

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

3410U10-1



S19-3410U10-1

WEDNESDAY, 12 JUNE 2019 – MORNING

**CHEMISTRY – Unit 1:
Chemical Substances, Reactions and
Essential Resources**

FOUNDATION TIER

1 hour 45 minutes

ADDITIONAL MATERIALS

In addition to this examination paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page at the back of the booklet, taking care to number the question(s) correctly.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	7	
2.	7	
3.	8	
4.	6	
5.	6	
6.	6	
7.	10	
8.	10	
9.	7	
10.	7	
11.	6	
Total	80	

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INFORMATION FOR CANDIDATES

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

Question 7(a) is a quality of extended response (QER) question where your writing skills will be assessed.

The Periodic Table is printed on the back cover of this paper and the formulae for some common ions on the inside of the back cover.

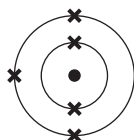


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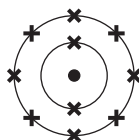
Answer all questions.

1. (a) The diagrams show the atoms of four elements, **A-D**.

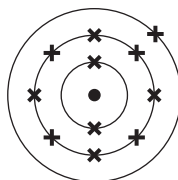
These letters are **not** the chemical symbols for the elements.



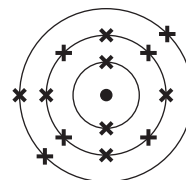
A



B



C



D

- (i) Use the letters **A-D** to complete the following sentences.

Two atoms found in the same group are and

The atom found in Group 1 is

[2]

- (ii) I Give the electronic structure of atom **B**.

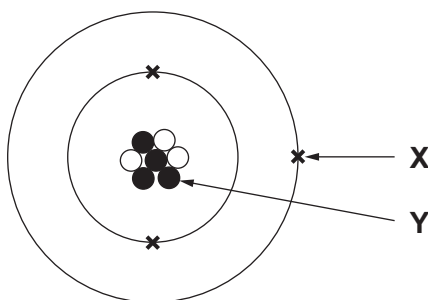
[1]

II Give the atomic number of atom **B**.

[1]



(b) The following diagram shows an atom of lithium.



(i) Complete the following sentences.

[2]

Particle **X** is an

Particle **Y** found in the nucleus is a

(ii) Use the diagram to explain why lithium has a mass number of 7.

[1]

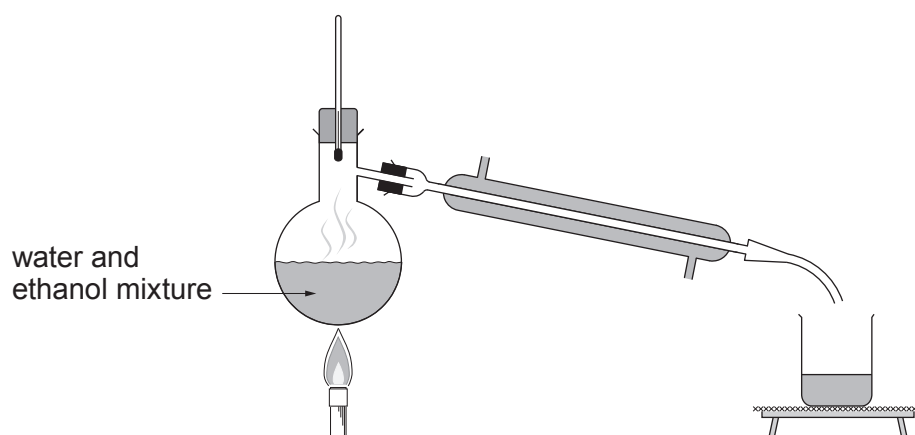
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7



2. (a) A teacher carried out an experiment to show how to separate a mixture of ethanol and water.



- (i) Choose from the box the name of the method used.

[1]

chromatography	filtration	distillation	evaporation
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Method

- (ii) The following sentences show the steps involved in this method of separation.

- A** Ethanol vapour cools and condenses
- B** Ethanol boils and evaporates
- C** The mixture of water and ethanol is heated
- D** Ethanol is collected

Put the steps in the correct order. Use the letters **A-D**.

[1]

.....

- (iii) Tick (✓) the box below that explains why it is the water that is left in the flask.

