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10/10

Best Reason to Rebel _____

Show your work, circle your answers, and use sig figs to receive full credit.

1. What is the frequency of a 2.0 m radio wave? (1.5×10^8 Hz)

$$v = f\lambda$$

$$(3E8) = f(2)$$

$$f = 150000000 \approx \boxed{1.5E8 \text{ Hz}}$$

2. What is the energy in electron volts of a 150 nm photon? (8.3 eV)

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

$$= \frac{(6.626E-34)(3E8)}{150E-9} = \frac{1.9878E-18}{1.5E-7} = 1.3252E-11 \text{ J}$$

$$= \frac{1.3252E-11}{1.602E-19} = 8.272 \text{ eV} \approx \boxed{8.3 \text{ eV}}$$

3. 400. nm light ejects photo-electrons from a metal that have a stopping potential of 1.17 V. What is the work function of the metal in electron volts? (1.93 eV)

$$\frac{hc}{\lambda} = W_0 + eVs$$

$$\frac{(6.626E-34)(3E8)}{400E-9} = W_0 + (1.17)(1.602E-19)$$

$$W_0 = \frac{3.09914E-19}{1.602E-19} = \boxed{1.93 \text{ eV}}$$

4. How fast must an alpha particle ($m = 6.64 \times 10^{-27}$ kg) go to get within 5.0×10^{-15} m of an Iron nucleus ($Z = 26$)
(2.69×10^7 m/s)

$$\frac{1}{2}m_\alpha v_\alpha^2 = q_\alpha \left(\frac{kqQ}{r} \right)$$

$$v_\alpha = \sqrt{\frac{2(26)(k)(24e)}{(5E-15)(6.644E-27)}}$$

$$= \boxed{2.69E7 \text{ m/s}}$$

5. What is the velocity of an electron with a wavelength of 12 nm? (6.1×10^4 m/s)

$$p = \frac{h}{\lambda}$$

$$p = mv$$

$$mv = \frac{h}{\lambda}$$

$$v = \frac{(6.626E-34)(3E8)}{12E-9} = \frac{1.9878E-18}{12E-9} = 1.6565E-10 \text{ J}$$

$$v = \frac{1.6565E-10}{9.109E-31} \approx \boxed{6.00E4 \text{ m/s}}$$