The City School

Unified Mid-Year Examinations
2018 - 2019
Class 10

SCHOOL NAME	
INDEX NUMBER	
DATE	

CHEMISTRY **5070/42**
Paper 4 Alternative to Practical **1 hour**

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

READ THESE INSTRUCTIONS FIRST

Write your School name, Index number and Date in the spaces provided.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use paper clips, glue or correction fluid.

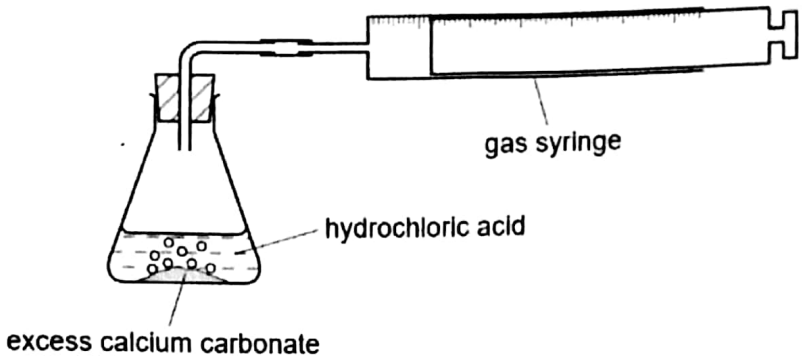
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.
Electronic calculators may be used.

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.

Invigilated By: _____ Checked By:_____ Marks Tallied By: _____

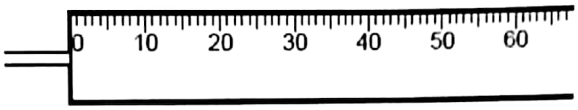
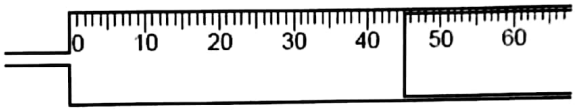
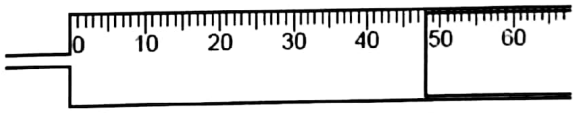
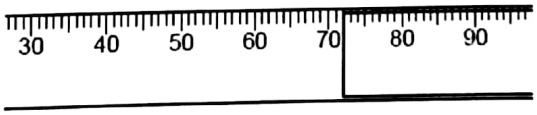
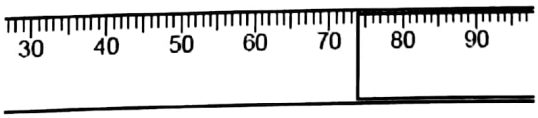
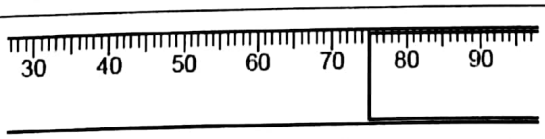
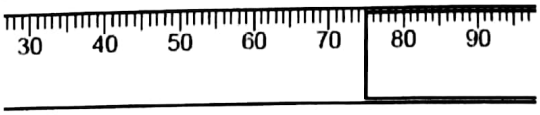
This document consists of **11** printed **pages and 1 blank page.**

1 The rate of reaction between excess calcium carbonate and dilute hydrochloric acid was investigated using the apparatus shown below. The temperature of the hydrochloric acid was 25 °C.



