21 The diagram below shows four pieces of laboratory equipment.



Which equipment is essential to find out if dissolving a salt in water is an exothermic process?

	balance	pipette	stop-clock	thermometer
Α	×	×	X	\checkmark
в	\checkmark	×	X	\checkmark
С	×	\checkmark	X	\checkmark
D	\checkmark	×	\checkmark	×

22 A beaker containing solid carbon dioxide is placed in a fume cupboard at room temperature. The carbon dioxide becomes gaseous.

Which process describes this change of state?

- AboilingBcondensationCevaporationDsublimation
- 23 Which statement about paper chromatography is correct?
 - **A** The solvent should cover the start line.
 - **B** The start line should be drawn in pencil.
 - **C** A solvent is needed to dissolve the paper.
 - **D** Paper chromatography separates mixtures of solvents.

24 Which statement about diagrams P, Q and R is correct?



- A Diagram P contains two elements and diagram Q contains a mixture.
- **B** Diagram **Q** contains two compounds and diagram **R** contains a mixture.
- **C** Diagram **P** contains two elements and diagram **Q** contains one compound.
- **D** Diagram **P** contains two compounds and diagram **R** contains two elements.
- **25** Atom **M** has an electronic structure 2,5. Atom **N** has an electronic structure 2,8,5.

Which statement about element N is correct?

- **A N** has more electron shells than **M**.
- **B N** has more electrons in its outer shell than **M**.
- **C N** is in the same period of the Periodic Table as **M**.
- **D N** is in a different group of the Periodic Table from **M**.
- **26** X, Y and Z are three elements found in the third period of the Periodic Table. The nature of their oxides is shown in the following table.

element	elementtype of oxide formedXacidicYbasic	
Х		
Y		
Z	amphoteric	

Which of the following shows the order of increasing proton number for the three elements?

Α	X, Y, Z	В	Y, Z, X
С	Z , X , Y	D	Z , Y , X

27 The apparatus shown is used to prepare aqueous copper(II) sulfate. Solid **X** is added into solution **Y** before the mixture is filtered to remove solid **X** as the residue.



What are X and Y?

	X	Y
Α	copper	sulfuric acid
в	copper(II) carbonate	sulfuric acid
С	copper	aqueous iron(II) sulfate
D	sulfur	aqueous copper(II) chloride

28 The diagram shows the arrangement of electrons in a molecule of compound ST_2 .



legend			
 : valence 	electron	ofa S	atom
x : valence	electron	of a T	atom

Which of the following pairs could be **S** and **T**?

	S	Т
Α	calcium	chlorine
в	carbon	oxygen
С	oxygen	hydrogen
D	sulfur	chlorine

29 The table below shows some information about four substances, A to D.

Which substance is most likely to be potassium chloride?

	melting point / °C	boiling point / °C	conductor of electricity in solid state	conductor of electricity in molten state
Α	-95	69	no	no
в	770	1420	no	yes
С	1240	2100	yes	yes
D	1650	2230	no	no

30 A student passes air forward and backward over heated copper using the apparatus as shown until the volume of air remains constant. Some unreacted copper remains. The original volume of air in the apparatus is 50.0 cm³.



What is the final volume of gas in the apparatus? [All volumes are measured at room temperature and pressure.]

Α	10 cm ³	В	20 cm ³
С	40 cm ³	D	60 cm ³

31 Which volume of 0.1 mol/dm³ hydrochloric acid is required to react completely with 25 cm³ of 0.2 mol/dm³ aqueous lithium hydroxide?

HCl +	$LiOH \rightarrow$	LiCl +	H_2O
-------	--------------------	--------	--------

Α	6.25 cm ³	В	25 cm ³
С	50 cm ³	D	100 cm ³

- 32 Which of the following is **not** a property of Group I metals?
 - **A** They are soft and can be cut with a knife.
 - **B** They react readily when exposed to oxygen in the air.
 - **C** They react rapidly with water producing hydrogen gas.
 - **D** They produce an acidic solution when they react with water.

