Anglo-Chinese School (Barker Road)

PRELIMINARY EXAMINATION 2024

SECONDARY FOUR NORMAL (ACADEMIC)

SCIENCE (CHEMISTRY) PAPER 3
5105/3

1 HOUR 15 MINUTES (FOR BOTH PAPERS)

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

This document consists of **8** printed pages.

1 Which substance is a liquid at 50 °C?

	melting point/ °C	boiling point/ °C
A	–117	43
B	–93	69
C	36	49
D	55	103

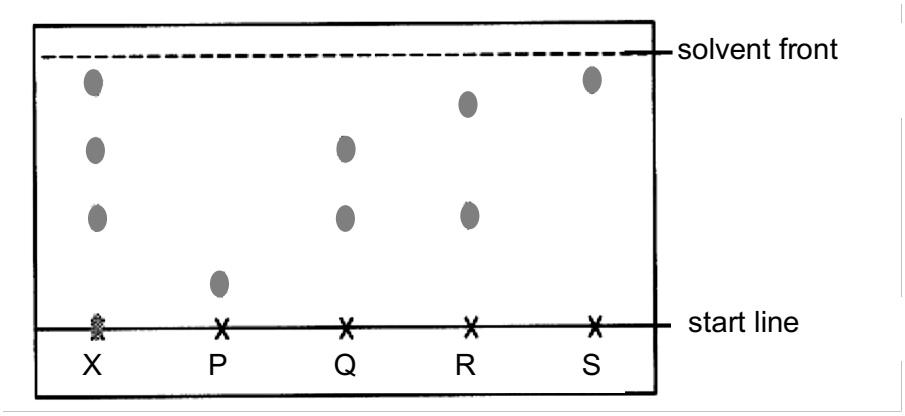
2 A salt is made by adding an excess of an insoluble metal oxide to an acid.

Which method is used to remove excess metal oxide from the mixture?

A chromatography
B crystallisation
C distillation
D filtration

3 Dye X is compared with four other dyes, P, Q, R and S using chromatography.

The chromatogram is shown below.

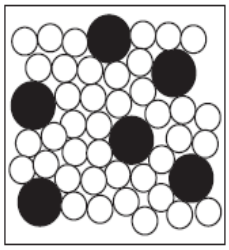


What can be deduced from the results of chromatography?

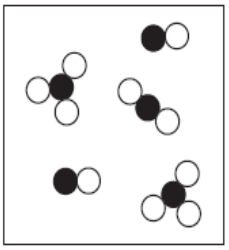
A Dyes P and S are insoluble in the solvent.
B Dyes P and S are pure.
C X consists of dyes Q, R and S.
D X contains two different components.

4 Which diagram shows a representation of a mixture of compounds?

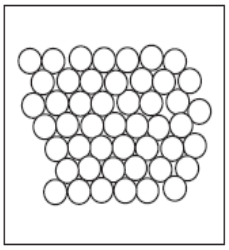
A



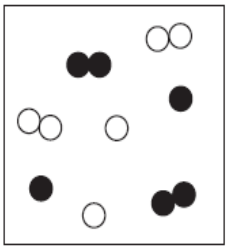
B



C



D



5 The number of atoms can be derived from the chemical formula of the compound.

Which row is **not** correct?

	formula	number of atoms
A	$CaCO_3$	1 calcium, 1 carbon, 3 oxygen
B	C_2H_5OH	1 carbon, 5 hydrogen, 1 oxygen
C	KOH	1 hydrogen, 1 oxygen, 1 potassium
D	H_2SO_4	2 hydrogen, 4 oxygen, 1 sulfur

6 In the Periodic Table, how does the metallic character of the elements vary from left to right across a period?

A It decreases.

B It increases.

C It increases then decreases.

D It stays the same.

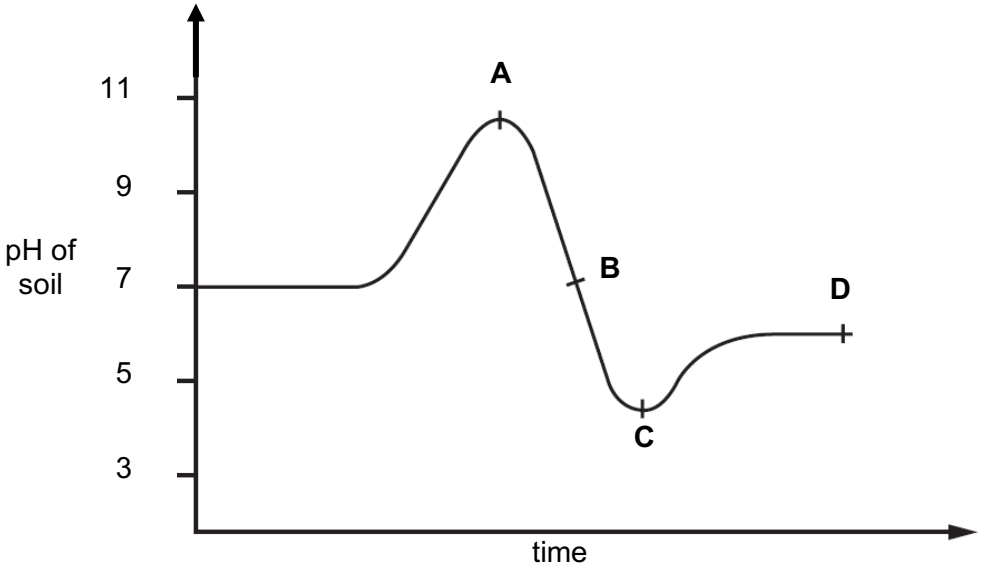
7 X and Y exist as diatomic molecules. X is less reactive than Y.

