

EASTERN UNIVERSITY, SRI LANKA

FIRST YEAR FIRST SEMESTER EXAMINATION IN SCIENCE-2012/2013

(Feb/March' 2015)

CH 101 PERIODICITY AND BONDING

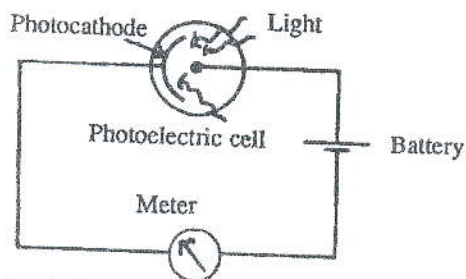
(Proper & Repeat)

Answer all questions

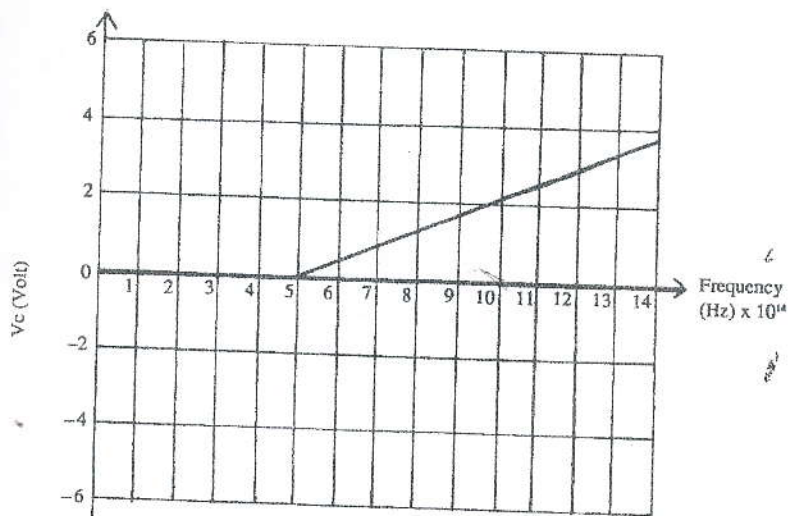
Time: one hour

Plank'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,
 $\epsilon_0 = 8.854 \times 10^{-12}$ $\text{C}^2\text{N}^2\text{m}^{-2}$, $e = 1.602 \times 10^{-19}$ C, $1\text{eV} = 1.6 \times 10^{-19}$ J

- 1 (a) The light meter of a particular camera consists of a circuit using a photoelectric cell as shown below.



The material of the photocathode has a cut-off potential versus frequency relationship as shown below.



- Define the terms work function and photoelectric effect.
- From this graph calculate the work function (in eV) of the cathode material.

Cont...

35

iii) What is the maximum kinetic energy (in eV) of an ejected electron when light of frequency 7.0×10^{14} Hz falls on the photocathode?

(40 marks)

(b) i) What are the postulates of Bohr theory?

ii) Describe how Bohr used line emission spectra to explain the existence of energy levels in atoms.

iii) Give reason(s) for why Bohr's atomic theory was updated?

(30 marks)

(c) What does Heisenberg's uncertainty principle say about an electron in an atom?

(10 marks)

(d) Calculate the energy of the states of the hydrogen atom with $n=2$ and $n=3$ and the wavelength of a photon when an electron makes a transition between these states.

(20 marks)

2 (a) i) Draw a valence molecular orbital diagram for F_2 . Your diagram must include labeled atomic, molecular orbitals and electrons in the appropriate orbitals.

(20 marks)

ii) Clearly label the HOMO and LUMO in the above orbital diagram for F_2

(10 marks)

iii) Calculate the bond order for F_2 .

(10 marks)

iv) Does the bond order change when an electron is removed from F_2 ? If so, justify your answer.

(20 marks)

v) Find the Magnetic character of the species; F_2 , F_2^+ and F_2^-

(15 marks)

(b) Write the four quantum numbers for each of eight electrons in oxygen atom in the ground state.

(15 marks)

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

i) H_2O

ii) NH_3

(10 marks)