Class	Register No.

Candidate Name _____

PEIRCE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2021
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

SCIENCE (CHEMISTRY, BIOLOGY) **5078/01**
Paper 1 Multiple Choice **01 September 2021**
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Index number on the Answer Sheet in the spaces provided.

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 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 15.
A copy of the Periodic Table is printed on page 16.
The use of an approved scientific calculator is expected, where appropriate.

This paper consists of **16** printed pages and **0** blank page.
Setter: Mr Brandon Sham (Chemistry) and Ms Tan Yin Chin (Biology)

[Turn Over

1 A group of students want to investigate if the mass of manganese(IV) oxide will affect the speed of decomposition of hydrogen peroxide. Hydrogen peroxide decomposes to form water and oxygen gas.

Which of the following apparatus is **not** required for this investigation?

A electronic balance
B gas syringe
C stopwatch
D thermometer

2 To obtain sodium chloride from a mixture of sand and sodium chloride solution, which of the following should be carried out first?

A crystallisation
B distillation
C evaporation to dryness
D filtration

3 A white solid was dissolved in distilled water and the resultant solution is tested with several reagents. The table shows the observations for the different tests.

reagent	observation
aqueous sodium hydroxide, warm	moist red litmus paper turns blue
aqueous ammonia	no visible change
dilute nitric acid, aqueous silver nitrate	effervescence observed, no precipitate formed
dilute nitric acid, aqueous barium nitrate	effervescence observed, no precipitate formed

What is the identity of the white solid?

A ammonium carbonate
B ammonium sulfate
C calcium chloride
D sodium carbonate

4 Which of the following statements is true when liquid stearic acid is cooled to a temperature below its melting point?

A The distance between the particles increases.
B The forces of attraction between particles become stronger.
C The particles become more disorderly arranged.
D The particles vibrate faster.

5 Which of the following statements is true about sub-atomic particles in an atom?

A A neutron has a relative mass of 1.
B All atoms have protons, neutrons and electrons.
C An electron has a relative charge of 1+.
D Protons are found orbiting around the nucleus.

6 Atoms W and X are isotopes.
W has 35 protons and 46 neutrons.
Which of the following shows the correct symbol for X?

A $^{35}_{46}X$ **B** $^{46}_{35}X$
C $^{79}_{35}X$ **D** $^{81}_{35}X$

7 Atom E has an electronic configuration of 2.8.3.
Atom F has an electronic configuration of 2.6.
Which row correctly describes the compound formed between E and F?

	bonding	melting point
A	covalent	low
B	covalent	high
C	ionic	low
D	ionic	high

8 Potassium dichromate(VI) has a chemical formula of $K_2Cr_2O_7$.

What is the charge of a dichromate(VI) ion?

A 2–
B 3+
C 6+
D 6–

9 Which of the following has the same number of moles as 16.0 g of oxygen gas?

A 12.0dm^3 of hydrogen gas at room temperature and pressure
B 16.0dm^3 of oxygen gas at room temperature and pressure
C 24.0dm^3 of steam at 120°C and pressure of 1 atmosphere
D 40.0g of calcium

10 Which of the following is an example of an endothermic change?

A combustion
B dissolving ammonium nitrate in water
C dissolving concentrated sulfuric acid in water
D respiration

11 When hydrogen peroxide is added into acidified potassium manganate(VII), the colour of the solution changes from purple to colourless.
When hydrogen peroxide is added into aqueous potassium iodide, the colour of the solution changes from colourless to brown.
What is the role of hydrogen peroxide in these reactions?

	reaction with acidified potassium manganate(VII)	reaction with potassium iodide
A	oxidising agent	oxidising agent
B	oxidising agent	reducing agent
C	reducing agent	oxidising agent
D	reducing agent	reducing agent

12 Which statement about acids and bases is **not** correct?

A Acids do not contain hydroxide ions.
B An acidic solution has a pH value of less than 7 at 25°C.
C Basic oxides can be formed from metals reacting with oxygen.
D Soluble bases that dissolve in water and producing hydroxide ions are called alkalis.

