Q- The maximum kinetic energy of photoelectrons is 2.8 eV. When the wavelength of the light is increased by 50%, the maximum energy decreases by 1.3 eV. What are the following quantities?

(a) The work function of the cathode

The Einstein's equation for photoelectric emission is

$$\frac{hc}{\lambda} - \phi = K.E.$$

For the first case

$$\frac{hc}{\lambda} - \phi = 2.8 * 1.6 * 10^{-19} \quad \text{---------- (1)}$$

As in the second case the wavelength increases by 50% means become 3λ/2 hence we get

$$\frac{2hc}{3\lambda} - \phi = 1.3 * 1.6 * 10^{-19} \quad \text{---------- (2)}$$

Multiplying equation (2) by 3/2 and subtraction from (1) we get

$$\frac{1}{2}\phi = (2.8 - 1.5 * 1.3) * 1.6 * 10^{-19}$$

Or $\phi = 0.85 * 1.6 * 10^{-19} J = 0.85\ eV$

(b) The initial wavelength

Substituting the value of work function in equation (1) we get

$$\frac{6.63*10^{-34}*3*10^{8}}{\lambda} = (2.8 + 0.85) * 1.6 * 10^{-19}$$

Gives $\lambda = \frac{6.63*10^{-34}*3*10^{8}}{(2.8+0.85)*1.6*10^{-19}} = 3.41 * 10^{-7} = 341\ nm$