33 Small portions of aqueous potassium iodide and of acidified, aqueous potassium manganate(VII) were separately added to a colourless solution **W**. The colour changes are shown in the table.

aqueous potassium iodide	acidified aqueous potassium manganate(VII)
colourless to brown	purple to colourless

Which statement about W is correct?

- **A W** is both an oxidising and a reducing agent.
- **B W** is neither an oxidising nor a reducing agent.
- **C W** is an oxidising agent but not a reducing agent.
- **D W** is a reducing agent but not an oxidising agent.
- 34 Which material is **not** involved in the large-scale extraction of iron from iron ore?

Α	coke	В	haematite
С	limestone	D	slag

35 Instant cooling packs are used to treat sports injuries. When the pack is squeezed, a chemical reaction takes place and the pack becomes very cold.

Which row shows the temperature change and the type of reaction taking place?

	temperature change	type of reaction
Α	decrease	endothermic
в	decrease	exothermic
С	increase	endothermic
D	increase	exothermic

- 36 Which reaction is endothermic?
 - $\mathbf{A} \qquad 2Ca + O_2 \rightarrow 2CaO$
 - $\textbf{B} \qquad \text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
 - $\textbf{C} \qquad \textbf{Ca+2HC}l \rightarrow \textbf{CaC}l_2 + \textbf{H}_2$
 - $\textbf{D} \qquad \text{CaO} + 2\text{HC}l \rightarrow \text{CaC}l_2 + \text{H}_2\text{O}$

37 The mass of a beaker and its contents is plotted against time.

Which graph represents what happens when sodium carbonate reacts with an excess of dilute hydrochloric acid in an open beaker?



38 Ethanol is made by fermentation.

How is ethanol obtained from the fermentation mixture?

Α	chromatography	В	crystallisation
С	filtration	D	fractional distillation

- **39** When crude oil is distilled, a number of fractions are collected. Which of these statements about the fractions is true?
 - **A** Each fraction is a single pure substance.
 - **B** Each fraction boils at the same temperature.
 - **C** The fraction with the highest range of boiling points burns least well.
 - **D** The fraction with the lowest range of boiling points burns with very sooty flame.
- 40 Which statement about the compound shown below is correct?



- A It is ethanoic acid.
- **B** It does not react with ammonia.
- **C** It is formed by oxidation of propanol.
- **D** It does not react with sodium carbonate.

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

	0	2	Ре	helium	4	10	Ne	neon	20	18	Ar	argon	40	36	ŗ	krypton	84	54	Xe	xenon 131	86	Ł	radon	ı				
	II					0	u.	fluorine	19	17	õ	chlorine	35.5	35	Ъ	bromine	80	53	-	lodine 127	85	At	astatine	ı				
	N					œ	0	oxygen	16	16	S	sulfur	32	34	Se	selenium	79	52	Te	tellurium 128	84	Ъ	polonium	I	116	2	livermorium	ı
	>					7	z	nitrogen	14	15	۵.	phosphorus	31	33	As	arsenic	75	51	ß	antimony 122	83	ï	bismuth	209				
	≥					9	o	carbon	12	14	ŝ	silicon	28	32	ge	germanium	73	20	ß	19 19	82	6	lead	207	114	F/	flerovium	1
	=					ۍ	ш	boron	1	5	٩	aluminium	27	31	Ga	gallium	20	49	Ę	115 115	81	Τī	thallium	204				
														30	Zn	zino	65	48	8	cadmium 112	80	£	mercury	201	112	ວົ	copernicium	1
													29	5 C	copper	64	47	B	silver 108	79	Au	gold	197	111	ß	roentgenium	I	
dno														28	Ī	nickel	59	46	Ъ	palladium 106	78	Ť	platinum	195	110	S	darmstadtium	ı
5														27	ပိ	cobalt	59	45	씸	rhodium 103	22	Ir	iridium	192	109	₫	meitnerium	1
		+	т	hydrogen	-									26	Fe	iron	56	44	Ru	ruthenium 101	76	so	osmium	190	108	Hs	hassium	I
														25	Mn	manganese	55	43	ц	technetium -	75	Re	rhenium	186	107	Вh	bohrium	1
						number	lod		mass					24	ວັ	chromium	52	42	ы	molybdenum 96	74	≥	tungsten	184	106	Sg	seaborgium	1
					Key	(atomic) n	mic sym	name	ve atomic i					23	>	vanadium	51	41	g	niobium 93	73	Та	tantalum	181	105	පි	dubnium	I
						proton	atc		relativ					22	F	titanium	48	40	Z	zirconium 91	72	Ŧ	hafnium	178	104	ř	Rutherfordium	1
														21	ပ္ပိ	scandium	45	39	≻	yttrium 89	57 - 71	lanthanoids			89 - 103	actinoids		
	=					4	Be	beryllium	6	12	Mg	magnesium	24	20	Ca	calcium	40	38	ي م	strontium 88	56	Ba	barium	137	88	Ra	radium	ı
	-					ო		lithium	7	1	Na	sodium	33	19	¥	potassium	39	37	å	rubidium 85	55	ပိ	caesium	133	87	۱Ľ	francium	I

