PEICAI SECONDARY SCHOOL
SECONDARY THREE EXPRESS
END OF YEAR EXAMINATION 2019

CANDIDATE NAME

CLASS REGISTER NUMBER

SCIENCE (PHYSICS, CHEMISTRY) 5076/01

Paper 1 Multiple Choice **3 October 2019**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.

There are **forty** 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.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Data Sheet is printed on page 19.
A copy of the Periodic Table is printed on page 20.
The use of an approved scientific calculator is expected, where appropriate.

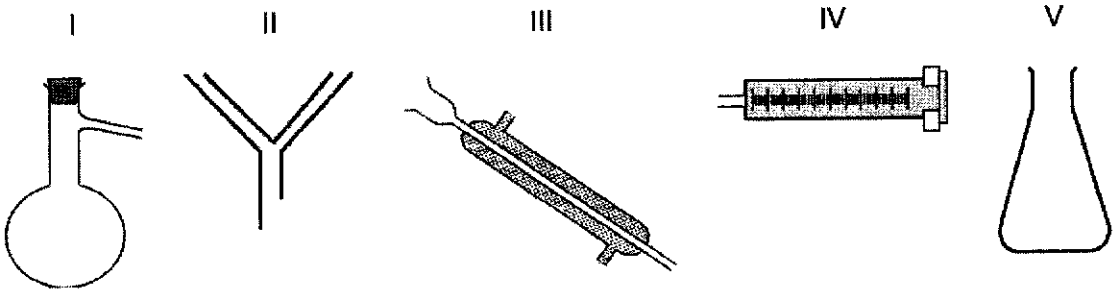
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21 Which of the following apparatus are needed to produce and collect a pure solvent from sodium chloride solution?



A II and V

B IV and V

C I, II and III

D I, III and V

22 Water boils at 100 °C.

Which other property shows proof of water being pure?

A It causes red and blue litmus paper to remain unchanged.

B It changes white anhydrous copper(II) sulfate blue.

C It does not leave a residue when boiled.

D It freezes at 0 °C.

23 Naphthalene, a chemical used in moth balls, has a melting point of 80 °C.

Which of the following statements best describe naphthalene when it is heated from 75 °C to 85 °C?

1. The size of the molecules decreases.
2. The kinetic energy of the molecules decreases.
3. The distance between the molecules increases.
4. The forces of attraction between the molecules weakens.

A 1 and 3

B 2 and 3

C 2 and 4

D 3 and 4

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24 Which row consists of an element, a compound and a mixture?

A calcium oxide, sodium chloride solution, mercury

B copper(II) sulfate, francium, lithium

C seawater, potassium carbonate, air

D sodium chloride, nitric oxide, zinc carbonate

25 Sulfide ion is represented by the symbol, S^{2-}.

Which row correctly states the number of neutrons, protons and electrons for this ion?

	number of		
	neutrons	protons	electrons
A	16	16	16
B	16	16	18
C	16	32	32
D	32	18	16

26 The table below shows the proton number for elements X and Y.

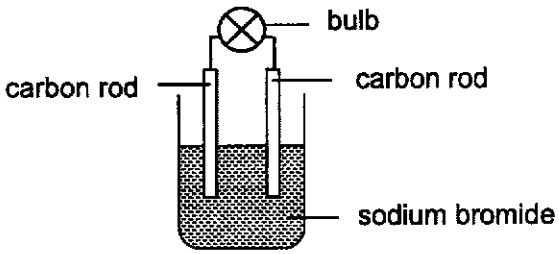
element	proton number
X	12
Y	9

Which of the following correctly describes the type of bonding and chemical formula for the compound formed between elements X and Y?

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

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27 The diagram below shows a set-up used to determine the electrical conductivity of an ionic compound sodium bromide.



Why does the bulb light up only when sodium bromide is melted?

A Sodium and bromine atoms are converted to ions when melted.

B Sodium and bromide ions are mobile when melted.

C Sodium and bromide ions release mobile electrons when melted.

D Sodium bromide molecules are mobile when melted.

28 What is the value of n, for a compound with the formula C_nH_{10}, and a relative molecular mass of 70?

A 4 **B** 5 **C** 12 **D** 60

29 One mole of an unknown acid, N, produces two moles of hydrogen ions when dissolved in water.

How many moles of hydrogen ions are present in 2 dm^3 of 0.05 mol/dm^3 of acid N?

A 0.025 **B** 0.5 **C** 0.1 **D** 0.2

30 Which numbers for x, y and z will correctly balance the chemical equation shown below?

$$x\ S_8 + y\ O_2 \rightarrow z\ SO_3$$

	x	y	z
A	1	8	8
B	1	11	8
C	1	12	8
D	2	12	16

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31 5 dm^3 of propane undergoes complete combustion as shown in the chemical equation below.

$$C_3H_8\ (g) + 5O_2\ (g) \rightarrow 3CO_2\ (g) + 4H_2O\ (l)$$

What is the volume of gaseous product obtained from this reaction at room temperature and pressure?

A 5 dm^3 **B** 10 dm^3 **C** 15 dm^3 **D** 35 dm^3

32 Which of the following compounds can be added to reduce the acidity of soils to help crops grow better?

A calcium chloride
B calcium hydroxide
C calcium nitrate
D calcium sulfate

33 The table below provides information on three indicators.

indicator	colour at pH 1	colour at pH 14	pH at which colour changes
thymol blue	red	yellow	3
congo red	blue	red	5
phenolphthalein	colourless	red	10

Which row shows the colour of the indicators when each are added separately to pure water?

	thymol blue	congo red	phenolphthalein
A	red	blue	red
B	yellow	blue	colourless
C	yellow	red	red
D	yellow	red	colourless

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34 Which statements about potassium hydroxide solution are correct?

