KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: CHEM 211

COURSE TITLE: PHYSICAL INORGANIC CHEMISTRY

STREAM: SESSION III

DAY: MONDAY

TIME: 2.00 – 4.00 P.M

DATE: 29/11/2010

INSTRUCTIONS

- ➢ Attempt **ALL** questions

CONSTANTS TO BE USED
1. Wien's displacement constant and equals 2.90×10^{-3} m-K (meter-Kelvins)
2. Stefan Boltzmann constant = 5.6703×10^{-8} watt/m^2.K^4
3. Planks's constant = $6.62606896(33) \times 10^{-34}$ J·s

PLEASE TURN OVER

QUESTION ONE (20marks)

a) The quantum view of a black body radiation is superior to the classical one. Explain.

(4marks)

b) Discuss the main postulates of Bohrs' atomic theory. **(3marks)**

c) Explain the term photoelectric effect? Outline the laws of photoelectric emission.

(6marks)

d) Briefly discuss on the dual nature of light form de Broglie's concept **(3marks)**

e) State and explain the significance of all the four quantum numbers and hence show all the possible quantum numbers for an electron in the third energy level.

(4marks)

QUESTION TWO (20marks)

a) Light from the moon has maximum intensity for a wavelength $\lambda = 14 \times 10\~^{6}$ m. Use Wien's displacement law to calculate the temperature of the moon. **(4marks)**

b) An electromagnetic radiation of λ=242nm is just sufficient to ionize Na atom. Calculate the ionization energy of Na atom. **(4marks)**

c) Calculate the power emitted by an incandescent lamp with a dimension of 5cm by 2cm at a temperature of 300K. **(4marks)**

d) Calculate the minimum energy that can be used to excite an oscillator corresponding to a yellow light at frequency of 5.2×10^{4}Hz? **(5marks)**

e) Show that the peak of the blackbody radiation curve is given by **(3marks)**

$$\lambda_{peak} T = 2.898 \times 10^{-3} m \cdot K$$

QUESTION THREE   (15MARKS)

a) Explain the bond order of oxygen molecule suing the molecular orbital diagrams

(7marks)

b) The position of the Fermi level in relation to the conduction band is crucial factor in determining the electrical properties of solids. Explain this statement with reference to the energy bands of conductors, semiconductors and insulators. **(8marks)**

QUESTION FOUR (15MARKS)

(a) Any factor that increases the covalent character of a substance decreases its melting point. In reference to Fajan's rules discuss this statement.

(5marks)

(b) Deduce the shapes of the following molecules; BH_3 and PCl_5

(4marks)

(c) Using the following heats of reactions, calculate the energy of crystallization of NaCl.

H_{sub} of Na = 108 kJ/mol (Heat of sublimation)
D of Cl_2 = 244 (Bond dissociation energy)
IP of Na(g) = 496 (Ionization potential or energy)
EA of Cl(g) = -349 (Electron affinity of Cl)
H_f of NaCl = -411 (Enthalpy of formation) **(6marks)**