Problems of Photoelectric effect

1) The work function of beryllium is 4.98 eV. We expose the metal to photons with a wavelength of 164 nm. Determine:

a) Maximum threshold wavelength (in nm) of photons to produce photoelectric effect.

b) Maximum kinetic energy (in eV) of the electrons that are emitted.

c) Maximum speed (in m/s) of the emitted electrons.

Data: $h = 6.6261\times10^{-34}$ J·s, $c = 3\times10^{8}$ m/s, $m_e = 9.109\times10^{-31}$ kg, 1 eV = 1.6022×10^{-19} J.

Answer: **a)** 249 nm, **b)** 2.59 eV, **c)** 9.54×10^{5} m/s.

2) We expose calcium to an electromagnetic radiation to emit electrons (photoelectric effect) with a maximum kinetic energy of 0.66 eV. The maximum threshold wavelength of this metal is 432 nm. Calculate:

a) Wavelength (in nm) of the incident photons.

b) Energy (in eV) of each incident photon.

c) Work function (in eV).

Data: $h = 6.6261\times10^{-34}$ J·s, $c = 3\times10^{8}$ m/s, $m_e = 9.109\times10^{-31}$ kg, 1 eV = 1.6022×10^{-19} J.

Answer: **a)** 351 nm, **b)** 3.53 eV, **c)** 2.87 eV.

3) The work function of caesium is 3.43×10^{-19} J. When caesium is exposed to electromagnetic radiation the emitted electrons have a maximum kinetic energy of 0.64 eV. Calculate:

a) Maximum threshold wavelength (in nm) of photons to produce photoelectric effect.

b) Wavelength (in nm) of the incident photons.

c) The De Broglie wavelength of the electrons that are emitted.

Data: $h = 6.6261\times10^{-34}$ J·s, $c = 3\times10^{8}$ m/s, $m_e = 9.109\times10^{-31}$ kg, 1 eV = 1.6022×10^{-19} J.

Answer: **a)** 580 nm, **b)** 447 nm, **c)** 1.538 nm.

4) We expose a sheet of potassium to light with a wavelength of 368 nm. The maximum threshold wavelength of this metal is 542 nm. Determine:

a) Minimum threshold frequency (in Hz).

b) Maximum speed (in m/s) of the emitted electrons.

c) The De Broglie wavelength of the electrons that are emitted.

Data: $h = 6.6261\times10^{-34}$ J·s, $c = 3\times10^{8}$ m/s, $m_e = 9.109\times10^{-31}$ kg, 1 eV = 1.6022×10^{-19} J.

Answer: **a)** 5.54×10^{14} Hz, **b)** 6.17×10^{5} m/s, **c)** 1.179 nm.

Problems of Photoelectric effect

5) A sample of gold is exposed to an electromagnetic radiation and the emitted electrons have a maximum speed of 7.60×10^{5} m/s. The work function of gold is 5.1 eV. Determine:

a) Maximum threshold wavelength (in nm) of photons to produce photoelectric effect.

b) Minimum threshold frequency (in Hz).

c) Wavelength (in nm) of the incident photons.

Data: $h = 6.6261\times10^{-34}$ J·s, $c = 3\times10^{8}$ m/s, $m_e = 9.109\times10^{-31}$ kg, 1 eV = 1.6022×10^{-19} J.

Answer: **a)** 243 nm, **b)** 1.23×10^{15} Hz, **c)** 184 nm.

6) We expose a sheet of copper to light with a wavelength of 142 nm. The emitted electrons have a maximum kinetic energy of 4.04 eV. Determine:

a) Maximum threshold wavelength (in nm) of photons to produce photoelectric effect.

b) Work function (in joules).

c) The De Broglie wavelength of the electrons that are emitted.

Data: $h = 6.6261\times10^{-34}$ J·s, $c = 3\times10^{8}$ m/s, $m_e = 9.109\times10^{-31}$ kg, 1 eV = 1.6022×10^{-19} J.

Answer: **a)** 264 nm, **b)** 7.53×10^{-19} J, **c)** 0.6104 nm.