“Time, Speed, & Distance Time & Work, Mensuration”

Pre Read

Relevel
by Unacademy

Important Formula and Conversions- Time, Speed, Distance:

- Speed= Distance/ Time ; S= D/T
- Units of conversion:
  a. 1km/hr =(5/18) m/sec
  b. 1m/sec = (18/5) km/hr
  c. 1.6 km = 1 mile
  d. 1 mile = 1600 m
  e. 1 km/hr = (5/8) miles/hr
  f. 1 yard = 3 feet
  g. 1 km= 1000 m
- When objects are going in the same direction,
  Relative speed = Difference of Speeds
- When objects are going in the opposite Direction,
  Relative Speed = Sum of Speeds

Practice Questions

1. A train does a journey without stopping in 8 hours. If it had travelled 5 km/hr faster, it would have done the journey in 6 hours 40 minutes. What is its speed?
2. A train covered 180 km in 4 hours. If it travels with 2/3rd of its usual speed, then find the extra time to cover the same distance?
3. Walking 5/7 of his usual speed, a boy reaches his school 6 minutes late. Find his usual time to reach the school.
4. If I walk at 4 km/hr, I miss the train by 10 minutes. If I walk at 5 km/hr, I reach 5 minutes before the departure of the train. Howfar I walk to reach the train/station. Also, find my usual time and usual speed.
5. If a man increases his speed by 2km/hr, he reaches the place 1 hour early and if he decreases his speed by 2km/hr, he reaches 1hour 30 minutes late. Find his usual speed and usual time and the distance.
6. Points A, P, Q and B lie on the same line such that P, Q and B are respectively 100km, 200km, and 300km away from A. Cars 1 and 2 leave A at the same time and move towards B. Simultaneously, Car 3 leaves B and moves towards A. Car 3 meets Car1 at Q and Car 2 at P. If each car is moving at a uniform speed, then the ratio of the speed of Car 2 to that of Car 1 is?
7. A goes to a certain place at 20 km/hr and returns at 30 km/hr, find his average speed.
8. A covers 75% of the journey at 20 km/hr and rest at 30 km/hr, find his average speed.
9. Two trains of equal lengths are running on parallel lines in the same direction at the rate of 46 km/hr. and 36 km/hr. The faster train passes the slower train in 36 seconds. Find the length of each train.
10. A thief is spotted by a policeman from a distance of 400 meters. When the policeman starts chasing, the thief starts running. If the speed of the thief is 10km/hr and that of the policeman is 15km/hr. How far the thief would have run when he is overtaken?

Time and Work- Rules and Formulae

1. If A can do a piece of work in 'a' number of days, then in one day $\frac{1}{a}$ th of the work is done. Conversely, if a man does $\frac{1}{a}$ th of a work in 1 day, then he can complete the work in $\frac{1}{1/a}$ = a days
2. If A is 'x' times as good a workman as B, then he will take $\frac{1}{x}$ th of the time taken by B to do the same work.
3. If A and B can do a piece of work in 'x' and 'y' days respectively, then working together, they will take $\frac{xy}{x+y}$ days to finish the work and in one day, they will finish $\frac{x+y}{xy}$ th part of the work.
4. To compare the work done by different people, first find the amount of work each can do in the same time.
5. If the number of men to do a job is changed in the ratio a:b, then the time required to do the work will be in the ratio b:a, assuming the amount of work done by each of them in the given time is the same, or they are identical.
6. If two men A and B together can finish a job in 'x' days and if A working alone takes 'a' days more than A and B working together and B working alone takes 'b' days more than A and B working together then $x=\sqrt{(ab)}$
7. To do a piece of work, the number of men employed and the number of days required to do the work are in inverse proportion, also, the number of men employed and the hours worked per day are in inverse proportion.

