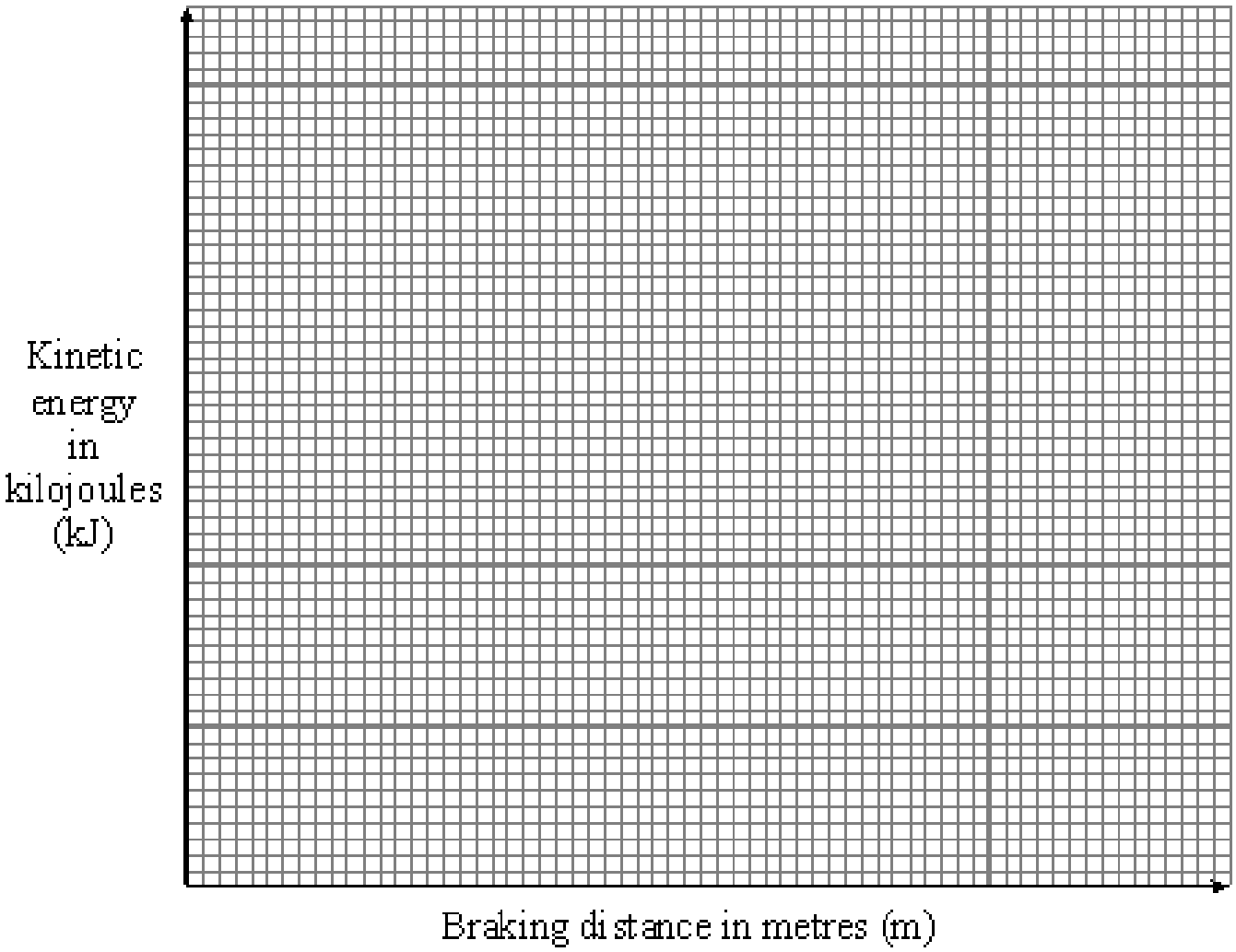
Q11.

The table shows the braking distances for a car at different speeds and kinetic energy. The braking distance is how far the car travels once the brakes have been applied.

Braking distance in m	Speed of car in m/s	Kinetic energy of car in kJ
5	10	40
12	15	90
20	20	160
33	25	250
45	30	360

(a) A student suggests, "*the braking distance is directly proportional to the kinetic energy*."

(i) Draw a line graph to test this suggestion.