1. It is a strong alkali.
2. It is a good conductor of electricity.
3. It is able to change the colour of blue litmus paper red.
4. Statement (II) is true because only hydroxide ions are present.

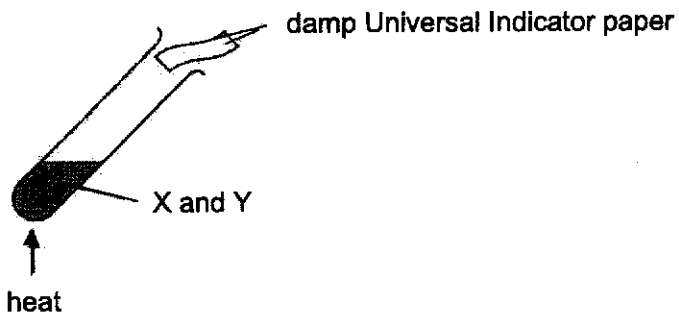
A 1 and 2

B 1 and 4

C 2 and 3

D 2 and 4

35 The diagram shows substances X and Y, being heated together.



The Universal Indicator paper turns blue during the experiment.

What are substances X and Y?

A ammonium nitrate and hydrochloric acid

B ammonium nitrate and sodium hydroxide

C sodium carbonate and hydrochloric acid

D sodium carbonate and sodium hydroxide

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36 Sodium, aluminium and sulfur can be found in the same period of the Perioidic Table.

Which of the following options correctly describe the nature of their oxides?

	sodium	aluminium	sulfur
A	acidic	amphoteric	basic
B	amphoteric	basic	acidic
C	basic	acidic	amphoteric
D	basic	amphoteric	acidic

37 Which of the following properties shown could be that of sodium?

	density / g/cm^3	melting point / °C	electrical conductivity
A	0.97	97.8	good
B	2.34	2300	poor
C	3.12	-7.2	poor
D	8.96	1083	good

38 Four elements have the following electronic configurations.

W	2, 1
X	2, 2
Y	2, 5
Z	2, 8

Which statement is correct?

A All four elements are in Period 2 of the Periodic Table.

B All four elements belong to Group II of the Periodic Table.

C X and Y are metals, W and Z are non-metals.

D Z is in Group VII and X is in Group I of the Periodic Table.

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39 Which statement best describes elements in Group I of the Periodic Table?

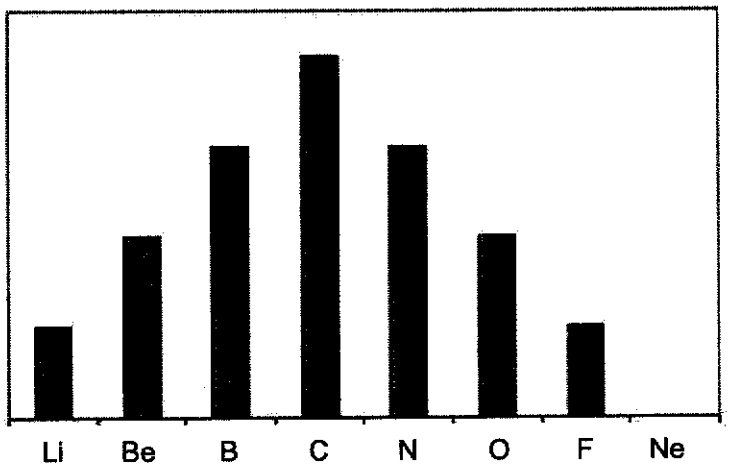
A The atoms become smaller down the group.

B The elements are equally reactive.

C The proton number of each element increases by one down the group.

D The reaction with chlorine results in a similar metal chloride formulae.

40 The bar chart below shows the elements across Period 2 of the Periodic Table.



Which property of these elements is shown in the chart?

A the number of electrons used in bonding

B the number of filled electron shells

C the number of protons

D the number of protons and neutrons

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The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							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											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 –		

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.).

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SECONDARY THREE EXPRESS
END OF YEAR EXAMINATION 2019

CANDIDATE NAME

CLASS REGISTER NUMBER

SCIENCE (PHYSICS, CHEMISTRY)

5076/03

Paper 3 Chemistry

27 September 2019

1 hour 15 minutes

Candidates to answer on the Question Paper.

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, when appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

A copy of the Data Sheet is printed on page 19.
A copy of the Periodic Table is printed on page 20.

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

For Examiner's Use	
Section A	/ 45
Section B	/ 20
Total	/ 65

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Section A

Answer **all** questions in the spaces provided.

1 Fig. 1.1 below shows the nuclei of five atoms, **F**, **G**, **H**, **I** and **J**. These are **not** symbols of elements.

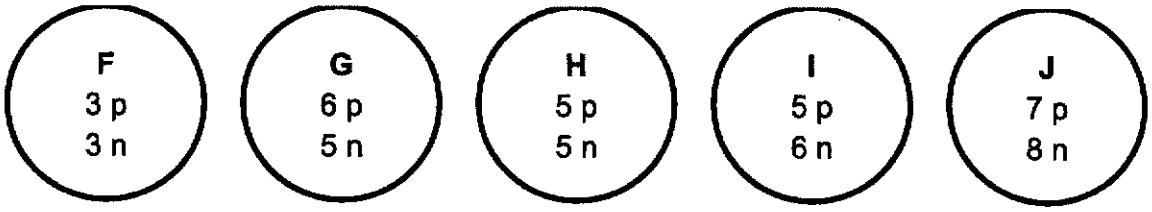


Fig. 1.1

Use the letters **F**, **G**, **H**, **I** or **J** to answer the following questions. Each letter may be used only once.

