Name of Candidate: _____( ) Class: _____ Calculator Model: [ ]

BUKIT PANJANG GOVERNMENT HIGH SCHOOL

Preliminary Examination 2019

SECONDARY 4 Express

Chemistry

Paper 2

6092/02

Date: 3 September, 2019
Duration: 1 hour 45 min
Time: 1115 – 1300 h

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

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

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

Section B
Answer all **three** questions, the last question is in the form either/or.
Answer **all** questions in the spaces provided.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic table is printed on page 23.
The use of an approved scientific calculator is expected, where appropriate.

Setter: AAS

[Turn over]

This document consists of **23** *printed pages.*

Sec 4 Pure Chem Mock Paper Set 5

Section A
Answer **all** questions in this section in the spaces provided.
The total mark for this section is 50.

A1 There are many types of reactions and chemical processes. The equations **A, B, C, D** and **E** illustrate some reactions and/or processes.

A $CuSO_4 + 5\ H_2O \rightarrow CuSO_4.5H_2O$

B $Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$

C $H_2 \rightarrow 2\ H$

D $2Na + H_2 \rightarrow 2\ NaH$

E $CH_4 + Cl_2 \xrightarrow{\text{UV light}} CH_3Cl + HCl$

Use the letters **A, B, C, D** and **E** to answer the following questions.

(a) Which two equations are redox reactions?

.....[2]

(b) Which equation shows a chemical reaction that involves bond-forming only?

.....[1]

(c) Which equation shows a substitution reaction?

.....[1]

(d) Which equation shows a chemical reaction that involves bond-breaking only?

.....[1]

(e) (i) Describe a chemical test to confirm the identity of the product formed in **A**.

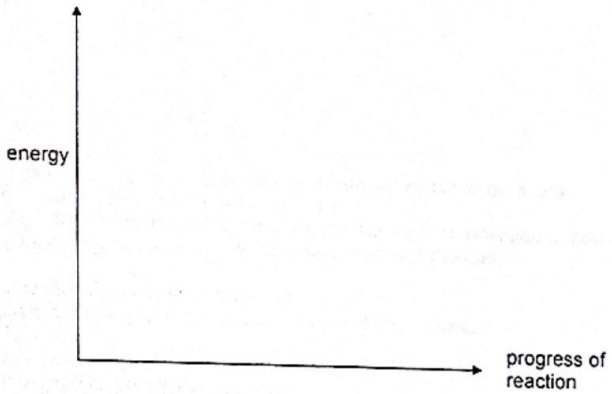
.....

..... [2]

(ii) Reaction A is an exothermic reaction. Complete the energy profile diagram for reaction A.

Your diagram should include

- the formulae of the reactants and the products of the reaction,
- a label for the enthalpy change of reaction,
- activation energy



[3]

(f) Draw the dot-and-cross diagram for the product in equation D, showing outermost electrons only.

[2]

[Total: 12]

A2 The following table is a list of few elements with some of their properties. The elements are labelled A, B, C, D, E and F.

element	density/ kgm^{-3}	melting point/ °C	boiling point/ °C	electrical conductivity	action with water / steam
A	2700	660	2470	Good	None
B	1.26	-210	-196	Poor	None
C	1.44	113	445	Very poor	None
D	970	98	890	Good	Violent reaction, forming a colourless solution
E	13600	-39	357	Good	None
F	7900	1535	3000	Good	Reacts with steam, forming a reddish brown solid

(a) Which of these elements could be a non-metal? Use the information in the table to give two reasons why.

element .....

reason 1 .....

.....

reason 2 .....

.....[3]

(b) (i) Which of these elements could be a transition metal? Use the information in the table to give two reasons why.

element .....

reason 1 .....

.....

reason 2 .....

.....[3]

(ii) Use ideas about bonding and structure to explain why the transition metal has a high electrical conductivity while non-metals have poor electrical conductivity.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Element **D** is an alkali metal.

Using your understanding of bonding, structure and reactivity of alkali metals, which of these statements would you predict to be true and which would you predict to be false?

Put a tick (✓) in one box in each row.

	true	false
D has a low melting point.		
D has poor electrical conductivity when in solid state.		
D forms a soluble basic oxide.		
D reacts with water to give metal oxide.		

[2]

[Total: 12]

A3 All living things undergo respiration, a type of biochemical process in which the cells of an organism obtain energy, to survive.

(a) Write the chemical equation for respiration.

..... [2]

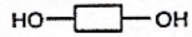
(b) Describe how the carbon cycle regulates the atmosphere.

.....

.....

.....[2]

(c) Plants undergo photosynthesis to make sugar. Simple sugars can undergo polymerisation to form starch. The structure of simple sugar is shown below:



a simple sugar

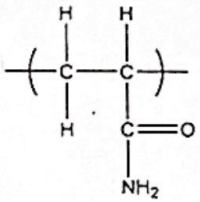
(i) What type of monomer is the simple sugar?

.....[1]

(ii) Simple sugars can undergo polymerisation, giving off water as the other by-product. Draw the structure of the polymer it forms, showing 2 repeat units.

[1]

(d) Polyacrylamide has many uses in molecular biology. One repeat unit of polyacrylamide is as follows:



Draw the monomer.

