***Photoelectric emission test***

***Attempt any 5***

***h=6.63 x 10-34JS***

***1eV=1.6 x 10-19J***

***Me=9.11 x 10-31Kg***

***C=3.0 x 108ms-1***

1) a) State the laws of photoelectric emission. ***(4marks)***

b) Define:

(i) A photon ***(1mark)***

(ii) Work function of a metal ***(1mark)***

c) A 100mW point source emits light of wave length 4.0 x 10-7m falls on caesium surface per second.

(i) The number of photons striking the caesium surface per second. (2.02E17)

***(5marks)***

(ii) The resulting photo – current if 70% of the photons emit photo electrons. (0.226A) ***(3marks)***

(iii) The maxium kinetic energy of the photoelectrons given that the work function of caesium is 2.15eV. (1.53E-19J) ***(3marks)***

d) Describe one application of photoelectric emission. ***(3marks)***

2. (a) State the characteristics of photo electric effect. (4marks)

(b) What is meant by the following?

(i) Threshold frequency? (1 mark)

(ii) Stopping potential? (1 mark)

(c) Explain how the wave theory and the quantum theory account for photo electric emission. (08 marks)

(c) Describe an experiment to measure the stopping potential for a given metal surface. (O6 marks)

1. (a) (i) Distinguish between thermionic emission and photoelectric emission

(2 marks)

(ii) Write down Einstein’s equation for the Kinetic energy of electrons due to photoelectric emission, defining the symbols used (1 mark)

1. Caesium has a work function of 1**.**98 eV. Find the stopping p**.**d when the metal is illuminated by light of wave length 4**.**5 x 10-7 m (0.781V) (4 marks)
2. Describe an experiement to demonstrate photo electric emission (05 marks)
3. Assuming that 10.0% of a 100-W light bulb’s energy output is in the visible range (typical for incandescent bulbs) with an average wavelength of 580 nm, calculate the number of visible photons emitted per second. (2.92E19) (04 marks)
4. Calculate the momentum of a visible photon that has a wavelength of 500 nm. (b) Find the velocity of an electron having the same momentum. (c) What is the energy of the electron, and how does it compare with the energy of the photon? (04 marks)

(4) (a) A clean zinc was placed on a plate of gold leaf electroscope and then irradiated with U-V light. Explain what will happen if;

(i) The Gold leaf was negatively charged.

(ii) The Gold leaf was positively charged.

(iii) The Gold leaf was neutral.

(iv) A glass is placed between the U-V source and zinc plate.

(v) Why was Zinc cleaned? (06 marks)

(b)(i) In an experiment on photoelectric effect, the following values of stopping potential were found at different frequencies. Use them to determine planks constant graphically. (05 marks)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Stopping potential (V) | 3.10 | 1.60 | 1.00 | 0.35 |
| Frequency x 105HZ | 1.20 | 0.84 | 0.70 | 0.55 |

(ii) When a light of 5.625 x 10-4m is incident on sodium metal, electrons of maximum kinetic energy 1.71 x 10-20J are emitted. If light of 4.5 x 10-7m is used, calculate maximum kinetic energy. (12.2E-20J) (04 marks)

(iii) a metal of work function 2.5eV is irradiated with light of unknown frequency. If maximum velocity was 1.14 x 106ms-1. Calculate its maximum wavelength. (2E-7m) (02 marks)

(c) Calculate the maximum speed of photoelectrons emmited by ceasium surface irradiated with light of wavelength 484nm and work function is 3 x 10-19J. (4.57E5ms-1) (03 marks)

(5) (A)(i) violet light of 0.4µm is incident on a metal surface of threshold wavelength 0.65µm. calculate maximum speed of electrons. (6.48E5ms-1) (04 marks)

(ii) When light of wave length 450nm falls on a certain metal, electrons of maximum kinetic energy 0.76eV are emmited. Find the threshold frequency of the metal. (4.83E14Hz)

(b) A 100mW beam of light of wave length 4.0 x 10-7m falls on ceasium surface of a photocell

(i) How many electrons are emmitedd by the surface per second? (2.02E17)

(ii) If 65% of the photons emit photoelectrons, find the resulting photocurrent. (0.021A)

(iii) Kinetic energy of each photon if work function is 2.20eV. (1.43E-19J)

(c)(i) Ultra violet light of 3.3 x 10-8m is incident on a metal of work function of 3.5eV, calculate maximum speed of photoelectrons. (3.46E6ms-1)

(ii) A metal whose work function is 4eV is illuminated by light of wavelength 4 x 10-7m, calculate threshold frequency, maximum energy and stopping potential of the metal. (9.653E14Hz, 1.43E-19J, 0.894V).

(d) Sodium has a work function of 2.0eV. What is the maximum energy and speed of emmited electrons when illuminated with 150nm. What is threshold frequency? (4.85E14Hz)

ALL ARE EQUAL IN THEIR IGNORANCE