GATE-2023 CRASH COURSE

GENERAL APTITUDE

PIPES & CISTERN

Lecture no-07

AMULYA RATAN SIR

PIPES AND CISTERN

$A = \frac{1}{6}$ $B = \frac{1}{5}$ $C = \frac{-1}{4}$

Empty (-)

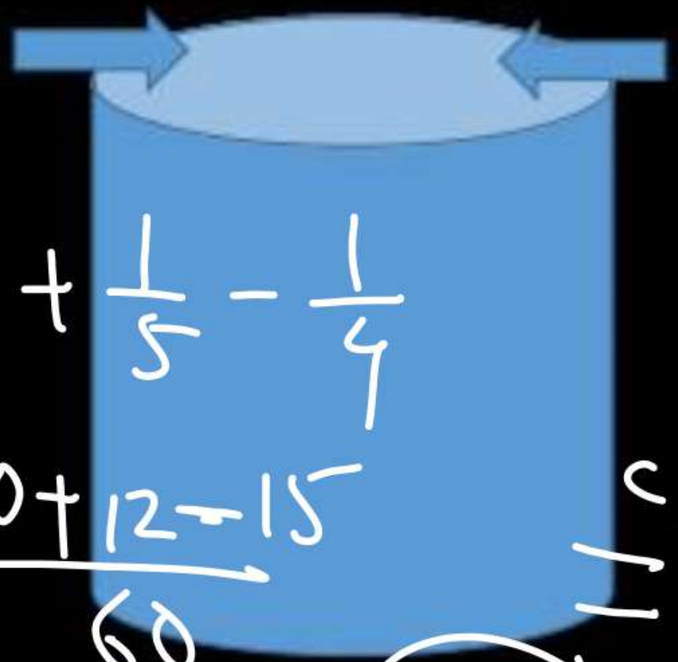
Filling (+)

TAP 'B'

5 hrs

TAP 'A'

6 hrs



$$\frac{1}{6} + \frac{1}{5} - \frac{1}{4}$$

$$= \frac{10 + 12 - 15}{60}$$

$$= \frac{7}{60} \rightarrow \frac{60}{7} = 8\frac{4}{7}\text{ hrs}$$

C = 4 hrs

TANK

$A = \frac{1}{6}$

$B = \frac{1}{5}$

$A\&B = \frac{1}{6} + \frac{1}{5} = \frac{11}{30} \rightarrow \frac{30}{11}$

$= 2\frac{8}{11}$ hrs

Q. Two pipes A and B can fill a tank in 8 minutes and 12 minutes respectively. Both the pipes are opened together and after 3 minutes, pipe A is turned off. What is the total time required to fill the tank?

A) 3 min

B) 7.5 min

C) 4.5 min

D) 10.5 min

$A = \frac{1}{8}$ $B = \frac{1}{12}$

$A\&B = \frac{1}{8} + \frac{1}{12} = \frac{5}{24}$

$\frac{5}{24} \times 3 = \frac{15}{24}$ $\frac{5}{8}$ left

B can fill work $= 12$

$\frac{9}{2} = 4.5$ $\frac{3}{8}$ " $= 12 \times \frac{3}{8}$

$\frac{3}{8}$?

$\frac{x}{12} + \frac{3}{8} = 1$

$2x + 9 = 24$

$2x = 15$

$x = \frac{15}{2} = 7.5$ min

Brainstorming 1

x min 3x min

48 × 3 = 144 min

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 how long will it take for the slower pipe to fill the tank alone?

A. 48 minutes

B. 144 minutes

C. 100 minutes

D. None of these

$$\frac{1}{x} + \frac{1}{3x} = \frac{1}{36}$$

$$= \frac{3+1}{3x} = \frac{1}{36}$$

$$\frac{4}{3x} = \frac{1}{36} \qquad x = 48 \text{ min}$$

$$\frac{4}{3x} = \frac{1}{12}$$

Brainstorming 2

$A = \frac{1}{4}$ $B = \frac{1}{8}$ $C = \frac{-1}{16}$

Pipes A and B can fill a tank in 4 hours and 8 hours respectively. Pipe C can empty it in 16 hours. If all the three pipes are opened together, then how long will it take to fill the tank?

