SINGAPORE SPORTS SCHOOL
PRELIMINARY EXAMINATION 2019
SECONDARY 4 EXPRESS
SECONDARY 5 NORMAL (ACADEMIC)

CANDIDATE NAME			
CLASS		INDEX NUMBER	

SCIENCE (CHEMISTRY, BIOLOGY) 5078/01

Paper 1 Multiple Choice **15 AUGUST 2019**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on the Answer Sheet and this Question Paper

You may use a soft pencil for any diagrams, graphs, tables or rough working.

Write in soft pencil.

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

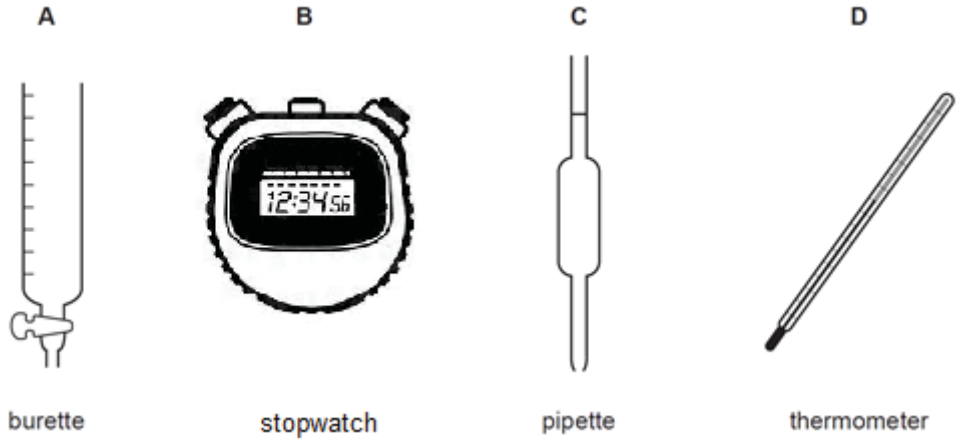
There are **forty** questions on this paper. Answer **all** questions. For **each** question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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 11.
A copy of the Periodic Table is printed on page 12.
The use of an approved scientific calculator is expected, where appropriate.

1 A student mixes 25 cm^3 samples of dilute hydrochloric acid with different volumes of aqueous sodium hydroxide.

In each case, the change in temperature is measured to test if the reaction is exothermic.

Which apparatus is **not** needed?



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

3 Three substances have the following properties:

- substance **1** is brittle and conducts electricity;
- substance **2** melts at 5°C and boils at 150°C;
- substance **3** has a high melting point of 800°C.

What is the state of each substance at 65°C?

	substance 1	**substance 2**	**substance 3**
A	solid	solid	liquid
B	liquid	solid	solid
C	solid	liquid	solid
D	liquid	liquid	solid

4 An excess of sodium hydroxide is added to an aqueous solution of salt V and boiled. Ammonia gas is only given off after aluminium foil is added to the hot solution.

What could salt **V** be?

A ammonium sulfate
B ammonium nitrate
C sodium sulfate
D sodium nitrate

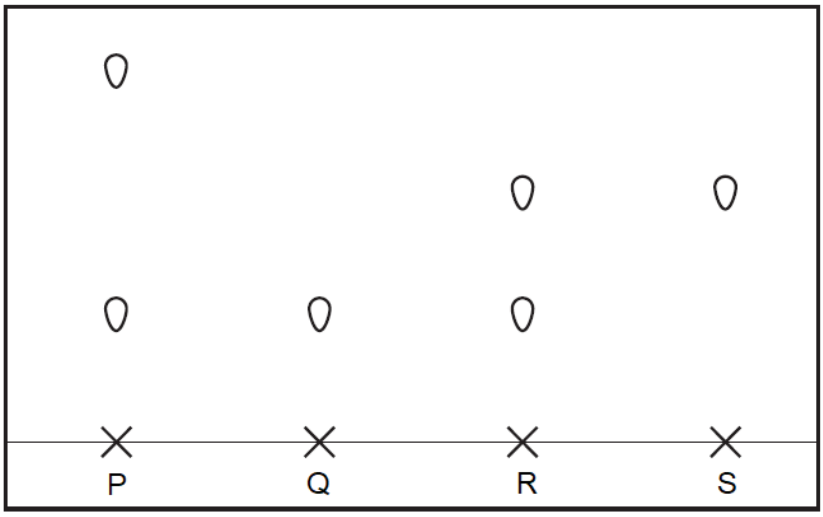
5 The following diagram shows the symbol and some information about two particles **T** and **U**.

