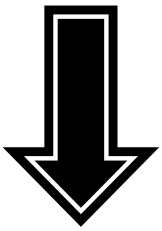
Problem-solving Example 7

When minerals absorb invisible UV light from mercury lamp, they emit visible light of a longer λ, converting the remaining energy to heat. How much energy per mole is converted to heat by a mineral that absorb UV light at 450 nm and emits green light at 535 nm?

Solution



Solution :

$E_{photon\ (UV\ light)}$ (absorbed) $= \frac{hc}{\lambda} = \frac{(6.626 \times 10^{-34}\ Js)(2.998 \times 10^{8}\ ms^{-1})}{(450 \times 10^{-9}\ m)}$

$= 4.4 \times 10^{-19}\ J\,photon^{-1}$

$E_{photon\ (green\ light)}$ (emission) $= \frac{hc}{\lambda} = \frac{(6.626 \times 10^{-34}\ Js)(2.998 \times 10^{8}\ ms^{-1})}{(535 \times 10^{-9})\ m}$

$= 3.7 \times 10^{-19}\ J\,photon^{-1}$

$\therefore$ Energy converted to heat $= (4.4 \times 10^{-19}) - (3.7 \times 10^{-19}) = 7.0 \times 10^{-20}\ J\,photon^{-1}$

$= (7.0 \times 10^{-20})(6.022 \times 10^{23}) = 4.2 \times 10^{4}\ J\,mole^{-1}$ (Ans)

(6.022×10^{23} ↖ Avogadro No.)

Prepared by
V.Manoharan
vmano@usm.my
manovv1955@yahoo.com
04-6533888 ext 3566