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Bukit Batok Secondary School

GCE 'O' LEVEL PRELIMINARY EXAMINATION 2020

Secondary 4 Express / 5 Normal Academic

SCIENCE (PHYSICS, CHEMISTRY)

Paper 1 Multiple Choice

5076/01

2 September 2020

0845 to 0945

1 hour

Additional Materials: Multiple Choice Answer Sheet (OAS)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, index number and class on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Data Sheet is printed on page

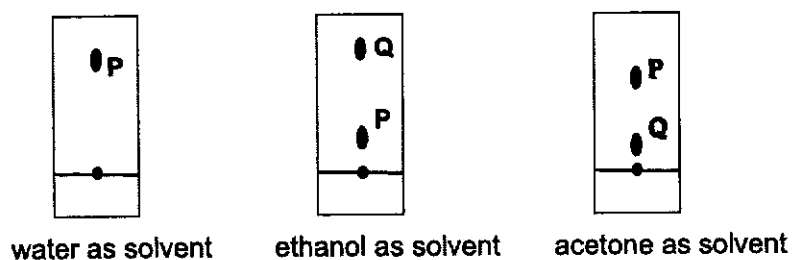
A copy of the Periodic Table is given on page

The use of an approved scientific calculator is expected, where appropriate.

21 Which statement is true of a pure compound?

- A It can be separated by distillation.
- B It consists of one type of atoms chemically combined.
- C It has properties different from the elements it is made up of.
- D It melts and boils over a range of temperature.

22 A scientist suspects that some canned drinks contain a mixture of two toxic dyes, P and Q. He analyses the mixtures using chromatography with three different solvents. The results of the analysis are shown below.



What can you conclude about the solubility of P and Q?

- A P is insoluble in water but Q is soluble.
 - B P is more soluble in ethanol than in acetone.
 - C Q is soluble in ethanol but insoluble in acetone.
 - D Q is less soluble in acetone than in ethanol.
- 23 The table shows the boiling points of some of the gases present in air.

gas	boiling point / °C
argon	-186
helium	-269
neon	-246
nitrogen	-196
oxygen	-183

When air is cooled to -200°C , some of these gases liquefy.

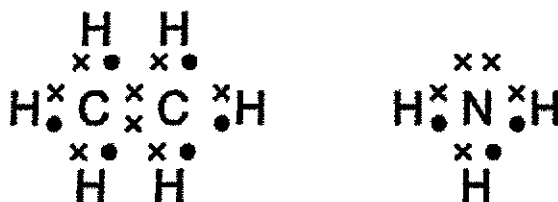
Which of the gases liquefy when air is cooled to -200°C ?

- A argon, helium and neon
- B argon, nitrogen and oxygen
- C helium and neon only
- D helium, neon and nitrogen

- 24 An element X has two isotopes, ^{238}X and ^{235}X .

How does ^{238}X differ from ^{235}X ?

- A It has 3 more protons and 3 more electrons.
 B It has 3 more protons.
 C It has 3 more neutrons and 3 more electrons.
 D It has 3 more neutrons.
- 25 Ethane, C_2H_6 , and ammonia, NH_3 , are covalent compounds.
 The dot and cross diagrams of these compounds are shown.



Which statements are correct?

- 1 A molecule of ethane contains twice as many hydrogen atoms as a molecule of ammonia.
 - 2 An uncombined nitrogen atom has five outer electrons.
 - 3 In a molecule of ethane, the bond between the carbon atoms is formed by sharing two electrons, one from each atom.
- A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3
- 26 A metal X and a non-metal Y react together to form an ionic compound X_2Y_3 .

Which row is correct?

	electrons given away by each atom of X	electrons received by each atom of Y
A	1	3
B	2	3
C	3	1
D	3	2

-
- A periodic table diagram with elements V, W, X, Y, and Z marked. Element V is in the second row, first column of the left block. Element W is in the second row, second column of the left block. Element Y is in the third row, first column of the left block. Element X is in the second row, eighth column of the right block. Element Z is in the third row, eighth column of the right block. There is an empty box above the main body of the table.

Which statement is correct?

- | | density | hardness |
|---|---------|----------|
| A | high | high |
| B | high | low |
| C | low | high |
| D | low | low |

- $$\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$$

What is the maximum volume of hydrogen evolved at room temperature and pressure?

- A** 1.2 dm³ **B** 2.0 dm³ **C** 2.4 dm³ **D** 24 dm³

- 30 The tables show the pH ranges of two indicators, methyl orange and methyl red.

methyl orange	red		yellow		
pH	2	3	4	5	6

methyl red	red				yellow
pH	2	3	4	5	6

The table below shows the pH of four solutions:

solution	W	X	Y	Z
pH	2.0	3.0	4.0	6.0

In which of the solutions are both indicators yellow?

- A W only
 B Z only
 C W and X
 D X and Y
- 31 The oxide of an element M was added separately to hydrochloric acid and aqueous sodium hydroxide.

The word equations for the reactions are shown

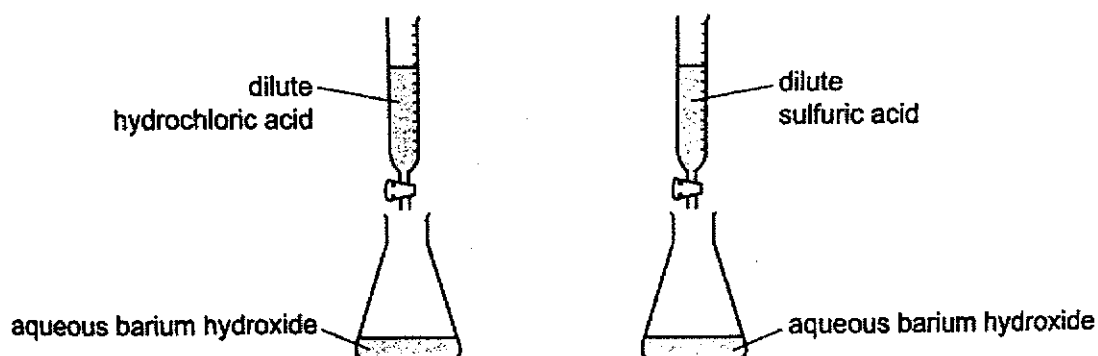
M oxide + hydrochloric acid → M chloride + water

M oxide + sodium hydroxide → no reaction

Which row describes M and its oxide?

	M	M oxide
A	metal	acidic
B	metal	basic
C	non-metal	amphoteric
D	non-metal	acidic

- 32 The diagrams show two experiments, one to make barium chloride and the other to make barium sulfate.



