Name and Index Number: ( )	Class:

SENG KANG SECONDARY SCHOOL
MID-YEAR EXAMINATION

SCIENCE (CHEMISTRY) 5076 & 5078/01

Secondary 3 Express

10 May 2019

Paper 1 Multiple Choice

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **forty** 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 Multiple Choice 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 question paper.
The use of an approved scientific calculator is expected, where appropriate.

A copy of the Periodic Table is printed on page 8.

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

This document consists of **7** printed pages and **1** blank page.

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

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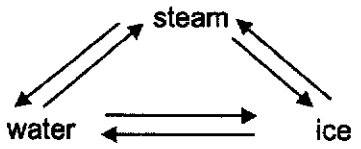
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1 Which changes take place when a liquid at 60°C become a gas at 120°C?

	separation of particles	energy of particles	attractive force between particles
A	increases	decreases	increases
B	increases	increases	decreases
C	decreases	decreases	increases
D	decreases	increases	decreases

2 In which conversion would water molecules lose speed?



A ice ⟶ water
B ice ⟶ steam
C steam ⟶ ice
D water ⟶ steam

3 The table shows the melting and boiling points of five compounds, S, T, U, V and W.

substance	melting point (°C)	boiling point (°C)
S	– 182	– 162
T	– 23	77
U	– 97	65
V	41	182
W	132	290

Which substance(s) exists as a gas at room temperature?

A S only **B** S and T only **C** T and U only **D** V and W only

4 Which are the properties of a gas that need to be considered to select the collection method?

1 the colour of the gas
2 the density of the gas
3 the solubility of the gas in water

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

5 Which of the following is likely to be a pure compound?

A a brown solution
B an oily liquid which gives two fractions when distilled
C blue crystals which all melt at 80 °C
D colourless crystals which melt over the range (78 °C to 80 °C)

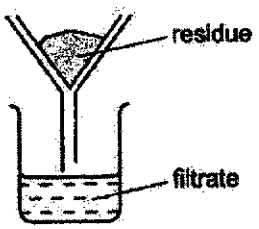
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6 The table shows the colours and solubilities in water of four solids.

solid	colour	solubility in water
W	blue	insoluble
X	blue	soluble
Y	white	insoluble
Z	white	soluble

A mixture containing two of the solids is added to excess water, stirred and filtered.
A blue filtrate and a white residue are obtained.

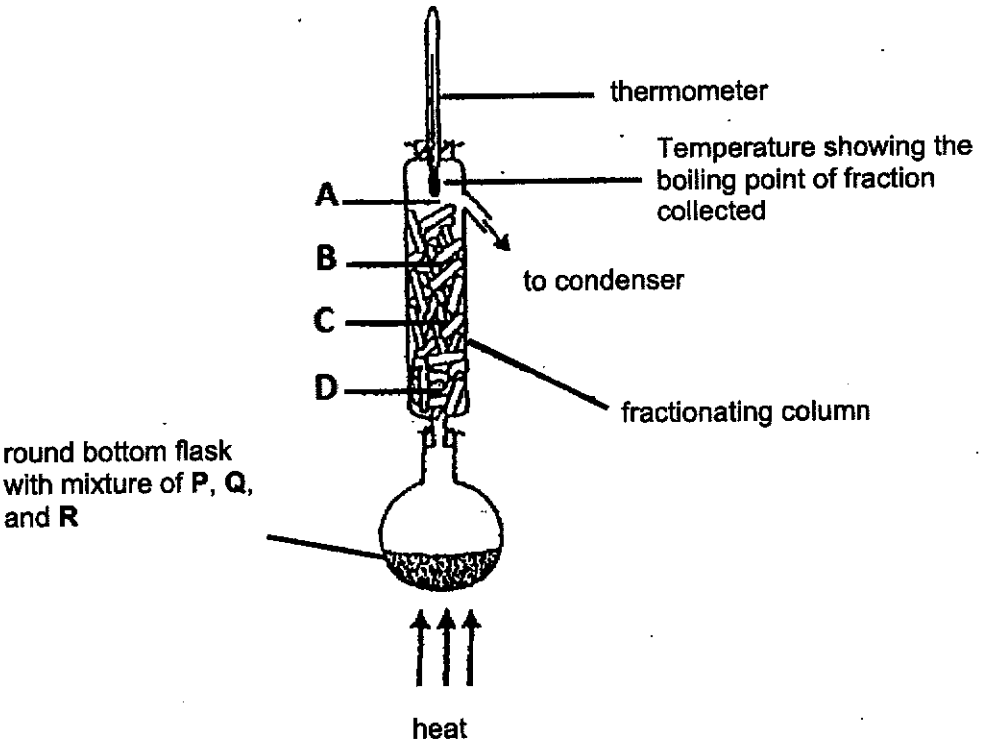


Which two solids are present in the mixture?