[1]

the boiling point of ethanol is equal to the boiling point of water

☐

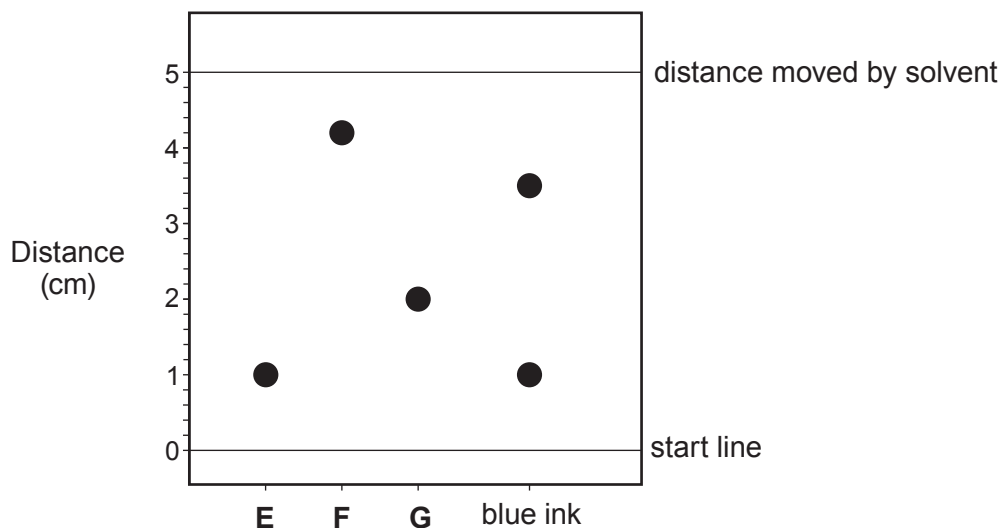
the boiling point of ethanol is lower than the boiling point of water

☐

the boiling point of ethanol is higher than the boiling point of water

☐


- (b) A student carried out an investigation to find out whether pigments **E**, **F** and **G** are present in a blue felt pen. The results are shown below.



- (i) State what the results tell you about the blue ink.

[2]

.....

.....

- (ii) Calculate the R_f value of pigment **F** using the equation given.

[2]

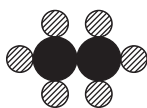
$$R_f = \frac{\text{distance moved by pigment}}{\text{distance moved by solvent}}$$

$$R_f = \dots\dots\dots$$

7



3. (a) The diagrams represent five substances, **A-E**.

**A****B****C****D****E**

Key carbon hydrogen oxygen

(i) State which diagram, **A-E**, represents an element. Give a reason for your answer. [2]

Element

Reason

(ii) State which diagram, **A-E**, represents carbon dioxide, CO_2 . [1]

.....

(iii) Give the formula of the substance represented by diagram **C**. [1]

.....

(b) When copper(II) sulfate solution reacts with sodium hydroxide, it forms copper(II) hydroxide, $\text{Cu}(\text{OH})_2$, and sodium sulfate, Na_2SO_4 .

(i) Write a **word** equation for the reaction taking place. [1]

(ii) Give the number of atoms of sulfur found in the formula Na_2SO_4 . [1]

.....

(iii) Give the **total** number of atoms in the formula $\text{Cu}(\text{OH})_2$. [1]

.....

(c) Iron(III) sulfate reacts with sodium hydroxide to produce iron(III) hydroxide.

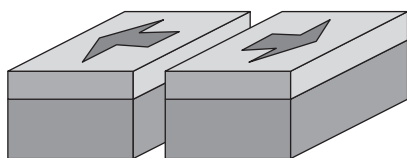
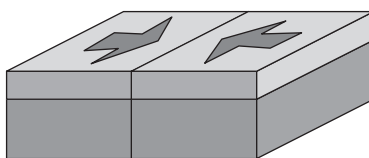
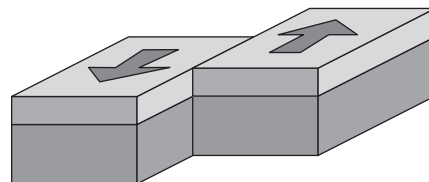
Write the formula of iron(III) hydroxide. [1]

.....



4. The surface of the Earth is divided into a number of tectonic plates. These plates are constantly moving.

Plate boundaries can be classified according to the direction of movement of the plates. The three main types of boundary are shown below.