13 Which set of reagents is the most appropriate to prepare a pure, dry sample of copper(II) sulfate?

A copper and dilute sulfuric acid
B copper(II) carbonate and dilute sulfuric acid
C copper(II) chloride solution and sodium sulfate solution
D copper(II) oxide and sodium sulfate solution

14 An atom of element J has 3 occupied electron shells and 5 valence electrons. What is element J?

A arsenic
B indium
C phosphorus
D thallium

15 Which of the following does **not** describe about elements in Groups I and VII?

	Group I	Group VII
A	alkali metals	halogens
B	boiling point decreases down the group	boiling point increases down the group
C	form covalent compounds	form ionic compounds only
D	react with cold water readily	exist as coloured substances

16 Which of the following shows the chemical equation when chlorine water is added into aqueous potassium bromide?

A $KBr(aq) + Cl(aq) \longrightarrow KCl(aq) + Br(aq)$
B $2KBr(aq) + Cl_2(aq) \longrightarrow 2KCl(aq) + Br_2(aq)$
C $KBr(aq) + Cl(l) \longrightarrow KCl(aq) + Br(l)$
D $2KBr(aq) + Cl_2(l) \longrightarrow 2KCl(aq) + Br_2(l)$

17 Which of the following will **not** produce a colour change?

A copper + aqueous silver nitrate
B iron + aqueous copper(II) sulfate
C magnesium + aqueous zinc chloride
D zinc + aqueous iron(III) sulfate

18 Which of the following is **not** added into the blast furnace during the extraction of iron?

A coke
B haematite
C limestone
D quicklime

19 Which statement does **not** explain the importance of recycling metals?

A Metals are finite resources.
B Metals obtained from recycling are more useful.
C Recycling of metals uses less energy than mining and extracting.
D The extraction of ores causes pollution to the environment.

20 What is the approximate volume composition of dry air?

	percentage of nitrogen / %	percentage of oxygen / %	percentage of noble gases and carbon dioxide / %
A	21	78	1
B	21	0.93	78
C	78	21	1
D	78	1	21

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

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.).

Class	Register No.

Candidate Name _____

PEIRCE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2021
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

SCIENCE (CHEMISTRY)
Paper 3

5076/03, 5078/03
24 August 2021
1 hour 15 minutes

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided at the top of this page.
Write in dark blue or black pen. You may use a soft pencil for any diagrams, graphs or rough working.

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

Section A [45 marks]
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B [20 marks]
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

A copy of the Data Sheet is printed on page 14.
A copy of the Periodic Table is printed on page 15.

The number of marks is given in brackets [ ] at the end of each question or part question.

PARENT'S SIGNATURE

For Examiner's Use	
Section A	
Section B	
Total	

This document consists of **15** printed pages and **1** blank page.
Setter: Mr Brandon Sham

Section A

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

1 Use the list of substances to answer the questions.

argon

calcium hydroxide

copper

helium

lead(II) oxide

magnesium oxide

sodium hydroxide

steel

zinc

(a) Which substance is used to neutralise acidity in soil to promote plant growth?

_____ [1]

(b) Which **two** substances are used to make brass?

_____ [1]

(c) Which substance can react with both acids and alkalis to form salt and water only?

_____ [1]

(d) Which substance is the main constituent of noble gases in clean, dry air?

_____ [1]

(e) Which substance melts over a range of temperatures?

_____ [1]

2 A drop of plant extract obtained from leaves was placed in the centre of a piece of round filter paper. A chromatogram was obtained as shown in Fig. 2.1.

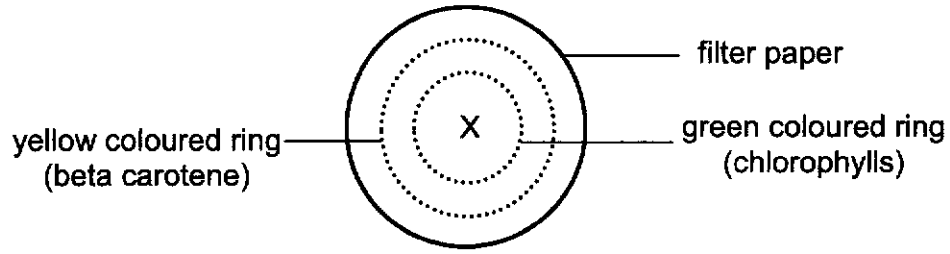


Fig. 2.1

(a) Using Fig. 2.1, state and explain which **substance** is more soluble in the solvent used.

_____

_____ [2]

(b) The chromatogram was repeated again using a long piece of filter paper.

(i) On Fig. 2.2, draw the results of the chromatogram that you will expect to see. Label your diagram.

