OCR
Oxford Cambridge and RSA

F

Monday 20 June 2016 – Morning

GCSE GATEWAY SCIENCE
FURTHER ADDITIONAL SCIENCE B

B761/01 Further Additional Science modules B5, C5, P5 (Foundation Tier)

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

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour 15 minutes

* B 7 6 1 0 1 *

* 4 4 0 0 1 0 6 7 5 5 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. 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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- A list of equations can be found on page 2.
- The Periodic Table can be found on the back page.
- 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**.
- This document consists of **32** pages. Any blank pages are indicated.

EQUATIONS

$$\text{energy} = \text{mass} \times \begin{matrix}\text{specific}\\ \text{heat}\\ \text{capacity}\end{matrix} \times \begin{matrix}\text{temperature}\\ \text{change}\end{matrix}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$GPE = mgh$$

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

$$v = u + at$$

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

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

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

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

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

$$I_e = I_b + I_c$$

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

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

$$V_pI_p = V_sI_s$$

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Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

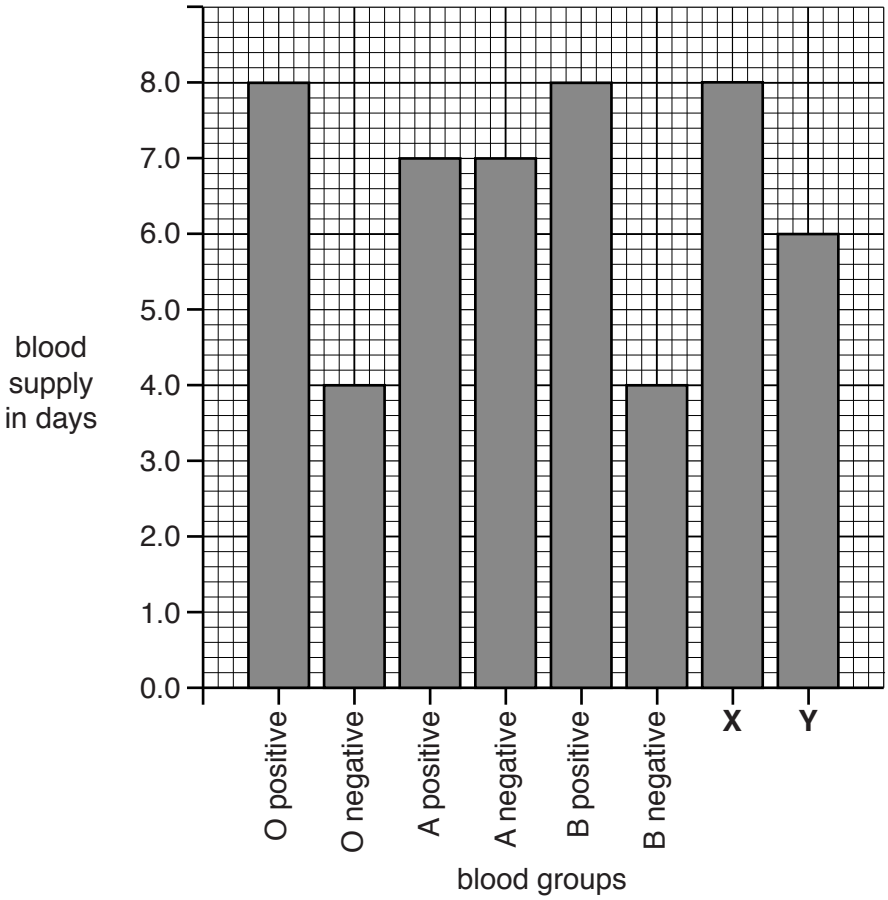
Answer **all** the questions.

SECTION A – Module B5

1 This question is about blood.

Look at the bar chart.

It shows how many days supply of blood there was in UK blood banks on 29th July 2013.



(a) The bar chart shows the eight possible blood groups found in humans.

Six of the groups are named.

The names of bars **X** and **Y** are missing.

