

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

B761/02

GATEWAY SCIENCE
FURTHER ADDITIONAL SCIENCE B
Further Additional Science modules
B5, C5, P5 (Higher Tier)

MONDAY 15 JUNE 2015: Morning

DURATION: 1 hour 15 minutes
plus your additional time allowance

MODIFIED ENLARGED

| | | | |
|-------------------------------|--|------------------------------|--|
| Candidate forename | | Candidate surname | |
|-------------------------------|--|------------------------------|--|

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

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR SUPPLIED MATERIALS:
A copy of The Periodic Table

OTHER MATERIALS REQUIRED:
Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

Use black ink. HB pencil may be used for graphs and diagrams only.

Answer ALL the questions.

Read each question carefully. Make sure you know what you have to do before starting your answer.

Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

The quality of written communication is assessed in questions marked with a pencil ().

A list of equations can be found on pages 4–5.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 75.

Any blank pages are indicated.

BLANK PAGE

EQUATIONS

$$\text{energy} = \text{mass} \times \frac{\text{specific heat}}{\text{capacity}} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{efficiency} = \frac{\text{useful energy output} (\times 100\%)}{\text{total energy input}}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{distance} = \text{average speed} \times \text{time}$$

$$s = \frac{(u + v)}{2} \times t$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{power} = \text{force} \times \text{speed}$$

$$KE = \frac{1}{2}mv^2$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

$$GPE = mgh$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$m_1u_1 + m_2u_2 = (m_1 + m_2)v$$

$$\text{refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}}$$

$$\text{magnification} = \frac{\text{image size}}{\text{object size}}$$

$$I_e = I_b + I_c$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of primary turns}}{\text{number of secondary turns}}$$

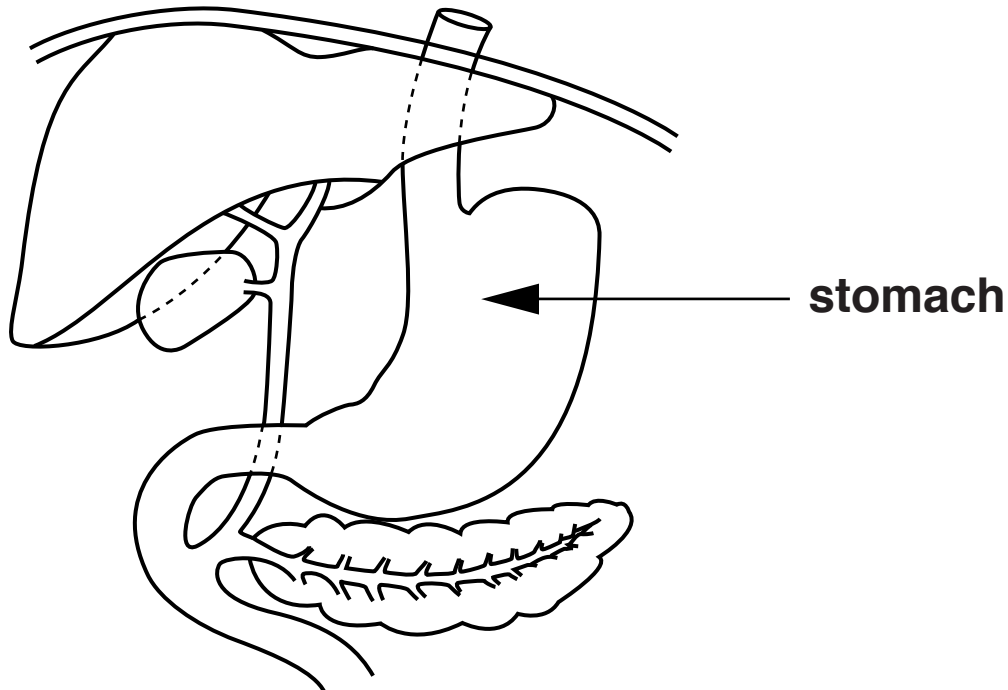
$$\text{power loss} = (\text{current})^2 \times \text{resistance}$$

$$V_p I_p = V_s I_s$$

Answer ALL the questions.

SECTION A – Module B5

- 1 Look at the diagram. It shows part of the digestive system.**



- (a) (i) Which enzyme in the stomach breaks down protein?**

_____ [1]

- (ii) Which type of substance is made when proteins are digested?**

_____ [1]

- (b) Some elderly people produce very little acid in their stomach.**

Explain why this would slow down digestion in the stomach.

[2]

- (c) The contents of the stomach then enter the small intestine.**

Explain TWO ways the small intestine is adapted for efficient absorption of digested food.