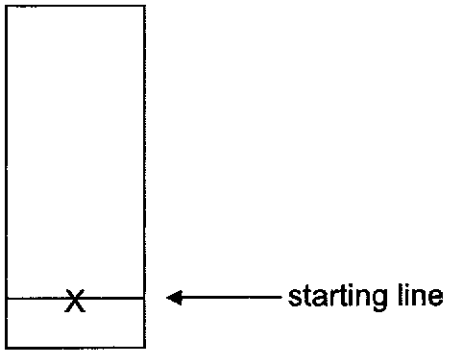


Fig. 2.2

[1]

(ii) Explain why the starting line cannot be submerged into the solvent.

_____ [1]

3 **(a)** Table 3.1 shows the information of some air pollutants and their sources. Fill in Table 3.1 with **one** source for each air pollutant.

Table 3.1

air pollutant	source
sulfur dioxide	
oxides of nitrogen	
carbon monoxide	

[3]

(b) Describe the effects of sulfur dioxide on human and on the environment when it is emitted to the atmosphere.

effect on human: _____

_____

effect on environment: _____

_____ [2]

[Turn Over

(c) **(i)** Under certain conditions, nitrogen monoxide reacts with oxygen in air to form nitrogen dioxide.

Write the chemical equation for this reaction.

_____ [1]

(ii) Explain why nitrogen monoxide is oxidised in this reaction.

_____

_____ [1]

(d) Although carbon dioxide is not considered as an air pollutant, a build-up of it in the atmosphere can lead to global warming.

Draw the 'dot and cross' diagram to show the arrangement of the outer shell electrons in carbon dioxide.
[Proton numbers: C, 6; O, 8]

[2]

4 Fig. 4.1 describes some of the reactions of several substances.

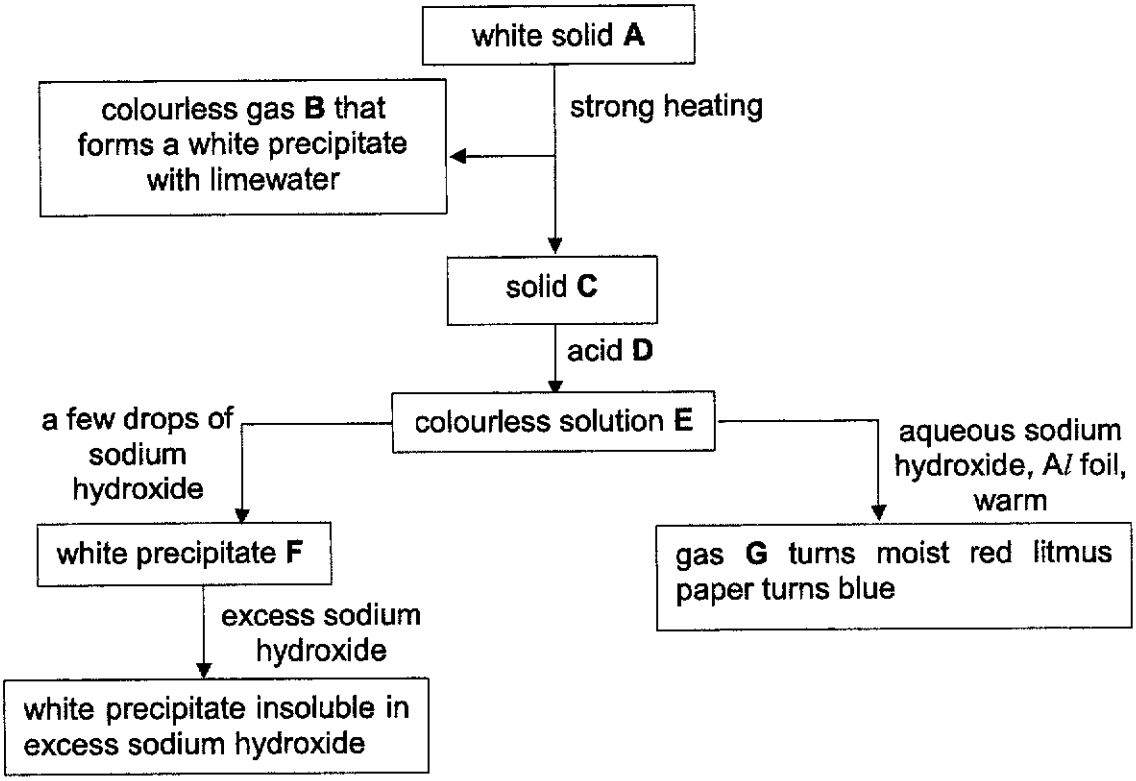


Fig. 4.1

(a) State the identities of **A**, **B**, **C**, **D**, **E**, **F** and **G**.

