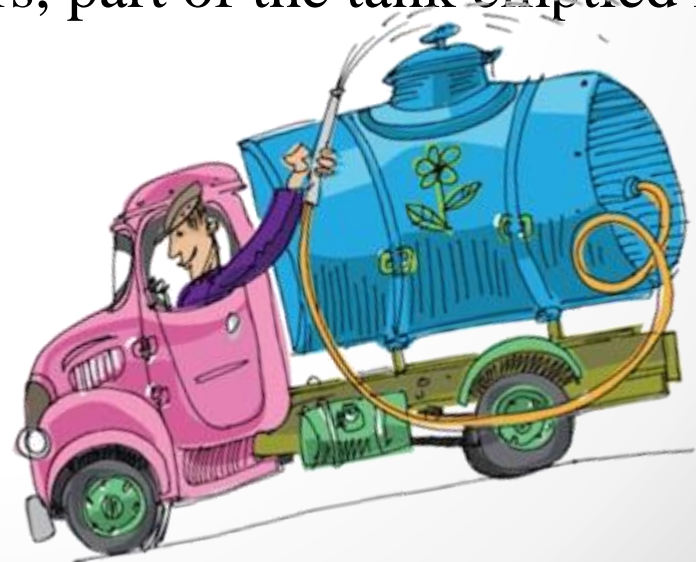# Pipes & Cisterns

BASIC CONCEPTS

Inlet is a pipe connected with a tank or cistern or reservoir. It is used to fill the tank.

Outlet is a pipe connected with a tank or cistern or reservoir. It is used to empty the tank.

If a pipe can fill a tank in x hours, part of the tank filled in 1 hour $=1/x$

If a pipe can empty a tank in y hours, part of the tank emptied in 1 hour $=1/y$

TYPE 1: If a pipe can fill a tank in x hours and another pipe can fill it in y hours, then both the pipes together can fill the tank in $\frac{xy}{x+y}$ hours.

TYPE 2: Suppose a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours. We can examine two cases here.

- If x<y
  net part filled in 1 hour =1/x–1/y
- If y<x
  net part emptied in 1 hour =1/y–1/x

EXAMPLE : Two pipes P and Q can fill a tank in 30 hours and 45 hours respectively. If both the pipes are opened together, how much time will be taken to fill the tank?

Solution: Using the concept already mentioned above:

$$\text{Time taken} = \frac{30*45}{30+45} = 18 \text{ hours}$$

PRACTICE QUESTIONS

1.Two pipes A and B together can fill a cistern in 4 hours. Had they been opened separately, then B would have taken 6 hours more than A to fill the cistern. How much time will be taken by A to fill the cistern separately?

A.8 hours   B. 9 hours   C. 6 hours   D. 11 hours

2.Two pipes A and B can fill a cistern in 37.5 minutes and 45 minutes respectively. Both pipes are opened. The cistern will be filled in just half an hour, if the B is turned off after:

A. 5 min   B. 9 min   C. 10 min   D. 15 min

TYPE 3: A pipe can fill a tank in x hrs. Because of a leak at the bottom of tank, it takes y hrs to fill up the tank. If the tank is full, how much time will it take to empty the full tank?

Time take to empty the tank $= \dfrac{xy}{y-x}$ hours.

TYPE 4: Three pipes can fill (or empty) a cistern in x, y and z hours while working alone. If all the three pipes are opened together, the time taken to fill (or empty) the cistern is given by

$$\dfrac{xyz}{xy+yz+zx} \text{ hours}$$

PRACTICE QUESTIONS

EXAMPLE 1:A water tank in a village is normally filled in 8 hours but takes 2 hours longer to fill because of a leak in its bottom. If the tank is full, in how many hours will the leak empty it ?

Explanation: The time taken by the leak to empty the tank =

$1/8 − 1/10 = (5 − 4)/40 = 1/40$

Therefore, the leak empties the tank in 40 hours.

Q. A tank is filled by three pipes with uniform flow. The first two pipes operating simultaneously fill the tank in the same time during which the tank is filled by the third pipe alone. The second pipe fills the tank 5 hours faster than the first pipe and 4 hours slower than the third pipe. The time required by the first pipe is:

A. 6 hours   B. 10 hours   C. 15 hours   D. 30 hours

TYPE 5: If a pipe can fill a cistern in ' x' hours and another can fill the same cistern in 'y' hours, but a third one can empty the full cistern in 'z' hours and all of them are opened together then

Net part of the cistern filled in 1 hour $= \dfrac{1}{x} + \dfrac{1}{y} - \dfrac{1}{z}$

Time taken to fill the full cistern $= \dfrac{xyz}{yz + xz - xy}$

Example: Pipes A and B can fill a tank in 5 and 6 hours respectively. Pipe C can empty it in 12 hours. If all the three pipes are opened together, then the tank will be filled in:
A.30/17 Hours   B.30/11hours   C.60/17hours   D.9/2hours

Explanation: Net part filled in 1 hour $= (1/5 + 1/6 - 1/12) = 17/60$
The tank will be full in 60/17 hours

PRACTICE QUESTIONS

1. One pipe can fill a tank three times as fast as another pipe. If together the two pipes can fill the tank in 36 minutes, then the slower pipe alone will be able to fill the tank in:

A.81 min.   B.108 min   C.144 min.   D.192 min.