$^{22}_{12}\mathbf{T}$ $^{39}_{19}\mathbf{U}$

Which of the following is correct?

A **T** and **U** are different elements with the same number of neutrons.
B **T** and **U** are different elements with the different number of neutrons.
C **T** and **U** will form negative ions of different charges.
D **T** and **U** are isotopes since they have the same number of neutrons.

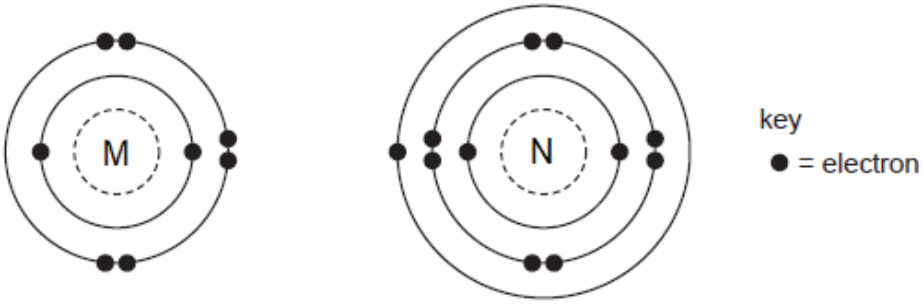
6 The diagram shows the paper chromatograms of four substances, **P**, **Q**, **R** and **S**. They are made up of either elements or mixtures.



Which of the following conclusions can be made, based on the results?

A **P** is a pure substance.
B **Q** and **S** are the same elements.
C **R** is a mixture of elements **Q** and **S**.
D **S** is less soluble in the solvent used to run the chromatogram than **Q**.

7 The electronic structures of atoms **M** and **N** are shown.



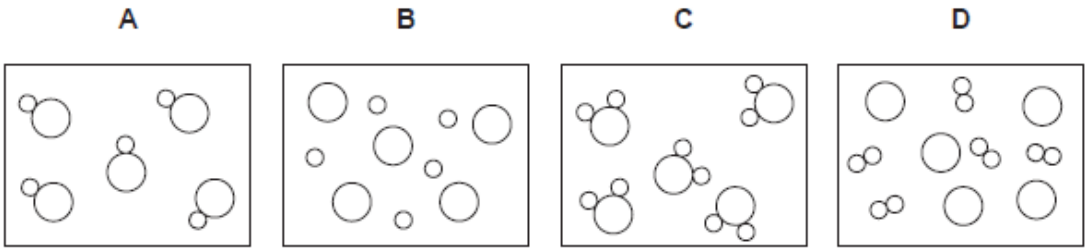
M and **N** react to form an ionic compound.

What is the formula of this compound?

A MN_2
B M_2N
C MN_6
D M_2N_6

8 The circles of different sizes represent atoms of different elements.

Which diagram can represent a gaseous mixture of oxygen and argon?



9 Nitrogen and hydrogen react together to form ammonia.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

What volume of nitrogen is needed to produce 48 dm^3 of ammonia?

A 7 dm^3
B 12 dm^3
C 17 dm^3
D 24 dm^3

10 The diagram shows a match.

By striking the match, a chemical reaction takes place.

Which of the following sets about the chemical reaction is correct?

A It is an endothermic reaction since energy is taken in as the match burns
B It is an endothermic reaction since energy is released as the match burns
C It is an exothermic reaction since energy is taken in as the match burns
D It is an exothermic reaction since energy is released as the match burns

11 When excess calcium carbonate chips are added to dilute hydrochloric acid, the reaction gradually becomes slower and finally comes to a stop.

Which statement best explains why this happens?

A The bubbles of carbon dioxide cover the surface of calcium carbonate.
B The concentration of acid gradually reduces to zero.
C The pieces of calcium carbonate gradually become smaller.
D An insoluble layer of oxide is formed on the calcium carbonate.

12 Copper metal reacts with silver bromide, according to the equation:

$$Cu + 2AgBr \rightarrow CuBr_2 + 2Ag$$

Which of the following correctly describes this change?

A Copper is the reducing agent in this reaction.
B Copper is reduced.
C Silver ions are oxidised in this reaction.
D Silver ions are neither oxidised nor reduced in this reaction.