A **W** and **X** **B** **W** and **Y** **C** **X** and **Y** **D** **X** and **Z**

7 A mixture of three miscible liquids **P**, **Q** and **R** were fractionally distilled. **P** has the lowest boiling point, followed by **Q**, and **R** has the highest boiling point.

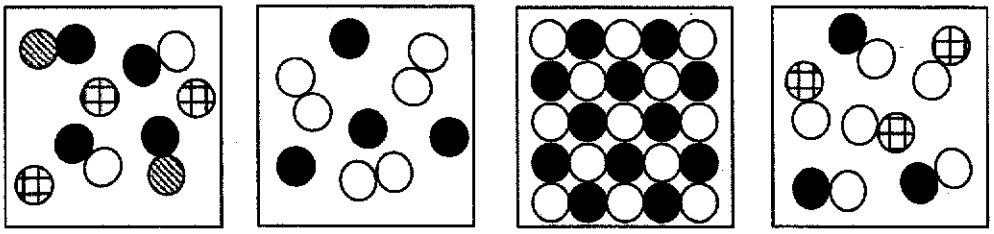
Which part of the fractionating column, **A**, **B**, **C** or **D** gives the least proportion of **R**?



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8 Which diagram shows a mixture of element and compounds?



A B C D

9 The atom of an element, Z, can be represented as ${}^{11}_{5}Z$.

Which of the following statement about this atom is correct?

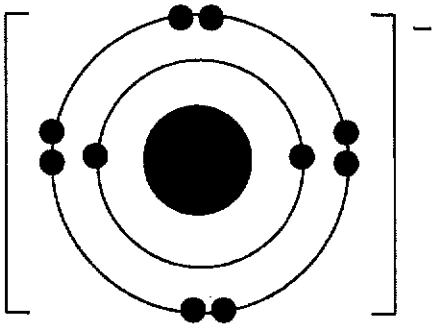
A An atom of Z has 5 electrons.
B An atom of Z has 6 protons.
C An atom of Z has 11 neutrons.
D An atom of Z has a relative mass of 16.

10 An element X has two isotopes, which may be represented as ${}^{238}X$ and ${}^{235}X$.
How does an atom of ${}^{238}X$ differ from an atom of ${}^{235}X$?

A ${}^{238}X$ has 3 more neutrons and the same number of electrons as ${}^{235}X$.
B ${}^{238}X$ has 3 more neutrons and 3 more electrons than ${}^{235}X$.
C ${}^{238}X$ has 3 more protons and the same number of electrons as ${}^{235}X$.
D ${}^{238}X$ has 3 more protons and 3 more electrons than ${}^{235}X$.

11 The diagram below shows the electron arrangement for an ion, J^-.

An atom of element J contains 10 neutrons.



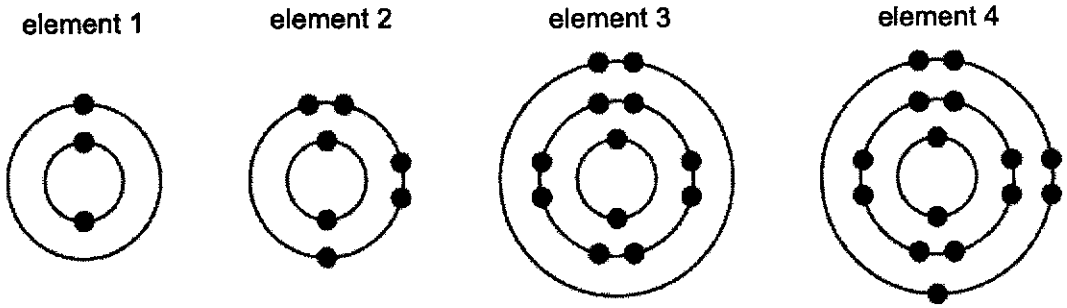
What is the nucleon number of element J?