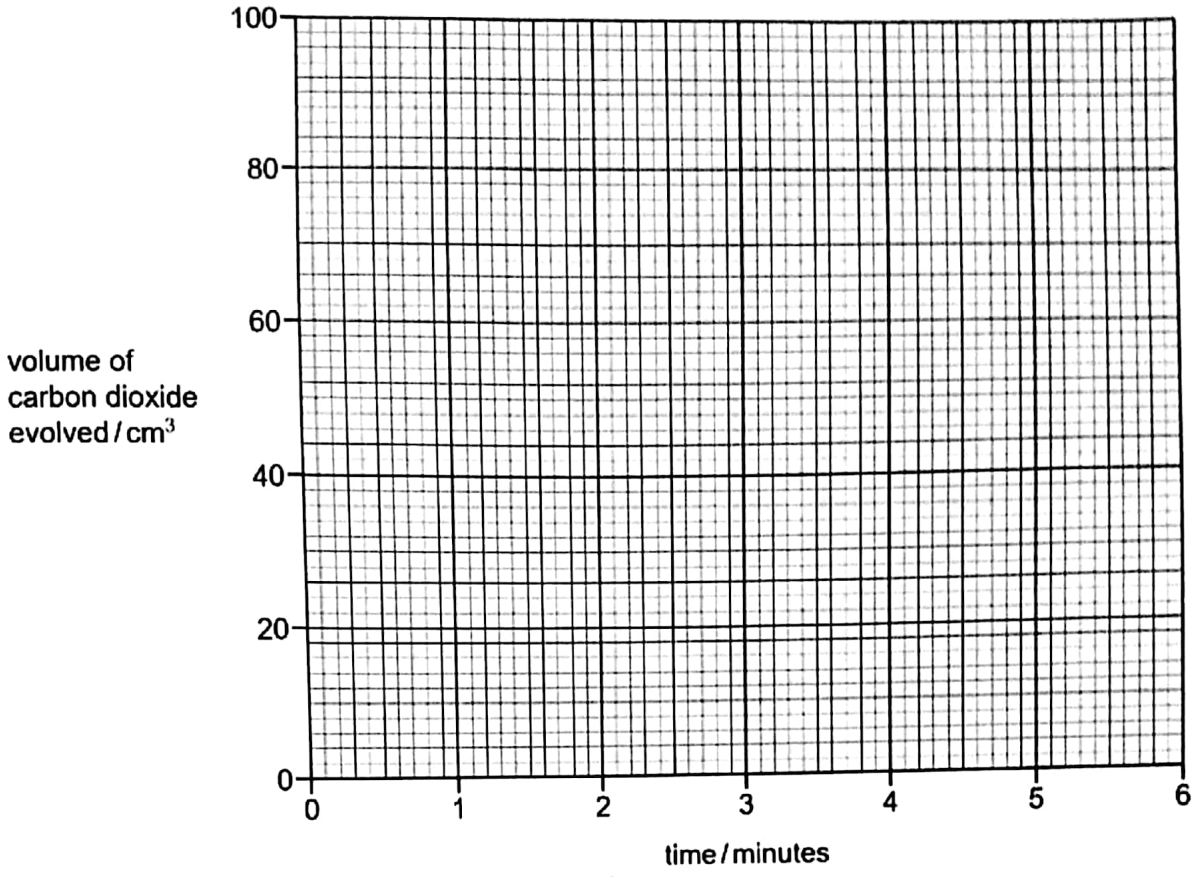
The volume of carbon dioxide evolved was measured every minute for six minutes.

(a) Use the gas syringe diagrams to complete the table of results.

time / minutes	gas syringe diagram	total volume of carbon dioxide evolved / cm^3
0		
1		
2		
3		
4		
5		
6		

[3]

(b) Plot the results on the grid below and draw a smooth line graph.



[4]

(c) (i) Which point appears to be inaccurate? Explain why.

.....

.....[2]

(ii) Use your graph to work out the volume of gas expected at that time. Show clearly **on the grid** how you worked out your answer.

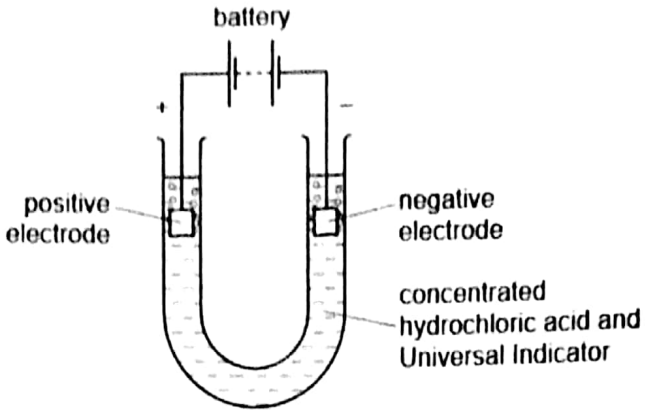
.....[2]

(d) Sketch, **on the grid**, the graph you would expect if the experiment was repeated using hydrochloric acid at a temperature of 50 °C.

[2]

[Total: 13]

2 Electricity was passed through concentrated hydrochloric acid using the apparatus shown.



Effervescence was observed at both electrodes.

(a) Name this process used to break down concentrated hydrochloric acid.

.....[1]

(b) Suggest why the electrodes are made of platinum and not aluminium.

.....[1]

(c) **(i)** Name the gas given off at the positive electrode.

.....[1]

(ii) What would be the colour of the Universal Indicator around the positive electrode at the end of the experiment?

.....[1]

[Total: 4]

3 Two metal salt solutions, **E** and **F**, were analysed.

E was a mixture of iron(II) sulfate and ammonium sulfate.

