PHYSICS

BOOKS - BAL BHARTI

LAW OF MOTION

Solved Examples

1. An athlete is running on a circular track. He runs a distance of 400 m in 25 s before

returning to his original position. What is his average speed and velocity?

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2. An aeroplane taxies on the runway for 30 s with an acceleration of $3.2 m / s^2$ before taking off. How much distance would it have covered on the runway?

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3. A kangaroo can jump 2.5 m vertically. What must be the initial velocity of the kangaroo?

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4. A motorboat starts from rest and moves with uniform acceleration, if it attains the velocity of $15m/s$ in 5s, calculate the acceleration and the distance travelled in that time.

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5. The mass of a cannon is 500 kg and it recoils with a speed of $0.25m/s$. What is momentum of the cannon?

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6. 2 balls have masses of 50 gm and 100 gm respectively and they are moving along the same line in the same direction with velocities of 3 m/s and 1.5 m/s respectively. They collide with each other and after the collision, the

first ball moves with a velocity of 2.5 m/s. Calculate the velocity of the other ball after collision.

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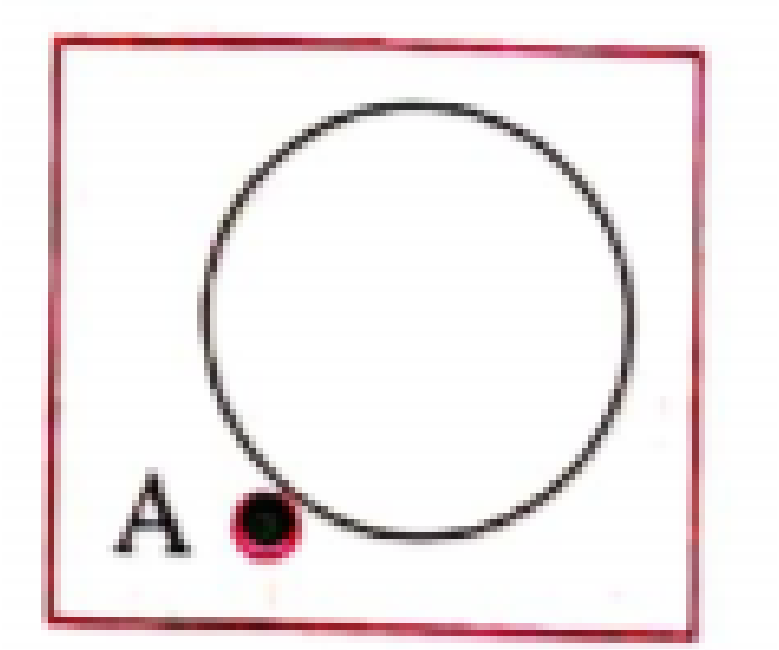
Use Your Brain Power

1. Use your brain power:



Every morning, Swaralee walks round the edge of a circular field having a radius of 100 m. As shown in Figure, if she starts from the point A and takes one round, how much distance has she walked and what is her displacement?

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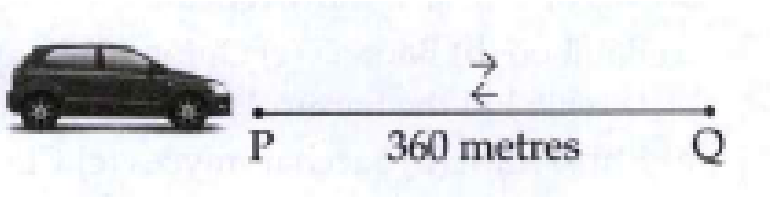
2. If a car, starting from point P, goes to point Q (see figure) and then returns to point P, how much distance has it travelled and what is its displacement?



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3. Use your brain power:

Amar, Akbar and Anthony are travelling in different cars with different velocities. The distance covered by them during different time intervals are given in the following table. What is the time interval between the noting's of distances made by Amar, Akbar and

Anthony?

Time in the clock	Distance covered by Amar in km	Distance covered by Akbar in km	Distance covered by Anthony in km
5:00	0	0	0
5:30	20	18	14
6:00	40	36	28
6:30	60	42	42
7:00	80	70	56
7:30	100	95	70
8:00	120	120	84

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4. Use your brain power:

Amar, Akbar and Anthony are travelling in different cars with different velocities. The

distance covered by them during different time intervals are given in the following table. Are all the distances covered by Akbar in the fixed time intervals the same?

