

EASTERN UNIVERSITY, SRI LANKA

FIRST YEAR FIRST SEMESTER EXAMINATION IN SCIENCE-2013/2014

(August 2015)

CH 101: PERIODICITY AND BONDING

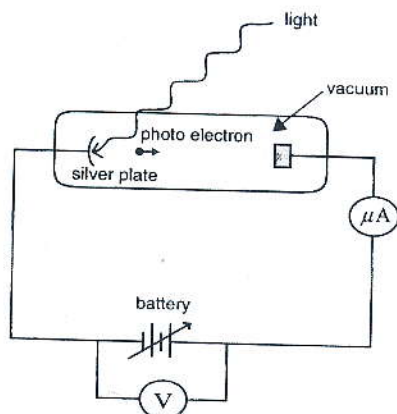
(Repeat)

Answer all questions

Time: one hour

Planck's constant (h) = 6.63×10^{-34} Js, Velocity of light (c) = 3×10^8 ms⁻¹, Mass of electron = 9.1×10^{-31} kg,
 $\epsilon_0 = 8.854 \times 10^{-12}$ C²N⁻²m⁻², $e = 1.602 \times 10^{-19}$ C, $1\text{eV} = 1.6 \times 10^{-19}$ J

1. The apparatus shown below was set up to investigate the photoelectric effect.



Using this apparatus it is found that light of wavelength 254 nm ejects photoelectrons from a silver plate. The work function of the silver surface is 4.7 eV.

- Define the terms work function and photoelectric effect.
- Calculate the energy, in eV, of a single photon of light of wavelength 254 nm.
- What is the kinetic energy, in eV, of the fastest moving photoelectrons ejected by light of 254 nm?
- What does Heisenberg's uncertainty principle say about an electron in an atom?
 - What are the orbitals associated with the principal quantum number $n = 3$?

(100 marks)

Cont...

2. a) What are the postulates of Bohr theory?

b) Identify the symbols in the following equation for Bohr theory.

$$\frac{1}{\lambda} = R \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

c) Calculate the ionization energy (KJmol^{-1}) of hydrogen atom using the following equation for Bohr theory.

$$E = E_i - E_f = R_E \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

where $R_E = 2.178 \times 10^{-18} \text{ J}$.

d) i) Draw a valence molecular orbital diagram for C_2 . Your diagram must include labeled atomic and molecular orbitals and include electrons in the appropriate orbitals.

ii) Clearly label the HOMO and LUMO in the above orbital diagram for C_2

iii) Calculate the bond order for C_2 .

iv) Find the Magnetic character of the species; C_2 , C_2^+ and C_2^-

e) Use the VSEPR model to predict the shape of the following molecules

i) Fluoromethane

ii) Sulfur hexafluoride

(100 marks)