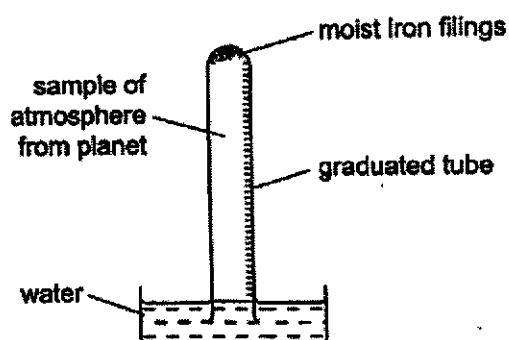
In each experiment, the acid is run into the conical flask until the pH is 7. Which are the next steps needed to obtain the solid salts?

	barium chloride	barium sulfate
A	crystallisation	crystallisation
B	crystallisation	filtration
C	filtration	crystallisation
D	filtration	filtration

- 33 The atmosphere of a newly discovered planet contains the following gases.

carbon dioxide	20 %
nitrogen	40 %
noble gases	10 %
oxygen	30 %

The apparatus below was set up with 100 cm³ sample of the atmosphere of the planet in the graduated tube. The volume of the sample was measured at intervals until no further change in volume took place.



What volume of the sample of the atmosphere would remain?

- A** 10 cm³ **B** 30 cm³ **C** 40 cm³ **D** 70 cm³

34 Which statements about the pollutant carbon monoxide are correct?

- 1 It is a colourless, odourless gas.
- 2 It is formed by incomplete combustion of natural gas.
- 3 It reacts with haemoglobin in the blood.

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

35 Limestone is decomposed to lime in the production of iron in the Blast Furnace.

Which substance does lime react with?

- A carbon
- B haematite
- C oxygen
- D sand

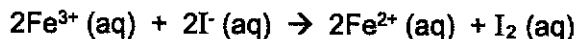
36 Excess aqueous sodium hydroxide is added to salt X and the solution is heated. A gas is given off which turns damp red litmus blue.

When this reaction is complete, aluminium foil is added to the solution. A gas is again given off which also turns damp red litmus blue.

What is salt X?

- A ammonium nitrate
- B ammonium sulfate
- C zinc nitrate
- D zinc sulfate

37 The reaction between iron(III) ions and iodide ions is represented by the equation.



Which statement is correct?

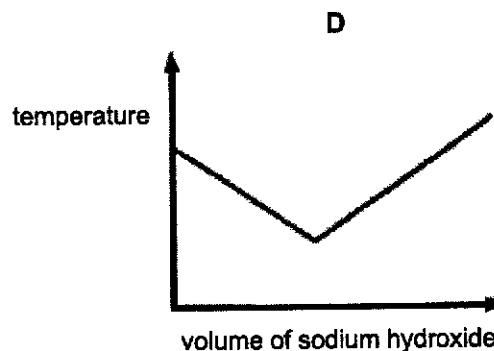
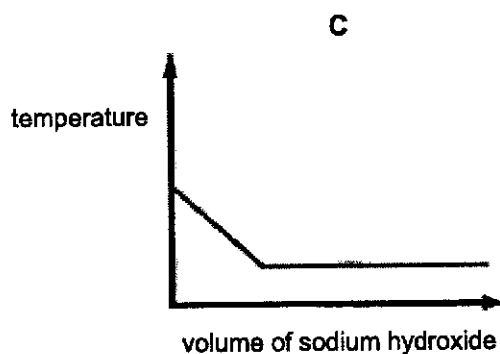
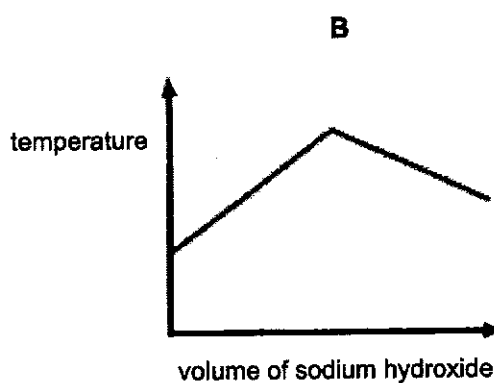
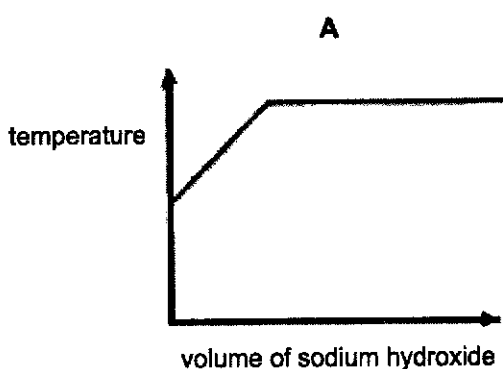
- A Fe^{3+} ions are oxidised by the loss of electrons.
- B Fe^{3+} ions are reduced by the gain of electrons.
- C I^{-} ions are reduced by the loss of electrons.
- D I^{-} ions are oxidised by the gain of electrons.

38 Which of the following is an endothermic process?

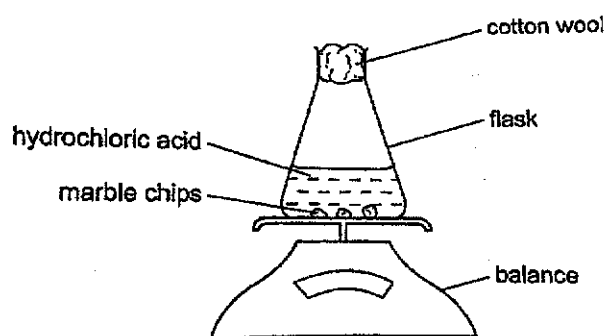
- A combustion of petrol
- B dissolving ammonium nitrate in water
- C the oxidation of carbon to carbon dioxide
- D the reaction between hydrogen and oxygen

39 The reaction between aqueous barium hydroxide and nitric acid is exothermic. Both the alkali and acid were initially at room temperature.

Which graph shows the change in temperature when aqueous barium hydroxide is added to nitric acid until the alkali is present in excess?



- 40 Two experiments were carried out using the apparatus below.

