Class	Full Name	Index Number

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PRELIMINARY EXAMINATION 2025

N

5105/5107/03

SCIENCE (CHEMISTRY)
Paper 3 Multiple Choice
Secondary 4 Normal Academic

Additional materials:
Multiple Choice Answer Sheet
30 July 2025

Papers 3 and 4: 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

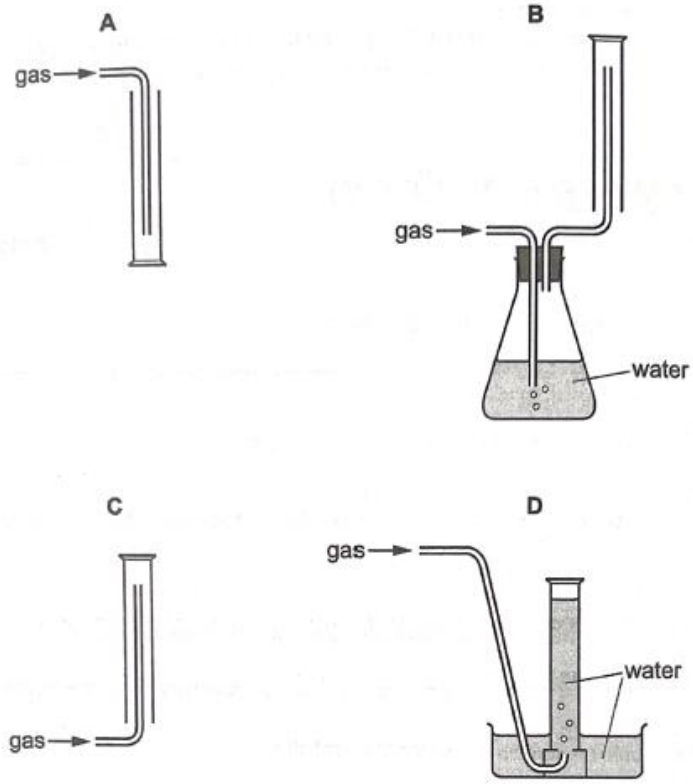
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on all the work you hand in.

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 the booklet.
A copy of Periodic Table is printed on page 12.
The use of an approved scientific calculator is expected, where appropriate.

1. Which apparatus is used to collect a gas that is soluble in water and denser than air?



2. Paper chromatography is carried out on a mixture X and four individual dyes.

Which dyes are **not** present in mixture X?

A 1 and 2

B 1 and 3

C 2 and 4

D 3 and 4

3. Dry ice is the solid form of carbon dioxide below –80 °C. When dry ice is exposed to room temperature, it changes directly into carbon dioxide gas.
Which statement describes what happens to the particles of dry ice when it is exposed to room temperature?

A They gain energy and move closer to each other.

B They gain energy and move further away from each other.

C They lose energy and move closer to each other.

D They lose energy and move further away from each other.

4. The boiling points of a few elements are shown below.

element	boiling point/ °C
X	-141
Y	50
Z	134

A mixture of elements X, Y and Z is heated gradually from -160 °C to 40 °C. Which element(s) would remain as a liquid at 40 °C?

A element X

B element Z

C element Y and Z

D element X and Y

5. Element X is represented as ${}^{a}_{b}X$ where a is greater than b.
Which statement about X is correct?

A The position of X in the Periodic Table is found from b.

B The number of protons in one atom of X is a.

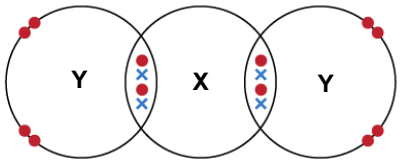
C The mass of one atom of X is b.

D The number of electrons in one atom of X is (a – b).

6. Which letter in the table represents a value of 0?

particle	relative charge	relative mass
proton	**A**	1
electron	**B**	**C**
neutron	**D**	1

7. The diagram below shows the arrangement of electrons in the outer shells of the atoms of compound XY_2.



Which of the following statements is correct?

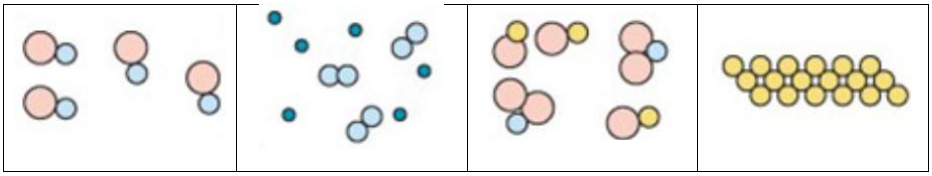
A X is likely to be a calcium atom.