[2]

2 This question is about tests on the circulatory system.

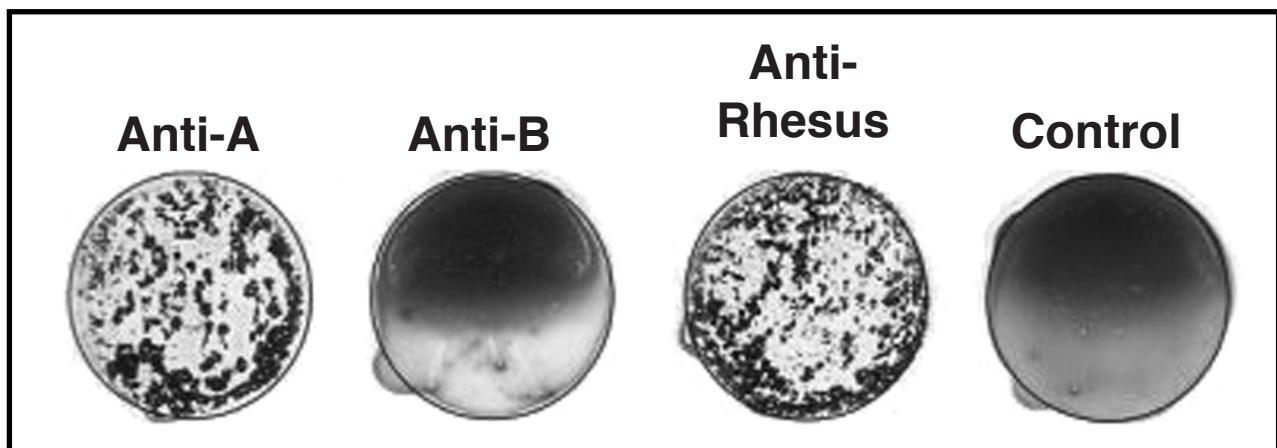
(a) A simple test can be done to find out which blood type a person has.

A drop of blood is added to antibodies.

There is also a control that contains no antibodies.

If blood clots in the control the test is invalid.

Look at the picture. It shows the result of a valid test.



(i) What is the blood type of the individual taking the test? Explain your answer.

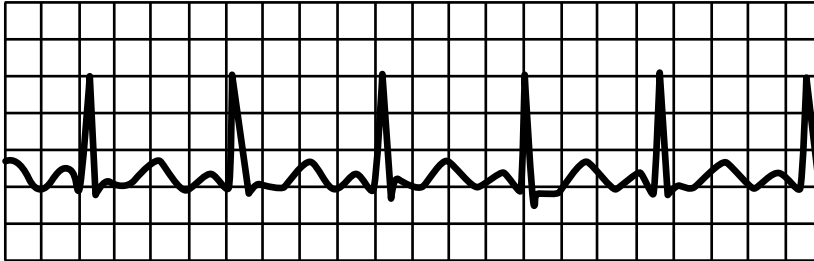
[3]

- (ii) Explain what would happen if this person received blood from a donor who was AB positive.**

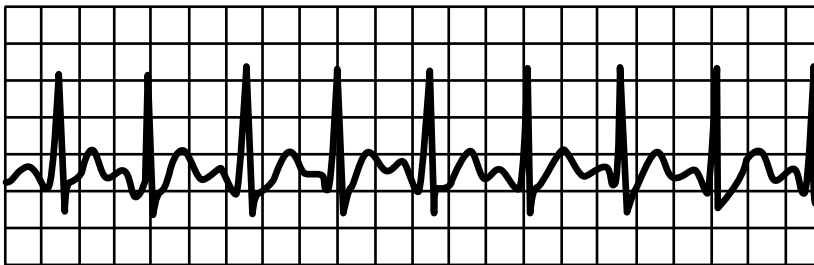
[1]

- (b) Look at the diagram. It shows an ECG trace of a normal heartbeat and three ECG traces that show heart problems.

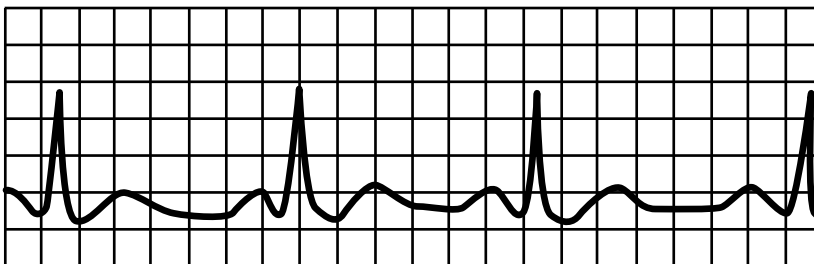
NORMAL HEARTBEAT



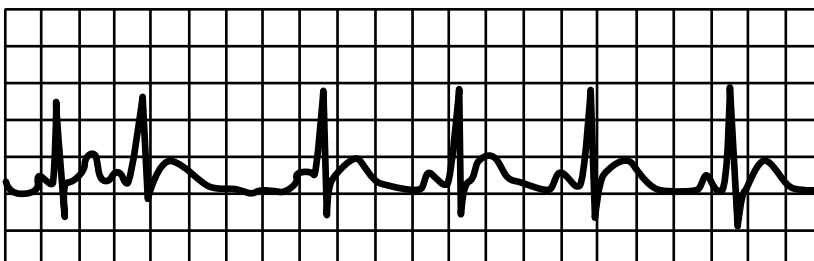
A



B



C



- (i) Match the letter of each ECG to its correct description.

