

Name: ()

Class:



WOODLANDS SECONDARY SCHOOL PRELIMINARY EXAMINATIONS 2023

Level: Secondary Four Normal (Academic) Marks: 30
 Subject: Science (Chemistry) Day: Wednesday
 Paper: 5105/04 and 5107/04 Date: 2 August 2023
 Duration: 1 hour 15 minutes (Papers 3 and 4) Time: 1145 – 1300

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work that you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions in Section A and any **two** questions in Section B.

The use of an approved scientific calculator is expected, where appropriate.

In calculations, you should show all the steps in your working, giving your answer in each stage.

You are advised to spend no longer than 30 minutes on Paper 3.

You may proceed to answer Paper 4 as soon as you have completed Paper 3.

A copy of the Periodic Table is printed on page **12**.

At the end of the examination hand in your answers to Paper 3 and Paper 4 separately.

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

FOR EXAMINER'S USE				
Paper 3	Paper 4			Total
/20	Section A	/14	/30	/50
	Section B	/16		

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

This document consists of **11** printed pages and **1** blank page.

Section A

Answer **all** questions in this section in the spaces provided.

- 1** The following table shows some substances, with their chemical formulae.

substance	chemical formula
ammonia	NH_3
hydrogen	H_2
potassium hydroxide	KOH
propane	C_3H_8
propene	C_3H_6
sulfuric acid	H_2SO_4

From the table, identify one substance which

- (a) decolourises reddish-brown aqueous bromine,
 [1]
- (b) extinguishes the flame on a lighted splint with a 'pop' sound,
 [1]
- (c) reacts with ammonium sulfate to produce ammonia gas,
 [1]
- (d) turns Universal Indicator red.
 [1]

NORMAL (ACADEMIC)

NORMAL (ACADEMIC)

NORMAL (ACADEMIC)

- 2 (a) Name the homologous series whose members undergo substitution reaction, and give the general formula for its members.

homologous series: [1]

general formula: [1]

- (b) State the name of the **third** member of the homologous series in part (a). Calculate its relative molecular mass and draw its structural formula.

name of third member: [1]

relative molecular mass, M_r =

[1]

structural formula:

[1]

- (c) For the substance you named in part (b), write a balanced chemical equation for its combustion reaction with oxygen. State symbols are not required.

..... [1]

- 3 (a) Complete the following table.

atom	nucleon number	proton number	number of protons	number of electrons	number of neutrons
magnesium	24		12		
fluorine		9			10

[2]

- (b) Draw a 'dot and cross' diagram to show the bonding in the compound formed by magnesium and fluorine. Show **only** the outermost shell electrons.

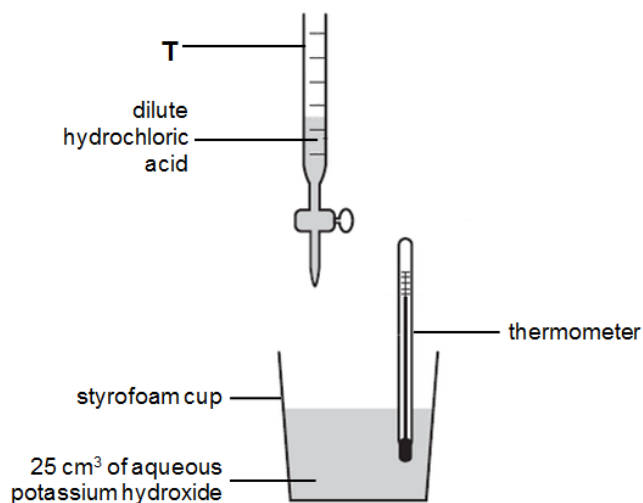
[2]

NORMAL (ACADEMIC)**NORMAL (ACADEMIC)****NORMAL (ACADEMIC)****BLANK PAGE**

Section B

Answer any **two** questions in this section in the spaces provided.

- 4 A student sets up the apparatus as shown below.



Hydrochloric acid was added 5 cm^3 at a time to the beaker of aqueous potassium hydroxide. This was continued until 35.00 cm^3 of acid had been added. The mixture was stirred and the temperature taken after the addition of each 5 cm^3 of acid. The results obtained are shown below.

volume of acid / cm^3	temperature of mixture / $^{\circ}\text{C}$
0.00	20
5.00	26
10.00	31
15.00	35
20.00	38
25.00	32
30.00	25
35.00	21

- (a) Name the piece of apparatus labelled T.

