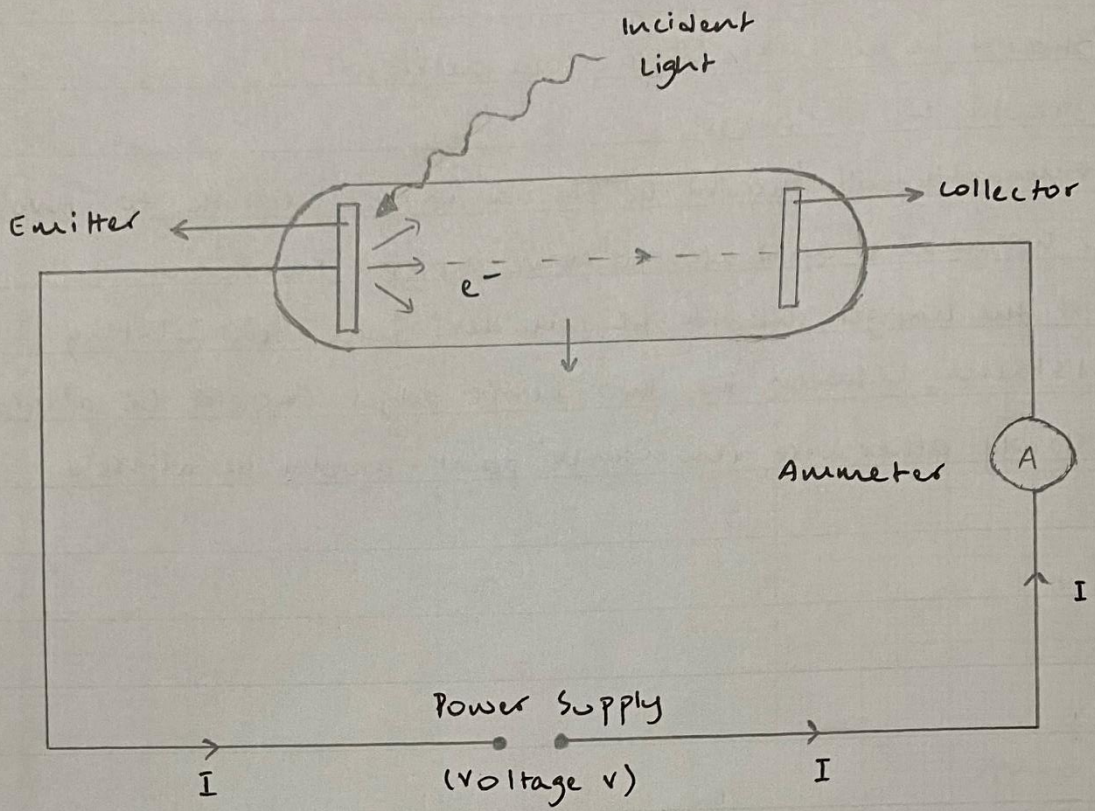



Figure 1: Photoelectric effect current measurement circuit diagram

| Metal | Work Function (eV) |
|---|---|
| Pt | 6.4 |
| Ag | 4.7 |
| Na | 2.3 |
| K | 2.2 |
| Cs | 1.9 |

Table 2.1 : Metals and their corresponding work functions.

Date 9/3/22

Expt. No. 2

Page No. 6

# Photoelectric Effect

## Aim:

To study the photoelectric effect and stopping voltage.

## Student learning Objectives:

Determination of Plancks constant
Determination of 'work function' of given metal
study of photo electric effect

## Apparatus Required:

Plancks constant measuring instrument and filters for light.

## Theory:

Hertz noticed a spark between two metallic balls when a high frequency radiation is incident on it. This is called photoelectric effect. Photoelectric effect is the emission of electrons when electromagnetic radiation having sufficient frequency is incident on certain metal surfaces. We call the emitted electrons as photoelectrons and the current they carry as photocurrent. The phenomenon was first observed by Heinrich Hertz in 1880, and explained by Albert Einstein in 1905 using Max Plancks quantum theory of light. As the first experiment which demonstrated the quantum theory of energy levels, photoelectric effect experiment is of great importance today.

It was been observed that there must be a minimum energy needed for electrons to escape from a particular metal surface

Teacher's Signature

| S. No. | Incident Photon wavelength (nm) | Frequency ($\times 10^{14}$ Hz) | Stopping Potential (V) |
|---|---|---|---|
| 1 | 460 | 6.52 | -0.98 |
| 2 | 500 | 6.00 | -0.75 |
| 3 | 540 | 5.56 | -0.66 |
| 4 | 570 | 5.26 | -0.51 |
| 5 | 635 | 4.72 | -0.32 |

Table 2.2: observation table from readings and for graph

and is called work function 'w' for that metal. The work function can be expressed in terms of frequency as:

$$w = h\nu_0$$

where h is the Planck's constant and $\nu_0$ is the threshold frequency (minimum frequency for photoelectric effect).