13 Two indicators, bromophenol blue and Congo red, show the following colours in acidic and alkaline solutions.

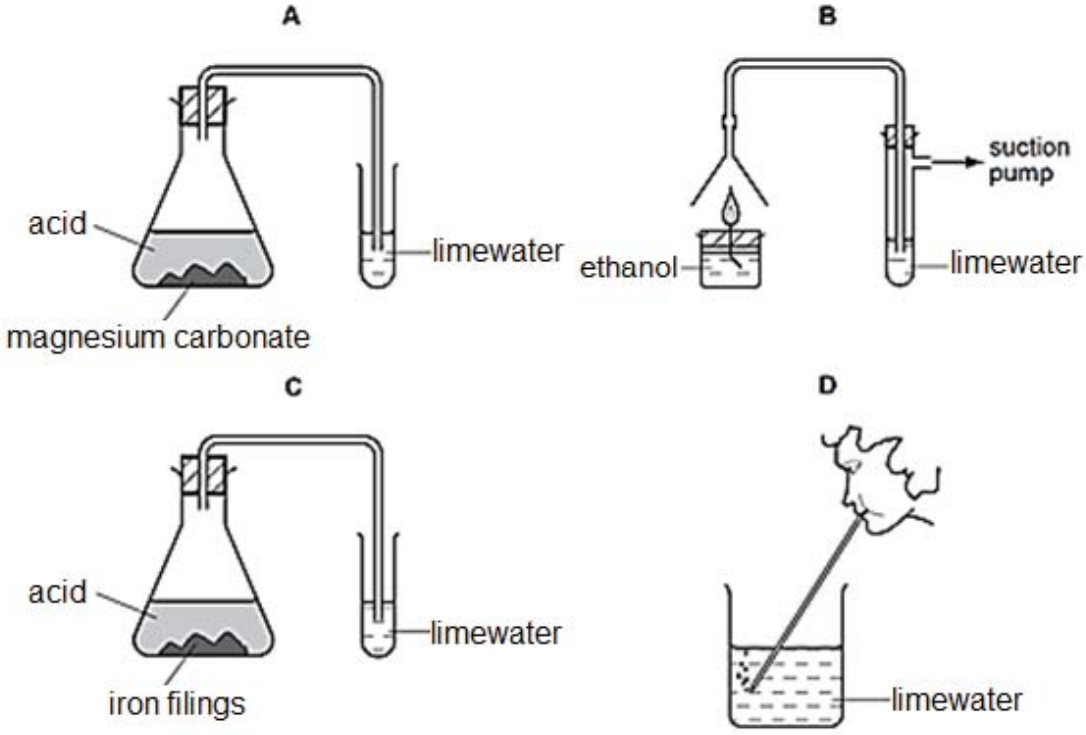
indicator	acid	alkali
bromophenol blue	yellow	blue
Congo red	violet	red

A few drops of each indicator are added to separate samples of a solution of pH 2.

What are the colours of the indicators in this solution?

	In a solution of pH 2	
	bromophenol blue is	**Congo red is**
A	blue	red
B	violet	yellow
C	yellow	violet
D	yellow	red

14 In which experiment is there **no** reaction with limewater?



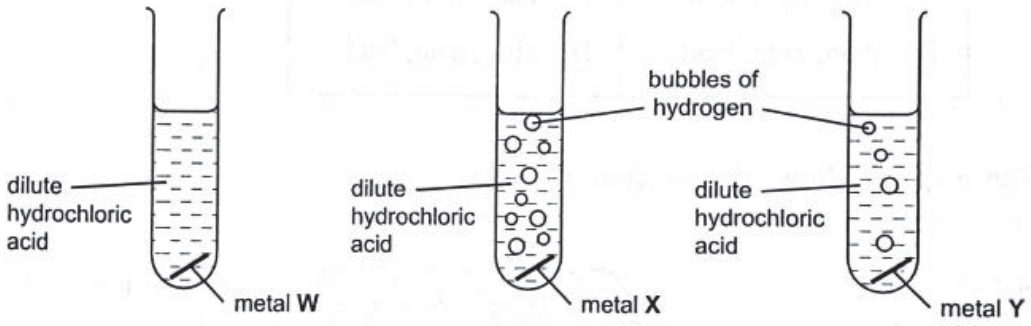
15 The table shows the densities of four Group I metals.

metal	density, g/cm^3
lithium	0.53
sodium	0.97
potassium	0.86
rubidium	1.53

Which of these metals sinks in benzene (density = 0.88 g/cm^3) but floats in nitrobenzene (density = 1.2 g/cm^3)?