Time in the clock	Distance covered by Amar in km	Distance covered by Akbar in km	Distance covered by Anthony in km
5:00	0	0	0
5:30	20	18	14
6:00	40	36	28
6:30	60	42	42
7:00	80	70	56
7:30	100	95	70
8:00	120	120	84

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5. Use your brain power:

Amar, Akbar and Anthony are travelling in different cars with different velocities. The distance covered by them during different time intervals are given in the following table. Considering the distances covered by Amar, Akbar, Anthony in fixed time intervals, what

can you say about their speeds?

Time in the clock	Distance covered by Amar in km	Distance covered by Akbar in km	Distance covered by Anthony in km
5:00	0	0	0
5:30	20	18	14
6:00	40	36	28
6:30	60	42	42
7:00	80	70	56
7:30	100	95	70
8:00	120	120	84

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6. If the velocity changes by equal amounts in equal time intervals, the object is said to be in.....

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7. If the velocity changes by equal amounts in equal time intervals, the object is said to be in.....

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8. In the distance-time graph above, what does the slope of the straight line indicate?

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9. Answer the following questions:

A train is moving with a uniform velocity of 60km/hour for 5 hours. The velocity-time graph for this uniform motion show in figure.

i. With the help of the graph, how will you determine the distance covered by the train

between 2 and 4 hours

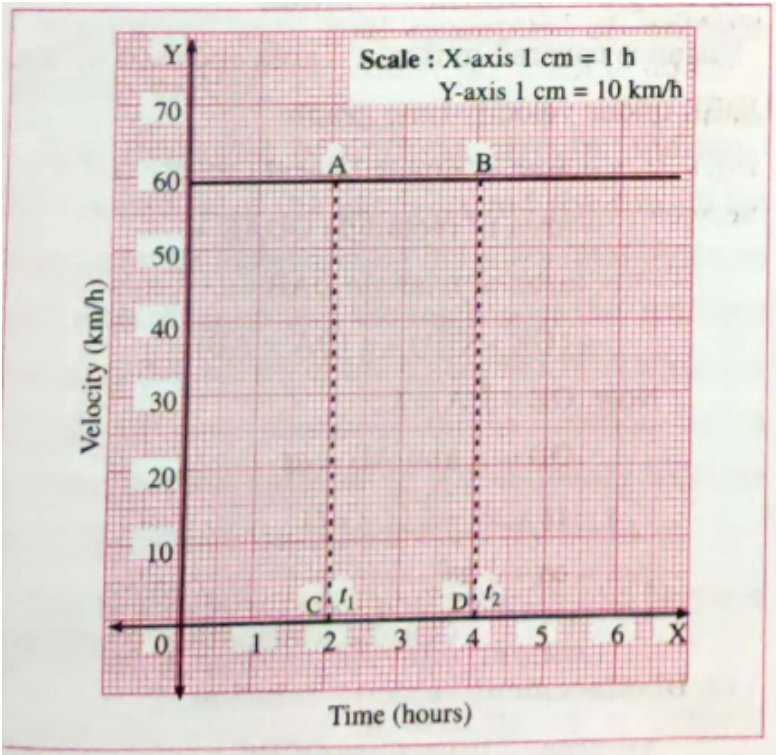

Fig. 1.4 : Velocity-time graph for uniform velocity

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10. Answer the following questions:

A train is moving with a uniform velocity of 60km/hout for 5 hours. The velocity-time graph for this uniform motion show in figure.

Is there a relation between the distance covered by the train between 2 and 4 hours and the area of a particular quadrangle in the

graph? What is the acceleration of the train?

