BEDOK VIEW SECONDARY SCHOOL
MID-YEAR EXAMINATION 2019

CANDIDATE NAME

REGISTER NUMBER

CLASS

CHEMISTRY
Secondary 3 Express

6092
13 May 2019
1 hour 30 minutes

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your index number and name 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, graphs or rough working.
Do **NOT** use staples, paper clips, highlighters, glue or correction fluid.

Section A
There are **twenty** questions in this section. 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.

Section B
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Candidates are reminded that **all** quantitative answers should include appropriate units.
Electronic calculators may be used.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of concepts than for correct answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

A copy of the Periodic Table is found on page 18 of this paper

For Examiner's use	
Paper 1	/ 20
1	/ 7
2	/ 6
3	/ 8
4	/ 5
5	/ 4
6	/ 10
Total	/ 60
% / Grade	/

Setter(s): Ms Wong W L

Parent's / Guardian's Signature: .....

This document consists of **17** printed pages and **1** blank page.

Do not turn over the page until you are told to do so.

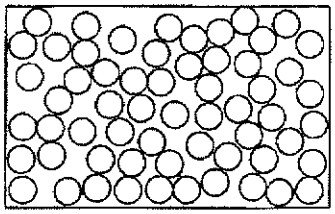
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Section A

Answer **all** questions in this section on the Multiple Choice Answer Sheet.

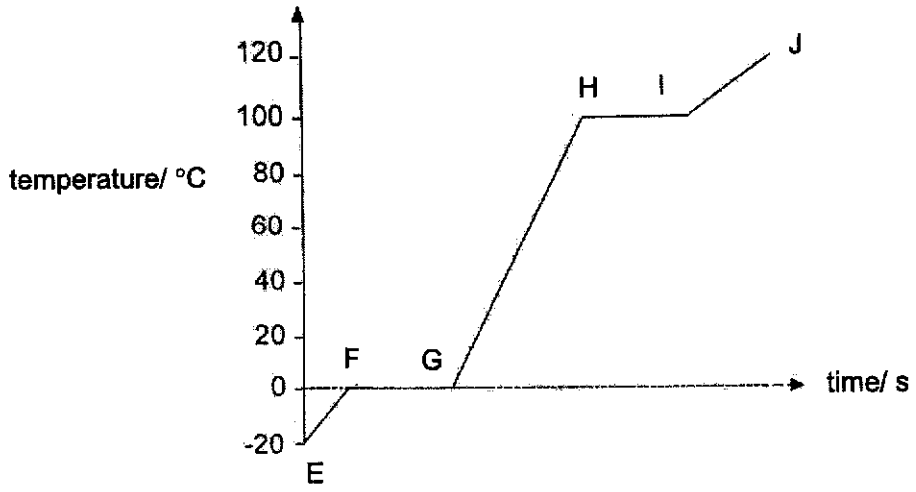
1 The diagram shows the arrangement of particles in a substance at room temperature and pressure.



Which of the following substances could the diagram represent?

	melting point / °C	boiling point / °C
A	– 165	– 101
B	– 113	– 78
C	– 20	113
D	87	202

2 The graph below shows the temperature changes with time when a substance is heated from - 20 °C.



Which of the following statements can be deduced from the heating curve?

A The volume of the substance is decreasing from points E to J.

B Energy is released from points G to H.

C The energy of the particles remains constant throughout from points E to F.

D The particles absorb energy to overcome the forces of attraction between them from points F to G.

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3 Which apparatus is most appropriate in measuring 22.6 cm^3 of vinegar?

