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Chapter 9: Time and Work, Pipes and Cisterns

Theory

Work is always taken as one unit. The unit time in which the work is being done may be in minutes, hours, days, weeks, or months.

Basic Concepts

1. If X does a work in 'a' days, then in one day X does 1/a of the work; this 1/a is known as Rate of A's work.
2. If Y does a work in 'b' days, then in one day B does 1/b of the work; and 1/b is Rate of B's work. Then in one day, if X and Y work together then combined work is (1/a) + (1/b) (Also known as combined rate of work), or, (a + b)/ab; and number of days required to complete the work is (ab)/(a + b). It can be said that the number of time periods required to complete the full work will be reciprocal of the fraction of the work done in one time of period.
3. The basic relation between total work done (W), rate of work (R), and time required to perform a work (t) is W = R.t

Concept of Variation

1. More the number of persons employed, more the work done.
2. More the number of days for which a work was done, more shall be the amount of work done.
3. More the number of persons employed, less will be the time required to finish the work.

Pipes and Cisterns

The principle used to solve problems on Pipes and Cisterns is same as in Time and Work. Here the work done is in terms of filling or emptying a cistern.

Time taken to fill a tank is taken as positive and the time taken to empty a tank is taken as negative.

1. If a pipe can fill a cistern in 'h' hours, then in 1 hour 1/h of the tank will be filled.
2. If a pipe can empty a filled tank in 'h' hours, then in 1 hour 1/h of the tank will be emptied.

If A does a % work in one day and B does b % of the same work in one day then A and B together will take 100/(a + b) days to complete the work.

Relation for building a wall of a certain length, breadth, and height is $L_1B_1H_1/L_2B_2H_2 = m_1t_1d_1/m_2t_2d_2$ where m stands for number of men, t stands for amount of time for which the work is done per day, and d stands for number of days taken to build the wall of given dimensions.

Relation between number of men and number of days taken to complete the work is number of men x number of days taken to complete the work = constant.

Travelling Round A Circle

1. **Given**
    1. Length of the circumference of the circle (C),
    2. rate of walking of A (V_A),
    3. rate of walking of B (V_B).

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To find

1. When A and B will be together at the starting point.
2. When will A and B be together again.

Solution

1. Both A and B will be together at the starting point after LCM(C/V_A, C/V_B).
2. Both A and B will be together again after $C/(V_A – V_B)$.

2. Given

1. Length of the circumference of the circle (C),
2. Rate of walking of A (V_A),
3. Rate of walking of B (V_B),
4. Rate of walking of C (V_C).

To find

1. Time after which A, B, and C will be together again.

Solution

1. A, B, and C will be together again in LCM ($V_A - V_C$, $V_A – V_B$).

Class Work

1) A pipe can fill a tank in 5 hours. Find the part of the tank filled in one hour.
   a) 1/2 b) 1/5 c) 1/3 d) 1/10

2) A pipe can empty a tank in 12 hours. Find the part of the tank emptied in 4 hours.
   a) 1/2 b) 1/12 c) 1/3 d) 1/4

3) A pipe can fill a tank in 8 hours and another can empty it in 16 hours. If both the pipes are opened simultaneously, find the time taken to fill the tank.
   a) 8 hrs b) 16 hrs c) 4 hrs d) 24 hrs

4) Two pipes P and Q can fill a tank separately in 20 minutes and 30 minutes. . If both the pipes are opened simultaneously, find the time taken to fill the tank.
   a) 10 min b) 11 min c) 12 min d) none of these

5) Two pipes can fill a tank in 8 hours and 12 hours respectively, while a third pipe can empty it in 6 hours. If all the pipes are opened simultaneously, find the time taken to fill the tank.
   a) 26 hrs b) 24 hrs c) 20 hrs d) 22 hrs

6) Two pipes can fill a tank in 30 mins and 60 mins respectively, while a leakage can empty it in 45 minutes. If all the pipes are opened simultaneously, find the time taken to fill the tank.
   a) 30 min b) 60 min c) 36 min d) 42 min

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7) A leak at the bottom of the tank can empty the full tank in 6 hours. An inlet fills water at the rate of 4 liters per minute. When the tank is full, the inlet is opened and due to leak, the tank gets empty in 8 hours. What is the capacity of the tank?
   a) 5760 liters b) 6600 liters c) 4550 liters d) 5885 liters

8) Three fourth of a tank is full of water. If 5 liters of water are added to it, four-fifth of the tank gets full. What is the capacity of the tank?
   a) 120 liters b) 90 liters c) 100 liters d) 80 liters

9) Two pipes P and Q running together can fill a tank in 6 minutes. If Q takes 5 minutes more than P to fill the tank, then the time in which P and Q will fill the tank separately will be respectively
   a) (15, 20) min b) (15, 10) min c) (10, 15) min d) (20, 25) min

10) A tank with capacity L liters is empty. If water flows into the tank from Pipe P at the rate of P liters per minute and water is pumped out by a pipe Q at the rate of Q liters per minute, and P > Q, then in how many minutes will the tank be filled?
   a) L/(Q – P) b) L (P – Q) c) L/(P – Q) d) 60L/(P – Q)

