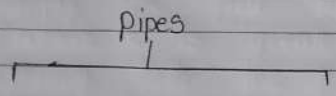
Unit - 4

Word problems

1) pipes and cistern
2) problems on Trains
3) Boats and stream
4) Aligation or mixture

★ Pipes and Cistern



Inlet ↓ — Inside / Reserve water

Outlet ↑ — Outside / open tap

4. Inlet
A pipe connected with a tank or a cisterns or reservoir that fills it is known as Inlet.
↓
Reserve / Inside

2. Outlet
A pipe connected with a tank or cistern or a reservoir emptying is known as outlet.

Outside
↑

Notes

1. If a pipe can filled a tank in a x hours then a part filled in 1 hour $= \frac{1}{x}$

2. If a pipe can filled a tank it can empty a full tank in 4 hour, then part empty in 1 hour $= \frac{1}{4}$.

3. If a pipe can filled a tank in x hours and another pipe can empty be full tank in y hours (where y is greater then x), on opening both the pipes the next part in 1 hour $= \frac{1}{x} + \frac{1}{y}$.

4. If a pipe can filled a tank in x hours and another pipe can empty the full tank in y hours (where x is greater then y), on opening both the pipes then next part is empty 1 hour $= \frac{1}{y} - \frac{1}{x}$

Examples :

$$\boxed{1 \text{ hour} = \frac{1}{x}}$$

- If a pipe can filled a tank in 'n' hours then in 1 hours it will filled $\frac{1}{n}$ part.

Q.1) If a pipe takes 6 hours to fill a tank 12 litre completely then in 1 hour it will filled ?

$$\boxed{1 \text{ hour} = \frac{1^{th}}{n} \text{ part}}$$

$$\therefore \frac{1}{n} = \frac{1}{6}$$

$$= \frac{12}{6}$$

$$= 2 \text{ litre}$$

∴ A pipe takes 6 hour to fill a tank 12 litre completely then in 1 hour It will filled 2 litre.

Examples :-

$$y \text{ hour} = \frac{y}{y} \text{ hours}$$

If a pipe can empty a tank in n hours in y hours it will empty $\frac{1}{n}^{th}$ part.

Q.) If a pipe takes 6 hours to empty a tank completely send off 18 litre in 1 hour it will empty $\frac{1}{6}^{th}$ of the ~~part~~ of tank.

$$y \text{ hour} = \frac{y}{n}^{th} \text{ part}$$

Soln ∴ n = 6 hour
Tank = 18 litre

$$\frac{y}{n} = \frac{1}{6}^{th} \text{ part}$$

$$= \frac{18}{6}$$
$$= 3 \text{ litre}$$

∴ A pipe takes 6 hours to empty a tank completely send off 18 litre in ~~One~~ 1 hour then it will empty $\frac{1}{6}^{th}$ of the tank send off 3 litre.

~~to~~ of tank.

Examples :-

$$\frac{1}{\text{hour}} = \frac{1}{x} + \frac{1}{y}$$

If a pipe can empty a tank in n hours in 1 hour it will empty $\frac{1}{n}$ part.

Q.1) If a pipe takes 6 hours to empty a tank completely

Q.2) Two pipes 'A' and 'B' can fill a tank separately in 12 hours and 16 hours respectively. If both of them are opened together when the tank is initially empty, how much time will it take to completely fill the tank?

Soln :- part of tank filled by pipe 'A' in one hour working alone $= \frac{1}{x} = \frac{1}{12}$

Before Soln

Note :
'A' = 12 hours
'B' = 16 hours
empty = ?
time = ? completely fill

∴ part of tank filled by pipe 'B' in 1 hour working alone $= \frac{1}{16}$

⇒ part of tank filled by pipe 'A' and pipe 'B' in one hour together = A + B

$$A + B = \frac{1}{12} + \frac{1}{16}$$

$$= \frac{16 + 12}{192}$$

$$= \frac{28}{192}$$

$$\boxed{A + B = \frac{7}{48}}$$

∴ Therefore, time taken to completely fill the tank If both 'A' and 'B' work together = 13 hour
7)

∴ (where y is greater then x)

Q.2) pipe 'A' can fill a tank in 30 hours and pipe 'B' in 45 hours. If both the pipes are opened in an empty tank How much time will they take to fill it.