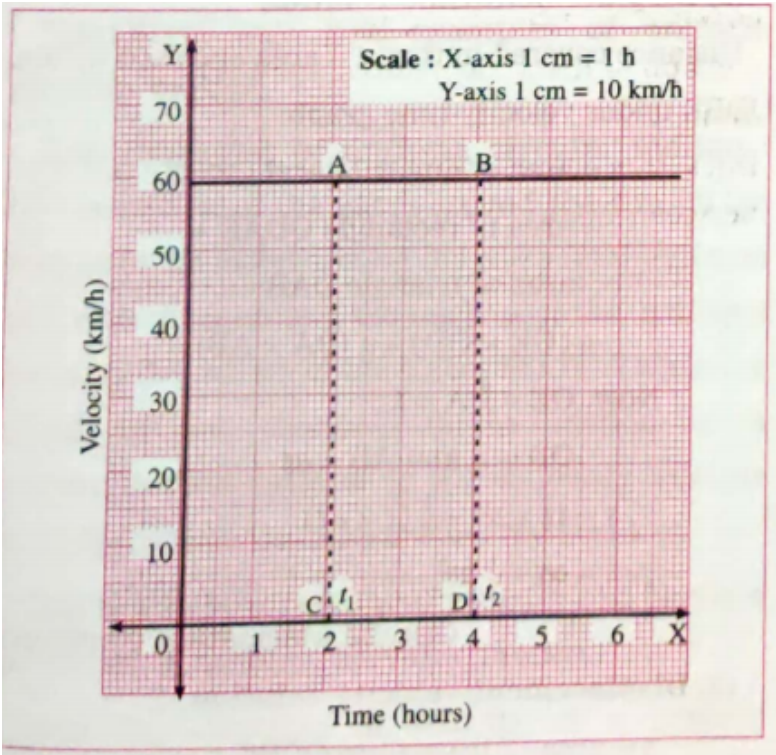

Fig. 1.4 : Velocity-time graph for uniform velocity

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11. Use your brain power:

Why is there a thick bed of sand for a high jumper to fall on after his jump?

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12. Use your brain power:

While hitting a ball with a bat, the speed of the bat decreases.

How will you explain these with the help of Newton's third law of motion?

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13. Answer the following questions:

When a bullet is fired from a gun, the gun recoils. Explain why.

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14. Use your brain power:

Mechanism of firing of a rocket.

How will you explain these with the help of Newton's third law of motion?

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Exercises

1. Match the first column with appropriate entries in the second and third columns and remake the table:

No.	Column I	Column II	Column III
(1)	Negative acceleration	The velocity of the object remains constant	A car, initially at rest reaches a velocity of 50 km/h in 10 seconds
(2)	Positive acceleration	The velocity of the object decreases	A vehicle is moving with a velocity of 25 m/s
(3)	Zero acceleration	The velocity of the object increases	A vehicle moving with the velocity of 10 m/s, stops after 5 seconds

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2. Distinguish between:

Distance and Displacement:

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3. Clarify the differences

Uniform and non-uniform motion.

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4. Complete the following table.

u (m/s)	a (m/s²)	t (sec)	v = u + at (m/s)
2	4	3	–
–	5	2	20

u (m/s)	a (m/s²)	t (sec)	$s = ut + \frac{1}{2}at^2$ (m)
5	12	3	–
7	–	4	92

u (m/s)	a (m/s²)	s (m)	$v^2 = u^2 + 2as$ $(m/s)^2$
4	3	–	8
–	5	8.4	10

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5. Complete the sentences and explain them.

The minimum distance between the start and finish points of the motion of an object is called the ..... of the object.

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6. Complete the sentences and explain them:

Deceleration is ..... acceleration.

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7. Complete the sentences and explain them:

When an object is in uniform circular motion, its _..... changes at every point

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8. Complete the sentences and explain them:

During collision ..... remains constant.

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9. Complete the sentences and explain them:

The working of a rocket depends on Newton's ..... law of motion.

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10. When an object falls freely to the ground, its acceleration is uniform.

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11. Give scientific reasons:

Even though the magnitudes of action force and reaction force are equal and their directions are opposite, their effects do not get cancelled.

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12. Give scientific reasons:

It is easier to stop a tennis ball as compared

to a cricket ball, when both are travelling with, the same velocity.

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13. Give scientific reasons:

The velocity of an object at rest is considered to be uniform.

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14. Answer the following questions:

Take 5 examples from your surroundings and give explanation based on Newton's law of motion.

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15. Solve the following examples: (numerical problems)

An object moves 18 m in the first 3 seconds, 22

m in the next 3 seconds and 14 m in the last 3 seconds. What is its average speed?

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16. An object of mass16 kg is moving with an acceleration of 3m/s2. Calculate the applied force. If the same force is applied on an object of mass 24 kg, how much will be the acceleration?

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17. Solve the following examples: (numerical problems)

A bullet having a mass of 10 g and moving with a speed of 1.5 $\frac{m}{s}$ penetrates a thick wooden plank of mass 90 g. The plank was initially at rest. The bullet gets embedded in the plank and both move together. Determine their velocity.

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18. Solve the following examples: (numerical problems)

A person swims 100 m in the first 40 s, 80 m in the next 40 s and 45 m in the last 20 s. What is the average speed?

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