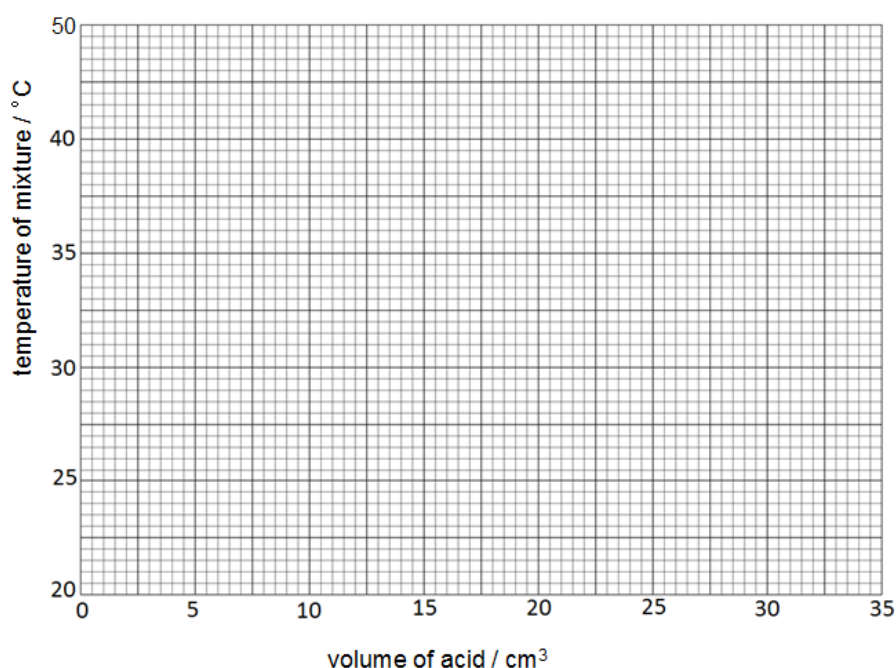
..... [1]

NORMAL (ACADEMIC)

NORMAL (ACADEMIC)

NORMAL (ACADEMIC)

- (b) (i) On the grid below, plot the values of temperature (y-axis) against the volume of acid (x-axis). Mark each point with a cross (x).
- (ii) Draw a best-fit straight line for the first four points and another best-fit straight line for the next four points. Extend the lines so that they intersect (cross) with each other.

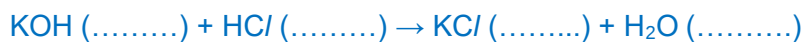


[2]

From the graph above, state the highest temperature that the mixture will be able to reach.

[1]

- (c) The product of the reaction between hydrochloric acid and potassium hydroxide is potassium chloride and water. The chemical equation represents the reaction.



- (i) Include the correct state symbols in the chemical equation above. [1]

- (ii) Write an ionic equation for the reaction.

[1]

- (d) Name the type of oxides that can react with both acids and alkalis.
Give the chemical formula of one such oxide.

Type of oxide: [1]

Chemical formula: [1]

5 (a) Xebium, X, is a newly discovered element. It has the properties listed below:

- *It is a solid at room temperature.*
- *It can be cut easily by a steel knife.*
- *It reacts explosively with cold water to form a colourless gas.*
- *It is also a good conductor of electricity.*

(i) In which Group of the Periodic Table would you expect to find Xebium?

..... [1]

(ii) State how you would store a sample of Xebium.

..... [1]

(iii) Write a balanced chemical equation for the reaction of Xebium with cold water. State symbols are not required.

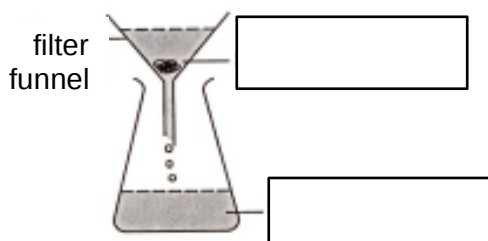
..... [1]

(b) (i) Silver chloride is an insoluble salt that can be prepared by precipitation reaction between silver nitrate solution and sodium chloride solution.

The diagram below shows how silver chloride can be separated from the mixture.

Label the “residue” and the “filtrate” in the diagram below.

State the name of the separation method.



Name of method: [2]

(ii) Explain why solid silver chloride cannot conduct electricity at room temperature and pressure.

..... [1]

NORMAL (ACADEMIC)

NORMAL (ACADEMIC)

NORMAL (ACADEMIC)

- (iii) Describe the changes in movement and arrangement of the ions in silver chloride when it changes from solid state to liquid state.

.....