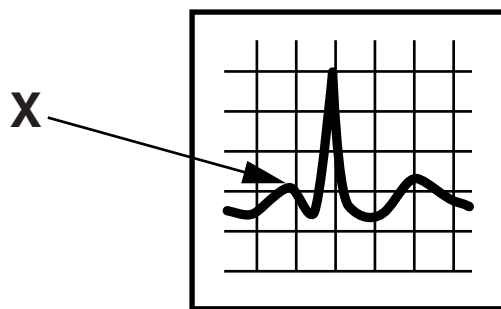
irregular heartbeat _____

fast heartbeat _____

slow heartbeat _____

[1]

- (ii) Look at an enlarged image of part of the ECG trace.



Describe what is happening inside the heart at point X.

_____ [1]

3 Read the article about a new type of artificial heart.

ARTIFICIAL HEARTS



Scientists have made a new artificial heart that can replace the human heart.

The heart is made of plastic and lined with animal tissue. The animal tissue should reduce the chance of rejection compared to a completely plastic heart.

Batteries kept on the outside of the body power the heart.

The scientists hope this new type of heart can keep someone alive for at least five years. This would mean that more patients would survive while they waited for a donor human heart. At the moment, if their hearts fail completely, they have to be kept alive on a heart–lung machine.

Compare the use of this new artificial heart to other artificial hearts and to a transplant of a donor human heart.

Use information from the article and your own knowledge to answer the question.



The quality of written communication will be assessed in your answer to this question.

[6]

- 4 During pregnancy the development of the foetus is monitored.**

One way to monitor development is to measure the size of the head.

Look at the graph opposite.

The dark line in the middle shows the average head size for a foetus of that age.

The other two lines show the healthy range for the head size of a foetus.

(a) Claire is pregnant.

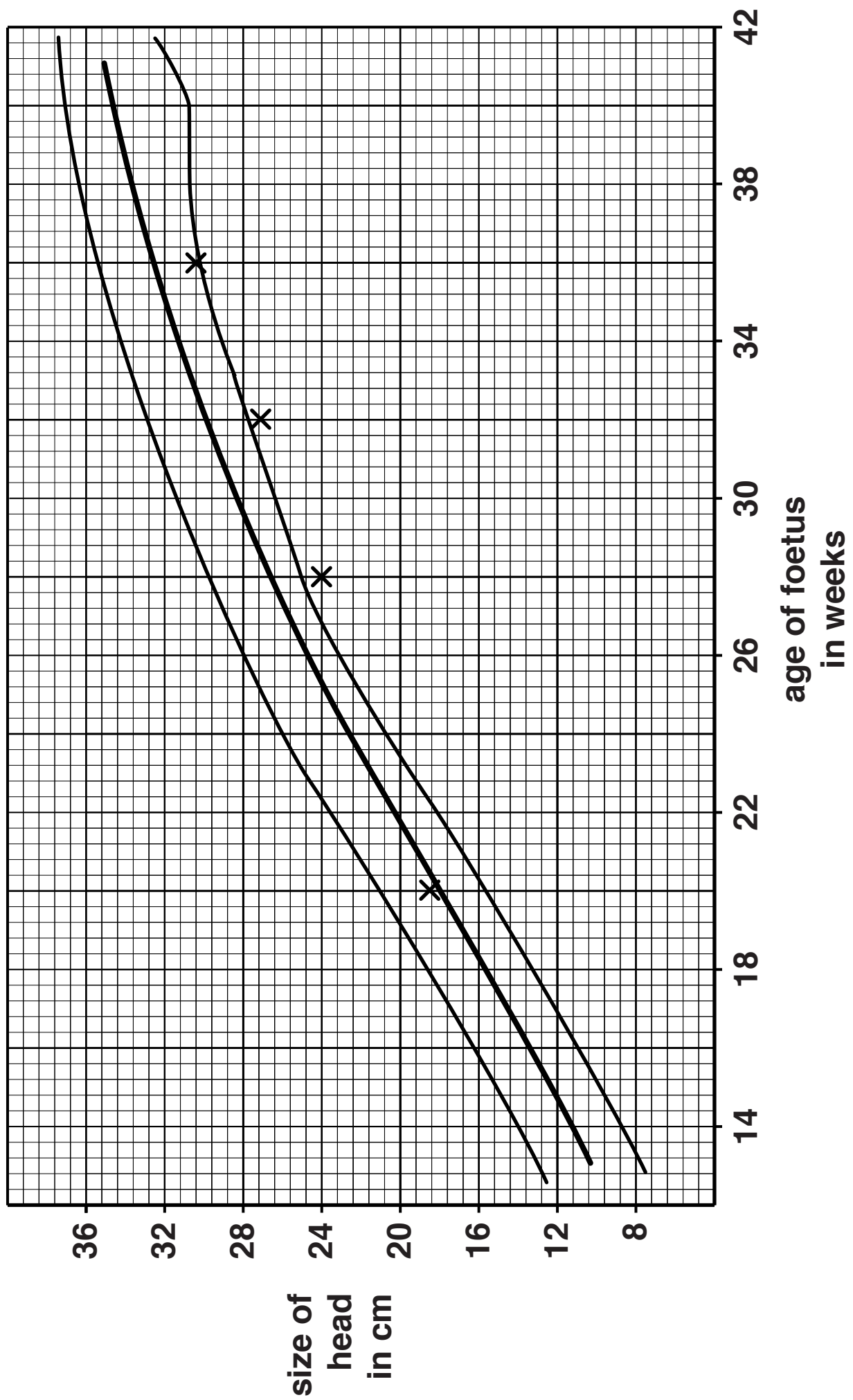
The head size of her foetus is measured four times.