A lithium
B sodium
C potassium
D rubidium

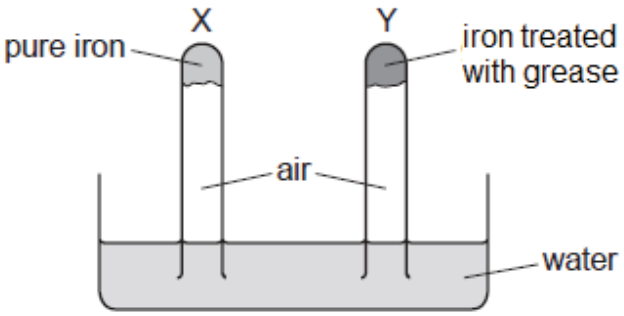
16 The diagrams show the reactions of three different metals with dilute hydrochloric acid.



Identify metals **W**, **X** and **Y**.

	W	**X**	**Y**
A	copper	magnesium	zinc
B	copper	zinc	magnesium
C	magnesium	zinc	copper
D	zinc	magnesium	lead

17 An experiment to investigate the effect of treating iron with grease is shown.



The experiment is left for seven days.

After seven days, what would happen to the water levels in tubes **X** and **Y**?

	tube X	**tube Y**
A	falls	no change
B	rises	no change
C	rises	falls
D	no change	rises

18 Compounds **S** and **T** occur naturally.

S is C_6H_{14} and **T** is $C_6H_{12}O_6$.

Which of the statements is correct?

A **T** is not a hydrocarbon but it is present in crude oil.
B **S** is not a hydrocarbon and it is not present in crude oil.
C **T** is a hydrocarbon and it is present in crude oil.
D **S** is a hydrocarbon and it is present in crude oil.

19 **X**, **Y** and **Z** are three hydrocarbons.

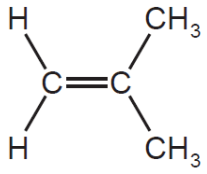
X $CH_2=CH_2$ Y $CH_3–CH=CH_2$ Z $CH_3–CH_2–CH=CH_2$

What do they have in common?

1. They are all alkenes.
2. They have the same general molecular formula.
3. They all have the same boiling point.

A Statements 1 and 2 are correct.
B Statements 1 and 3 are correct.
C Statements 2 and 3 are correct.
D Statements 1, 2 and 3 are correct.

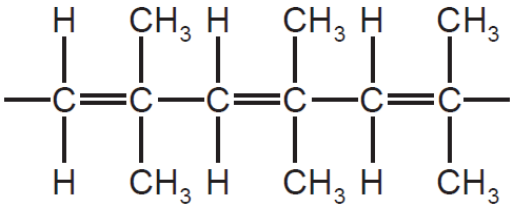
20 The structural formula of methyl propene is shown below.



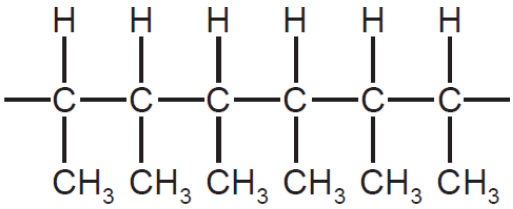
It can undergo polymerisation to form a polymer.

Which diagram shows the correct structure of the polymer?

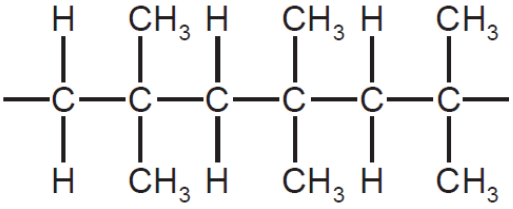
A



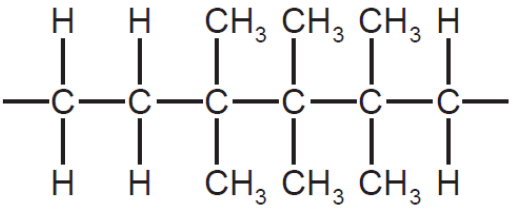
B



C



D



------- **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

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

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

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

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CANDIDATE NAME			
CLASS		INDEX NUMBER	

SCIENCE (CHEMISTRY, BIOLOGY) 5078/03

Paper 3 Chemistry **6 AUGUST 2019**

1 hour 15 minutes

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

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Write in a 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 15.
A copy of the Periodic Table is printed on page 16.

