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 = 9.11×10^{-31} kg, ε_0= 8.854×10^{-12} C^2 N^{-1}m^{-2}, e = 1.602×10^{-19} C

1. (a) Selenium has a work function of 5.11 eV.

    (i) What frequency of light would just eject electron?

    (ii) Calculate the maximum Kinetic Energy of the ejected electrons.

    (iii) Calculate the maximum speed of the electrons by the wave length of 5×10^{-7} nm.

    (40 marks)

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

    (30 marks)

    (c) Calculate the energy of the states of the hydrogen atom with n= 3 and n=4 Calculate the wave length of a photon emitted by the atom when an electron makes a transition between these states.

    (30 marks)

2. (a) Explain the following with an example in each case.
    i)   Quantum numbers
    ii)   Photo electric effect

    (40 marks)

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

    (10 marks)

    (c) Draw the molecular orbital energy level diagram for O_2^+ and HF molecules and determine the following
    i)   Molecular orbital configurations
    ii)   Bond order
    iii)   Magnetic character
    iv)   Compare the bond length and bond strength

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    (50 marks)