Sol^n Let,
'A' = 30 hour
'B' = 45 hour
Empty
Time = ? completely fill a tank

∴ pipe A in 1 hour = $\frac{1}{x} = \frac{1}{30}$ part

∴ pipe B in 1 hour = $\frac{1}{y} = \frac{1}{45}$ hour

$$A + B = \frac{1}{x} + \frac{1}{y}$$

$$\therefore A + B = \frac{1}{30} + \frac{1}{45}$$

$$= \frac{45 + 30}{1350}$$

$= \frac{75}{1350}$ ... (divide by 15)

$= \frac{5}{90}$ ... (divide by 5)

$= \frac{1}{18}$ hour

$\therefore$ Therefor, time taken to complete fill the tank If both A and B work together = 18 hour.

Note: $\frac{4}{x} \rightarrow \frac{x}{18}$

$= 18$ hour

Examples:

$\frac{1}{x}$ hour $= \frac{1}{y} - \frac{1}{x}$

Q.1) A pipe cistern can be filled by a tank pipes A and B in x hour and 6 hours respectively, when 'c' the cistern can be emptied by 'c' in 8 hours. If all the pipes worn turn off at the same time, in How much time will the cistern can filled.

~~Not part fill in 1 hour~~ $= \frac{1}{x}$

$\therefore$ A pipe cistern can be filled by a tank pipe A $= \frac{1}{4}$ hour

$\therefore$ A pipe cistern can be filled by a tank pipe B $= \frac{1}{6}$ hour

~~Not part fill in 1 hour~~ $= \frac{1}{4} \frac{1}{6}$

∴ the cistern can be emptied by C in $= \frac{1}{8}$ hours

Net part fill in $= \left[\left(\frac{1}{A} + \frac{1}{B}\right) - \frac{1}{C}\right]$
1 hour

$= \left(\frac{1}{4} + \frac{1}{6}\right) - \frac{1}{8}$

$= \left(\frac{6+4}{24}\right) - \frac{1}{8}$

$= \frac{(6+4)}{24} - \frac{1}{8}$

$= \frac{10}{24} - \frac{1}{8}$ ... (div

$= \frac{5}{12} - \frac{1}{8}$

$= \frac{40 - 12}{96}$

$= \frac{28}{96}$

Net part fill in 1 hour $= \frac{7}{24}$

∴ Therefore Time will the cistermed can filled is $\frac{7}{24}$ hour $= 3\frac{3}{7}$ hour

i.e = 3 3/7 hour

Q.2) Two pipes fill cistemed in 14 hours and 16 hours respectively the pipes are opened simultaneously and it is found that due to leakage in the bottom it took 32 minutes more to fill cistemed when a cistern full in a what time will leak empty it?

Sol: ∴ work done by two pipes in 1 hour $= \frac{1}{14} + \frac{1}{16}$ hour

$= \frac{16+14}{14\times16}$

$= \frac{30}{224}$ .... (divide by 2)

hours $= \frac{15}{112}$

∴ Therefore, Time taken by these pipes to fill the tank $= \frac{15}{112}$ hour

Notes :-

$7\frac{1}{2}$

$15h = \frac{15}{2}$

$= \frac{7\times2+1}{2}$

$15h = \frac{14+1}{2}$

∴ = 7 hours 28 minutes

∴ due to leakage time take is 7 hours
28 min + 32 min
= 7 hours 60 minutes
= 8 hour

Therefore, work done by 2 pipes + leak in 1 hour $= \frac{1}{8}$

∴ Work done by a leak in 1 hour $= \frac{15}{112} - \frac{1}{8}$

$= \frac{120-112}{896}$

$= \frac{8}{896}$ (divide by 8)

∴ work done by a leak $= \frac{1}{112}$ in 1 hour.