Write down the names of the **blood** groups shown by bars **X** and **Y**.

..... and ..... **[1]**

(b) (i) How many days would blood group **O negative** have lasted if no more blood was donated?

..... days **[1]**

(ii) What other conclusion can you make from the data?

Put a tick (✓) next to **one correct** conclusion.

The supply of O positive would have lasted longer than the other blood groups.	☐
There was less supply of group B positive blood than group B negative.	☐
The banks would have run out of O positive blood in 3 days.	☐
The supply of blood group O negative and B negative was the same.	☐

[1]

(c) If someone loses a lot of blood from an injury they can have a blood donation.

Suggest **one other** reason why someone would need a blood donation.

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..... **[1]**

(d) Human blood is transported around the body in a closed circulatory system.

Insects have an open circulatory system.

Describe how a closed circulatory system is different to an open circulatory system.

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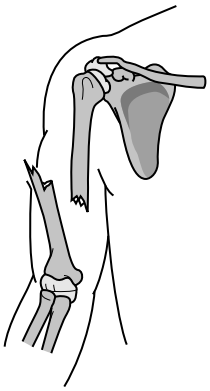
..... **[2]**

[Total: 6]

2 Look at the diagram of a bone fracture in the human arm.



(a) Write down the name of the bone in the arm that has been fractured.

..... **[1]**

(b) Name and describe the type of fracture seen in the diagram.

.....

.....

..... **[2]**

[Total: 3]

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Question 3 begins on page 8

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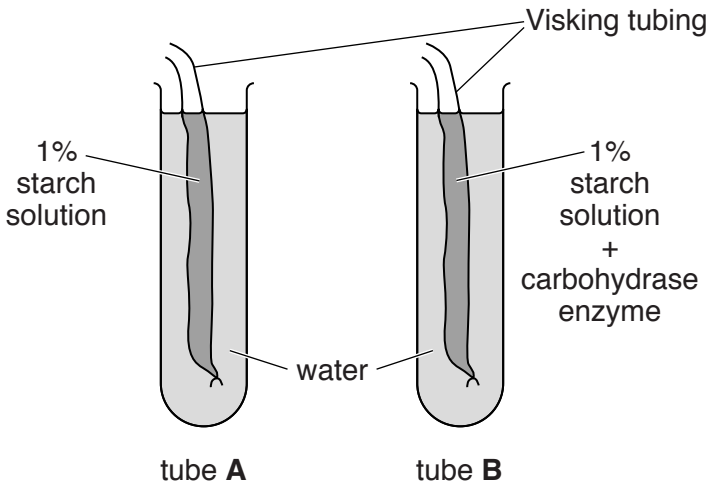
3 Benazir and Toby investigate digestion.

They use Visking tubing as a model gut.

Visking tubing has tiny holes in its membrane that only let very small molecules pass through.

Look at the apparatus they use.



Benazir and Toby leave the apparatus set up for 30 minutes.

They then test the water for starch and sugar.

The table shows their results.

Test	Tube A	Tube B
starch	no starch	no starch
sugar	no sugar	contains sugar

(a) There is no starch or sugar in the water at the start of the experiment.

Explain the results in the table.

Use ideas about what happens during digestion and absorption in your answer.

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

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..... **[6]**

(b) Benazir wants to extend their investigation.

She suggests they set up tube **A** in the same way but add starch and lipase to the Visking tubing in **B**.

Toby tells her that they would just get the same result.

Is Toby correct? .....

Explain your answer.

.....