The results are plotted on the graph.

- (i) What is the rate of growth of the head size between 28 and 36 weeks?**

Write your answer to 2 decimal places.

_____ cm per week [1]



- (ii) Why is it important to consider the overall rate of growth of the head size rather than the head size measurement from one day?**

[1]

- (b) (i) A foetus can be tested for conditions such as Down's syndrome.**

Describe how a foetus can be tested for Down's syndrome.

[3]

(ii) People have different opinions about foetal testing.

Describe the ethical arguments FOR and AGAINST foetal testing.

[2]

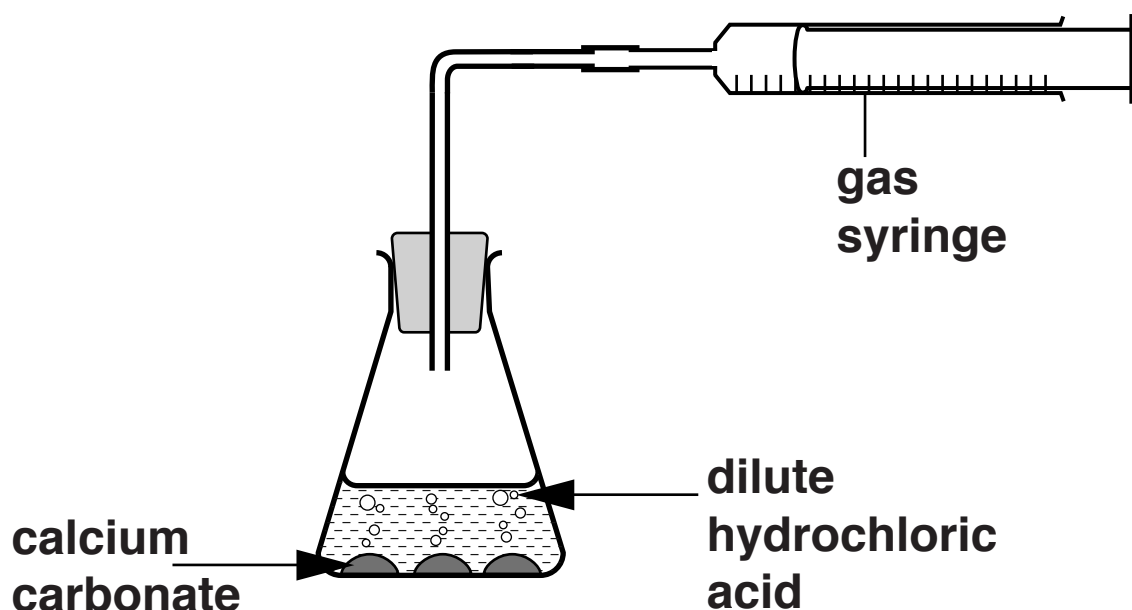
SECTION B – Module C5

5 Greg and Steph investigate the reaction between calcium carbonate and hydrochloric acid.

calcium carbonate + hydrochloric acid

→ calcium chloride + carbon dioxide + water

Look at the diagram. It shows the apparatus they use.



Greg and Steph do the experiment several times.

Each time they use a different mass of calcium carbonate.

