DAY 8

In this section, we shall discuss problems related to water flow. Here **given water flow is considered as height or length** in given time then we shall solve sums like in previous. Lets discuss some problems.

1. **A hemispherical tank full of water is emptied by a pipe at the rate of $3\frac{4}{7}$ $litres$ per second. How much time will it take to empty half the tank, if it is 3 m in diameter.**

[Example 11]

Sol:- Diameter of hemispherical tank $= 3m$ So radius of tank $(r) = \frac{3}{2}m$

Volume of water in the tank $= \frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} = \frac{99}{14}\ m^3$

Now Volume of water in half tank $= \frac{1}{2} \times \frac{99}{14} = \frac{99}{28}m^3 = \mathbf{\frac{99}{28} \times 1000\ litres}$

Given rate of water in pipe $= 3\frac{4}{7}$ litres per second

$i.e.$ In one second, Volume of water in pipe $= 3\frac{4}{7}$ litres $= \frac{25}{7}$ litres

So time taken to empty the tank $= \frac{\text{Volume of water in half tank}}{\text{Volume of water in pipe}}$ **seconds**

$= \frac{\frac{99000}{28}}{\frac{25}{7}} = \frac{99000}{28} \times \frac{7}{25} = 990$ Seconds $= \frac{990}{60}$ minutes $= 16.5$ minutes

Hence pipe emptied half tank in 16.5 minutes.

2. **Water in a canal, 6 m wide and 1.5 m deep is flowing with a speed of 10 km/h. How much area will it irrigate in 30 minutes if 8 cm of standing water is required?**

[Ex 13.3, Q8]

Sol:- Width of the canal $= 6\ m$, Depth of the canal $= 1.5\ m$
and flow of water $= 10\ km/h = 10000m/h$

[Speed of water is taken as length of the canal]

$\therefore$ In 1 hour, Volume of water flows out of the canal $= lbh$

$= 6 \times 1.5 \times 10000 = 90000\ m^3$

$\Rightarrow$ In 30 minutes, Volume of water flows out $= \frac{1}{2} \times 90000 = 45000\ m^3$

Now For irrigation, Height (Standing Water) required in field $(h) = 8\ cm = \frac{8}{100}m$

Given Condition:

In 30 minutes, Volume of water in canal = Volume of water in field with height 8cm

$\Rightarrow 45000 =$ (**Area for irrigation**) $\times h$

$\Rightarrow 45000 =$ (Area for irrigation) $\times \frac{8}{100}$

$\Rightarrow$ (Area for irrigation) $= \frac{45000 \times 100}{8} =$ **562500 m^2**

3. A farmer connects a pipe of internal diameter 20 cm from a canal into a cylindrical tank in her field, which is 10 m in diameter and 2 m deep. If water flows through the pipe at the rate of 3 km/h, in how much time will the tank be filled? [Ex 13.3, Q9]

Sol:- Diameter of cylindrical tank $= 10\ m$ So radius (R) $= 5\ m$ and height (H) $= 2m$

Diameter of the pipe $= 20\ cm$ so radius$(r) = 10cm = \frac{10}{100} = \frac{1}{10}m$

and flows of water in pipe $= 3km/h$

$i.e.$ In 1 hour, length(height) of the water $(h) = 3\ km = 3000m$

According to given condition: In some time, pipe will fill the tank.

$$\textbf{Time taken} = \frac{\textbf{Volume of water in tank}}{\textbf{Volume of water in pipe}}\ \textbf{hours}$$

$$= \frac{\pi R^2 H}{\pi r^2 h} = \frac{R^2 H}{r^2 h} = \frac{5\times5\times2}{\frac{1}{10}\times\frac{1}{10}\times3000} = \frac{5}{3}\ \text{hours} = 1\ h\ 40\ minutes$$

Hence pipe filled tank in 1 hour 40 minutes.