**A****B****C****conservative****destructive****constructive**

- (a) Choose the name of each type of boundary from the box.

[2]

A

B

C

- (b) Describe what happens as a result of the movement shown at boundary **A**.

[2]

.....

.....

.....

- (c) Explain what happens at boundary **C** as a result of the plate movement shown.

[2]

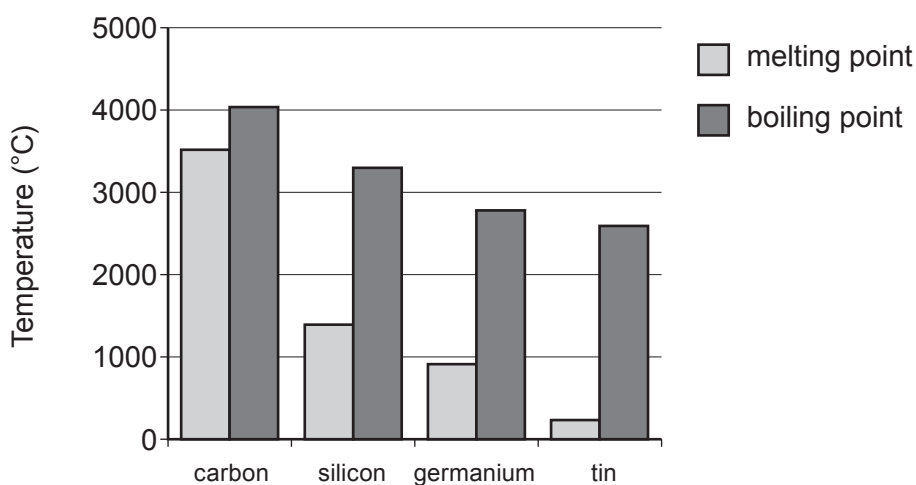
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5. (a) The chart below shows the melting points and boiling points of some Group 4 elements.



- (i) Describe the trend in melting point going down Group 4. [1]

- (ii) Name the element which has the greatest **difference** between its melting point and boiling point. [1]

.....

- (b) (i) Name an element in Group 4 that is considered to be a semi-metal (metalloid). [1]

.....

- (ii) Tick (✓) the box below that describes where semi-metals are found in the Periodic Table. [1]

some are found in all groups

☐

they are all found in Group 4

☐

some are found in Group 1 and Group 2

☐

they are all found between metals and non-metals

☐


(c) Carbon is the main element found in coal. When carbon burns it forms carbon dioxide.

(i) Write a **word** equation to show the reaction taking place. [1]

(ii) Name **one** environmental problem caused by increased levels of carbon dioxide in the atmosphere. [1]

6

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6. This question is about the development of the Periodic Table.

In 1890, not all the elements had been discovered. A Russian scientist named Dmitri Mendeleev used the reactions of the known elements and their relative atomic masses to arrange them in the following table.

I	II	III	IV	V	VI	VII			
H 1.01									
Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0			
Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5			
K 39.1	Ca 40.1		Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7
Cu 63.5	Zn 65.4			As 74.9	Se 79.0	Br 79.9			
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9		Ru 101	Rh 103	Pd 106
Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127			
Ce 133	Ba 137	La 139		Ta 181	W 184		Os 194	Ir 192	Pt 195
Au 197	Hg 201	Tl 204	Pb 207	Bi 209					
			Th 232		U 238				

Mendeleev's table

Based on the properties of the known elements, he predicted that new elements would be discovered and left gaps for these in his table. He even predicted what the properties of these undiscovered elements would be. He gave the name *ekasilicon* to one of them. The element that fits into this gap was eventually discovered and named *germanium*.

	Predicted properties of ekasilicon (Ek)	Actual properties of germanium (Ge)
Atomic mass	72	72.59
Density (g/cm ³)	5.5	5.35
Melting point	high	937.4 °C
Colour of metal	grey	grey-white
Formula of oxide	EkO ₂	GeO ₂
Formula of chloride	EkCl ₄	GeCl ₄

Comparison of the properties of ekasilicon and germanium

The modern day Periodic Table is based on Mendeleev's original table.



