



# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

*Faculty of Engineering and Technology*

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

**DIPLOMA IN BUILDING & CIVIL ENGINEERING  
DIPLOMA IN CIVIL ENGINEERING  
DIPLOMA IN ARCHITECTURE**

ACH 2125: CHEMISTRY

**SPECIAL/SUPPLEMENTARY EXAMINATION**

SERIES: OCTOBER 2011

**TIME: 2 HOURS**

## **Instructions to Candidates:**

You should have the following for this examination

- *Answer booklet*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **FIVE** printed pages

## SECTION A (COMPULSORY)

### Question 1

- a) The grid given below represents part of the periodic table. Study it and answer the questions that follow. (The letters do not represent the actual symbol of the elements)

									A
					B				
	C				D		E		
	F								

- i) What name is given to the group of elements to which C and F belong? (1 mark)
- ii) Which letter represents the element that is the least reactive (1 mark)
- iii) What type of bond is formed when B and E react? Explain (2 marks)
- iv) Write the electron configuration of D. What group is it? (2 marks)
- b) Describe the changes in electronegativity as we move;
- i) Down a periodic group (2 marks)
- ii) Across the periodic group from left to right (2 marks)
- c) Use Lewis dot symbols to show the formation of: (Indicate lone pairs of electrons if applicable)
- i)  $\text{NH}_3$  (2 marks)
- ii)  $\text{NaF}$  (2 marks)
- d) List **THREE** advantages of radioactivity (3 marks)
- e) Give the formula for the conjugate acid of  $\text{HSO}_4^-$  (1 mark)
- f) (i) Define the term oxidation. (2 marks)
- $$2\text{Fe}_2\text{O}_3(\text{s}) + 3\text{C}(\text{s}) \longrightarrow 4\text{Fe}(\text{s}) + 3\text{CO}_2(\text{g})$$
- (ii) Which element in the equation above has been oxidized and which has been reduced? Show your working. (4 marks)
- (iii) Identify the oxidizing agent and the reducing agent (2 marks)
- iv) Give **ONE** disadvantage of rusting (2 marks)
- g) Define a monomer (2 marks)

## SECTION B (Answer any TWO questions from this section)

## Question 2

a) (i) Radioactivity is often called ionization radiation. Why? (1 mark)



(ii) How many half-lives does it take a 10g sample of  ${}_{53}^{123}\text{I}$  to drop to 0.039g? What length of time is this? (half-life is 13.1hour) (3 marks)

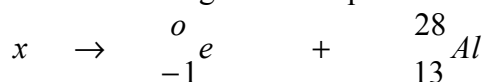
b) (i) Name the **THREE** types of radiation (3 marks)

(ii) Give **THREE** differences between nuclear reactions and chemical reactions (3marks)

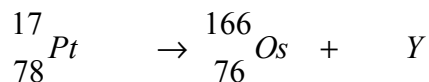
c) Of the types of radiation studied, which is least likely to damage you upon external exposure? Which one is most likely? Explain fully. (4 marks)

d) State **THREE** characteristics of alpha particles (3 marks)

e) Complete the following nuclear equations and name the particle Y formed. (3 marks)



(i)



(ii)

## Question 3

a) Differentiate between soft and hard water (2 marks)

b) Name **TWO** ways of removing permanent hardness (2 marks)

c) In an experiment, soap solution was added to three separate samples of water. The table below shows the volumes of soap solution required to form lather with 1000cm<sup>3</sup> of each sample of water before and after boiling.

	Sample I	Sample II	Sample III
Volume of soap before water is boiled	27.0	3.0	10.6
Volume of soap water is boiled	27.0	3.0	3.0

(i) Which water sample is likely to be soft? Explain (3 marks)

(ii) Which water sample is likely to be hard? Explain (3 marks)

(iii) Which type of hardness was being investigated (1 mark)

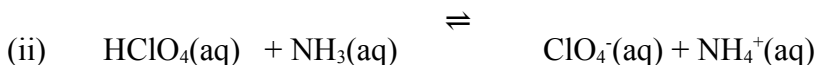
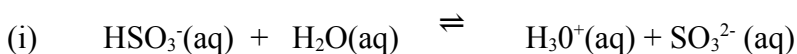
d) The column below was used to soften hard water.

Permutit (contains  $\text{Na}^+$ )

- (i) Explain how the hard water softened as it passed through the column. (3 marks)
- (ii) After some time the material in the column is not able to soften hard water. How can the material be reactivated? (2 marks)
- (iii) Give TWO advantages of using soft water for domestic purposes (2 marks)
- (iv) Give TWO disadvantages of using hard water for domestic purposes (2 marks)

#### Question 4

- a) Define a weak acid (2 marks)
- b) Identify the stronger acid in each of the following pairs (2 marks)
  - (i)  $\text{H}_2\text{SO}_3$  or  $\text{H}_2\text{SO}_4$
  - (ii)  $\text{HCN}$  or  $\text{HCl}$
- c) Write a balanced equation for the dissociation of  $\text{H}_2\text{SO}_4$  in  $\text{H}_2\text{O}$  (2 marks)
- d) Give the formula for the conjugate base of  $\text{HNO}_3$  (1 mark)
- e) For each of the following reactions, identify the Brsted-Lowry acids and bases and their conjugate acid-base pairs (4 marks)



- f) A solution prepared by dissolving 0.25g of  $\text{BaO}$  in enough water to make 0.500L solution. Calculate the pH of the solution ( $\text{BaO}=153\text{g/mol}$ ) (4 marks)
- g) (i) In each of the salts below, state the acid and the base to which they were obtained from. (4 marks)
  - $\text{NaI}$
  - $\text{NH}_4\text{Cl}$
- (ii) Classify each of the salt solutions above as acidic, basic or neutral (1 mark)

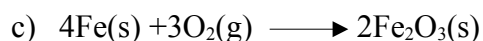
### Question 5

a) State **ONE** disadvantage of rusting (1 mark)



b) (i) Determine the oxidation states on N in  $\text{NO}_3^-$  and NO (2 marks)

(ii) Classify the reaction as either an oxidation or reduction (1 mark)



i) Which element has been oxidized and which has been reduced? Show your working (4 marks)

ii) Identify the oxidizing agent and the reducing agent (2 marks)

d) Give **FOUR** applications for Redox reaction (4 marks)

e) Give **TWO** applications of nylon (2 marks)

f) Show the structure of polyvinyl chloride (PVC) by drawing three repeating units. Vinyl chloride is  $\text{H}_2\text{C}=\text{CHCl}$  (2 marks)

g) Show the monomer units you would use to prepare the following polymer (2 marks)