7. Motion, Force and Work

Q 1) Fill in the blanks with the proper words from the brackets.

(Stationary, Zero, Changing, constant, Displacement, Velocity, speed, Acceleration, Stationary but not zero, Increases)

1. If a body traverses a distance in direct proportion to the time, the speed of the body is ....

Ans : Constant

2. If a body is moving with a constant velocity its acceleration is............ .

Ans : Zero

3. .... is a scalar quantity.

Ans : Speed

4. .... is the distance traversed by a body in a particular direction in unit time.

Ans : Velocity

5. The unit of .... m/s².

Ans : Acceleration

6. .... is measured by the acceleration that it produces.

Ans : Force

Q 2) Distinguish between.

1. Distance and Displacement

Ans :

Distance	Displacement
1. It is the length of the actual path followed by a body between the points under consideration.	1. It is the shortest distance from the initial point to the final point of movement of a body.
2. Its magnitude is equal or greater than that of displacement.	2. Its magnitude is equal or less than that of distance.
3. Distance does not have direction.	3. Displacement has direction
4. It is Scalar quantity.	4. It is vector quantity.

2. Speed and Velocity

Ans :

Speed	Velocity
1. Speed is the distance covered per unit time.	1. Velocity is the displacement per unit time.
2. It does not have direction.	2. It has direction.

3. From the group B and C, choose the proper words, for each of the words in group A.

A	B	C
Work	Newton	erg
Force	Meter	cm
Displacement	Joule	dyne

Ans :

A	B	C
Work	Joule	erg
Force	Newton	dyne
Displacement	Meter	cm

Q. 4). A bird sitting on a wire, flies, circles around and comes back to its perch. Explain the total distance it traversed during its flight and its eventual displacement.

Ans : If bird takes a circular turn and returns. The distance traversed by the bird is equal to the circular path that it has taken. Since bird returns to its original position, the displacement will be zero.

Q. 5). Explain the following concepts in your own words with everyday examples: Force, Work, Displacement, Velocity, Acceleration, Distance.

Ans : By using force we perform many activities in our day to day routine. e. g. Pushing a vehicle, lifting the luggage, riding a bicycle, taking things from lower floor to upper ones.

The work done by force (F), W = F × s. Here s is the displacement taking place in the direction of the force.

Some work is done by pushing a hand cart with force is pushed by using force work is done. Lifting our school bag and carry it to school is also a work. We go to school from home we cover some distance and the displacement takes place. If we travel by vehicle, that time distance is crossed with a certain velocity; however this velocity is not constant. When the velocity is increased, then acceleration becomes positive while when the brake is applied on the vehicle, the acceleration becomes negative.

Q. 6). A ball is rolling from A to D on a flat and smooth surface. Its speed is 2 cm/s. On reaching B, it was pushed continuously up to C. On reaching D from C, its speed had become 4 cm/s. It took 2 seconds for it to go from B to C. What is the acceleration of the ball as it goes from B to C?
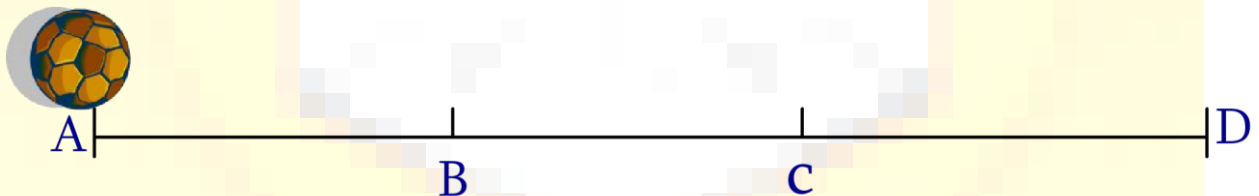
Ans : It will not face the frictional resistance, as the ball is rolling on a flat and smooth surface. So, the speed of ball from A to B is 2 cm/sec.

At B the speed of ball is 2 cm/second.

From C to D force acts on a ball. So, the speed of the ball is 4 cm/sec.

Due to linear motion, the speed of the ball is same at all the points so, the magnitude of velocity of ball = speed of the ball.

∴ Increase in the speed from B to C = 4 cm/sec - 2 cm/sec = 2 cm/sec

Acceleration in the displacement = change in the velocity/ time = 2 cm/s/2 sec=1 cm/s²

Therefore the acceleration between B to C =1cm/s²

Q. 7). Solve the following problems.

a). A force of 1000N was applied to stop a car that was moving with a constant velocity. The car stopped after moving through 10m. How much is the work done?

