VQAR-II

UNIT- 1

QUANTITATIVE ABILITY III

Time, Speed and Distance:

Speed: The rate at which a body or an object travels to cover a certain distance is called **speed** of that body.

Time: The duration in hours, minutes or seconds spent to cover a certain distance is called the **time**.

Distance: The length of the path travelled by any object or a person between two places is known as **distance**.

Relation between Speed, Time and Distance

Speed is the distance covered by an object in unit time. It is calculated by dividing the distance travelled by the time taken.

$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$ $\text{Time} = \frac{\text{Distance}}{\text{Speed}}$ $\text{Distance} = \text{Speed} \times \text{Time}$

Note: Units of Speed, time and distance should be in the same metric system.

Example: 1 A car covers 125 km in 5 h, then find the speed of the car.

Solution: We know that, $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$

$\text{Required speed} = \frac{125}{5} = 25 \text{ km/h}.$

Example: 2 A train covers a distance of 200 km with a speed of 10 km/h. What time is taken by the train to cover this distance?

Solution: Speed = 10 km/h and distance = 200 km

$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{200}{10} = 20$

Required time = 20 h.

Example: 3 A bike crosses a bridge with a speed of 108 km/h. What will be the length of the bridge, if the bike takes 8 h to cross the bridge?

Solution: Here, length of the bridge = Distance travelled by bike in 8 h

$= \text{Speed} \times \text{Time}$

Given that, Speed = 108 km/h

Time = 8 h then length of the bridge = 108 × 8 = 864 km.

Basic Formulae Related to Speed, Time and Distance

Formula: 12

$$\text{Conversion of units a km/h} = \frac{a \times 1000\ m}{3600\ s} = \frac{5a}{18}\ m/s$$

$$am/s = \frac{a \times 1/1000\ km}{1/3600h} = \frac{18a}{5}\ km/h$$

Example: 4 Convert 72 km/h into m/s.

Solution: We know that, $a\ km/h = \left(a \times \frac{5}{18}\right) m/s$

$$72\ km/h = \left(72 \times \frac{5}{18}\right) m/s = 4 \times 5 = 20\ m/s.$$

Example: 5 Convert 25 m/s into km/h.

Solution: We know that, $a\ m/s = \left(a \times \frac{18}{5}\right) km/h$

$$25\ m/s = \left(25 \times \frac{18}{5}\right) m/s = 5 \times 18 = 90\ km/h.$$

Formula: 2

If speed is kept constant, then the distance covered by an object is proportional to time.

ie., Distance ∞ Time (Speed constant) or $\frac{D_1}{T_1} = \frac{D_2}{T_2}$

Example: 6 A person covers $20\ \frac{2}{5}$ km in 3 h. What distance will he cover in 5 h?

Solution: Here, speed is kept constant. Therefore, according to the formula,

$$\frac{D_1}{T_1} = \frac{D_2}{T_2}$$

Given that $D_1 = 20\ \frac{2}{5} = \frac{102}{5}\ km$

$T_1 = 3\ h, T_2 = 5\ h$ and $D_2 = ?$

$$\frac{102/5}{3} = \frac{D_2}{5}$$

$$D_2 = \frac{102 \times 5}{5 \times 3} = 34\ km$$

Distance covered by the object in 5 h = 34 km.

Formula: 3

If time is kept constant, then the distance covered by an object is proportional to speed.

ie., Distance ∞ Speed (time constant) or $\frac{D_1}{S_1} = \frac{D_2}{S_2}$

Example: 7 A person covers a distance of 12 km, while walking at a speed of 4 km/h. How much distance he would cover in same time, if he walks at a speed of 6 km/h ?

Solution: Given that $D_1 = 12$ km, $S_1 = 4$ km/h, $S_2 = 6$ km/h, $D_2 = ?$

Since, the time is kept constant. Therefore, according to the formula, $\frac{D_1}{S_1} = \frac{D_2}{S_2}$.

$$\Rightarrow \frac{12}{4} = \frac{D_2}{6} \quad \Rightarrow D_2 = 18 \text{ km}$$

Therefore, the person will cover 18 km.

Formula: 4

If distance is kept constant, then the speed of a body is inversely proportional to time.

ie, Speed ∞ $\frac{1}{\text{Time}}$(distance constant) (or) $S_1T_1 = S_2T_2 = S_3T_3 = \ldots\ldots\ldots$

Note: If the ratio of speeds of two objects is $x : y$, then to cover same distance, the ratio of time taken will be $y : x$.

Example: 8 A person covers a certain distance with a speed of 18 km/h in 8 min. If he wants to cover the same distance in 6 min, what should be his speed?

Solution: We know that, Speed = $\frac{\text{Distance}}{\text{Time}} \Rightarrow 18 = \frac{\text{Distance} \times 60}{8}$ [8 min = $\frac{8}{60}h$]

Distance = $\frac{18 \times 8}{60} = \frac{12}{5}$ km

Speed to cover $\frac{12}{5}$ km in 6 min = $\frac{\text{Distance}}{\text{Time}} = \frac{\frac{12}{5}}{\frac{1}{10}}$ [6 min = $\frac{1}{60}h$]

$= \frac{12}{5} \times 10 = 12 \times 2 = 24$ km /h.

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