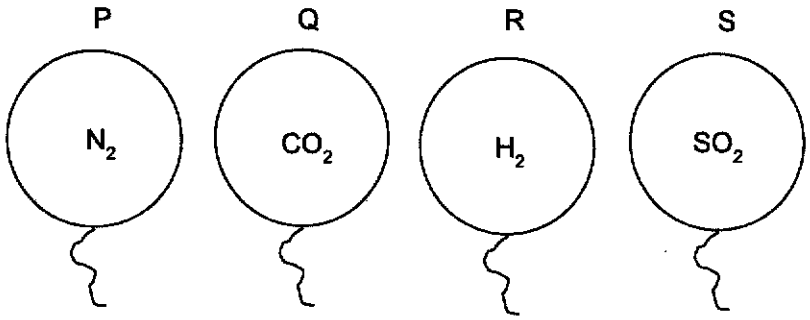
A beaker

B burette

C measuring cylinder

D pipette

4 Four balloons were filled with equal volume of different gases and left in a room for 8 hours.



The balloons are found to have shrunk to different extent after 8 hours.

Which of the following gives the correct sequence in increasing order of size of balloon after 8 hours?

A P, R, Q, S

B R, Q, P, S

C R, P, Q, S

D P, R, S, Q

5 The boiling point of solid X is 742 °C and it is soluble in water.
What is the most likely boiling point of water if it contains a small amount of X?

A 99 °C

B 101 °C

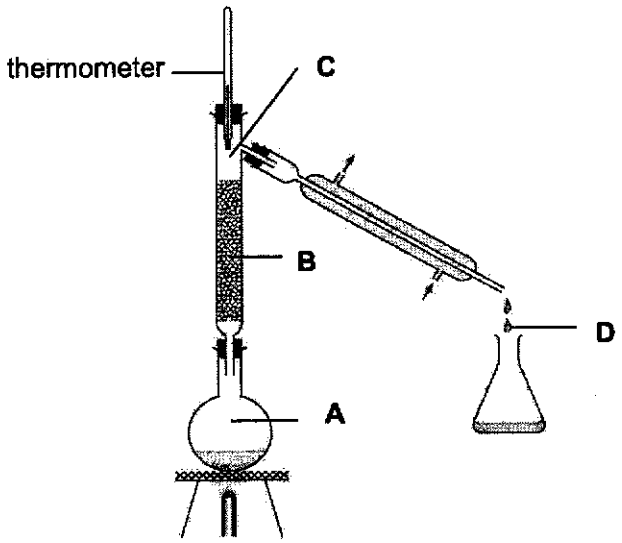
C 740 °C

D 744 °C

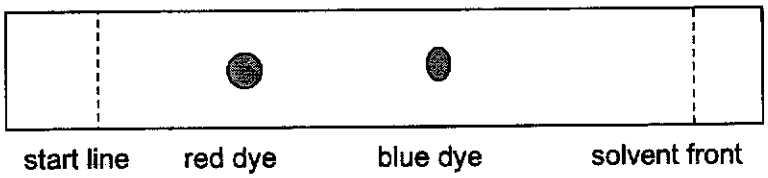
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6 A mixture contains equal volumes of two miscible liquids that do not react together. The mixture is placed in the apparatus as shown in the diagram below. Heat is applied to the mixture until the thermometer first shows a steady reading for some time.

At which point will there be the highest proportion of the liquid with the higher boiling point?



7 The diagram shows the chromatogram of a food colouring used in a candy.



Which of the following can best be deduced from the chromatogram above?

A The colour of the sweet is purple.

B The molecules of the red dye are heavier than those of the blue dye.

C The red dye is more soluble in the solvent than the blue dye.

D The R_f value of the red dye is less than that of the blue dye.

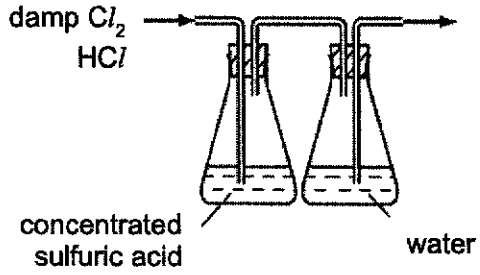
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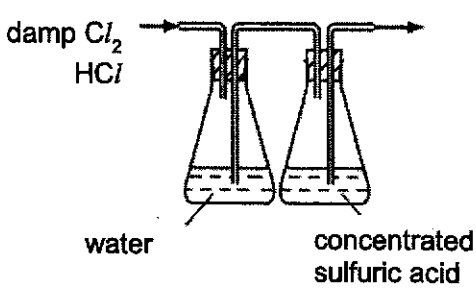
8 Hydrogen chloride is very soluble in water, whereas chlorine is only slightly soluble in water. Both gases can be dried using concentrated sulfuric acid.

