# IX Physics Motion and Rest

CBSE chapter-wise MCQ Multiple Choice Questions, Test Paper, Sample paper   on CCE pattern for class 9 science Motion. Distance and displacement, velocity; uniform and non-uniform motion along a straight line; acceleration, distance-time and velocity-time graphs for uniform motion and uniformly accelerated motion, equations of motion by graphical method; elementary idea of uniform circular motion.

IX Physics Motion and Rest solved Numerical:

. in a circular track (distance 400 m) an athlete runs 1/4 the of the ground. So what would be the displacement?

Ans: Given length of the circular track = 400m. Since the athlete runs ¼ of the circular track the distance covered by the athlete is 100m. The displacement is the shortest distance between the initial and final position, therefore, displacement in above question is length of the straight line AB as given in the diagram below.
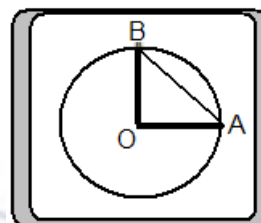
 To calculate length of the line AB we need to first calculate the radius of the circular track.

Now, Length of track = $2\pi R \Rightarrow 400 = 2\pi R \Rightarrow R = \frac{200}{\pi}$

Now, In right $\triangle$ OAB; $AB^2 = OA^2 + OB^2 \Rightarrow AB^2 = R^2 + R^2 = \sqrt{(\frac{200}{\pi})^2 + (\frac{200}{\pi})^2} = \frac{200\sqrt{2}}{\pi}\ 90.06m\ (appx.)$

Q. A train travels 40 km at a uniform speed of 30 km/hr. Its average speed after travelling another 40 km is 45 km/hr for the whole journey. It's speed in the second half of the journey is ?

Ans: Suppose speed of the train in second half be v km/hr ; Total distance travelled by the train = 80 km

Total time taken T = $\frac{Distance}{Average\ speed} = \frac{80}{45} = \frac{16}{9}\ hrs$

 Time taken to cover first half, T1 = $\frac{40}{30}\ hrs = \frac{4}{3}$ hrs

Time taken to cover second half , T2 = $\frac{40}{v}\ hrs$

 Now, T1 + T2 = T $\Rightarrow \frac{4}{3} + \frac{40}{v} = \frac{16}{9} \Rightarrow v = 90 km/h$

Thus the speed to travel second-half = 90km/hr

Q. a motorcyclist drives from a to b with the uniform speed of 30 km/h-1 and returns back with the speed of 20 km/h-1.find the average speed?

Given: Speed to travel from point a to b = 30km/hr; Speed of return journey = 20 km/hr

Let distance between a and b is x km so, Total distance covered = 2x km

Total time = $t_1 + t_2 = \frac{x}{30} + \frac{x}{20} = \frac{50x}{600}$

Average speed = Total distance/ total time = $\frac{2x}{\frac{50x}{600}} = 25$ km/h

Q. A cheetah is the fastest land animal and it can achieve a peak velocity of 100 km per hour upto distances less than 500 metres. If the cheetah spots his prey at a distance of 100 metres what is the minimum time it will take to get its prey?

Ans: If the cheetah spots the prey at its top speed, the cheetah will hunt down the prey with the speed of 100 Km/h.= 27.7 m/s   Now, speed = d/t $\Rightarrow$ time = d/s= 100/27.7 = 3.6 sec.

So, the minimum time the cheetah will take to get the prey is 3.6 s.

Q. A police jeep is chasing with velocity of 45 km/h. A thief in another jeep moving with a velocity of 153 km/h. police fires a bullet with muzzle velocity of 180 m/s. the velocity it will strike the car of the thief is ____?

Ans: Given: Velocity of police jeep =45km/hr = 12.5 m/s Velocity of thief's jeep = 153 km/hr = 42.5 m/s

Velocity of bullet = 180 m/s

Now, since bullet is fired from police jeep which is going at 42.5 m/s,

Therefore, velocity of bullet is (180+12.5) = 192.5m/s.

To calculate velocity with which bullet will hit the thief we use concept of relative velocity.

Therefore, we have V_{BT} = V_B - V_T Here VB is velocity of bullet and VT is velocity of thief

V_{BT} = 192.5m/s - 42.5 m/s =   150m/s

Q. A car moves with a speed of 30km/h for half an hour; 25km/h for 1 hr and 40km/hr for 2 hrs. Find average speed.

Ans: Distance travelled with a speed of 30km/h for half an hour = 30km/h x1/2hr =15km

Distance travelled with a speed of 25km/h for an hour = 25km/h x1hr =25km

Distance travelled with a speed of 40km/h for 2 hour = 40km/h x2hr =80km

Average speed = $\frac{\text{total diistance}}{\text{total time}}$ = $\frac{(15+25+80)\text{km}}{\left(\frac{1}{2}+1+2\right)\text{hrs}} = \frac{120\text{km}}{\frac{3}{2}\text{hrs}} = 80\text{km/h}$

Q. If a car travels first 40km at speed of 20km/h and next 80km at a speed of 40km/h. What is the average speed of cat during journey?

Ans: Average speed = $\dfrac{\text{total diistance}}{\text{total time}}$ $= \dfrac{(40+80)\text{km}}{\left(\frac{40}{20}+\frac{80}{40}\right)\text{hrs}} = \dfrac{120\text{km}}{4\text{hrs}} = 30\text{km/h}$

Q. On a 120 km long track, a train travels the first 30 km at a speed of 30km/h .How fast train travel the next 90km so that average speed would be 60km/h?