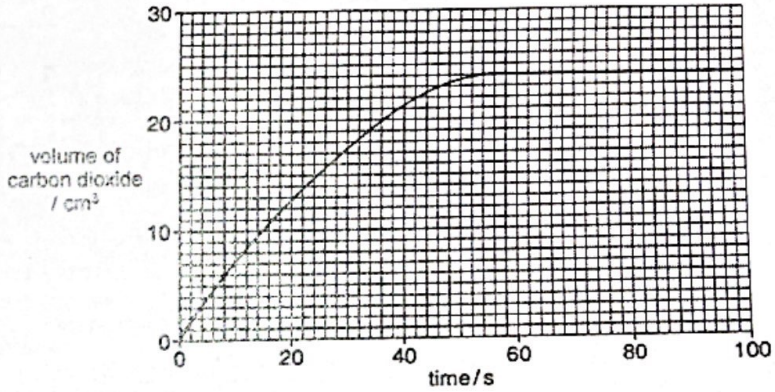
[1]

[Total: 7]

A4 Barium carbonate reacts with dilute hydrochloric acid in an experiment. The equation for the reaction is:

$$BaCO_3 + 2HCl \rightarrow BaCl_2 + CO_2 + H_2O$$

During the experiment, barium carbonate was added to an excess of dilute hydrochloric acid. The graph shows the volume of gas collected over time.



(a) Calculate the mass of barium carbonate added.

[2]

(b) Draw and label the graph if hydrochloric acid was replaced with dilute sulfuric acid of the same concentration. [1]

(c) Explain your graph in (b).

.....

.....[1]

(d) (i) Predict the volume of carbon dioxide gas formed if the experiment is repeated using dilute ethanoic acid of the same concentration.

.....[1]

(ii) The rate of reaction of dilute ethanoic acid with carbonates is slower than that of dilute hydrochloric acid and dilute sulfuric acid. Explain why.

.....

.....

.....

.....[2]

(e) After the reaction in (d)(i) is complete, how is a dry sample of the salt obtained?

.....

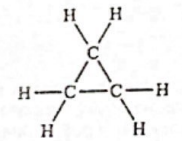
.....

.....

.....[2]

[Total: 9]

A5 The enthalpy change of combustion, ΔH, is the energy released when one mole of the compound is burned completely in oxygen. The table below illustrates the enthalpy change of combustion for some hydrocarbons.

hydrocarbon	structural formula	enthalpy change of combustion / kJ mol^{-1}
propane	$CH_3 - CH_2 - CH_3$	−2220
propene	$CH_2 = CH - CH_3$	−2058
cyclopropane		−2091
butane	$CH_3 - CH_2 - CH_2 - CH_3$	−2877

(a) Which hydrocarbon gives out the greatest amount of heat during combustion?

.....[1]

(b) Propene and cyclopropane are isomers of each other. Suggest why the enthalpy change of combustion for the two isomers are different.

.....

.....[1]

(c) Calculate the enthalpy change of combustion when 1 g of propane burns.

[2]

(d) Describe what happens to enthalpy change of combustion as the hydrocarbon changes from propane to butane. Suggest a reason why.

.....

.....[2]

[Total: 6]

A6 The overall energy change between nitrogen and hydrogen to form ammonia is −93 kJ/mol in the Haber process.

(a) Write the chemical equation for the reaction.

.....[1]

(b) State the conditions required for the Haber process.

.....[1]

(c) Calculate the bond energy for 1 mole of H-H bonds.

Bond	Bond Energy / kJ mol^{-1}
N – N	167
N = N	418
N ≡ N	945
N – H	391

[2]

[Total: 4]

Name of Candidate: _____( ) Class: _____

Section B

Answer all **three** questions in this section.

The last question is in the form of an either/or and only one of the alternatives should be attempted.

B7 Instrumental techniques in analysis

Many chemicals are indistinguishable by their appearance. Though some chemicals have different colours, odours, or textures compared with others, this is seldom sufficient to identify the structure of those compounds.

Spectroscopy is the measurement and analysis of the effect of a compound on light that is shone on it. Spectroscopy involves passing light through a sample and looking at what frequencies of light are transmitted. **Fig. 7.1** shows a simple view of how spectroscopy works.

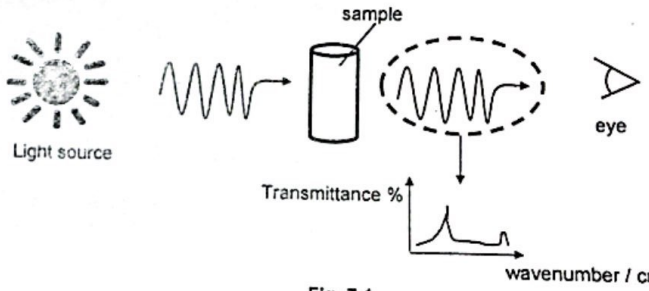


Fig. 7.1

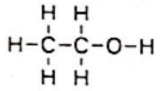
When light is passed through the sample, waves of certain wavenumbers are absorbed. By looking at what portions of the spectrum are absorbed or transmitted and comparing these results with those of known chemicals, chemists can determine the composition and structure of unknown samples. Transmittance percentage describes the percentage of light that passes through a sample unchanged. In other words, it is light that is not absorbed, scattered, or reflected.

Infrared spectroscopy

Infrared spectroscopy is an instrumental method of analysis, which is used to identify bonds and functional groups in organic compounds. When infra red light is shone through an organic compound, some of the light is absorbed. When this happens, less of the light is transmitted and this produces a pattern of troughs called an infra red spectrum. Different bonds and functional groups absorb different amounts of infra red light and produce different patterns. Identification of a particular bond or functional group is made by matching it to its absorption range in the infra red spectrum.

