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Sahi Prep Hai Toh Life Set Hai

Pipe and Cistern

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Agenda

{ Pipe & Cistern →
Concept +
9 solved examples

(60 - 65) min

+ 2 Questions from Homework → (18 - 20) min

PIPE & CISTERN

Capacity = 60 litres

Eg fill Pipe A → 20 hrs (3)

fill Pipe B → 30 hrs (2)

empty Pipe C → 15 hours (-4)

(A+B+C) → ??

$\frac{60}{1}$ = 60 hours

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Eg1. Pipe A can fill a tank in 12 hours whereas Pipe B can empty the same tank in 20 hours. If both the pipes are operating simultaneously, then in how many hours, half of the tank gets filled?

fill A → 12 hours (5l)
empty B → 20 hours (-3l)

Capacity = 60 litres

A+B

$\frac{30}{2}$

15 hours

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Ans. 15 Hours

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Eg2. Pipe A can fill a tank in 20 hours, but because of a leakage in the tank, the tank gets filled in 28 hours. Find in how many hours leakage alone can empty the completely filled tank?

A → 20 hrs (7l)

leakage B

A + B → 28 hours (5l)

B → ??

Capacity = 140 litres

$\frac{140}{x} = 70$ hours

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Ans. 70 Hours

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Eg3. Pipe A alone can fill a tank in 12 hours whereas pipe B alone can fill the same tank in 15 hours and pipe C can empty at the rate of 7.5 litres/min. from the same tank. If all the three pipes operate simultaneously then the tank gets filled in 10 hours. Find the capacity of the tank.

fill A → 12 hrs (5x)

fill B → 15 hrs (4x)

empty C → 7.5 l/min → 450 l/hr

fill (A+B+C) → 10 hrs (6x)

$5x + 4x - 450 = 6x$

$3x = 450$

Capacity = 60x litres

$3x = 450$ litres

$60x \rightarrow 9000$ litres

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Ans. 9000 Litres

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Capacity = 180 l

fill A → 30 min (6 l/min)

fill B → 36 min (5 l/min)

A* → $5/6 \times 6 = 5$ l

B* → $9/10 \times 5 = 4.5$ l

Let the problem exist for X min

$$9.5X + 11 \times 15\tfrac{1}{2} = 180$$

$$9.5X = 9.5$$

$$\boxed{X = 1}$$

Eg4. A cistern can be filled by one of two pipes in 30 minutes and by the other in 36 minutes. Both pipes are opened together for a certain time but being particularly clogged, only 5/6 of the full quantity of water flows through the former and only 9/10 through the latter. The obstructions, however, being suddenly removed, the cistern is filled in 15½ minutes from that moment. How long was it before the full flow of water began?

(a) 1 min. **(b) 2 min.**

(c) 5 min. **(d) 1½ min.**

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Ans. (a)

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fill A → 20 hrs (3 l/h)

fill B → 30 hrs (2 l/h)

I^st

Capacity = 60 l

1/3rd → 20 l

20/5 → 4 hrs.

Leakage → 5/3 l/h

5 − 5/3 = 10 litres / 3

Eg5. Pipe A and B can fill a tank in 20 hours and 30 hours respectively. Both the pipes are opened to fill the tank but when the tank is 1/3rd full a leak develops in the bottom of the tank, through which 1/3rd of the water supply by both the pipes leak out. Then calculate in how much time the tank will full?

(a) 16 hours

(b) 12 hours

(c) 18 hours

(d) None of these

40.3 / 10

12 hours

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fill A → 20 hrs (3)

fill B → 30 hrs (2)

Capacity = 60 l

Full Task → 12 hours

$1/3^{rd}$ → 4 hours

48 hrs × 3/2

= 12 hours

Speed	Time
2/3	3/2

→ 16 hours

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Ans. (a)

