

Name and Index Number: ()	Class:
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**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.

[Turn over

PartnerInLearning

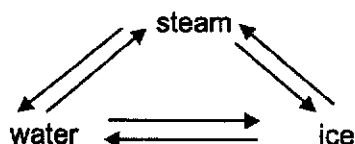
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2

- 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 \longrightarrow water
 B ice \longrightarrow steam
 C steam \longrightarrow ice
 D water \longrightarrow 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?

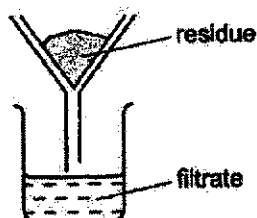
- A S only B S and T only C T and U only D V and W only
- 4 Which are the properties of a gas that need to be considered to select the collection method?
- 1 the colour of the gas
 2 the density of the gas
 3 the solubility of the gas in water
- A 3 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3
- 5 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)

[Turn over

- 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

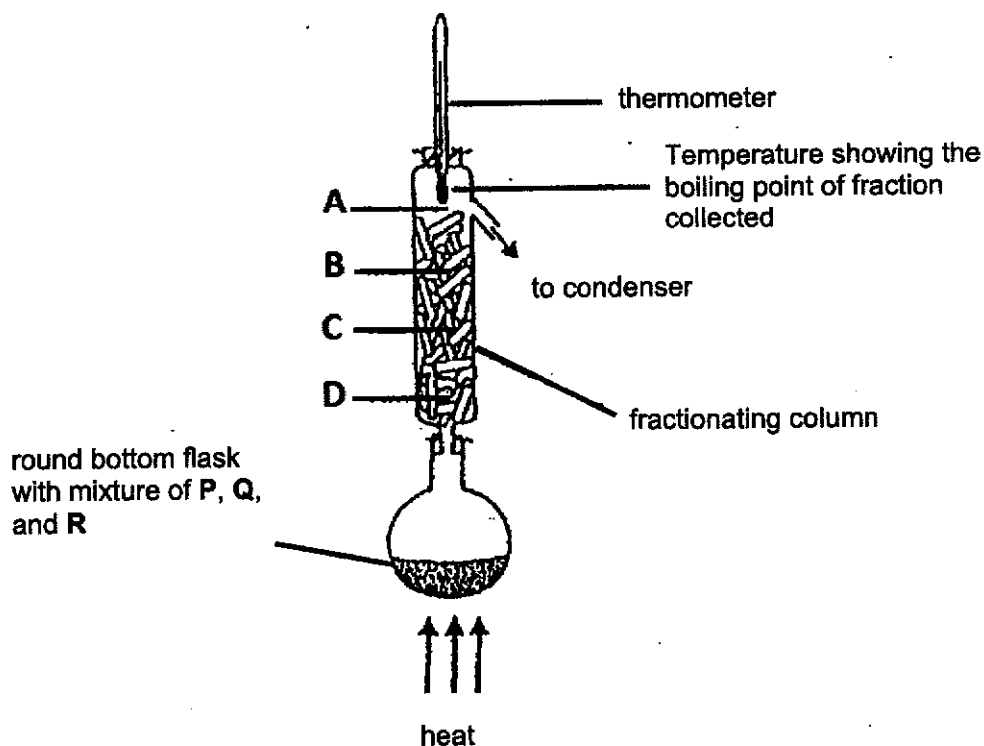
A mixture containing two of the solids is added to excess water, stirred and filtered. A blue filtrate and a white residue are obtained.



Which two solids are present in the mixture?

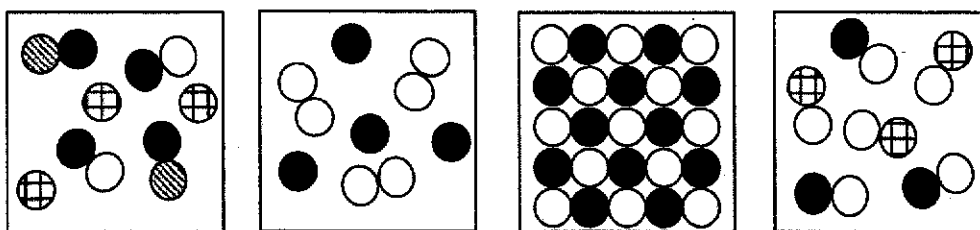
- A W and X B W and Y C X and Y D X and Z
- 7 A mixture of three miscible liquids P, Q and R were fractionally distilled. P has the lowest boiling point, followed by Q, and R has the highest boiling point.

