Answer on Question #50773 – Physics – Nuclear Physics

1. When the electromagnetic radiation of frequency 4*10^15 Hz and 6*10^15 Hz fall on a same metal in different experiment, the ratio of the maximum kinetic energy of electron liberated 1:3. What is the threshold frequency for the metal?

$\nu_1 = 4\cdot 10^{15}\, GHz$ $\nu_2 = 6\cdot 10^{15}\, GHz$ $E_1 : E_2 = 1:3$	*Solution.* According to the law of the photoelectric effect, $h\nu_1 = A + E_1, \quad h\nu_2 = A + E_2,$ where A is the work function for the given metal, E_1, E_2 are maximum kinetic energies of a photoelectron.
$\nu_{th} - ?$	

After subtracting one can get that

$$h\nu_1 - h\nu_2 = E_1 - E_2, \quad h(\nu_1 - \nu_2) = E_1 - E_1/3, \quad E_1 = \frac{3h}{2}(\nu_1 - \nu_2).$$

The work function is $A = h\nu_1 - E_1 = h\nu_1 - \frac{3h}{2}(\nu_1 - \nu_2) = \frac{h}{2}(3\nu_2 - \nu_1).$

For the threshold frequency, $h\nu_{th} = A.$

Thus, the threshold frequency for the metal is $\nu_{th} = \frac{A}{h}, \boxed{\nu_{th} = \frac{3\nu_2 - \nu_1}{2}}.$

Let check the dimension: $[\nu_{th}] = GHz.$

Let evaluate the quantity: $\nu_{th} = \frac{3\cdot 6\cdot 10^{15} - 4\cdot 10^{15}}{2} = 7\cdot 10^{15}\,(GHz).$

Answer: $7\cdot 10^{15}\, GHz.$