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.

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Section A

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

1 (a) Define the terms *molecule* and *element*.

molecule .....

.....

element .....

..... [2]

(b) Table 1.1 shows the composition of four particles **E**, **F**, **G** and **H**.
The letters are **not** the chemical symbols.

Table 1.1

Particle	number of protons	number of neutrons	number of electrons
E	12	12	12
F	12	10	10
G	16	16	18
H	10	12	10

(i) What is the nucleon number of **E**? .....

(ii) Which particles are ions? .....

(iii) Which particles have the same chemical symbol? .....

(iv) Which particle is inert? .....

(v) Which particle is non-metal? ..... [5]

[Total: 7]

2 This question is about carbon compounds.
Look at the displayed formulae of some compounds in Fig. 2.1.

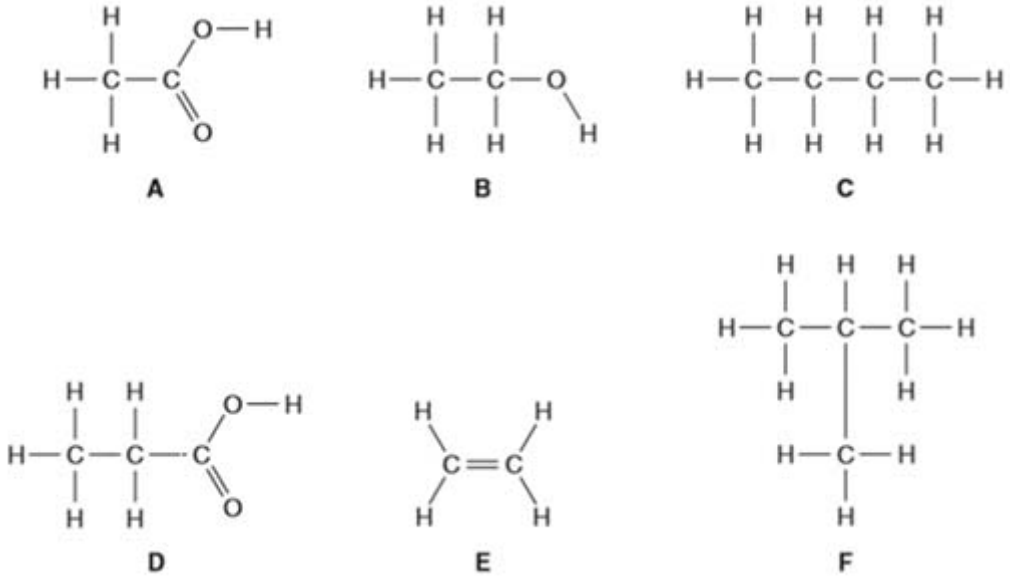

Fig. 2.1

(a) Which of the compounds is a hydrocarbon that forms a single product with bromine?

.....

[1]

(b) Which **two** compounds have the same molecular formula?

.....

[1]

(c) When cracked, a molecule of dodecane, $C_{10}H_{22}$, gives compound **E** and one other hydrocarbon, **X**.
Deduce the molecular formula of **X**.

.....

[1]

(d) Which of the compounds is formed when compound **B** is reacted with acidified potassium manganate (VII)?

.....

[1]

[Total: 4]