B X is likely to be a sulfur atom.

C Y is likely to be a carbon atom.

D Y is likely to be an oxygen atom.

8. Which of the following best represents a mixture of two elements?



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

9. Trimethylamine is a covalent compound that gives off the 'fishy' odour in fishes.

Which of the following properties would you expect trimethylamine to have?

A It is hard but brittle.

B It has low melting and boiling points.

C It conducts electricity when molten but not in solid state.

D It dissolves in water.

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Commented [GSEA2]: remove the "a"

10. Which chemical equation is **not** balanced?

A $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$

B $C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g)$

C $2C_3H_6F_2(g) + 3F_2(g) \rightarrow 2C_3H_5F_3(g) + 4HF(g)$

D $C_{12}H_{26}(l) \rightarrow C_8H_{18}(l) + 2C_2H_4(g)$

11. The compound magnesium nitrate has the formula $Mg(NO_3)_2$.
What is the relative formula mass (M_r) of calcium nitrate?

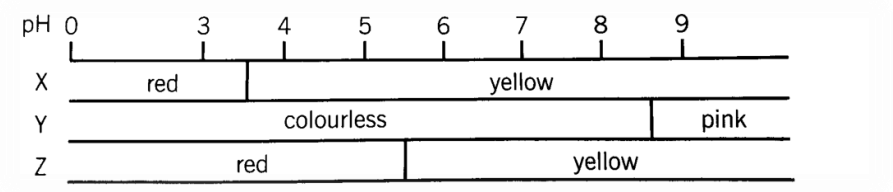
A 102

B 148

C 150

D 164

12. The diagram below shows the pH ranges of three indicators, X, Y and Z.



The three indicators are mixed together in a beaker.
A few drops of this mixture was added into a solution, and the solution turned red.
What is the pH value of the solution?

A pH 3

B pH 4

C pH 6

D pH 10

13. Which row about zinc oxide is correct?

	react with acids	react with alkalis
A	yes	yes
B	yes	no
C	no	yes
D	no	no

Commented [GSEA4]: Should this be alkalis?

14. Which statements about the Periodic Table are correct?

1 From left to right across a period, the number of electron shells increase.
2 From left to right across a period, the metallic character of the elements decreases.
3 The elements are arranged in order of increasing proton number.
4 The number of outer shell electrons increases down a group.

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

Commented [GSEA5]: Font size for all the statements is smaller.

15. Metal Q reacts slowly with cold water.
When metal S is added to an aqueous compound of metal R, a displacement reaction takes place.
Metal S does not react with water.
What is the order of reactivity for Q, R and S?

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

Commented [GSEA6]: I think there is smth wrong with this question? S is more reactive than R (by displacement). But S does not react with water and R reacts with acid.

16. Some metals can be extracted from their ores by carbon.
Iron and metals less reactive than iron can also be extracted from their ores by hydrogen.

Which row shows the correct metals which can be extracted from their ores by carbon and hydrogen respectively?

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	extraction by carbon	extraction by hydrogen
A	sodium	lead
B	calcium	zinc
C	copper	potassium
D	zinc	copper

17. A non-renewable resource is one which cannot be replaced quickly enough to keep up with consumption.
What are two examples of non-renewable fuels?

A bioethanol and natural gas

B crude oil and coal

C fossil fuel and biofuel

D natural gas and biofuel

18. Which of the following is an alkane?

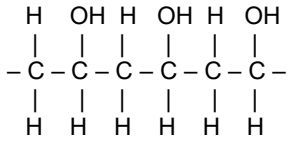
A C_2H_2

B C_2H_4

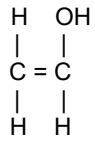
C C_3H_6

D C_3H_8

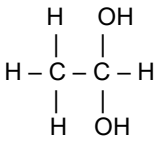
19. The diagram shows three repeating units in the structure of an addition polymer.



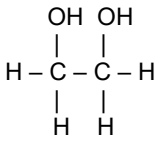
Which monomer is used to make this polymer?



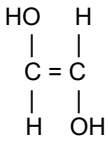
A



B



C



D

20. Which atmospheric pollutants are responsible for the damage of buildings?

1 nitrogen dioxide
2 carbon monoxide
3 methane
4 sulfur dioxide

A 1 and 2

B 1 and 4

C 2 and 3

D 3 and 4

- End of paper -

Commented [GSEA8]: Can we put all the OH pointing up, or all pointing down? And make the monomer in the answer the same direction too.

Let's keep it more manageable, because it's quite a tough concept to visualise.

Commented [GSEA9]: ..for **the** damage.

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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, $L = 6.02 \times 10^{23}\ mol^{-1}$.