Paya Lebar Methodist Girls' School (Secondary)
Preliminary Examination 2024
Secondary 4 Normal Academic / G2

CANDIDATE NAME		CLASS		CLASS INDEX NO	

CENTRE NUMBER	S					INDEX NO				

SCIENCE **5105 & 5107/03**

Paper 3 Chemistry **30 July 2024**

(Taken together with Paper 4) **1 hour 15 mins**

READ THESE INSTRUCTIONS FIRST

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

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

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

You are advised to spend no more than 30 minutes on Paper 3 and 45 minutes on Paper 4. You may proceed to Paper 4 as soon as you have completed Paper 3.

The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the **Periodic Table** is printed on **page 10**.

This document consists of <u>10</u> printed pages.

[Turn over

1 A student wishes to add exactly 17.20 cm^3 of acid to exactly 25.0 cm^3 of an alkali as part of an experiment. Which apparatus should the student use to measure these volumes?

	acid	alkali
A	burette	measuring cylinder
B	burette	pipette
C	measuring cylinder	pipette
D	pipette	burette

2 Lead(II) chloride is an insoluble salt which is formed in the reaction of aqueous lead(II) nitrate with aqueous potassium chloride.

How is pure lead(II) chloride obtained after the reaction?

A crystallisation → evaporation

B evaporation → washing and drying

C filtration → evaporation

D filtration → washing and drying

3 A new element has seven electrons in its outermost shell.

Which statement about the element is correct?

A It is monoatomic.

B It forms a positive ion, X^+.

C It forms a diatomic molecule.

D It forms covalent compounds with sodium.

4 What is the chemical formula of iron(II) sulfate?

A FeS

B $FeSO_4$

C $Fe(SO_4)_2$

D Fe_2SO_4

5 The nucleon number and proton number of an atom of X and an atom of Y are shown.

	X	Y
nucleon number	39	40
proton number	19	18

Which statement about X and Y is correct?

A An atom of X has fewer electrons than an atom of Y.

B An atom of X has fewer neutrons than an atom of Y.

C X is above Y in the same group of the Periodic Table.

D X is in the same period in the Periodic Table as Y.

6 The table shows the results of adding dilute hydrochloric acid, HC*l*, and aqueous sodium hydroxide, NaOH to four metal oxides (**A**, **B**, **C** and **D**).
Which of the metal oxides displays amphoteric properties?

	addition of dilute HC*l*	addition of aqueous NaOH
A	no reaction	no reaction
B	no reaction	reaction
C	reaction	no reaction
D	reaction	reaction

[Turn over

7 The table shows the boiling points of some substances present in air.

substance	boiling point / °C
argon	-186
nitrogen	-196
oxygen	-183
carbon dioxide	-79

Which substance(s) is/are liquid(s) at −150 °C?

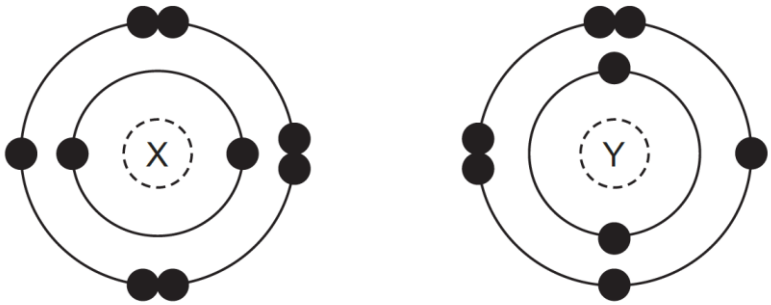
A carbon dioxide only

B carbon dioxide and nitrogen

C oxygen and argon

D nitrogen, oxygen and argon

8 The electronic structure of two atoms, X and Y, are shown.



X and Y combine to form a compound.

What is the type of bonding in the compound and what is the chemical formula of the compound?

	type of bonding	chemical formula
A	covalent	X_2Y
B	covalent	XY_2
C	ionic	X_2Y
D	ionic	XY_2

9 Sodium is the 6th most abundant element in the Earth's crust while gold is ranked 72nd. However, gold was discovered long before sodium.

Why is sodium more abundant but harder to discover than gold?

A Gold exists in an uncombined form but sodium is combined with other elements.
B Gold has a higher density than sodium.
C Sodium is a softer metal than gold.
D Sodium is less pure than gold.

10 Aqueous hydrochloric acid is added to aqueous ammonium carbonate.
A gas is given off.
Which of the following is a property of the gas?

