Index Number	Class	Name

CHIJ ST JOSEPH'S CONVENT
PRELIMINARY EXAMINATIONS

NA **NA**

SCIENCE (CHEMISTRY) **5105/03**
Paper 3 Multiple Choice **5107/03**

Secondary 4 Normal (Academic) Thursday, 27 July 2023
Papers 3 and 4: 1 hour and 15 minutes

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

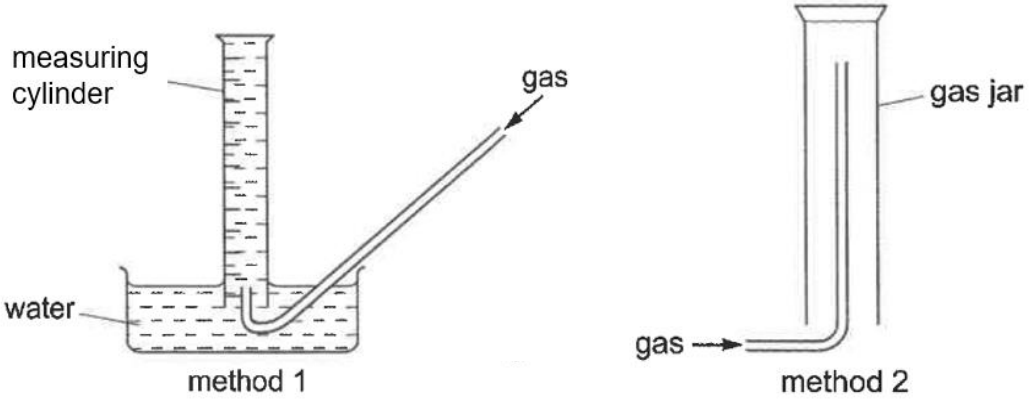
Paper 3:
There are **twenty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

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 8.

Paper 3 (20 marks)

Answer **all** questions.

1 The diagrams below show two methods of collecting gases.



Which row gives the properties of a gas which can be collected by both methods?

	property 1	property 2
A	insoluble in water	denser than air
B	insoluble in water	less dense than air
C	soluble in water	denser than air
D	soluble in water	less dense than air

2 The table shows the boiling points of some of the elements present in air.

element	boiling point / °C
argon	-186
helium	-269
neon	-246
nitrogen	-196
oxygen	-183

Which elements are liquid at -200 °C?

A argon, helium and neon
B argon, nitrogen and oxygen
C helium and neon only
D nitrogen and oxygen only

3 Which observation shows that a liquid is a pure substance?

A It boils at a fixed temperature.
B It cannot be broken down into any simpler substances.
C It conducts electricity at room temperature.
D It is colourless.

4 A sample of a white crystalline substance is heated in the absence of oxygen. It melts sharply at 120 °C, but on further heating gives off smoky fumes and a black solid remains.

From this information, we can conclude that the white crystalline substance is

A a compound which combusted to form two products.
B a compound which decomposed to form simpler substances.
C a mixture of substances which combined chemically.
D an element which decomposed to form simpler substances.

5 A sodium atom is represented as $^{23}_{11}Na$.
How many electrons does one atom of sodium contain?

A 11
B 12
C 23
D 34

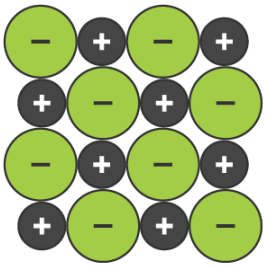
6 Which row represents an ion?

	number of protons	number of neutrons	number of electrons
A	1	0	1
B	3	4	3
C	6	6	6
D	11	12	10

7 The isotopes of chlorine, ^{35}Cl and ^{37}Cl both form ions with a single negative charge. Which of the following statements about these ions are true?

A Both ions have an electronic configuration of 2.8.7.
B ^{37}Cl has a greater number of protons and electrons compared to ^{35}Cl
C The ions have the same number of electrons but different number of neutrons.
D The ions have the same number of neutrons but different number of protons.

8 In the diagram below, each sphere represents a particle about the size of an atom and the sign indicates the charge on the particle.



In which of the following substances would the above model be a reasonable representation of how the particles are arranged in the structure?

A barium chloride
B carbon monoxide
C lithium bromide
D zinc metal

9 A newly discovered element, Xylonium (Xy), is placed in Group II of the Periodic Table.
Which is the correct chemical formula for its sulfate?