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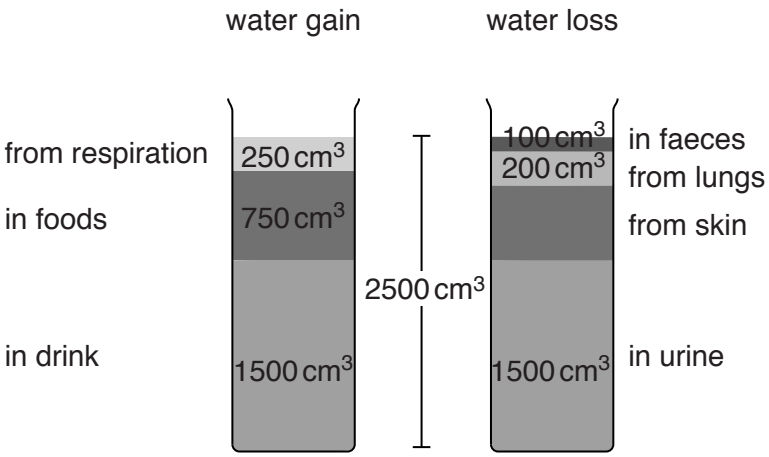
..... **[2]**

[Total: 8]

4 This question is about water loss from the body.

Look at the diagram.

It shows the amount of water the body gains and loses in one day.



(a) (i) Calculate the amount of water lost through the skin.

..... cm^3 **[2]**

(ii) The amount of water calculated in part **(i)** is from a cold day.

Explain how and why this amount will change on a **hot** day.

.....

.....

..... **[2]**

(b) How much water is lost as part of **egestion**?

..... cm^3 **[1]**

(c) (i) Which organ in the body makes **urine**?

..... **[1]**

(ii) Sometimes this organ can stop working and needs replacing with a donated organ.

Describe ethical arguments **for** and **against** organ donations.

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..... **[2]**

[Total: 8]

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Question 5 begins on page 13

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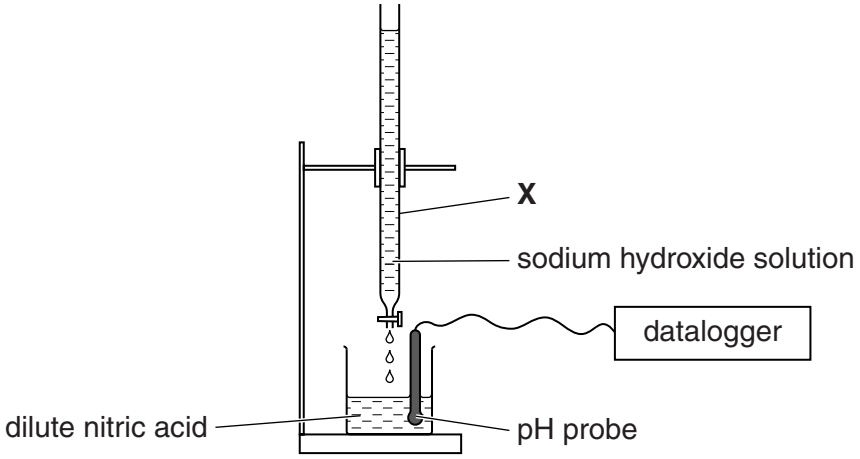
SECTION B – Module C5

5 This question is about acid-base titrations.

Terry is neutralising dilute nitric acid with sodium hydroxide solution.

Look at the diagram. It shows the apparatus he uses.



(a) What is the name of apparatus **X**?

Choose from:

burette

flask

measuring cylinder

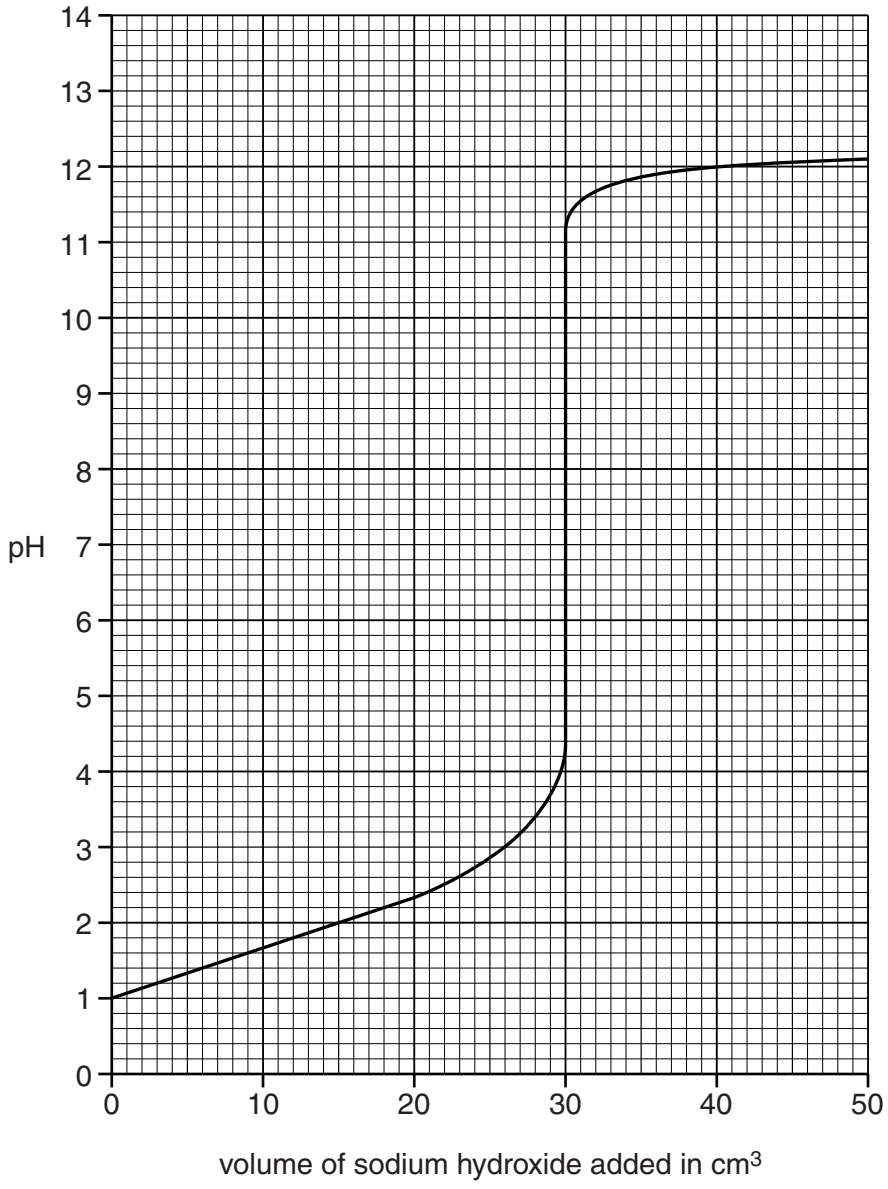
pipette

answer ..... **[1]**

(b) Terry slowly adds 50 cm^3 of sodium hydroxide solution to 25 cm^3 of dilute nitric acid.

He measures the pH of the solution in the beaker.

Look at the graph of his results.



(i) What is the pH after 15 cm^3 of sodium hydroxide solution are added?

answer ..... **[1]**

(ii) What volume of sodium hydroxide solution is needed to exactly **neutralise** the nitric acid?

answer ..... cm^3 **[1]**

(iii) Terry repeats his experiment with another sample of nitric acid.

The second sample of nitric acid is **twice as concentrated** as the first sample.

Terry still uses the same concentration of sodium hydroxide solution.

A different volume of sodium hydroxide solution is needed to exactly neutralise 25 cm^3 of the more concentrated nitric acid.

