Photoelectric Effect

Talk to a Teacher
http://spoken-tutorial.org
National Mission on Education through ICT
http://sakshat.ac.in

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Learning Objectives

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We will learn,

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We will learn,

- **How to use Interactive PhET simulation, Photoelectric Effect**

Pre-requisites

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- **Learners should be familiar with topics in High School Science**

System Requirement

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- **Ubuntu Linux OS v 14.04**

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- **Java v 1.7.0**

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- **Ubuntu Linux OS v 14.04**
- **Java v 1.7.0**
- **Firefox Web Browser v 53.02.2**

Learning Goals

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- **Study Photoelectric Effect**

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- **Study Photoelectric Effect**
- **Determine Threshold Frequency**

Learning Goals

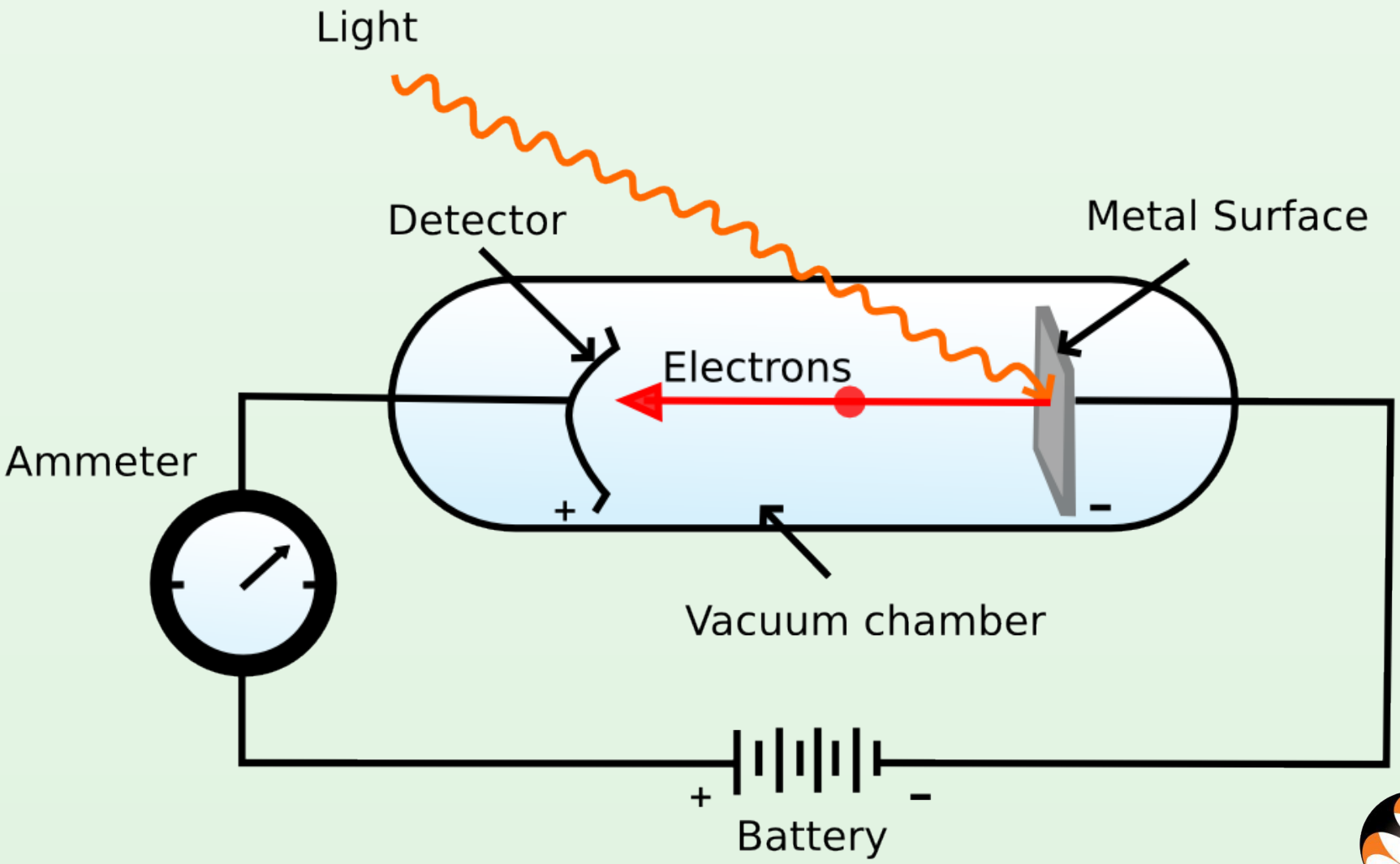
- Study Photoelectric Effect
- Determine Threshold Frequency
- Find Stopping Potential and Work Function