(3)

(ii) Does the graph show that the student's suggestion was correct or incorrect? Give a reason for your answer.

_____

_____

(1)

(iii) Use your graph and the equation for kinetic energy to predict a braking distance for a speed of 35 metres per second (m/s). The mass of the car is 800 kilograms (kg). Show clearly how you obtain your answer.

_____

_____

Braking distance = _____ m

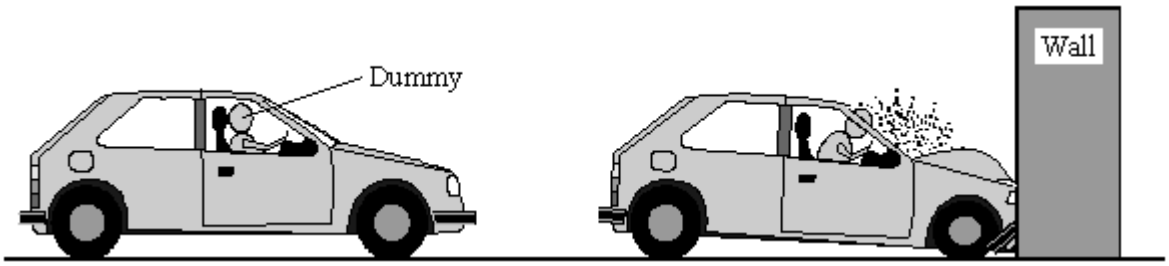
(2)

(iv) State **one** factor, apart from speed, which would increase the car's braking distance.

_____

(1)

(b) The diagram shows a car before and during a crash test. The car hits the wall at 14 metres per second (m/s) and takes 0.25 seconds (s) to stop.



(i) Write down the equation which links acceleration, change in velocity and time taken.

_____ **(1)**

(ii) Calculate the deceleration of the car.

_____

Deceleration = _____ m/s^2

(1)

(iii) In an accident the crumple zone at the front of a car collapses progressively. This increases the time it takes the car to stop. In a front end collision the injury to the car passengers should be reduced. Explain why. The answer has been started for you.

By increasing the time it takes for the car to stop, the _____

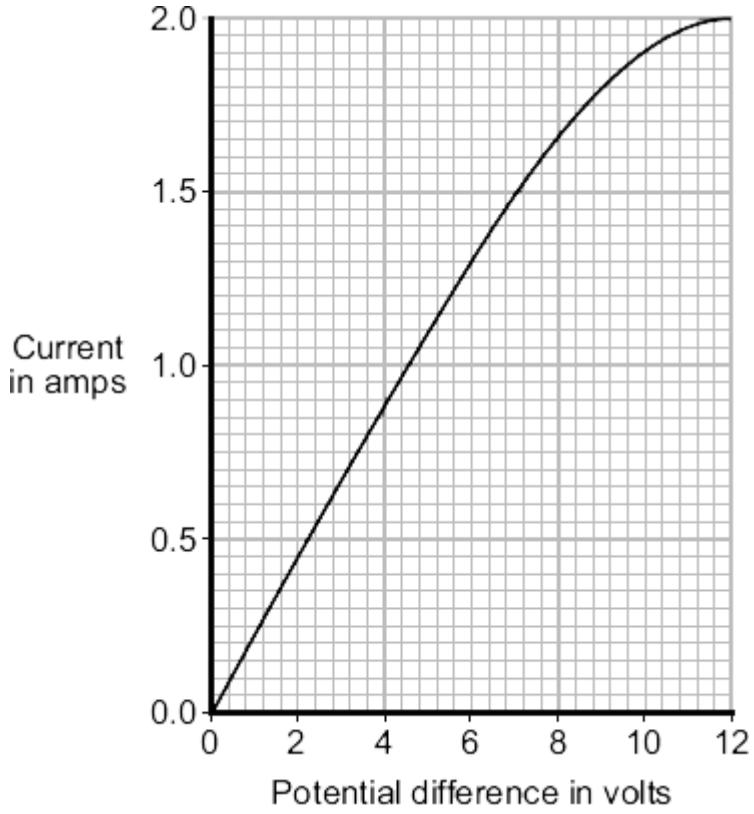
_____

_____

_____ **(2)**

(Total 11 marks)

Q12. The graph shows how the electric current through a 12 V filament bulb varies with the potential difference across the bulb.