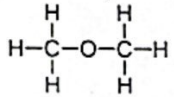
A scientist would like to investigate the identity of substances A and B with the molecular formula C_2H_6O, that are suspected to either be an alcohol or an ether respectively or vice-versa with the following structural formula:

Ethanol



OR

Dimethyl ether



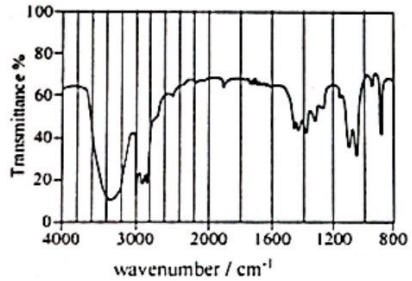
He carries out infra red spectroscopy.

The table shows the approximate wavenumber absorption range of some bonds:

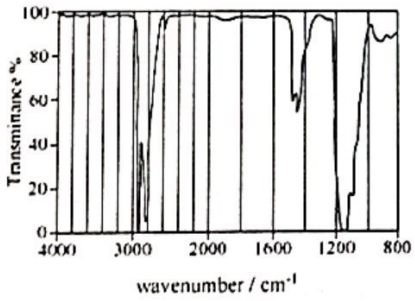
Bond	wavenumber absorption range / cm^{-1}
C – H	2850 – 3000
C – C	800 – 1000
C – O	1000 – 1300
O – H	3230 – 3550

The infra red spectra of the substances are shown below:

Spectrum of substance A



Spectrum of substance B



(a) Give two pieces of evidence each to explain why substance A is ethanol and substance B is dimethyl ether.

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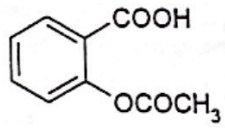
.....[4]

(b) Draw the structural formula formed when A is heated with acetylsalicylic acid in the presence of concentrated sulfuric acid. The structural formula of the acid is as follows:



[1]

(c) A is from a particular homologous series. State the general trend of the solubility of this homologous series in water and their boiling points as the number of carbon atoms increase.

.....

.....[2]

(d) A can be made from an alkene in a chemical reaction. Give the balanced chemical equation, including the state symbols and the conditions.

.....

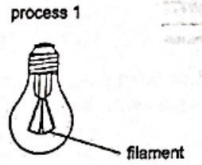
.....[2]

(e) Name another process from which A is made.

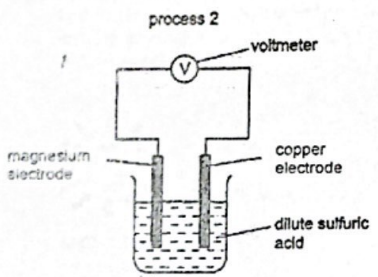
.....[1]

[Total: 10]

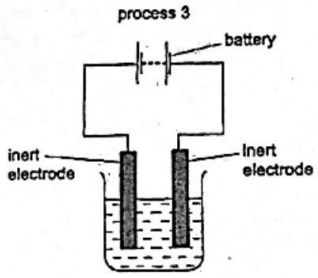
B8 Processes 1, 2, and 3 each involve the movement of charged particles.



conduction of electricity through the metal filament of a light bulb



the production of electricity by a simple cell



electrolysis of aqueous sodium chloride

For process 2, the table below shows the results when rods of four metals **W**, **X**, **Y** and **Z** are used in separate experiments.

	metal rod 1	metal rod 2	voltmeter reading / V
Trial run 1	magnesium	copper	+2.72
Trial run 2	copper	magnesium	–2.72
Experiment 1	W	Y	–2.00
Experiment 2	Z	X	+0.32
Experiment 3	W	Z	–1.10

Use the information above to answer the following questions.

(a) In process 2, why was effervescence observed at both electrodes in the trial runs?

.....

.....[2]

(b) Place the metals **W**, **X**, **Y** and **Z** used in process 2 in order of increasing reactivity. Explain how you arrived at your answer.

.....

.....

.....

.....

.....[3]

(c) In process 3, the electrolysis of aqueous sodium chloride yields products at the cathode and anode.

(i) What happens to the concentration of aqueous sodium chloride during the electrolysis? Explain your reasoning.

.....

.....

.....

.....[2]

(ii) The same apparatus in process 3 can be used to electrolyse concentrated aqueous copper (II) chloride. Predict the products formed.

cathode .....

anode .....[1]

Explain your reasoning.

.....

.....

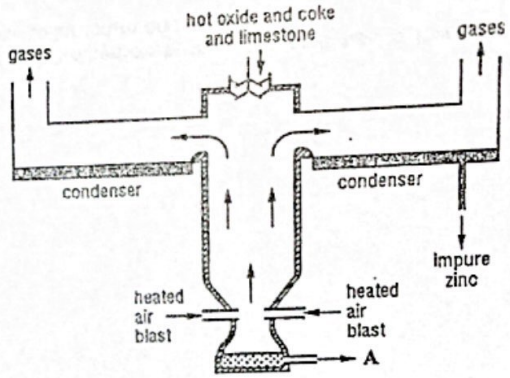
.....

