Explore | Expand | Enrich

TIME AND WORK (PIPES AND CISTERNS)

PIPES AND CISTERNS

- The problems of pipes and cisterns usually have two kinds of pipes, **Inlet pipe and Outlet pipe / Leak.**
- **Inlet pipe** is the pipe that fills the tank/reservoir/cistern and **Outlet pipe / Leak** is the one that empties it.
- If a pipe can fill a tank in ‘n’ hours, then in 1 hour, it will fill ‘1 / n’ parts.
- **For example,** if a pipe takes 6 hours to fill a tank completely, say of 12 liters, then in 1 hour, it will fill 1 / 6 th of the tank, i.e., 2 liters.
- If a pipe can empty a tank in ‘n’ hours, then in 1 hour, it will empty ‘1 / n’ parts.
- **For example,** if a pipe takes 6 hours to empty a tank completely, say of 18 liters, then in 1 hour, it will empty 1 / 6 th of the tank, i.e., 3 liters.

PIPES AND CISTERNS

- If a pipe can fill a tank in *x* hours and another pipe can empty the full tank in *y* hours (where *y* > *x*), then on opening both the pipes, then the net part filled in 1 hour = (1/X - 1/Y).
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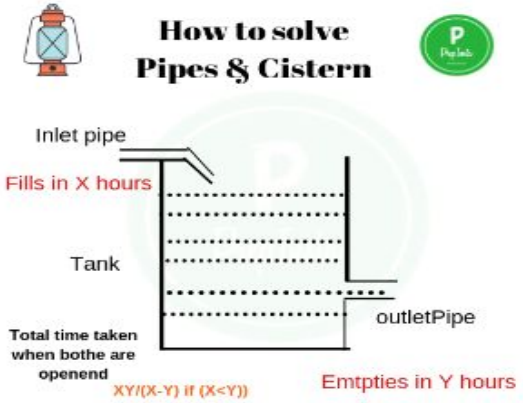

Question: 01

Two pipes A and B can fill a tank separately in 12 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?

A. 7/48

B. 21/48

C. 48/7

D. 48/21

Answer: C

Explanation:

Solution 1: Part of tank filled by pipe A in one hour working alone = 1 / 12

Part of tank filled by pipe B in one hour working alone = 1 / 16

=> Part of tank filled by pipe A and pipe B in one hour working together = (1 / 12) + (1 / 16) = 7 / 48

Therefore, time taken to completely fill the tank if both A and B work together = 48 / 7 hours

Solution 2:

Let the capacity of tank be LCM (12, 16) = 48 units

=> Efficiency of pipe A = 48 / 12 = 4 units / hour

=> Efficiency of pipe B = 48 / 16 = 3 units / hour

=> Combined efficiency of pipes A and B = 7 units / hour

Therefore, time taken to completely fill the tank = 48 / 7 hours

Question: 02

There are two pipe A and B connected to a tank. The tank can be filled in 6 minutes, if pipe A takes 5 minutes less than pipe B, How much time will pipe B take if it is alone filling the tank.

A. 15 min

B. 12 min

C. 10 min

D. 5 min

Answer: A

Explanation:

- ➔ Time taken by Pipe A to fill the tank = x minutes
- ➔ Therefore, pipe B will fill the bucket in (x+5) minutes.
- ➔ Now, when both the pipes are filling the tank = 1/x + 1/(x+5) = 1/6
- ➔ On solving we get, x = 10
- ➔ So, pipe A can fill in 10 minutes and pipe B can fill the bucket in (x+5)= 10+ 5 =15 mins.

Question: 03

Three Pipes P1, P2, P3 can fill a swimming pool in 6 hours. The pipe P3 is twice as fast as P2 and P2 is twice as fast as P1. Find out how much time will pipe P1 alone take to fill the swimming pool?

A. 35 hrs

B. 42 hrs

C. 24 hrs

D. 38 hrs

Answer: B

Explanation:

- ➔ Let the Pipe P1 take ‘a’ hours to fill the swimming pool
- ➔ It means P2 and P3 will take a/2 and a/4 respectively
- ➔ Now together they takes 5 hours
- ➔ Therefore 1/x + 2/x + 4/x = 1/6
- ➔ 7/x = 1/6
- ➔ x = 42 hrs.
- ➔ Therefore, a will take 42 hours

Question: 04

A cistern takes 5 hrs to be filled by pipe. But there is one leakage in the pipe due to which it takes 10 hrs. Find out how much time will the leakage pipe to empty the cistern?

A. 10 hrs

B. 10 min

C. 20 hrs

D. 20 min

Answer: A

Explanation:

- ➔ Cistern is filled in 5 hours,
- ➔ Therefore in 1 hour part filled is = 1/5
- ➔ Now, due to leakage in pipe, filled part in 1 hour = 1/10
- ➔ Part of the cistern emptied, due to leakage in 1 hour = 1/5 – 1/10 = 1/10
- ➔ Therefore the leak pipe will empty the cistern in 10 hrs.