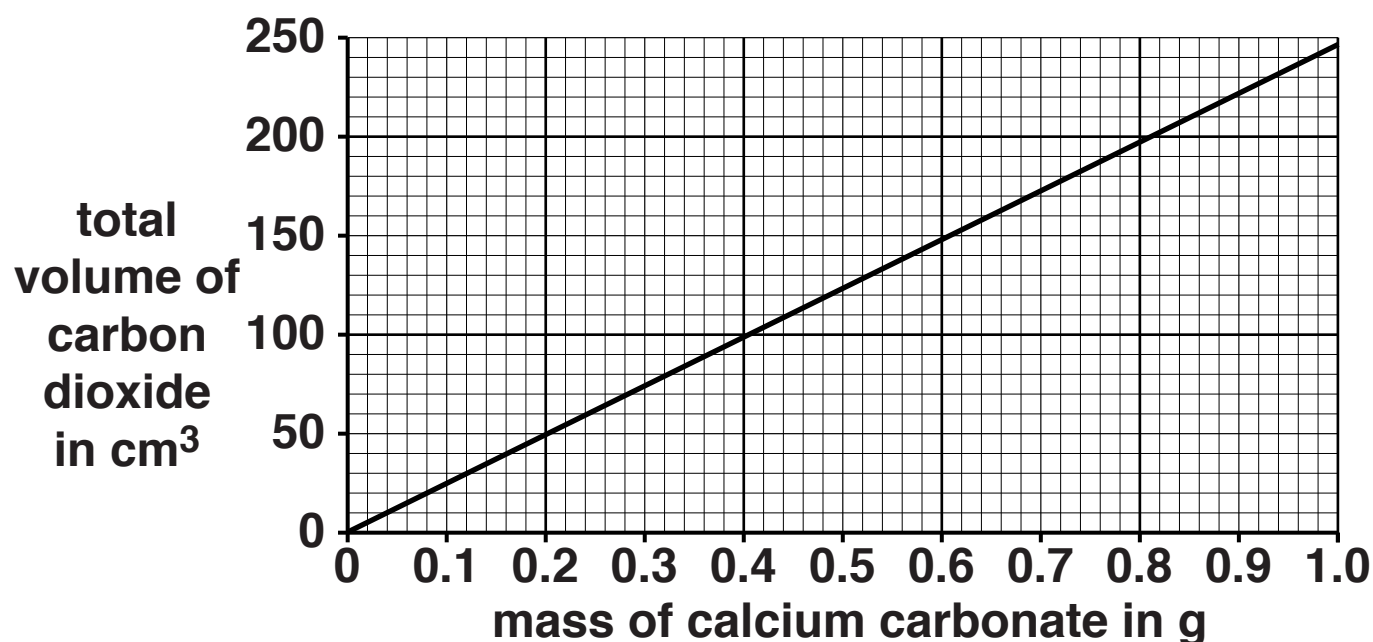
They measure the volume of carbon dioxide made at the end of the reaction.

In each experiment the hydrochloric acid is **IN EXCESS**.

(a) Explain why each reaction stops.

_____ [2]

(b) Look at the graph. It shows their results.



Greg and Steph want to make exactly 90 cm³ of carbon dioxide at the end of the reaction.

What mass of calcium carbonate should they use?

answer _____ g [1]

- (c) 120 cm^3 of carbon dioxide, at room temperature and pressure, is made when 0.48 g of calcium carbonate react.

Calculate the number of moles of carbon dioxide in 120 cm^3 of gas at room temperature and pressure.

(1 mole of any gas occupies $24\,000\text{ cm}^3$ at room temperature and pressure.)

answer _____ moles

[2]

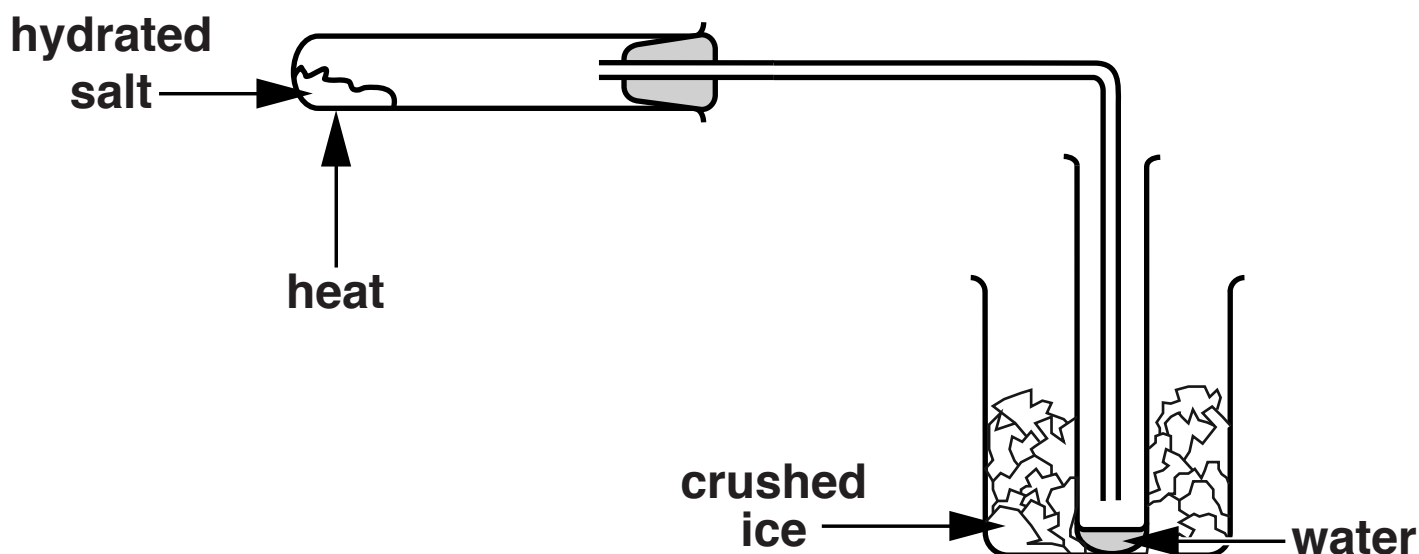
6 Peter is heating two hydrated salts.

