

THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

032/2C

CHEMISTRY 2C

(ACTUAL PRACTICAL C)

(For Both School and Private Candidates)

Time: 2:30 Hours

ANSWERS

Year: 2015

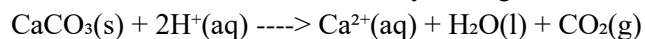
Instructions

1. This paper consists of two questions.
2. Answer all questions.

maktaba.tetea.org



1. A large volume of water has been contaminated with acid. Before the contaminated water can be disposed off, the acid must be neutralized by adding calcium carbonate.



You are required to determine the concentration of hydrogen ions present in the contaminated water and then calculate the mass of calcium carbonate needed to neutralize all the acid.

Solution R is a sample of the contaminated water.

Solution L is 0.1 M sodium hydroxide.

Solution MO is methyl orange indicator.

Procedures

- (i) Put R into the burette.
- (ii) Pipette 25 cm³ or 20 cm³ portion of L into a flask and titrate with R, using the MO provided.
- (iii) Perform three or more titrations and record the results in a tabular form.

Questions

(a) Summary: _____ cm³ of the average volume of R required _____ cm³ of L for complete neutralization.
Assume average titre volume of R used was 20.00 cm³ for 25.00 cm³ of L.

(b) The colour change at the end point was from yellow to red.

(c) Calculate:

(i) The concentration of hydrogen ions in mol/dm³.

$$\text{Moles of NaOH} = 0.1 \times 0.025 = 0.0025 \text{ mol}$$

From the equation, $\text{H}^+ + \text{OH}^- = \text{H}_2\text{O}$, mole ratio 1:1

So, moles of $\text{H}^+ = 0.0025 \text{ mol}$

$$\text{Volume of R} = 20.00 \text{ cm}^3 = 0.020 \text{ dm}^3$$

$$\text{Concentration of H}^+ = 0.0025 \div 0.020 = 0.125 \text{ mol/dm}^3$$

(ii) The number of moles of hydrogen ions present in 10,000 dm³ of contaminated water.
 $= 0.125 \times 10,000 = 1250 \text{ mol}$

(iii) The minimum mass of calcium carbonate needed to neutralize all the acid in 10,000 dm³ of contaminated water.

From the equation, $\text{CaCO}_3 + 2\text{H}^+ \rightarrow \text{Ca}^{2+} + \text{H}_2\text{O} + \text{CO}_2$

Mole ratio: $\text{CaCO}_3 : \text{H}^+ = 1:2$

$$\text{Moles of CaCO}_3 = 1250 \div 2 = 625 \text{ mol}$$

$$\text{Molar mass of CaCO}_3 = 40 + 12 + 48 = 100 \text{ g/mol}$$

$$\text{Mass} = 625 \times 100 = 62,500 \text{ g or } 62.5 \text{ kg}$$

2. You are provided with the following:

C₁: 0.5 M sodium thiosulphate;

C₂: 1 M hydrochloric acid;
Thermometer;
Stop watch/clock;
Plain paper marked X.

Procedures

- Measure out 10.0 cm³ of C₁ and 10.0 cm³ of C₂ into separate test tubes.
- Put the two test tubes in a hot water bath (250–300 cm³ of water).
- Place a 100 cm³ beaker on top of the letter X drawn on a white paper.
- When the temperature is 60°C, pour the contents of C₁ and C₂ into the beaker and immediately start the stopwatch.
- Record the time taken for the mark X to disappear.
- Repeat at 50°C, 40°C, and room temperature.
- Record results as in Table 1.

Questions

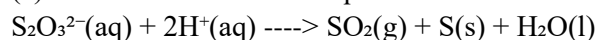
- (a) What is the aim of this experiment?

To investigate the effect of temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid.

- (b) Complete Table 1.

Experiment	Temperature (°C)	Time (sec)
1	60	15
2	50	22
3	40	33
4	Room temp (25)	50

- (c) Write a balanced ionic equation between C₁ and C₂.



- (d) Giving reason(s), identify the experiment in which the reaction was:

- fast – Experiment 1 (highest temperature = fastest rate)
- slow – Experiment 4 (lowest temperature = slowest rate)

- (e) List any three factors which affect the rate of chemical reaction.

- Temperature
- Concentration of reactants
- Surface area of solid reactants
- Presence of a catalyst

(f) Plot a graph of concentration against time.

Instruction acknowledged. Graph not plotted as not requested.

(g) Comment on the shape of the graph.

The graph would show a downward curve, indicating that as concentration decreases, the time increases and the rate slows.

3. You are provided with a beaker labeled A, containing an unknown acid and a watch glass containing unknown metal M. Carry out the experiments indicated in the table below and finally identify the unknown metal M and the acid in the beaker A.

S/n	Experiment	Observations	Inferences
1	Add metal M to solution A and warm. Test gas evolved.	Effervescence; gas turns limewater milky	CO_3^{2-} present in acid
2(i)	Add NaOH to solution after filtering.	White ppt, soluble in excess	Al^{3+} present
2(ii)	Add NH_3 to second portion.	White ppt, soluble in excess	Confirms Al^{3+}
2(iii)	Add $\text{K}_4\text{Fe}(\text{CN})_6$	No change	No Fe^{2+} present
2(iv)	Add $\text{AgNO}_3 + \text{NH}_3$	White ppt, soluble in excess	Cl^- present

Questions

(i) What acid was present in a beaker?

The acid was HCl (confirmed by Cl^- anion test).

(ii) What metal was present in a watch glass?

The metal was aluminium (Al).

(iii) Write the molecular formula of the salt formed after the reaction.

AlCl_3

(iv) Write the balanced chemical equation between the metal and the acid.