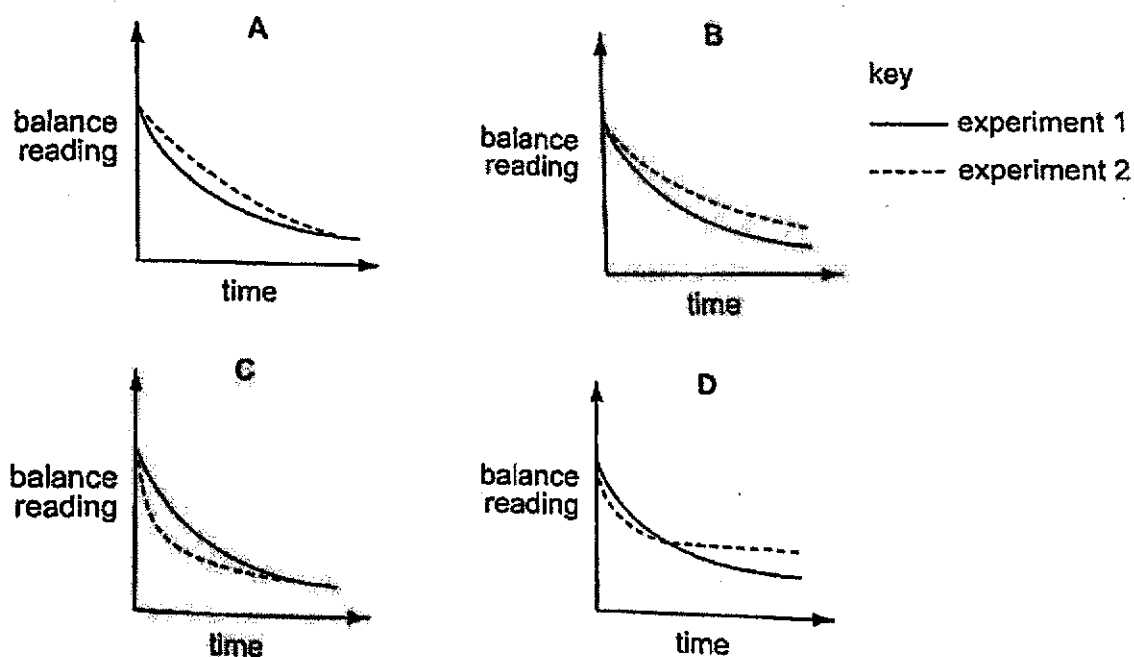


In experiment 1, dilute hydrochloric acid is used.

In experiment 2, concentrated hydrochloric acid is used.

All other conditions are the same. In both experiments all the marble chips completely reacted.

Which diagram shows the results obtained?



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

Group																	
I	II	1 H hydrogen 1										III	IV	V	VI	VII	0
Key																	
		proton (atomic) number atomic symbol name relative atomic mass															
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 -
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 -			

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
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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 -
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The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Name: Index No. Class:



Bukit Batok Secondary School

GCE 'O' LEVEL PRELIMINARY EXAMINATION 2020

Secondary 4 Express / 5 Normal Academic

SCIENCE (CHEMISTRY)

Paper 3

5076/03

27 August 2020

0800 to 0915

1 hour 15 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces provided at the top of this page.
You may use a pencil for any diagrams, graphs or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions in the spaces provided.
Write your answers in the spaces provided on the Question Paper.

Section B

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

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

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
Total	

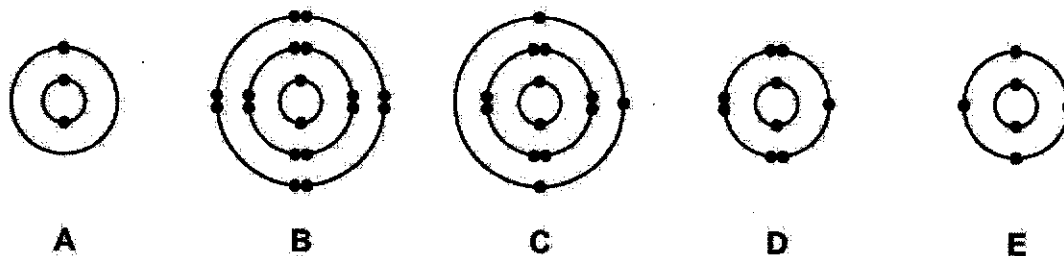
This document consists of 20 printed pages.

Section A [45 marks]

Answer all the questions..

Write your answers in the spaces provided on the question paper.

- 1 The electronic structures of five atoms, A, B, C, D and E, are shown.



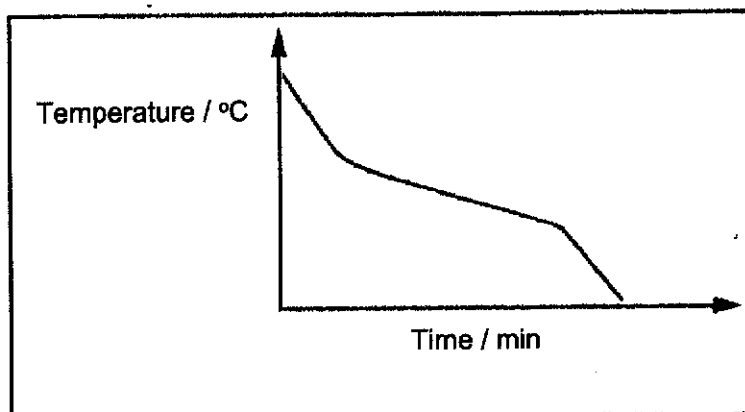
Answer the following questions about these electronic structures.

Each electronic structure may be used once, more than once or not at all.

State which electronic structure, A, B, C, D or E, represents an atom

- (a) of an element in Group I of the Periodic Table, [1]
- (b) of a monatomic gas, [1]
- (c) of carbon, [1]
- (d) which has 13 protons. [1]

- 2 This curve resulted when liquid H was cooled.



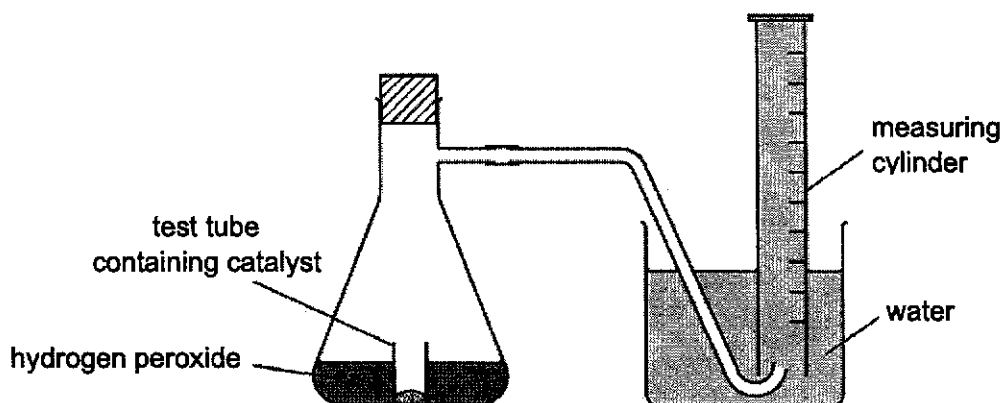
- (a) Suggest whether liquid H is an element, a compound or a mixture. Explain your answer.