**Observations:**

Readings tabulated in table 2.2.

**Calculations:**

Slope from graph = $3.16 \times 10^{-15}$ V.s

y-intercept = $-1.35$ V

$\frac{h}{e}$ = gradient and $-\frac{w}{e}$ = y-intercept

$\therefore h = 5.056 \times 10^{-34}$

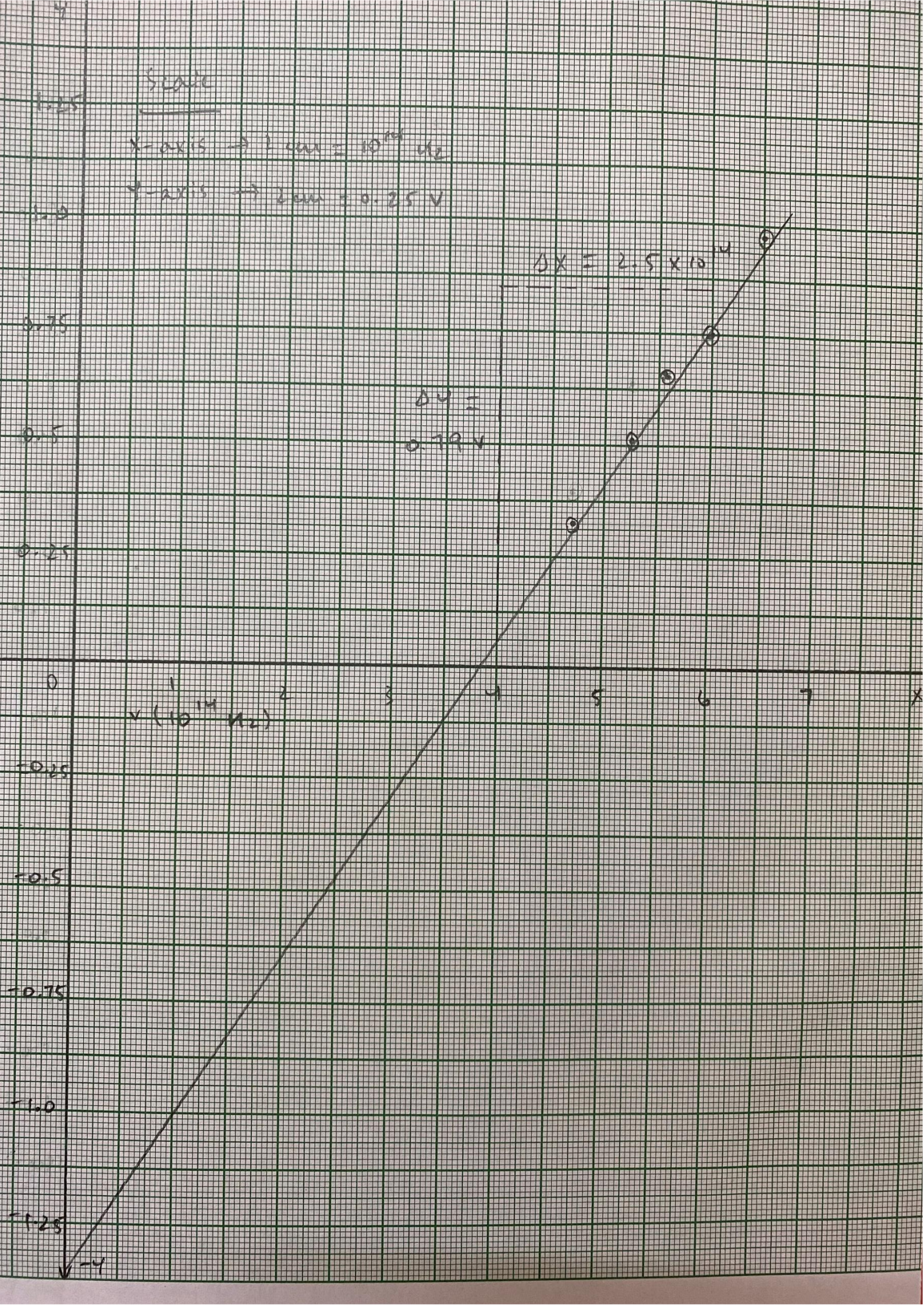
$w = 1.35$ eV

**Result:**

Work-function of the given metal = 1.35 eV

Planck's constant = $5.056 \times 10^{-34}$ J.s

Teacher's Signature _____


Scale
X-axis → 1 cm = $10^{14}$ Hz
Y-axis → 1 cm = 0.25 V
ΔX = $2.5 \times 10^{14}$
ΔV = 0.19 V
1.25
1.0
0.75
0.5
0.25
0
-0.25
-0.5
-0.75
-1.0
-1.25
-4
1
2
3
4
5
6
7
X
$\nu$ ($10^{14}$ Hz)