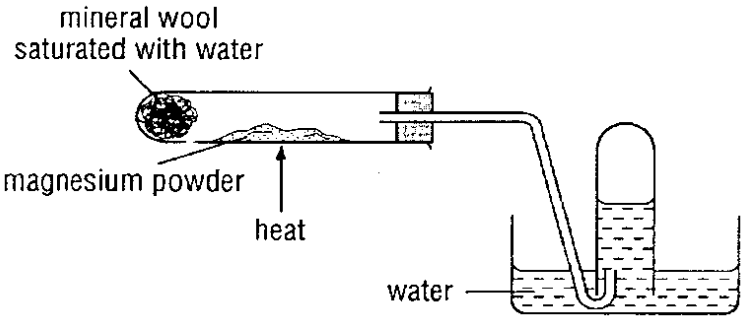
A A green colour is observed when the gas is tested with Universal Indicator.
B A white precipitate is formed when the gas is bubbled into limewater.
C The gas extinguishes a lighted splint with a 'pop' sound.
D The gas turns moist red litmus blue.

11 Which of the following compounds **cannot** be used to control soil acidity?

A calcium carbonate
B calcium chloride
C calcium hydroxide
D calcium oxide

[Turn over

12 The figure below illustrates the reaction between magnesium and steam.



Which equation represents the reaction taking place?

A $Mg + H_2O \rightarrow MgO + H_2$

B $Mg + 2H_2O \rightarrow MgOH_2 + H_2$

C $Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$

D $Mg + H_2O \rightarrow$ no reaction

13 Which volume of air contains approximately 20 cm^3 of oxygen?

A 20 cm^3

B 40 cm^3

C 80 cm^3

D 100 cm^3

14 The list shows some physical properties of metals.

1. good conductors of electricity
2. soft solids
3. high densities
4. high melting points

Which properties do the metals in Group 1 of the Periodic Table have?

A 1 only **B** 1 and 2 **C** 2 and 3 **D** 1, 2, 3 and 4

15 The pH values of four aqueous solutions are shown.

solution	pH
P	3
Q	5
R	9
S	11

If pairs of solutions are mixed, which pair must produce an alkaline solution?

A P and Q

B P and S

C Q and R

D R and S

16 The equation shows the reaction that occurs when propene burns completely in air.

$$wC_3H_6 + 9O_2 \rightarrow yCO_2 + zH_2O$$

Which values of w, x, y and z balance the chemical equation?

	w	y	z
A	1	3	3
B	1	6	6
C	2	3	3
D	2	6	6

17 Which of the following represents a substitution reaction?

A $C_{10}H_{22} \rightarrow C_4H_8 + C_6H_{14}$

B $C_3H_6 + Cl_2 \rightarrow C_3H_6Cl_2$

C $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

D $(C_2H_4)_n \rightarrow [-CH_2CH_2-]_n$

[Turn over

18 Which property of alkanes decreases as the molecular masses of alkanes increase?

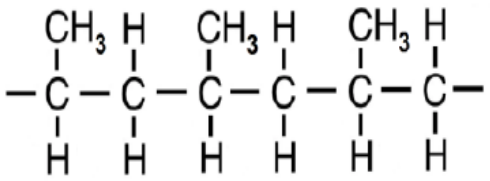
A flammability

B boiling point

C melting point

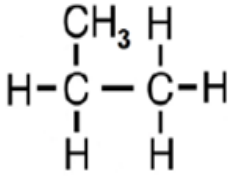
D viscosity

19 The diagram shows part of a polymer molecule.



Which monomer was used to make this polymer?

A



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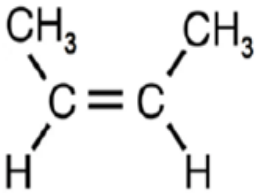

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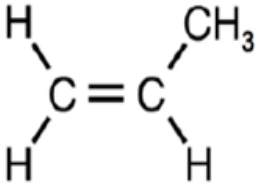
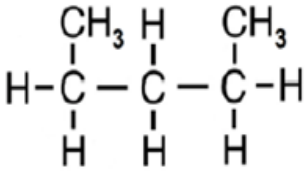


D



20 The table shows the type and number of bonds that are present in compound X.

type of bond	number of bonds
C–C	several
C=C	several
O–H	one
C–H	several

What type of compound is X?

A alkane

B hydrocarbon

C monounsaturated

D polyunsaturated

End of paper 3

Answers to 4NA Sci Chem Prelim P3 2024

1 B	2 D	3 C	4 B	5 B	6 D	7 A	8 A	9 A	10 B
11 B	12 A	13 D	14 B	15D	16 D	17 C	18 A	19 C	20 D

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		**Key** proton (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	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 –		114 Fl 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 mendeleviu m –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm3 at room temperature and pressure (r.t.p).

The Avogadro constant, L = 6.02×10^{-23} mol^{-1}