(a) What is the meaning of the following terms?

electric current

_____

_____

potential difference

_____

_____ **(2)**

(b) The resistance of the metal filament inside the bulb increases as the potential difference across the bulb increases.

Explain why.

_____

_____

_____

_____

_____

_____

_____

(3)

(c) Use data from the graph to calculate the rate at which the filament bulb transfers energy, when the potential difference across the bulb is 6 V.

Show clearly how you work out your answer.

_____

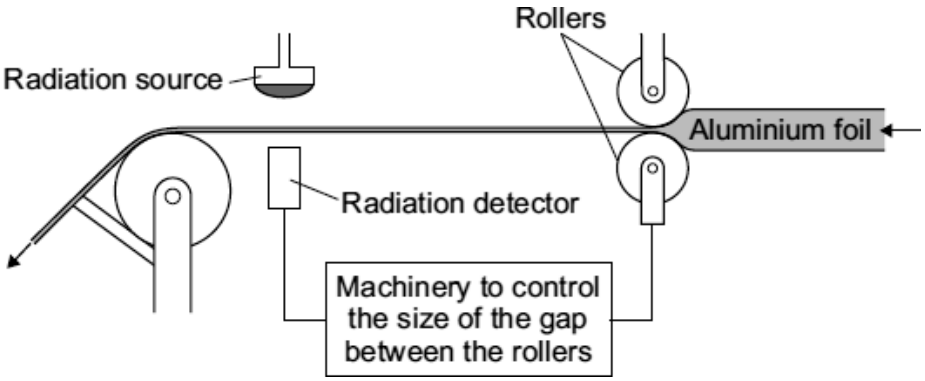
_____

Rate of energy transfer = _____ W

(2)

(Total 7 marks)

Q13. The diagram shows a system used to control the thickness of aluminium foil as it is being rolled. A radiation source and detector are used to monitor the thickness of the foil.



(a) Which type of source, alpha, beta or gamma, should be used in this control system? _____

Explain why each of the other two types of source would **not** be suitable.

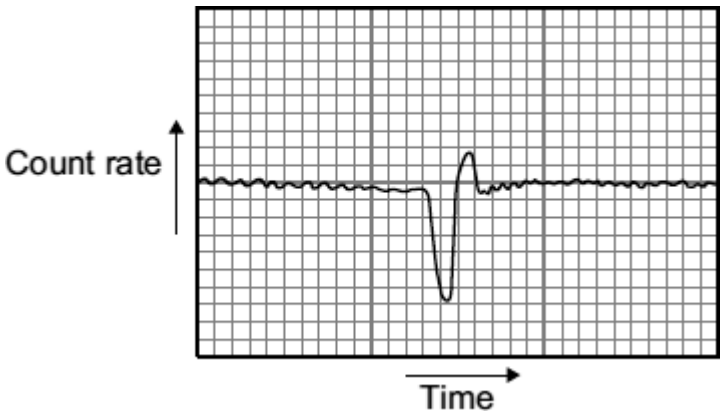
_____

_____

_____

_____ **(3)**

(b) The chart shows how the count rate recorded by the detector varies over a short period of time.



Use the graph to explain how the thickness of the foil changes, and how the control system responds to this change.