A _____

B _____

C _____

D _____

E _____

F _____

G _____ [7]

(b) Write a balanced chemical equation, with state symbols, for any **one** of the reactions in Fig. 4.1.

_____ [2]

[Turn Over

5 Fig. 5.1 shows different particulate models to represent different substances.

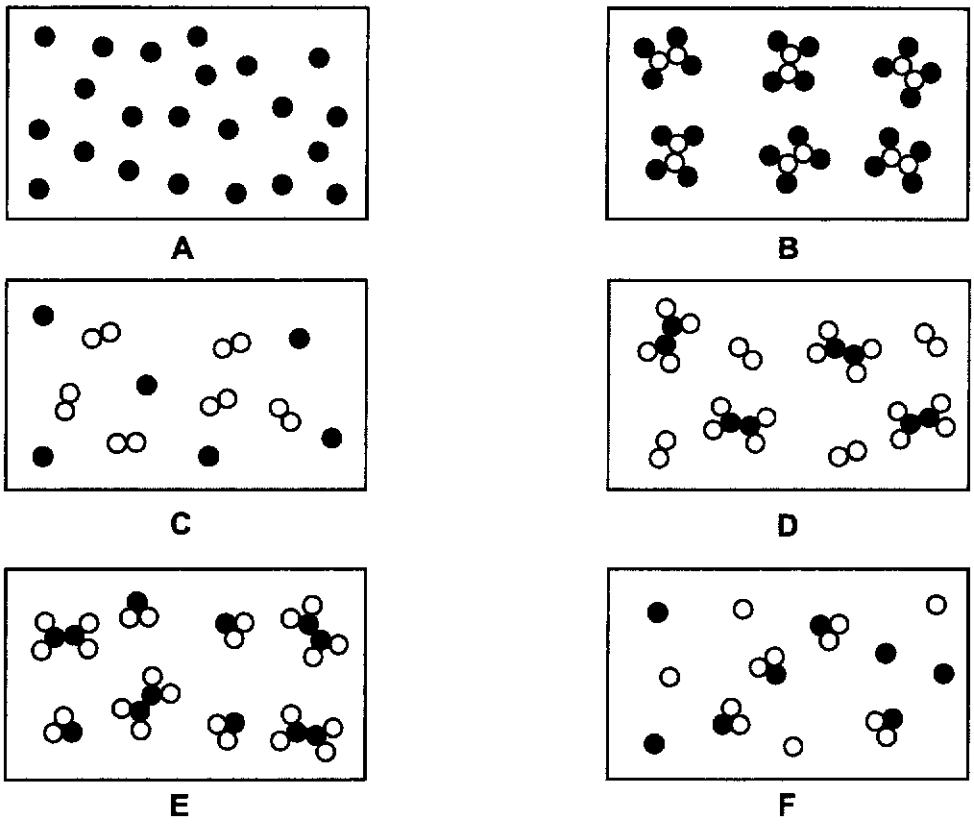


Fig 5.1

Fill in Table 5.1 with the appropriate letter(s) in each row to match the descriptions given.

Table 5.1

description	diagram
a compound	
an element	
a mixture of an element and a compound	
a mixture of two compounds	

[4]

6 10 g of sodium hydroxide pellets was dissolved into 250 cm^3 of distilled water.

(a) Calculate the concentration of this solution in mol/dm^3.
[Relative atomic masses: H, 1; O, 16; Na, 23]

concentration = _____ mol/dm^3 [2]

(b) **(i)** Write the ionic equation for neutralisation.

_____ [1]

(ii) Hence, calculate the number of moles of ions required to completely neutralise 25.0 cm^3 of the above sodium hydroxide solution.

number of moles = _____ [2]

(c) Neutralisation reaction is an example of an exothermic reaction.
Define the term *exothermic*.

_____ [1]

7 **(a)** State the order by which the elements are arranged in the Periodic Table.

_____ [1]

(b) Fill in Table 7.1 with the electronic configurations of atoms of lithium-7 and potassium-39.

Table 7.1

atom	number of electrons	electronic configuration
lithium-7	3	
potassium-39	19	

[2]

(c) A few drops of Universal Indicator are added into two separate beakers of distilled water. Lithium and potassium are then added into one beaker each.

