NRich Problem Rudolf Otto Rice

→ Bacteria double every 30 mins
→ Molecule of light half every 10 mins.
→ Molecule of light are produced every min.

Starting from 1 bacteria we have 24 hours to get 10^{11} molecules of light in every ml.

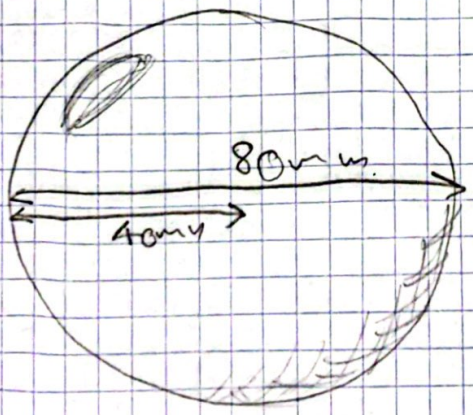
$$1mm^3 = 0.001ml$$

After the 24 hours there will be 2^{48} bacteria so $2.814749767 \times 10^{14}$

$2.814... \div 10^{11} = 2814.749767$

~~2814.~~ $2815 \times 15 = 42225$

We must get ~~10^{11}~~ 8.04×10^{13} molecules of light



~~$4\pi \times (40)^3$~~

Volume

$\frac{4}{3}\pi \times (40^3) = 256000\pi\ mm^3$

$256000\pi\ mm^3 \rightarrow 256\pi\ ml$

$804247.719 = 804.247719$

$2.814 \times 10^{14} \div 2 = 1.407 \times 10^{14}$

Half hour before the end

$1.407 \times 10^{14} \times 30 = 4.221 \times 10^{15}$

$4.221 \times 10^{15} \div 8 = 5.27625 \times 10^{14}$

Divide for the half life.

$5.27625 \times 10^{14} > 8.04 \times 10^{13}$, therefore Rudolphs nose will shine.

8.04×10^{2} is the volume when assuming the nose has diameter of 80mm