MURANG'A UNIVERSITY COLLEGE

2015/2016 ACADEMIC YEAR

SUPPLEMENTARY/SPECIAL EXAMINATION FOR THE DIPLOMA IN ELECTRICAL ENGINEERING/CIVIL ENGINEERING

SEE 1109/SEB 1160: INTRODUCTION TO CHEMISTRY

DATE: JUNE, 2016 TIME: 2 HRS

Instructions: Answer question **ONE** and **THREE** of the other questions. Question one carries 40 marks and the rest carry 10 marks each.

Use the data provided; c=3.0×10^{8} ms^{-1}, R=8.314JK^{-1} F=96500C, h=6.626×10^{-34} Js c=3.0×108 ms-1 R_H=1.097×107m^{-1}.

QUESTION 1 (40 mks)

a) State the differences between the following terms;
   (i) Electronegativity and ionization energy (2 mks)
   (ii) Covalent bond and ionic bond
   (2 mks)

b) Indicate the oxidation numbers of the named elements in the species below
   (i) S in SO_3
   (ii) Mn in MnO_2
   (iii) Cr in CrO_4^-
   (iv) I in I_2
   (6 mks)

c) Write a balanced chemical equation for a reaction taking place in a basic solution
   $CrO_4^- + SO_3^{2-} \rightarrow Cr(OH)_4^- + SO_4^{2-}$ (6 mks)

d) Explain the following
   (i) Atomic radius increase down a group in the periodic table (2 mks)
   (ii) The first ionization energy of chromium (24) is higher than the first ionization energy of manganese (25) (3 mks)

(iii) Glucose ($C_6H_{12}O_6$) is more soluble in water than benzene while cyclohexane (C_6H_{12}) is more soluble in benzene than in water (3 mks)

e) Complete and balance the following nuclear equations by supplying the missing particle

(i) $^{87}_{37}Rb \rightarrow {}^{87}_{38}Sr + ?$

(ii) $^{227}_{92}U \rightarrow {}^{223}_{90}Th + ?$

(iii) $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + ?$ (6 mks)

f) Name the element that undergoes oxidation in the following reactions

(i) $Br_2 + H_2S \rightarrow 2HBr + S$ (2 mks)

(ii) $2FeCl3 + SnCl2 \rightarrow 2FeCl2 + SnCl4$ (2 mks)

g) Write the electronic configurations of the following elements using s, p,d,etc orbitals

(i) Na (11) (ii) Co(27) (iii) Ba(56) (6mks)

QUESTION FOUR

a) What is the frequency of radiation that has a wavelength of 1.9mm (3mks)

b) What is the wavelength of radiation that has a frequency of $1.1 \times 10^{-13}\ s^{-1}$ (3 mks)

c) Would the radiations in part (a) be visible to the human eye (1 mk)

d) What time does it take electromagnetic radiation to travel 1.5×10^{13} km (3 mks)

QUESTION THREE

a) Indicate whether each of the following statements is true or false

(i) If something is reduced, it is formally losing electrons

(ii) A reducing agent gets oxidized as it reacts

(iii) Oxidizing agents can convert CO into CO_2 (3 mks)

b) Draw the Lewis dot structures for each of the following molecules (the underlined letters represents the central atom)

(i) $H_2\underline{S}$

(ii) $\underline{S}O_3$

(iii) CH_2Br_2

(iv) H<u>C</u>N (7 mks)

QUESTION FOUR

a) Indicate the number of protons and neutrons in the following nuclei

(i) $^{52}_{24}Cr$ (ii) $^{85}_{37}Rb$ (iii) $^{119}_{50}Sn$ (6 mks)

b) Classify the following bonds as polar or non-polar. Explain your answer

(i) Be-F

(ii) Br-Br

(iii) S-O

(iv) H-Cl

(4 mks)

QUESTION FIVE

a) Calculate the decay constant, k (in yr-1) of a radionuclide that decays with a half-life of 4.3×10^5 years. (2 mks)

b) (i) Calculate the change in energy of an electron in the hydrogen atom moving from n=2 and when n=4

(ii) Calculate the wavelength of the released radiation when an electron moves from n=4 to n=2

(6 mks)

c) The specific heat capacity of a solid copper metal is 0.385J/g.k. How many joules of heat are needed to raise the temperature of 1,550 block of copper from 33.0^{o}C to 77.5^{o}C?

(2mks)