PRSS_2019_S4E5N_PRELIM_SCI_5076_P1

europium E 83

samarium 82 Sm

71	Ξ	lutetium	175	103	۲	lawrencium	I	
2	٩۲	ytterbium	173	102	٥	nobelium	ı	
69	Tm	thulium	169	101	ΡM	mendelevium	I	
68	ш	erbium	167	100	Еm	fermium	I	
67	우	holmium	165	66	ß	einsteinium	ı	
99	ð	dysprosium	163	86	ັບ	californium	I	
65	đ	terbium	159	97	耑	berkelium	ı	
64	в	gadolinium	157	96	ő	curium	I	
83	Ш	europium	152	95	Am	americium	I	
62	Sm	samarium	150	94	Ъ	plutonium	I	
61	Pm	promethium	1	93	d	neptunium	I	
09	PN	neodymium	144	92	∍	uranium	238	
59	ŗ	praseodymium	141	91	Ра	protactinium	231	
58	ő	cerium	140	06	Ę	thorium	232	
57	La	lanthanum	139	89	Ac	actinium	I	
lanthanoids				actinoids				

The volume of one mole of any gas is $24\,\text{dm}^3$ at room temperature and pressure (r.t.p.).



Pasir Ris Secondary School

Name	Class	Register No.

SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC PRELIM EXAMINATION 2019

SCIENCE (C	CHEMISTRY)
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Paper 3 Chemistry

Thursday 1040 – 1155

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in. You may use a soft 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, where 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 14. A copy of the Periodic Table is printed on page 15.

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.

This document consists of **15** printed pages, including the cover page.

For Examiner's Use					
Section A					
Total					



5076/03, 5078/03

29 August 2019 1 hour 15 minutes

[Turn over

Section A

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

1 Fig. 1.1 shows the formulae of some gases found in a sample of polluted air.



Fig. 1.1

- (a) Choose formulae from Fig. 1.1 to answer the following questions.
 - (i) Give the formulae of a gas that is produced by incomplete combustion of fuels.

sent in [1] n state [2]
[1] n state [2]
n state
[2]
[2]
[1]

- 2 ⁴⁴Ca is an isotope of calcium.
 - (a) Explain what is meant by the term *isotope*.

......[1]

(b) Complete Table 2.1 to show the numbers of each type of particle in an **atom** of ⁴⁴Ca.

Table 2.1

particle	number
proton	
neutron	
electron	

[2]

(c) Table 2.2 shows an **ion** of ⁴⁴Ca containing the following particles.

Table 2.2

particle	number
proton	20
neutron	24
electron	18

Would you expect the number of electrons in an **atom** of calcium to be the same as that of its **ion**?

Give a reason to justify your answer.

 3 Table 3.1 shows the soil pH ranges required by different crops for growth.

crop	pH range
peanut	5.0 - 6.5
millet	6.0 - 6.5
sunflower	6.0 – 7.5
paprika	7.0 – 8.5
mango	5.5 - 6.0

Table 3.1

- (a) A farmer plants peanuts and millet crops. Only the peanut crop grows well.
 - (i) Predict the pH of the soil the farmer used.