3 Fig. 3.1 below shows properties and reactions of several chemical substances.

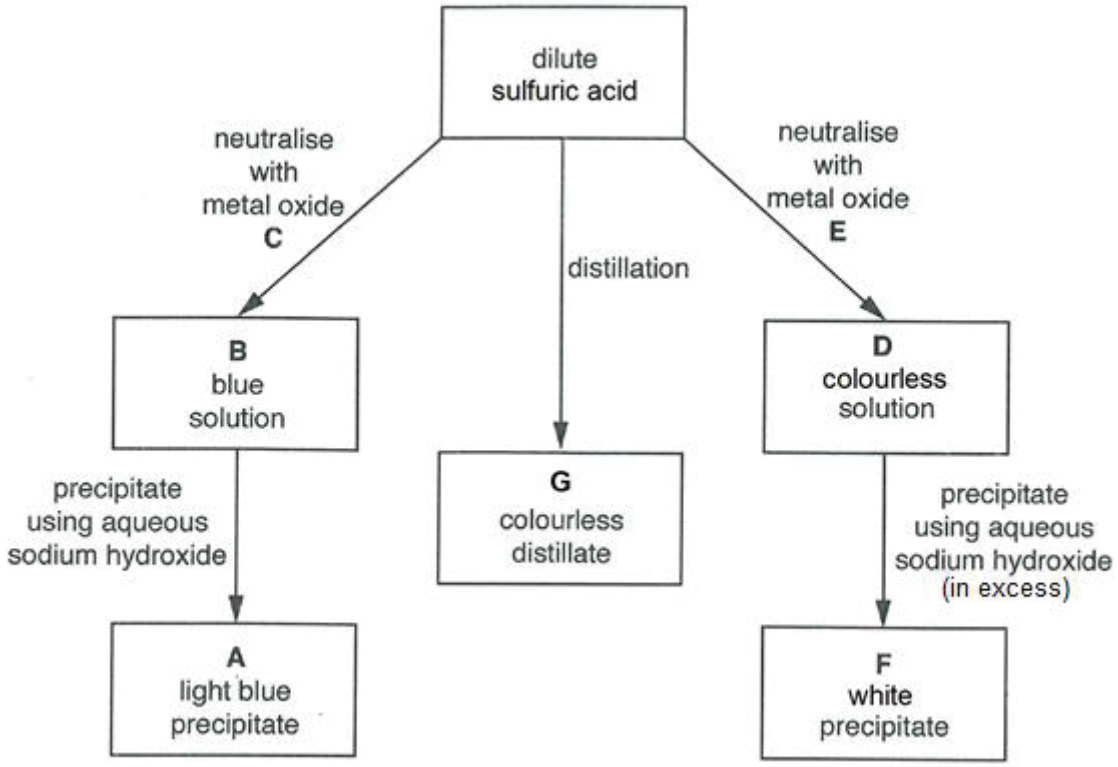

Fig. 3.1

(a) Identify substances **A**, **B**, **C**, **D**, **E**, **F** and **G**.

A .....

B .....

C .....

D .....

E .....

F .....

G ..... [7]

(b) Give the ionic equation for any **one** of the reactions included in Fig. 3.1.

..... [2]

[Total: 9]

4 Table 4.1 shows the atmospheric compositions for Earth and Venus.

Table 4.1

	Earth	**Venus**
Distance from Sun / millions of km	150	108
Surface temperature / °C	15	462
Composition of atmosphere	78% N_2 21% O_2 0.03% CO_2 (plus other gases)	97% CO_2 (plus other gases)

(a) On both Earth and Venus, there are evidence of sulfur dioxide in their atmospheres.
Suggest a possible source of sulfur dioxide in the atmosphere of Venus.

.....

.....

[1]

(b) There is more sulfur dioxide in the atmosphere of Venus than in that of Earth. Sulfur dioxide dissolves in water droplets present in the atmosphere of Venus.
Predict, with a reason, the pH of water found on Venus.

.....

.....

.....

[2]

(c) Rainwater never reaches the surface of Venus.
Use the information in the table to suggest the reason.

.....

.....

.....

.....

[2]

(d)(i) On Earth, besides sulfur dioxide, nitrogen oxides are also found in its atmosphere.
Explain in brief details, how nitrogen oxides come about on Earth.

.....

.....

.....

.....

[2]

(ii) What impact would the presence of sulfur dioxide and nitrogen oxides have on humans and buildings?

_____

_____

_____

_____

_____

_____ [3]

[Total: 10]

5 12.16 g of anhydrous iron (II) sulfate was heated. It decomposed, according to the equation shown.

$$2FeSO_4\ (s) \rightarrow Fe_2O_3\ (s) + SO_2\ (g) + SO_3\ (g)$$

(a) Calculate the mass of iron (III) oxide formed.

[3]

(b) What is the total volume of gases produced (at r.t.p.) at the end of this decomposition reaction?

[2]

(c) Sulfur dioxide decolourises acidified potassium manganate (VII) solution. What can be said of its nature? Explain your answer.

_____

_____

_____

_____ [2]

[Total: 7]

6 (a) Complete the Table 6.1.

Table 6.1

solution	approximate pH
(i) 0.2 mol/dm^3 hydrochloric acid	
(ii) 0.1 mol/dm^3 sodium hydroxide	
(iii) a mixture of 20 cm^3 of **(i)** and 40 cm^3 of **(ii)**	

[3]

(b) Table 6.2 lists the solubility of some substances in cold water.