.....[2]

[Total: 10]

EITHER

B9 Zinc is manufactured from the ore zinc blende, which contains zinc sulfide (ZnS) and impurities including sand. The ore is heated in air to produce zinc oxide and sulfur dioxide. A simplified diagram of which is shown below.



The zinc is distilled off and is collected.

Use the information above to answer the following questions.

(a) Explain why sulfur dioxide should not be allowed to escape into the atmosphere.

.....

.....

.....[2]

(b) Sulfur dioxide can be removed by several methods. One method is through the use of flue gas desulfurisation.
Describe and explain how flue gas desulfurisation is carried out. Include chemical equations in the explanation.

.....

.....

.....

.....[2]

(c) The zinc oxide can be heated at very high temperature with coke in a blast furnace to form zinc. Construct the chemical equation for the formation of zinc from zinc oxide in the furnace.

.....[1]

(d) State the oxidising agent for the reaction in (c). Give a reason for your answer.

.....

.....[2]

(e) The blast furnace used to manufacture iron is different from the one shown above. Unlike iron, impure zinc is collected in a condenser rather than at the base of the blast furnace. Suggest a reason why.

.....

.....[1]

(f) Name substance A.

.....[1]

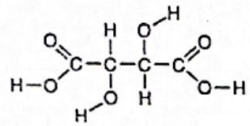
(g) What type of oxide is zinc oxide?

.....[1]

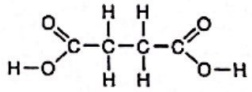
[Total: 10]

OR

B9 2,3-dihydroxybutanedioic acid and butanedioic acid have similar structures.



2,3-dihydroxybutanedioic acid



butanedioic acid

(a) Describe a chemical test that can be carried out to differentiate between the two acids.

.....

.....

.....[3]

(b) Draw the full structural formula of the product(s) formed when butanedioic acid is heated with methanol in the presence of concentrated sulfuric acid under reflux conditions.

[2]

(c) Predict if 2,3-dihydroxybutanedioic acid has a low or high melting point, with reference to structure and bonding.

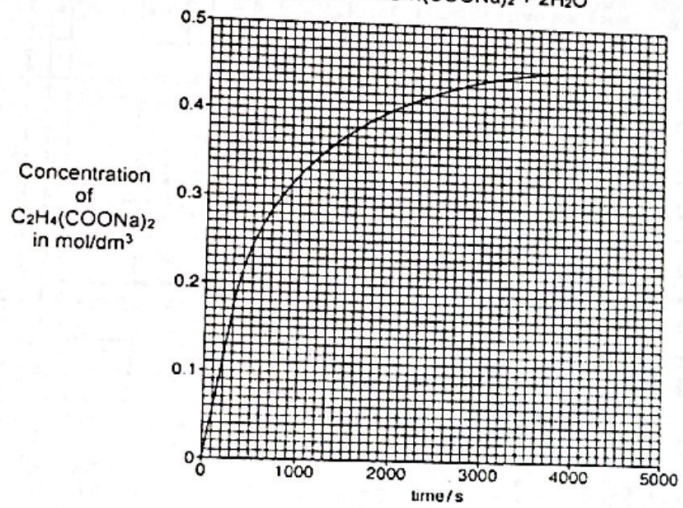
.....

.....

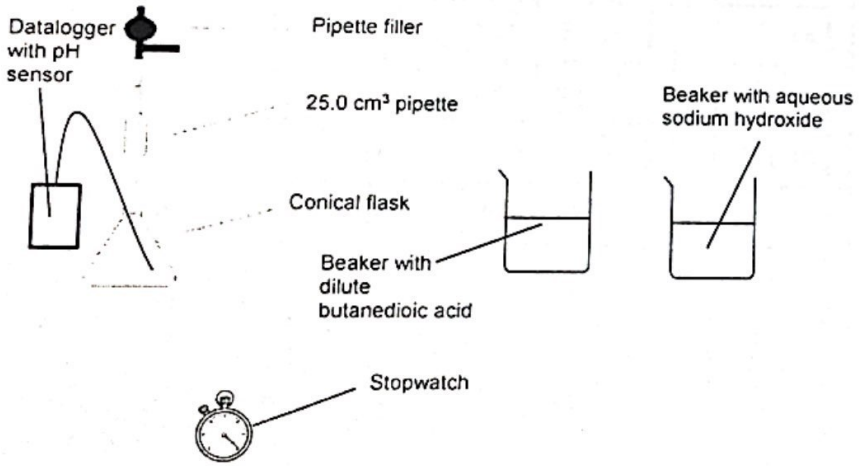
.....[2]

(d) In an experiment, butanedioic acid was neutralised by aqueous sodium hydroxide:

$$C_2H_4(COOH)_2 + 2NaOH \rightarrow C_2H_4(COONa)_2 + 2H_2O$$



The above results were obtained with the help of the following apparatus and chemicals only, where equal volumes of the acid and alkali were used:



Calculate the concentration of aqueous sodium hydroxide used.

[3]

[Total: 10]

Name of Candidate: _____( ) Class: _____ Calculator Model:

BUKIT PANJANG GOVERNMENT HIGH SCHOOL

Preliminary Examination 2019

SECONDARY 4 Express

Chemistry **6092/01**

Paper 1

Date: 16 September, 2019
Duration: 1 hour
Time: 0745 h – 0845 h

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 and index number on the Answer Sheet in the spaces provided unless this has been done for you.

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 Periodic table is printed on page 17.
The use of an approved scientific calculator is expected, where appropriate.