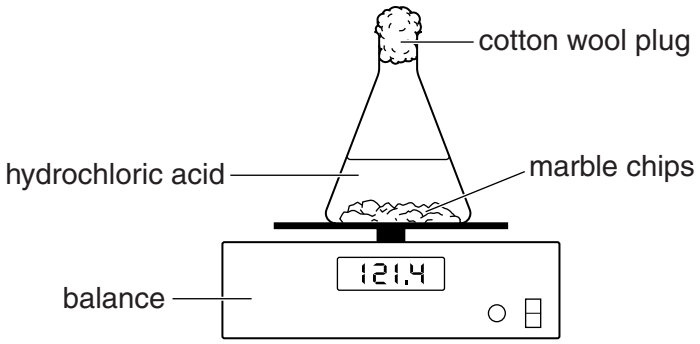
What is this volume?

answer ..... cm^3 **[1]**

[Total: 4]

6 Sue and Steve investigate the reaction between dilute hydrochloric acid and marble chips (calcium carbonate).

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



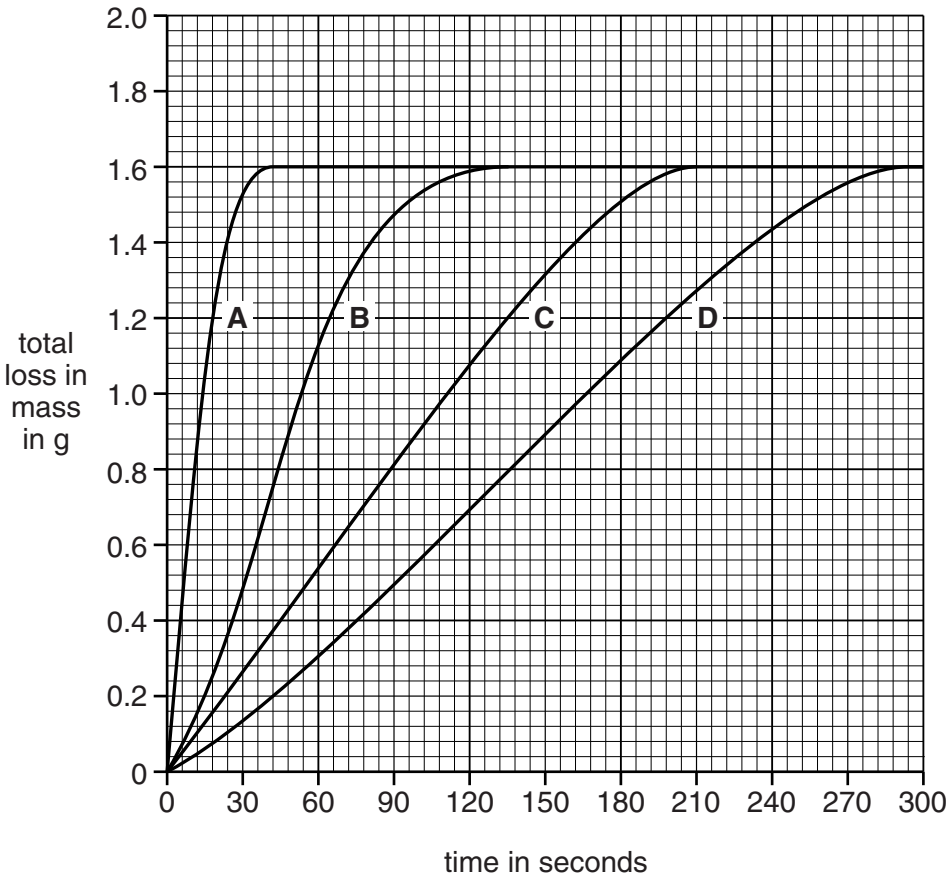
They add 50 cm^3 of dilute hydrochloric acid to 20.0 g of marble chips.

They measure the total loss in mass of the flask and its contents every 30 seconds for 5 minutes.

They do the experiment four times.

Each time they use different sized marble chips, **A**, **B**, **C**, and **D**.

The graph shows their results.



(a) Sue thinks that marble chips **D** give the fastest reaction.

Is she correct? Explain your answer.

.....

.....

..... **[2]**

(b) Hydrochloric acid is the **limiting reactant** in this reaction.

What is meant by the limiting reactant?

.....

..... **[1]**

(c) In this reaction, calcium carbonate, $CaCO_3$, reacts with hydrochloric acid, HCl.