A 18 B 19 C 20 D 21

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12 The diagrams show the arrangement of the electrons of four elements.



Which two elements are from the same Group?

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

13 Which pair of elements form a compound by sharing electrons?

A carbon and chlorine
B lithium and iodine
C neon and oxygen
D potassium and bromine

14 An element Q reacts with chlorine to form a solid of formula QC*l*.

What could be the electronic configuration of Q?

A 2,6
B 2,8,1
C 2,8,2
D 2,8,7

15 Which ions are present in an aqueous solution of sodium sulfate, Na_2SO_4?

A Na_2^+, SO_4^-, H_2^+ and OH^-
B Na_2^+, SO_4^{2-}, H^+ and OH^-
C Na^+, SO_4^{2-}, H^+ and OH^-
D Na^+, SO_4^{2-}, H^+ and OH^{2-}

16 Which two statements about a covalent bond are correct?

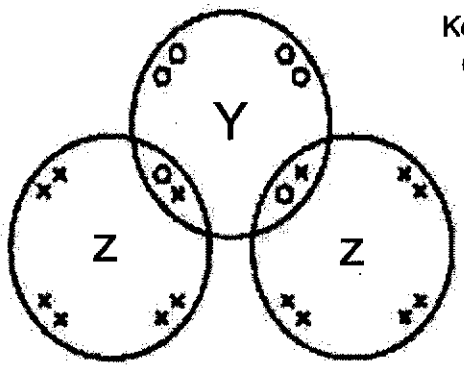
1 It can be formed between two metal atoms.
2 It can be formed between two non-metals.
3 It can be formed by the transfer of electrons between atoms.
4 It can be formed by sharing electrons between atoms.

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

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17 The diagram shows the arrangement of electrons in the outer shells of the atoms in the compound Z_2Y.

Which pair of elements could be Y and Z?



Key
O electrons of Y atom
X electrons of Z atom

	Y	Z
A	neon	chlorine
B	carbon	fluorine
C	oxygen	fluorine
D	sulfur	oxygen

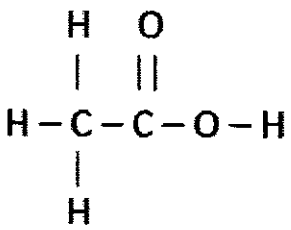
18 How many oxygen atoms are there in a molecule of ethanedioic acid, $(COOH)_2$?

A 2
B 4
C 6
D 8

19 How many elements are there in copper(II) sulfate crystals, $CuSO_4 .5H_2O$?

A 4 B 5 C 6 D 21

20 Ethanoic acid has the formula CH_3COOH. The structural formula of this acid is shown below.



What is the total number of electrons in the covalent bonds found in one molecule of ethanoic acid?

A 8 B 10 C 14 D 16

END OF PAPER

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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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SENG KANG SECONDARY SCHOOL
MID-YEAR EXAMINATION

SCIENCE (CHEMISTRY) 5076 & 5078/03

Secondary 3 Express

10 May 2019

Paper 3 Theory

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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

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

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 printed on page 11.
The use of an approved scientific calculator is expected, where appropriate.

For Examiner's use	
Section A	/ 45
1	/ 10
2	/ 5
3	/ 5
4	/ 5
5	/ 10
6	/ 5
7	/ 5
Section B	/ 20
8	/ 10
9	/ 10
Total	/ 65
Total %	/ 100

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Section A

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

1 **(a)** Substances can be classified as elements, compounds and mixtures.

When completed, Table 1.1 describes four substances.

Complete Table 1.1.

Table 1.1

substance	classification (element, compound or mixture)	atoms within this substance
hydrogen chloride	compound	hydrogen and chlorine
water		
carbon dioxide		
air		

[6]

(b) **(i)** Name the type of chemical bonding present in ammonia.

..... [1]

(ii) Draw a 'dot and cross' diagram to show the arrangement of electrons in a molecule of ammonia in the space below.

[2]

(iii) State one physical property of ammonia.

..... [1]

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2 Name the most suitable piece of apparatus that is used to carry out the following.

(a) To collect 15.6 cm^3 of carbon dioxide gas from a reaction.

..... [1]

(b) To measure the boiling point of a solution.