The tests on the solutions and some of the observations are in the following table. Complete the observations in the table.

tests	observations
<u>tests on solution **E**</u> **(a)** Appearance of solution **E**.	..... [1]
The solution was divided into three equal portions in separate test-tubes. **(b)** Dilute nitric acid and aqueous barium nitrate were added to the first portion of the solution.	..... [1]
(c) (i) Excess aqueous sodium hydroxide was added to the second portion of the solution. **(ii)** The mixture was filtered and the filtrate heated. The gas given off was tested with damp litmus paper.	..... [2] .... [2]
(d) Dilute sulfuric acid and aqueous potassium manganate(VII), an oxidising agent, were added to the third portion of the solution. Aqueous sodium hydroxide was then added to the mixture.	..... [1]
<u>tests on solution **F**</u> **(e)** Appearance of solution **F**.	yellow liquid
(f) Zinc powder was added to solution **F**. The solution was observed for five minutes. The gas given off was tested with a splint.	rapid effervescence turned blue, then green and finally lightpurple lighted splint popped

(g) Identify the gas given off in test **(f)**.

.....[1]

(h) What conclusions can you draw about solution **F**?

.....

.....[2]

[Total: 10]

4 A catalyst is a substance that speeds up the rate of a chemical reaction and remains unchanged at the end of the reaction.

Hydrogen peroxide solution, H_2O_2, breaks down to form oxygen. This decomposition is very slow if a catalyst is not used.

Plan an investigation to show that copper(II) oxide is a suitable catalyst for this reaction. You can use aqueous hydrogen peroxide and common laboratory apparatus.

Step 1 Show that copper(II) oxide catalyses the decomposition of hydrogen peroxide and measure the rate of the reaction.

.....

.....

.....

.....

.....

.....

.....

Step 2 Show that the copper(II) oxide is unchanged at the end of the decomposition.

.....

.....

.....

.....

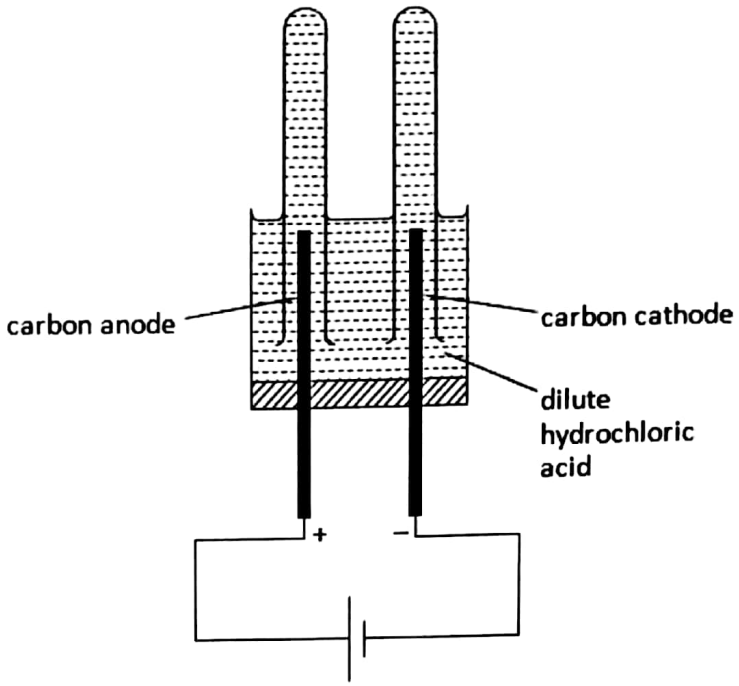
.....

.....

.....

[Total: 8]

5 The apparatus shown is used to electrolyse dilute hydrochloric acid.



(a) Name the gas given off at the carbon anode. Give a test and observation to identify this gas.

name of gas .....

test and observation .....[2]

(b) Name the gas given off at the carbon cathode. Give a test and observation to identify this gas.

name of gas .....

test and observation .....[2]

(c) **(i)** The electrolyte, dilute hydrochloric acid, is replaced by another dilute acid. The gas given off at the carbon cathode is unchanged. At the carbon anode bubbles of another gas are seen.

Suggest the name of the replacement electrolyte.

..... [1]

(ii) Name the gas given off at the carbon anode using the replacement electrolyte. Give a test and observation to identify this gas.

name .....

test .....

observation ..... [2]

[Total: 7]

6 A student is given an impure sample of magnesium carbonate, $MgCO_3$ .The student determines the percentage of magnesium carbonate by mass in the sample.

(a) The student adds a sample of the impure magnesium carbonate to a previously weighed beaker.

mass of beaker + sample = 53.28 g

mass of beaker = 52.86 g

Calculate the mass of the sample used in the experiment.