......[1]

- (ii) Which other crop is most likely to grow well in the same soil?
 -[1]
- (b) The farmer adds calcium hydroxide to the soil before adding fertiliser containing ammonium sulfate to the soil. Suggest one purpose of using calcium hydroxide.

......[1]

(c) A reaction occurs between calcium hydroxide, Ca(OH)₂ and ammonium sulfate, (NH₄)₂SO₄. Explain why the farmer should **not** have added these two substances to the soil.

Include one chemical equation to support your answer.

 4 Fig. 4.1 describes a series of reaction for four substances **A**, **B**, **C** and **D**.





Give the names of the following substances.

Α, (a) (i) (ii) Β, С, (iii) (iv) D. [4] Suggest the name of the metal ore from which grey metal A can be extracted from. (b) (C) Write an ionic equation to show the reaction between colourless solution B and aqueous sodium hydroxide.[1]

5 A student carried out some experiments to determine the relative reactivity of four metals, **P**, **Q**, **R** and **S**. Table 5.1 shows the results.

	metal P	metal Q	metal R	metal S
solution of P nitrate	—	×	X	X
solution of Q nitrate	\checkmark	_	\checkmark	\checkmark
solution of R nitrate	\checkmark	×	—	\checkmark
solution of S nitrate	\checkmark	X	X	_

Key ✓ shows a reaction happened

- **X** show no reaction happened
- show the experiment was not performed
- (a) Arrange the metals in order of reactivity, starting with the most reactive metal.

 (b) Metal S reacts with hydrochloric acid. What would you observe when metal S reacts with hydrochloric acid? Explain your reasoning.

(c) Metal P melts at 650 °C and boils at 1091 °C.

Describe the arrangement and movement of the particles in metal P at 666 °C. Draw a diagram in Fig. 5.2 to illustrate your answer.



Fig. 5.2

 6 Fig. 6.1 shows some characteristics and chemical reactions of two organic compounds, ethane and ethene.





(a)	Fill i	n the missing boxes in Fig. 6.1.	[3]
(b)	lden	tify the following:	
	(i)	name of reaction J	
	(ii)	condition K	[2]
(c)	Defi	ne what is meant by the term <i>homologous series</i> .	
			[1]

(d) Both ethane and ethene exist as colourless gases at room temperature and pressure. Describe a test which can be used to distinguish between these two gases.

7 Photochromic glass is used in sunglasses. In bright light, the glass darkens reducing the amount of light reaching the eye. When the light is less bright, the glass becomes colourless increasing the amount of light reaching the eye.

Photochromic glass contains very small amounts of the halides silver chloride and copper(I) chloride. The reaction between these two chlorides is considered to be a redox reaction.

 $AgCl + CuCl \rightleftharpoons Ag + CuCl_2$ colourless colourless grey colourless

(a) Explain why the reaction is redox.

- (b) A student attempted to make a sample of pure silver chloride by reacting silver oxide with dilute hydrochloric acid. He did not succeed.
 - (i) Explain why the student was **not** successful in obtaining pure silver chloride.

.....

......[1]

(ii) Suggest and name **two** reagents that can be used to make silver chloride.

Outline the steps the student should take in order to make a **pure** and **dry** sample of silver chloride.

[3]

Section B

Answer any two questions in this section.

Write your answers in the spaces provided.

8 Ammonia, NH₃, has many uses. It is used predominantly in the manufacture of fertilisers to support agriculture. It is also used extensively in the chemical and textile industries. A very soluble gas, ammonia dissolves in water to form aqueous ammonia, an alkali.

Ammonia is made via a reaction between nitrogen and hydrogen known as the Haber process. This reaction can be represented by the following chemical equation:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Fig. 8.1 shows the percentage yield of ammonia when different temperatures and pressures are used during the manufacture of ammonia.





(a) State a source of hydrogen gas.

......[1]

(b) A student made the following claim:

"Ammonia does not conduct electricity in gaseous state but it can conduct electricity in aqueous state."