(i) Write the chemical equation for the reaction of any **one** of the metals listed above with water. State symbols are **not** required.

_____ [1]

(ii) Describe and explain **one** similarity and **one** difference in the observations for the reactions carried out in **(c)**.

similarity: _____

explanation: _____

_____

difference: _____

explanation: _____

_____ [4]

Section B (20 marks)

Answer **all** questions from this section.

Write your answers in the spaces provided.

8 Some metals can be extracted from their oxides when heated with carbon. Table 8.1 shows the experimental results after heating 0.25 g of four different metal oxides with excess carbon for 10 minutes.

Table 8.1

metal oxide	volume of carbon dioxide produced / cm^3
calcium oxide	0
copper(II) oxide	32
iron(II) oxide	10
nickel(II) oxide	25

(a) Using the information from Table 8.1, arrange the metals in decreasing reactivity.

_____ [1]

(b) **(i)** Explain why no carbon dioxide is produced when calcium oxide is heated with carbon.

_____

_____ [1]

(ii) Suggest a method to extract calcium from its ore.

_____ [1]

[Turn Over

(c) **(i)** Draw the 'dot and cross' diagram to show the arrangement of the outer shell electrons in calcium oxide.
[Proton numbers: O, 8; Ca, 20]

[2]

(ii) Explain why solid calcium oxide is unable to conduct electricity, but molten calcium oxide can conduct electricity.

[2]

(d) Electrical wiring are often made of pure copper because of its high electrical conductivity and high ductility.

State one **other** physical property of copper.

[1]

(e) Iron is another metal that is widely used in daily life. However, iron will undergo rusting over time.

(i) State a method which can prevent iron from rusting.

[1]

(ii) Describe how the method in **(e)(i)** helps in rust prevention.

[1]

9 The speed of reaction between zinc granules and excess 0.1 mol/dm^3 dilute sulfuric acid was studied by collecting the gas produced at regular time intervals.

No effervescence was observed after 120 seconds. The total volume of gas collected was 82 cm^3 at room temperature and pressure.

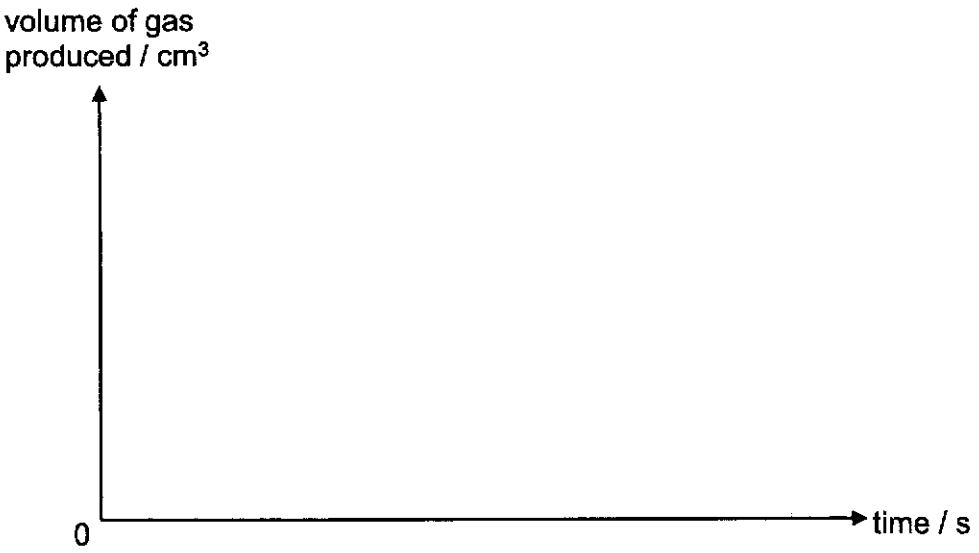
(ii) State the identity of the gas produced.

[1]

(ii) Calculate the number of moles of gas produced.

[1]

(b) Sketch the graph of volume of gas produced against time on the axes provided. Label this graph **A**.



[2]

[Turn Over

(c) Describe how the graph in **(b)** shows that the speed of the reaction decreases as the reaction proceeds.

_____

_____ [1]

(d) Sketch on the axes provided in **(b)** to show the expected result when the experiment is repeated,

(i) at a higher temperature. Label this graph **B**.

