Name: ..... ( ) Class: .....

WOODLANDS SECONDARY SCHOOL
PRELIMINARY EXAMINATIONS 2023

Level:	Secondary Four Normal (Academic)	Marks:	20
Subject:	Science (Chemistry)	Day:	Wednesday
Paper:	5105/03 and 5107/03	Date:	2 August 2023
Duration:	1 hour 15 minutes (Papers 3 and 4)	Time:	1145 – 1300

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided.

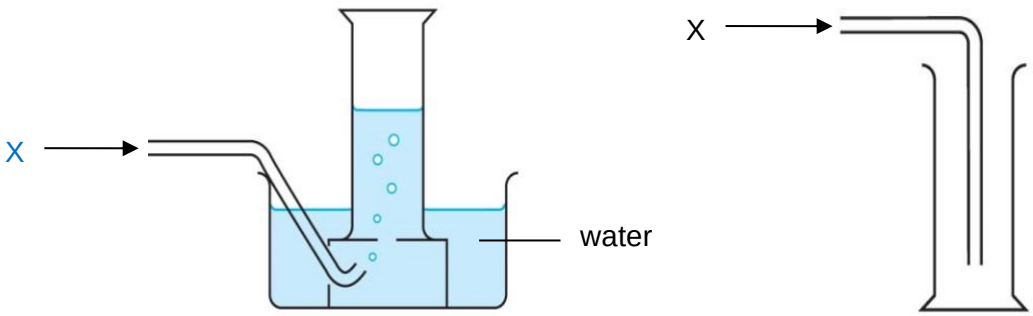
There are **twenty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Answers to Paper 3 and Paper 4 must be handed in separately.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
You are advised to spend no more than **30** minutes on **Paper 3**.
You may proceed to answer Paper 4 as soon as you have completed Paper 3.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page **12**.
The use of an approved scientific calculator is expected, where appropriate.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.
This document consists of **11** printed pages and **1** blank page.

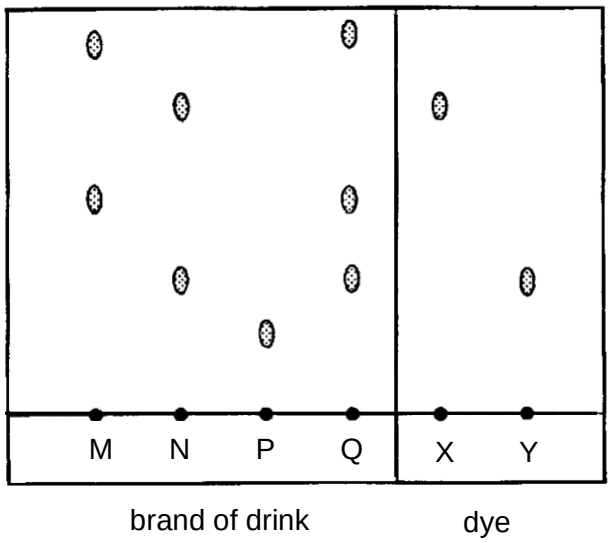
1 Two methods of collecting gas X are shown.



What can you infer about the properties of X?

	solubility of X in water	density of X
A	high	higher than air
B	high	lower than air
C	low	higher than air
D	low	lower than air

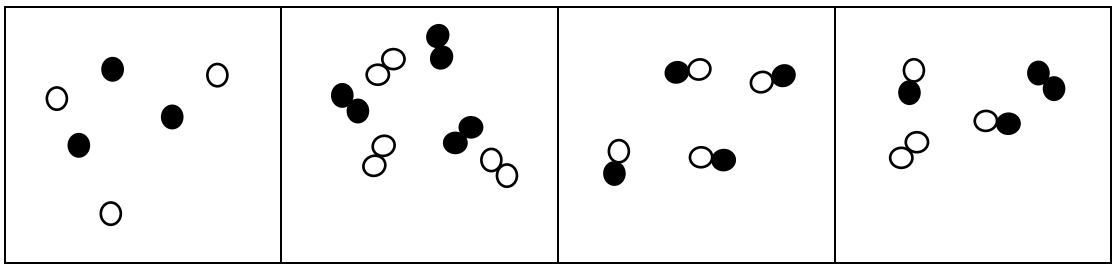
2 The diagram shows a paper chromatogram.