What are elements X and Y?

	X	Y
A	bromine	iodine
B	iodine	bromine
C	potassium	sodium
D	sodium	potassium

8 The graph shows how the pH of soil in a field changes over time.

At which point was the soil neutral?



9 Which of the following oxides is amphoteric?

A aluminium oxide
B calcium oxide
C copper(II) oxide
D iron(III) oxide

10 Which statement about acids and bases is correct?

A Acids react with metal oxides to form salts and hydrogen.
B Alkalis are bases which are insoluble in water.
C Neutralisation is the reaction between acids and bases.
D Potassium hydroxide dissolves in water and turns blue litmus red.

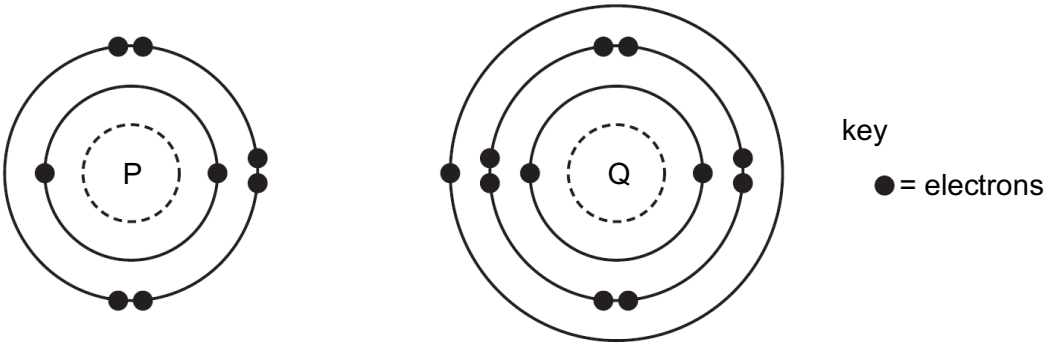
11 Aqueous solution X is added to aqueous ammonium chloride.

The mixture is heated and ammonia gas is given off.

Which is X?

A ammonium sulfate
B hydrochloric acid
C sodium chloride
D sodium hydroxide

12 The electronic structures of atoms P and Q are shown.



P and Q react to form an ionic compound.

What is the formula of this compound?

A PQ_2 **C** Q_2P

B P_2Q **D** QP_2

13 Which is the most abundant noble gas in clean air?

A argon **C** krypton

B helium **D** xenon

14 Some processes that produce pollutants are listed below.

1 combustion of fossil fuels
2 lightning activity
3 volcanic eruptions

Which process may produce sulfur dioxide?

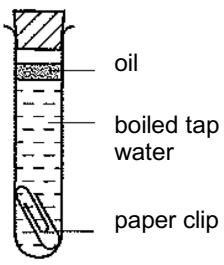
A 1 and 3 only **C** 1, 2 and 3

B 2 and 3 only **D** 3 only

15 Four shiny steel paper clips are placed in test-tubes and left for some days.

In which test-tube does the paper clip rust?

A



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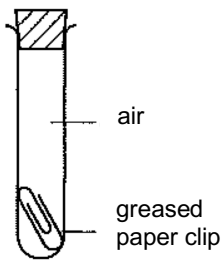

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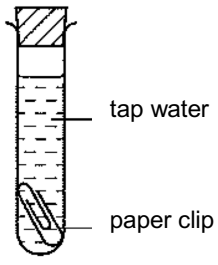

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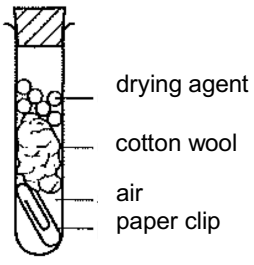


16 The reactions of four metals, W, X, Y and Z, with water, steam or dilute hydrochloric acid are described.

W reacts violently with cold water.

X does not react with cold water but reacts with steam.

Y reacts slowly with cold water.

Z does not react with hydrochloric acid.

What is the order of reactivity of W, X, Y and Z?

	most reactive ⟶ least reactive			
A	W	Y	X	Z
B	W	X	Y	Z
C	Z	X	Y	W
D	Z	Y	X	W

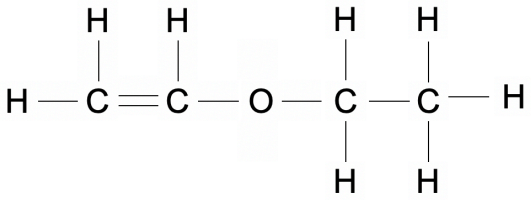
17 What is the main source of energy in natural gas?

A carbon monoxide
B hydrogen
C methane
D nitrogen

18 Which substance is an alkane?

A C_4H_8
B C_5H_{10}
C C_6H_{14}
D C_7H_{14}

19 The structure of a compound is shown.



Which row correctly describes the properties of the compound?

	decolourises aqueous bromine	hydrocarbon
A	no	no
B	no	yes
C	yes	no
D	yes	yes

20 Which statement about recycling of plastics is correct?

A During the chemical method of recycling, plastic waste is converted into long-chain alkanes and alkenes.

B Plastics can be recycled by melting and cooling small pieces of polyethene waste before being pulled and cut into pellets.

C Plastic waste is converted into different raw materials like short-chain alkanes and alkenes through chemical reactions such as combustion.

D Recycling of plastic waste is important because plastics are biodegradable.

The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1										2 He helium 4
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 23	12 Mg magnesium 24	3	4	5	6	7	8	9	10	11	12	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl 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 Tl 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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

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.).
The Avogadro constant, L = 6.02 x 10^{23} mol^{-1}