(ii) using excess 0.05mol/dm^3 dilute sulfuric acid. Label this graph **C**. [2]

(e) Using the collision theory, explain why the speed of reaction would increase when powdered zinc is used instead.

_____

_____

_____

_____ [2]

(f) Another student wanted to investigate the speed of reaction between copper and dilute sulfuric acid instead. He observed no effervescence after adding a strip of copper into dilute sulfuric acid.

Explain why he was unable to carry out this investigation.

_____

_____ [1]

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

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.).

PSS 2021 4E/5N Science(Chemistry) 5076/5078 Preliminary Examination

Marking Scheme – MCQ

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

Distribution

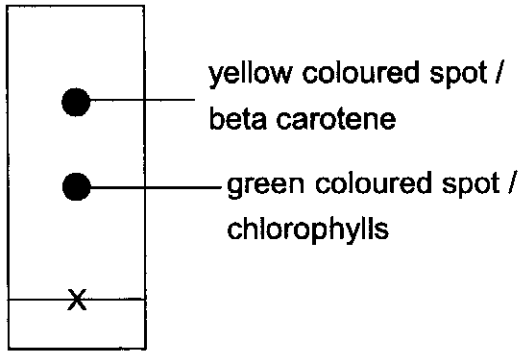
A – 5

B – 5

C – 6

D – 4

PSS 2021 Sec 4E/5N Express Science (Chemistry) 5076/5078 Preliminary Examination **Paper 3 Marking Scheme**

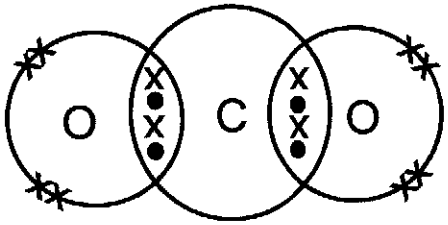
		Section A	Marks	Marker's comments
1	(a)	calcium hydroxide	1	Correct answer only
	(b)	zinc, copper	1	
	(c)	lead(II) oxide	1	
	(d)	argon	1	
	(e)	steel	1	
2	(a)	Beta carotene. It travels further from the starting point.	1 1	Do not accept if candidates state the colour.
	(c)(i)		1	
	(c)(ii)	The plant extract would dissolve into the solvent before separation can occur.	1	

<table>
<tr>
<td>3</td>
<td>(a)</td>
<td>
<table>
<tr><th>air pollutant</th><th>source</th></tr>
<tr><td>sulfur dioxide</td><td>volcanic eruption / combustion of fossil fuels</td></tr>
<tr><td>nitrogen dioxide</td><td>internal combustion engine / lightning activity</td></tr>
<tr><td>carbon monoxide</td><td>incomplete combustion of carbon-containing fuel</td></tr>
</table>
</td>
<td>3</td>
<td>1 mark for each box

Do not accept 'incomplete combustion of fuels'.</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>Effect on human: irritation of eyes and lungs / cause respiratory problems (bronchitis)

Effect on environment: reacts with oxygen and water in the atmosphere to form acid rain, which corrodes limestone buildings or metal structures / harms aquatic life and plants</td>
<td>2</td>
<td>Do not accept if candidates just state 'death'.

Do not accept if candidates just state 'formation of acid rain'.</td>
</tr>
<tr>
<td></td>
<td>(c)(i)</td>
<td>$2NO + O_2 \rightarrow 2NO_2$</td>
<td>1</td>
<td>Do not penalise for wrong state symbols.</td>
</tr>
</table>

	(c)(ii)	It has gained oxygen / reacted with oxygen	1	Accept explanation using oxidation state
	(d)		2	1 mark for covalent bonding 1 mark for correct number of electrons
4	(a)	A: calcium carbonate B: carbon dioxide C: calcium oxide D: nitric acid E: calcium nitrate F: calcium hydroxide G: ammonia	7	Accept chemical formula. e.c.f. (deduct max 1 for wrong identification of cation) e.c.f. (deduct max 1 for including wrong valency) e.c.f. for wrong acid identified

	(b)	Accept any 1 of the following: $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ $CO_2(g) + Ca(OH)_2(aq) \rightarrow CaCO_3(s) + H_2O(l)$ $CaO(s) + 2HNO_3(aq) \rightarrow Ca(NO_3)_2(aq) + H_2O(l)$ $Ca(NO_3)_2(aq) + 2NaOH(aq) \rightarrow Ca(OH)_2(s) + 2NaNO_3(aq)$	1	1 mark for balanced chemical equation 1 mark for correct state symbols e.c.f from (a)