Setter: Ms Chew Ee Wei **[Turn over]**

This document consists of 17 printed pages.

1 Which molecule contains six bonding electrons?

A C_2H_4 **B** CH_4
C NH_3 **D** CO_2

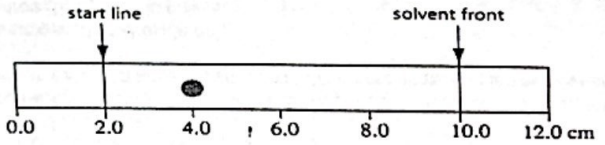
2 An analysis of a sample of sulfur shows that it contains three isotopes, $^{32}_{16}S$, $^{33}_{16}S$ and $^{34}_{16}S$. The abundance of each isotope is shown in the table.

isotope	abundance (%)
$^{32}_{16}S$	95.00
$^{33}_{16}S$	0.75
$^{34}_{16}S$	4.25

What is the relative atomic mass of this sample of sulfur?

A 32.0 **B** 32.1
C 32.2 **D** 32.3

3 A food dye U is analysed using paper chromatography. The resulting chromatogram is shown in the diagram below.



What is the R_f value of the dye represented by the spot at 4.0 cm?

A 0.17 **B** 0.25
C 0.40 **D** 0.50

4 The symbol $^{9}_{4}Be$ shows the nucleon number and proton number of the beryllium atom. What is the correct symbol for the beryllium ion in beryllium chloride?

A $^{9}_{4}Be^{+}$ **B** $^{9}_{4}Be^{2+}$
C $^{4}_{9}Be^{-}$ **D** $^{4}_{9}Be^{2-}$

5 Which element would be expected to form an ion with the largest ionic radius?

A fluorine
B magnesium
C oxygen
D chlorine

6 On heating, 0.02 mol of an element M reacts with 0.025 mol of oxygen gas. What is the empirical formula of the oxide of M?

A M_2O
B MO_2
C M_2O_5
D MO_5

7 What volume of 0.10 mol/dm^3 aqueous silver nitrate reacts with 20.0 cm^3 of 0.20 mol/dm^3 barium chloride?

A 10.0 cm^3
B 20.0 cm^3
C 40.0 cm^3
D 80.0 cm^3

8 Consider the following redox reaction.

$$KClO_4 + H_2O_2 \rightarrow KClO_3 + O_2 + H_2O$$

Which of the following is true for the reaction?

A $KClO_3$ is reduced during the reaction.
B $KClO_4$ is oxidised during the reaction.
C Hydrogen ions are oxidised when they form H_2O.
D The oxidation state of chlorine decreases from +7 in $KClO_4$ to +5 in $KClO_3$.

9 W, X and Y are three metals which form cations W^{2+}, X^{2+} and Y^+ respectively.

reaction I	$W^{2+} + Y \rightarrow$ no reaction
reaction II	$2Y^+ + X \rightarrow X^{2+} + 2Y$
reaction III	$X^{2+} + W \rightarrow X + W^{2+}$

What is the order of the metals in decreasing reactivity?

A Y, X, W
B X, W, Y
C W, X, Y
D W, Y, X

10 When zinc metal is added to the copper (II) sulfate solution, the blue solution gradually fades to a pale blue and a reddish brown metal is formed.

$$Zn + CuSO_4 \rightarrow Cu + ZnSO_4$$

Which of the following statement is true for the above reaction?

A Copper (II) sulfate is the reducing agent.
B Copper metal reduces to copper (II) sulfate.
C Zinc sulfate is the oxidising agent.
D Zinc metal displaces copper from aqueous copper (II) sulfate.

11 An aqueous solution containing a mixture of copper (II), iron (II) and lead (II) ions was treated with an excess of aqueous ammonia. What precipitate was left by this reaction?

A copper (II) hydroxide only
B iron (II) hydroxide only
C iron (II) hydroxide and lead (II) hydroxide
D iron (II) hydroxide and copper (II) hydroxide

12 Which reagent, when mixed and heated with ammonium sulfate, liberates ammonia?

A limewater
B dilute hydrochloric acid
C aqueous copper (II) chloride
D acidified potassium dichromate (VI) solution

13 Which pair of reactants can be best used to prepare lead (II) chloride?

A aqueous lead (II) nitrate with aqueous sodium chloride
B lead (II) carbonate and aqueous sodium chloride
C lead (II) oxide with dilute hydrochloric acid
D lead metal and dilute hydrochloric acid

14 Which substance has a high melting point and does **not** conduct electricity in any state?

A NH_3
B Fe
C NaCl
D SiO_2

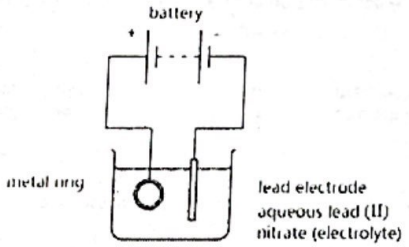
15 The following reactions shown below may occur in the air during a thunder-storm.

reaction I	$N_2 + O_2 \rightarrow 2NO$
reaction II	$2NO + O_2 \rightarrow 2NO_2$
reaction III	$NO + O_3 \rightarrow NO_2 + O_2$

Which of the following correctly shows what happens to the reactant molecules in each of these reactions?