Calcium chloride, $CaCl_2$, carbon dioxide, CO_2, and water, H_2O, are made.

Write a **balanced symbol** equation for this reaction.

..... **[2]**

(d) Scientists such as Sue and Steve have their work **peer reviewed**.

What is peer review and why is it important?

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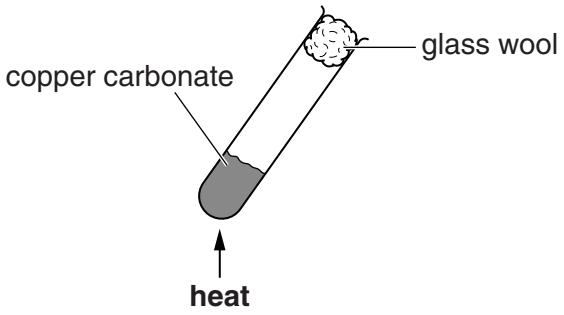
..... **[2]**

[Total: 7]

7 Zach is heating copper carbonate.



Zach finds the mass of the tube and its contents before and after heating.

Look at the equations for the reaction.

copper carbonate $\longrightarrow$ copper oxide + carbon dioxide

$CuCO_3(s) \longrightarrow CuO(s) + CO_2(g)$

(a) The mass of the test tube and its contents **decreases** when it is heated.

Explain why.

.....

..... **[1]**

(b) Zach heats 2.48 g of copper carbonate.

He makes 0.88 g of carbon dioxide.

What mass of **copper oxide** does he make?

answer ..... g **[1]**

(c) (i) The formula of copper carbonate is $CuCO_3$.

Calculate the molar mass of copper carbonate.

The relative atomic mass, A_r, of Cu is 64, of C is 12 and of O is 16.

molar mass of copper carbonate = ... g/mol **[1]**

(ii) This molar mass of copper carbonate contains 64 g of copper.

Calculate the percentage by mass of copper in copper carbonate.

Show your working.

percentage by mass of copper in copper carbonate = ... % **[1]**

[Total: 4]

8 Hydrochloric acid is a **strong** acid.

Ethanoic acid is a **weak** acid.

Mike and Jan compare the two acids.

Both acids have the **same concentration**.

Mike and Jan compare

- the pH of each acid
- the reaction of each acid with a 3 cm length of magnesium ribbon.

How are the results of their tests **similar** for both acids and how are they **different**?

Where relevant, you should write about the speed of the reactions and the products made.

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

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..... **[6]**

[Total: 6]

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Question 9 begins on page 22

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9 Ethanol is made in an industrial process.

Ethene reacts with steam to make ethanol.

$$\text{ethene} + \text{steam} \rightleftharpoons \text{ethanol}$$

The reaction is reversible.

The reaction forms an equilibrium mixture.

Look at **Table 1**.

It shows the percentage of ethanol in the mixture at:

- 100 atmospheres pressure
- different **temperatures**.

Table 1

Temperature in °C	**Percentage (%) of ethanol at 100 atmospheres**
100	78
200	54
300	22
400	17

Look at **Table 2**.

It shows the percentage of ethanol in the mixture at:

- 200 °C
- different **pressures**.

Table 2

Pressure in atmospheres	**Percentage (%) of ethanol at 200 °C**
25	30
50	44
100	54
200	63

(a) How does

- increasing the temperature
- increasing the pressure

affect the percentage of ethanol in the equilibrium mixture?

.....

.....

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..... **[2]**

(b) Look at the word equation for the reaction.

The reaction is **reversible**.

What is meant by a reversible reaction?

How can you tell the reaction is reversible from the word equation?