A $XySO_4$
B $Xy(SO_4)_2$
C Xy_2SO_4
D $Xy_2(SO_4)_2$

10 Which is the correct description of the oxide of the element?

	element	type of oxide
A	copper	amphoteric
B	magnesium	basic
C	sodium	acidic
D	sulfur	basic

11 What is used to decide the order of the elements in the Periodic Table?

A density
B number of neutrons
C number of protons
D relative atomic mass

12 Astatine is an element in Group VII of the Periodic Table. Which of the following describes the properties of astatine at room temperature and pressure?

	state	colour of substance
A	gas	pale
B	liquid	dark
C	solid	pale
D	solid	dark

13 The table below gives information about the reactivity of three metals, X, Y and Z.

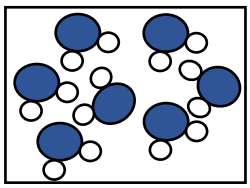
metal	reaction with steam	reaction with dilute hydrochloric acid
X	forms an oxide	forms hydrogen
Y	no reaction	no reaction
Z	no reaction	forms hydrogen

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

	most reactive	→	least reactive
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	X	Y

14 Which diagram correctly represents an alloy?

A



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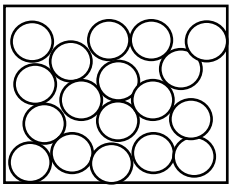

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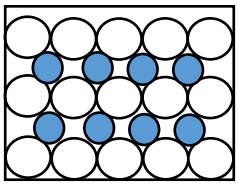

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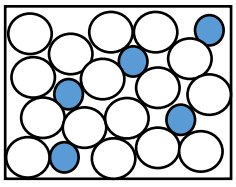


15 Which statement(s) is/are true for **all** metals?

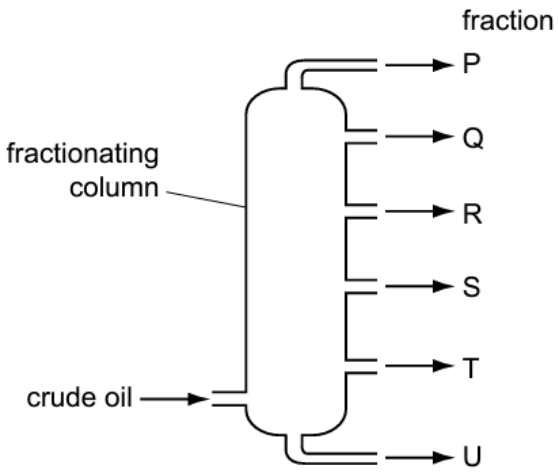
1 conducts electricity
2 reacts with hydrochloric acid
3 high melting point
4 high density

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

16 Air is a mixture of gases.
In air, which gas is present in the greatest amount?

A carbon dioxide
B hydrogen
C nitrogen
D oxygen

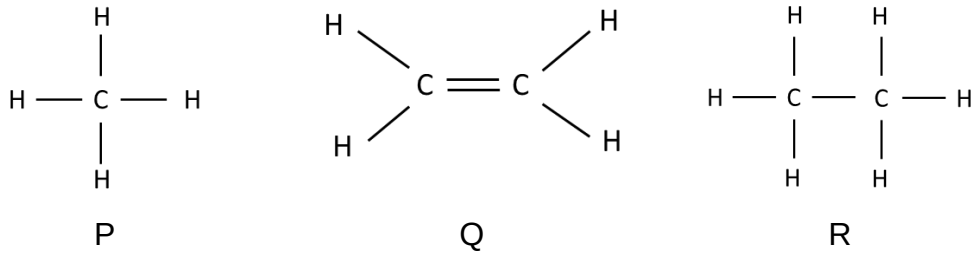
17 The diagram shows a fractionating column used in the separation of petroleum.



Which row explains why fraction R is collected above fraction S?

	boiling point of R	average molecular mass of R
A	greater than S	greater than S
B	greater than S	smaller than S
C	lower than S	greater than S
D	lower than S	smaller than S

18 The diagrams below show the structures of three compounds.



P Q R

Which of these compounds belong to the same homologous series?

A P and Q
B P and R
C Q and R
D P, Q and R

19 Pentadecane, $C_{15}H_{32}$, undergoes a process, forming substance Z and other products.

$$C_{15}H_{32} \rightarrow C_{10}H_{20} + Z + H_2$$

What is the name of this process and what is substance Z?

	name of process	substance Z
A	cracking	C_5H_{10}
B	cracking	C_5H_{12}
C	fractional distillation	C_5H_{10}
D	thermal decomposition	C_5H_{10}

20 A student investigated the reaction of vegetable oils with hydrogen.
100 cm^3 of hydrogen was bubbled through 1 g samples of four different vegetable oils. The volume of hydrogen remaining after each experiment was recorded.

vegetable oil	volume of hydrogen remaining / cm^3
P	100
Q	87
R	63
S	0

Which vegetable oil(s) is/are unsaturated?

A P only
B Q and R only
C Q, R and S only
D S only

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 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 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.)