2.A large tanker can be filled by two pipes A and B in 60 minutes and 40 minutes respectively. How many minutes will it take to fill the tanker from empty state if B is used for half the time and A and B fill it together for the other half?

A.15 min   B.20 min   C.27.5 min   D.30 min

3. A tap can fill a tank in 6 hours. After half the tank is filled, three more similar taps are opened. What is the total time taken to fill the tank completely?

A.3 hrs 15 min   B.3 hrs 45 min   C.4 hrs   D.4 hrs 15 min

4. Three taps A, B and C can fill a tank in 12, 15 and 20 hours respectively. If A is open all the time and B and C are open for one hour each alternately, the tank will be full in:

A.6 hours   B.6hours   C.7 hours   D.9hours

5. Three pipes A, B and C can fill a tank in 6 hours. After working at it together for 2 hours, C is closed and A and B can fill the remaining part in 7 hours. The number of hours taken by C alone to fill the tank is:

A.10   B.12   C.14   D.16

6.Two pipes A and B can fill a tank in 15 minutes and 20 minutes respectively. Both the pipes are opened together but after 4 minutes, pipe A is turned off. What is the total time required to fill the tank?
A. 10 min. 20 sec.   B. 11 min. 45 sec   C. 12 min. 30 sec
D. 14 min. 40 sec.

7.Three pipes A, B and C can fill a tank in 6 hours. After working at it together for 2 hours, C is closed and A and B can fill the remaining part in 7 hours. The number of hours taken by C alone to fill the tank is:

A) 10 B) 12 C) 14 D) 16

8.A pump can fill a tank with water in 2 hours. Because of a leak, it took 213 hours to fill the tank. The leak can drain all the water of the tank in:

A) 7 hours   B) 8 hours   C) 12 hours   D) 14 hours

9.A tap can fill a tank in 6 hours. After half the tank is filled, three more similar taps are opened. What is the total time taken to fill the tank completely?

A) 3 hrs 15 min   B) 3 hrs 45 min   C) 4 hrs 15 min   D) 4 hrs

10. Three taps A,B and C can fill a tank in 12,15 and20 hours respectively. If A is open all the time and B,C are open for one hour each alternatively, the tank will be full in:

A. 6 hrs   B. 20/3 hrs   C. 7 hrs   D. 15/2 hrs

11. Two pipes can fill a tank in 20 and 24 minutes respectively and a waste pipe can empty 3 gallons per minute. All the three pipes working together can fill the tank in 15 minutes. The capacity of the tank is:

A. 60 gallons   B. 100 gallons   C. 120 gallons   D. 180 gallons

12.A cistern is normally filled in 8 hours but takes two hours longer to fill because of a leak in its bottom. If the cistern is full, the leak will empty it In ?

A. 20 hrs   B. 28 hrs   C. 36 hrs   D. 40 hrs

13.A water tank is two-fifth full. Pipe A can fill a tank in 10 minutes and pipe B can empty it in 6 minutes. If both the pipes are open, how long will it take to empty or fill the tank completely?

A. 6 min.to empty   B. 6 min.to fill   C. 9 min.to empty D. 9 min.to fill

SOL.A

14.A booster pump can be used for filling as well as for emptying a tank. The capacity of the tank is 2400 m^3 . The emptying capacity of the tank is 10 m^3 per minute higher than its filling capacity and the pump needs 8 minutes lesser to empty the tank than it needs to fill it. What is the filling capacity of the pump?

A) 50 m^3 /min B) 60 m^3 /min   C) 72 m^3 /min   D) None of these

SOL. A

15.One pipe can fill a tank three times as fast as another pipe. If together the two pipes can fill the tank in 36 min, then the slower alone will be able to fill the tank in:

A) 81 min   B) 108 min   C) 144 min   D) 192 min

SOL.C

16.Taps X and Y can fill a tank in 30 and 40 minutes respectively. Tap Z can empty the filled tank in 60 minutes. If all the three taps are kept open for one minute each, How much time will the taps take to fill the tank?

A) 48min   B) 72min   C) 24min   D) None of these

SOL.C

17. buckets of water fill a tank when the capacity of each tank is 13.5 liters. How many buckets will be needed to fill the same tank, if the capacity of each bucket is 9 liters?

A) 8   B) 15   C) 16   D) 18

 SOL.D

18.A large tanker can be filled by two pipes A and B in 60 and 40 minutes respectively. How many minutes will it take to fill the tanker from empty state if B is used for half the time and A and B fill it together for the other half ?

A) 31 min   B) 29 min   C) 28 min   D) 30 min

SOL.D

19.Pipe A can fill a tank in 16 minutes and pipe B cam empty it in 24 minutes. If both the pipes are opened together after how many minutes should pipe B be closed, so that the tank is filled in 30 minutes ?
A. 21 min   B. 24 min   C. 20 min   D. 22 min
SOL.A

20.Two pipes A and B can separately fill a cistern in 10 and 15 minutes respectively. A person opens both the pipes together when the cistern should have been was full he finds the waste pipe open. He then closes the waste pipe and in another 3 minutes the cistern was full. In what time can the waste pipe empty the cistern when fill ?
A. 8.21 min   B. 8 min   C. 8.57 min   D. 8.49 min
SOL.C