



Physics 30 Unit C: EMR

The Photoelectric Effect WS

Name: Key!

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Use the diagram below to answer the following questions.

- Examine the **Physics Principles** on your formula sheet. What physics principles are needed to understand the photoelectric effect?

Conservation of Energy

- Explain how to calculate the energy of the photons (1) incident on the photoelectric metal.

Either: $E = hf$ or $E = \frac{hc}{\lambda}$
 Units of h depend on units given in question.

- Explain the role of varying the wavelength (2) of the photons. State the wavelength range that typically produces photoelectrons (give the name and the numerical value).

Decreasing λ increases photon energy. Typically, photons with energies green and higher produce electrons (about 550nm)

- Explain how to calculate the energy lost by the photons to the metal (3).

This is called work function

$$W = h f_0 \leftarrow \begin{matrix} \text{threshold} \\ \text{frequency} \end{matrix}$$

- Explain how to calculate the kinetic energy in the photoelectrons (4).

Either: $E_{kmax} = q U_{stop}$ or $E_k = \frac{1}{2} m v^2$
 charge of electron $\rightarrow q$ stopping voltage $\rightarrow U_{stop}$

- Justify the use of an ammeter (5) in the photoelectric effect apparatus.

The ammeter allows the experimenter to know whether electrons are produced or not.

- Justify the use of a voltage source (6) and the cathode and anode in the photoelectric effect apparatus.

The voltage source varies the electric field that creates the electric force that stops the electrons.

The voltage source creates the stopping voltage.

