

## Photoelectric Effect

- What is meant by 'photoelectric emission' from a metal surface?
  - Explain why photoelectric emission from a metal surface only takes place if the frequency of the incident radiation is greater than a certain value.
- Calculate the frequency and energy of a photon of wavelength:  
i) 450 nm      ii) 1500 nm
  - A metal surface at zero potential emits electrons from its surface if light of wavelength 450 nm is directed at it, but not if light of wavelength 650 nm is used. Explain these observations.

- Use the table of work functions to answer the following questions.

Metal	Work Function (eV)
Caesium	1.4
Potassium	2.2
Sodium	2.3
Zinc	4.2
Iron	4.5
Silver	4.7

- Which of the metals will emit electrons in visible light?
  - Which of these metals has the greatest threshold frequency?
  - Will any of the metals emit electrons when exposed to infrared radiation ( $\lambda > 700$  nm)?
  - What is the maximum kinetic energy of electrons emitted from the surface of zinc when it is illuminated by electromagnetic radiation of wavelength 300 nm?
  - What stopping voltage would be needed to prevent electrons emitted from a sodium electrode from reaching a copper electrode if the sodium is illuminated with a light of wavelength 500 nm?
- What stopping voltage must be applied to a photocell with a potassium emitter if it is illuminated by light of wavelength 350 nm?
  - What is the maximum velocity of electrons emitted from the surface of caesium when it is illuminated by ultraviolet light of wavelength 380 nm? Will all the emitted electrons have this velocity? Explain your answer.

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6. Light of wavelength 635 nm is directed at a metal plate at zero potential. Electrons are emitted from the plate with a maximum kinetic energy of  $1.5 \times 10^{-19}$  J. Calculate:
- the energy of a photon at this wavelength.
  - the work function of the metal.
  - the threshold frequency of electromagnetic radiation incident on this metal.

$$h = 6.63 \times 10^{-34} \text{ J s}, c = 3.00 \times 10^8 \text{ m s}^{-1}$$