..... g [1]

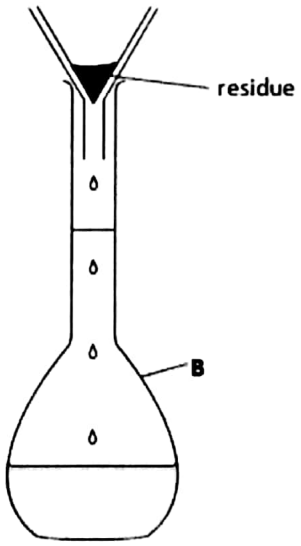
(b) 25.0 cm^3 of 1.00 mol /dm^3 hydrochloric acid, HCl, (an excess) is added to the beaker using a pipette. The contents of the beaker are stirred.

Magnesium carbonate reacts with hydrochloric acid.

$$MgCO_3 + 2HCl \longrightarrow MgCl_2 + CO_2 + H_2O$$

The impurities do not react with hydrochloric acid and remain undissolved.

After reaction, the mixture is filtered into apparatus **B**. The student washes the residue on the filter paper with distilled water, which also passes into apparatus **B**.



(i) The student then makes up the solution to the 250 cm^3 mark with distilled water. This is solution **C**.

Name apparatus **B**.

..... [1]

(ii) Why does the student wash the residue with distilled water?

..... [1]

(c) The student transfers 25.0 cm^3 of **C** into a conical flask and adds three drops of methyl orange indicator.

A solution of 0.100 mol / dm^3 sodium hydroxide, NaOH, is put into a burette and run into the conical flask until the end-point is reached.

The sodium hydroxide reacts with the hydrochloric acid that remains after reaction with magnesium hydroxide. The equation for the reaction is shown.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

What is the colour change of the methyl orange indicator at the end-point?

The colour changes from ..... to ..... [1]

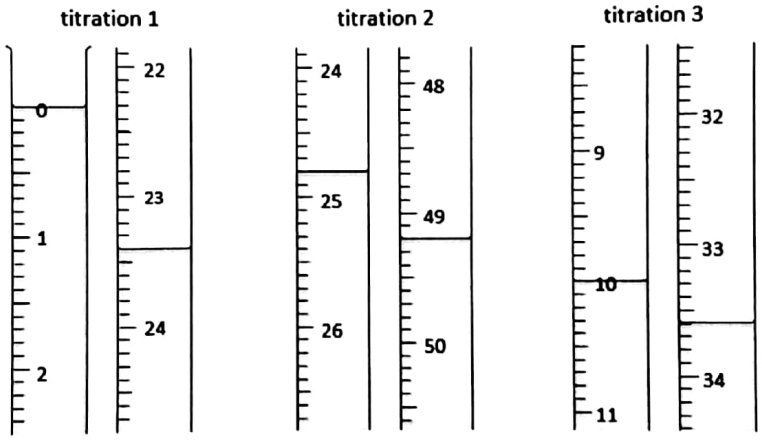
(d) The student does three titrations, using 25.0 cm^3 of **C** in each case.

(i) Give two reasons why the student does three titrations using 25.0 cm^3 of **C**, rather than carrying out one titration using 250 cm^3 of **C**.

1 .....

2 ..... [2]

The diagrams show parts of the burette with the liquid levels both at the beginning and at the end of each titration.



(ii) Use the diagrams to complete the table.

titration number	1	2	3
final burette reading / cm^3			
initial burette reading / cm^3			
volume of 0.100 mol / dm^3 sodium hydroxide used / cm^3			
best titration results (✓)			

Summary

Tick (✓) the best titration results.
Using these best titration results, the average volume of 0.100 mol / dm^3 sodium hydroxide used is

..... cm^3. [4]

(e) Calculate the number of moles of sodium hydroxide in the average volume of 0.100 mol / dm^3 sodium hydroxide in **(d)(ii)**.

..... moles [1]

(f) Using your answer to **(e)** and the equation

$$NaOH + HCl \rightarrow NaCl + H_2O$$

calculate the number of moles of hydrochloric acid in 25.0 cm^3 of **C**.

..... moles [1]

(g) Calculate the number of moles of hydrochloric acid in 250 cm^3 of **C**.

..... moles [1]

(h) Calculate the number of moles of hydrochloric acid in 25.0 cm^3 of 1.00 mol / dm^3 hydrochloric acid.

..... moles [1]

(i) Using your answers to both **(g)** and **(h)**, calculate the number of moles of hydrochloric acid that react with the magnesium carbonate in the sample.

..... moles [1]

(j) Using your answer to **(i)** and the equation

$$MgCO_3 + 2HCl \rightarrow MgCl_2 + CO_2 + H_2O$$

calculate the number of moles of magnesium carbonate in the sample.

..... moles [1]

(k) Calculate the mass of magnesium carbonate in the sample.

[A_r: Mg, 24; C, 12; O, 16]

..... g [1]

(l) Using your answers to **(a)** and **(k)**, calculate the percentage by mass of magnesium carbonate in the sample.

.....% [1]

[Total: 18]