Do you agree with the student's claim? Explain your answer.

.....[2]

(c) (i) With reference to Fig. 8.1, do you think that it is better to use a higher temperature to manufacture ammonia? Explain your answer.

.....

(ii) Use your knowledge of reacting particles to explain how the rate of reaction may be affected when the pressure used to manufacture ammonia increases.

......[2]

(d) Calculate the maximum volume of ammonia gas that can be produced if 60 dm³ of hydrogen was made to react with excess nitrogen in the Haber process. [All volumes are measured at room temperature and pressure.]

[2]

(e) Draw a 'dot and cross' diagram to show the arrangement of electrons in one molecule of ammonia. Only the outer shell electrons need to be shown.

[2]

- **9** Potassium is a Group I metal and it is typically stored in kerosene. When potassium is reacted with oxygen, potassium oxide is formed.
 - (a) (i) Explain why potassium is stored in kerosene.

......[1]

(ii) Describe what you will observe when a piece of potassium metal reacts with cold water. Include a balanced chemical equation, with state symbols, to support your answer.

......[4]

- (iii) Suggest another use for kerosene.
 -[1]
- (b) Draw a 'dot and cross' diagram to show the arrangement of electrons in potassium oxide. Only the outer shell electrons need to be shown.

(c) Potassium oxide exists as a solid at room temperature and pressure.

Use your knowledge of the bonding and structure in potassium oxide to justify this observation.

.....[2]

- **10** Group VII elements, also known as halogens, exist as diatomic molecules.
 - (a) (i) Define the term *diatomic*.
 - (ii) Explain why halogens exist as diatomic molecules.[1] (b) Describe **two** trends, in terms of physical properties, that can be observed in the Group VII elements. (C) A student wanted to investigate the relative reactivity of two Group VII elements. Chemicals provided include: aqueous sodium bromide aqueous sodium iodide • bromine solution iodine solution No other chemicals are available. Describe two tests which the student can carry out to determine the relative reactivity of bromine and iodine. Include observations that may occur during the tests.[3]

(d) Iodine can react with hydrogen to form hydrogen iodide, HI.

$$I_2(s) + H_2(g) \rightarrow 2HI(g)$$

(i) Calculate the mass of solid that is required to form 256 g of hydrogen iodide.

[2]

(ii) Sketch a graph to show how the volume of hydrogen iodide produced changes with time during the experiment.



time / min

[1]

End of Paper

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

								Gru	UID								
-	=							5	1				N	>	N	NI	0
							+										2
							Ι.					•					He
				Key			nydrogen 1										nellum 4
3	4		proton	(atomic) n	umber	-1						5	9	7	80	6	10
:I	Be		ato	mic syml	loc							ß	U	z	0	ш	Ne
lithium	beryllium			name								boron	carbon	nitrogen	oxygen	fluorine	neen
7	6		relativ	'e atomic	mass							11	12	14	16	19	20
11	12											13	14	15	16	17	18
Na	Mg											AI	Si	٩.	S	Cl	Ar
molium	magnesium											aluminium	silicon	phosphorus	sulfur	chlorine	argon
23	24											17	207	10	32	00.00	40
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
¥	Ca	Sc	F	>	ບັ	Mn	Fe	ပိ	ī	CG	Zn	Ga	Ge	As	Se	Ъ	z
potassium	calcium	scandium	titanium	vanadium	chromium	manganese	iron	cobalt	nicket	copper	zinc	gallium	germanium	arsenic	selenium	bromine	krypton
39	40	45	48	51	52	55	56	59	59	64	65	70	73	75	79	80	84
37	38	39	40	41	42	43	4	45	46	47	48	49	50	51	52	53	54
Вb	ы К	≻	Zr	qN	Mo	Lc	Ru	Rh	Pd	Ag	B	IJ	Sn	Sb	Te	н	Xe
rubidium	strontium	yttrium	zirconium	niobium	molybdenum	technetium	ruthenium	rhodium	palladium	silver	cadmium	indium	tin	antimony	tellurium	iodine	xenon
85	88	89	91	93	96	1	101	103	106	108	112	115	119	122	128	127	131
55	56	57 - 71	72	73	74	75	76	11	78	6/	80	81	82	83	84	85	86
S	Ba	lanthanoids	Ŧ	Ta	3	Re	So	L	£	Au	Hg	11	Pb	Bi	Ро	At	R
caesium	barium		hafnium	tantalum	tungsten	rhenium	osmium	iridium	platinum	gold	mercury	thallium	lead	bismuth	polonium	astatine	radon
100	101		0/1	101	40	001	130	194	CRI	181	201	204	201	503	1	1	1
87	88	89 - 103	104	105	106	107	108	109	110	111	112		114		116		
F	Ra	actinoids	Rf	Db	Sg	뭠	Hs	¥	Ds	Rg	อี		FI		2		
francium	radium		Rutherfordium	dubnium	seaborgium	bohrium	hassium	meitnerium	darmstadtium	roentgenium	copernicium		flerovium		livermorium		
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231