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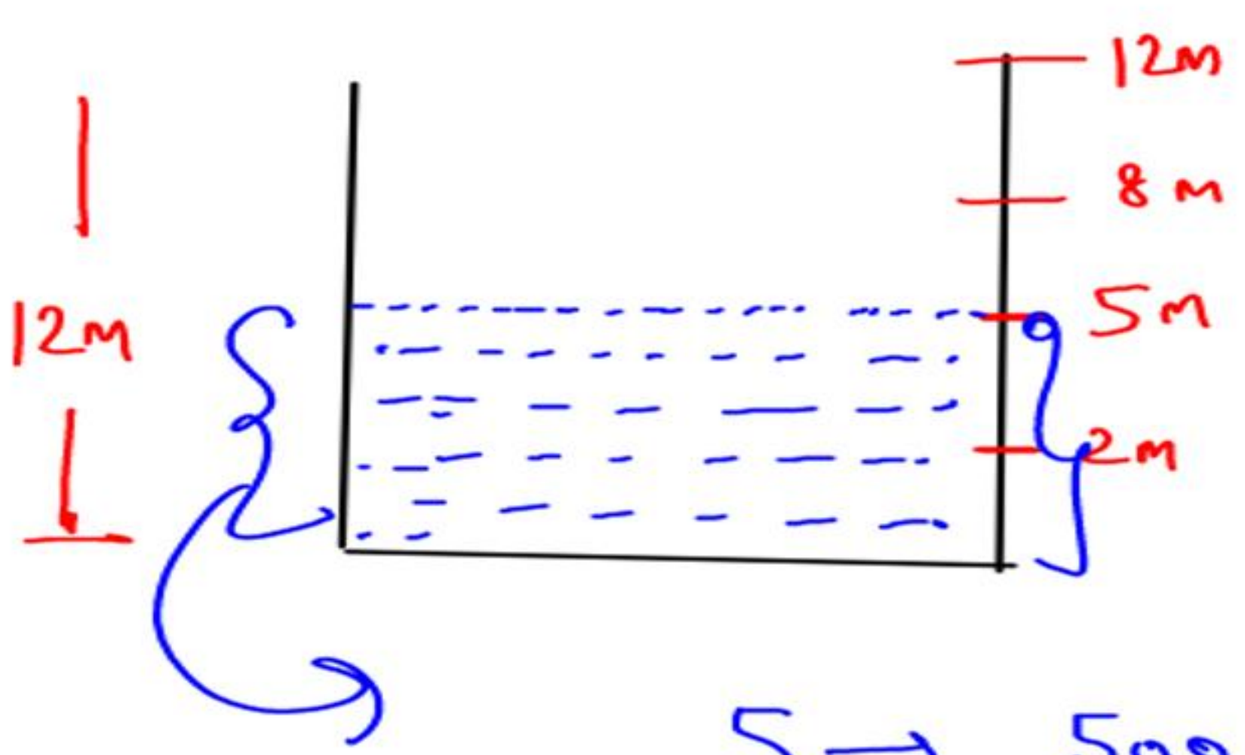

Capacity = 1200 litres

5 → 500 litres

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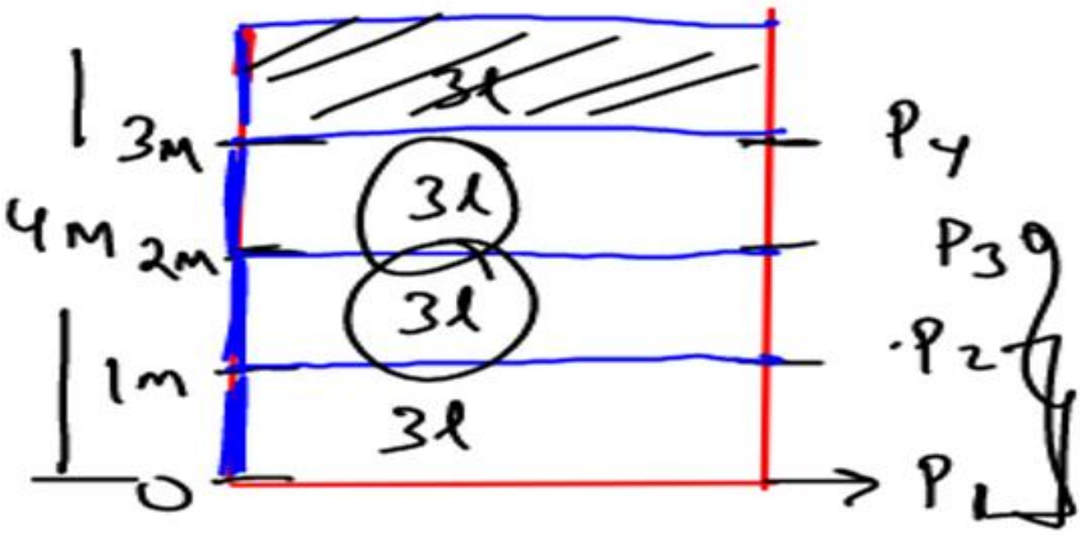
Eg6. In a tank four taps of equal efficiency are fitted on equal intervals. The first pipe is at the base of the tank and the 4th pipe is at ¾ of height of the tank. Then calculate in how much time the whole tank will empty. If the first pipe can empty the tank in 12 hours.

