

Answer on Question #53705 - Chemistry - General Chemistry

Question:

The binding energy of electrons in a metal is 177 kJ/mol. Find the threshold frequency of the metal.

Answer:

The binding energy is essentially the workfunction of the metal, the energy it takes to bring a bound electron to the surface of the metal. So $W = h \cdot f$, where f is the frequency, W is the binding energy (or workfunction) and h is Planck's constant. First, we need to convert 177 kJ/mol to J. To do this, we divide our value of the binding energy by Avogadro's number (cancels mol.) and then multiply by 1000 (to convert kJ to J).

$$1. 177\text{kJ/mol} / 6,023 \cdot 10^{23}\text{mol}^{-1} = 2.94 \cdot 10^{-23}\text{kJ}$$

$$2. 2.94 \cdot 10^{-23}\text{kJ} \cdot 1000 = 2.94 \cdot 10^{-20}\text{J}$$

After this, the equation is rearranged to $f = W/h$

$$f = 2.94 \cdot 10^{-20}\text{J} / 6.63 \cdot 10^{-34}\text{J} \cdot \text{sec} = 4.4 \cdot 10^{13}\text{sec}^{-1}$$

Answer: $4.4 \cdot 10^{13}\text{sec}^{-1}$