(A) 4.5 hrs

(B) 2 hrs

(C) 6 hrs

(D) 3.2 hrs

$$\frac{1}{4} + \frac{1}{8} - \frac{1}{16} = \frac{12+6-3}{48}$$

$$= \frac{15}{48} \rightarrow \frac{16}{5} = 3.2 \text{ hrs}$$

Brainstorming 3

$A = \frac{1}{1.5}$ $B = \frac{-1}{x}$

A pump can fill a tank with water in 1.5 hours. However due to leak it took 2.5 hours to fill the tank. How long will the leak take to drain all the water in the tank?

$\frac{1}{1.5} - \frac{1}{x} = \frac{1}{2.5}$

$\frac{20}{75} = \frac{1}{x}$

$\frac{75}{25} \overset{15}{} = 3\frac{3}{4}$ hrs

(A) $3\frac{3}{4}$ hrs

(B) $7\frac{1}{2}$ hrs

(C) $1\frac{5}{9}$ hrs

(D) $2\frac{2}{5}$ hrs

$\frac{10}{15} - \frac{10}{25} = \frac{1}{x}$

$\frac{50-30}{75} = \frac{1}{x}$

Brainstorming 4

$A = \frac{1}{20}$ $B = \frac{1}{24}$ $C = \frac{-1}{x}$

Two pipes can fill a tank in 20 minutes 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. What is the capacity of the tank?

A) 60 gallons

B) 100 gallons

C) 120 gallons

D) 40 gallons

$\frac{120}{3} \times 3$

$\frac{1}{20} + \frac{1}{24} - \frac{1}{x} = \frac{1}{15}$

$= 120$

$\frac{1}{20} + \frac{1}{24} - \frac{1}{15} = \frac{1}{x}$

$\frac{6+5-8}{120} = \frac{1}{x}$

$\frac{3}{120} = \frac{1}{x}$

$x = \frac{120}{3}$

Brainstorming 5

$I = x \quad O = y$

$x + y = 12$

$I = \frac{1}{8} \quad O = \frac{-1}{6}$

There are 12 pipes connected to a tank. Some are inlet whereas others are drain pipes. Each inlet can fill the tank in 8 hours and each drain can empty the tank in 6 hours. When all these pipies are open, an empty tank gets filled in 24 hours. How many are inlet pipes?

$\frac{x}{8} - \frac{y}{6} = \frac{1}{24}$

$\frac{3x - 4y}{24} = \frac{1}{24}$

$3x - 4y = 1$

$4x + 4y = 48$

$3x - 4y = 1$

$7x = 49$

$x = 7$

(A) 8

(B) 7

(C) 6

(D) 5

Brainstorming 6

$A = \frac{1}{20}$ $B = \frac{1}{30}$ $C = \frac{1}{45}$

Three pipes A, B and C can fill a tank in 20 minutes, 30 minutes and 45 minutes respectively. A is opened for 5 minutes and closed. B is opened for 6 minutes and then closed. In how many minutes the remaining part will be filled by C?

$\frac{5}{20} + \frac{6}{30} + \frac{x}{45} = 1$

(A) $21\frac{3}{4}$ minutes

(C) $24\frac{3}{4}$ minutes

$45 + 36 + 4x = 180$

(B) $20\frac{2}{3}$ minutes

$4x = 99$

$x = \frac{99}{4} = 24\frac{3}{4}$

(D) $14\frac{3}{5}$ minutes

Brainstorming 7

Three pipes A, Band C can fill a tank in 30 min, 40 min and 60 min respectively. A and B work in alternative minutes, A beginning the work whereas C works continuously. In how many minutes will the tank be filled?

A 16.4

B 21.8

C 18.2

D 19.6

$A = \frac{1}{30}$ $B = \frac{1}{40}$ $C = \frac{1}{60}$

1st A&C $= \frac{1}{30} + \frac{1}{60} = \frac{3}{60} = \frac{1}{20}$

2nd B&C $= \frac{1}{40} + \frac{1}{60} = \frac{5}{120}$

$\frac{6}{120} + \frac{5}{120} = \frac{11}{120}$ → 2min ×10

$\frac{110}{120}$ = 20min

21st $\frac{10}{120} - \frac{6}{120} = \frac{4}{120}$?