(a) 6 hours (b) 7 hours

(c) 8 hours (d) None of these



Let Capacity of Tank → 12l

empty $P_1 \rightarrow$ 12l / H

$$\frac{3}{4} + \frac{3}{3} + \frac{3}{2} + \frac{3}{1}$$

$$0.75 + 1 + 1.5 + 3$$

$$= 6.25 \text{ hours}$$

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Ans. (d)

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V.Imp

No. { Taps → 12

fill Inlets → 6 hrs (2l/h)

empty Outlets → 12 hrs (1l/h)

All Taps → 4 hrs (3l/h)

I^st

Capacity → 12 litres

Inlet → x Outlet → 12−x

$2x - 1(12-x) = 3$

$3x = 15$

$x = 5$

Eg7. 12 taps are fitted in a tank some are inlet taps and some are outlet taps. Each water tap can fill the tank in 6 hours and each outlet tap can empty the tank in 12 hours. If all the taps are open together then the tank is full in 4 hours. Then find the number of inlet taps.

(a) 5 **(b) 4**

(c) 6 **(d) None of these**

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II nd

No. of Taps ⟶ 12

Inlet ⟶ 6 hours (24/4) Outlet ⟶ 12 hours (12/4)

All Taps ⟶ 4 hours (31/4)

Sol^n

Let I assume

all are Inlet Tap

12 x 2 = (24l/4)

Cap ⟶ 24l / 3 = 7 outlet

(2l) (-1l)

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Ans. (a)

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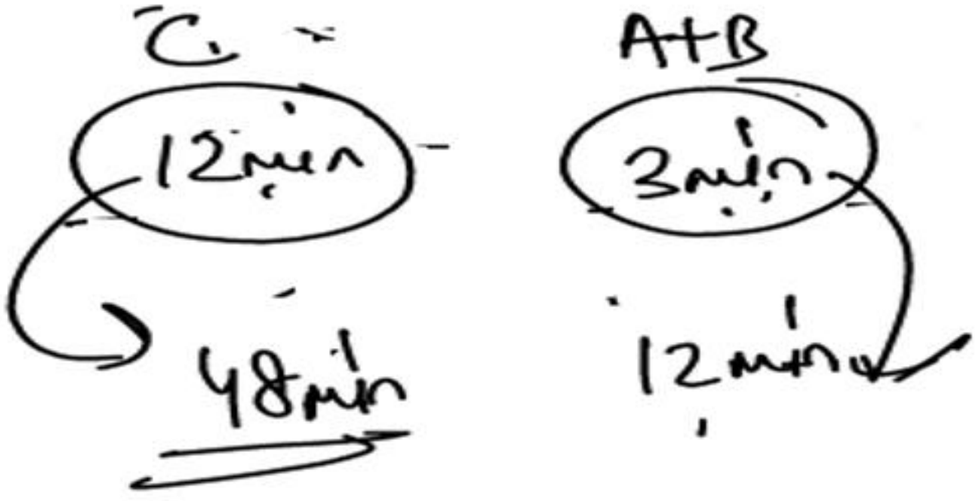
fill A → 20 min (3)
fill B → 30 min (2)
empty C

A+B → 12 min



Eg8. Two taps A and B can fill a tank 20 and 30 minutes respectively while a waste pipe C empty the tank. Initially pipe A and B are opened together but when the tank was supposed to be filled it was found that pipe C was opened mistakenly. Now pipe C is turn off and the remaining tank is fill in next 3 minutes. In how much time pipe C can empty the whole tank?