(a) atom that are isotopes of the same element, ...[1]

(b) atom that forms a positively charged ion, ...[1]

(c) atom that has four valence electrons, ...[1]

(d) atom that forms a diatomic molecule. .....[1]

2 Name the apparatus most suitable for carrying out the following procedures.

(a) adding 150 cm^3 of liquid into a beaker, ...[1]

(b) collecting a gas from a reaction, ...[1]

(c) measuring exactly 22.7 cm^3 of alkali into a beaker, ...[1]

(d) measuring the boiling point of water. .....[1]

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3 Fig. 3.1 shows the atomic structure of three elements **P**, **Q** and **R**.
They are isotopes of each other.

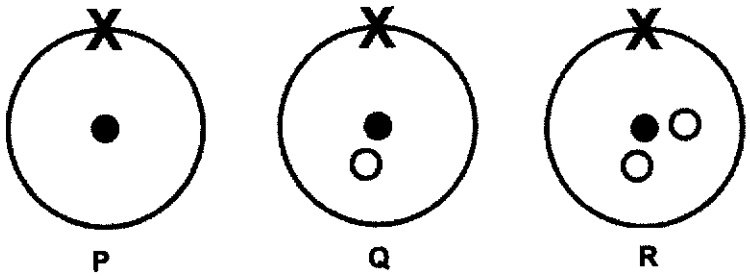


Fig. 3.1

(a) Using the information from Fig. 2.1 complete Table 3.2.

symbol	sub-atomic particle	relative charge	relative mass
○			
●	proton		1
X		-1	

[3]

Table 3.2

(b) Define the term *relative atomic mass.*

.....

.....[1]

[Turn Over

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4 Fig. 4.1 below shows five models **A**, **B**, **C**, **D** and **E** used to represent the particles in gases.

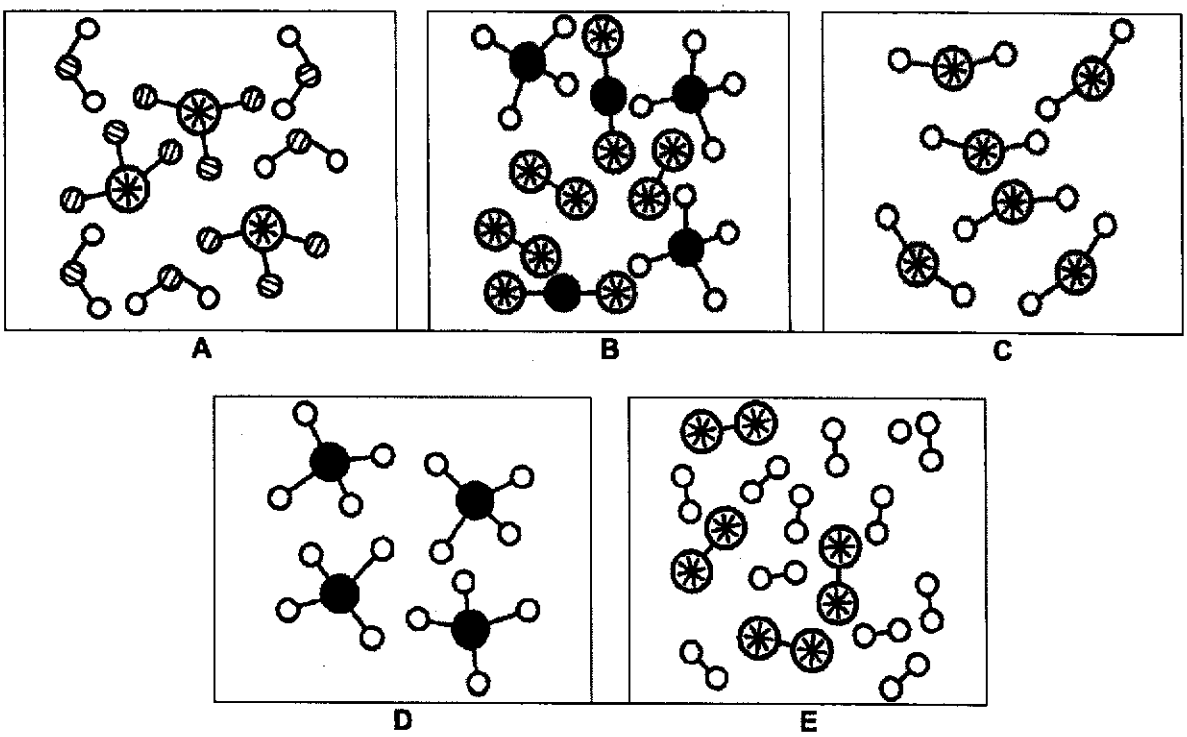


Fig. 4.1

Using **A**, **B**, **C**, **D** or **E** identify the model that best represent(s),

(a) a mixture of oxygen and hydrogen, ...[1]

(b) molecules of sulfur dioxide, ...[1]

(c) a pure compound, ...[1]

(d) a mixture of elements, ...[1]

(e) a mixture of element and compounds. .....[1]

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5 Fig. 5.1 shows the chromatogram obtained from an experiment used to identify the metals present in metal mixture **A**.