Important formulae for Pipes & Cisterns related problems:

1. If an inlet pipe fills a cistern in 'a' hour, then $\frac{1}{a}$ th part is filled in 1 hour.
2. Concept of negative work: The concept of negative work implies work that is destructive in nature. The work of outlet or leakage is negative work.
3. If pipe A is 'x' times bigger than pipe B, then pipe A will take $\frac{1}{x}$ th of the time taken by pipe B to fill the cistern.
4. If A and B fill a cistern in 'm' and 'n' hours, respectively then together they will take $\frac{mn}{m+n}$ hours to fill the cistern and in one hour $\frac{m+n}{mn}$ th part of the cistern will be filled.
5. If an outlet pipe empties the cistern in 'n' hours and an inlet pipe fills a cistern in 'm' hours then the net part filled in 1 hour when both the pipes are opened is $\left(\frac{1}{m} - \frac{1}{n}\right)$ i.e. $\frac{n-m}{mn}$ and the cistern will get filled in $\frac{mn}{n-m}$ hours. For the cistern to get filled, it is necessary that $m < n$. If $m > n$, the cistern will never get filled.
6. If an inlet pipe fills a cistern in 'a' minutes, takes 'x' minutes longer to fill the cistern due to a leak in the cistern, then the time in which the leak will empty the cistern is given by $a \times \left(1 + \frac{a}{x}\right)$.

Practice Questions- Time and Work

1. If A can do a work in 20 days while B in 30 days, in how many days A & B together will finish the work?
2. A & B together can finish a work in 12 days. However, A can alone do it in 15 days. In how many days B can do it alone?
3. A & B can respectively finish the same work in 12 & 20 days. A worked for 9 days at it. Find in how many days B will finish the remaining work.
4. A can do a work in 15 days while B in 30 days. Both started together but A left after 6 days. In how many days the whole work finished?
5. A & B can finish a work in 18 & 24 days respectively. A started it alone and B joined after 6 days. In how many days the whole work was finished?
6. A worked for 8 days on a task which he can complete fully in 12 days, but B finished the rest in 6 days. In how many days can B finish the whole work alone?
7. A can do a piece of work in 20 days. He worked for 5 days at it and then B joined him. The whole work lasted for 15 days. In how many days B can do it alone?
8. A & B together can finish a work in 12 days. A is twice as good a workman as B. In how many days B can do the work alone?
9. A pipe can fill a tank in 36 mins and the other in 18 mins. When should the first pipe be opened so that the tank may be full in 15 mins? Assume that the second pipe has been functioning since the beginning.
10. Two pipes can fill a tank in 36 mins & 45 mins respectively while a waste pipe can empty it in 30 mins. If the waste pipe is opened 7 mins after the first two pipes, at what time, the empty tank will be full?

Volume and Surface area of 3-D figures

1. Cube:

Volume = a^3,

Length of body diagonal = $a\sqrt{3}$

Surface Area:

Lateral Surface Area = $4a^2$

Total Surface Area = $6a^2$

2. Cuboid:

Volume = l.b.h,

Length of body diagonal = $\sqrt{(l^2+b^2+h^2)}$

Surface Area:

Lateral Surface Area = 2(l+b).h

Total Surface Area = 2(lb+bh+hl)

3. Right Circular Cylinder

Volume $=\pi r^2 h$

Surface Area:

Curved Surface Area = $2\pi rh$

(Lateral Surface Area)

Total Surface Area = $2\pi rh + 2\pi r^2$

$= 2\pi r(r + h)$

4. Right Circular Cone:

Base radius = r, Height = h, slant height = l, then

$l^2 = r^2 + h^2$

Volume = $\frac{1}{3} r^2 h$

Surface Area:

Curved Surface Area = πrl

(Lateral Surface Area)

Total Surface Area = $\pi rl + \pi r^2$

5. Sphere

Volume = $\frac{4}{3} \pi r^3$

Surface Area:

Curved Surface Area = Total Surface Area = $4\pi r^2$