(a) 18 min. **(b) 16 min.**
(c) 12 min. **(d) 48 min.**

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Ans. (d)

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Speed of pipe $\propto$ (Radius)^2

Pipes $\longrightarrow$ Cylindrical

Volume of cylinder $\longrightarrow$ $\pi r^2 h$

$h \longrightarrow$ flow of water

Speed of Pipe $\propto r^2$

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Eg.	A	B
Radius	2 cm	3 cm
Time	225 hours	??

Sol^{n}

$$\text{speed} \propto (\text{Radius})^2$$

A → 4 l/h B → 9 l/h

$$4 \cdot 225 = 9 \cdot T$$

$$T = 100 \text{ hours}$$

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Eg .

	A	B	C
Radius	2 cm	3 cm	5 cm
Time	170 hours		

(B + C) = ??

$$4 \cdot 1\cancel{76} = \cancel{34} \cdot T$$

$$T \rightarrow 20 \text{ hours}$$

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Eg9 (i).

	Pipe 1	Pipe 2
Radius	2 cm $4\pi/h$	5 cm $25\pi/h$
Time	100 hours	??

$$4 \cdot 100 = 25 \cdot T$$

$$T = 16 \text{ hours}$$

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Ans. 16 Hours

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Eg9 (ii).

	Pipe A		Pipe B		Pipe C
Radius	1	:	2	:	3
	12/h		4l/h		9l/h

If pipe B alone can fill the tank in 70 hours, then in how many hours the tank gets filled if all the pipes are working simultaneously?

$4 \cdot 70^{5} = 14 \cdot T$

$T \rightarrow 20$ hours

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Ans. 20 Hours

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Eg

fill A | empty B | fill C | empty D | fill E

Radius ① : ② : ③ : ④ : ⑤

A+B+C+D+E → 210 hours

A+C+E → ??

$(1 - 4 + 9 - 16 + 25) \cdot \frac{210}{6} = (1+9+25) \cdot T$

$T = 90$ hours

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Practice Questions
Time & Work

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Q28. 3 cooks have to make 80 burgers. They are known to make 20 pcs every minute by working together. The 1st cook began working alone and made 20 pcs having worked for sometime more than 3 min and rest work completed by 2nd & 3rd cook and it takes a total of 8 min to complete the whole work. In how much time the 1st will make 160 burgers?

(a) 16 Minute
(b) 24 Minute
(c) 32 Minute
(d) 40 Minute

A, B & C → 80 burgers

A+B+C → 20 / min

A → 20 pcs (3+x) min

(B+C) 60 pcs (5−x) min

Sol^n

$$\frac{20}{3+x} + \frac{60}{5-x} = 20$$

$$\frac{5-x+9+3x}{15+2x-x^2} = 1$$

$$2x+14 = -x^2+2x+15$$

$$x^2 = 1 \qquad x = 1$$

20 → 4 min

160 → 32 min

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Ans. (c)

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V-Imp

Q29. It takes 6 days for 3 women and 2 men together to complete a work. 3 men would do the same work five days sooner than 9 women. How many times does the output of a man exceed that of women?

(a) 3 times **(b) 4 times**

(c) 5 times **(d) 6 times**

3w + 2M → 6 days

3M 9w

4.5 days less

Let $\frac{M}{w} = \frac{K}{1}$

Total work → (3+2K)6

→

$$\frac{(3+2K)6}{9} - \frac{(3+2K)6}{3K} = 5$$

$$\frac{(3+2K)6}{3}\left[\frac{1}{3} - \frac{1}{K}\right] = 5$$

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Ans. (c)

$$\frac{(3+2k)}{3}^{2}\left[\frac{k-3}{3k}\right] = S$$

$$2\left[(2k+3)(k-3)\right] = 15k$$

$$4k^2 - 6k - 18 = 15k$$

$$4k^2 - 21k - 18 = 0$$

$$k = 6, \frac{-3}{4}$$