71 Lu 175 103 Lr

70 Yb 173 173 102 No No Pobelium

Md 169 Md 89

68 167 167 Fm

67 Ho 165 99 Es

66 Dy dysprosium 163 98 Cf

65 Tb 159 97 Bk berkelium

64 Gd 157 157 26 Cm Cm

63 Eu 152 95 Am

62 Sm

61 Pm

Pr Pr

lanthanoids

marium 150 94 Pu

60 Nd 144 144 238 238

58 Cerium 140 90 232 232

57 La tanthanum 139 89 Ac Ac

actinoids

91 91 Pa

93 Np neptunium

wrenciu

ndelen

rmium

einsteini

californium -

americium

plutonium

PAPER 1 (20 marks)

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

<u>SEC 4E5N – SCIENCE (CHEMISTRY) 5076/5078 – PRELIM 2019 – SUGGESTED</u> <u>ANSWERS</u>

PAPER 3 – Section A (45 marks)

Qn	Answers	Mark
1	(a) (i) <u>CO</u> [1]	[8]
	 (ii) CO₂ [1] (iii) CO [1] and NO [1] (b) (i) nitrogen dioxide [1] and sulfur dioxide [1] (ii) acidic gas that irritates the eyes and attacks the lungs, causing breathing difficulties / can lead to bronchitis or reacts with rainwater and causes acid rain, corrodes metal buildings / destroy stone structures / leaches important nutrients from the soil thereby destroy forest / lowers pH of water thereby killing aquatic lives [1] 	
	(c) <u>Argon / Ar</u> as it is an <u>inert</u> / <u>unreactive</u> gas [1]	
2	 (a) Isotopes are <u>atoms of the same element</u> / with <u>same number of protons</u> but <u>different number of neutrons / nucleon number</u>. [1] (b) proton: <u>20</u> neutron: <u>24</u> electron: <u>20</u> 3 answers correct – [2] 1 – 2 answers correct – [4] 0 answer correct – [0] (c) the no. of electrons in an atom is <u>expected to be different</u> from that of an ion. [<i>must answer but no mark awarded</i>] <u>Atom is electrically neutral</u> / <u>no. of electrons is the same as no. of protons</u> in an atom [1] whereas the <u>no. of electrons is 2 fewer</u> in a calcium ion as a calcium atom has <u>lost 2 valence electrons</u> [0.5] to <u>achieve the stable noble gas</u> 	[5]
	configuration [0.5]	
3	 (a) (i) any pH greater than or equals to 5.0 but less than 6.0 [1] (ii) mango [1] (b) calcium hydroxide: to neutralise / remove excess H[±] ion / soil acidity [1] reject: to increase pH of the soil (c) Ammonium sulfate will react with calcium calcium hydroxide to form ammonia [1] which is liberated and leads to a loss of nitrogen that is essential for plant growth [1]. 	[6]

