Name	Register No	Class

QUESTION PAPER

SINGAPORE PIAGET ACADEMY MEDAN
PRELIMINARY EXAMINATION 2008-2009

SINGAPORE PIAGET ACADEMY MEDAN

CHEMISTRY   SECONDARY FOUR

PAPER 4   1 hour

Additional Materials: Answer Booklet
                      1 graph paper
                      Electronic Calculator

INSTRUCTIONS TO CANDIDATES

Read these instructions first.

Write your Centre number, candidate number and name on the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.
You may use a calculator.

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

_____
This document consists of 8 printed pages including this cover page

Section A (60 marks)
Answer ALL questions. Write your answers in the spaces provided.

1 A student conducted titration in the lab using sodium hydroxide and hydrochloric acid.

(a) State the **two** apparatus needed for the reaction.

…………………………………. and …………………………………. [2]

(b) Write a balanced chemical equation with state symbols for the reaction.

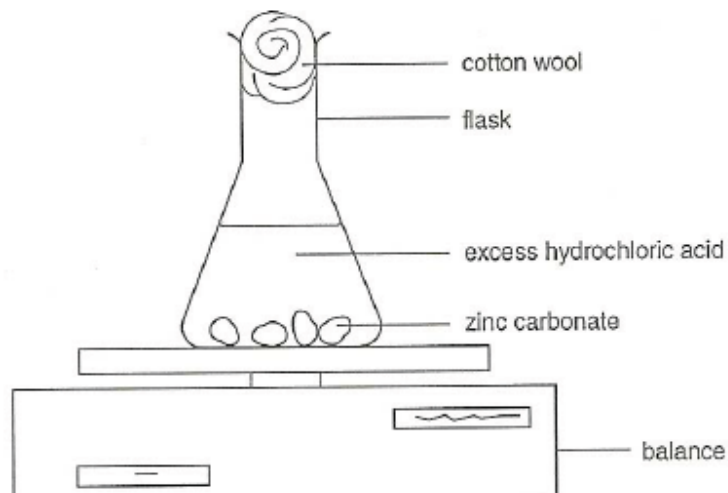……………………………………………………………………………[2]

(c) Calculate the number of moles of sodium hydroxide used if the number of moles of hydrochloric acid used is 4.5 moles.

[2]

(d) From your answer in part **(c)**, hence calculate the mass of sodium hydroxide used

[2]

2 The following set-up is conducted to determine the factors affecting rate of reaction. Small lumps of zinc carbonate were added to hydrochloric acid.

(a) State the use of the cotton wool in the set-up.

……………………………………………………………………………………[1]

(b) Write a balanced chemical equation for the above reaction.

……………………………………………………………………………………[2]

(c) Describe a chemical test for the gas produced.

……………………………………………………………………………………[1]

(d) The time taken for the reaction to complete is 5.13 minutes. The initial mass recorded was 120.7 g and the mass recorded at the end of the experiment was 98.8 g.

   (i) Sketch a labelled graph (mass of flask and content vs time) to show the progress of this reaction.

[4]

   (ii) Suggest **two** ways to reduce the time taken for the reaction.

   ……………………………………………………………………………… [2]

**3** A student was given a sample of an organic acid, **T**, and asked to

   • determine its relative molecular mass, and
   • suggest its molecular formula.

   A sample of the acid was placed in a previously weighed container and reweighed.
   mass of the container and the acid = 8.25 g
   mass of container = 6.74 g

(a) Calculate the mass of the acid used in the experiment.

   .... g   [1]

   The student transferred the sample to a beaker and added 50.0 cm3 of 1.00 mol/dm3 sodium hydroxide. The contents of the beaker were allowed to react and then transferred to a volumetric flask. The solution was made up to 250 cm3 with distilled water. This was solution **S**.

1st titration   2nd titration   3rd titration
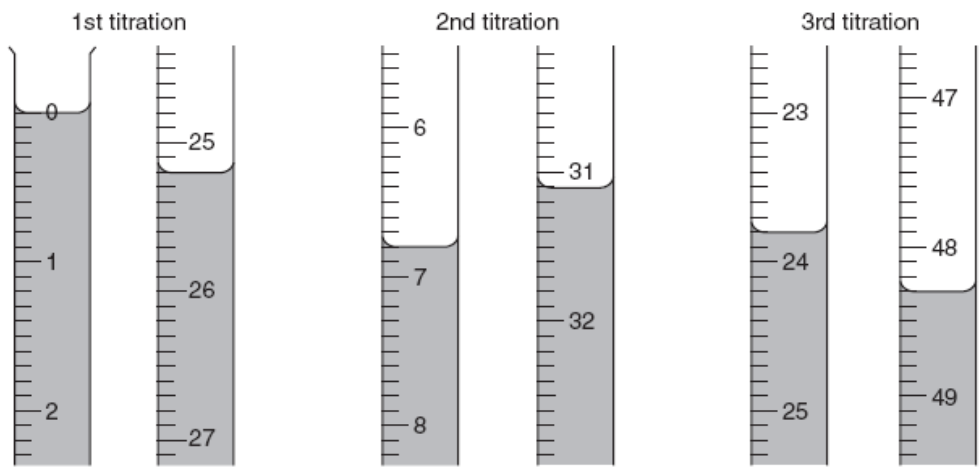
25.0 cm3 of **S** was transferred into a conical flask.

(b) What piece of apparatus was used to measure this volume of **S**?