Which brand of drink is made by mixing dyes X and Y?

A M
B N
C P
D Q

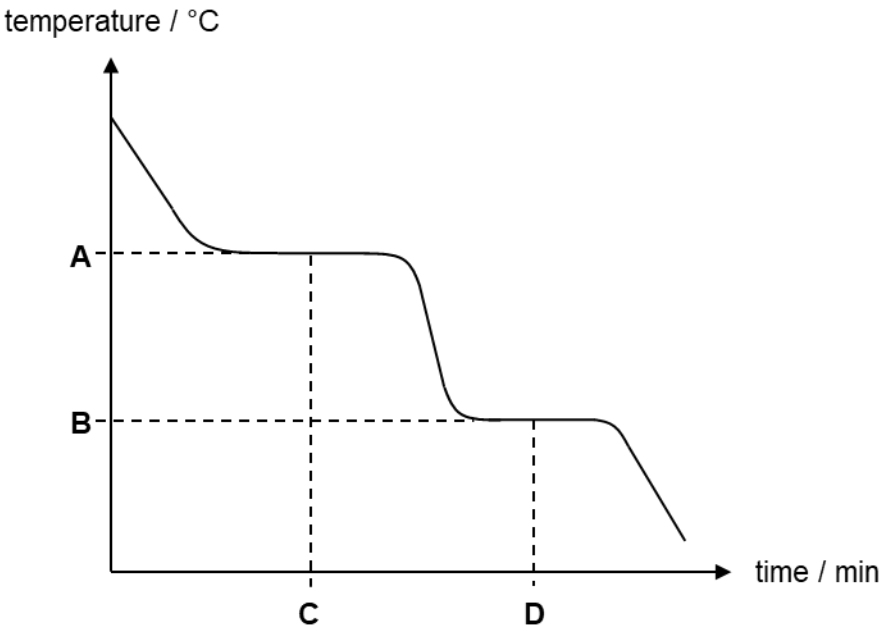
3 Which diagram represents a mixture of hydrogen chloride gas, hydrogen gas and chlorine gas?



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

4 A gaseous substance was allowed to cool. The graph of its temperature against time is shown.

Which letter denotes the boiling point of the substance?



5 The table gives information about four atoms E, F, G and H.

atom	number of protons	number of neutrons
E	10	10
F	10	12
G	12	12
H	14	10

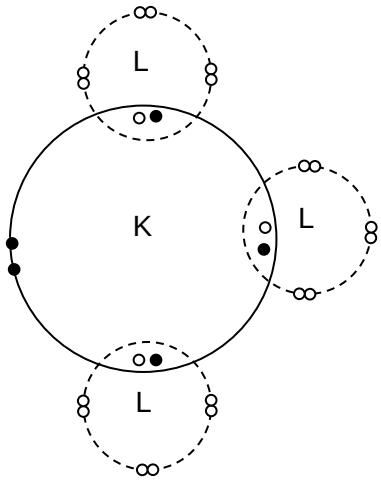
Which two atoms are isotopes of each other?

A E and F
B E and H
C F and G
D G and H

6 Which of the following particles does **not** have the same number of electrons as a neon atom?

A $^{24}_{12}Mg$
B $^{14}_{7}N^{3-}$
C $^{23}_{11}Na^{+}$
D $^{16}_{8}O^{2-}$

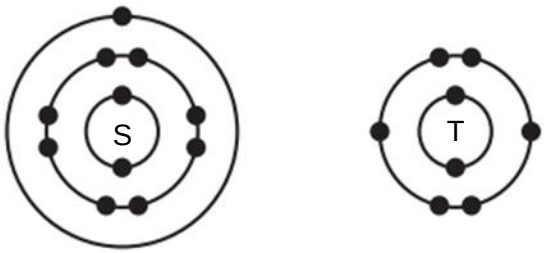
7 The diagram below shows the electron arrangement in compound KL_3.



Which elements could be K and L?

	K	L
A	sodium	sulfur
B	aluminium	nitrogen
C	phosphorus	fluorine
D	sulfur	nitrogen

8 The electronic structures of atoms S and T are shown below.



Which row describes the physical properties of the compound formed between S and T correctly?

	melting point / °C	electrical conductivity	
		solid state	aqueous state
A	-113	no	no
B	180	no	yes
C	801	no	yes
D	1132	yes	yes

9 How many moles of argon are there in 20 g of argon?
[relative atomic mass of Ar: 40]

A 0.5 mol
B 2 mol
C 20 mol
D 800 mol

10 The formula of a chloride of strontium is $SrCl_2$.

What is the formula of the strontium oxide?

