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University Examinations 2024/2025

FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING, ELECTRICAL AND MECHANICAL ENGINEERING, BACHELOR OF SCIENCE IN FOOD SCIENCE AND TECHNOLOGY AND BACHELOR OF EDUCATION TECHNOLOGY IN (CIVIL, MECHANICAL AND ELECTRICAL)

SCS 3111: PHYSICAL INORGANIC CHEMISTRY

DATE: JANUARY 2025 **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) Write the electron configuration for the following atoms using spdf notation.
   (i) Mn(25) (1 mark)
   (ii) Mg (12) (1 mark)
   (iii) C (6) (1 mark)

b) Define the terms acid and base as per Bronsted and Lowry (2 marks)

c) Differentiate between a buffer solution and a true solution (2 marks)

d) Define atomic radius (1 mark)

e) Illustrate hydrogen bonding in water molecules (2 marks)

f) Define
   (i) Radioactivity (1 mark)
   (ii) Isotopes (1 mark)
   (iii) Nucleons (1 mark)

(iv) Half life of a radioisotopes (1 mark)

(v) pH (1 mark)

g) explain the meaning of the term chemical equilibrium (2 marks)

h) what is the meaning of the term oxidation state (1 mark)

i) define the following terms (5 marks)

(i) thermochemistry

(ii) exothermic reactions

(iii) endothermic reactions

(iv) bond energy

(v) potential energy

j) write the equilibrium constant Kc for the following equation

$N_2O_4(g) \rightleftharpoons 2NO_2(g)$ (2 marks)

k) Explain the meaning of the term common ion effect. Give an example (3 marks)

l) Differentiate between frequency and wave length (2 marks)

QUESTION TWO (20 MARKS)

a) Discuss factors that affect chemical equilibrium (10 marks)

b) Discuss ionic bonding using sodium chloride as an example (10 marks)

QUESTION THREE (20 MARKS)

a) Discuss factors that affect chemical equilibrium (10 marks)

b) (i) State Roult's Law (1 mark)

(ii) Discuss each of the following

Suspensions (2 marks)

Colloids (2 marks)

c) The molar solubility of $BaSO_4$ in water is 1.0×10^{-5} mol/dm^{-3}. Calculate the molar solubility of $BaSO_4$ when 0.1 mole of Na_2SO_4 is added (KSP of $BaSO_4$ is 1.0×10 mol^{2}dm^{-6}) (5 marks)

QUESTION FOUR (20 MARKS)

a) Explain the periodic trend of each of the following factors from left to right on the periodic table. (10 marks)

(i) Atomic radius

(ii) Ionization energy

(iii) Electron affinity

(iv) Electronegativity

(v) Metallic character

b) Discuss industrial applications of electrolysis (10 marks)