	N_2	NO	O_3
A	oxidised	oxidised	oxidised
B	oxidised	oxidised	reduced
C	reduced	reduced	oxidised
D	reduced	reduced	reduced

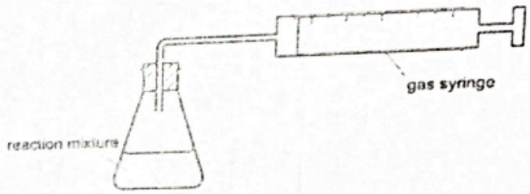
16 The diagram shows apparatus used in an attempt to electroplate a metal ring with lead.



The experiment did not work. What change should be made to the experiment to make it work?

A Add solid lead (II) sulfate to the electrolyte.
B Increase the temperature of the electrolyte.
C Replace the lead electrode with a carbon electrode.
D Reverse the terminals of the battery.

17 The apparatus shown below can be used to measure the rate of some chemical reactions.



Which two of the following reactions would this apparatus be suitable for?

reaction I	$AgNO_3 + HCl \rightarrow AgCl + HNO_3$
reaction II	$2H_2O_2 \rightarrow 2H_2O + O_2$
reaction III	$MgO + 2HCl \rightarrow MgCl_2 + H_2O$
reaction IV	$ZnCO_3 + 2HCl \rightarrow ZnCl_2 + CO_2 + H_2O$

A I and II
B I and III
C II and IV
D III and IV

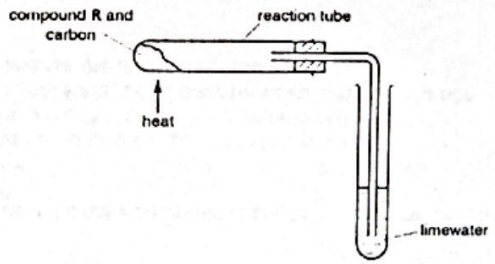
18 The table below shows the results of adding three metals, X, Y and Z to dilute hydrochloric acid and to water.

metal	dilute hydrochloric acid	water
X	hydrogen produced	hydrogen produced
Y	no reaction	no reaction
Z	hydrogen produced	no reaction

What is the order of reactivity of the metals?

	most reactive → least reactive		
A	X	Z	Y
B	X	Y	Z
C	Z	Y	X
D	Z	X	Y

19 Compound R is heated with carbon using the apparatus shown below.

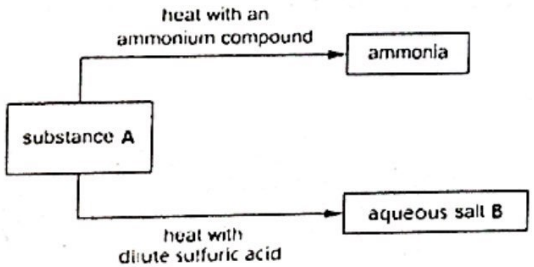


A reddish brown solid is formed in the reaction tube and the limewater turns cloudy.

What is compound R?

A	sodium oxide	B	calcium (II) oxide
C	copper (II) oxide	D	magnesium oxide

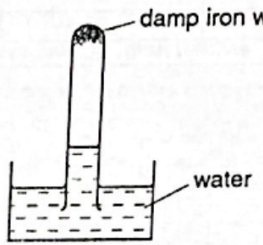
20 The following diagram show some tests done on substance A.



What is the identity of substance A and salt B?

	substance A	salt B
A	aqueous ammonium carbonate	ammonium sulfate
B	solid zinc oxide	zinc sulfate
C	aqueous calcium hydroxide	calcium sulfate
D	aqueous sodium hydroxide	sodium sulfate

21 A test-tube containing damp iron wool is inverted in water. After three days, the water level inside the test-tube has risen.



Which statement correctly explains the rise in the water level inside the test-tube?

A Carbon dioxide has been formed.
B Hydrated iron (III) oxides has been formed.
C Iron wool has been reduced.
D Temperature of the water has increased.

22 5.95 g of cobalt (II) carbonate was added to 50 cm^3 of 2.0 mol/dm^3 of hydrochloric acid during the preparation of the hydrated salt, cobalt (II) chloride, $CoC/_2.6H_2O$. What is the maximum yield of the hydrated cobalt (II) chloride salt formed?

A	6.50 g	B	7.40 g
C	11.90 g	D	12.30 g

23 Which statement is true of chlorine, bromine and iodine?

A They are reducing agents.
B They form diatomic molecules.
C They form covalent compounds with Group I elements.
D They displace fluorine from aqueous potassium fluoride.

24 Zirconium, Zr, is a transition metal used in flash bulbs.

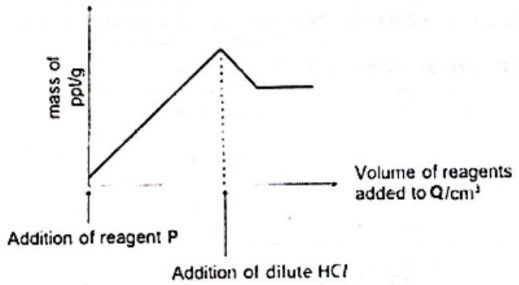
When the filament inside the bulb gets hot, zirconium burns with a white light to form a mixture of zirconium (II) oxide and zirconium (IV) oxide. These oxides react with both acids and bases. Zirconium has no reaction with water or steam.

Which statement shows that zirconium is a transition metal?

