

Pipes and cisterns

Pipes and cisterns is an application of Time and work. So before you solve this chapter please read time and work. [Click Here](#)

Let us say a pipe can fill a tank in x minutes. So per minute it can fill $\frac{1}{x}$ of the capacity of the tank. Assume there is a leak exists, and it empties the tank in y minutes. It empties the tank at the rate of $\frac{1}{y}$. Net capacity at which the tank fills is $\frac{1}{x} - \frac{1}{y}$

Solved Examples

1. Two pipes can fill a tank in 10 hrs. and 12 hrs. respectively while a third pipe empties the full tank in 20 hrs. If all the three pipes operate together, in how much time the tank will be filled?

- 1) 6 hrs.
- b) 8 hrs.
- c) 7.5 hrs.
- d) 8.5 hrs.

Correct option: c

Explanation:

$$\text{Net part filled in 1 hour} = \left(\frac{1}{10} + \frac{1}{12} - \frac{1}{20} \right) = \frac{6+5-3}{60} = \frac{8}{60} = \frac{2}{15}$$

The tank will be full in $15/2$ hrs. = 7 hrs.30 min.

2. A cistern can be filled in 9 hrs. but it takes 10 hours, due to a leak in its lower part. If the cistern is full, then the time that the leak will take to empty it, is :

- a) 60 min.
- b) 70 min.
- c) 80 min.
- d) 90 min.

Correct option:

Explanation:

Work done by the leak in 1 hr.

$$= \left(\frac{1}{9} - \frac{1}{10} \right) = \frac{1}{90}$$

Leak will be empty the full cistern in 90 min.

3. To fill a cistern, pipes P, Q & R take 20, 15 & 12 minutes respectively. The time in minutes that the three pipes together will take to fill the cistern is :

- a) 5 min.
- b) 10 min.
- c) 12 min.
- d) 15.66 min.

Correct option: a

Explanation:

Part filled by (P + Q + R) in 1 min.

$$= \left(\frac{1}{20} + \frac{1}{15} + \frac{1}{12} \right) = \frac{12}{60} = \frac{1}{5}$$

All the three pipes together will full the tank in 5 min.

4. Two pipes P and Q can fill a cistern in 12 minutes and 16 minutes respectively. Simultaneously both the pipes are opened together, then after how much time Q should be closed so that the tank is full in 9 min ?

- a) 3.5 min.
- b) 4 min.
- c) 4.5 min.
- d) 4.75 min.

Correct option: b

Explanation:

Let Q be closed after x min. Then part filled by (P+Q) in x min + part filled by P in (9 - x)min

$$x \left(\frac{1}{12} + \frac{1}{16} \right) + (9 - x) \frac{1}{12} = 1$$

$$\Rightarrow 7x + 36 - 4x = 48$$

$$\Rightarrow x = 4. \text{ That means 'Q' must be closed after 4 minutes.}$$

5. A tap can fill a tank in 32 min. and another can empty it in 16 min. If the tank is already half full and both the tanks are opened together, the tank will be

- a) filled in 4 min.
- b) emptied in 18 min.
- c) filled in 12 min.
- d) emptied in 16 min.

Correct option: d

Explanation:

In this problem, rate of water pipe (waste) is more, the tank will be emptied when the pipes are opened.

Work done in total emptying in 1 min.

$$= \frac{1}{16} - \frac{1}{32} = \frac{1}{32}$$

Now, full tank will be emptied by them in 32 minutes.

Half full tank will be emptied in 16 minutes.

6. A leak in the lower portion of a tank can empty the full tank in 9 hrs. An inlet pipe fills water at the rate of 10 lit. a minute. When the tank is full, the inlet is opened and due to leak, the tank is empty in 16 hrs. How many litres does the cistern hold ?

- a) 17,580
- b) 17,960
- c) 18,290
- d) 12,342

Correct option: d

Explanation:

$$\text{Work done by the inlet in 1 hr} = \frac{1}{9} - \frac{1}{16} = \frac{7}{144}$$

$$\text{Work done by the inlet in 1 min.} = \left(\frac{7}{144} \times \frac{1}{60} \right) = \frac{7}{8,640}$$

$$\text{Volume of } \frac{7}{8,640} \text{ part} = 10 \text{ litres.}$$

$$\text{Whole volume} = 10 \times 8,640/7 = 12,342 \text{ litres.}$$

7. Two pipes P and Q can fill a cistern in 12 min. and 15 min. respectively but a third pipe 'R' can empty the full tank in 6 min. P and Q are kept open for 5 min. in the beginning and then 'R' is also opened. In what time is the cistern emptied ?

- a) 30 min.
- b) 33 min.
- c) 37.5 min.
- d) 45 min.

Correct option: d

Explanation:

Part filled in 5 min.

$$= 5 \left(\frac{1}{12} + \frac{1}{15} \right) = \left(5 \times \frac{9}{60} \right) = \frac{3}{4} = 45 \text{ min.}$$

Part emptied in 1 min. when all the pipes are opened.

$$= \frac{1}{6} - \left(\frac{1}{12} + \frac{1}{15} \right)$$

$$= \left(\frac{1}{6} - \frac{3}{20} \right) = \frac{1}{60}$$

$$\frac{1}{60} \text{ part is emptied in 1 min.}$$

$$3/4 \text{ part will be emptied in } (60 \times 3/4) = 45 \text{ min.}$$

8. Two pipes X and Y fill a tank in 15 hrs. and 20 hrs. respectively, while a third pipe 'Z' can empty the full tank in 25 hrs. All the three pipes are opened in the beginning. After 10 hrs. Z is closed. In how much time, will the tank be full ?

- a) 12 hrs.
- b) 13 hrs.

c) 16 hrs.

d) 18 hrs.