Table 6.2

substance	solubility in cold water
ammonium chloride	soluble
calcium chloride	soluble
calcium sulfate	insoluble
lead (II) carbonate	insoluble
lead (II) chloride	insoluble
lead (II) nitrate	soluble
sodium carbonate	soluble
sodium sulfate	soluble

(i) Which two substances from Table 6.2, when dissolved in water, can be mixed to form each of the following precipitates?

calcium sulfate: 1. .....

2. .....

lead (II) carbonate: 1. .....

2. .....

[2]

(ii) How could you prepare a pure sample of powdered lead (II) chloride from using two substances from Table 6.2?

.....

.....

.....

..... [3]

[Total: 8]

Section B

*Answer any **two** questions in this section.*
Write your answers in the spaces provided.

7 Iron is extracted from its ore using coke in a blast furnace in Fig. 7.1.

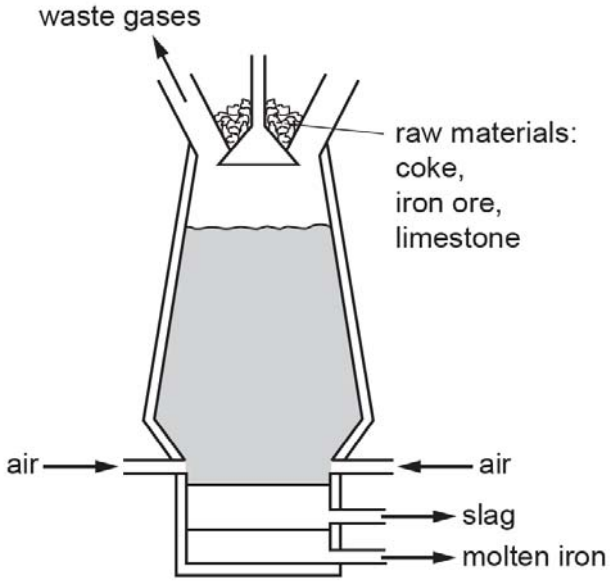

Fig. 7.1

(a) Name the ore of iron that is mainly iron (III) oxide.

.....

[1]

(b) Describe the reactions occurring in the blast furnace.
In your answer, include

- two reasons for using coke in the blast furnace;
- a chemical equation for the reduction of iron (III) oxide;
- an explanation for using limestone in the blast furnace.

.....

.....

.....

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.....

.....

[5]

(c) Crude iron, also called pig iron, is first obtained from the blast furnace. This form of iron has high carbon content, making it very brittle. From your knowledge of iron and its alloys, explain its brittleness.

[2]

(d) Iron reacts with dilute sulfuric acid, producing iron (II) sulfate solution as one of the products. When aqueous hydrogen peroxide is added to this solution of iron (II) sulfate, a yellow solution was formed.
Explain this change.

[2]

[Total: 10]

8 Zinc reacts with hydrochloric acid to produce zinc chloride and hydrogen gas.

(a) Write the balanced chemical equation for this equation.

---------- [1]

An investigation was carried to find out how fast different metals reacted with an acid. Zinc powder and iron powder were reacted separately with excess dilute hydrochloric acid, using the set up shown in Fig. 8.1 below.

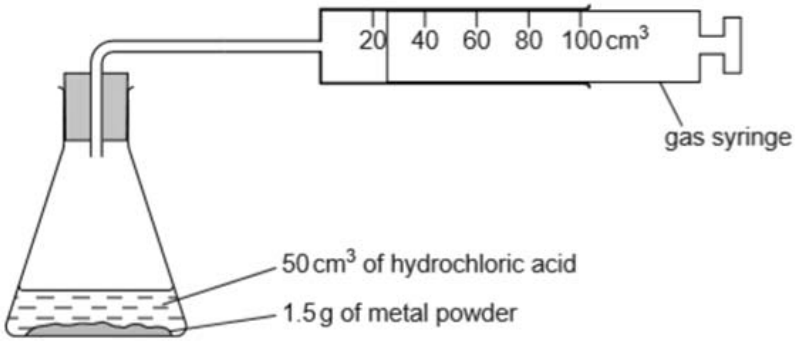

Fig. 8.1

The volume of gas produced was measured and recorded every 10 seconds.

Three different experiments were conducted, according to the following:

- 50 cm^3 hydrochloric acid and 0.15 g of zinc powder
- 50 cm^3 hydrochloric acid and 0.15 g of iron powder
- 50 cm^3 hydrochloric acid and 0.075 g of zinc powder mixed with 0.075 g of iron powder

The first two sets of results were plotted in the graph in Fig. 8.2 below.