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..... **[2]**

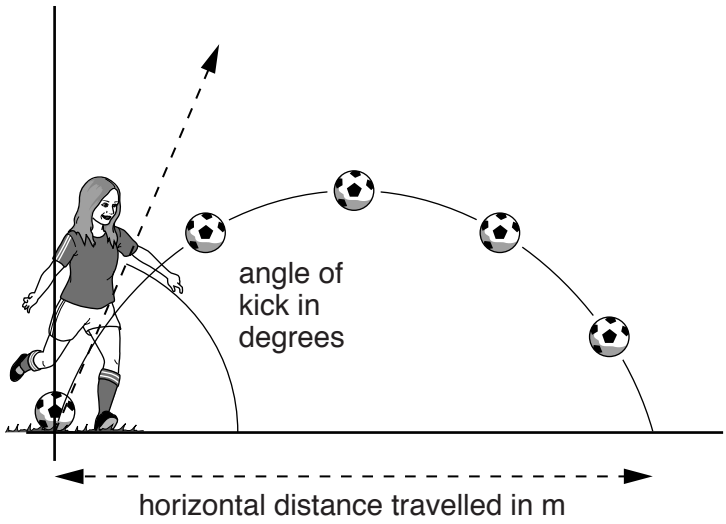
[Total: 4]

SECTION C – Module P5

10 Paola kicks a football into the air. She wants the ball to travel as far as possible.

Paola changes the angle at which she kicks the ball.

Look at the diagram.



Look at her results. They were taken on a day when there was no wind.

Speed of football in m/s	Angle of kick in degrees	Horizontal distance travelled in m
18	10	16.1
18	20	24.2
18	30	30.6
18	40	33.9
18	50	33.9
18	60	30.6
18	70	24.2
18	80	
18	90	

(a) What is the path of a projectile called?

Choose from: **altitude** **angle** **distance** **trajectory**

..... **[1]**

(b) Describe how the angle of kick affects the horizontal distance travelled.

.....

.....

..... **[2]**

(c) Paola thinks that the ball travels the **greatest** horizontal distance when she kicks it at an angle of 40 or 50 degrees.

She is not sure that her results show this.

Suggest the angle that would give the greatest horizontal distance and how she could improve her results to show this.

angle ..... degrees

.....

.....

..... **[2]**

(d) Paola did not take results for 80 or 90 degrees.

Suggest the horizontal distances travelled by the ball at these angles.

The horizontal distance travelled at 80 degrees is ..... m.

The horizontal distance travelled at 90 degrees is ..... m.

[2]

[Total: 7]

11 Samuel sees an interference pattern on a pond.

He decides to make an interference pattern in the lab.

He uses a screen, a point red light source and a barrier.

The barrier has two very small gaps (slits) which allow light to pass through them.

Look at the diagram.

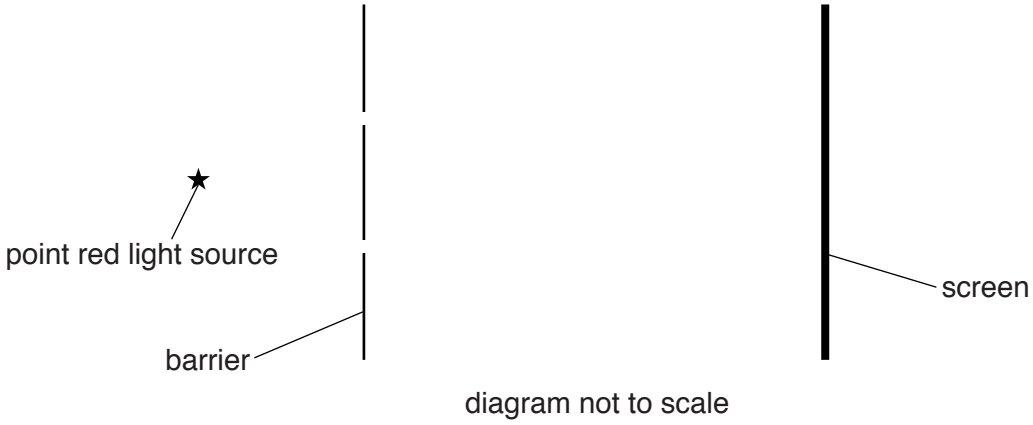


diagram not to scale

(a) The light passes through both gaps (slits).