Brainstorming 8

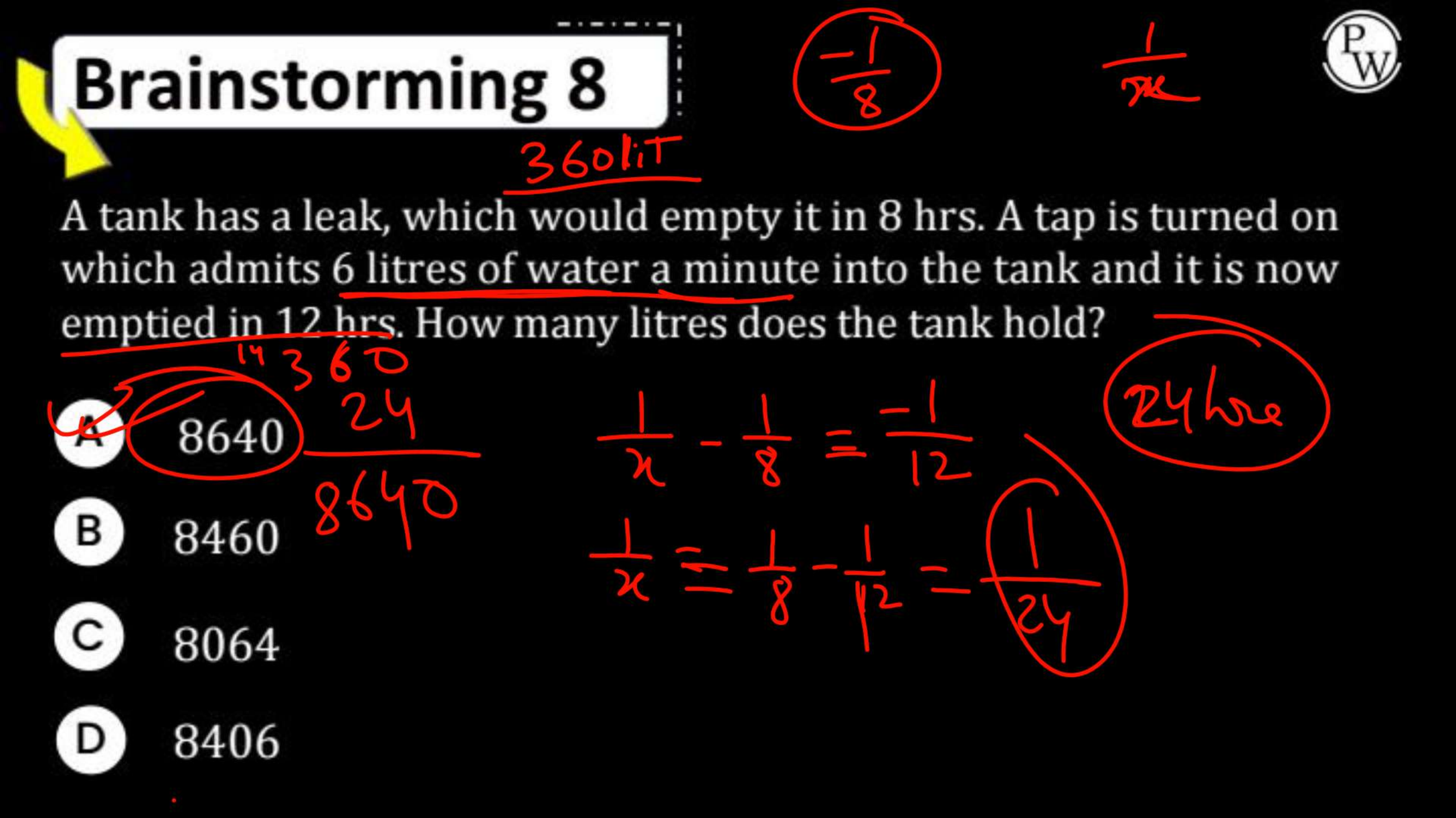
A tank has a leak, which would empty it in 8 hrs. A tap is turned on which admits 6 litres of water a minute into the tank and it is now emptied in 12 hrs. How many litres does the tank hold?