Which diagram represents the correct method of obtaining pure dry chlorine from damp chlorine containing a small amount of hydrogen chloride?

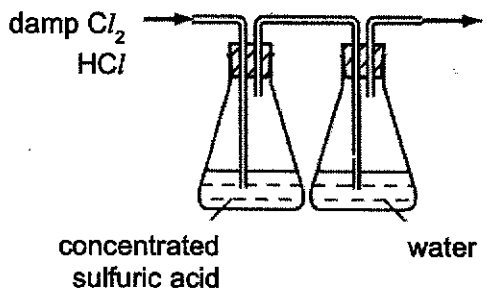
A



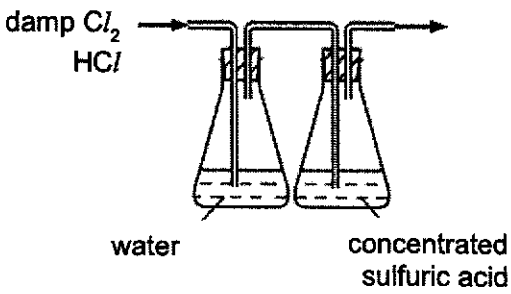
B



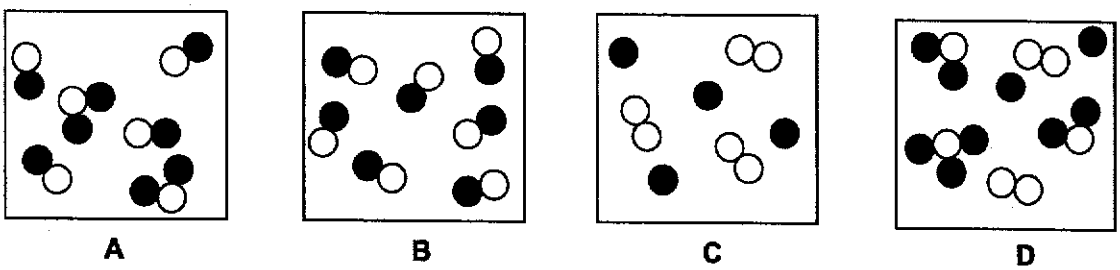
C



D



9 Which of the following diagrams represents a mixture of compounds?



10 Which list contains an element, a compound and a mixture?

A air, magnesium, soil

B air, pure water, copper(II) sulfate

C gold, seawater, sodium chloride

D mineral water, soil, sugar

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11 A new substance was discovered recently by a scientist.
Which observation suggests that the substance is **not** an element?

A It dissolves in water to form a colourless solution.

B When exposed to air, it changes colour gradually.

C When heated in air, it could form two oxides.

D Electrolysis of the molten substance gives two products.

12 Which statement about an atom is correct?

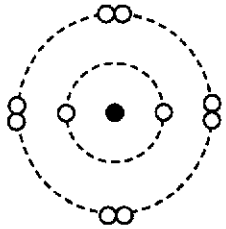
A Each element has only one nucleon (mass) number.

B The nucleon (mass) number can be equal to the proton number.

C The nucleon (mass) number can be less than the proton number.

D The number of neutrons never equals the number of electrons.

13 The diagram shows the arrangement of electrons in a particle with a charge of –1.



Which group and period does the atom of this particle belong to in the Periodic Table?

	group	period
A	I	2
B	VII	2
C	I	3
D	VII	3

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14 An ion J^{3-} has x protons and y electrons. How many protons are there in an atom of J?