_____

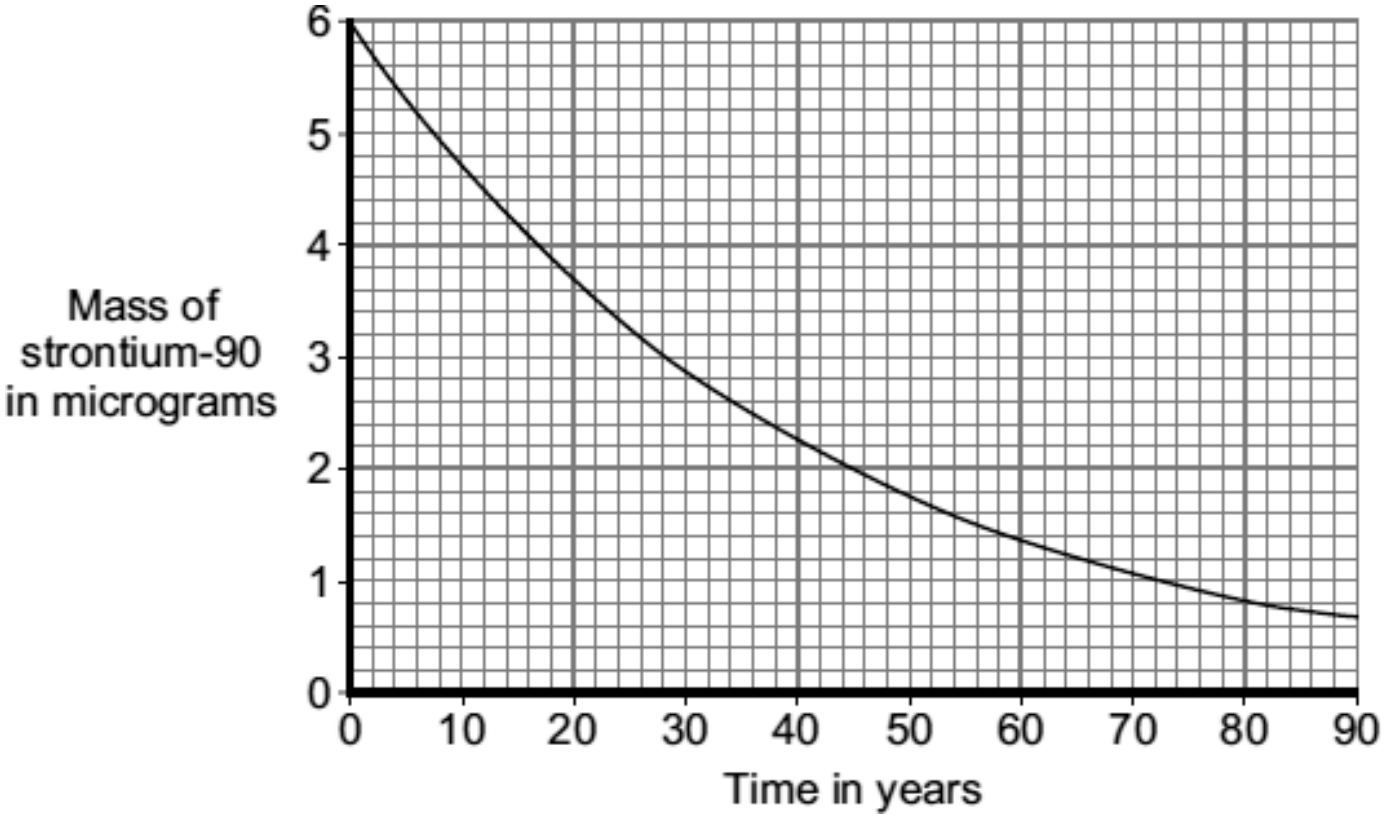
_____

_____

_____

(2)

(c) When first used, the radiation source contains 6 micrograms of strontium-90.
The graph shows how the mass of the strontium-90 will decrease as the nuclei decay.



The control system will continue to work with the same source until 75 % of the original strontium-90 nuclei have decayed.

After how many years will the source need replacing?

Show clearly your calculation and how you use the graph to obtain your answer.