Learning Goals

- Study **Photoelectric Effect**
- Determine **Threshold Frequency**
- Find **Stopping Potential** and **Work Function**
- **Study the factors affecting current and energy of electrons**

Photoelectric Effect

Photoelectric Effect



Link For PhET Simulation

Link For PhET Simulation

http://phet.colorado.edu

Threshold Frequency

Threshold Frequency

- **Each metal has a characteristic minimum frequency to cause photoelectric emission**

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- **This frequency is, Threshold Frequency, denoted by ν_0**

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- **Each metal has a characteristic minimum frequency to cause photoelectric emission**
- **This frequency is, Threshold Frequency, denoted by ν_0**
- **Below the ν_0, Photoelectric Effect is not observed**

Threshold Frequency For Sodium

Threshold Frequency For Sodium

$$539nm = 539 * 10^{-9}m$$
$$c = \nu * \lambda$$
$$\nu = c/\lambda$$
$$\nu = (3 * 10^{8}\, m/s)/(539 * 10^{-9}m)$$
$$\nu = 0.56 * 10^{15}hz$$

Assignment

Assignment

As an assignment,

1. **Calculate the Threshold Frequency of platinum**

Work Function

Work Function

- **Work Function is minimum amount of energy necessary to start photoelectric emission**

Work Function

- **Work Function is minimum amount of energy necessary to start photoelectric emission**
- **Different metals have different values of Work Function**

Work Function

- **Work Function is minimum amount of energy necessary to start photoelectric emission**
- **Different metals have different values of Work Function**
- **It is denoted by Φ_0**

Work Function

Work Function

- **Work Function is given by $\Phi_0 = h\nu_0$**

Work Function

- **Work Function is given by $\Phi_0 = h\nu_0$**
- **Elements with low Ionization enthalpy values have low work function**

Work Function

- **Work Function** is given by $\Phi_0 = h\nu_0$
- Elements with low Ionization enthalpy values have low work function
- Example - Li, Na, K, Rb, and Cs

Work Function For Sodium

Work Function For Sodium

For Sodium,

$$\nu_0 = 0.56 * 10^{15} hz$$

$$w_0 = h\nu_0$$

$$w_0 = 6.626 * 10^{-34} * 0.56 * 10^{15}$$

$$w_0 = 3.711 * 10^{-19} J$$

$$w_0 = 3.711 * 10^{-19} / 1.6021 * 10^{-19}$$

$$w_0 = 2.31\, eV$$

Work Function For Calcium

Work Function For Calcium

For Calcium,

$$\nu_0 = 0.703 * 10^{15} hz$$

$$w_0 = h\nu_0$$

$$w_0 = 6.626 * 10^{-34} * 0.703 * 10^{15}$$

$$w_0 = 4.66 * 10^{-19} J$$

$$w_0 = 4.66 * 10^{-19} / 1.6021 * 10^{-19}$$

$$w_0 = 2.9\, eV$$

Stopping Potential

Stopping Potential

- **It is a negative voltage required to stop electrons from reaching the other side**

Stopping Potential

- It is a negative voltage required to stop electrons from reaching the other side
- At Stopping Potential, photoelectric current becomes zero

Assignment

Assignment

As an assignment,

1. **Calculate the Work Function for Zinc, Copper and Calcium**
2. **Determine the Stopping Potential for the same metals**

Summary

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We have learnt about,

Summary

We have learnt about,

- **Photoelectric Effect, PhET simulation**

Summary

Using this simulation we have learnt,

- About Photoelectric Effect
- To determine Threshold Frequency
- To find Stopping Potential and Work Function and
- Study the factors affecting current and energy of electrons

About the Spoken Tutorial Project

- **Watch the video available at http://spoken-tutorial.org /What_is_a_Spoken_Tutorial**
- **It summarises the Spoken Tutorial project**

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- **Gives certificates to those who pass an online test**
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Forum for specific questions

- Do you have questions in THIS Spoken Tutorial?
- Please visit

  http://forums.spoken-tutorial.org
- Choose the minute and second where you have the question
- Explain your question briefly
- Someone from our team will answer them

Acknowledgements

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- More information on this Mission is available at

http://spoken-tutorial.org/NMEICT-Intro