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



[Turn over

- 8 Which diagram shows a mixture of element and compounds?



A

B

C

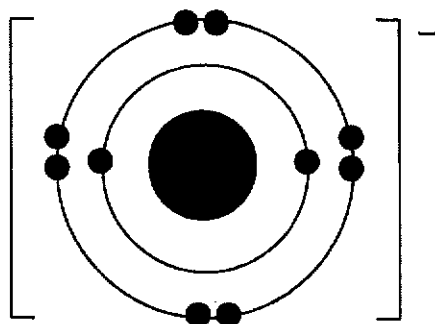
D

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

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 ${}^{238}\text{X}$ and ${}^{235}\text{X}$.
 How does an atom of ${}^{238}\text{X}$ differ from an atom of ${}^{235}\text{X}$?
- A ${}^{238}\text{X}$ has 3 more neutrons and the same number of electrons as ${}^{235}\text{X}$.
 B ${}^{238}\text{X}$ has 3 more neutrons and 3 more electrons than ${}^{235}\text{X}$.
 C ${}^{238}\text{X}$ has 3 more protons and the same number of electrons as ${}^{235}\text{X}$.
 D ${}^{238}\text{X}$ has 3 more protons and 3 more electrons than ${}^{235}\text{X}$.
- 11 The diagram below shows the electron arrangement for an ion, J⁻.

An atom of element J contains 10 neutrons.

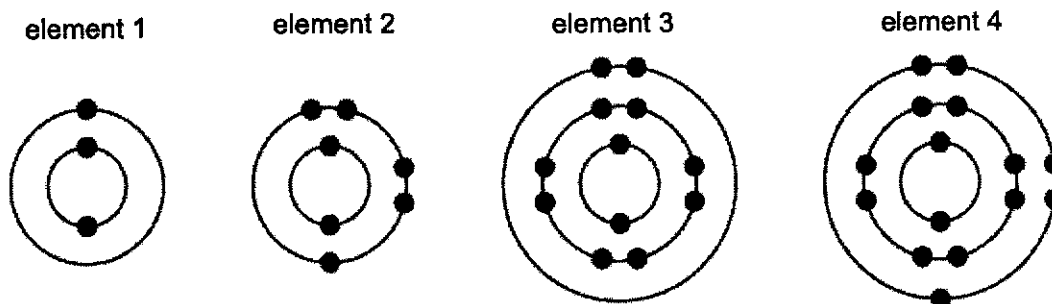


What is the nucleon number of element J?

- A 18 B 19 C 20 D 21

[Turn over

- 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 QCl .

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?

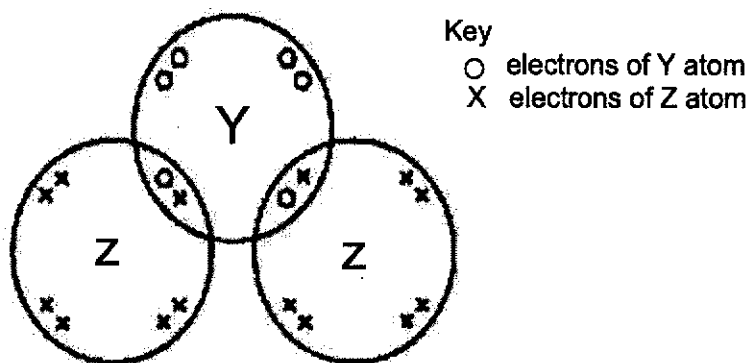
- 1 It can be formed between two metal atoms.
 2 It can be formed between two non-metals.
 3 It can be formed by the transfer of electrons between atoms.
 4 It can be formed by sharing electrons between atoms.