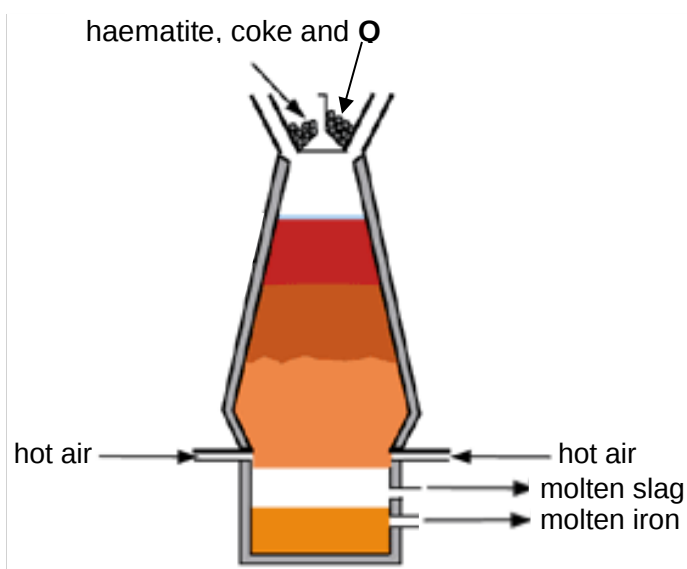
.....

.....

.....

..... [2]

- 6 The diagram shows a blast furnace for the extraction of iron.



- (a) (i) Name reactant Q.

..... [1]

- (ii) Explain why Q is added to the blast furnace.

..... [1]

- (b) (i) The iron produced by the blast furnace is converted into alloys. Explain what is meant by the term *alloy*.

..... [1]

- (ii) Name an example of an alloy that can be used to manufacture road railings instead of iron to prevent rusting.



..... [1]

- (iii) Over time, these iron road railings rust quickly. Painting these road railings help to prevent rusting. Explain how this method works.

.....

.....

..... [2]

- (c) Table 6.1 shows the reactions of copper, iron and zinc metals with copper(II) sulfate and iron (II) sulfate salt solutions.

aqueous salt	colour of solution	colour of solution after the addition of metal		
		copper	iron	zinc
copper (II) sulfate	blue	blue	green	colourless
iron (II) sulfate	green	green	green	

Table 6.1

- (i) Arrange copper, iron and zinc metals according to their reactivity. Write the **least reactive** element first.

..... [1]

- (ii) Complete Table 6.1 by stating the colour of the solution after the addition of zinc to iron (II) sulfate. [1]

~End of Paper~

Group														
I	II	Key					III	IV	V	VI	VII	0		
		atomic number atomic symbol name relative atomic mass					1 H hydrogen 1							
3 Li lithium 7	4 Be beryllium 9						5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20		
11 Na sodium	12 Mg magnesium						13 Al aluminium	14 Si silicon	15 P phosphorus	16 S sulfur	17 Cl chlorine	18 Ar argon		
19 K potassium	20 Ca calcium	21 Sc scandium	22 Ti titanium	23 V vanadium	24 Cr chromium	25 Mn manganese	26 Fe iron	27 Co cobalt	28 Ni nickel	29 Cu copper	30 Zn zinc	31 Ga gallium		
37 Rb rubidium	38 Sr strontium	39 Y yttrium	40 Zr zirconium	41 Nb niobium	42 Mo molybdenum	43 Tc technetium	44 Ru ruthenium	45 Rh rhodium	46 Pd palladium	47 Ag silver	48 Cd cadmium	49 In indium		
55 Cs caesium	56 Ba barium	57–71 lanthanoids		72 Ta tantalum	73 W tungsten	74 Re rhenium	75 Os osmium	76 Ir iridium	77 Pt platinum	78 Au gold	79 Hg mercury	80 Tl thallium		
87 Fr francium	88 Ra radium	89–103 actinoids		104 Rf rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium	111 Rg roentgenium	112 Cn copernicium		
								114 Fl flerovium	115 Mc moscovium	116 Lv livermorium	117 Ts tennessine	118 Og oganesson		
lanthanoids														
		57 La lanthanum	58 Ce cerium	59 Pr praseodymium	60 Nd neodymium	61 Pm promethium	62 Sm samarium	63 Eu europium	64 Gd gadolinium	65 Tb terbium	66 Dy dysprosium	67 Ho holmium		
		89 Ac actinium	90 Th thorium	91 Pa protactinium	92 U uranium	93 Np neptunium	94 Pu plutonium	95 Am americium	96 Cm curium	97 Bk berkelium	98 Cf californium	99 Es einsteinium		
												101 Md mendelevium	102 No nobelium	103 Lr lawrencium

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.)