- (a) (i) Put a tick (✓) in the correct column to show whether the following statements apply to Mendeleev's table only, today's table only or to both tables. [2]

	Mendeleev only	Today only	Both tables
the table is organised into groups			
copper and potassium are in the same group			
there are gaps in the table			
fluorine and chlorine are in the same group			

- (ii) Tick (✓) the **two** statements that **best** describe why germanium was confirmed to be the element ekasilicon predicted by Mendeleev. [1]

germanium has exactly the same atomic mass as that predicted for ekasilicon

☐

germanium has a different colour to that predicted for ekasilicon

☐

germanium has a similar density to that predicted for ekasilicon

☐

germanium oxide has the same ratio of atoms as that predicted for ekasilicon oxide

☐

germanium oxide and germanium chloride have the same ratio of atoms

☐


- (b) (i) Calculate the percentage of oxygen present in the formula of germanium oxide, GeO_2 . [2]

$$A_r(\text{Ge}) = 73$$

$$A_r(\text{O}) = 16$$

Percentage = %

- (ii) When germanium oxide reacts with hydrochloric acid it produces germanium chloride and water.

Balance the following equation for the reaction that takes place. [1]



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- State the main stages involved in the treatment of the public water supply. Describe the purpose of each stage. [6 QER]



- (b) Fluoride is sometimes added to water supplies.

State why fluoride is added and give **one** reason why some people oppose the addition of fluoride to water. [2]

Reason for adding fluoride

.....

.....

Reason why some people oppose its addition

.....

.....

- (c) This advert was published to encourage people to save water by taking a shower instead of a bath.

To
Shower
or to
Bathe?

A shower for
8 minutes
uses 76 litres



A full bath
uses 160 litres

Use the data in the advert to calculate the percentage of water **saved** by taking a shower for 8 minutes rather than running a full bath. [2]

Percentage of water saved = %

10



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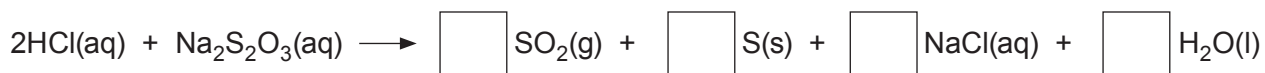
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8. (a) A student was investigating how the concentration of sodium thiosulfate solution affects its reaction with hydrochloric acid.

- (i) The reaction taking place can be represented by the following equation, which is **not** balanced.

Write the number **2** in **one of the boxes** on the right hand side in order to balance the equation. [1]



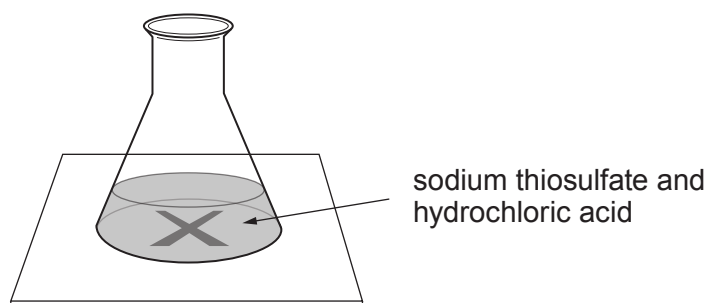
- (ii) During the reaction, the solution becomes cloudy due to the formation of a precipitate. State the meaning of the term *precipitate*. [1]

.....

.....



(iii) The time taken for the cross to disappear was measured as shown below.



The results are shown in the table.