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

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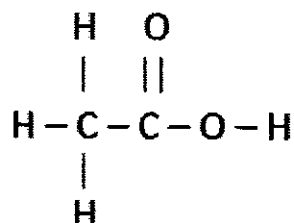
- 17 The diagram shows the arrangement of electrons in the outer shells of the atoms in the compound Z_2Y .

Which pair of elements could be Y and Z?



	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, $CuSO_4 \cdot 5H_2O$?
- 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

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The Periodic Table of Elements

		Group																																																																																																																																																																																																																																																																																																																																																																																																																
I	II	III	IV	V	VI	VII	0																																																																																																																																																																																																																																																																																																																																																																																																											
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	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	58 Fr francium 133	87 Fr francium 133	88 Ra radium 137	89-103 actinoids	86 Rn radon 131	85 At astatine -	84 Po polonium -	83 Bi bismuth 209	82 Pb lead 207	81 Tl thallium 204	80 Hg mercury 201	79 Au gold 197	78 Pt platinum 195	77 Ir iridium 192	76 Os osmium 190	75 Re rhenium 186	74 W tungsten 184	73 Ta tantalum 181	72 Hf hafnium 178	71 Rf rutherfordium -	70 Db dubnium -	69 Bh bohrium -	68 Mt meitnerium -	67 Ds darmstadtium -	66 Cn copernicium -	65 Nh nihonium -	64 Fl flerovium -	63 Lv livermorium -	62 Uu unbinilium -	61 Ts tennessine -	60 Og oganeson -	59 Me mendelevium -	58 Lr lawrencium -	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	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 -	104 Uu unbinilium -	105 Ts tennessine -	106 Og oganeson -	107 Nh nihonium -	108 Fl flerovium -	109 Lv livermorium -	110 Ts tennessine -	111 Og oganeson -	112 Nh nihonium -	113 Fl flerovium -	114 Lv livermorium -	115 Uu unbinilium -	116 Ts tennessine -	117 Og oganeson -	118 Nh nihonium -	119 Fl flerovium -	120 Lv livermorium -	121 Ts tennessine -	122 Og oganeson -	123 Nh nihonium -	124 Fl flerovium -	125 Lv livermorium -	126 Ts tennessine -	127 Og oganeson -	128 Nh nihonium -	129 Fl flerovium -	130 Lv livermorium -	131 Ts tennessine -	132 Og oganeson -	133 Nh nihonium -	134 Fl flerovium -	135 Lv livermorium -	136 Ts tennessine -	137 Og oganeson -	138 Nh nihonium -	139 Fl flerovium -	140 Lv livermorium -	141 Ts tennessine -	142 Og oganeson -	143 Nh nihonium -	144 Fl flerovium -	145 Lv livermorium -	146 Ts tennessine -	147 Og oganeson -	148 Nh nihonium -	149 Fl flerovium -	150 Lv livermorium -	151 Ts tennessine -	152 Og oganeson -	153 Nh nihonium -	154 Fl flerovium -	155 Lv livermorium -	156 Ts tennessine -	157 Og oganeson -	158 Nh nihonium -	159 Fl flerovium -	160 Lv livermorium -	161 Ts tennessine -	162 Og oganeson -	163 Nh nihonium -	164 Fl flerovium -	165 Lv livermorium -	166 Ts tennessine -	167 Og oganeson -	168 Nh nihonium -	169 Fl flerovium -	170 Lv livermorium -	171 Ts tennessine -	172 Og oganeson -	173 Nh nihonium -	174 Fl flerovium -	175 Lv livermorium -	176 Ts tennessine -	177 Og oganeson -	178 Nh nihonium -	179 Fl flerovium -	180 Lv livermorium -	181 Ts tennessine -	182 Og oganeson -	183 Nh nihonium -	184 Fl flerovium -	185 Lv livermorium -	186 Ts tennessine -	187 Og oganeson -	188 Nh nihonium -	189 Fl flerovium -	190 Lv livermorium -	191 Ts tennessine -	192 Og oganeson -	193 Nh nihonium -	194 Fl flerovium -	195 Lv livermorium -	196 