.....
..... [2]

- (b) Describe, using kinetic particle theory, what happens to the spacing and movement of the particles as liquid H cools to become a solid.

.....
.....
..... [2]

- 3 A catalyst is a substance that speeds up a reaction but itself does not take part in it. Hydrogen peroxide decomposes to produce oxygen in the presence of a catalyst. A student uses the apparatus shown to investigate the rate of decomposition of hydrogen peroxide.



The experiment starts when the test tube is tipped so that the catalyst comes into contact with the hydrogen peroxide. The oxygen gas is then collected in the measuring cylinder.

- (a) Explain why oxygen is collected using this method.

.....
..... [1]

- (b) Name another apparatus that could be used to measure the volume of oxygen.

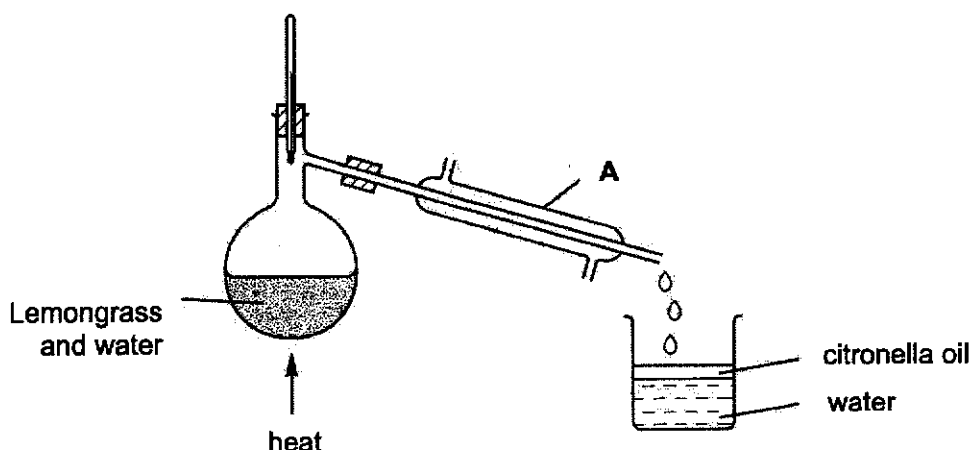
..... [1]

- (c) Describe a test to identify oxygen gas.

.....
..... [1]

[Total 3 marks]

- 4 Citronella oil can be extracted from lemongrass by distillation using the following apparatus shown below. The citronella oil is carried off in small droplets with the steam.



- (a) (i) State why the oil condenses in the piece of apparatus labelled A.

.....
..... [1]

- (ii) The citronella oil and water are collected in the beaker.
What information in the diagram shows that citronella oil is less dense than water?

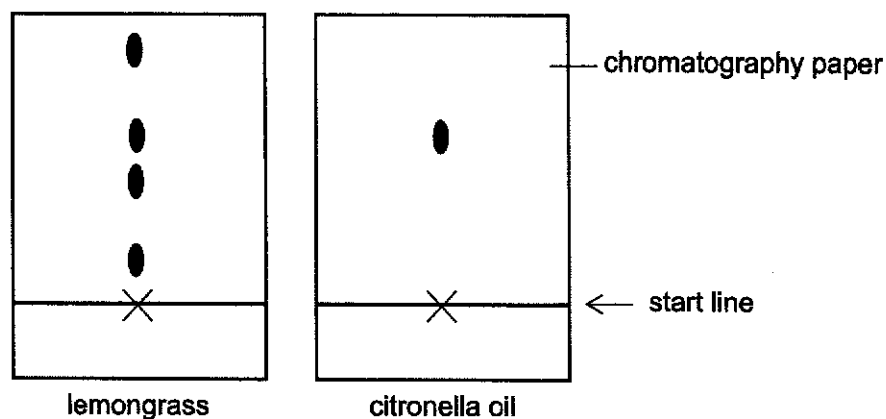
..... [1]

- (iii) Based on the diagram and information given, suggest how the citronella oil can be separated from the water after distillation.

..... [1]

- (b) Lemon grass contains a variety of different pigments. These pigments can be separated using paper chromatography with ethanol as the solvent.

The chromatograms of lemongrass and citronella oil are shown in the diagram below.



- (i) How many pigments does lemongrass contain?

..... [1]

- (ii) Deduce one conclusion from these two chromatograms.

..... [1]

- 5 The Periodic Table contains an element with proton number 9 and another element with proton number 17.

(a) (i) Explain why both elements appear in the same group of the Periodic Table.

.....
 [1]

(ii) Other than colour, state one trend in the properties of this group of elements.

.....
 [1]

(b) The colours of several substances are shown in the table below.

substance	colour
chlorine (aqueous)	pale yellow
iodine (aqueous)	brown
iodine (solid)	purplish-black
magnesium chloride (aqueous)	colourless
magnesium iodide (aqueous)	colourless

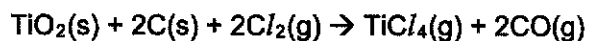
Aqueous iodine was added to a solution of magnesium chloride.

Describe the change that would be observed. Explain your answer.

Description

Explanation
 [2]

- 6 A sample of 400 g of titanium(IV) oxide, TiO_2 , is mixed with carbon and heated in a reaction chamber through which chlorine gas is passed into. One of the products formed is gaseous titanium(IV) chloride, TiCl_4 .



- (a) Calculate the number of moles in 400 g of TiO_2 .

moles of TiO_2 = [1]

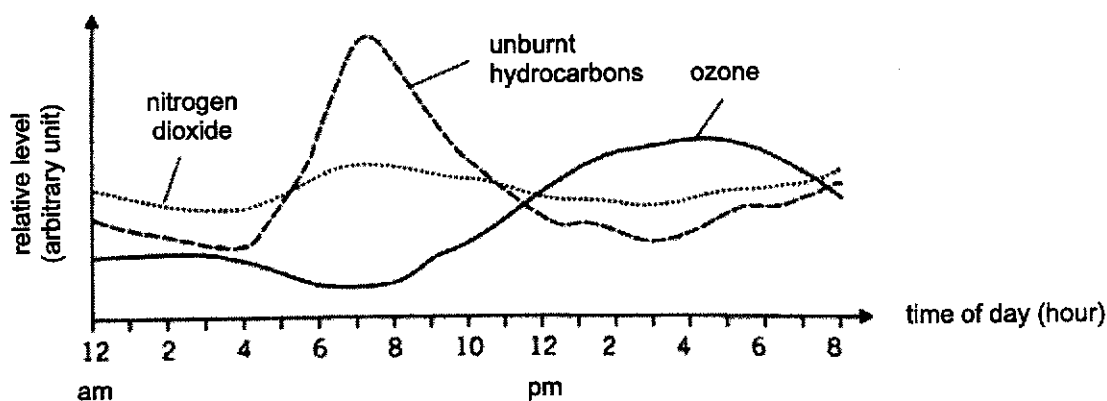
- (b) Determine the number of moles of Cl_2 that has reacted with 400 g of TiO_2 .

moles of Cl_2 =mol [1]

- (c) Calculate the volume of Cl_2 gas that has reacted with 400 g of TiO_2 at room temperature and pressure.

volume of Cl_2 = dm^3 [1]

- 7 The graph shows the relative levels of three air pollutants on major traffic roads of a city measured over a period of 20 hours on a particular day.