Correct option:

Explanation:

Part filled in 10 hrs.

$$= 10 \left[\frac{1}{15} + \frac{1}{20} - \frac{1}{25} \right] = \frac{23}{30}$$

$$\text{Remaining part} = \left(1 - \frac{23}{30} \right) = \frac{7}{30}$$

$$(x + y)\text{'s 1 hour work} = \left(\frac{1}{15} + \frac{1}{20} \right) = \frac{7}{60}$$

$$\frac{7}{60} : \frac{7}{30} :: 1 : p$$

$$\Rightarrow p = \left(\frac{7}{30} \times 1 \times \frac{60}{7} \right) = 2 \quad \text{hrs.}$$

The tank will be full in $(10 + 2)$ hrs = 12 hrs

9. A tank can be filled by a pipe in 20 min. and by another pipe in 60 min. Both the pipes are kept open for 10 min. and then the first pipe is shut off. After this, the tank will be completely filled in

a) 10 min.

b) 12 min.

c) 15 min.

d) 20 min.

Correct option: d

Explanation:

Part filled in 10 min.

$$= 10 \left(\frac{1}{20} + \frac{1}{60} \right) = \left(10 \times \frac{4}{60} \right) = \frac{2}{3}$$

$$\text{Remaining part} = \left(1 - \frac{2}{3} \right) = \frac{1}{3}$$

Part filled by second tap in 1 min. = $\frac{1}{60}$

$$\frac{1}{60} : \frac{1}{3} :: 1 : x \Rightarrow x = \left(\frac{1}{3} \times 1 \times 60 \right) = 20 \quad \text{min.}$$

10. Two taps X and Y can fill a tank in 10 hrs. and 15 hrs. respectively. If the both taps are opened together, the tank will be full in

a) 5 hrs.

b) 6 hrs.

c) 12.5 hrs.

d) 7.5 hrs.

Correct option: b

Explanation:

X's 1 hour work = $\frac{1}{10}$

Y's 1 hour work = $\frac{1}{15}$

$$(x+y)\text{'s 1 hour work} = \frac{1}{10} + \frac{1}{15} = \frac{5}{30} = \frac{1}{6}$$

Both the taps can fill the tank in 6 hrs.

11. If two pipes function together, the cistern will be filled in 6 hrs. One pipe fills the cistern 5 hrs. faster than the other. How many hours it take the second pipe to fill the cistern?

- a) 20 hrs.
- b) 38 hrs.
- c) 15 hrs.
- d) 30 hrs.

Correct option: c

Explanation:

Let the reservoir filled by first pipe in (k) hours. Then, second pipe will fill it in (k+5) hrs.

$$\frac{1}{k} + \frac{1}{k+5} = \frac{1}{6} \Rightarrow \frac{2k+5}{k^2+5k} = 1/6$$

$\Rightarrow x = 10$ Second pipe takes 15 hrs to fill the reservoir.

12. A cistern has two taps which fill it in 12 min. and 15 min. respectively. There is one outlet pipe in the cistern.

When all the taps & pipe are opened, the empty cistern is full in 20 min. How long will the waste pipe (outlet) take to empty the full cistern ?

- a) 8 min.
- b) 10 min.
- c) 12 min.
- d) 16 min.

Correct option: b

Explanation:

Work done by waste pipe in 1 minute

$$= \frac{1}{20} - \left(\frac{1}{12} + \frac{1}{15} \right) = -1/10$$

Waste pipe will empty the full cistern in 10 minutes.

13. Two pipes P and Q can fill a tank in 6 hrs. and 4 hrs. respectively. If they are opened on alternate hours and if pipe P is opened first, in how many hours, the tank shall be full ?

- a) 4
- b) 5
- c) 4.5
- d) 6.5

Correct option: b

Explanation:

P's work in 1 hr. = $1/6$

Q's work in 1 hr. = $1/4$

$$(P + Q)'s\ 2\ hour's\ work\ when\ opened\ alternately = \left(\frac{1}{6} + \frac{1}{4} \right) = 5/12$$

(P+Q)'s 4 hour's work when opened alternately

$$= \frac{10}{12} = 5/6$$

Remaining part = $(1 - 5/6) = 1/6$

Now, it is P's turn and $1/6$ part filled by 'P' in 1 hour.

Total time taken to fill the tank = $(4+1) = 5$ hrs.

14. A leak in the bottom of a tank can empty the full tank in 6 hrs. An inlet pipe fills water at the rate of 4 lit. a minute. When the tank is full, the inlet is opened and due to the leak, the tank is empty in 8 hrs. The capacity of the tank in litres is :

a) 5,260

b) 5,760

c) 6,970

d) 5,846

Correct option: b

Explanation:

$$\text{Work done by the inlet in 1 hr.} = \left(\frac{1}{6} - \frac{1}{8} \right) = 1/24$$

Work done by the inlet in

$$1 \text{ min.} = \left(\frac{1}{24} \times \frac{1}{60} \right) = \frac{1}{1,440}$$

$$\text{Volume of } \frac{1}{1,440} \text{ part} = 4 \text{ litres.}$$

$$\text{Whole volume} = (1,440 \times 4) = 5,760 \text{ litres.}$$

15. 12 buckets of water fill a tank when the capacity of each bucket is 13.5 litres. How many buckets will be needed to fill the same tank, if the capacity of each bucket is 9 litres?

a) 8

b) 16

c) 15

d) 18

Correct option: d

Explanation:

$$\text{Capacity of the tank} = (12 \times 13.5) = 162 \text{ litres}$$

$$\text{Capacity of each bucket} = 9 \text{ litres.}$$

$$\text{Number of buckets needed} = \frac{162}{9} = 18$$