4	(a) (i) <u>iron</u> [1]	[6]
	(ii) <u>sulfuric acid</u> [1]	
	(iii) <u>iron(II) sulfate</u> [1]	
	(iv) <u>iron(II) hydroxide</u> [1]	
	(b) <u>haematite</u> [1]	
	(c) <u>H⁺(aq) + OH</u> ⁼(aq) → H ₂ O(<i>l</i>) [1]	
5	(a) P, S, R, Q [1]	[6]
	(b) <u>effervescence can be observed</u> [1] metal S <u>reacts</u> with hydrochloric acid to <u>form salt and hydrogen gas</u> [1]	
	(c) the particles are <u>close together</u> in a <u>disorderly arrangement</u> [1] the particles are able to <u>move freely throughout the entire volume</u> [1]	
	students must draw at least 9 particles – [0.5] particles are close together and of the same size – [0.5] zero mark if student identified wrong physical state	
6	(a) structural formula of ethene [1]	[8]
	polymerisation of ethene [1] $\begin{pmatrix} H \\ -C \\ -C \\ H \\ H \\ -H \end{pmatrix}_n$	
	general formula of alkanes: C _n H _{2n+2} [0.5]	
	general formula of alkenes: C _n H _{2n} [0.5]	
	(b) (i) <u>hydrogenation</u> [1]	
	(ii) <u>UV light</u> [1]	
	 (c) A homologous series is a family of organic compounds which has the <u>same functional group</u>, [0.5] + one of the following <u>same general formula</u> [0.5] acch successive member differing in composition by a -CHer 	
	 group [0.5] similar chemical properties [0.5] 	

	(d) <u>Bubble the gases</u> separately into <u>aqueous bromine</u> / <u>bromine</u> solution [1]	
	Gas is <u>alkene</u> if <u>reddish-brown solution decolourises</u> . Gas is <u>alkane</u>	
	if the reddish-brown solution remains .	
7	(a) O.S. of copper <u>increased</u> from <u>+1 in CuCl</u> to <u>+2 in CuCl</u> ₂ or Cu ⁺ <u>loses an electron</u> and is <u>oxidised</u> to form Cu ²⁺ [1]	[6]
	O.S. of silver <u>decreased</u> from <u>+1 in AgC<i>l</i></u> to <u>0 in Ag</u> or Ag⁺ <u>gains an electron</u> and is <u>reduced</u> to form Ag [1]	
	Since reduction and oxidation occurred simultaneously, the reaction is redox. (-0.5 if concluding statement is missing)	
	(b) (i) the silver chloride produced forms an <u>insoluble layer</u> around the insoluble <u>silver oxide</u> , <u>preventing further reaction</u> with the acid. [1]	
	(ii) <u>any 2 aqueous reagents</u> that can be used to make silver chloride [1]	
	mix the two aqueous reagents together [0.5] filter the mixture to obtain <u>silver chloride as residue</u> [0.5] wash the silver chloride residue with distilled water [0.5] dry by pressing between sheets of filter paper [0.5]	

PAPER 3 - Section B (20 marks)

Qn	Answers	Marks
8	(a) <u>cracking of petroleum</u> <i>t</i> <u>crude oil</u> [1]	[10]
	(b) <u>Agree with student</u> [no mark awarded] Ammonia does not conduct electricity in gaseous state as there are <u>no</u> <u>free moving ions and electrons</u> to act as charge carriers. [1] The <u>presence of free moving ions</u> in aqueous ammonia act as charge carriers to conduct electricity. [1]	
	(c) (i) <u>No, it is better to use lower temperature</u> the <u>percentage of ammonia produced decreases</u> when a higher temperature is used [1]	
	(ii) as <u>pressure increases</u> , there are <u>more particles per unit volume</u> [0.5] <u>no. of effective collisions increase</u> , [0.5] therefore <u>rate of</u> <u>reaction increases</u> [1]	
	(d) Based on the given equation, no. of moles of H_2 :NH ₃ is 3:2. [1]	
	max. volume of NH ₃ produced = (2 ÷ 3) x 60 = <u>40.0 dm³</u> [1]	
	alternative answer max. volume of NH ₃ produced = (60 ÷ 24) x (2 ÷ 3) x 24	