_____

_____

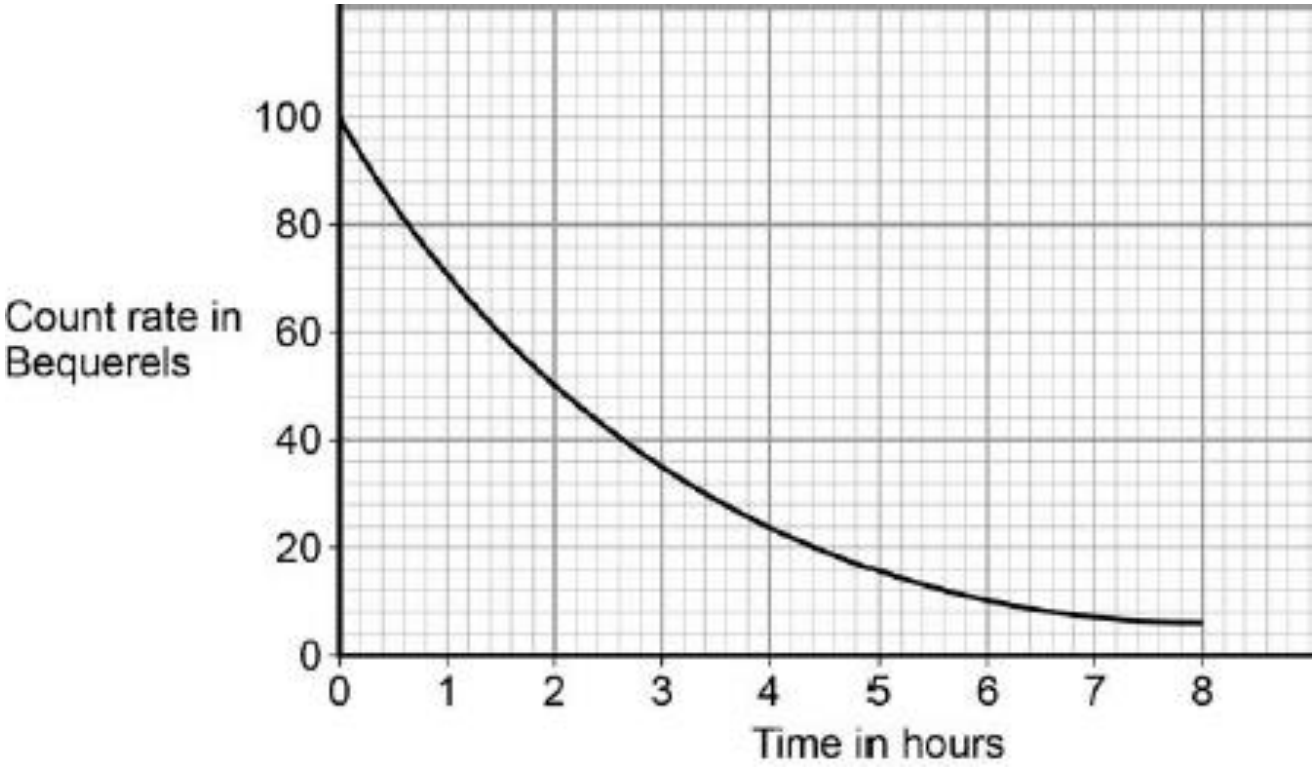
_____

Number of years = _____

(2)

(Total 7 marks)

Q14. The figure below shows how the activity of a radioactive isotope changes over an 8 hour period of time.



(a) Predict how long it will take for the count rate to fall from 100 to 1.56 Bequerels.

_____

_____

_____

Time = _____ hours **(2)**

(b) Lead-210 is a radioactive isotope that decays to an isotope of mercury by alpha decay.

Complete the nuclear equation to show the alpha decay of lead-210.

$$^{210}_{\quad}Pb \longrightarrow {}^{\quad}_{80}Hg + {}^{\quad}_{\quad}\quad$$ **(3)**

(c) Explain how ionising radiation can have hazardous effects on the human body.

_____

_____

_____

_____

_____

_____

_____

_____

_____ **(5)**

(Total 10 marks)

Q15.

Figure 1 shows a kettle a student used to determine the specific heat capacity of water.

Figure 1

The student placed different masses of water into the kettle and timed how long it took for the water to reach boiling point.

The student carried out the experiment three times.

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

	Time for water to boil in seconds					
Mass of water in kg	**1**	**2**	**3**	**Mean**	**Mass × change in temperature in kg°C**	**Energy supplied in kJ**
0.25	55	60	63	59	20	131
0.50	105	110	116	110	40	243
0.75	140	148	141	143	60	314
1.00	184	190	183	182	80	401
1.25	216	215	211	214	100	471
1.50	272	263	266	267	120	587
1.75	298	300	302		140	

(a) Suggest how the student was able to ensure that the change in temperature was the same for each mass of water.

_____

_____

_____

_____ **(2)**

(b) Calculate the uncertainty in the student's measurements of time to boil when the mass of water was 1.75 kg.

_____

_____

Uncertainty = _____ s

(2)

(c) The power rating of the kettle is 2.20 kW.

Calculate the average electrical energy used by the kettle, in kJ, for 1.75 kg of water to reach boiling point.

_____

_____

_____

Average energy = _____ kJ

(2)

(d) Use information from the table above to calculate the change in temperature of the water during the investigation.