..... [1]

(c) To measure 22.3 cm^3 of sodium hydroxide.

..... [1]

(d) To measure the rate of dissolving salt in water.

..... [1]

(e) Measuring the volume of about 20 cm^3 of a liquid.

..... [1]

3 For each of the following substances, fill in Table 3.1 with 'True' or 'False'

Table 3.1

(a)	When a gas is compressed, the gas particles becomes smaller.	
(b)	The smallest particles that exist freely in a sample of helium gas are atoms.	
(c)	In fractional distillation, the first distillate that is collected is usually the liquid with the highest boiling point.	
(d)	Each molecule of sodium chloride consists of only one Na^+ ion and one Cl^- ion.	
(e)	The only element in the Periodic Table without neutron is hydrogen.	

[5]

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4 Table 4.1 show the various methods for separation of mixtures.

Table 4.1

filtration	fractional distillation	chromatography
crystallisation	magnetic attraction	simple distillation

With reference to Table 4.1, name the most suitable method to:

(a) obtain pure water from salt water solution,

..... [1]

(b) identify banned food colourings in a food sample,

..... [1]

(c) separate sand from a mixture of sand and water,

..... [1]

(d) separate water and ethanol,

..... [1]

(e) obtain copper(II) sulfate crystals from copper(II) sulfate solution.

..... [1]

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5 **(a)** Table 5.1 shows the formula of some common ions.

Table 5.1

CO_3^{2-}	NH_4^+	OH^-
SO_4^{2-}	NO_3^-	

Using the formula of the ions in Table 5.1 and the Periodic Table, state the chemical formula of the following substances:

(i) calcium nitrate,

..... [1]

(ii) sodium carbonate,

..... [1]

(iii) aluminium sulfate.

..... [1]

(b) Balance the following chemical equations.

(i) ..... Zn + ...HC*l* → ..... Zn$C l_2$ + ... H_2 [1]

(ii) ..... $CuCO_3$ + ... HC*l* → ..... Cu$C l_2$ + ... CO_2 + ... H_2O [1]

(iii) ..... NaOH + ... H_2SO_4 → ..... Na_2SO_4 + ... H_2O [1]

(c) Write balanced chemical equations for the following word equations.

State symbols are **not** required.

(i) ammonium chloride + sodium hydroxide→sodium chloride + ammonia + water

..... [2]

(ii) iron(II) sulfate + sodium hydroxide → iron(II) hydroxide + sodium sulfate

..... [2]

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6 Table 6.1 lists the number of protons, neutrons and electrons in several different particles.

Table 6.1

particle	electrons	protons	neutrons
A	8	8	8
B	14	14	14
C	2	2	2
D	13	13	14
E	10	13	14
F	8	8	10
G	10	7	7

Which of the particles, **A**, **B**, **C**, **D**, **E**, **F** and **G** in Table 6.1, match each description?

(a) Which **two** particles are ions?

..... [1]

(b) Which particle is an atom of a noble gas?

..... [1]

(c) Which **two** particles are an atom and an ion of the same element?

..... [1]

(d) Which **two** particles are isotopes of the same element?

..... [1]

(e) Which particle has the largest mass number?

..... [1]

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7 Fig 7.1 shows the change in temperature with time when a compound, naphthalene is being heated from room temperature to 300°C.

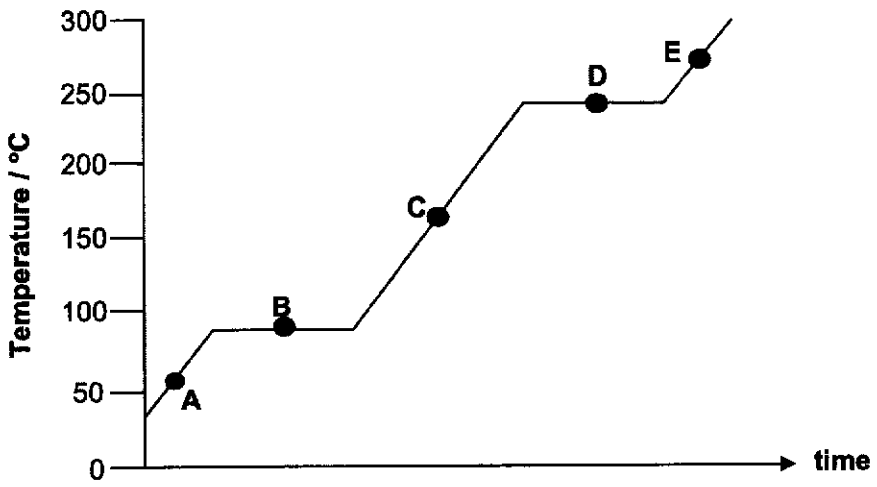


Fig. 7.1

(a) On which point, **A**, **B**, **C**, **D** or **E**, of the graph would

(i) the distance between naphthalene particles be the furthest,

..... [1]