These are

hydrated sodium carbonate, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

hydrated copper(II) sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

Look at the apparatus he uses.



When each hydrated salt is heated, the water in the hydrated salt is given off as steam.

The steam is condensed and collected in the test tube placed in crushed ice.

(a) When hydrated copper(II) sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, is heated, anhydrous copper(II) sulfate, CuSO_4 , and water are made.

Write a BALANCED SYMBOL equation for this reaction.

_____ [2]

(b) Look at Peter's results for hydrated copper(II) sulfate.

Complete the table.

| Mass of hydrated copper(II) sulfate in g | Mass of anhydrous copper(II) sulfate in g | Mass of water in g |
|---|--|---------------------------|
| 0.50 | 0.32 | 0.18 |
| 1.00 | 0.64 | 0.36 |
| 1.50 | | |
| 2.00 | 1.28 | 0.72 |
| 2.50 | 1.60 | 0.90 |

[2]

(c) Look at Peter's results for hydrated sodium carbonate.

| Mass of hydrated sodium carbonate in g | Mass of anhydrous sodium carbonate in g | Mass of water in g |
|---|--|---------------------------|
| 1.00 | 0.37 | 0.63 |
| 1.50 | 0.70 | 0.80 |
| 2.00 | 1.00 | 1.00 |

Before he starts the experiment, Peter makes a prediction for BOTH hydrated salts.

Peter says 'When I double the mass of each hydrated salt, I will double the mass of water made'.

Do Peter's results support his prediction about BOTH hydrated salts?

Explain your answer quoting information from BOTH tables.

[2]

7 (a) Benzene is a hydrocarbon.

The molecular formula of benzene is C_6H_6 .

What is the EMPIRICAL formula of benzene?

_____ **[1]**

(b) Look at the table. It shows the percentage composition of compound A.

| ELEMENT | PERCENTAGE BY MASS (%) |
|-----------------|-------------------------------|
| carbon | 38.7 |
| hydrogen | 9.7 |
| oxygen | 51.6 |

(i) Calculate the empirical formula of compound A.

(The relative atomic mass, A_r , of carbon is 12, of hydrogen is 1 and of oxygen is 16.)

empirical formula _____ **[2]**

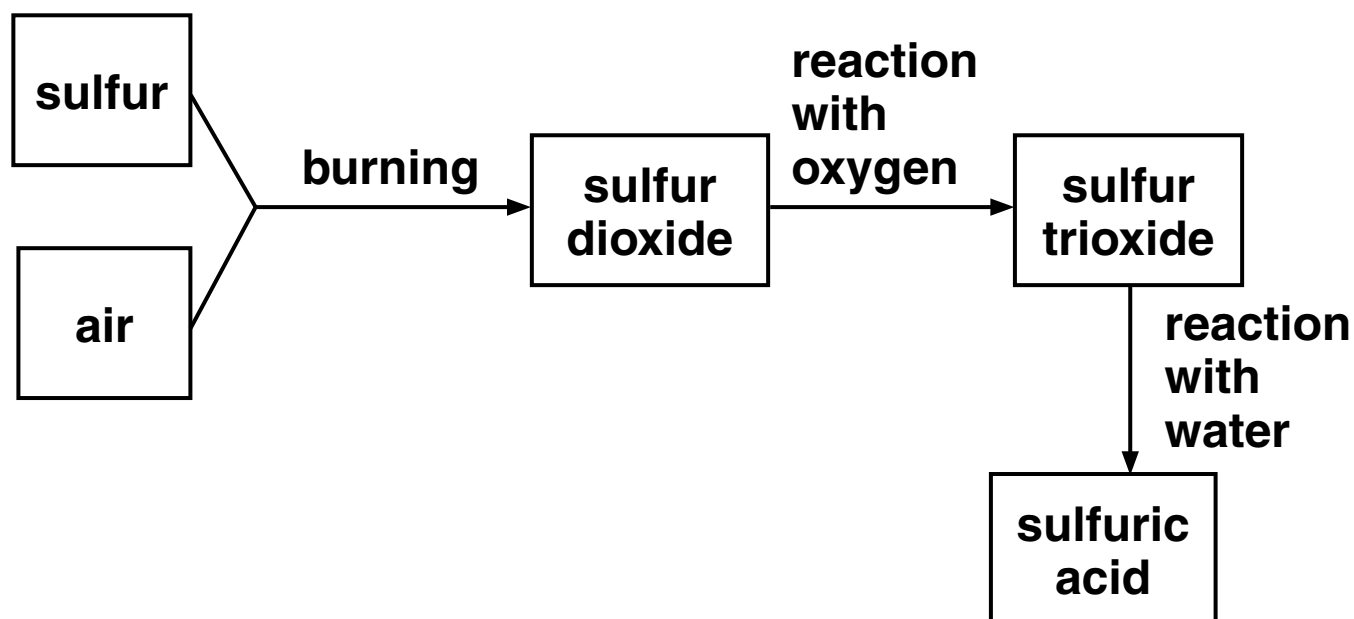
(ii) The molar mass of compound A is 62 g/mol.