_____

_____

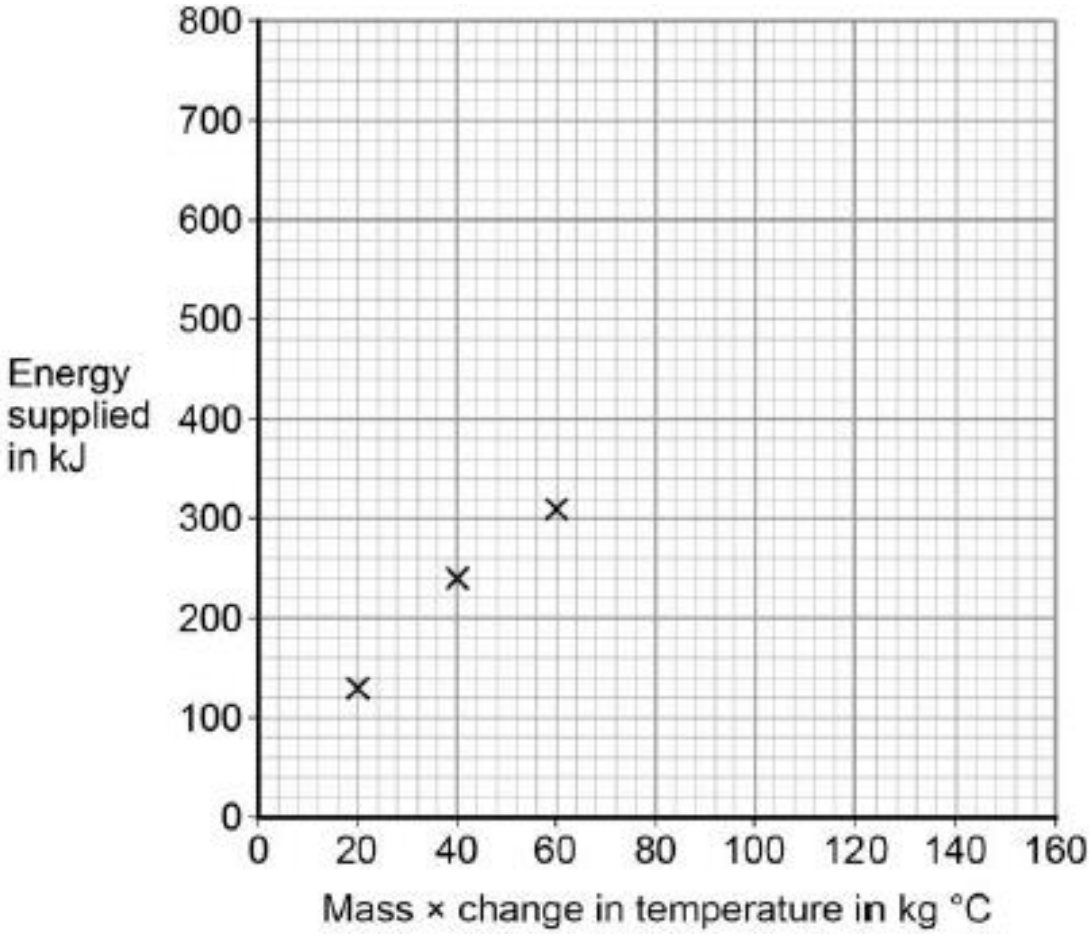
Change in temperature = _____ °C

(2)

(e) The student plotted a graph of energy supplied in kJ against mass × change in temperature in kg °C.

Figure 2 shows the graph the student plotted.

Figure 2



Use data from the table above to plot the four missing points.

Draw a line of best fit on the graph. **(3)**

(f) Use the graph to determine the mean value of the specific heat capacity of water, for the student's investigation.

_____

_____

_____

_____

_____

Specific heat capacity of water = _____ J / kg °C

(4)

(g) The student's value for the specific heat capacity of water was greater than the accepted value.

Suggest why.

_____

_____

(1)

(h) The kettle used in the experiment had a label stating that the power rating of the kettle was 2.2 kW.

The student did not measure the power of the kettle.

Suggest why measuring the power of the kettle may improve the student's investigation.

_____

_____

(1)

(17 marks)