



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE

SCH 110: CHEMISTRY I

DATE: Thursday 15th December 2011

TIME: 8.00 a.m -10.00 a.m

INSTRUCTIONS: Answer ALL Questions

Inorganic Chemistry Section

1)

- a. With regard to models of atomic structure
 - i. Briefly explain the Quantum model (3 marks)
 - ii. What is your understanding of dual nature of matter (2 marks)
 - iii. State an experiment that supports dual nature of light. (2 marks)
- b. Elements X and Y have atomic numbers 38 and 53 respectively
 - i. Write the electronic configuration of X and Y (2marks)
 - ii. Use the configuration to identify the group and period of X and Y in the IUPAC periodic table (2 marks)
 - iii. Which of the two atoms, X and Y has a larger atomic radius, Explain your answer (3 marks)

2)

- a. The energy possessed by electrons in atoms is quantized.
 - i. What do you understand by the statement in c above(2 marks)
 - ii. State an experiment that provides evidence that supports the statement (2 marks)

- 3) Draw the Lewis structures of the following molecule and ions and clearly show your working. (The atomic numbers of N, O, F, and Br are 7, 8, 9 and 35 respectively)
- NO_2^- (2 marks)
 - BrF_3 (2 marks)
 - Use the Lewis structures of 3a-c above to predict their molecular geometry (2 marks)
- 4) Balance the following redox reaction
- $\text{Cr}(\text{OH})_3(\text{s}) + \text{ClO}^-(\text{aq}) \rightarrow \text{CrO}_4^{2-}(\text{aq}) + \text{Cl}_2(\text{g})$ (basic media) (4marks)
 - Complete the following equations
 - ${}_{27}^{59}\text{Co} + {}_0^1n \rightarrow {}_{25}^{56}\text{Mn} + ?$ (1 marks)
 - ${}_{92}^{238}\text{U} + ? \rightarrow {}_{99}^{246}\text{Es} + 6{}_0^1n$ (1marks)

Physical Chemistry Section

Some useful constants

$$R = 8.314 \text{ JK}^{-1}\text{mol}^{-1} = 0.08205 \text{ l atm K}^{-1} \text{ mol}^{-1}, 0^\circ\text{C} = 273 \text{ K},$$

$$E_{\text{Cu}^{2+}/\text{Cu}}^0 = +0.34\text{V}, E_{\text{Ag}^+/\text{Ag}}^0 = +0.80\text{V}$$

- Give mathematical expressions for the following gas laws. Define each symbols used
 - Boyles' law 2 mk
 - Van der Waals law 2 mk
 - Ideal gas equation 2 mk
- Calculate the pressure exerted by 1.00 mol of CO_2 gas when it is confined to a volume of 2.50 L at 298 K by using
 - The ideal gas equation 3 mks
 - The Van der Waals equation 3 mks
($a = 3.59 \text{ L}^2\text{atm mol}^{-2}$, $b = 0.0427 \text{ L mol}^{-1}$)

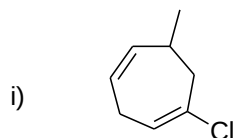
- c. Compare the two results and comment on the reason(s) for the difference between them **(2 mks)**
3. a) What would be the effects of increasing
- Pressure
 - Temperature
- On the following reactions? Explain your answer in each case
- i) $\text{N}_{2(g)} + 3\text{H}_{2(g)} = 2\text{NH}_{3(g)} \quad \Delta H = -5508 \text{ J}$ **(3 mks)**
- ii) $\text{H}_{2(g)} + \text{I}_{2(g)} = 2\text{HI}_{(g)} \quad \Delta H = +3204 \text{ J}$ **(3 mks)**
- b) On what principle do you base your arguments on the above? **1 mk**
4. Consider the cell made up of Cu/Cu^{2+} and Ag/Ag^+ electrodes
- Represent the cell on a linear diagram **3 mks**
 - Write the half cell and cell reactions **3 mks**
 - Determine the emf of the cell **3 mks**

Organic Chemistry Section

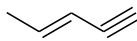
- Q1** (a) Write down the structures of all isomeric compounds with molecular formula $\text{C}_4\text{H}_9\text{OH}$. **[2 mks]**
- b) In 1934, Edward Doisy of Washing University extracted 300 *g* of hog ovaries to isolate few milligrams of pure estradiol, a potent female hormone. He burnt 5.00 *mg* of this precious sample in oxygen and found that 14.54 *mg* of CO_2 and 3.97 *mg* of H_2O were generated. Use $\text{C} = 12.01$, $\text{H} = 1.008$, $\text{O} = 15.99$ where necessary
- Calculate the amount of oxygen in *mg* in the sample **[2mks]**
 - Determine the empirical formula of estradiol **[2mks]**
 - If the molecular mass of estradiol was later found to be 272. What is the molecular formula estradiol **[2mks]**
 - What is the name of the instrument that was used to measure the molecular mass of estradiol? **[1mk]**

Q2. (a) Provide a systematic (IUPAC) name for each of the following compounds indicating the stereochemistry where appropriate

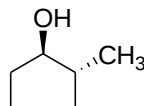
[5 mks]



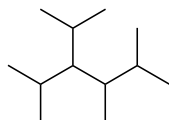
ii)



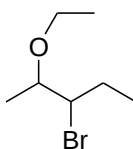
iii)



iv)



iv)



(b) Draw structures of each of the following indicating stereochemistry where appropriate.

[4 mks]

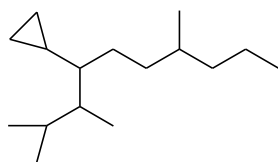
i) Trans-3-heptene

ii) 2-Bromohexa(2Z,4E)-diene

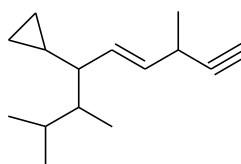
iii) 2-Methylpropene

iv) 1,4 -Difluorobut-2-yne

(c) Give any one simple visual chemical test you would perform to differentiate between the following pairs of compounds . Explain what happens in each case. [3 mks]



and



(b) Provide the structure(s) of the major organic compounds that are expected in the following reactions. Indicate the stereochemistry where necessary

[9 mks]