(ii) naphthalene exist as both liquid and gas,

..... [1]

(iii) be the melting point of naphthalene?

..... [1]

(b) Describe the arrangement and movement of the naphthalene particles at temperature at point **C**.

arrangement: .....

.....

movement: .....

..... [2]

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Section B

Answer **all** the questions in this section.

Write your answers in the spaces provided.

8 Magnesium chloride and sodium chloride have high melting points and form colourless solution in water.

(a) **(i)** Draw a diagram to show the electronic structure of magnesium chloride.

[2]

(ii) Describe how this structure differs from the electronic structure of sodium chloride.

.....

.....

.....

..... [3]

(b) Explain why these two substances have high melting points.

.....

.....

.....

..... [3]

(c) Solid magnesium chloride does not conduct electricity. However, magnesium chloride solution conducts electricity.

Account for the properties of solid magnesium chloride and magnesium chloride solution. Your answer should **clearly state** the reason(s) for each substance.

.....

.....

.....

..... [2]

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9 Paper chromatography was used to investigate a forgery case. A sample of ink from a forged signature was compared with inks from the pens of five suspects, **A**, **B**, **C**, **D** and **E**. The results obtained are as shown in Fig. 9.1.

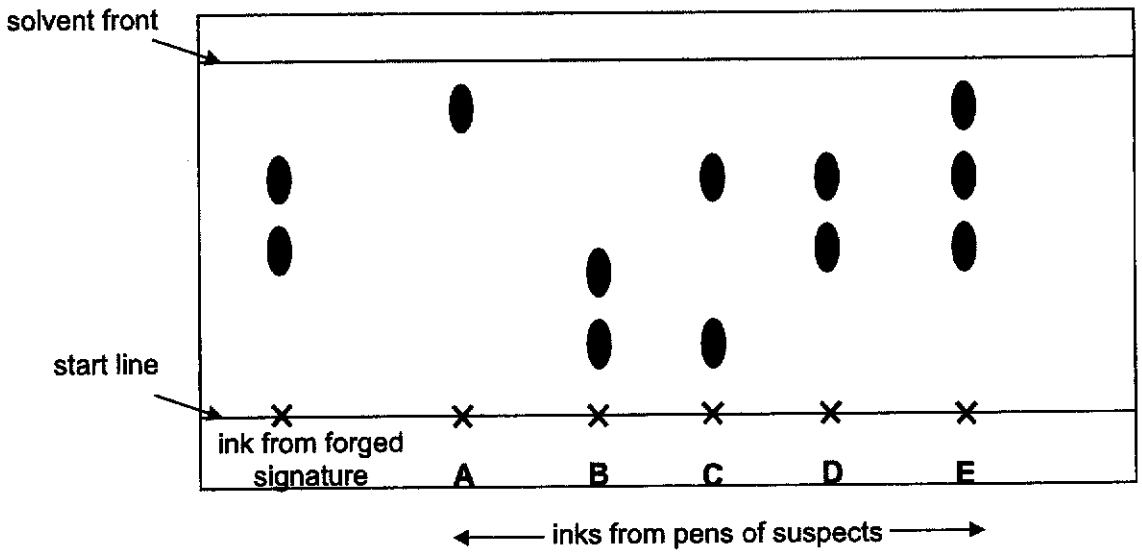


Fig. 9.1

(a) How many dyes were present in the ink from the forged signature?

..... [1]

(b) Which ink/s could have been used to forge the signature?

..... [1]

(c) The police concludes that ink **A** is made up of a pure dye.

Do you agree? Explain.

.....

..... [2]

(d) Why is the start line usually drawn with a pencil instead of a pen?

..... [1]

(e) Why must the solvent be below the start line at the start of the experiment?