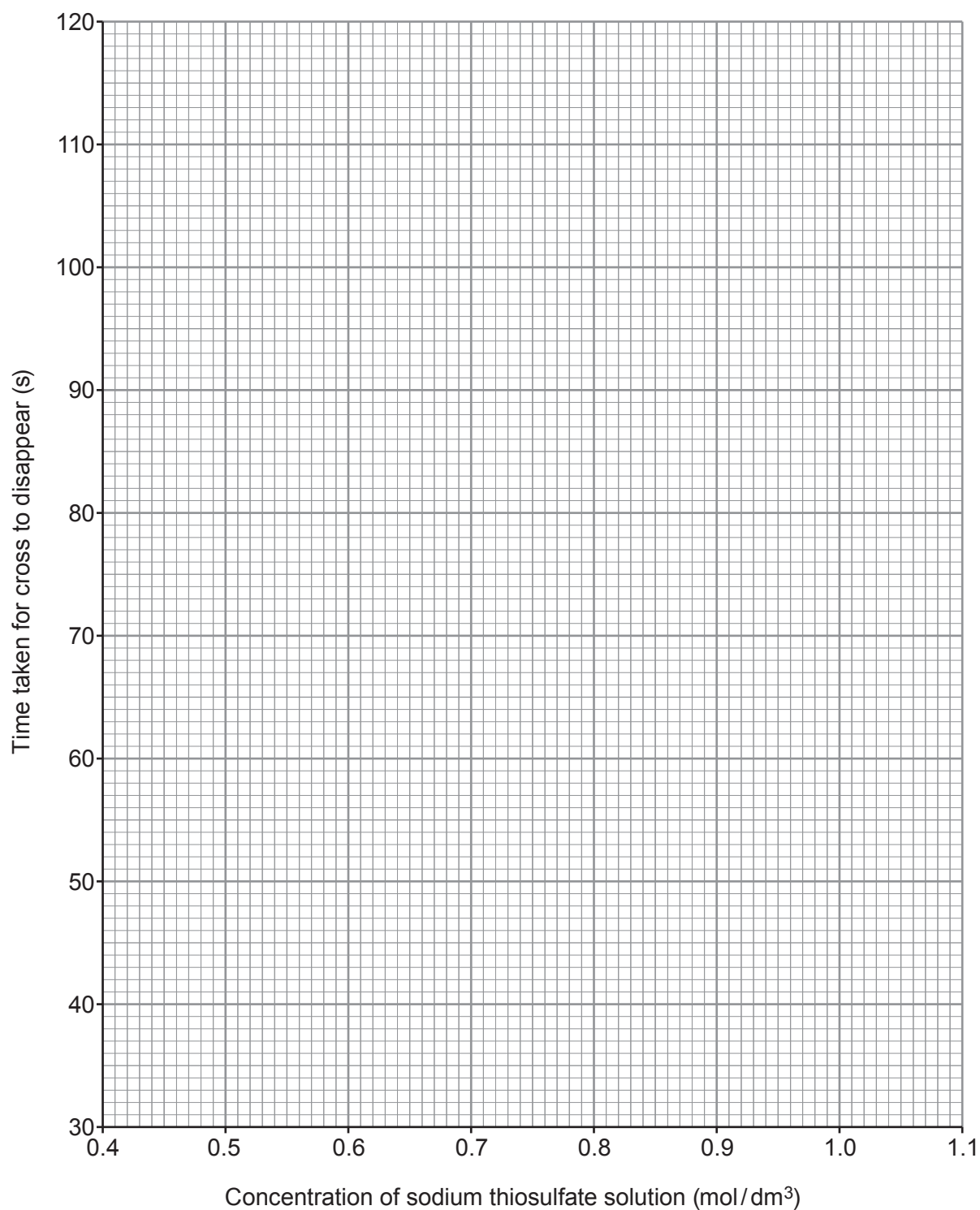
Concentration of sodium thiosulfate solution (mol/dm^3)	Time taken for cross to disappear (s)
1.0	42
0.9	46
0.8	53
0.7	66
0.6	87
0.5	110



Plot the results from the table on the grid. Draw a suitable line.

[3]

Examiner
only



- (iv) State how concentration affects the **time taken** for the cross to disappear. [1]

.....

.....

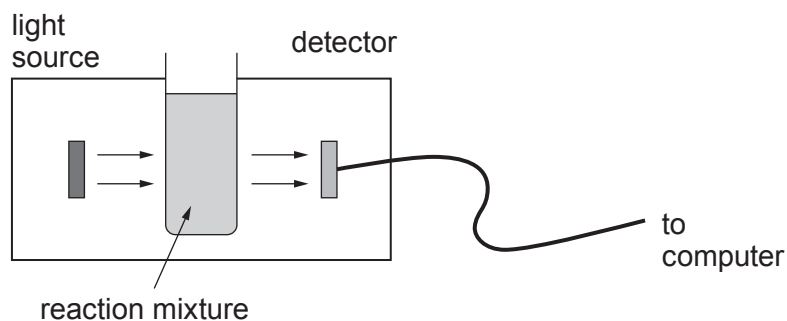
- (v) What conclusion can be drawn about the effect of concentration on the **rate** of this reaction? [1]

.....

