

# THE PHOTOELECTRIC EFFECT

## Essential info

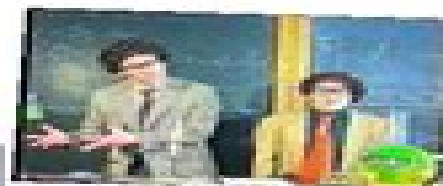
$$hf = \phi + E_{k, \max}$$

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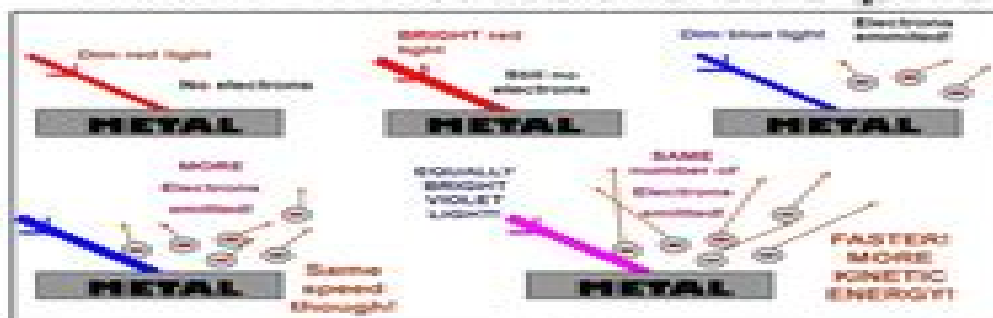
$$E = hf$$

$$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$$

$$h = 6.63 \times 10^{-34} \text{ Js}$$



## TASK 1: What is the photoelectric effect?



Different colours of light are shone on to a metal surface. The **number** of electrons emitted from the surface and their **maximum velocity** is observed.

1. Explain the observations to the left using the **photon model of light**. Use the terms "**threshold frequency**" and "**work function**" in your answers.
2. Why can't the **wave model of light** explain these observations?

## TASK 2: Photoelectric Questions!

1. The **threshold frequency** of caesium metal is  $4.7 \times 10^{14} \text{ Hz}$ . This is in the red (visible light) section of the electromagnetic spectrum.
  - a) Explain what the above information tells us about caesium metal with respect to the **photoelectric effect**.
  - b) Calculate the **work function** of caesium metal i) in joules ii) in electron volts.
  - c) Explain if electrons will be emitted when the following types of light are shone onto the caesium metal.
    - i) infrared light is shone onto caesium.
    - ii) ultraviolet light is shone on to caesium.
    - iii) very high intensity infrared light.
    - iv) low intensity green light.
    - v) visible light of frequency  $7 \times 10^{14} \text{ Hz}$ .
    - vi) high intensity light of wavelength  $7.4 \times 10^{-7} \text{ m}$ .
2. Copper metal has a **work function** of 4.84 eV.
  - a) Calculate the **threshold frequency** of copper?
  - b) Will red light cause electrons to be emitted from this metal? (Think!)
  - c) What type of light must be shone on to this metal in order to cause electrons to be emitted?

# Photoelectric Effect Gizmo Worksheet

**Lajos Jánossy**

A red circular graphic with a gradient, appearing as a semi-circle or a partial circle, located to the right of the name Lajos Jánossy.

## Photoelectric Effect Gizmo Worksheet:

The Photoelectric Effect Karl Taylor Compton, Owen Willans Richardson, 1913      Photoelectric Effect M. Doss, R. D. Masterton, 1983      **Photoelectric Effect Revisited** Donald W. Boys, 1978      **THE PHOTOELECTRIC EFFECT.** K. A. Yumatov, FARADAY TRANSLATIONS NEW YORK., 1944      Experiments on the Photoelectric Effect and on the Diffusion of Electrons in Gases E. M. Didwall, C. J. Rigby, G. McClellan, 1977      The Photoelectric Effect Owen Willans Richardson, F. J. Rogers, 1915      *Photoelectric Effect* M. Doss, 1983      The Photoelectric Effect, by Leigh Page ... Leigh Page,      *Element of Time in the Photoelectric Effect* Ernest Orlando Lawrence, Jesse Wakefield Beams, 1928      Theory of the Photoelectric Effect M. E. Rose, Lawrence C. Biedenharn (Physicist, United States), 1954      *L'effet Thermionique Et la Photoélectricité* Lee Alvin DuBridge, 1935      The Element of Time in the Photoelectric Effect Charles Erwin Tyler, 1969      *The Influence of Gases on the Photoelectric Effect* William F. Radle, 1929      The Photoelectric Effect of Phosphorescent Material Chester A. Butman, 1912      **Remark on the Theory of the Photoelectric Effect** Lajos Jánossy, 1975

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