A $x - 3$

B $x + 3$

C $y - 3$

D $y + 3$

15 The outer shell electrons in a molecule of a liquid, carbon dioxide.



How many electrons in a molecule of carbon dioxide are **not** involved in bonding?

A 8 **B** 10

C 12 **D** 14

16 What occurs when silicon dioxide melts?

A Electrostatic forces of attraction between atoms in a giant lattice are broken.

B Strong covalent bonds in the macromolecular structure are broken.

C Electrostatic forces of attraction between ions in a giant lattice are broken.

D Weak intermolecular forces between silicon dioxide molecules are broken.

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17 The table below provides information about four substances J, K, L and M. Letters J to M are not element symbols.

substance	melting point / °C	boiling point / °C	electrical conductivity at r.t.p.	
			molten	aqueous
J	770	1420	good	good
K	1540	2860	good	insoluble
L	−110	−90	poor	good
M	−114	78	poor	poor

Which substance could be potassium chloride?

A J **B** K

C L **D** M

18 Some information about a particle is summarised in the form

$$^{135}_{56}R^{2+}$$

Which statements are correct?

1 An atom of R has 2 electrons in its outermost shell.

2 An ion of R has 56 electrons.

3 An isotope of R has 79 neutrons.

4 Element R is in Group VII of the Periodic Table.

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

19 An element G forms hydroxide of formula $G(OH)_2$.
What is the formula of the oxide of element G?

A GO **B** GO_2

C G_2O **D** G_2O_3

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20 The reaction of hydrochloric acid and iron(III) oxide is represented by the equation below.

$$Fe_2O_3\,(s) + xHCl\,(aq) \rightarrow yFeCl_3\,(aq) + zH_2O(l)$$

Which of the following shows the correct values of x, y and z to balance the equation?

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

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Section B

Answer **all** questions in the spaces provided

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1 Table 1.1 shows some information about atoms of the elements P, Q, R and S. The letters, P to S do not represent the chemical symbols of the elements.

Table 1.1

element	atomic number	number of protons	number of neutrons	mass number	electronic configuration
P	17	17	18	35	2.8.7
Q	8	8	8	16	2.6
R	1	1	1	2	1
S			20	39	

(a) **(i)** Complete Table 1.1 by filling in the information for element S. [1]

(ii) Is element S a metal or a non-metal? Give a reason for your answer.

.....

..... [2]

(b) Explain why the relative atomic mass of element P has a value of 35.5 and not a whole number?

.....

..... [1]

(c) Describe the change in electronic configuration that occurs to an atom of element Q when it forms an ion.

..... [1]

(d) Elements P and R combine to form a covalent molecule.

Draw a 'dot and cross' diagram to show the bonding in this molecule.
(show outer electrons only)

[2]

[Total: 7]

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2 (a) Fig.2.1 shows a large beaker filled with methane gas, CH_4 being inverted over a porous pot containing nitrogen gas, N_2. The water level in the right-arm of the U-tube is observed after 3 hours.

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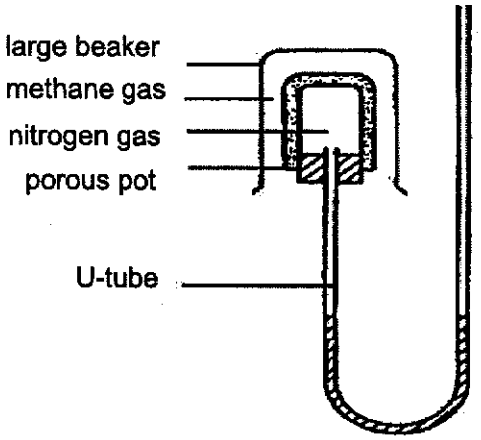


Fig. 2.1

(i) Deduce whether water level in the right-arm of the U-tube rises or drops? Explain your answer.

.....

.....

..... [3]

(ii) Suggest why ammonia gas is not suitable to be placed in the porous pot.