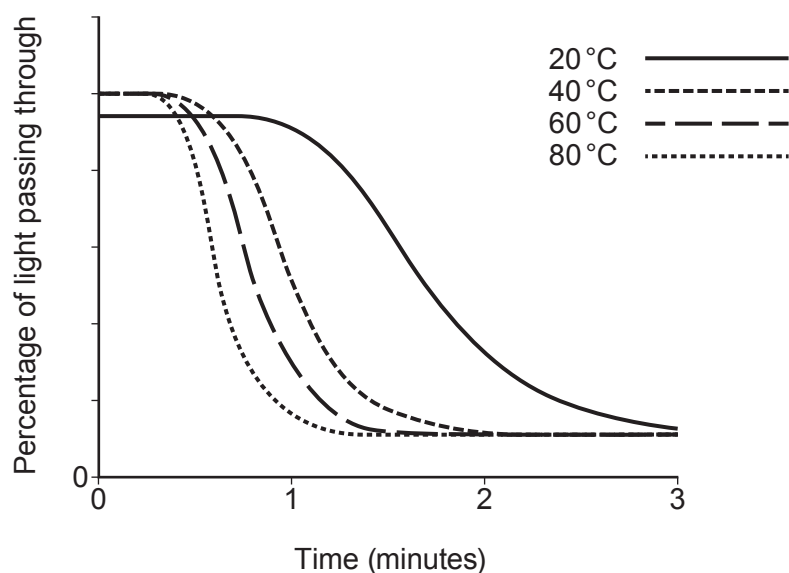
.....



- (b) A second student used a light sensor to investigate the effect of temperature on the rate of this reaction.



He obtained the following results.



- (i) Give **one** conclusion that can be drawn from these results. State how this is shown by the graph. [2]

.....

.....

.....

- (ii) Slightly less light passed through the tube at the start of the experiment at 20 °C than in the others. Suggest a possible practical reason for this. [1]

.....

.....



9. (a) The following table shows some information about Group 1 elements.

Metal	Melting point (°C)	Boiling point (°C)	Density (g/cm ³)	Reaction with chlorine
lithium	180	1342	0.54	reacts slowly to make a white salt
sodium	97	883	0.97	burns vigorously with a yellow flame to make a white salt
potassium	63	759	0.88	reacts violently to make a white salt
rubidium	39	688	1.53	explosive reaction
caesium	28	671	1.93	explosive reaction

- (i) Describe the trend in density going down the group.

[1]

.....

- (ii) Explain the difference in reactivity down the group in terms of electronic structure.

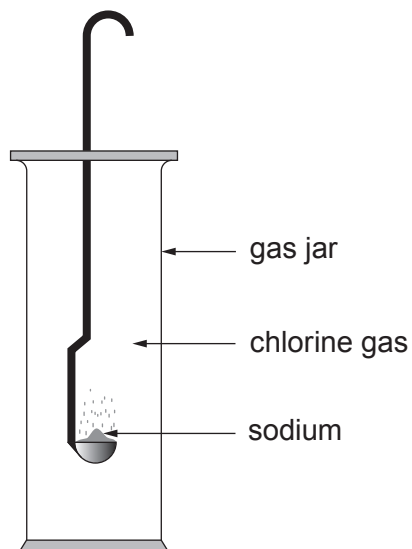
[2]

.....

.....



- (b) The apparatus below can be used to demonstrate the reaction between sodium and chlorine.



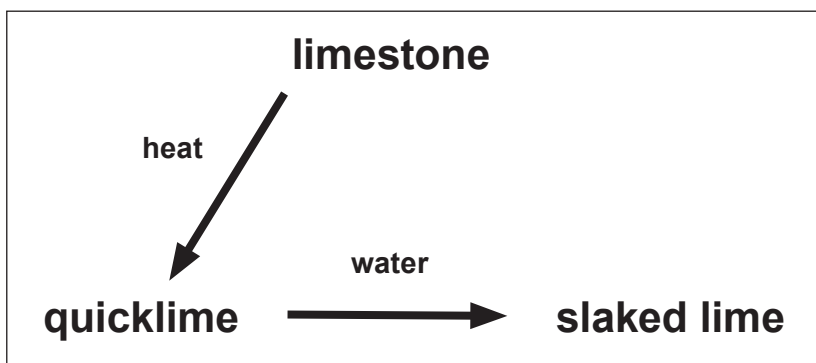
- (i) Apart from the use of safety goggles, state **one** safety precaution that needs to be followed when using **each** of these elements. [2]

Element	Safety precaution
sodium	
chlorine	

- (ii) Complete and balance the symbol equation for the reaction that takes place between sodium and chlorine. [2]



10. The following diagram shows how limestone, CaCO_3 , can be converted into useful products.



- (a) When a piece of limestone is heated strongly its mass decreases.