- (a) State the possible source of nitrogen dioxide that is shown in this graph.

.....
 [1]

- (b) Unburnt hydrocarbons are produced by incomplete combustion of petrol. Explain why the concentration of unburnt hydrocarbons reach the maximum level from 6 am to 10 am.

.....
 [1]

- (c) Suggest another possible air pollutant that can be found in the city.

..... [1]

- 8** Sulfur dioxide, an air pollutant, dissolves in water and reacts with oxygen to form sulfuric acid that falls as acid rain and damage the soil.

- (a) (i)** Describe a laboratory test that can be used to test for the pH levels of the water from the soil.

.....
..... [1]

- (ii)** Describe how the soil that has been damaged by acid rain can be treated.

.....
..... [1]

- (b)** Describe how a pure and dry sample of calcium sulfate can be prepared in the laboratory, using sulfuric acid as one of the reactants.

.....
.....
.....
..... [3]

- 9 In separate experiments, powdered samples of metal **I** and metal **J** reacted with solutions of nickel(II) sulfate and iron(II) sulfate. The following table shows how the colours of the solutions changed.

	metal I	metal J
nickel(II) sulfate	solution turns from green to colourless	solution turns from green to colourless
iron(II) sulfate	solution remains pale green	solution turns from pale green to colourless

- (a) (i) Predict the order of reactivity for the four metals: **I**, **J**, nickel and iron.

most reactive

.....

.....

least reactive

[1]

- (ii) Metal **J** does not react with cold water but burns in steam to produce a solid. What is the identity of metal **J**?

..... [1]

- (b) (i) Iron is currently one of the most commonly used metals. However, it tends to rust easily when in contact with water and air.

Suggest **one** method of preventing iron from rusting.

..... [1]

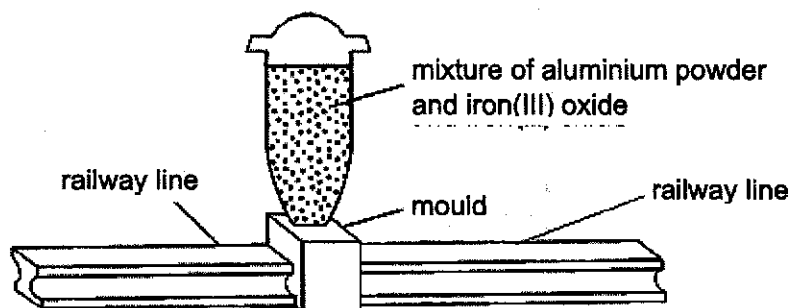
- (ii) With the present rate of extraction of iron and its high demands for industrial and domestic use, it is estimated that the reserves of iron will run out within 300 years. Global efforts to recycle metals are more crucial now than ever.

Suggest **one** way to promote recycling of iron in your community.

.....

..... [1]

- (c) The diagram shows how the reaction between aluminium and iron(III) oxide can be used to repair cracks in railway lines.



The mixture is ignited and an exothermic reaction takes place. The molten iron formed is collected in the mould. The molten iron solidifies and repairs the crack between the rails. The mould is then removed.

The chemical equation for the reaction that took place is:



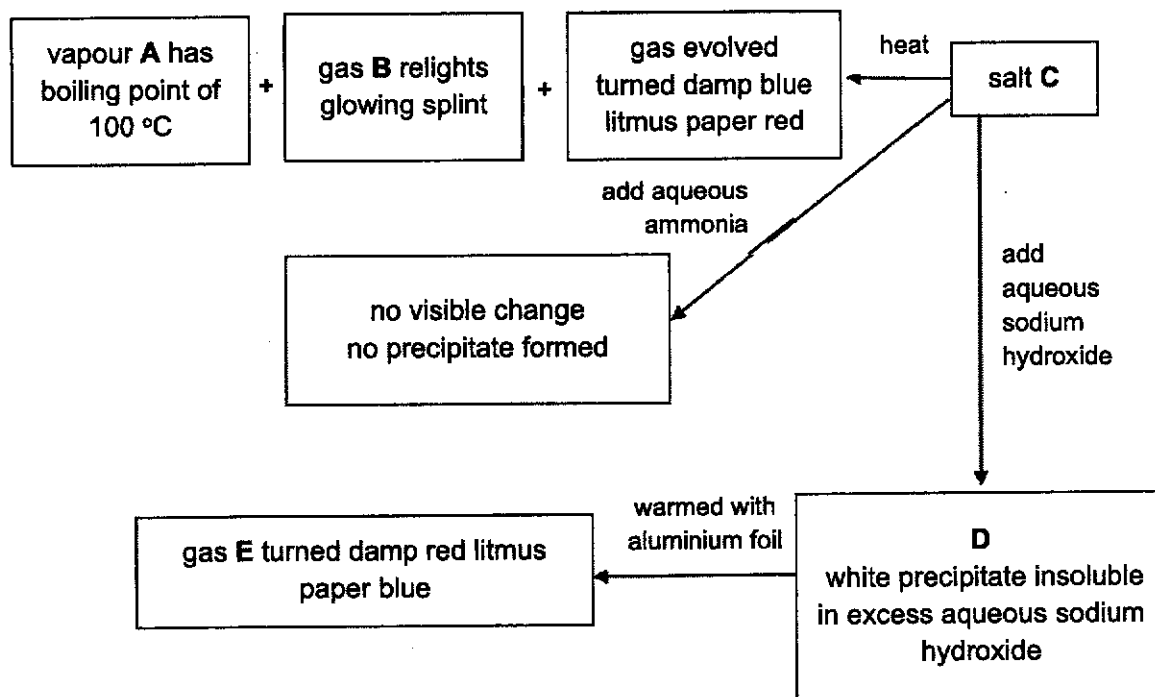
- (i) Explain why iron is produced in the reaction that took place.