Before the chromatography experiment can be carried out, the mixture **A**, was dissolved in acid to form solutions of metal compounds from the mixture. The results obtained were then compared against known samples of metals.

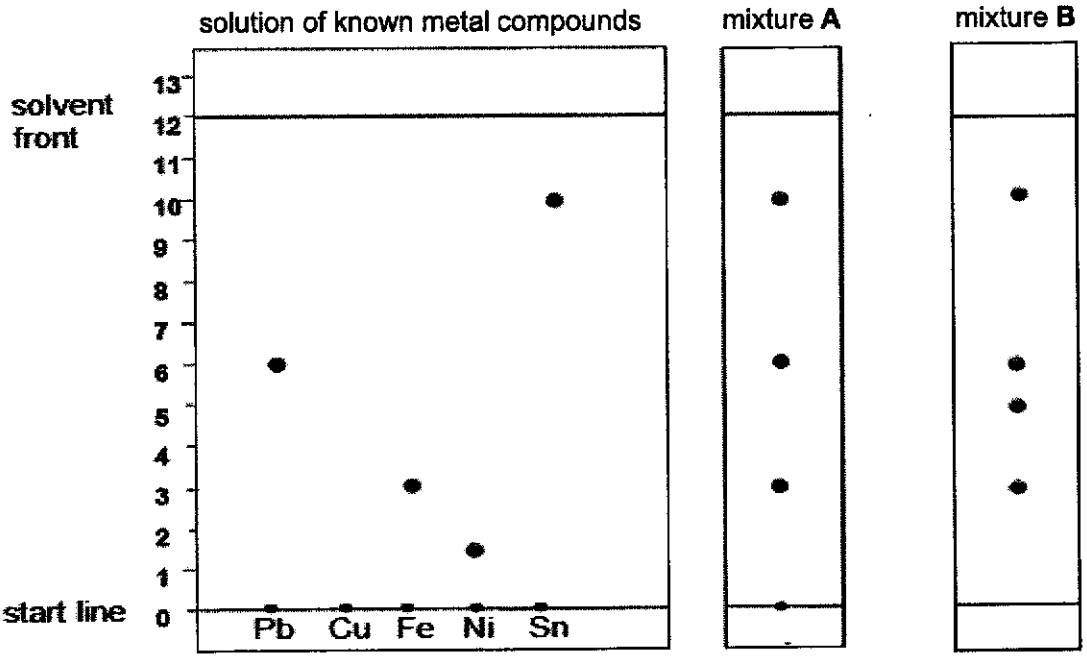


Fig. 5.1

(a) Explain why the start line is drawn with a pencil and the reason for its use in chromatography.

.....

.....[2]

(b) Identify the metals found in mixture **A**.

.....[1]

(c) A trader claims that metal mixture **B**, is from a different source of metal. Explain why this claim was made.

.....

[1]

(d) Using knowledge on acid reaction, explain why the metal copper showed no result on the chromatogram.

.....[1]

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6 Solid **K** was heated for 30 minutes. Fig. 6.1 shows the incomplete graph for the temperature of **K** against time.

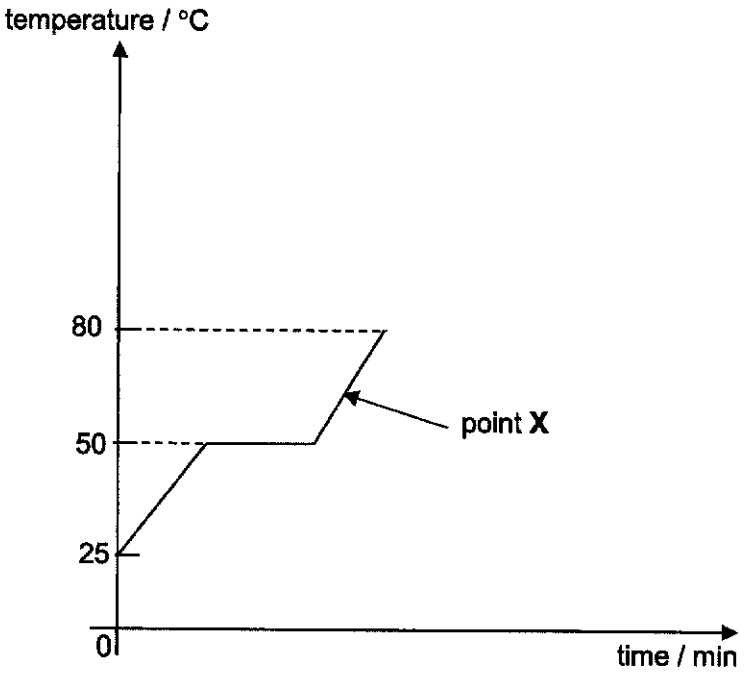


Fig. 6.1

(a) Using the box provided below, show the arrangement for the particles of **K** at point **X**.

[1]

(b) On Fig. 6.1 above, complete the graph to show the temperature change against time when solid **K** is heated from 80 °C to 140 °C. The boiling point of solid **K** is 120 °C.

[2]

(c) Using knowledge on Kinetic Particle Theory, describe the arrangement and movement for the particles of **K** at 127 °C.

.....

.....

.....[2]

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7 When magnesium ribbon burns completely in oxygen, the compound magnesium oxide, a white solid is formed.

(a) State the charges for both magnesium and oxide ion.

Charge on magnesium ion .....

Charge on oxide ion .....