..... [1]

(b) Natural gas is stored as a mixture with methane as the main component. The natural gas is stored as Liquefied Natural Gas.

Suggest how natural gas can be liquefied and stored in a cylinder at room temperature.

..... [1]

(c) Suggest an advantage of storing natural gas in liquid state.

.....

..... [1]

[Total: 6]

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3 Tritium is an isotope of hydrogen. An ion of tritium has the following structure as shown in Fig. 3.1.

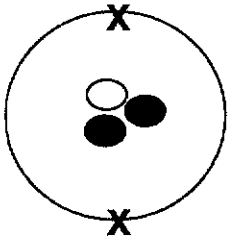


Fig. 3.1

(a) Complete Table 3.2

Table 3.2

symbol	name of sub-atomic particle	charge
●		0
○	proton	
X		- 1

[3]

(b) Define isotopes.

.....

..... [1]

(c) Explain why isotopes have similar chemical properties but slightly different physical properties.

.....

.....

.....

..... [2]

(d) Using T to represent tritium, write the formula of

(i) tritium ion: .....

(ii) the compound formed between tritium and magnesium: ..... [2]

[Total: 8]

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4 The formulae of some substances are given in the following list.

$MgCO_3$ N_2 Al_2O_3 NH_3 H_2O $ZnSO_4$ Ar

(a) Choose from the list **all** those substances to answer the following questions. You may use the substance once, more than once or not at all.

(i) Which substance(s) consist(s) of molecule(s)?

..... [1]

(ii) Which substance(s) can be classified as elements(s)?

..... [1]

(iii) Give the substance which contains a triple covalent bond.

..... [1]

(b) Which substance reacts with hydrochloric acid to form ammonium chloride?

..... [1]

(c) Write a chemical equation for the reaction in **(b).**

..... [1]

[Total: 5]

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5 Fig. 5.1 shows the structures of graphite and silicon dioxide.

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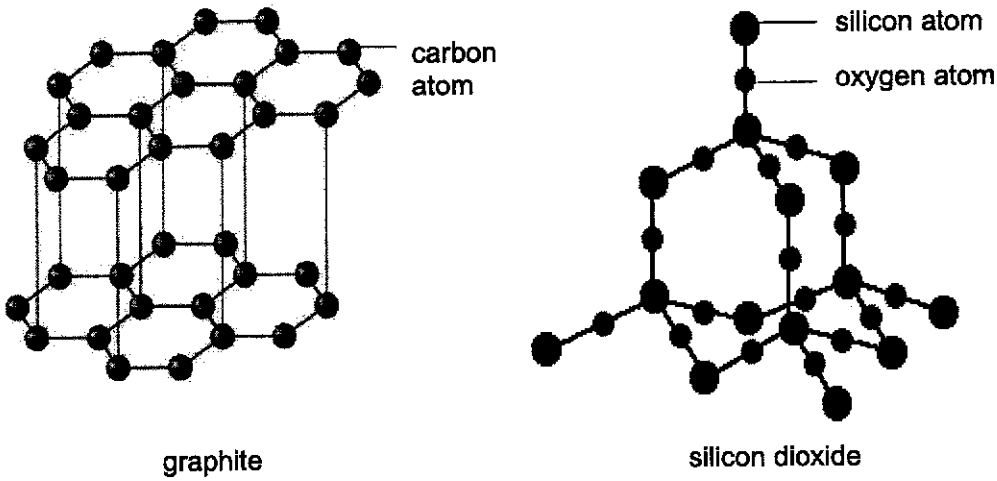


Fig. 5.1

(a) Explain in terms of structure, why graphite conducts electricity but silicon dioxide does not.

.....

.....

..... [2]

(b) Graphite is used to make lubricants for engines.
Explain, in terms of its structure, why graphite can act as a lubricant.

.....

.....

..... [2]

[Total: 4]

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6 Use the information in Table 6.1 to answer the following questions.

