Answer on Question#58590 – Chemistry – Organic chemistry

Question: assuming that the earths radius is 6378Km and that a molecule of a benzene may be treated as a disc of radius 300 pm, calculate the mass of benzene needed to create a chain of molecules around the equator?

Solution:

$r(\text{Earth}) = 6378 \, \text{km} = 6378 \cdot 10^3 \text{m}$

$c(\text{Earth}) = 2\pi r(\text{Earth}) = 2 \cdot 3.14 \cdot 6378 \cdot 10^3 \text{m} = 40053.84 \cdot 10^3 \text{ m}$

r(benzene) = 300 pm = $300 \cdot 10^{-12}$ m

d(benzene) = 2r(benzene) = 600 pm = $600 \cdot 10^{-12}$ m

$N(C_6H_6) = \dfrac{r(\text{Earth})}{r(\text{benzene})} = \dfrac{40053.84 \cdot 10^3 \text{ m}}{600 \cdot 10^{-12} \text{ m}} = 66.75 \cdot 10^{15}$

$m(C_6H_6) = \dfrac{N(C_6H_6) \cdot M(C_6H_6)}{N_A} = \dfrac{66.75 \cdot 10^{15} \cdot 78 \frac{g}{mol}}{6.02 \cdot 10^{23} \, mol^{-1}} = 864.9 \cdot 10^{-8} \, g = 8.65 \cdot 10^{-6} \, g = 8.65 \mu g$

Answer: 8.65µg