[1]

(b) Draw a 'dot-and-cross' diagram to show the electronic structure for the compound formed between magnesium and oxygen. Show all electrons.
[Proton numbers: Mg, 12; O, 8]

[2]

(c) Explain **how** and **why** this change has taken place.

.....

.....

.....

.....

.....

.....[3]

(d) Explain why the compound formed between magnesium and oxygen has a high melting point.

.....

.....

.....[2]

[Turn Over

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8 The salt calcium nitrate, $Ca(NO_3)_2$, can be prepared by reacting calcium carbonate with dilute nitric acid, HNO_3.

(a) Write the balanced chemical equation for the reaction between calcium carbonate and dilute nitric acid.

.....[2]

(b) Describe a positive test for the gas produced in this reaction.

test : .....

observation : .....

.....[1]

(c) **(i)** As part of the process, dilute nitric acid was prepared by dissolving 12.6 g of nitric acid into 500 cm^3 of distilled water.

Calculate the concentration of this solution in g/dm^3.

concentration = ... g/dm^3 [1]

(ii) Calculate the mass of calcium nitrate produced when 6.5 g of calcium carbonate reacts with excess dilute nitric acid.
[Relative atomic masses: A_r: H, 1; C, 12; N, 14; O, 16; Ca, 40]

mass = ... g [1]

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9 Fig. 9.1 describes a series of experiments resulting from the chemical reaction of solid **C**.

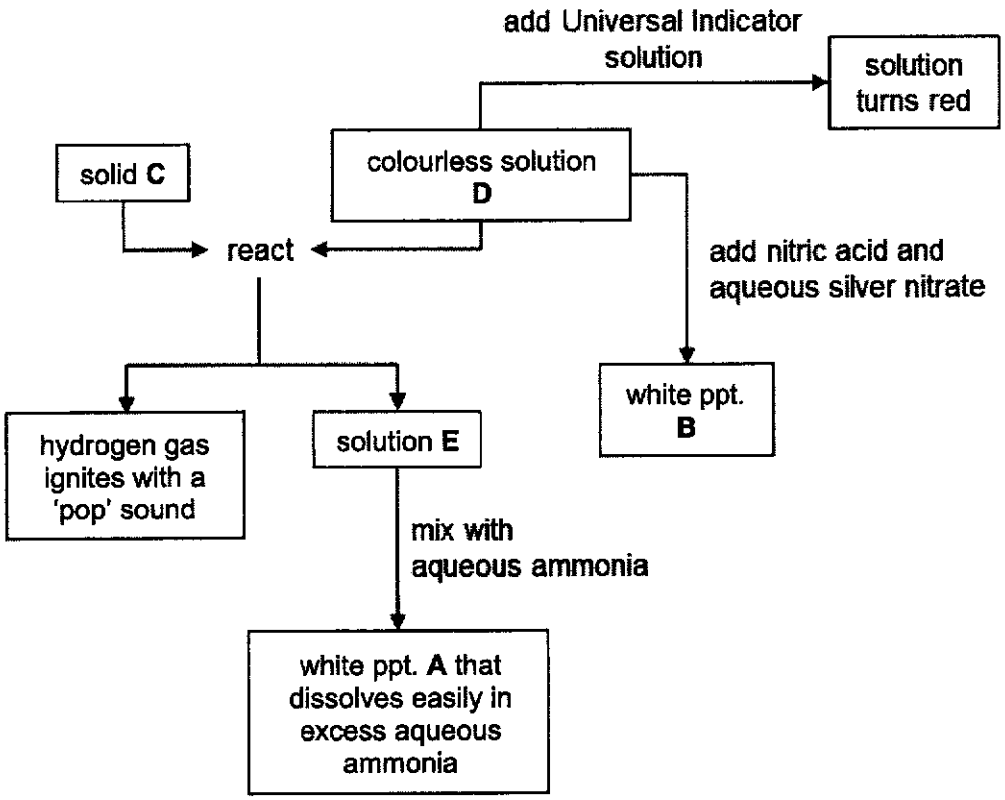


Fig. 9.1

Identify **A**, **B**, **C**, **D** and **E**.

A : .....

B : .....

C : .....

D : .....

E : .....

[5]

[Turn Over

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Section B

Answer any **two** questions in this section.

Write your answers in the spaces provided.

10 The elements are labelled as **W, X and Y** are from Period 2 of the Periodic Table. Table 10.1 below gives information about some elements and the formula of their chlorides.

formulae of chloride	melting point / °C	boiling point / °C	able to conduct electricity in aqueous state
WCl_2	714	1418	yes
XCl	790	1407	yes
YCl_4	-70	-2	no

Table 10.1

(a) Arrange elements **W, X** and **Y** in ascending order of its proton number.

.....[1]

(b) **(i)** State the group of the Periodic Table where element **X** is likely to be from.

.....[1]

(ii) Explain your answer in part **(b)(i)**.

.....

.....

.....[1]

(iii) Write the balanced chemical equation for element **X** when it is placed into a beaker of water.

.....[1]

(iv) State the observation seen when Universal Indicator is added into the beaker of water before and after the reaction in **(b)(iii)**.

.....[1]

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(c) It was observed that YCl_4 has a very low boiling point and that it was also extremely volatile. Explain this observation.

.....

.....

.....[2]

(d) Draw a 'dot-and-cross' diagram to show the bonding in YCl_4. Show only the valence electrons.
[Proton number: Cl, 17]

[3]

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11 Fig. 11.1 shows a method that uses an acid and an alkali for the preparation of the salt potassium sulfate.