Question: 05

There are two rivers R1 and R2. Both the rivers can fill a dam in 12 and 20 hours respectively. The rivers are opened simultaneously. An engineer found that there is a hole in the dam due to which half hour extra is taken for the dam to be filled up completely. If the dam is completely full then in what time will the leak empty it?

A. 100 hrs

B. 110 hrs

C. 107 hrs

D. 120 hrs

Answer: D

Explanation:

- ➔ Dam filled by both rivers in one hour = 1/12+1/20=2/15
- ➔ Therefore both rivers filled the dam in 15/2hrs.
- ➔ Now, due to leakage both rivers filled the dam in 15/2 + 30min / 60min = 8hrs.
- ➔ Due to leakage, part filled in one hour = 1/8
- ➔ Therefore, part of dam emptied, due to leakage in one hour = 2/15 – 1/8 = 1/120
- ➔ Therefore, in 120 hrs, the leak would empty the dam.

Question: 06

Two taps T1 and T2 can fill a bucket in 10 minutes and 15 minutes. Both the taps are opened together. However, after 2 minutes, tap T1 is closed. What is the total time required to fill the bucket?

A. 11 min and 20 sec

B. 15 min and 20 sec

C. 13 min and 40 sec

D. 15 min and 40 sec

Answer: B

Explanation:

- ➔ Part filled in 2 min = 2 * (1/10 + 1/ 15) = 2 * 5/30 = 5/15
- ➔ Remaining part = (1-1/3) = 2/3
- ➔ Now, part filled by tap T2 = 1/20
- ➔ Therefore, 1/20 : 1/ 3:: 1 : x
- ➔ On solving we get x = 40/3 (13 min 20 sec)
- ➔ Therefore, the bucket will be filled in = 2 minutes + 13 minutes + 20seconds = 15 min and 20 sec

Question: 07

A pond can be filled by two pipes P1 and P2. P1 takes 3 hours and P2 takes 5 hours. There is another pipe P3 attached to the pond which can empty the pond in 7 hours. If all the pipes are opened at the same time then in how much time will the empty pond be fully filled?

A. 105/41 hrs

B. 41 hrs

C. 134/43 hrs

D. 122/13 hrs

Answer: A

Explanation: 07

- ➔ Time taken by Pipe P1 to fill the tank = 3 hr
- ➔ Time taken by pipe P2 to fill the tank = 5 hr
- ➔ Time taken by pipe P3 to empty the tank = 7 hr
- ➔ Therefore, pipe P1 and P2 fills 1/3 th and 1/5th part of the pond in 1 hour respectively.
- ➔ Part of the pond emptied in 1 hour by pipe P3 = 1/7
- ➔ Therefore, in 1 hour part of the pond filled is = (1/3 + 1/5 – 1/7) = 41/105
- ➔ Therefore, tank will be filled completely in 105/41 hrs

Question: 08

Three pipes A, B and C are connected to a tank. Out of the three, A is the inlet pipe and B and C are the outlet pipes. If opened separately, A fills the tank in 10 hours, B empties the tank in 12 hours and C empties the tank in 30 hours. If all three are opened simultaneously, how much time does it take to fill / empty the tank ?

A. 85 hours

B. 67 hours

C. 72 hours

D. 60 hours

Answer: D

Explanation: 08

Solution 1:

Part of tank filled by pipe A in one hour working alone = 1 / 10

Part of tank emptied by pipe B in one hour working alone = 1 / 12

Part of tank emptied by pipe C in one hour working alone = 1 / 30

=> Part of tank filled by pipes A, B and C in one hour working together = (1 / 10) – (1 / 12) – (1 / 30) = -1 / 60

Therefore, time taken to completely empty the tank if all pipes are opened simultaneously = 1 / 60 hours = 60 hours

Solution 2:

Let the capacity of tank be LCM (10, 12, 30) = 60 units

=> Efficiency of pipe A = 60 / 10 = 6 units / hour

=> Efficiency of pipe B = – 60 / 12 = – 5 units / hour (Here, '-' represents outlet pipe)

=> Efficiency of pipe C = – 60 / 30 = – 2 units / hour (Here, '-' represents outlet pipe)

=> Combined efficiency of pipes A, B and C = 6 – 5 – 2 = – 1 units / hour (Here, '-' represents outlet pipe)

Therefore, time taken to completely empty the tank = 60 / (1) = 60 hours

Question: 09

Three pipes A, B and C are connected to a tank. Out of the three, A and B are the inlet pipes and C is the outlet pipe. If opened separately, A fills the tank in 10 hours and B fills the tank in 30 hours. If all three are opened simultaneously, it takes 30 minutes extra than if only A and B are opened. How much time does it take to empty the tank if only C is opened?

