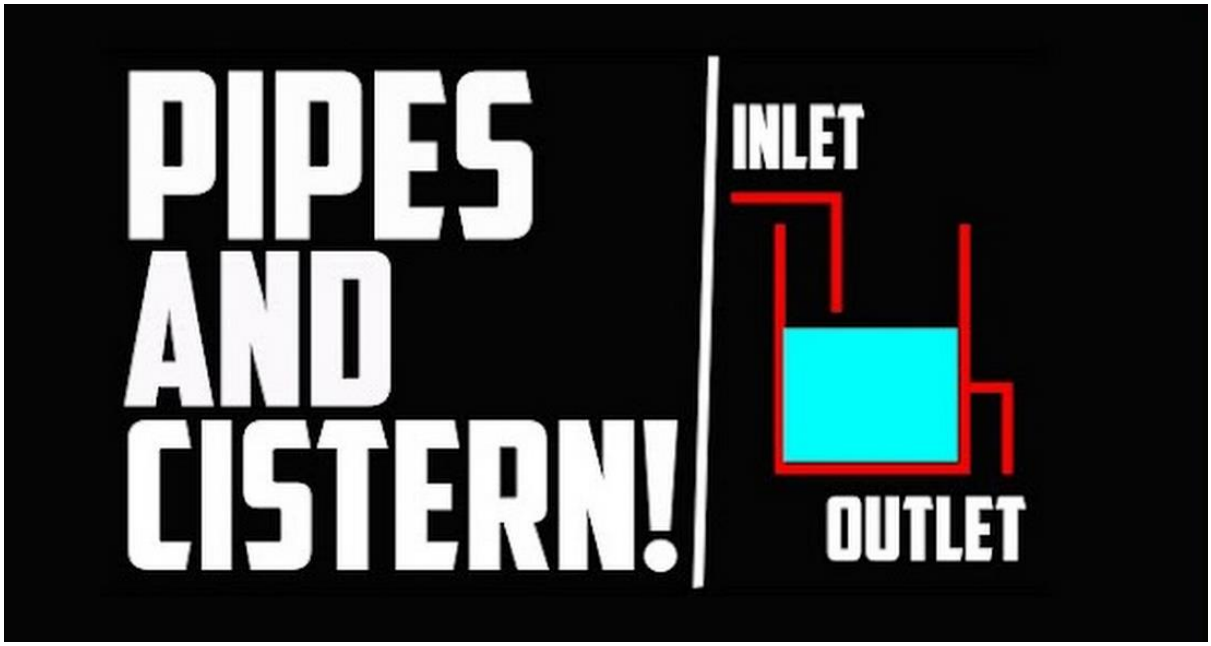

A pipe is connected to a tank or cistern. It is used to fill or empty the tank; accordingly, it is called an inlet or an outlet.

Inlet: A pipe which is connected to fill a tank is known as an inlet.

Outlet: A pipe which is connected to empty a tank is known as an outlet.

Problems on pipes and cisterns are similar to problems on time and work. In pipes and cistern problems, the amount of work done is the part of the tank of filled or emptied. And, the time taken to do a piece of work is the time take to fill or empty a tank completely or to a desired level.

Points to remember:

1) If an inlet connected to a tank fills it in X hours, part of the tank filled in one hour is = 1/X

2) If an outlet connected to a tank empties it in Y hours, part of the tank emptied in one hour is = 1/Y

3) An inlet can fill a tank in X hours and an outlet can empty the same tank in Y hours. If both the pipes are opened at the same time and Y > X, the net part of the tank filled in one hour is given by;

$$= \left(\frac{1}{X} - \frac{1}{Y}\right)$$

Therefore, when both the pipes are open the time taken to fill the whole tank is given by;

$$= \left(\frac{XY}{Y-X}\right) \text{ hours}$$

If X is greater than Y, more water is flowing out of the tank than flowing into the tank. And, the net part of the tank emptied in one hour is given by;

$$= \left(\frac{1}{Y} - \frac{1}{X}\right)$$

Therefore, when both the pipes are open the time taken to empty the full tank is given by;

$$= \left(\frac{YX}{X-Y}\right) \text{ hours}$$

4) An inlet can fill a tank in X hours and another inlet can fill the same tank in Y hours. If both the inlets are opened at the same time, the net part of the tank filled in one hour is given by;

$$= \left(\frac{1}{X} + \frac{1}{Y}\right)$$

Therefore, the time taken to fill the whole tank is given by;

$$= \left(\frac{XY}{Y+X}\right) \text{ hours}$$

In a similar way, if an outlet can empty a tank in X hours and another outlet can empty the same tank in Y hours, the part of the tank emptied in one hour when both the pipes start working together is given by;

$$= \left(\frac{1}{X} + \frac{1}{Y}\right)$$

Therefore, the time taken to empty the full tank is given by;

$$= \left(\frac{XY}{Y+X}\right) \text{ hours}$$

5) Three inlets A, B, and C can fill a tank in X, Y and Z hours respectively. If all the inlets are opened together, the time taken to fill the tank is given by;

$$= \left(\frac{X+Y+Z}{XY+YZ+ZX}\right) \text{ hours}$$

6) Two pipes can fill a tank in X and Y hours respectively and an outlet can empty the same tank in Z hours. If all the pipes are opened together, part of the tank filled in one hour is given by;

$$= \frac{1}{X} + \frac{1}{Y} - \frac{1}{Z}$$

∴ Time taken to fill the tank completely when all the pipes are working is given by;

$$= \frac{XYZ}{YZ+XZ-XY}$$

7) A pipe can fill a tank in X hours but due to a leak in the bottom, it can be filled in Y hours. The time taken by the leak to empty the tank is given by;

$$= \frac{XY}{Y-X}$$

8) An inlet A is X times faster than inlet B and takes Y minutes less than the inlet B, time taken to fill a tank when both the pipes are opened together is given by;

$$= \frac{XY}{(X-1)^2}$$

And, A alone will fill the tank in $\left(\frac{Y}{X-1}\right)$ minutes

And, B alone will fill the tank in $\left(\frac{XY}{X-1}\right)$ minutes