<table>
<tr><td>5</td><td colspan="2"><table><tr><th>description</th><th>diagram</th></tr><tr><td>a compound</td><td>B</td></tr><tr><td>an element</td><td>A</td></tr><tr><td>a mixture of an element and a compound</td><td>D</td></tr><tr><td>a mixture of two compounds</td><td>E</td></tr></table></td><td>4</td><td>1 mark for each correct row</td></tr>
<tr><td>6</td><td>(a)</td><td>$n_{NaOH} = \frac{10}{23 + 16 + 1}$
$= 0.25$ mol

$c_{NaOH} = \frac{0.25}{\frac{250}{1000}}$
$= 1.00$ mol/dm^3 (3 s.f.)</td><td>1

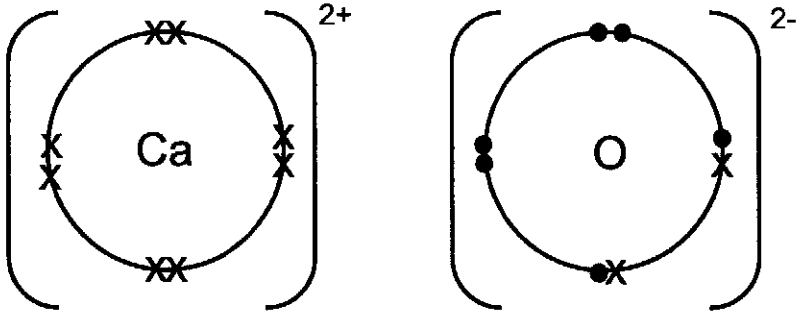
1</td><td>Accept if candidates find concentration in g/dm^3, followed by mol/dm^3.
Do not penalise if candidates did not leave final answer in 3 s.f.</td></tr>
<tr><td></td><td>(b)(i)</td><td>$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$</td><td>1</td><td>Do not penalise if no state symbols included</td></tr>
<tr><td></td><td>(b)</td><td>$n_{OH^-} = \frac{25}{1000} \times 1.00$
$= 0.025$ mol
$n_{OH^-} : n_{H^+} = 1 : 1$
$n_{H^+} = 0.0250$ mol (3 s.f.)</td><td>1

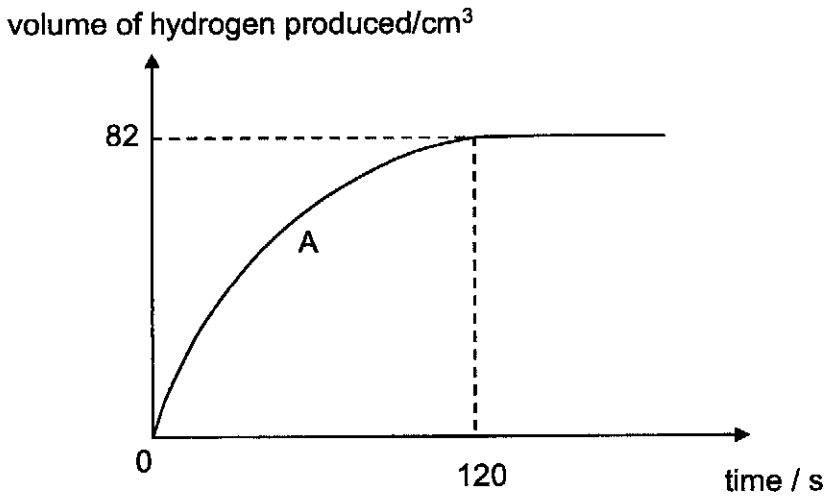
1</td><td>Allow e.c.f. from (a)