(A) 8640

(B) 8460

(C) 8064

(D) 8406



Brainstorming 9

$A = \frac{1}{60}$. $B = \frac{1}{75}$ $C = \frac{-1}{x}$

Two pipes A and B can separately fill a cistern in 60 and 75 minutes respectively. There is a third pipe at the bottom of the cistern to empty it. If all the three pipes are simultaneously opened, then the cistern is full in 50 minutes. In how much time can third pipe alone empty the cistern?

$$\frac{1}{60} + \frac{1}{75} - \frac{1}{x} = \frac{1}{50}$$

$$\frac{5 + 4 - 6}{300} = \frac{1}{x}$$

$$\frac{3}{300} = \frac{1}{x}$$

$$\frac{1}{100} = \frac{1}{x}$$

(A) 110 minutes

(B) 120 minutes

(C) 100 minutes

(D) 90 minutes

Brainstorming 10

A = 9 min
B = 18 min

One fill pipe A is 2 times faster the second fill pipe B. If A can fill a cistern in 9 minutes, then find the time when the cistern will be full if both fill pipes are opened together.

$$\frac{1}{9} + \frac{1}{18} = \frac{3}{18} = \frac{1}{6}$$

(A) 9 min

(B) 3 min

(C) 11 min

(D) 6 min

Brainstorming 11

$P = x$ $\quad$ $Q = x+5$

$\frac{1}{x}$ $\quad$ $\frac{1}{x+5}$

A reservoir is provided by two pipes P and Q. P can fill the reservoir 5 hours faster than Q. If both together fill the reservoir in 6 hours, the reservoir will be filled by P alone in ___?

(A) 10 hrs

(B) 8 hrs

(C) 12 hrs

(D) 11 hrs

$$\frac{1}{x} + \frac{1}{x+5} = \frac{1}{6}$$

$$\frac{x+5+x}{x(x+5)} = \frac{1}{6}$$

$$12x + 30 = x^2 + 5x$$

$$x^2 + 5x - 12x - 30 = 0$$

$$x^2 - 7x - 30 = 0$$

$$x^2 - 10x + 3x - 30 = 0$$

$$x(x-10) + 3(x-10) = 0$$

$$(x-10)(x+3) = 0$$

NOW TRY THIS

If 9 MONKEYS EAT 9 BANANAS IN 9 MINUTES, THEN HOW MANY MONKEYS WILL EAT 45 BANANAS IN 45 MINUTES?

$$9 \times \frac{45}{9} \times \frac{9}{45}$$

$$9$$

Monkeys	Bananas	Mins
9	9	9
?	45	45

CHAIN RULE

$45\% \text{ of } x = 63$

$x = 63 \times \frac{100}{45}$

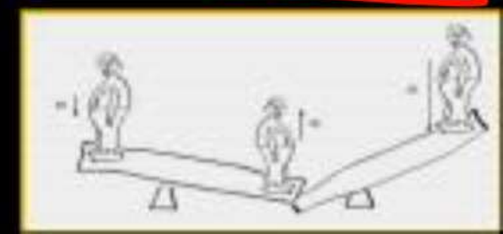
$92\% \text{ of } x = \frac{92}{100} \times 63 \times \frac{100}{45}$

$45\% \rightarrow 63$

$92\% \rightarrow ?$

$63 \times \frac{92}{45}$

%	No
45	63
92	?



Brainstorming 12

12 men can do a work in 15 days working 8 hours a day. In how many days can 9 men do the same work, working 10 hours a day?

$$15 \times \frac{12}{9} \times \frac{8}{10}$$

Men	Days	hrs/day
12	15	8
9	?	10

16 days

Brainstorming 13

If 12 tailors can stitch 15 shirts working 8 hours daily in 56 days, then 15 tailors can stitch 18 shirts working 6 hours daily in how many days?

Tailors	Shirts	hrs/day	Days
12	15	8	56
15	18	6	?

$$56 \times \frac{8}{8} \times \frac{18}{15} \times \frac{12}{15} = \frac{56 \times 32}{25} = \frac{1792}{25} = 71.6$$


thank you