.....
 [2]

- (ii) State the substance that is oxidised in the reaction.
 Explain your answer in terms of changes in oxidation state.

substance oxidised
explanation
 [2]

10 The figure below describes some of the reactions of salt C.



(a) Identify the substances A to E.

- A [5]
 B
 C
 D
 E

(b) Write a chemical equation for any one of the above reactions.

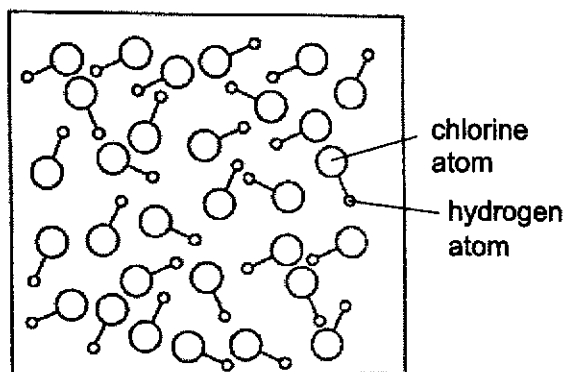
..... [1]

End of Section A

Section B [20 marks]Answer any **two** questions.

Write your answers in the spaces provided on the question paper.

- 11 The diagram below show the structure of gaseous hydrogen chloride.



- (a) (i) Explain why hydrogen chloride has a low melting point.

.....
 [2]

- (ii) Use 'dot-and-cross' diagram to show the arrangement of electrons in a molecule of hydrogen chloride.

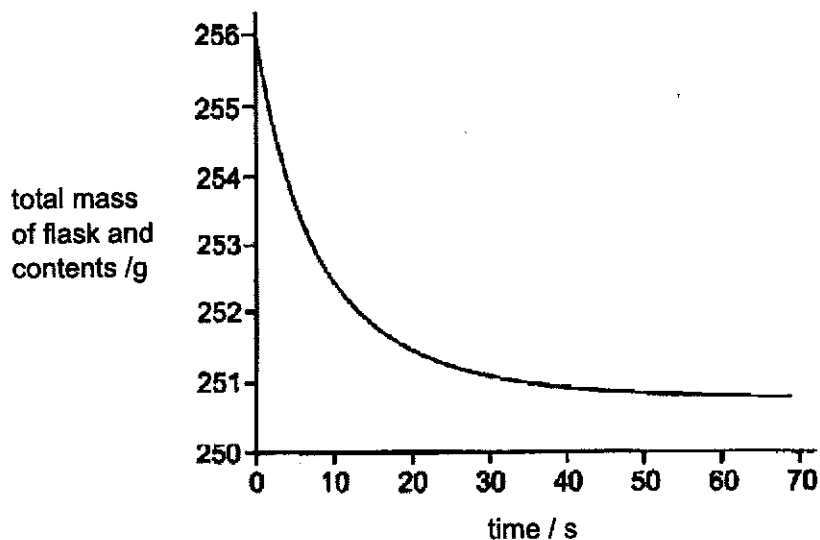
Only the outer shells electrons need to be shown.

[2]

- (iii) Hydrogen chloride dissolves in water to form an acidic solution.
 Explain why this solution is acidic.

.....
 [1]

- (b) Indigestion tablets such as magnesium carbonate reduce stomach acidity. Magnesium carbonate is placed in a flask on a top-pan balance and dilute hydrochloric acid is added. The total mass of the flask and its contents is recorded every ten seconds.



- (i) Describe how you would use the graph to determine the speed of the reaction at 20 seconds.

.....

 [2]

- (ii) Suggest one condition to increase the speed of this reaction. Explain your answer.

.....

 [2]

- (iii) Write a balanced chemical equation for this reaction.

..... [1]

12 The table below shows the names and formulae of some compounds.

compound	name	formulae
A		PbCO_3
B	sodium hydroxide	NaOH
C	iron(III) sulfate	
D	dilute nitric acid	HNO_3
E	lithium chloride	LiCl

(a) Complete the table above. [1]

(b) Use the letters, A, B, C, D and E to answer the following questions.
You may use the letters once, more than once or not at all.

(i) Which substance, when dissolved in water, turns the Universal indicator purple?

..... [1]

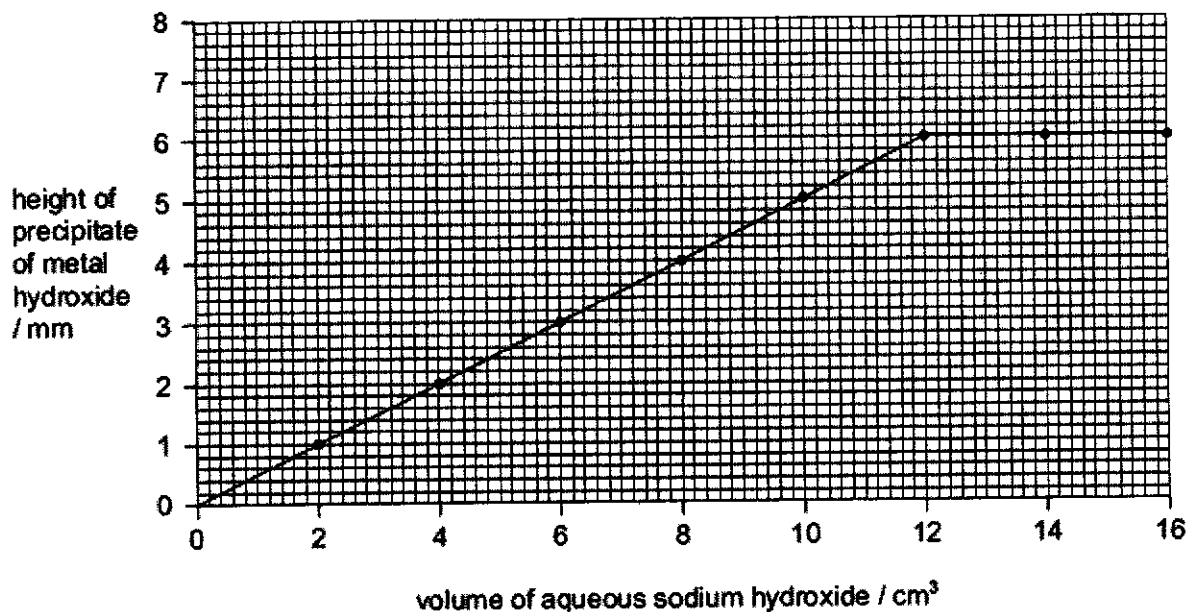
(ii) Which substance can be prepared using the titration method?

..... [1]

(iii) Which substance, when reacted with ammonium salts, produces a gas which turns moist red litmus paper blue?