A SrO

B SrO_2

C Sr_2O

D Sr_2O_3

11 When compound U is added to zinc strip, hydrogen gas is produced.

When compound V is added to sodium carbonate, a gas that forms a white precipitate with limewater is produced.

What are U and V?

	U	V
A	acid	acid
B	acid	alkali
C	alkali	acid
D	alkali	alkali

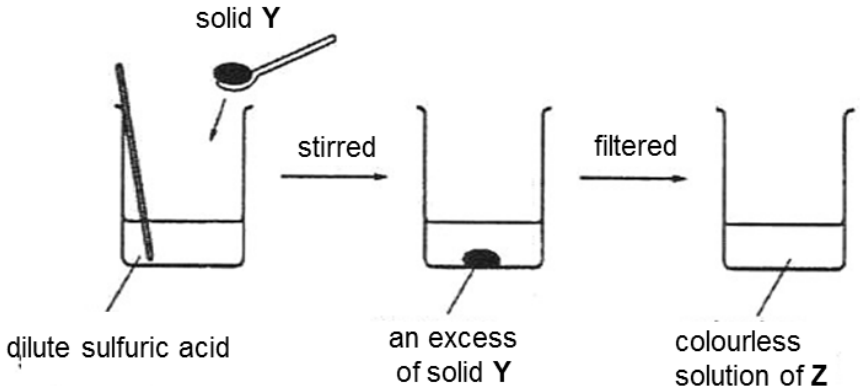
12 The table below shows the colours of methyl orange and phenolphthalein at different pH ranges.

methyl orange			phenolpthalein		
pH range	1 to 4	4.1 to 14	pH range	1 to 10	10.1 to 14
colour	red	yellow	colour	colourless	pink

What would be the colour of each indicator in pure water?

	methyl orange	phenolpthalein
A	red	colourless
B	red	pink
C	yellow	colourless
D	yellow	pink

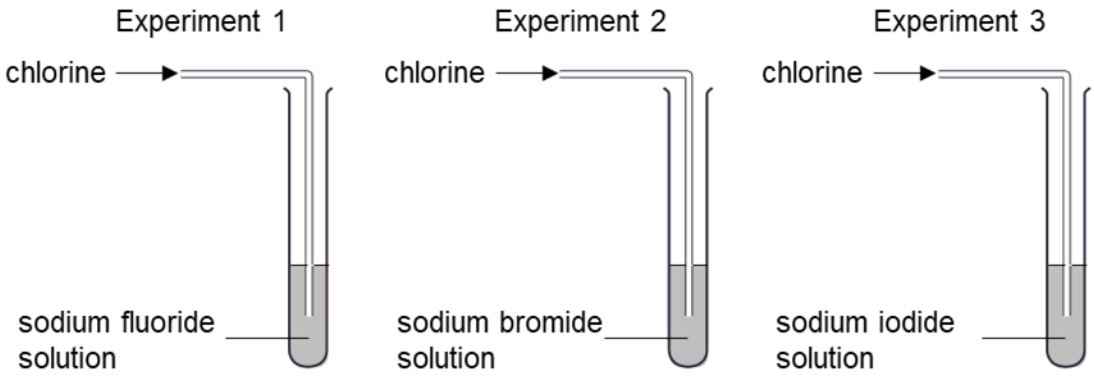
13 The diagrams below show how a colourless solution of Z is produced from the reaction between dilute sulfuric acid and a solid Y.



What are Y and Z?

	Y	Z
A	barium nitrate	barium sulfate
B	calcium chloride	calcium sulfate
C	copper	copper(II) sulfate
D	magnesium carbonate	magnesium sulfate

14 In three experiments, chlorine gas was bubbled into different solutions.



In which experiment(s) will a displacement reaction **not** occur?

A 1 only

B 3 only

C 1 and 2

D 2 and 3

15 Which of the following statements represents a trend as we move from the left to the right across a period?

A The aqueous solutions of their oxides have increasing pH values.

B The metallic properties decrease.

