3055 BA SANGAM COLLEGE

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WORKSHEET 22

SCHOOL:BA SANGAM COLLEGE YEAR 12

SUBJECT: PHYSICS NAME OF STUDENT: _____

STRAND	*ATOMIC PHYSICS*
SUB-STRAND	*RADIOACTIVITY*
Content Learning Outcome	Apply ideas about the photoelectric effect to different situations in a variety of contexts

PHOTOELECTRIC EFFECT

Definitions:

Retarding / Stopping potential / Cut-off voltage (V_{co})

The potential applied to a photocell whereby the current in the circuit becomes zero. At this potential the electrons leaving the emitter plate have zero kinetic energy.

Threshold frequency (f_o)

The minimum frequency of light needed for photoelectric effect to occur.

Threshold wavelength (λo)

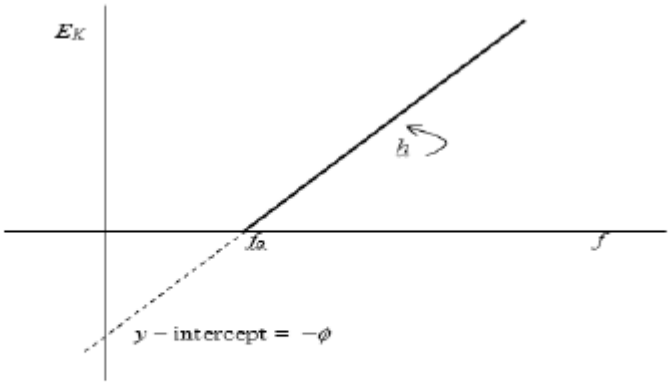
The maximum wavelength of light needed for photoelectric effect to occur.

Work function (ϕ)

The amount of energy needed for a photoelectron to eject from the metal surface.

At threshold frequency or wavelength the following relation can be used: $c = f_o \lambda_o$

A graph of ***kinetic energy*** (E_K) against ***frequency*** (f) of incident light in a photoelectric set-up.



Analysing the Einstein's equation we get: $E_K = hf - \phi$

Which corresponds to the linear equation $y = mx + c$

It can also be deduced that the *x – intercept* is the threshold frequency (f_o).

Two other relations can be obtained are:

$\phi = hf_o$ and $E_K = eV_{co}$

In photoelectric effect the unit of energy used is called the ***electron-volt*** (*eV*)

$1\ eV = 1.602 \times 10^{-19}$ J , $1\ J = \frac{1}{1.602 \times 10^{-19} eV} = 6.24 \times 10^{18}$ eV.

Example
A radioactive material emits photons, each having energy of 1.6×10^{-13} J.

(A). Calculate the frequency of the electromagnetic radiation emitted by the radioactive material.

$E = hf$
$f = E/h$
$= (1.6 \times 10^{-13}\ J)/(6.63 \times 10^{-34})$
$= 241.33\ H_z$

(B). Calculate the wavelength of the electromagnetic radiation.

$c = f\lambda$
$\lambda = c/f$
$= 3 \times 10^{8}/241.33$
$= 1.26 \times 10^{6}\ m$

Exercise:

What is the energy of one quantum of 5.0×10^{14} Hz light?

(2 Marks)

What is the lowest frequency of light that can cause the release of electrons from a metal that has a work function of 2.8 eV?

(2 Marks)

THE END