First Name:_____   Last Name:_____

L15 – FQ – Photoelectric Effect 1

Q1: In the photoelectric effect the kinetic energy of emitted electrons is determined by the __freq.__ of the incident light, and the number of emitted electrons is determined by the __intensity__ of the incident light.

↓
Number of photons where each one "knocks off" an electron.

	Kinetic energy of emitted electrons is determined by:	Number of emitted electrons is determined by:
A.	Frequency	Frequency
B.	Frequency	Intensity
C.	Intensity	Frequency
D.	Intensity	Intensity

(B is circled)

Q2: An incident photon of wavelength 450nm is incident on a Sodium surface with a work function of 2.28eV. Determine the kinetic energy of the emitted electrons, measured in electronvolts.

*(Record you **three-digit** answer in the numerical response boxes below.)*
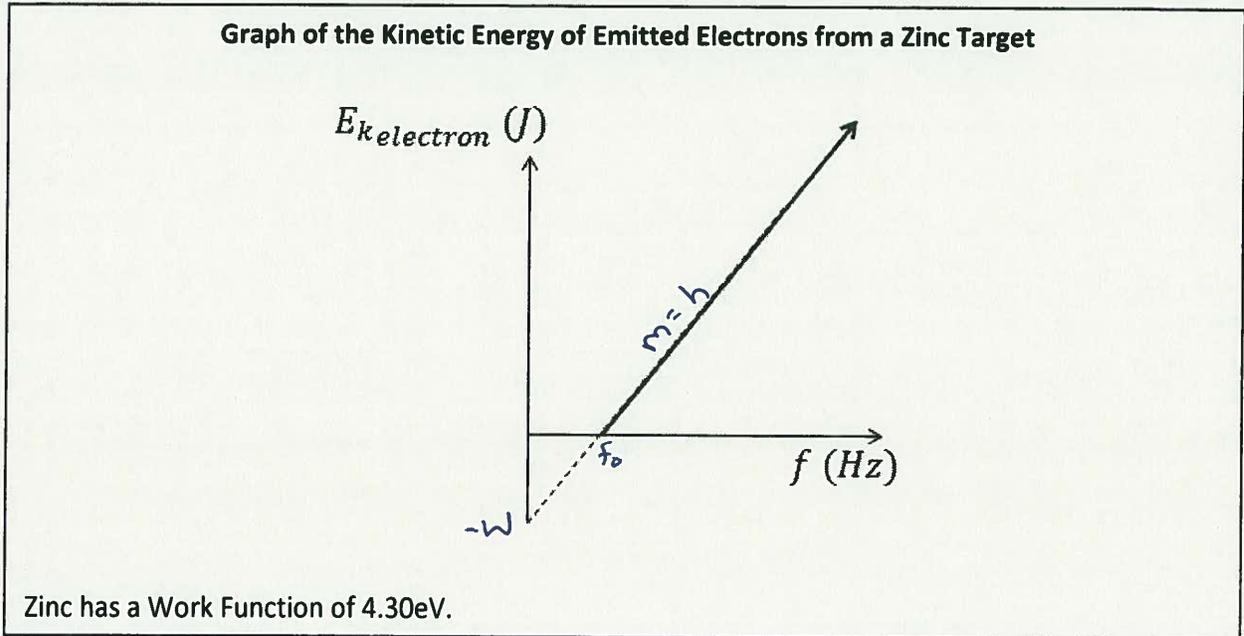
0	.	4	8

$$E_{photon} = W + E_{k\,electron}$$

$$\frac{hc}{\lambda} = W + E_k$$

$$\frac{(4.14 \times 10^{-15}\ eVs)(3 \times 10^8\ m/s)}{(450 \times 10^{-9}\ m)} = 2.28eV + E_k$$

$$2.76 = 2.28 + E_k$$

$$E_k = 0.48eV$$

Use the following information to answer Q3 and Q4:

Graph of the Kinetic Energy of Emitted Electrons from a Zinc Target

Zinc has a Work Function of 4.30eV.

Q3: The slope of this graph is $a.b \times 10^{-cd}$ Js, where $a, b, c,$ and d are ____, ____, ____, and ____.

*(Record you **four-digit** answer in the numerical response boxes below.)*

6	6	3	4

Slope = Plank's constant

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

$m \approx 6.6 \times 10^{-34}$

Q4: The threshold frequency of the incident photons required for electron emission from a zinc target is $a.b \times 10^{cd}$ Hz, where $a, b, c,$ and d are ____, ____, ____, and ____.

*(Record you **four-digit** answer in the numerical response boxes below.)*

1	0	1	5

$W = h f_0$

$4.30 eV = (4.14 \times 10^{-15} eVs) f_0$

$f_0 = 1.0386... \times 10^{15}$ Hz

$f_0 = 1.0 \times 10^{15}$ Hz

Low T
Large λ
RMIVUXG
$\downarrow$
ROY G. BIV
750nm   400nm

High $\uparrow$
Small λ

Q5: The energy of a single red photon is

    a. 2.65×10^{-28} J
    b. 4.97×10^{-28} J
    (c.) 2.65×10^{-19} J
    d. 4.97×10^{-19} J

$$E = \frac{hc}{\lambda}$$

$$E = \frac{(6.63 \times 10^{-34})(3.0 \times 10^{8})}{(750 \times 10^{-9})}$$

$$E = 2.652 \times 10^{-19} \text{ J}$$

Use the following information to answer Q6:

White light is shown through a double-slit apparatus (Diagram #1) and a glass prism (Diagram #2).

Diagram #1   *Diagram #2*

1 Blue

2 Red

...but Diffraction is Different

3 Red

4 Blue

Blue bends better...

In both cases, a rainbow spectrum appears.

Q6: The locations of **blue** and **red** light can be identified using the numbers given above.

Direction:	1	2	4	3
Force:	Location of blue light in Diagram #1	Location of red light in Diagram #1	Location of blue light in Diagram #2	Location of red light in Diagram #2

*(Record your **four digit** answer in the Numerical Response boxes below)*

1	2	4	3

MARKING:

Beginning	0.0 – 2.5
Progressing	3.0 – 4.0
Competent	4.5 – 5.5
Exemplary	6.0