For examiner's use

Table 6.1

substance	conducts electricity when solid	melting point/ °C	boiling point/ °C	soluble in water
sodium chloride	no	808	1413	yes
bromine	no	-7.2	58.8	yes
zinc	yes	419.5	907	no
sugar	no	186	-	yes
wax	no	35 - 50	245 - 270	no

(a) What is the physical state of bromine at room temperature and pressure?

..... [1]

(b) Which substance is a mixture? Explain your answer with evidence.

.....

..... [1]

(c) Give a reason why no value was given for the boiling point of sugar.

.....

..... [1]

(d) Describe how the arrangement and movement of particles in zinc change as the temperature increases from 419 °C to 420 °C.

.....

.....

.....

..... [2]

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(e) Suggest how you could separate a mixture of sodium chloride and zinc to obtain a dry sample of each.

.....

.....

.....

.....

..... [3]

(f) Draw a 'dot-and-cross' diagram to show the bonding in sodium chloride.

[2]

[Total: 10]

End of Paper

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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: 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											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.).

BVSS

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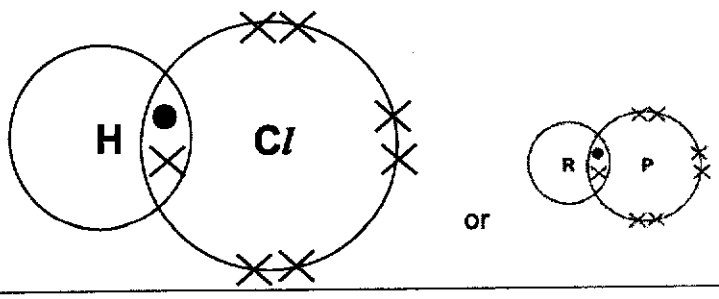
Paper 1

1	2	3	4	5	6	7	8	9	10
C	**D**	**B**	**C**	**B**	**A**	**D**	**D**	**A**	**C**

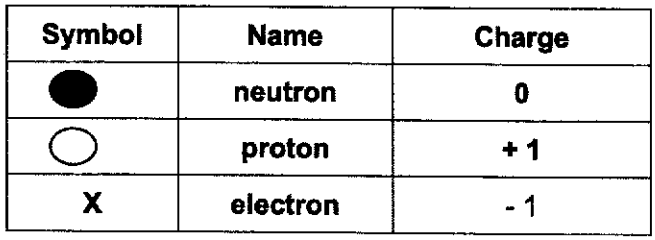
11	12	13	14	15	16	17	18	19	20
D	**B**	**B**	**C**	**D**	**B**	**A**	**A**	**A**	**B**

Paper 2
/ – or; A – accept; R – reject; CAO – correct answer only; ECF – error carry forward; only award marks for working; OWTTE – or words to that effect; w/o – without

Section A

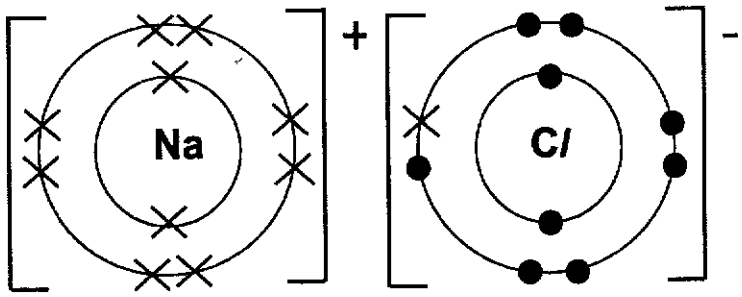
Q/No.	Answer	Comments/ Instructions
1ai)	<table><tr><th>element</th><th>atomic number</th><th>number of protons</th><th>number of neutrons</th><th>mass number</th><th>electronic configuration</th></tr><tr><td>**P**</td><td>17</td><td>17</td><td>18</td><td>35</td><td>2.8.7</td></tr><tr><td>**Q**</td><td>8</td><td>8</td><td>8</td><td>16</td><td>2.6</td></tr><tr><td>**R**</td><td>1</td><td>1</td><td>1</td><td>2</td><td>1</td></tr><tr><td>**S**</td><td>**19**</td><td>**19**</td><td>20</td><td>39</td><td>**2.8.8.1**</td></tr></table>	B1
aii)	Metal [1] It has 19 protons, potassium, one of the metals in Group I [1] Or It has one outermost shell electron, Group I alkali metal.	B2
b)	Atomic mass is calculated as the weighted average of all the naturally occurring isotopes. A: Element P has **isotopes. (plural)**	B1 Reject: P has an isotope (singular)
c)	Q has electronic configuration of 2.6. It will gain 2 electrons achieve stable noble gas configuration, (2.8) • **Must state change in electron configuration from 2.6 to 2.8** • **gain 2e**	B1
d)		B2 1m for correct H (R) atom 1m for correct Cl (P) atom