Ts tennessine -	197 Og oganeson -	198 Nh nihonium -	199 Fl flerovium -	200 Lv livermorium -	201 Ts tennessine -	202 Og oganeson -	203 Nh nihonium -	204 Fl flerovium -	205 Lv livermorium -	206 Ts tennessine -	207 Og oganeson -	208 Nh nihonium -	209 Fl flerovium -	210 Lv livermorium -	211 Ts tennessine -	212 Og oganeson -	213 Nh nihonium -	214 Fl flerovium -	215 Lv livermorium -	216 Ts tennessine -	217 Og oganeson -	218 Nh nihonium -	219 Fl flerovium -	220 Lv livermorium -	221 Ts tennessine -	222 Og oganeson -	223 Nh nihonium -	224 Fl flerovium -	225 Lv livermorium -	226 Ts tennessine -	227 Og oganeson -	228 Nh nihonium -	229 Fl flerovium -	230 Lv livermorium -	231 Ts tennessine -	232 Og oganeson -	233 Nh nihonium -	234 Fl flerovium -	235 Lv livermorium -	236 Ts tennessine -	237 Og oganeson -	238 Nh nihonium -	239 Fl flerovium -	240 Lv livermorium -	241 Ts tennessine -	242 Og oganeson -	243 Nh nihonium -	244 Fl flerovium -	245 Lv livermorium -	246 Ts tennessine -	247 Og oganeson -	248 Nh nihonium -	249 Fl flerovium -	250 Lv livermorium -	251 Ts tennessine -	252 Og oganeson -	253 Nh nihonium -	254 Fl flerovium -	255 Lv livermorium -	256 Ts tennessine -	257 Og oganeson -	258 Nh nihonium -	259 Fl flerovium -	260 Lv livermorium -	261 Ts tennessine -	262 Og oganeson -	263 Nh nihonium -	264 Fl flerovium -	265 Lv livermorium -	266 Ts tennessine -	267 Og oganeson -	268 Nh nihonium -	269 Fl flerovium -	270 Lv livermorium -	271 Ts tennessine -	272 Og oganeson -	273 Nh nihonium -	274 Fl flerovium -	275 Lv livermorium -	276 Ts tennessine -	277 Og oganeson -	278 Nh nihonium -	279 Fl flerovium -	280 Lv livermorium -	281 Ts tennessine -	282 Og oganeson -	283 Nh nihonium -	284 Fl flerovium -	285 Lv livermorium -	286 Ts tennessine -	287 Og oganeson -	288 Nh nihonium -	289 Fl flerovium -	290 Lv livermorium -	291 Ts tennessine -	292 Og oganeson -	293 Nh nihonium -	294 Fl flerovium -	295 Lv livermorium -	296 Ts tennessine -	297 Og oganeson -	298 Nh nihonium -	299 Fl flerovium -	300 Lv livermorium -	301 Ts tennessine -	302 Og oganeson -	303 Nh nihonium -	304 Fl flerovium -	305 Lv livermorium -	306 Ts tennessine -	307 Og oganeson -	308 Nh nihonium -	309 Fl flerovium -	310 Lv livermorium -	311 Ts tennessine -	312 Og oganeson -	313 Nh nihonium -	314 Fl flerovium -	315 Lv livermorium -	316 Ts tennessine -	317 Og oganeson -	318 Nh nihonium -	319 Fl flerovium -	320 Lv livermorium -	321 Ts tennessine -	322 Og oganeson -	323 Nh nihonium -	324 Fl flerovium -	325 Lv livermorium -	326 Ts tennessine -	327 Og oganeson -	328 Nh nihonium -	329 Fl flerovium -	330 Lv livermorium -	331 Ts tennessine -	332 Og oganeson -	333 Nh nihonium -	334 Fl flerovium -	335 Lv livermorium -	336 Ts tennessine -	337 Og oganeson -	338 Nh nihonium -	339 Fl flerovium -	340 Lv livermorium -	341 Ts tennessine -	342 Og oganeson -	343 Nh nihonium -	344 Fl flerovium -	345 Lv livermorium -	346 Ts tennessine -	347 Og oganeson -	348 Nh nihonium -	349 Fl flerovium -	350 Lv livermorium -	351 Ts tennessine -	352 Og oganeson -	353 Nh nihonium -	354 Fl flerovium -	355 Lv livermorium -	356 Ts tennessine -	357 Og oganeson -	358 Nh nihonium -	359 Fl flerovium -	360 Lv livermorium -	361 Ts tennessine -	362 Og oganeson -	363 Nh nihonium -	364 Fl flerovium -	365 Lv livermorium -	366 Ts tennessine -	367 Og oganeson -	368 Nh nihonium -	369 Fl flerovium -	370 Lv livermorium -	371 Ts tennessine -	372 Og oganeson -	373 Nh nihonium -	374 Fl flerovium -	375 Lv livermorium -	376 Ts tennessine -	377 Og oganeson -	378 Nh nihonium -	379 Fl flerovium -	380 Lv livermorium -	381 Ts tennessine -	382 Og oganeson -	383 Nh nihonium -	384 Fl flerovium -	385 Lv livermorium -	386 Ts tennessine -	387 Og oganeson -	388 Nh nihonium -	389 Fl flerovium -	390 Lv livermorium -	391 Ts tennessine -	392 Og oganeson -	393 Nh nihonium -	394 Fl flerovium -	395 Lv livermorium -	396 Ts tennessine -	397 Og oganeson -	398 Nh nihonium -	399 Fl flerovium -	400 Lv livermorium -