A Zirconium burns with a white light.
B Oxides of zirconium are amphoteric.
C Zirconium has oxidation numbers of +2 and +4 in its oxides.
D Zirconium is unreactive.

25 Mary carried out an experiment to find out the identity of an unknown salt solution Q that contains either one or two anions. She added reagent P slowly to the salt solution Q, followed by the addition of dilute hydrochloric acid.

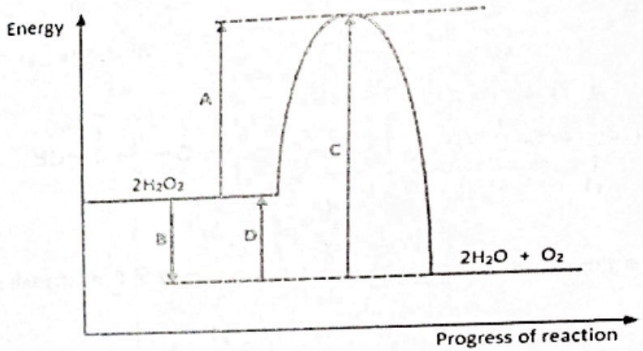
The graph below shows how the mass of the precipitate formed changes when reagent P and dilute hydrochloric acid were added respectively.



What is the identity of reagent P and the anion(s) in Q?

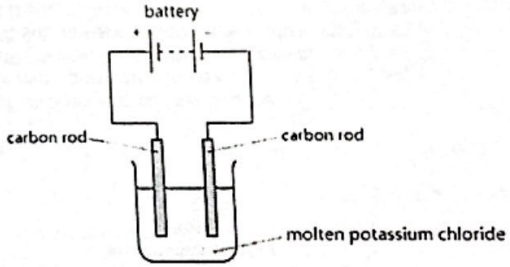
	reagent P	anion(s) in Q
A	aqueous barium chloride	Cl^-
B	aqueous barium chloride	CO_3^{2-}
C	aqueous silver nitrate	Cl^-, CO_3^{2-}
D	aqueous silver nitrate	I^-

26 The energy profile diagram for the decomposition of hydrogen peroxide is shown below.



Which one of the energy changes in the energy profile diagram, correctly shows the activation energy?

27 The diagram below shows the electrolysis of molten potassium chloride using carbon rods.



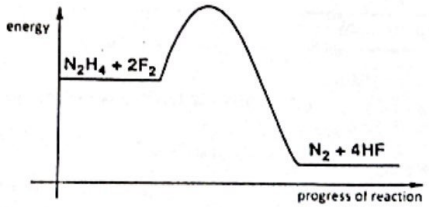
What are the expected products of this electrolysis at the cathode and anode?

	cathode	anode
A	chlorine	potassium
B	hydrogen	oxygen
C	potassium	chlorine
D	oxygen	hydrogen

28 Hydrazine, N_2H_4, is often used in rocket fuel. It reacts with fluorine as shown in the equation below.

$$N_2H_4 + 2F_2 \rightarrow N_2 + 4HF$$

The energy profile diagram for this reaction is shown below.



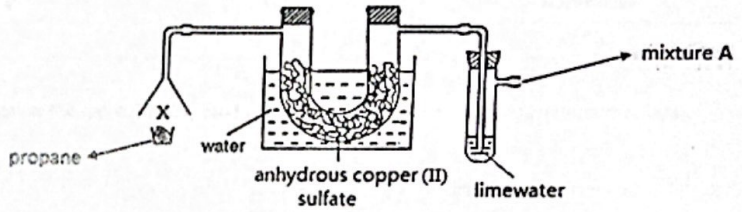
Which statement about the reaction is correct?

A Heat is taken in during the reaction.
B The products have more energy than the reactants.
C The total energy given out during bond formation is more than the total energy taken in during bond breaking.
D The total energy taken in during bond breaking is more than the total energy given out during bond formation.

29 Peter added two substances together in a chemical reaction and was surprised that the reaction allows him to identify the cations in both substances. Which of the following is the correct pair of substances that he used?

	substance 1	substance 2
A	iron (III) chloride	aqueous sodium hydroxide
B	copper (II) carbonate	dilute hydrochloric acid
C	zinc chloride	barium nitrate
D	calcium nitrate	aqueous ammonia

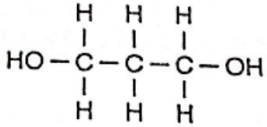
30 The apparatus shown in the figure below can be used to investigate the gaseous products of combustion. When propane is burnt at position X, the anhydrous copper (II) sulfate turned blue and a white precipitate formed in limewater.



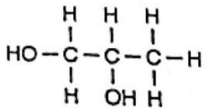
What is mixture A?

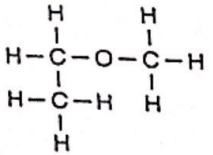
A mixture of nitrogen and carbon dioxide
B mixture of hydrogen and nitrogen
C mixture of hydrogen and carbon monoxide
D mixture of nitrogen and carbon monoxide

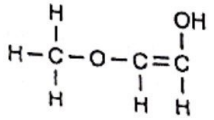
31 An organic compound has the following structure shown.

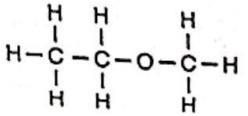


Which of the following is an isomer of the organic compound shown in the diagram above?