Ans: Let train travel the next 90km at speed of x km/h, Average speed given =60km/h

Average speed = $\dfrac{\text{total diistance}}{\text{total time}}$ $= \dfrac{(30+90)\text{km}}{\left(\frac{30}{30}+\frac{90}{x}\right)\text{hrs}} = \dfrac{120\text{km}}{1+\frac{90}{x}}$

$\Rightarrow 60\text{km/h} = \dfrac{120\,x}{x+90}$ $\quad \Rightarrow 60x + 540 = 120x \Rightarrow 540/60=x \Rightarrow x=90\text{km/hr}$

Q. Q. An object covers half the distance with the speed of 20m/s and other half with a speed of 30m/s.Find average speed?

Ans: Let S be the total distance traveled by the object.

It covers (S/2) with speed 20 m/s. Time taken to cover this (S/2) is = (S/2)/20 = S/40

It covers the other (S/2) with speed 30 m/s. Time taken to cover this (S/2) is = (S/2)/30 = S/60

Average speed = Total distance/Total time = (S/2 + S/2)/(S/40 + S/60) = 24 m/s

Q. A 150 metres long train crosses a man walking at the speed of 6km/h in the opposite direction in 6 seconds. The speed of the train in km/h is how much?

Ans: Let 'v' be the speed of the train with respect to the ground. The velocity of the man with respect to ground is (- 6) km/h (negative sign is included because the man and the train are moving in opposite directions).

So, the velocity of the man with respect to the train (relative speed)= [v - (-6)] = (v + 6) km/h

Time taken by the man to cross the 0.15 Km train is = 6 s = (6/3600) h

Using, Distance = speed X time $\Rightarrow$ 0.15 = (v + 6) X (6/3600) $\Rightarrow$ v = 84 Km/h

So, the speed of the train is 84 Km/h

Q. The velocity of a car in 10 sec. changes from 10 m/s to 50 m/s. What will be its acceleration?

Ans: a = $\dfrac{v-u}{t}$ $\Rightarrow$ a = $\dfrac{50-10}{10} = 4m/s^2$

Q. A train acquire velocity of 80km/h in just half an hour after start. Find its acceleration?

Ans: u = 0m/s ; v = $80 \times \frac{1000}{3600}$ $m/s = \frac{800}{36} m/s$ a = $\frac{v-u}{t}$ $\Rightarrow$ a = $\frac{\frac{800}{36} m/s}{\frac{1}{2} \times 3600}$ = $0.12 \ m/s^2$

Q.A Car is travelling at 20 m/s along a road. A child runs out into the road 50 m ahead and the car driver steps on the brake pedal . What must the car's deceleration be if the car is to stop just before it reaches the child?

Ans: u = 20m/s ; s = 50 m v = 0 m/s Using, 2as = v²- u² $\Rightarrow$ a = $\frac{v2-u2}{2s}$ = $\frac{(0-20^2)}{2 \times 50}$ = - 4 m/s²

Acceleration = -4 m/s² or, retardation = 4 m/s²

Q.A Car is travelling along the road at 8m/s. It accelerates at 1m/s² for a distance of 18m. How fast is it travelling?

Ans: applying; v² = u² + 2as $\Rightarrow$ v² = 64 + 2x8 $\Rightarrow$ v² = 100 So, V= 10m/s

Q. Stone dropped in a well hits water surface after 2 sec. What is the depth of well and with what speed will the stone hit water surface?

Ans: a = -g = -9.8m/s²; t = 2 sec; u = 0 m/s: Using s = u t + $\frac{1}{2}$ at² you get s = - 19m or simply = 19 m

Using, $v^2 = u^2 + 2as$ you get v = 19.6m/s

Q. A ball hits a wall horizontally at 6m/s. it rebounds horizontally at 4.4m/s. The ball is in contact with the wall for 0.04 s. What is the acceleration of the ball?

Ans: u = 6m/s v= 4.4m/s t = 0.04sec. Using a = $\frac{v-u}{t}$ = $\frac{4.4-6}{0/04}$ = $-40m/s^2$

Q. A train starting from rest move with a uniform acceleration of 0.2m/s² for 5 min calculate the speed acquired and the distance travelled in this time?

Ans: u=0m/s a=0.2m/s² t=5 min. = 300s

Using, s = s = u t + $\frac{1}{2}$ at² $\Rightarrow$ s=0 + 1/2x 0.2x (300)² =0+900=900m

Using, $v^2 = u^2 + 2as$ you get v = 60m/s

Q. Q. A car acquires a velocity of 180km/h in 20sec starting from rest find a) acceleration b) average velocity c)the distance travelled in this time

Ans: a) At first we have to change speed in m/s, s = 180km/hr = 50m/s ; Given, u=0m/s , v = 50 m/s, t=20s

Using a = $\frac{v-u}{t}$ we get , a=50/20 = 2.5m/s²

(b) Average velocity = $\frac{v+u}{2}$ = 50 /2 => 25m/s

(c) Distance (s) = u t + $\frac{1}{2}$ at^2 = 0 + 1/2 at^2 = 1/2 x 2.5x(20)^2 We get, S = 500m

Q. 2 stones are thrown vertically upwards simultaneously with their initial velocities u_1 and u_2 respectively. Prove that the heights reached by them would be in ratio $(u_1)^2$: $(u_2)^2$

Ans: Using, $v^2 = u^2 + 2ah$. At the top final velocity will be zero.

Using, $v^2 - u^2 = 2gh$ or, h = $\frac{v^2 - u^2}{2a}$ but v = 0m/s and a = -g we get, h= $\frac{u^2}{2g}$

Therefore: $h_1 = \frac{u_1^2}{2g}$ and h_2 = $\frac{u_2^2}{2g}$ $\Rightarrow$ $\frac{h_1}{h_2}$ = $\frac{\frac{u_1^2}{2g}}{\frac{u_2^2}{2g}}$ = $\frac{u_1^2}{u_2^2}$