Samuel sees an interference pattern on the screen.

Describe or draw the interference pattern he sees.

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..... **[1]**

(b) Explain how this interference pattern is produced.

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..... **[2]**

[Total: 3]

12 Jenny rides her bike and takes some measurements.

(a) Jenny accelerates steadily at 0.4 m/s^2 for 12 s. After 12 s she reaches a speed of 4.8 m/s.

Initial speed

4.8 m/s

Use this information to find her initial speed.

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.....

answer ..... m/s **[2]**

(b) Jenny continues to travel at a steady speed of 4.8 m/s but then brakes steadily and stops.

It takes her 3 s to stop.

Calculate her braking distance.

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.....

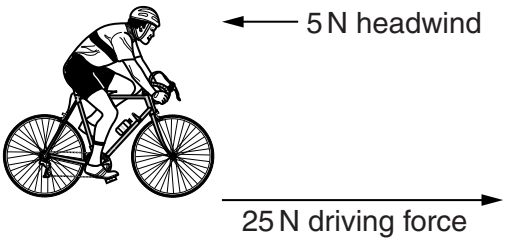
answer ..... m **[2]**

(c) Jenny then rides her bike with a driving force of 25 N.

She rides into a headwind.

This provides a resistance force of 5 N.

Look at the diagram.



Calculate the resultant force.

Choose from: **5 N** **20 N** **25 N** **30 N** **125 N**

..... **[1]**

[Total: 5]

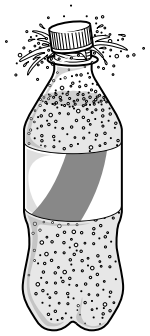
13 George takes a bottle of cold fizzy lemonade from his fridge.

He opens the bottle and a few bubbles of gas are released.

George thinks this is because of the pressure of the gas inside the bottle.

He closes the bottle and leaves it in a warm room for a few hours.

When he opens the bottle the lemonade sprays out rapidly.



Explain how the gas particles produce a pressure and explain why the lemonade sprays out rapidly when it is warmer.

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

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..... **[6]**

[Total: 6]

14 Lenses are used to produce images.

A camera uses a convex lens to produce an image.

(a) Describe the type of image formed and state where it is produced in the camera.

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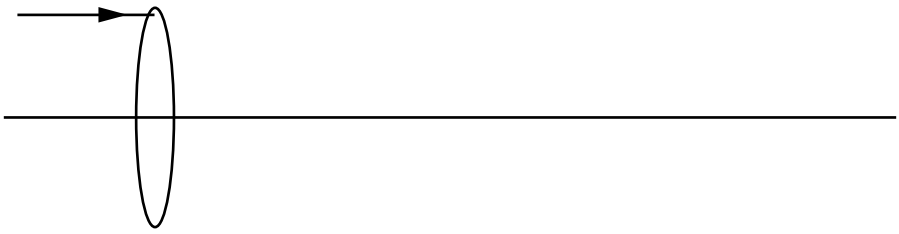
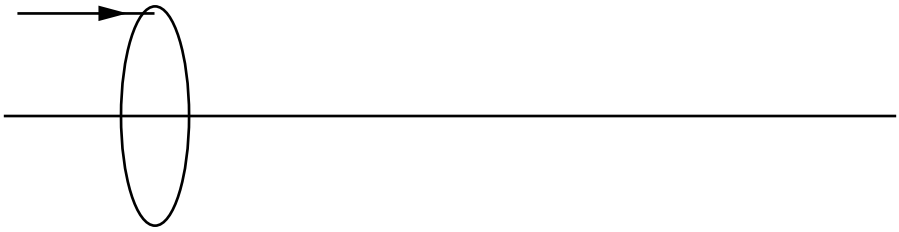
..... **[2]**

(b) Look at the diagrams.

They show rays of light hitting thin and thick convex lenses.



thin lens



thick lens

Complete both diagrams by continuing the rays as they pass through and leave the lenses. **[2]**

[Total: 4]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.