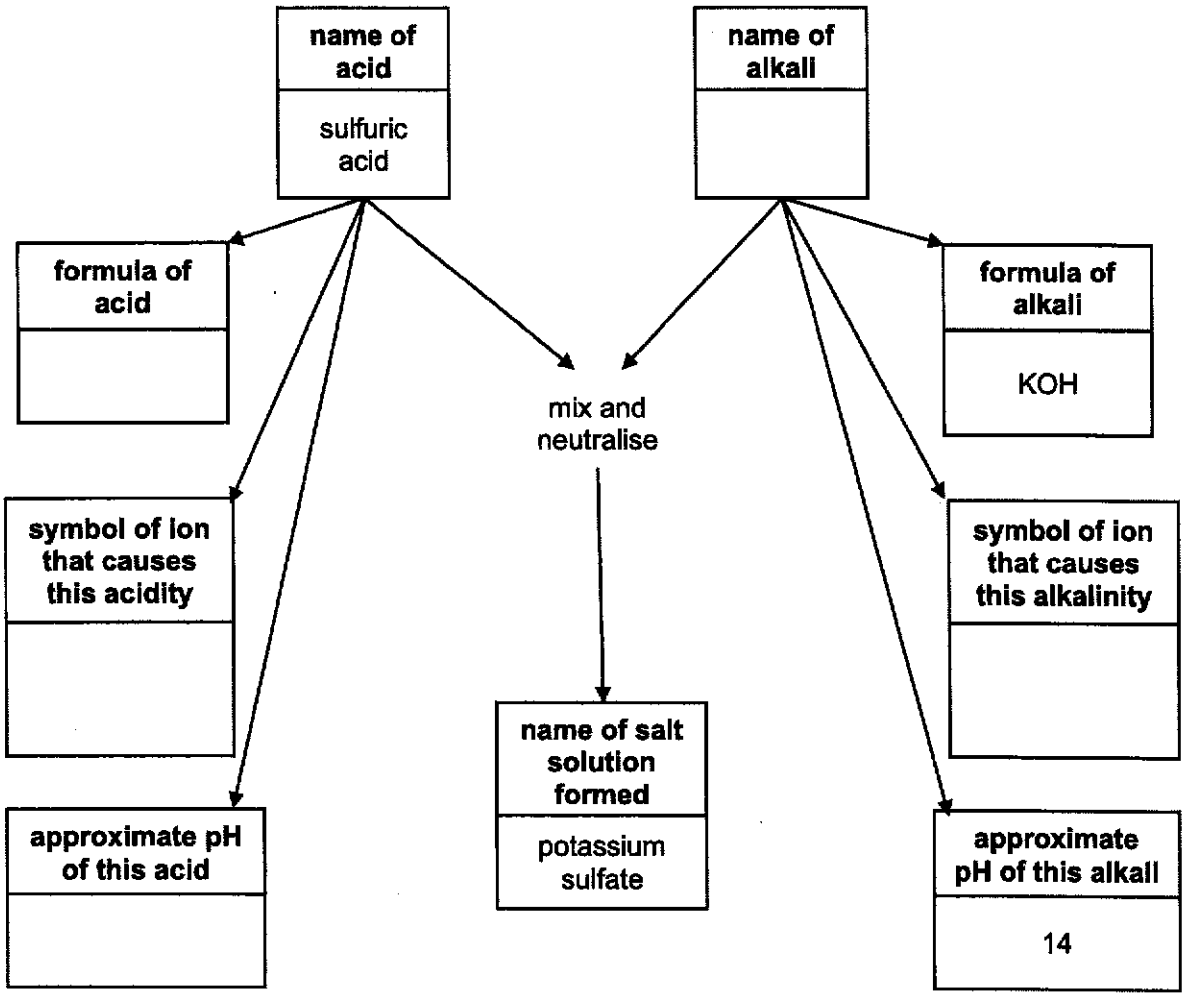


Fig. 11.1

(a) Complete the missing information for Fig. 11.1

[5]

(b) **(i)** Name the salt preparation method shown in Fig. 11.1.

.....[1]

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(ii) Describe how one might be able to obtain pure, dry crystals of the potassium sulfate salt produced in Fig. 11.1.

.....

.....

.....

.....

.....

.....

.....

.....

.....[2]

(c) Write the balanced chemical equation for the reaction in Fig. 11.1. Include state symbols.

.....[2]

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12 In the exploration of a new planet termed "*X-023-hailed*", it was discovered that its atmosphere contained two elements, **T** and **U**. Through scientific tests, it was determined that the elements had a relative atomic number 17 and 35 respectively.

Excited scientists immediately predicted that the elements **T** and **U**, will show similar chemical and physical properties to one group of elements here on earth. More importantly, elements **T** and **U** are also diatomic in nature.

Using the information and assuming if the scientists are right, answer the following questions.

(a) State the name, and group of the element in the Periodic Table, that the scientists are referring to.

.....[1]

(b) Predict **two** trends the scientists can expect for elements **T** and **U**.

.....

.....

.....[2]

(c) On further tests, it was found that chemical reactions of element **T**, closely matched the predictions made by scientist. Confirmation of this can be done through the use of sodium bromide solution, NaBr.

(i) Write the balanced chemical equation for the reaction of element **T**, with aqueous sodium bromide solution. Include state symbols.

.....[2]

(ii) State one observation for the reaction in **(c)(i)** for a positive test.

.....[1]

(iii) Explain the observation in **(c)(ii)**.

.....