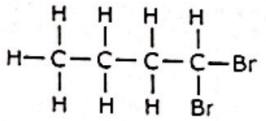
A 

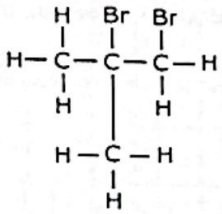
B 

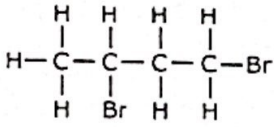
C 

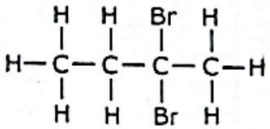
D 

32 Which of the following compounds could be formed by the action of bromine on an alkene of formula C_4H_8?

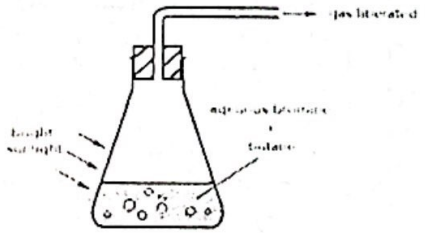
A 

B 

C 

D 

33 A mixture of bromine and excess butane, C_4H_{10} was exposed to bright sunlight. The mixture in the flask began to bubble, giving off a colourless gas that turns moist blue litmus paper red.

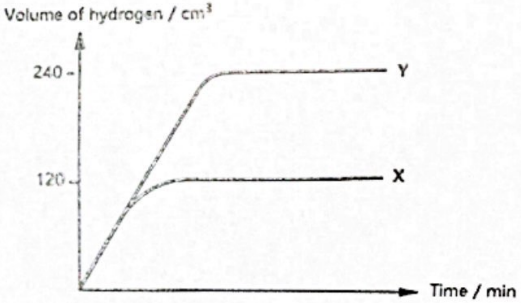


Which row shows the correct type of reaction and gas liberated in the reaction?

	type of reaction	gas liberated
A	addition	hydrogen
B	substitution	hydrogen bromide
C	catalytic cracking	bromine
D	addition polymerisation	oxygen

34 Excess zinc granules were added to 100 cm^3 of 0.1 mol/dm^3 hydrochloric acid at room temperature and pressure. The volume of hydrogen produced was measured over a period of time. Graph X was obtained as shown.

The experiment was repeated with one change and graph Y was obtained.



Which of the following changes to the experiment produced the result shown in graph Y?

A 100 cm^3 of 0.2 mol/dm^3 of dilute hydrochloric acid was used.
B 50 cm^3 of 0.1 mol/dm^3 dilute hydrochloric acid was used.
C 200 cm^3 of 0.05 mol/dm^3 dilute sulfuric acid was used.
D Double the mass of zinc granules was used.

35 Which of the following isomers is likely to have the highest boiling point?

A $(CH_3)_3CCH_2CH_3$ B $(CH_3)_2CHCH(CH_3)_2$
C $CH_3CH_2CH_2CH_2CH_2CH_3$ D $CH_3CH_2CH(CH_3)CH_2CH_3$

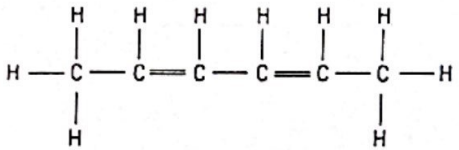
36 Which equation represents an addition reaction?

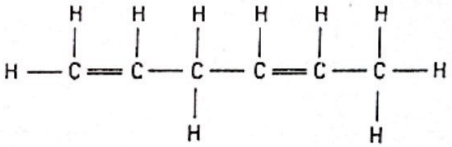
A $C_2H_4 + HCl \rightarrow C_2H_5Cl$
B $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$
C $Cl_2 + C_2H_6 \rightarrow C_2H_5Cl + HCl$
D $C_3H_7COOH + NaOH \rightarrow C_3H_7COONa + H_2O$

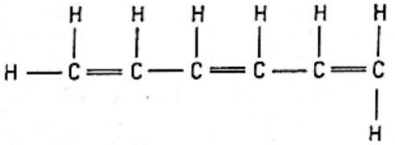
37 Hydrogenation was carried out in an attempt to investigate the number of double bonds in a hydrocarbon.

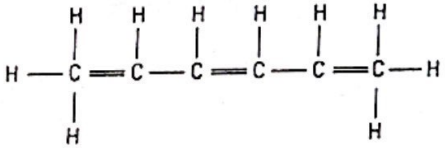
It was found that 10.0 g of the hydrocarbon with a relative molecular mass of 80.0 would require 9.00 dm^3 of hydrogen for complete hydrogenation at room temperature and pressure.

Which displayed formula could be the hydrocarbon?

A 

B 

C 

D 

38 Compound A is an unsaturated compound containing more than one carbon-carbon double bond. The molecular formula of compound A is $C_{16}H_{22}$.

How many carbon-carbon double bonds are present in one molecule of compound A?

A	5	B	6
C	7	D	8

39 A sweet smelling ester is created for use in a new lollipop taste. The ester has the formula $C_3H_7CO_2C_2H_5$. Which pair of reactants would produce this ester?

A	C_2H_5Cl and $C_3H_7CO_2H$	B	C_2H_5OH and C_2H_5COCl
C	C_2H_5OH and $C_3H_7CO_2H$	D	C_3H_7OH and $C_2H_5CO_2H$

40 Which organic compound will decolourise aqueous bromine?

A	C_3H_6	B	C_4H_9OH
C	$CH_3COOC_2H_5$	D	CH_3CH_2COOH