**Concept of Speed, Time and Distance**

**1.**Speed is a very basic concept in motion which is all about how fast or slow any object moves.

We define speed as distance divided by time.  
Distance is directly proportional to speed when time is constant.

* **Speed = distance/time**
* **Time = distance/ Speed**
* **Distance = Speed \* Time**

**2.**Convert from kmph (km/h) to mps(m/sec)

**x km/hr=(x∗5/18) m/sec**

**3.**Convert from mps(m/sec) to kmph(km/h)

**x m/sec= x \*(18/5)  km/h**

**4.**If the ratio of the speeds of A and B is a : b, then the ratio of the times taken by then to cover the same distance is :1/a : 1/b  or  **b : a**

**5.**Suppose a man covers a certain distance at x km/hr and an equal distance at y km/hr. Then,  
the average speed during the whole journey is

**2xy/(x + y)**

**6. If Distance is Constant**

If distance travelled for each part of the journey, ie d1=d2=d3=...=dn=d, then average speed of the object is Harmonic Mean of speeds.  
Let each distance be covered with speeds s1,s2,...sn in t1,t2,...tn times respectively.  
Then t1 =d/s1, t2 = d/s2 & tn =d/sn  
then, Average Speed=   [(d + d + d+ ... ntimes)]/ [d/s1 + d/s2+ d/s3+ ... d/sn]  
**Average Speed= (n)/[(1/s1  + 1/s2+ .... 1/sn)]**

**7. If Time is Constant**  
If time taken to travel each part of the journey, ie t1=t2=t3=…tn=t, then average speed of the object is Arithmetic  
Let distance of parts of the journey be d1,d2,d3,...dn and let them be covered with speed s1,s2,s3,...sn respectively.  
Then d1=s1 t ,  d2=s2t, d3=s3t, ... dn=snt  
then ,  Average Speed= [(s1/t+ s2/t+ .... sn/t)/(t + t+ ...  n times)]  
**Average Speed=( s1+ s2+s3+ ... + sn)/n**

**8. Relative Speed**

* If two objects are moving in same direction with speeds a and b, then their relative speed is **|a-b|**
* If two objects are moving is opposite direction with speeds a and b, then their relative speed is **(a+b).**

**SOLVED EXAMPLES**

**1.A man covers a distance of 600m in 2min 30sec. What will be the speed in km/hr?**  
**Solution:**

Speed =Distance / Time  
Distance covered = 600m,

Time taken = 2min 30sec = 150sec  
Therefore, Speed= 600 / 150  
= 4m/sec

=(4\*18/5) km/hr = 14.4 km/ hr.

**2.** **A car travels along four sides of a square at speeds of 200, 400, 600 and 800 km/hr. Find average speed?**  
**Solution:**

Let x km be the side of square and y km/hr be average speed  
Using basic formula,

Time = Total Distance / Average Speed  
x/200 + x/400 + x/600 + x/800= 4x/y  
=25x/ 2400 = 4x/ y  
= y= 384  
Average speed = 384 km/hr

**3. A motor car does a journey in 10 hrs, the first half at 21 kmph and the second half at 24kmph. Find the distance?**  
**Solution:**

**Distance** = (2 x 10 x 21 x 24) / (21+24)  
= 10080 / 45  
= 224 km.

**4. A boy goes to school at a speed of 3 kmph and returns to the village at a speed of 2 kmph. If he takes 5 hrs in all, what is the distance between the village and the school?**

**Solution:**

Let the required distance be x km.  
Then time taken during the first journey = x/3 hr.  
and time taken during the second journey = x/2 hr.  
x/3 + x/2 = 5 => (2x + 3x) / 6 = 5  
=> 5x = 30.  
=> x = 6  
Required distance = 6 km.

**5. Walking ¾ of his speed, a person is 10 min late to his office. Find his usual time to cover the distance?**  
**Solution:**

Usual time = Late time / {1/ (3/4) - 1)  
= 10 / (4/3 -1 )  
= 10 / (1/3)  
= 30 minutes.