A. 120 hours

B. 160 hours

C. 140 hours

D. 170 hours

Answer: A

Explanation:

Let the capacity of tank be LCM (10, 30) = 30 units
=> Efficiency of pipe A = 30 / 10 = 3 units / hour
=> Efficiency of pipe B = 30 / 30 = 1 units / hour
=> Combined efficiency of pipes A and B = 4 units/hour
Therefore, time taken to completely fill the tank if only A and B are opened = 30 / 4 = 7 hours 30 minutes
=> Time taken to completely fill the tank if all pipes are opened = 7 hours 30 minutes + 30 minutes = 8 hours
=> Combined efficiency of all pipes = 30 / 8 = 3.75 units / hour
Now, efficiency of pipe C = Combined efficiency of all three pipes – Combined efficiency of pipes A and B
Therefore, efficiency of pipe C = 4 – 3.75 = 0.25 units / hour
Thus, time taken to empty the tank if only C is opened = 30 / 0.25 = 120 hours

Question: 10

Time required by two pipes A and B working separately to fill a tank is 36 seconds and 45 seconds respectively. Another pipe C can empty the tank in 30 seconds. Initially, A and B are opened and after 7 seconds, C is also opened. In how much more time the tank would be completely filled ?

A. 41 seconds

B. 39 seconds

C. 49 seconds

D. 39 seconds

Answer: B

Explanation:10

Let the capacity of the tank be LCM (36, 45, 30) = 180 units

=> Efficiency of pipe A = 180 / 36 = 5 units / second

=> Efficiency of pipe B = 180 / 45 = 4 units / second

=> Efficiency of pipe C = – 180 / 30 = – 6 units / second

Now, for the first 7 seconds, A and B were open.

=> Combined efficiency of A and B = 5 + 4 = 9 units / second

=> Part of the tank filled in 7 seconds = 7 x 9 = 63 units

=> Part of tank empty = 180 – 63 = 117 units

Now, all pipes are opened.

=> Combined efficiency of all pipes = 5 + 4 – 6 = 3 units / second

Therefore, more time required = 117 / 3 = 39 seconds

Question: 11

Two pipes A and B can fill a tank in 20 hours and 30 hours respectively. If both the pipes are opened simultaneously, find after how much time should pipe B be closed so that the tank is full in 18 hours?

A. 8 hours

B. 4 hours

C. 6 hours

D. 3 hours

Answer: D

Explanation: 11

Let the capacity of the tank be LCM (20, 30) = 60 units

=> Efficiency of pipe A = 60 / 20 = 3 units / hour

=> Efficiency of pipe B = 60 / 30 = 2 units / hour

=> Combined efficiency of pipes A and B = 5 units / hour

Let both A and B be opened for ‘n’ hours and then, B be closed and only A be opened for the remaining ’18 – n’ hours.

=> 5n + 3 x (18 – n) = 60

=> 2n + 54 = 60

=> 2n = 6

=> n = 3

Therefore, B should be closed after 3 hours.

Question: 12

A tank is filled in 5 hours by three pipes A, B and C. The pipe C is twice as fast as B and B is twice as fast as A. How much time will pipe A alone take to fill the tank?

A. 20 hours

B. 25 hours

C. 35 hours

D. Cannot be determined

Answer: C

Explanation:12

- Suppose pipe A alone takes *x* hours to fill the tank.
- Then, pipes B and C will take *x/2* and *x/4* hours respectively to fill the tank.
- Therefore 1/x + 2/x + 4/x = ⅕
- 7/x = ⅕
- X = 35 hours

Question: 13

Two pipes A and B independently can fill a tank in 20 hours and 25 hours. Both are opened together for 5 hours after which the second pipe is turned off. What is the time taken by first pipe alone to fill the remaining portion of the tank?

A. 11 hours

B. 22 hours

C. 55 hours

D. 9 hours

Answer: A

Explanation:13

- ➔ Total unit water = LCM(20, 25) = 100 unit
- ➔ A's efficiency = 100/20 = 5 unit/hour
- ➔ B's efficiency =100/25 = 4 unit/hour
- ➔ After 5 hour the water filled by A and B together = 5 x 9 =45 unit
- ➔ Remaining unit = 100 – 45 = 55 unit
- ➔ Time taken by A alone = 55/5 = **11 hours**

Question: 14

Two taps M and N can separately fill a cistern in 30 and 20 minutes respectively. They started to fill a cistern together but tap A is turned off after few minutes and tap B fills the rest part of cistern in 5 minutes. After how many minutes was tap M turned-off?

A. 9 min

B. 10 min

C. 12 mi

D. None of these

Answer: A

Explanation:14

- ➔ Let M was turned off after x min. Then, cistern filled by M in x min + cistern
- ➔ filled by N in (x+5) min = 1 ⇒ x/30 + (x+5)/20 = 1 ⇒ 5x+15=60 ⇒ x = 9 min.

Question: 15

Three fill pipes A, B and C can fill separately a cistern in 12, 16 and 20 minutes respectively. A was opened first. After 2 minute, B was opened and after 2 minutes from the start of B, C was also opened. Find the time when the cistern will be full after opening of C?

A. 3 (21/47) min

B. 4 (½) min

C. 3 (15/16) min

D. None of these

Answer: A

Explanation:15

➔ Let cistern will be full in x min. Then part filled by A in x min + part filled by

➔ B in (x-2) min + part filled by C in (x-4) min = 1

➔ $x/12 + (x-2)/16 + (x-4)/20 = 1 \Rightarrow 47x - 78 = 240 \Rightarrow x = 162/47 = 321/47$ min

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THANK YOU