

(1) The carton containing a 50-watt light bulb promises an output of 900 lumens and a life of 750 hours. Is this bulb destined to emit as much as one mole of photons during its life?

One watt in the form of photons of wavelength 5500 Å is equivalent to 680 lumens. That was on our “One-page Handbook” in January, but you don’t need that number for a rough calculation if you happen to remember that the efficiency of an ordinary tungsten bulb in producing light is around two percent. The 50-W bulb will be emitting roughly 1 W worth of visible photons. In 750 hours, at 3×10^{-17} J/photon, that will amount to 10^{23} photons, somewhat less than one mole. But some possibly larger fraction of the 50 W will be emitted as infrared photons. I am unable to say whether this will raise the total by an order of magnitude, so I cannot confidently answer the question as posed. It would have been better to ask about visible photons only.