



EASTERN UNIVERSITY, SRI LANKA

FIRST YEAR FIRST SEMESTER EXAMINATION IN SCIENCE-2015/2016

(AUGUST/SEPTEMBER'2017)

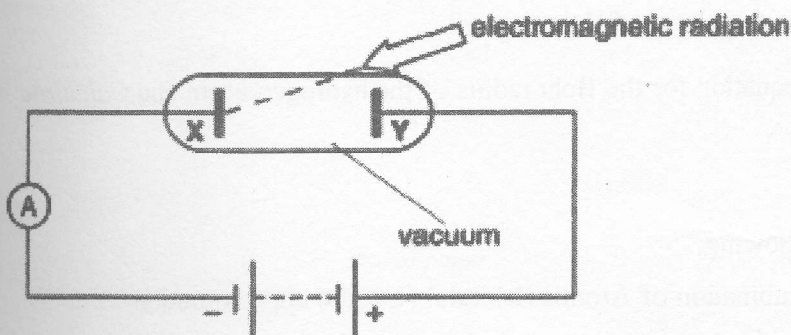
CH 101 Periodicity and Bonding

Answer all questions

Time: One Hour

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

a) The following figure shows an electrical circuit including a photocell



The photocell contains a metal plate X that is exposed to electromagnetic radiation and the positive electrode Y.

i) Name and describe the process by which the photoelectrons are released from the plate X by electromagnetic radiation.

ii) State what property of electromagnetic radiation is demonstrated by the photoelectric effect.

iii) Define each of the following terms

I) photon

II) threshold frequency

(20 marks)

contd...

b) The surface of sodium metal is exposed to electromagnetic radiation of wavelength  $6.5 \times 10^{-7} \text{ m}$ . This wavelength is the maximum for which photoelectrons are released.

i) Calculate the threshold frequency

ii) Show that the work function energy of the metal is  $1.9 \text{ eV}$ .

(20 marks)

c) For a particular wavelength of incident light, sodium releases photoelectrons. State how the rate of release of photoelectrons changes when the intensity of light is doubled.

(20 marks)

d) i) What are the postulates of Bohr theory?

ii) Derive an equation for the Bohr radius of the hydrogen atom and Calculate its radius.

(20 marks)

e) Explain the following:

i) Linear Combination of Atomic Orbitals' (LCAO) approximation

ii) de Broglie equation

(20 marks)

2 a) The following questions pertain to the nitric oxide (NO) molecule,

i) Draw the molecular orbital energy diagram for this molecule. Label all of the orbitals specifically.

ii) Write the molecular electron configuration for the molecule

iii) Indicate whether the species is paramagnetic or diamagnetic

iv) Determine the bond order for the molecule

v) Compare the relative stability of this molecule to  $\text{NO}^+$  and  $\text{NO}^-$

(30 marks)

contd...

b) Write the electron configuration of each of the following diatomic molecule and state whether it is diamagnetic or paramagnetic.



(20 marks)

c) What is the hybridisation of the atom B in  $\text{BF}_3$ ? Explain by using the orbital diagrams.

(20 marks)

d) What are the orbitals associated with the principal quantum number  $n = 3$ ?

(10 marks)

e) Write the Lewis structure of the following molecules and predict the shapes of the molecules using VSEPR theory.



(10 marks)

*End of paper*