Key
proton (atomic) number
atomic symbol
name
relative atomic mass

1
H
hydrogen
1

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 dm³ 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

Parent's / Guardian's Signature:

This document consists of 11 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 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]

[Turn over

3

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

(a) To collect 15.6 cm³ of carbon dioxide gas from a reaction.

..... [1]

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

..... [1]

(c) To measure 22.3 cm³ of sodium hydroxide.

..... [1]

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

..... [1]

(e) Measuring the volume of about 20 cm³ 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]

[Turn over

- 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]

[Turn over

- 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 + HCl \rightarrow ZnCl₂ + H₂ [1]
- (ii) CuCO₃ + HCl \rightarrow CuCl₂ + CO₂ + H₂O [1]
- (iii) NaOH + H₂SO₄ \rightarrow Na₂SO₄ + H₂O [1]

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

State symbols are **not** required.

- (i) ammonium chloride + sodium hydroxide \rightarrow sodium chloride + ammonia + water
..... [2]
- (ii) iron(II) sulfate + sodium hydroxide \rightarrow iron(II) hydroxide + sodium sulfate
..... [2]

[Turn over

- 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]

[Turn over

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

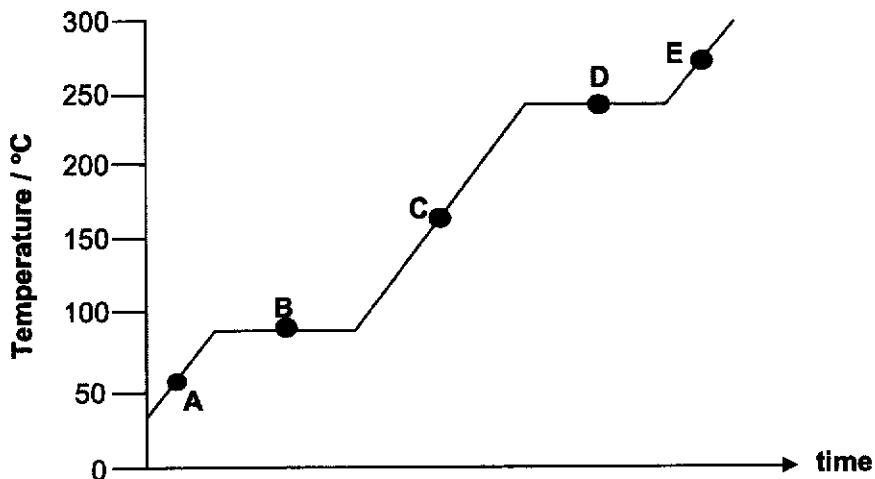


Fig. 7.1

- (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]

[Turn over

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]

[Turn over

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.