Ans : Solution: The direction of force and displacement are opposite to each other.

That means,

F=1000 N and s = - 10 m

∴ W= F × s

    = 1000 N × (- 10 m)

    = - 10000 J

The work done W= -10000 J

b). A cart with mass 20 kg went 50m in a straight line on a plain and smooth road when a force of 2N was applied to it. How much work was done by the force?

Ans :

Solution: Force (F) = 2N

Displacement (s) = 50 meter

$\therefore$ W = F × s

$\therefore$ W = 2 N × 50 m

= 100 J

The work done by the force W= 100 J

Q 8) Use your brain power!

1. The unit of acceleration is m/s² Verify this.

Ans : Acceleration = $\frac{\text{Change in the velocity}}{\text{Time taken of change}}$

The unit of change of velocity = m/s

Unit of time period = s

So, the unit of acceleration = m/s² × 1/s = m/s²

2. Acceleration is a vector quantity. Is force a vector quantity, too?

Ans : Yes, acceleration is a vector quantity.

According to Newton's first law of motion, if a force is applied on an object, acceleration takes place. The effect of force depends on both, direction and magnitude of the force then force can increase or decrease the velocity. Sometimes the magnitude of velocity can remain constant but the direction of the velocity can change. This shows that acceleration is a vector quantity.

Q 9) Observes the figure and answer the questions.

Sachin and Sameer started on a motorbike from place A, took the turn at B, did a task at C, travelled by the route CD to D and then went on to E. Altogether, they took one hour for this journey. Find out the actual distance traversed by them and the displacement from A to E. From this, deduce their speed. What was their velocity from

A to E in the direction AE? Can this velocity be called average velocity?
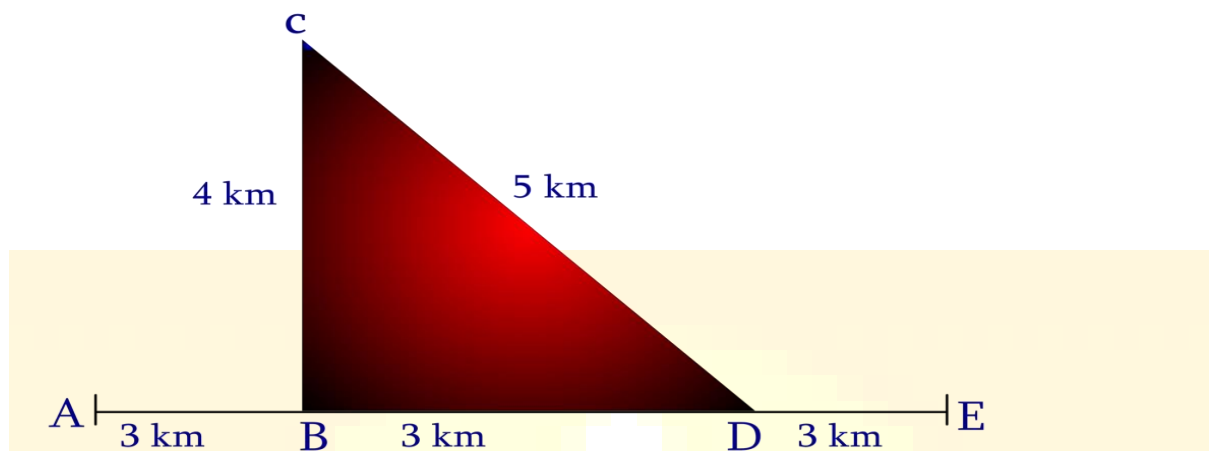
Ans : The distance covered by Sachin and Sameer-

A $\longrightarrow$ B (3km), B $\longrightarrow$ C (4km), C $\longrightarrow$ D (5km), D $\longrightarrow$ E (3km)

Total distance:- 3 + 4 + 5 + 3 = 15km

Total actual distance covered = 15km

Total displacement:- From A to E = 3 + 3 + 3 = 9km

Total displacement = 9 km

Speed = Distance/ Time =15 km/1 hour =15 km/hour

Velocity = Displacement /time =9 km/1 hour =9 km/ hour

The velocity from A to E is 15 km/hour which can be called the average velocity.

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