.....[2]

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(d) To conduct the confirmation test in part **(c)**, 250 cm^3 of 4.00 mol/dm^3 of sodium bromide solution was used. Calculate the volume of element **T** used in the reaction, at room temperature and pressue.

volume of element T used = ... cm^3 [2]

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DATA SHEET
Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

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The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							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											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 –		

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.).

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PEICAI SECONDARY SCHOOL
SCIENCE DEPARTMENT
RESULT ANALYSIS AND MARKING SCHEME

Name of Marker(s):	Mr Gerard Yong
Name of Assessment:	Sec 3 End of Year Examinations
Year:	2019
Subject:	Science Chemistry
Level/Stream:	Sec 3 Express

Paper 1 Answers

21	22	23	24	25	26	27	28	29	30
D	**D**	**D**	**A**	**B**	**D**	**B**	**B**	**D**	**C**
31	32	33	34	35	36	37	38	39	40
C	**B**	**D**	**A**	**B**	**D**	**A**	**A**	**D**	**A**

Marker's Remarks on Specific Questions

Structured Questions (Please insert marker's remarks after every answer)

Paper 3 Section A

Qn No.	**Marking Scheme** (showing suggested and all possible/alternative answers) *(Please include any alternative answers/rejected answers or points to take note of after marking, within the marking scheme)*	**Mark (C1/A1/B 1)**
1a	H and I	1
1b	F	1
1c	G	1
1d	J	1
2a	measuring cylinder	1
2b	gas syringe	1
2c	burette	1
2d	thermometer / alcohol-in-glass thermometer	1

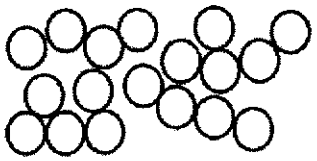
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RESULT ANALYSIS AND MARKING SCHEME

<table>
<tr><td>3a</td><td>
<table>
<tr><th>symbol</th><th>sub-atomic particle</th><th>relative charge</th><th>relative mass</th></tr>
<tr><td>○</td><td>neutron</td><td>0</td><td>1</td></tr>
<tr><td>●</td><td>proton</td><td>+1</td><td>1</td></tr>
<tr><td>X</td><td>electron</td><td>-1</td><td>$\frac{1}{1836}$ / $\frac{1}{1840}$</td></tr>
</table>
</td><td>6C – 3
4C to 5C – 2
2C to 3C – 1
0C to 1C– 0</td></tr>
<tr><td>3b</td><td>the ratio of the average mass of one atom of an element to one twelfth of the mass of an atom of carbon-12</td><td>1</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>4a</td><td>E</td><td>1</td></tr>
<tr><td>4b</td><td>C</td><td>1</td></tr>
<tr><td>4c</td><td>D and C</td><td>1</td></tr>
<tr><td>4d</td><td>E</td><td>1</td></tr>
<tr><td>4e</td><td>B</td><td>1</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>5a</td><td>Pencil is <u>made of carbon</u>, it <u>does not dissolve in the solvent</u> and its use <u>does not affect the accuracy of the results</u>.

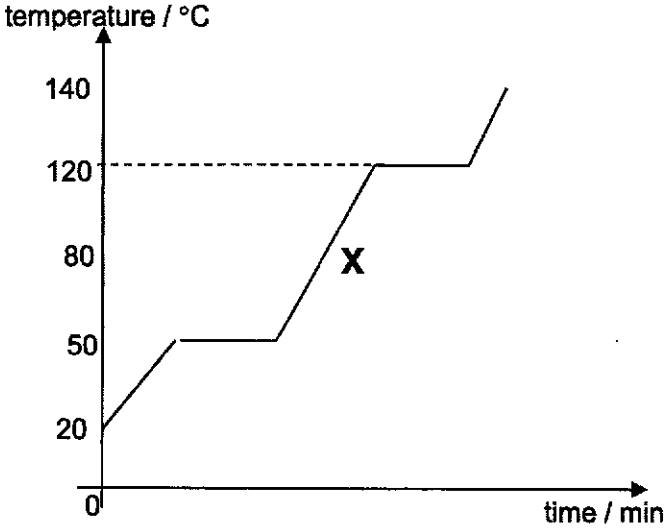
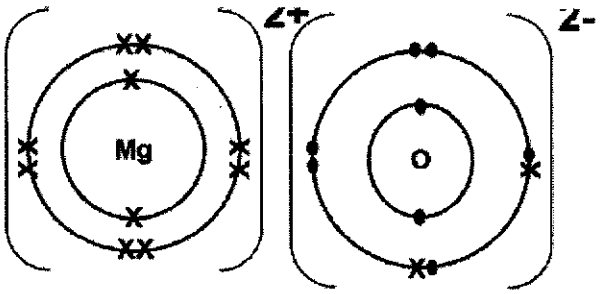
or

Pencil lead is <u>insoluble in the solvent used</u>, and it <u>does not affect the accuracy of the results</u>.</td><td>1
1

1
1
[2]</td></tr>
<tr><td>5b</td><td>Sn, Pb, Fe</td><td>1</td></tr>
<tr><td>5c</td><td>Mixture B <u>contains an unknown metal</u> not present in mixture A.</td><td>1</td></tr>
<tr><td>5d</td><td>Copper is an <u>unreactive metal</u> and <u>does not react with the acid used</u>.</td><td>1</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>6a</td><td>
• particles should be in contact to show closely packed
• particles to be irregularly arranged, should not resemble closely to that of solid
• particles' shape to be consistent
• ¾ of box to be filled.</td><td>1</td></tr>
</table>