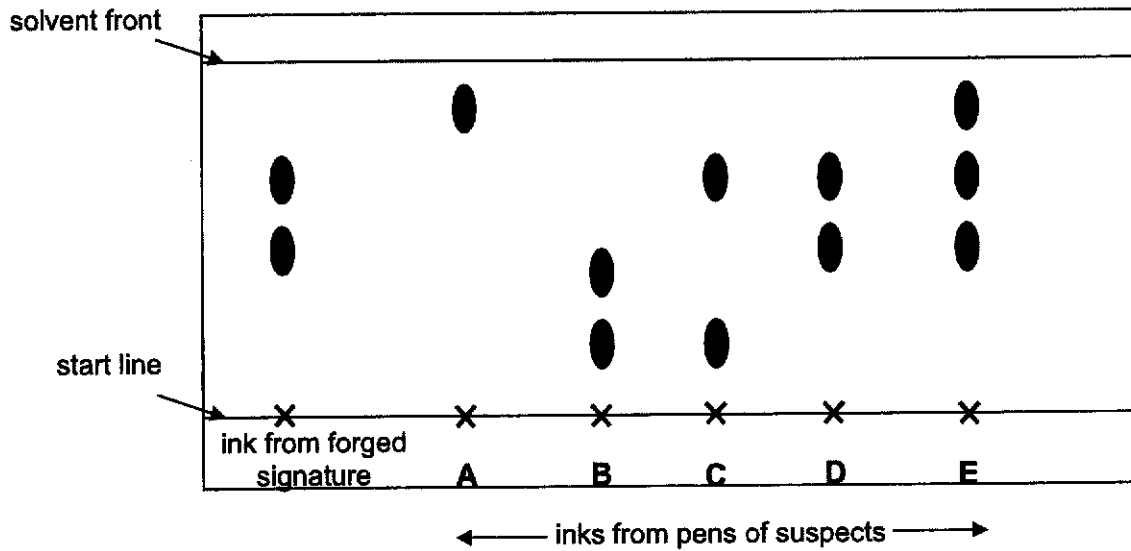


Fig. 9.1

- (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]

[Turn over

10

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

[2]

END OF PAPER**[Turn over**

The Periodic Table of Elements

		Group																	
I	II	III	IV	V	VI	VII	0					0							
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					2 He helium 4							
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					36 Kr krypton 84							
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	86 Rn radon -	
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 -	116 Lv livermorium -	
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 -	116 Lv livermorium -	116 Lv livermorium -	116 Lv livermorium -	116 Lv livermorium -	116 Lv livermorium -	116 Lv livermorium -

1
H
hydrogen
1

Key
 proton (atomic) number
 atomic symbol
 name
 relative atomic mass

lanthanoids

actinoids

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 158	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
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 mandeleevium -	102 No nobelium -	103 Lr lawrencium -

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

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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]

- 4 (a) simple distillation [1]
 (b) chromatography [1]
 (c) filtration [1]
 (d) fractional distillation [1]
 (e) crystallisation [1]
- 5 (a) (i) $\text{Ca}(\text{NO}_3)_2$ [1]
 (ii) Na_2CO_3 [1]
 (iii) $\text{Al}_2(\text{SO}_4)_3$ [1]
 (b) (i) $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$ [1]
 (ii) $\text{CuCO}_3 + 2\text{HCl} \rightarrow \text{CuCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ [1]
 (iii) $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ [1]
 (c) (i) $\text{NH}_4\text{Cl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{NH}_3$
 [1m for correct chemical formulas & 1m for balanced equation]
 (ii) $\text{FeSO}_4 + 2\text{NaOH} \rightarrow \text{Fe}(\text{OH})_2 + \text{Na}_2\text{SO}_4$
 [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]