..... [1]

- (c) A student added 2.0 cm^3 portions of aqueous sodium hydroxide to a beaker of aqueous copper(II) chloride. After each addition of sodium hydroxide, the mixture was stirred, allowed to settle for 30 minutes and the height of the precipitate formed was measured. The results are shown in the graph below.



- (i) State the volume of aqueous sodium hydroxide required for the reaction to complete.

..... [1]

- (ii) Write a balanced chemical equation for the formation of the precipitate.

..... [2]

- (iii) The experiment was repeated using aqueous ammonia of the same concentration and copper(II) chloride.

- On the graph above, draw how the new graph will look like
- Give a reason for your answer

.....

..... [2]

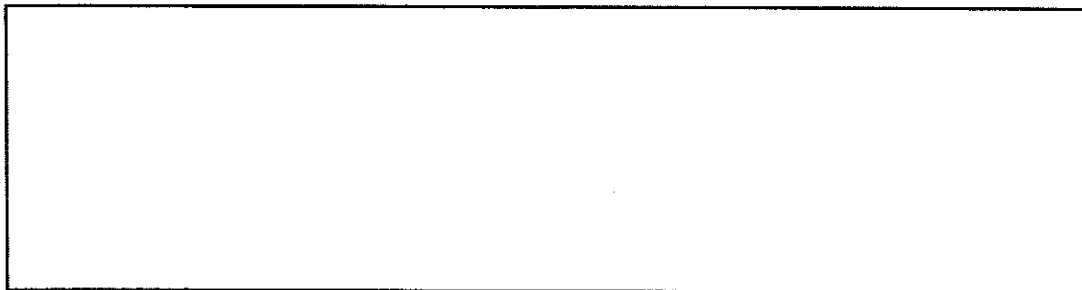
- (iv) Another student did the above experiment but the mixture was allowed to settled for 15 minutes.

How would the result of this experiment be different, if any?

..... [1]

[Total 10 marks]

13



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

Group																	
I	II											III	IV	V	VI	VII	0
1 H hydrogen 1																	
Key proton (atomic) number atomic symbol name relative atomic mass																	
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 sulphur 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 -	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 -	118 Og oganeson -	119 Ts tennessine -	120 Ug unbinilium -

lanthanoids		71 Lu lutetium 175	70 Yb ytterbium 173	69 Tm thulium 169	68 Er erbium 167	67 Ho holmium 165	66 Dy dysprosium 163	65 Tb terbium 159	64 Gd gadolinium 157	63 Eu europium 152	62 Sm samarium 150	61 Pm promethium -	60 Nd neodymium 144	59 Pr praseodymium 141	58 Ce cerium 140	57 La lanthanum 139
actinoids		103 Lr lawrencium -	102 No nobelium -	101 Md mendelevium -	100 Fm fermium -	99 Es einsteinium -	98 Cf californium -	97 Bk berkelium -	96 Cm curium -	95 Am americium -	94 Pu plutonium -	93 Np neptunium -	92 U uranium 238	91 Pa protactinium 231	90 Th thorium 232	89 Ac actinium -

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Bukit Batok Secondary School
 Science Chemistry 5076
 Secondary 4E5N
 Preliminary Exam 2020

Answer Sheet

Paper 1

21	C	A compound is made up of 2 or more elements chemically combined. It has different properties from the elements it is made of. It is a pure substance with fixed melting and boiling points. It can only be separated by chemical means.
22	D	The more soluble the substance in the solvent, the further up it moves with the solvent.
23	B	Boiling point = condensation point Argon will condense at -186°C . Nitrogen will condense at -196°C . Oxygen will condense at -183°C . At -200°C , they turned into liquid.
24	D	Isotopes are with atoms with same number pf protons but different number of neutrons. Number of protons is the same, the difference is $238 - 235 = 3$ neutrons
25	D	(1) C_2H_6 has 6 H atoms, NH_3 has 3 H atoms. (2) x represents valence electrons of N. There are 5 x around N atom. (3) There are 2 electrons (x) between the 2 C atoms.
26	D	To form formula X_2Y_3 , 2 ions of X^{3+} are required to bond with 3 ions of Y^{2-} . Thus atom of X gives away 3 electrons while atom of Y receives 2 electrons to form these ions.
27	C	(A) In Group I, reactivity increases down the group. (B) Across the period, metallic character decreases. (becomes more non-metallic) (C) In Group I, melting point decreases down the group. (D) In Group VII, reactivity decreases down the group.
28	D	Group I metals are light (low density) and soft (can be cut with knife).
29	A	no of moles of HCl = concentration x volume $= 1.0 \text{ mol/dm}^3 \times \frac{100}{1000} \text{ dm}^3 = 0.100\text{mol}$ 2mol of HCl produces 1mol of H_2 0.100mol of HCl produces 0.0500mol of H_2 volume of H_2 = no of moles x molar volume $= 0.0500\text{mol} \times 24\text{dm}^3 = 1.2\text{dm}^3$
30	B	At pH 6, both indicators will be yellow in colour.
31	B	M oxide can only react with acid, thus it's a base (metal oxide/hydroxide).

32	B	Barium chloride is a soluble salt – crystallisation to obtain solid salt from solution. Barium sulfate is an insoluble salt – filtration to obtain solid salt from solution.
33	D	30% oxygen used up to react with moist iron filling (rusting). 100cm ³ of air – 30cm ³ oxygen = 70cm ³ air left
34	D	(2) $2\text{CH}_4 + \text{limited } 3\text{O}_2 \rightarrow 2\text{CO} + 4\text{H}_2\text{O}$ (3) CO reacts with haemoglobin to form carboxyhaemoglobin.
35	D	$\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$ lime removes acidic impurity (sand)
36	A	Add NaOH, warm, produce NH_3 – NH_4^+ ion present Add Al to warm mixture, produce NH_3 – NO_3^- ion present
37	B	$2\text{Fe}^{3+} + 2\text{e}^- \rightarrow 2\text{Fe}^{2+}$ Two Fe^{3+} ion the gain of 2 electron for form two Fe^{2+} ion – reduction $2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^-$ Two I^- ion the loses of 2 electron for form I_2 molecule – oxidation
38	B	Temperature of surrounding drops during dissolving of NH_4NO_3 .
39	B	Temperature of surrounding rises (exothermic) and falls back to room temperature when the reaction ends.
40	C	Expt 2 is faster than Expt 1. Same amount of marble chips used thus same mass of CO_2 lost.