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6b	 • Boiling point of K at 120 °C must be indicated clearly.	Correct shape of graph sketched – 1 Boiling point clearly indicated with dotted lines – 1
6c	• At 127 °C, K is a gas. • The particles are **very far apart** with **(a lot of empty spaces)** between them. • The particles are **moving rapidly and randomly / in all directions**.	1 1
7a	Mg^{2+} O^{2-}	1
7b	 key • electron of O × electron of Mg	Correct electronic configuration of ions – 1 Correct charges of ions – 1
7c	Magnesium atom loses **two valence electrons** to form magnesium **ion with (two positive charges)** Oxygen atom **gains two electrons** to form oxide **ion with (two negative charges)**. This results in the **formation of stable noble gas electronic configuration** for both magnesium and oxygen.	1 1 1 [3]

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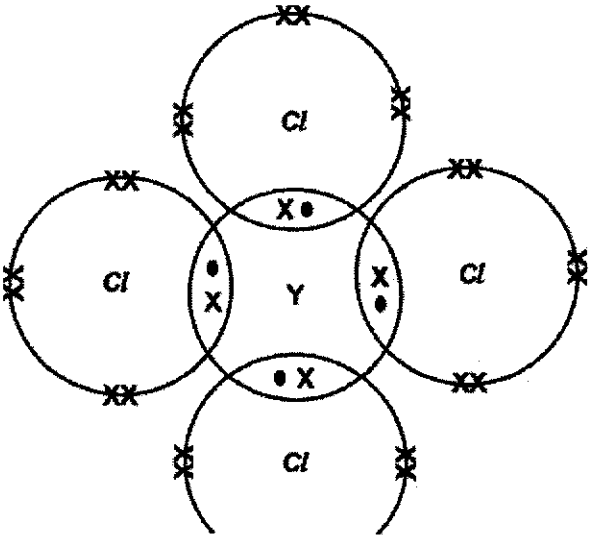
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7d	**A large amount of heat energy** is needed to **overcome the strong ionic bonds / strong electrostatic forces of attraction** between the **(oppositely charged) ions**.	3C – 2 1C to 2C – 1 0C – 0 [2]
8a	$CaCO_3 + 2HNO_3 \rightarrow Ca(NO_3)_2 + H_2O + CO_2$	1 – balanced chemical equation 1 – correct chemical equation
8b	test: Bubble gas into test tube of limewater observation: gas produces a white precipitate in limewater.	1
8c	concentration of nitric acid = 12.6 g ÷ (500 ÷ 1000) dm^3 = 25.2 g/dm^3	 A1
8d	number of moles of calcium carbonate = 6.5 ÷ 100 = 0.065 mol Compare mole ratio $CaCO_3$: $Ca(NO_3)_2$ 1 : 1 Therefore 0.065 mol of $Ca(NO_3)_2$ is produced. mass of $Ca(NO_3)_2$ produced = 0.065 mol x [40 + (2 x 14) + (6 x 16)] = 10.7 g (3.s.f)	 M1 A1
9	A: Zinc hydroxide / $Zn(OH)_2$ B: Silver chloride / $AgCl$ C: Zinc / Zn D: Hydrochloric acid / HCl E: Zinc chloride / $ZnCl_2$	1 1 1 1 1 [5]
10a	X, W, Y	1
10bi	Group I	1
10bii	X has **one valence electron** and **loses one electron** to ***form a* positive ion with single positive charge**. Hence it is in Group I	1
10biii	$2X + 2H_2O \rightarrow 2XOH + H_2$	1
10biv	The Universal Indicator changes from green to purple / violet	1

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10c	**A small of amount of heat energy** is needed to **overcome the weak intermolecular forces of attraction** Or **A small of amount of heat energy** is needed to **overcome the weak forces of attraction between the molecules (of YCl_4)**. Hence it has a low boiling point and is volatile.	1 1 1 1 [2]
10d	 Key × electron of Cl • electron of Y •	Correct sharing of electrons – 1 Correct electronic configuration of Cl – 1 Correct electronic configuration of Y – 1 [3]
11a	H_2SO_4 H^+ 1 Potassium hydroxide OH^-	Each – 1 [5]
11bi	Titration	1
11bii	• **Heat** the **potassium sulfate solution / solution** until it is **saturated / evaporate until crystals are formed** • Allow the solution to **cool and crystals to form / allow the crytals to cool** • **Filter** the mixture to **collect the crystals** • Wash with cold distilled water and **press dry between sheets of filter paper**.	4C – 2 2C to 3C – 1 0C to 1C – 0 [4]
11c	$2KOH\ (aq) + H_2SO_4\ (aq) \rightarrow K_2SO_4\ (aq) + 2H_2O\ (l)$	Correct balanced equation – 1

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		Correct state symbols – 1
12a	Group VII, Halogens	1
12b	• Colour of the elements become darker down the group • melting and boiling points increase down the group • reactivity of the elements decreases down the group • density of the element increases down the group	1 – each [2]
12ci	T_2 (g) + 2NaBr (aq) → 2NaT (aq) + Br_2 (*l*)	Correct balanced equation – 1 Correct state symbols – 1
12cii	The **colourless solution** of potassium bromide **turns reddish brown**.	1
12ciii	**T is more reactive than bromine** and **displaces bromine** from sodium bromide solution.	1 1
12d	Number of moles of sodium bromide = 4.00 x (250 ÷ 1000) = 1 mole Compare mole ratio NaBr : T_2 2 : 1 Therefore number of mole of T2 = 0.5 x 1= 0.5 mole Volume of T_2 = 0.5 x 24 dm^3 = 12 dm^3	 M1 A1

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