

PROBLEM 8 (KRAVE 33)

If $V_s = 0.65 \text{ V}$ WHERE $\lambda_1 = 4.2 \cdot 10^2 \Rightarrow K_{max} = 0.65 \text{ eV}$

+ $V_s = 1.69 \text{ V}$ WHERE $\lambda_2 = 3.1 \cdot 10^2 \text{ nm} \Rightarrow K_{max} = 1.69 \text{ eV}$

WE CAN WRITE A SYSTEM OF TWO EQUATIONS
WITH h + ϕ UNKNOWN AS FOLLOWS:

(Equation 3.23)

$$\begin{cases} 0.65 \text{ eV} = hf_1 - \phi = \frac{hc}{\lambda_1} - \phi \\ 1.69 \text{ eV} = hf_2 - \phi = \frac{hc}{\lambda_2} - \phi \end{cases}$$

$$\Rightarrow 0.65 \text{ eV} + 1.69 \text{ eV} = hc \left(\frac{1}{\lambda_1} + \frac{1}{\lambda_2} \right)$$

$$\Rightarrow \underline{h} = \frac{0.65 \text{ eV} + 1.69 \text{ eV}}{c \left(\frac{1}{\lambda_1} + \frac{1}{\lambda_2} \right)} = \frac{-1.041 \cdot 1.6 \cdot 10^{-19} \text{ J}}{2.998 \cdot 10^8 \text{ s}^{-1} \left(\frac{1}{4.2 \cdot 10^{-7} \text{ m}} + \frac{1}{3.1 \cdot 10^{-7} \text{ m}} \right)} = \boxed{6.57 \cdot 10^{-34} \text{ J.s}}$$

$$\Rightarrow \underline{\phi} = \frac{hc}{\lambda_2} + 1.69 \text{ eV} = \frac{(6.57 \cdot 10^{-34} \text{ J.s}) \cdot (2.998 \cdot 10^8 \text{ s}^{-1})}{3.1 \cdot 10^{-7} \text{ m}} + 1.69 \text{ eV}$$

$$= 6.35 \cdot 10^{-19} \text{ J} + 1.69 \text{ eV}$$

$$= \frac{6.35}{1.6} \text{ eV} + 1.69 \text{ eV} = \boxed{2.28 \text{ eV}}$$

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In[39]:= NSolve[ x * Exp[x] * (Exp[x] - 1) ^ -1 - 5 == 0, x, Reals]
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Out[39]= {{x -> 4.96511}}
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