C There is a decrease in the number of filled electron shells.

D There is a decrease in the number of valence electrons.

16 Metals are often recycled.

What is/are the advantage(s) of recycling metals?

1 conserve finite metal resources on the Earth's surface
2 more energy consumption
3 reduces environment problems

A 1 only
B 1 and 2 only
C 1 and 3 only
D All of the above

17 The table gives information about three different metals.

metal	method of extraction	reacts with cold water
P	reduction by carbon monoxide	×
Q	reduction by carbon monoxide	√
R	electrolysis	√

What is the correct order of reactivity of these metals?

	most reactive → least reactive		
A	P	Q	R
B	Q	P	R
C	Q	R	P
D	R	Q	P

18 Some processes that produce pollutants are shown below:

I combustion of nitrogen at high temperature in car engines
II incomplete combustion of fossil fuels
III lightning activity
IV volcanic eruptions

Which of these processes may produce nitrogen dioxide?

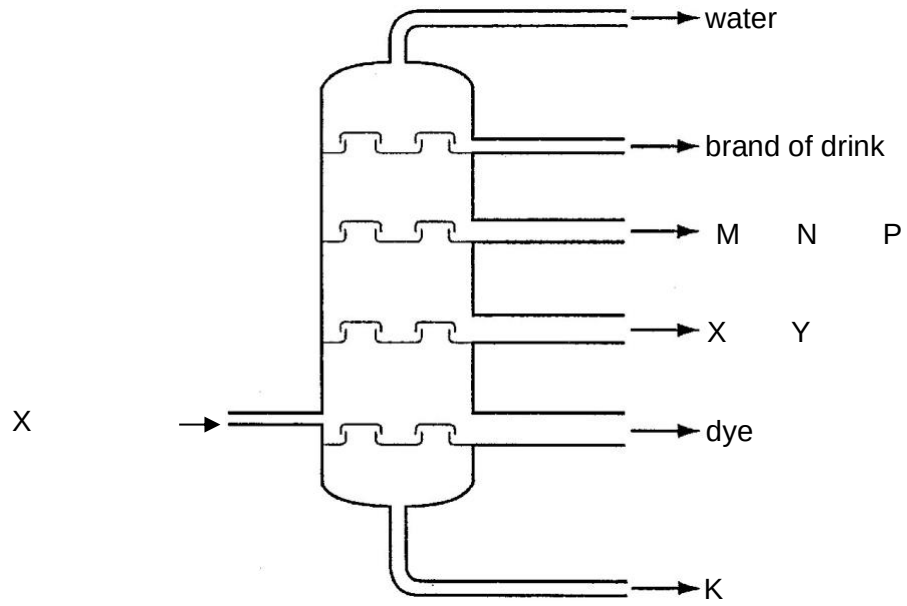
A I and IV only

B I and III only

C II only

D II and III only

19 The diagram shows the refining of crude oil.

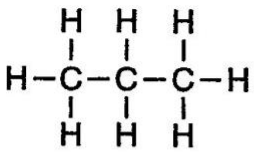


Which of the following is a use for W?

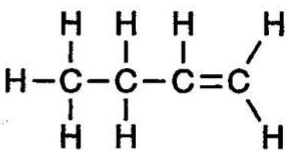
A fuel for aircraft
B fuel for buses and lorries
C fuel for cars
D surfacing roads

20 Which hydrocarbon is unsaturated?

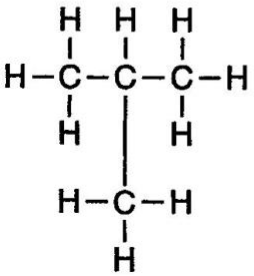
A



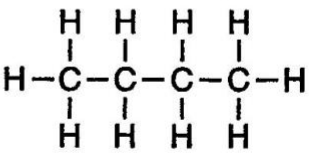
B



C



D



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The Periodic Table of Elements

	Group																	
	I	II										III	IV	V	VI	VII	0
						1 H hydrogen 1											2 He helium 4
	3 Li lithium 7	4 Be beryllium 9	Key atomic number atomic symbol name relative atomic mass									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 23	12 Mg magnesium 24										13 A/ aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 C/ chlorine 35.5	18 Ar argon 40
	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
	37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
	55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 T/ thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
	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 F/ flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	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.)