State the type of reaction taking place.

[1]

.....

- (b) (i) Describe what is **seen** when limestone is heated and converted into quicklime. [1]

.....

- (ii) Write a balanced symbol equation for the reaction taking place.

[2]

.....

- (c) (i) Describe what is observed when quicklime is converted into slaked lime. [1]

.....

- (ii) Write a balanced symbol equation for the reaction taking place.

[2]

.....



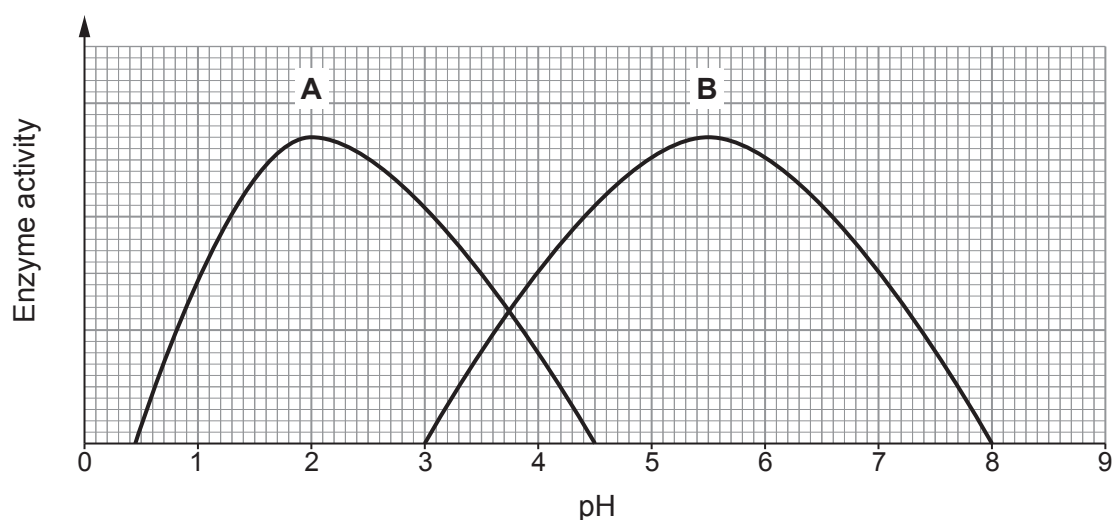
11. (a) Enzymes are biological catalysts. State what is meant by the term *catalyst*. [2]

.....

.....

.....

- (b) The following graphs show how the activity of two enzymes, **A** and **B**, varies with pH.



- (i) Use the graphs to compare the activities of the two enzymes. [2]

.....

.....

.....

- (ii) Enzyme **C** is found in saliva. It works between pH 5 and pH 9 but is best at a neutral pH. **Sketch on the grid above** how the activity varies with pH. [2]

END OF PAPER



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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	Formula	Name	Formula
aluminium	Al^{3+}	bromide	Br^-
ammonium	NH_4^+	carbonate	CO_3^{2-}
barium	Ba^{2+}	chloride	Cl^-
calcium	Ca^{2+}	fluoride	F^-
copper(II)	Cu^{2+}	hydroxide	OH^-
hydrogen	H^+	iodide	I^-
iron(II)	Fe^{2+}	nitrate	NO_3^-
iron(III)	Fe^{3+}	oxide	O^{2-}
lithium	Li^+	sulfate	SO_4^{2-}
magnesium	Mg^{2+}		
nickel	Ni^{2+}		
potassium	K^+		
silver	Ag^+		
sodium	Na^+		
zinc	Zn^{2+}		





2
1



4

5

9

1

0

Key

A_r	Symbol	Name	Z
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ame — atomic number