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		Total – 7
2ai)	Water level in the right-arm of the U-tube **rises**. As methane has a lower relative molecular mass than nitrogen, methane will diffuse faster into the porous pot than nitrogen gas diffusing out. The increase in pressure in pot then forces the water level to rise in the right arm.	B1 B1 B1
aii)	Ammonia gas is very soluble in water. Hence, it will **dissolve in water** instead of diffusing out of the porous pot.	B1
b)	Use of high pressure.	B1
c)	More methane can be stored in a given /fixed volume in liquid form	B1
		Total - 6
3a)	 **Symbol** / **Name** / **Charge** ● / **neutron** / **0** ○ / **proton** / **+ 1** **X** / **electron** / - 1	B1 B1 B1
b)	Isotopes are atoms of the same element with same number of protons but different number of neutrons/ nucleon number. **R: different mass**	B1
c)	Isotopes have similar chemical properties as they have the same number of valence electrons and valence electrons are involved in chemical reactions but Different physical properties as they have different relative atomic masses which determine their physical property such as melting/boiling point.	B1 B1
d)	tritium ion: T^- the compound formed between tritium and magnesium: MgT_2 **R:** T_2Mg	B1 B1
		Total - 8
4a)	(i) Molecules: N_2 NH_3 H_2O (ii) Elements(s): N_2 **and Ar** (iii) Triple bond: N_2	B1 B1 B1
b)	NH_3	B1
c)	$NH_3 + HCl \rightarrow NH_4Cl$	B1
		Total - 5

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5a)	In graphite, each carbon atom is covalently bonded to **three other carbon atoms and has one electron** which is delocalised and **moves freely to act as charge carriers.** In silicon dioxide, all atoms have used their valence electrons to form covalent bonds and there are **no free mobile electrons** to act as charge carriers.	B1 B1
b)	A **small amount of force** is required to **overcome the weak intermolecular forces** between the layers of carbon atoms in graphite. The layers of carbon atoms can **slide past one another easily**. **R: Energy/heat**	B1 B1
		Total - 4
6a)	Bromine is in **liquid state**	B1
b)	Wax. It melts and boils over a range of temperature	B1
c)	Sugar is not stable to heat, decomposes instead of boiling	B1
d)	At **419 °C**, zinc atoms are **packed close together** in **neat regular arrangement** and are **vibrating at its fixed positions** within the metallic lattice. At **420 °C**, the zinc atoms are in **random arrangement and are slightly further apart.** The atoms are able to move by **sliding past each other within the liquid.**	B1 B1 Mark awarded for **comparison**
e)	1) Add the mixture of sodium chloride and zinc to water and stir to dissolve sodium chloride. 2) Filter the mixture. 3) Collect zinc as the residue and rinse with distilled water. Dry zinc between filter paper. 4) Collect filtrate from step 2 and evaporate to dryness to obtain sodium chloride.	B3
f)	 x - electron of Na ● - electron of Cl	B2 1m for charge on Na ion. 1m for transferred electron on Cl ion. **Minus 1m for no bracket.**
		Total - 10

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