....[1]

A few drops of phenolphthalein indicator were added to the conical flask.
0.100 mol/dm3 hydrochloric acid was placed in a burette and added to the solution in the conical flask until an end-point was reached.
Phenolphthalein is colourless in acidic solution and pink in alkaline solution.

(c) What was the colour of the solution in the conical flask

• before the acid was added, ...

• at the end-point? ....
                                                         [1]

(d) Use these diagrams to complete the table of results

titration number	1	2	3
final reading/cm3			
first reading/cm3			
volume of solution **G**/cm3			
best titration results (✔)			

Summary.

                                                    [4]

Tick (✔) the best titration results. Using these results, the average volume of **S** was
.... cm3.

(e) The acid **T** contains two carboxylic acid groups and has the formula
HOOCC$_x$H$_y$COOH where **x** and **y** are whole numbers.
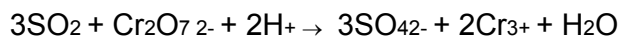 **(i)** Deduce the values of **x** and **y** in the formula.[A_r: C, 12; O, 16; H, 1]

    x ....

    y ....   [2]

(f) Sulphur dioxide is often detected in a sample of polluted air by reacting it
with acidified potassium dichromate(VI). The ionic equation for the reaction
is shown below :

$$3SO_2 + Cr_2O_7{}^{2-} + 2H^+ \rightarrow 3SO_4{}^{2-} + 2Cr^{3+} + H_2O$$

i) How does sulphur dioxide enter the air?

…………………………………………………………………………   [1]

ii) What observation will confirm the presence of sulphur dioxide in the
air?

…………………………………………………………………………   [1]

iii) A solution of 0.100 mol/dm3 of dichromate(VI) ions was used in the test. Calculate
the minimum volume of this solution that will be needed to remove the sulphur
dioxide in 3000dm3 of polluted air, which contained 2.40 % by volume of sulphur
dioxide, measured at room temperature and pressure.

                                                                    [3]

4 Element **X** forms a chloride **X**Cl_n which melts at 3_oC.
a) Suggest with reason
(i) the type of bonding in the chloride of **X**Cl_n and
(ii) whether **X** is a metal or non-metal.

…………………………………………………………………………… [2]

b) In Experiment **I**, when 0.500g of the chloride, **X**Cl_n was reacted with an excess of acidified silver nitrate, 1.19g of AgCl was formed.
(i) Calculate the number of moles of AgCl formed in Experiment I.

…………………………………………………………………………… [1]

(ii) If all the chloride in AgCl were obtained from **X**Cl_n, find th number of moles of Cl present in 0.500g of **X**Cl_n.

…………………………………………………………………………… [1]

c) In Experiment **II**, another 0.500g of the chloride, **X**Cl_n was heated strongly and chlorine gas was given off. The equation of the reaction is as follows:

$$X Cl_n \rightarrow X Cl_m + Cl_2$$

When the residue, **X**Cl_m was treated with an excess of acidified silver nitrate, only 0.714g of AgCl was precipitated.
(i) Calculate the number of moles of AgCl formed in Experiment II.

…………………………………………………………………………… [1]

(ii) If all the Cl in AgCl were obtained from **X**Cl_m, find the number of moles of Cl present in **X**Cl_m.

…………………………………………………………………………… [1]

d) Using your answer to **(b)** and **(c)**, calculate the mole ratio of Cl in **X**Cl_n to **X**Cl_m.

…………………………………………………………………………… [2]

e) Suggest the group in the Periodic Table to which the element **X** belongs.

…………………………………………………………………………… [1]

f) Element **X** also reacts with oxygen to form an oxide.
(i) Suggest a possible molecular formula (in terms of **X** and O) for the oxide formed.

…………………………………………………………………………… [2]

(ii) Describe the observation when a few drops of phenolphthalein indicator is added to an aqueous solution of the oxide of **X**.

.... [1]

5 Aqueous sodium sulphate can be prepared by titrating dilute sulphuric acid with aqueous sodium hydroxide. The equation for the reation is

$$H_2SO_4(aq) + 2\ NaOH(aq) \rightarrow Na_2SO_4\ (aq) + 2H_2O(l)$$
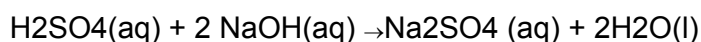
a In the titration, 25.0 cm^3 of 2.0 mol/dm^3 sulphuric acid was used.
  i) Calculate the number of moles of H_2SO_4 used in the reaction.

.... [2]
  ii) Calculate the number of moles of NaOH used in the reaction.

.... [2]

iii) Calculate the volume of 0.5 mol/dm^3 sodium hydroxide used to neutralize the acid.

.... [2]

iv) Calculate the mass, in grams of sodium sulphate produced in the reaction.

.... [2]

b) Why this method cannot be used to prepare magnesium sulphate?
  [relative atomic masses: Na = 23; Cl =35.3]

.... [1]

6 In an experiment, 0.65 g of zinc granules and 200 cm^3 of 0.2 mol/dm^3 hydrochloric acid are allowed to react together in a beaker.

a)i) Calculate the number of moles of zinc in 0.65g and the number of moles of hydrochloric acid in the acid solution.

…………………………………………………………………………… [2]

b) Give the equation with state symbols for the reaction.

…………………………………………………………………………… [1]

c) Explain why the reaction stops and state what is present in the beaker at the end.

…………………………………………………………………………… [2]

d) Give one method of making the reaction in the beaker faster. Explain, in terms of collisions between reating particles, how this method works.
[Relative atomic mass of zinc = 65]

…………………………………………………………………………… [1]

END OF PAPER