Paper 3 Section A

- 1a A 1m
 1b B 1m
 1c E 1m
 1d C 1m
- 2a A mixture. 1m
 It has no fixed freezing point / It freezes over a range of temperatures. 1m
- 2b The particles' arrangement changed from closely packed in disorderly manner to closely packed in orderly manner. 1m
 The particles changed from being able to slide over one another to vibrating in fixed positions. 1m
- 3a Oxygen is very slightly soluble in water. 1m
- 3b Gas syringe 1m
- 3c Put a glowing splint into a test tube of oxygen, it will relight. 1m
- 4ai Cold water flowing through the condenser cools down the vapours of the oil and turn them to liquid. 1m
- 4aii The oil is above the water / floats on water. 1m
- 4aiii Use a separating funnel to separate the oil and water. 1m

- 4bi Four 1m
- 4bii Lemongrass is a mixture whereas citronella is a pure substance / compound. 1m
- 5ai Both elements have 7 valence electrons (2.7 and 2.8.7). 1m
- 5aii Down the group
- melting and boiling point increases
- states change from gas (F_2, Cl_2) to liquid (Br_2) to solid (I_2, At_2) either 1m
- 5b Colourless solution turns brown. 1m
Iodine is less reactive than chlorine. It is not able to displace chlorine from magnesium chloride. 1m
Iodine dissolves in the magnesium chloride solution forming a brown solution. Bonus 1m
- 6a no of moles of $TiO_2 = \frac{mass}{molar\ mass} = \frac{400g}{48+16+16} = 5.00\ mol\ (3sf)$ 1m
- 6b 1 mol TiO_2 reacts with 2 mol Cl_2
5.00 mol TiO_2 reacts with 10.0 mol Cl_2 (3sf) 1m
(a) and (b) no 3sf minus 1m
- 6c volume of $Cl_2 = no\ of\ moles \times molar\ volume = 10.0 \times 24 = 240\ dm^3$ 1m
- 7a Oxygen and nitrogen from the air reacts under high temperature in the car combustion engines. 1m
- 7b Between 6 am to 10 am, there is a lot of people commute to work using vehicles therefore high level of unburnt hydrocarbons are produced from these vehicles. 1m
- 7c Carbon monoxide 1m
- 8ai Use a pH meter to measure the pH of the water from the soil, pH is 5-6
OR
Add 2-3 drops of Universal indicator into soil water and compare the colour with pH chart. Colour of indicator shows orange / yellow (or pH is 5-6). either 1m
- 8aii Calcium hydroxide / calcium carbonate / calcium oxide can be used to treat the acidic soil 1m
- 8b 1) Mix sulfuric acid and calcium nitrate. (accept any correct Ca^{2+} solution) 1m
2) Filter to obtain calcium sulfate as residue. 1m
3) Wash residue with deionized water and pat dry between filter papers. 1m
- 9ai $J > iron > I > nickel$ 1m

9aii	Magnesium / Zinc	1m
9bi	• Painting / greasing / plating • Coat iron with a sacrificial / more reactive metal eg zinc or magnesium • Use alloy eg stainless steel	either 1m
9bii	• Educate the public about importance of recycling iron. • partner with businesses or government bodies to set up recycling bins outside of homes and offices to be used for waste iron objects.	either 1m
9ci	Aluminium is more reactive than iron.	1m
	Aluminium displaces iron from its oxide.	1m
9cii	Aluminium	1m
	Its oxidation state increased from 0 in Al to +3 in aluminium oxide.	1m
10a	A – water	1m
	B – oxygen gas	1m
	C – calcium nitrate	1m
	D – calcium hydroxide	1m
	E – ammonia gas	1m
10b	$\text{Ca}(\text{NO}_3)_2 + 2\text{NaOH} \rightarrow \text{Ca}(\text{OH})_2 + 2\text{NaNO}_3$	1m

Paper 3 Section B

11ai	Weak intermolecular force of attraction between (hydrogen chloride) molecules	1m
	requires little amount of heat energy to overcome the force	1m
11aii		
		bond 1m
		Cl ⁻ 1m
11aiii	When dissolved in water, HCl ionised to form H ⁺ and Cl ⁻ ions. H ⁺ ions give the acidic property of solution.	1m
11bi	A tangent is to be drawn at the 20 th second.	1m
	Total mass loss between two points are to be recorded. (e.g. 10s and 20s).	
	The total mass loss is divided by 10s to determine the speed of reaction at 20s.	1m
11bii	1) Increase in temperature of hydrochloric acid.	any

Increase in temperature will result in particles gaining heat energy and move faster. Frequency of effective collisions increases.

factor 1m
explain 1m
total 2m

2) Increase in concentration of acid.
There will be more particles per unit volume and they are closer together.
Frequency of effective collisions increases.

3) Decrease in particle size of magnesium carbonate.
Smaller particle size will lead to larger surface area.
Frequency of effective collisions increases.

11biii $\text{MgCO}_3 + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ 1m

12a Lead (II) carbonate
 $\text{Fe}_2(\text{SO}_4)_3$ both 1m

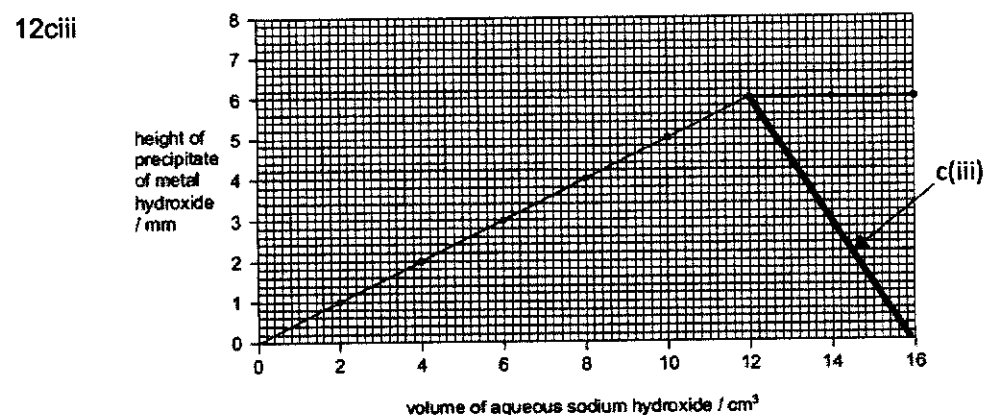
12bi B 1m

12bii E 1m

12biii B 1m

12ci 12cm^3 1m

12cii $2\text{NaOH}_{(\text{aq})} + \text{CuCl}_{2(\text{aq})} \rightarrow \text{Cu}(\text{OH})_{2(\text{s})} + 2\text{NaCl}_{(\text{aq})}$ Eqn 1m
Sym 1m



1m

12ciii The (blue) precipitate formed is soluble in excess aqueous ammonia (forming a dark blue solution). 1m

12civ Height of precipitate will be lower. 1m