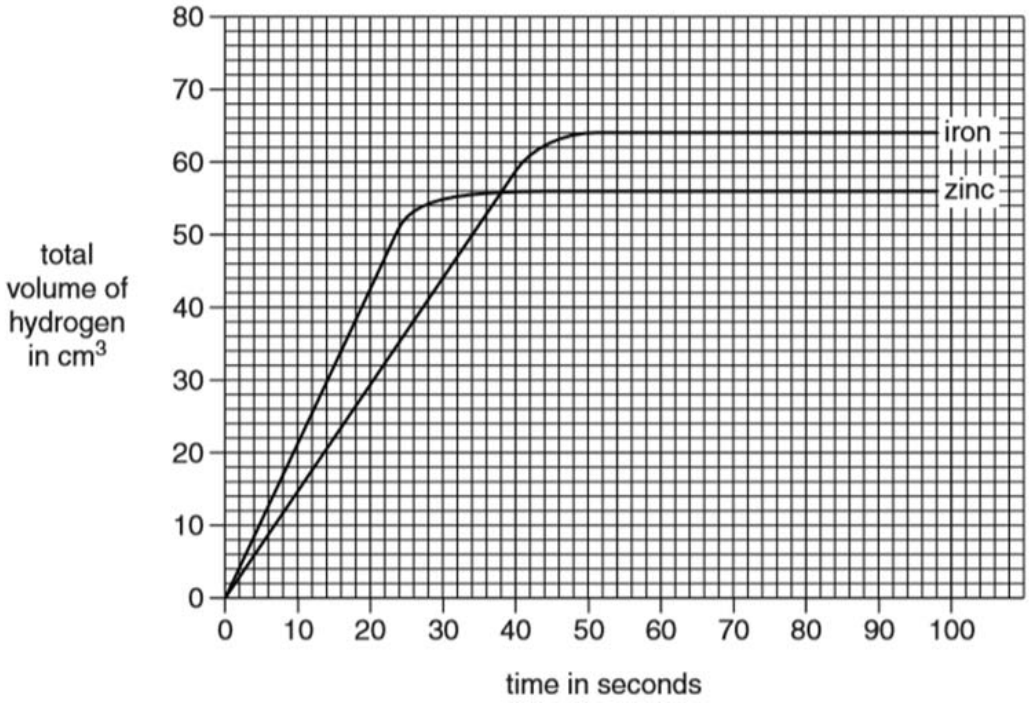

Fig. 8.2

(b)(i) What was the rate of reaction of iron during the first 30 seconds of reaction?

rate of reaction = …….. cm^3/s [1]

(ii) Predict the total volume of hydrogen formed for the third experiment.

Total volume of hydrogen = …….. cm^3 [1]

(c) Using the mass of zinc, calculate the minimum concentration of hydrochloric acid used in the investigation.

[3]

(d) (i) How would the experiment differ, if the concentration of acid be doubled?

[2]

(ii) Explain your answer for **(d)(i)**.

[2]

[Total: 10]

9 **(a)(i)** In the space below, draw the "dot and cross" diagram for potassium chloride, showing only the outershell electrons.

[2]

(ii) How does the structure of a molecule of chlorine differ from this?

.....

..... [1]

(b) An experiment was carried out to determine the trend in reactivity of halogens. Table 9.1 shows the results obtained when solutions of halogens were added to different halide solutions.

Table 9.1

		Halide solution		
		potassium chloride	potassium bromide	potassium iodide
Halogen added	bromine	no reaction	no reaction	turns brown
	chlorine	no reaction	turns yellow orange	turns brown
	iodine	no reaction	no reaction	no reaction

(i) Use the results in the table to give the order of reactivity of the halogens. Explain your answer.

.....

.....

.....

.....

.....

..... [3]

(ii) Write a balanced chemical equation for **any** of the reactions.

..... [1]

(c) When silver nitrate solution is added to a solution of potassium bromide, a cream precipitate of silver bromide is formed. The following reaction takes place.

$AgNO_3$ (aq) + KBr (aq) → KNO_3 (aq) + AgBr (s)

Calculate the mass of silver nitrate needed to form 47 g of silver bromide.

[3]

[Total: 10]

------- **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

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key: proton (atomic) number; atomic symbol; name; relative atomic mass									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 –		

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.).