Suggest the MOLECULAR formula for compound A.

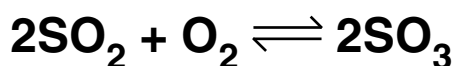
molecular formula _____ [1]

8 This question is about the Contact Process used for the manufacture of sulfuric acid.

Look at the flow chart for the Contact Process.



In the Contact Process, sulfur dioxide reacts with oxygen to make sulfur trioxide.



The forward reaction is EXOTHERMIC.

Two of the conditions used in this reaction are

a temperature of 450 °C

a catalyst of vanadium(V) oxide, V_2O_5 .

(a) Write down ONE OTHER condition used in this reaction.

_____ [1]

(b) Explain why a temperature of 450 °C rather than 350 °C or 550 °C is used in this reaction.

[2]

(c) What effect does using a catalyst of vanadium(V) oxide have on

the rate of the reaction

percentage yield?

Effect on rate of reaction _____

Effect on percentage yield _____ **[1]**

9 Barium sulfate, BaSO_4 , is an insoluble salt.

Steve wants to make a pure, dry sample of barium sulfate.

Steve uses solutions of barium chloride and sodium sulfate in a PRECIPITATION reaction.

Barium chloride solution contains barium ions, Ba^{2+} .

Sodium sulfate contains sulfate ions, SO_4^{2-} .

Describe the stages that Steve can use to prepare a PURE, DRY sample of barium sulfate.

Include an IONIC equation for the reaction.

You may wish to draw a LABELLED diagram. [6]



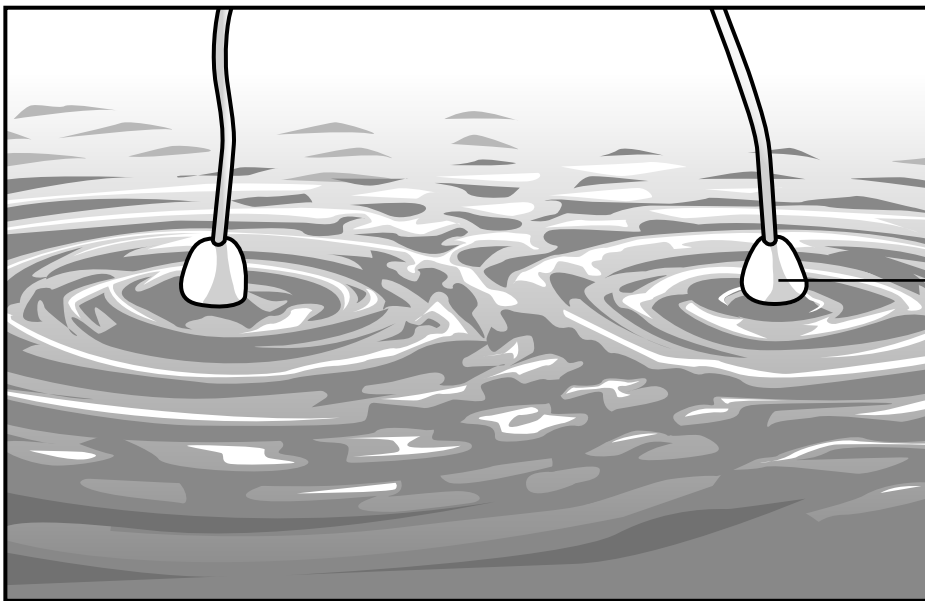
The quality of written communication will be assessed in your answer to this question.

SECTION C – Module P5

10 In his science class Bilhar investigates the behaviour of water waves.

(a) He uses a ripple tank to produce and study the water waves.

Look at the diagram.



**moved up and
down to produce
waves**

The waves cause interference.

This makes a pattern of high waves and calm water.

Explain how the high waves and calm water are produced by interference.

You may draw a diagram to explain your answer.

[2]

(b) Hundreds of years ago scientists such as Huygens and Newton experimented to find out about the nature of light.

They wanted to know if light was made of waves or particles.

Many scientists at this time shared their results and findings.

Suggest HOW they shared their results and findings.

Suggest WHY they shared their results and findings.