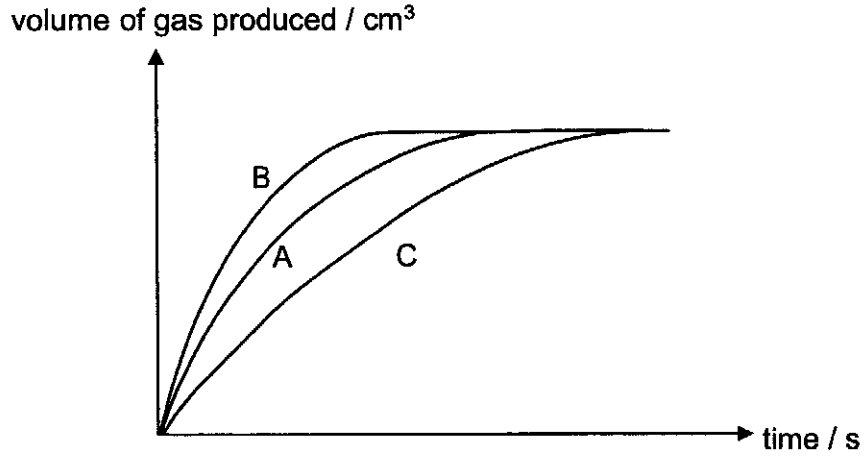
Do not penalise if candidates did not leave final answer in 3 s.f.</td></tr>
<tr><td></td><td>(c)</td><td>Heat is given out to the surrounding</td><td>1

1</td><td>Do not accept if candidates simply states that the temperature increases</td></tr>
</table>

<table>
<tr><td>7</td><td>(a)</td><td>Increasing proton / atomic number</td><td>1</td><td>Do not accept if candidates did not state 'increasing'.</td></tr>
<tr><td></td><td>(b)</td><td>
<table>
<tr><th>element</th><th>number of electrons</th><th>electronic configuration</th></tr>
<tr><td>lithium-7</td><td>3</td><td>2.1</td></tr>
<tr><td>potassium-39</td><td>19</td><td>2.8.8.1</td></tr>
</table>
</td><td>1</td><td>1 mark for each row</td></tr>
<tr><td></td><td>(c)(i)</td><td>Accept any 1 of the following:
$2Li + 2H_2O \rightarrow 2LiOH + H_2$
$2K + 2H_2O \rightarrow 2KOH + H_2$</td><td>1</td><td></td></tr>
<tr><td></td><td>(c)(ii)</td><td>Similarity: the colour of the solution changes from green to purple / effervescence observed.
Explanation: The solutions formed are alkalis / are alkaline or hydrogen is produced.
Difference: Lithium reacts quickly while potassium reacts very violently with water / The rate of effervescence is faster in potassium than lithium / The rate of effervescence is slower in lithium than potassium.
Explanation: Potassium is more reactive than lithium / lithium is less reactive than potassium / the reactivity increases down for Group I.</td><td>1
1
1
1</td><td></td></tr>
</table>

	Section B			
8	(a)	Calcium, iron, nickel, copper	1	
	(b)(i)	Calcium is placed above carbon in the reactivity series / carbon is not strong enough to reduce calcium oxide to calcium.	1	Do not accept if candidates state that calcium is more reactive than carbon
	(b)(ii)	Electrolysis	1	Do not accept if wrongly spelt
	(c)(i)		1 1	1 mark for each correct ion drawn Accept drawing with all electron shells
	(c)(ii)	In solid calcium oxide, the ions are held together in their fixed position by strong electrostatic forces of attraction in the giant lattice structure / have no free-moving ions In molten calcium oxide, the ions are free-moving and can act as charge carriers.	1 1	
	(d)	Accept any 1 of the following: High melting and boiling points Malleable High density Hard	1	Do not accept: flexible solid at r.t.p. shiny sonorous
	(e)(i)	Electroplating / galvanising / coating the iron with oil or paint or plastic	1	

	(e)(ii)	It prevents the iron from being in contact with <u>air (oxygen) and water</u>.	1	
9	(a)(i)	Hydrogen / H_2	1	Correct answer only
	(a)(ii)	$n_{H_2} = \frac{82}{24000}$ $= 0.00342$ mol (3 s.f.)	1	
	(b)		1 1	1 mark for correct shape 1 mark for label (120, 82) and A
	(c)	As the reaction proceeds, the gradient decreases / becomes gentler.	1	

	(d)		1 1	For curve B: steeper initial gradient and plateau off before 120s For curve C: gentler initial gradient and plateau off after 120s Deduct maximum 1 mark from (b) or (d) for no label
	(e)	When powdered zinc instead of zinc granule is used, the surface area to volume ratio of zinc increases. This increases the frequency of collision between zinc and hydrogen ions. Thus, there is an increase in the frequency of effective collision, increasing the speed of reaction.	2	3 points – 2 marks 1/2 points – 1 mark
	(f)	Copper is placed below hydrogen in the reactivity series / copper is unreactive	1	