11) A person can complete a piece of work in 6 days and another person can complete the same work in 12 days. If both of them work together, find the time taken to complete the work.
   a) 6 days b) 4 days c) 8 days d) 9 days

12) Three persons can finish a piece of work in 10, 15 and 18 days respectively. If all of them work together, what is the time taken to finish the work?
   a) 5 days b) 4.5 days c) 4 days d) 6 days

13) A and B can finish a piece of work in 12 days, B and C in 15 days and A and C in 20 days. How long would each of them take separately to do the same work?
   a) 20, 40, 60 days b) 10, 20, 30 days c) 15, 20, 25 days d) 30, 20, 60 days

14) Sohan takes twice as much time as Mohan to complete a work and Rohan does it in the same time as Sohan and Mohan together. If all of them working together can finish the work in 6 days, then find the time taken by each of them separately to finish the work.
   a) 20, 38, 14 days b) 36, 18, 12 days c) 24, 42, 18 days d) none of these

15) 5 bulls and 2 men working together can do four times as much work as a bull and a man together. Find the ratio of the work done by a bull to a man.
   a) 1:2 b) 2:1 c) 1:3 d) 3:1

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16) Running at the same constant rate, 6 identical machines can produce a total of 270 breads per minute. At this rate, how many breads could 10 such machines produce 4 in minutes?
a) 900 b) 1800 c) 2700 d) 3600

17) A man who works in a farm is paid Rs. 56 for 35 hour a week. Up to 40 hrs, he is paid at the normal rate and on overtime, 1.5 times the normal. How many hrs did he work to get Rs. 88?
a) 48 b) 52 c) 58 d) 50

18) If 10 cats can kill 20 mice in 3 days hunting for 12 hours a day. Then in how many days can 24 cats kill 32 mice hunting for 4 hours a day?
a) 4 b) 6 c) 8 d) 10

19) A man and a half can build a wall and a half in a day and a half, then how many walls do six men build in six days?
a) 6 b) 12 c) 18 d) 24

20) A computer can perform 30 identical tasks in six hours. At that rate, what is the minimum number of computers that should be assigned t complete 80 of the tasks within 3 hours?
a) 5 b) 6 c) 7 d) 8

Home Work

1) A can do a piece of work in 10 days and B alone do it in 12 days. how much time will both take to finish if both of them are given a similar job?
a) 60/11 days b) 58/11 days c) 55/9 days d) 61/11 days

2) A and B can do a piece of work in 10 days, B and C in 12 days, C and A in 15 days. In how many days will they finish it, if they all work together?
a) 9 days b) 8 days c) 7 days d) 10 days

3) A can do a piece of work in 15 days and B can finish it in 20 days. They work together for 5 days and then A goes away. In how many days will B finish the work?
a) 28/3 days b) 25/3 days c) 31/3 days d) 29/3 days

4) A can do a work in 12 days. B is 60% more efficient than A. Find the number of days it takes B to do the same piece of work.
a) 17/2 days b) 19/2 days c) 21/2 days d) 15/2 days

5) 3 men and 6 women finish a job in 9 days, while 2 men and 8 women finish it in 12 days. In how many days will 12 women working alone finish the same job?
a) 432 days b) 436 days c) 36 days d) 38 days

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6) If 18 men and 10 boys can do in a day as much as 10 men and 22 boys, how much should a man be paid a day if a boy is to get Rs. 5 a day?

a) Rs. 8 a day b) Rs. 7.50 a day c) Rs. 8.50 a day d) Rs. 9 a day

7) Two pipes can fill a cistern in 9 hours and 12 hours respectively. In how much time they fill the cistern when opened together?

a) 36/7 hrs. b) 7/36 hrs. c) 5 1/7 hrs. d) 12 hrs.

8) A cistern can be filled by pipes A and B in 2 hours and 3 hours respectively. When full, the tank can be emptied by a pipe C in 6 hrs. If all the taps be turned on at the same time, in what time will the cistern be full?

a) 2/3 hrs. b) 3/2 hrs. c) 1/3 hrs. d) 4/3 hrs.

9) Two pipes M and N can fill a cistern in 24 mins and 32 mins resp. If both the pipes are opened together, then after how many mins should N be closed so that the tank is full in 18 mins?

a) 10 mins b) 6 mins c) 12 mins d) 8 mins

10) A and B together can complete a piece of work in 35 days while A alone can complete it in 60 days. B alone can complete the work in:

a) 42 days b) 72 days c) 96 days d) 84 days

Answer Keys: Class Work

11) b	2) c	3) b	4) c	5) b	6) c	7) a	8) c	9) c	10) c	11) b
12) b	13) d	14) b	15) b	16) b	17) d	18) b	19) d	20) b		

Answer Keys: Home Work

1) a	2) b	3) b	4) d	5) c	6) b	7) a	8) b	9)d	10) d

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