[2]

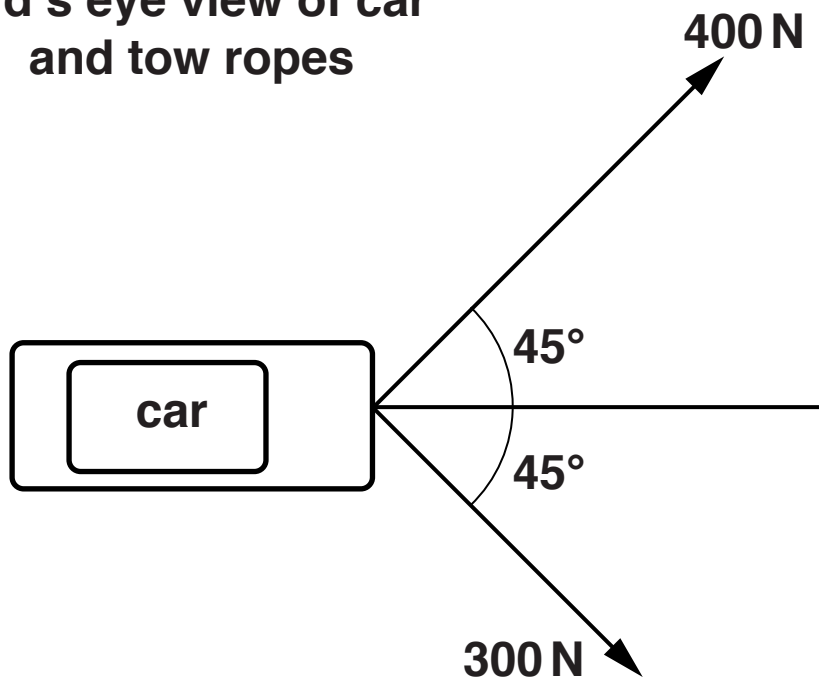
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11 A car is stuck in the snow.

Two vehicles try to pull the car free using tow ropes.

Look at the diagram showing the forces used by the two vehicles.

**bird's eye view of car
and tow ropes**



The car needs a force of more than 450N to overcome friction.

- (a) Calculate the resultant force to show that the car will move.**

You may draw on the diagram to show your answer.

[3]

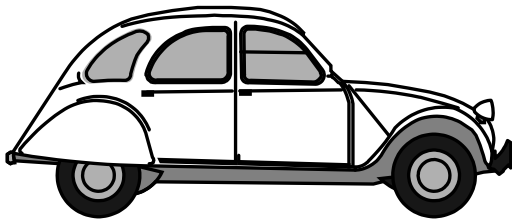
- (b) Describe how the VELOCITY of a car is different from the SPEED of a car.**

[1]

(c) Look at the diagram of a car accelerating.

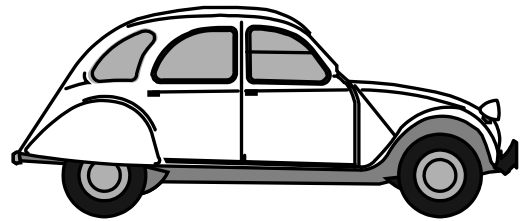
BEFORE

6 m/s 



AFTER

final speed 



The car accelerates at 0.5 m/s^2 for 16 s.

Calculate the final speed of the car.

answer _____ **m/s**

[2]

BLANK PAGE

12 Artificial satellites are put into orbit around Earth.

Some satellites are used for weather forecasting.

Look at the information about two types of weather satellite.

| Satellite | Meteosat | POES |
|-------------------------------|---------------------------------------|--|
| Average orbital height | 38 500 km | 807 km |
| Orbital period | 24 hours | 101 minutes |
| Shape of orbit | circular | elliptical |
| Uses | low definition weather imaging | high definition weather imaging |

(a) Meteosat is in orbit above the equator AND it moves around the Earth once every 24 hours.

POES has a different orbit and it passes over the North and South Poles.

Describe the ADVANTAGES of each orbit for weather forecasting.

Describe the DISADVANTAGES of each orbit for weather forecasting.

[3]

(b) Satellites are kept in orbit by a centripetal force.

What causes this force?

[1]

**(c) The POES satellite is closer to Earth.
It has a lower orbit and travels faster than the
Meteosat satellite.**

Explain why the POES satellite travels faster.

[1]

**(d) Explain why it is important that the Meteosat
satellite has a CIRCULAR orbit rather than an
elliptical orbit.**

[2]

(e) TV satellites use microwaves for transmission.

**Explain how communications between
TV satellites and Earth take place.**

[2]

BLANK PAGE

13 Sam and Jared race their bikes.

Their speeds are measured as they accelerate steadily over a distance of 30 m.

Look at the information about this section of the race.

| | Starting speed | Finishing speed |
|-------|----------------|-----------------|
| Sam | 2 m/s | 4 m/s |
| Jared | 1 m/s | 5 m/s |

Jared says, 'my acceleration was four times greater than Sam's'.

Sam says, 'it's not fair; Jared had a longer time to accelerate than I did'.

Use the data and calculations to explain why both Sam and Jared are incorrect.



The quality of written communication will be assessed in your answer to this question.

[6]

END OF QUESTION PAPER

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