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Team Rocket - Poke'Balls - Coit Tower

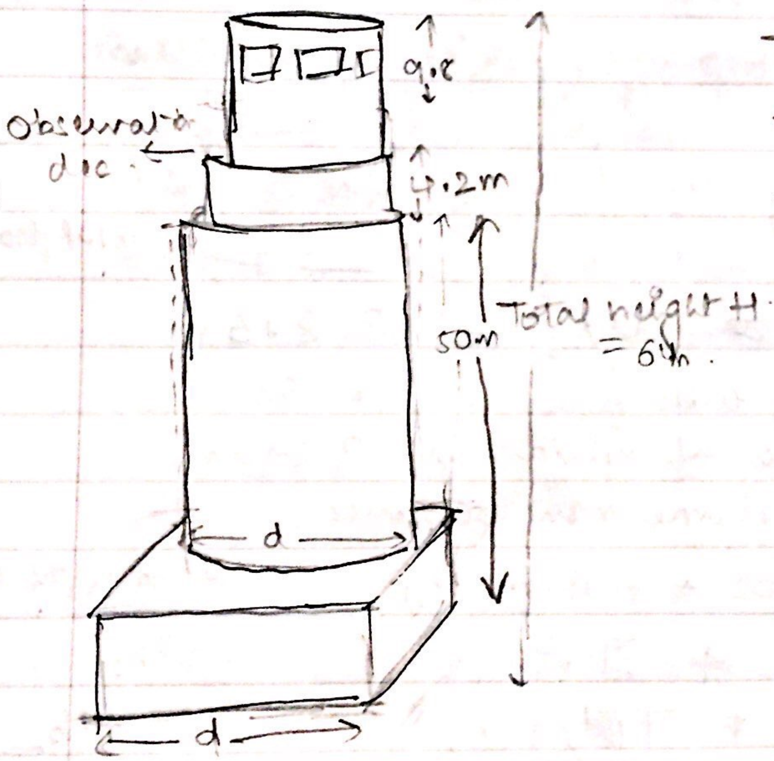
Step 1 **Structure of Coit Tower:**

From pictures and description searched from internet structure of Coit Tower:

→ Three nesting cylinder, outermost a tapering

→ Observation deck, an arcade & skylight

⇒ ground floor.



Total height (H) = 64m.

Height occupied = 54.2m.

floor above ground 13.

observation deck = 9.8 m below the top.

To calculate capacity or volume of tower

= capacity of ground floor (cube) + capacity of first cylinder + capacity of second cylinder

donot include top cylinder as it is open floor thus cannot contain poke balls

Assumptions

Even though, actual coit tower, first tower from ground is tapering, we are considering it right angle cylinder.

We are assuming ratio of first & second cylinder radius equal to one. Therefore radius are same for both cylinder.

Let consider ground floor cube with side equal diameter of cylinder $h_1 = 2r_1$

Third cylinder can hold poke balls as it open space.

Calculating height of ground floor.

As found from internet

Total floor = 13

height till top of first cylinder = 50 m.

$\therefore$ height of each floor = Total height / Total floor.

$= 50/13 = 3.846$ m.

$\therefore$ height of cubic floor = 3.846 m.

$\therefore$ diameter of cylinder = 3.846 m

radius " = 1.923 m.

Total volume = Volume of cube + vol of cylinder1 + vol of c_2.

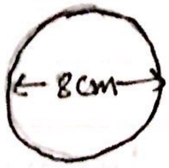
$= (\text{side})^3 + \pi r^2 h_1 + \pi r^2 h_2$.

$= (3.846)^3 + \pi (1.923)^2 \times 50 + \pi (1.923)^2 \times 4.2$

$= 791.790 \text{ m}^3$

step 2

Pokeball dimensions as searched from internet



diameter = 8 cm

= .08 m

radius = $.08/2$ m = .04 m

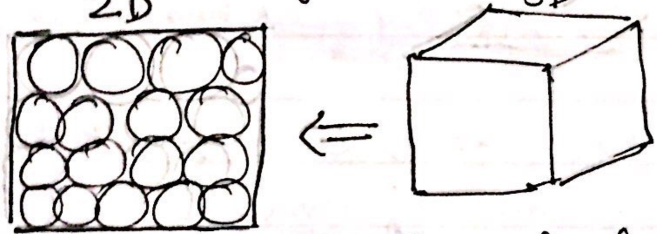
volume of pokeball = $\frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \pi \, (.04)^3 = 2.6 \times 10^{-5} \, m^3$

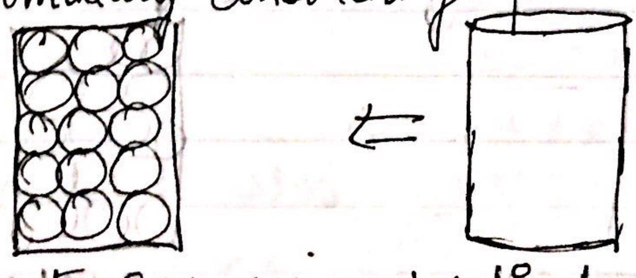
step 2 Calculate number of pokeball in Tower

For optimal packing, consider 2D view of base and cylinder

2D 3D



Similarly considering optimal packing for cylinder.



rectangle mapping of cylinder.

Using Kepler conjecture, average density of packing = $\frac{\pi}{3\sqrt{2}}$

and maximum packing density cannot exceed
= 74.048 percent.

∴ In ideal condition, when poke ball fills entire volume of coit tower.

number of balls = $\dfrac{\text{Total volume of tower}}{\text{volume of ball}}$

$= \dfrac{791.790 \text{ m}^3}{2.6 \times 10^{-5} \text{ m}^3}$

$= 30460384.615$

≈ 30460384 balls.

Taking packing density in consideration, ~~numb.~~

number of balls = $\dfrac{\text{Total volume of tower}}{\text{volume of ball}} \times \dfrac{\pi}{3\sqrt{2}}$

$= \dfrac{791.790}{2.6 \times 10^{-5}} \times \dfrac{\pi}{3\sqrt{2}}$

$= 30460384.615 \times \dfrac{\pi}{3\sqrt{2}}$.

$= 22540684.6$ ~~balls~~.

≈ 22540684 balls.