



EASTERN UNIVERSITY, SRI LANKA

FIRST YEAR FIRST SEMESTER EXAMINATION IN SCIENCE-2014/2015

(AUGUST/SEPTEMBER' 2016)

CH 101 PERIODICITY AND BONDING

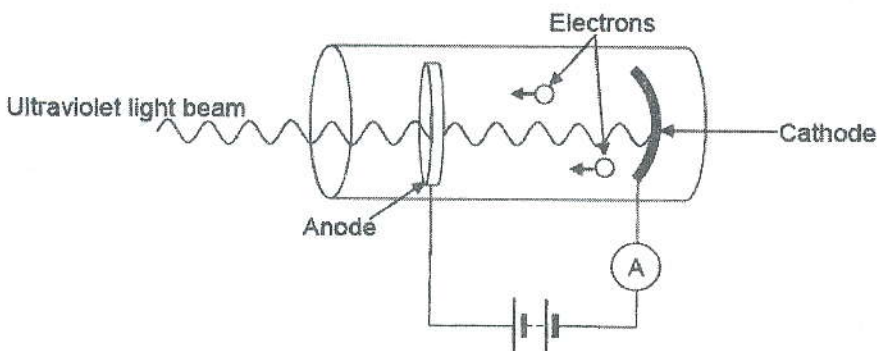
Answer all questions

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, $\epsilon_0 = 8.854 \times 10^{-12}$ C²N²m⁻², $e = 1.602 \times 10^{-19}$ C, $1\text{eV} = 1.6 \times 10^{-19}$ J

The photo-electric effect has many practical applications. A photocell, such as the one below used in burglar alarm systems.



Ultraviolet light of wavelength 100 nm is used to illuminate the photocell. When a person interrupts the ultraviolet beam, the sudden drop in current activates a switch, which sets off an alarm.

i) Define the terms 'threshold frequency', 'wave function' and 'photoelectric effect'.

ii) The work function of the metal used as a cathode in the photocell is 8.7×10^{-19} J.

Calculate the velocity at which the electrons are emitted.

iii) What conclusion about the nature of light is drawn from the photoelectric effect?

(30 marks)

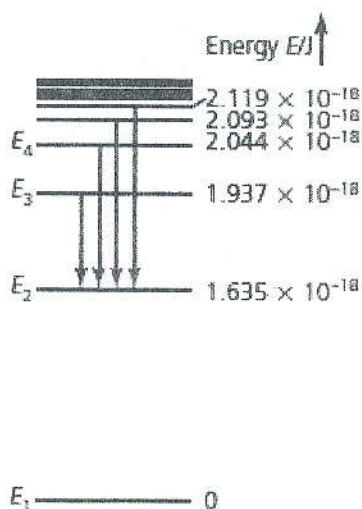
iv) What are the postulates of Bohr theory?

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

(30 marks)

Contd...

- c) Calculate the frequency of light emitted by a transition from level E_3 to level E_2 in the energy level diagram of some of transition for a hydrogen atom given below.



- d) Explain the following;

- Heisenberg's uncertainty principle
- Quantum numbers

- 2 a) i) What is meant by 'Linear Combination of Atomic Orbitals' (LCAO) approximation?

- Sketch the combination of atomic orbitals that produces the lowest-energy bonding sigma orbital of BeCl_2 in LCAO-MO theory.

- b) Using a Molecular Orbital (MO) energy level diagram, describe the bonding in HCl and give the electron configuration of its valence electrons.

- c) Using the valence-bond theory describes the bonding in CH_3^+ .

- d) i) What is meant by VSEPR theory?

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



End of paper