..... [1]

(f) How are the different dyes in the ink separated?

..... [1]

(g) State one other real life application of paper chromatography.

..... [1]

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(h) Draw and label the apparatus that could be used to produce this chromatogram.

[2]

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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
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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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SKSS 3E MYE 2019 Mark Scheme

Paper 1 [20 marks]

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

Paper 3 [65 marks]

Section A [45 marks]

1 (a)

substance	classification (element, compound or mixture)	atoms within this substance
hydrogen chloride	compound	hydrogen and chlorine
water	**compound [1]**	**hydrogen and oxygen [1]**
carbon dioxide	**compound [1]**	**carbon and oxygen [1]**
air	**mixture [1]**	**nitrogen, carbon, oxygen, hydrogen, argon [1]**

(b) (i) covalent bonding [1]

(ii) electrons of nitrogen (2.5) and hydrogen (1) correctly drawn [1]

correct number of electrons in covalent bonding using dot and cross [1]

(iii) low boiling point; does not conduct electricity [1]

2 (a) gas syringe [1]
(b) thermometer [1]
(c) burette [1]
(d) electronic stopwatch [1]
(e) measuring cylinder [1]

3

(a)	When a gas is compressed, the gas particles becomes smaller.	False [1]
(b)	The smallest particles that exist freely in a sample of helium gas are atoms.	True [1]
(c)	In fractional distillation, the first distillate that is collected is usually the liquid with the highest boiling point.	False [1]
(d)	Each molecule of sodium chloride consists of one Na^+ ion and one Cl^- ion.	False [1]
(e)	The only element in the Periodic Table without neutron is hydrogen.	True [1]

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4 (a) simple distillation [1]
(b) chromatography [1]
(c) filtration [1]
(d) fractional distillation [1]
(e) crystallisation [1]

5 (a) (i) $Ca(NO_3)_2$ [1]
(ii) Na_2CO_3 [1]
(iii) $Al_2(SO_4)_3$ [1]
(b) (i) $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ [1]
(ii) $CuCO_3 + 2HCl \rightarrow CuCl_2 + CO_2 + H_2O$ [1]
(iii) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ [1]
(c) (i) $NH_4Cl + NaOH \rightarrow NaCl + H_2O + NH_3$
[1m for correct chemical formulas & 1m for balanced equation]
(ii) $FeSO_4 + 2NaOH \rightarrow Fe(OH)_2 + Na_2SO_4$
[1m for correct chemical formulas & 1m for balanced equation]

6 (a) E and G [1]
(b) C [1]
(c) D and E [1]
(d) A and F [1]
(e) B [1]

7 (a) (i) E [1]
(ii) D [1]
(iii) B [1]
(b) arrangement: The particles are closely packed and disorderly/irregularly. [1]
movement: The particles are sliding past one another. [1]

Section B [20 marks]

8 (a) (i) electrons of magnesium ion (2.8) and chloride ion (2.8.8) correctly drawn [1]
correct number of 2 electrons transferred and using dot and cross [1]
(ii) magnesium ion has a charge of 2+ while sodium has a charge of 1+. [1]
Each magnesium ion has two chloride ions that are bonded [1] whereas each sodium ion has one chloride ion that is bonded. [1]

(b) During melting, a lot of energy is needed [1] to overcome the strong electrostatic forces of attraction [1] between the oppositely charged ions [1] which results in their high melting points.

(c) For solid magnesium chloride, the oppositely charged ions are held by strong electrostatic forces of attraction and hence not mobile to conduct electricity. [1]
In magnesium chloride solution, the oppositely charged ions are mobile and act as charge carriers to conduct electricity. [1]

9 (a) 2 dyes [1]
(b) ink D [1]
(c) Yes [1] ink A has only one spot on the chromatogram. [1]
(d) Pencil is insoluble in water but pen is soluble in water. [1]
(e) This ensures effective separation of the mixture instead of the mixture dissolving directly into the solvent. [1]
(f) The different dyes have different solubilities in the water which allows them to be separated. [1]
(g) To identify unknown or banned drugs in athletes / any suitable real life application can be accepted [1]
(h) Drawing of suitable apparatus for chromatography such as beaker, boiling tube, stopper, chromatography paper with baseline and the mixture to be separated and identified and water as solvent [1] Label the apparatus and do so correctly [1]

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