Class – IX (Science)

CHEMISTRY

CHAPTER 1: MATTER IN OUR SURROUNDINGS

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1. Which of the following is matter?

Chair, air, love, smell, hate, almonds, thought, cold, cold drink, smell of perfume.

Answer: Chair, air, almonds and cold drink

2. Give reasons for the following observation:

The smell of hot sizzling food reaches you several meters away, but to get the smell from cold food you have to go close.

Answer: Solids diffuse at a very slow rate. But, if the temperature of the solid is increased, then the rate of diffusion of the solid particles into air increases. This is due to an increase in the kinetic energy of solid particles. Hence, the smell of hot sizzling food reaches us even at a distance, but to get the smell from cold food we have to go close.

3. A diver is able to cut through water in a swimming pool. Which property of matter does this observation show?

Answer: This observation shows that the particles of matter have intermolecular spaces. The intermolecular spaces in liquids are fair enough to let the diver pass through it.

4. What are the characteristics of particles of matter?

Answer: The characteristics of particles of matter are:

→ Particles of matter have spaces between them.

→ Particles of matter are continuously moving.

→ Particles of matter attract each other.

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1. The mass per unit volume of a substance is called density (density = mass/volume). Arrange the following in order of increasing density - air, exhaust from chimney, honey, water, chalk, cotton, and iron.

Answer: Air, Exhaust from chimneys, cotton, water, honey, chalk, and iron.

2. (a) Tabulate the differences in the characteristics of states of matter.

(b) Comment upon the following: rigidity, compressibility, fluidity, filling a gas container, shape, kinetic energy, and density.

Answer:

(a)

Property	Solid state	Liquid state	Gaseous state
	Definite shape and volume.	No definite shape. Liquids attain the shape of the vessel in which they are kept.	Gases have neither a definite shape nor a definite volume.
2.	Incompressible	Slightly Compressible	Highly compressible
3.	Cannot flow	Can flow	Can flow
4.	Particles don't move freely	Particles move freely but are confined within boundary.	Particles move freely.
5.	Force of attraction between particles are maximum.	Force of attraction between particles is less than solid but more than that in gas	Force of attraction between particles is least.

(b)

→ Rigidity: It is the property of matter to resist the change of its shape.→ Compressibility: It is the property of matter in which its volume is decreased by applying force.

→ Fluidity: It is the ability of matter to flow.

→ Filling a gas container: On filling a gas takes the shape of the container.

→ Shape: Having definite boundaries.

→ Kinetic Energy: It is the energy possessed by the particles of matter due to its motion.

→ Density: It is the ratio of mass with per unit volume.

3. Give reasons:

(a) A gas fills completely the vessel in which it is kept.

► The force of attraction between particles of gas is negligible. Because of this, particles of gas move in all directions. Thus, a gas fills the vessel completely in which it is kept.

(b) A gas exerts pressure on the walls of the container.

► Particles of gas move randomly in all directions at high speed. As a result, the particles hit each other and also hit the walls of the container with a force. Therefore, gas exerts pressure on the walls of the container.

(c) A wooden table should be called a solid.

► A wooden table has fixed shape and fixed volume, which are the main characteristics of solid. Thus a wooden table should be called a solid.

(d) We can easily move our hand in air, but to do the same through a solid block of wood, we need a karate expert.

► Particles of air have large spaces between them. On the other hand, wood has little space between its particles. Also, it is rigid. For this reason, we can easily move our hands in air, but to do the same through a solid block of wood, we need a karate expert.

4. Liquids generally have lower density as compared to solids. But you must have observed that ice floats on water. Find out why.

Answer: Ice which is a solid has vacant spaces between water molecules thus making ice lighter than water. Thus ice floats on water.

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1. Convert the following temperature to Celsius scale:

(a) 300 K

► 300 K = (300 - 273)°C

= 27°C

(b) 573 K

► 573 K = (573 - 273)°C

= 300°C

2. What is the physical state of water at:

(a) 250°C

► Gaseous State (As Boiling temperature of water is 100° C).

(b) 100°C

► Since water boils at this temperature thus it can exist in both liquid and gaseous form. At this temperature, after getting the heat equal to the latent heat of vaporization, water starts changing from liquid state to gaseous state.

3. For any substance, why does the temperature remain constant during the change of state?

Answer: During the change of state of any substance, the heat supplied or released is utilised in phase change. Such heat is called latent heat. So, the temperature of any substance remains constant during the change of state.

4. Suggest a method to liquefy atmospheric gases.

Answer: The gases can be converted into liquids by bringing its particles closer so atmospheric gases can be liquefied either by decreasing temperature or by increasing pressure.

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1.Why does a desert cooler cool better on a hot dry day?

Answer: A desert cooler increases the humidity of the surrounding air. The water particles in the air take the heat from the surrounding objects and evaporate. In hot and dry days the moisture level is very low in atmosphere which increases the rate of evaporation. Because of faster evaporation, cooler works well. That's why desert cooler cool better on a hot dry day.

2. How does water kept in an earthen pot (matka) become cool during summers?

Answer: There are some pores in an earthen pot through which the liquid inside the pot evaporates. This evaporation makes the water inside the pot cool. In this way, water kept in an earthen pot becomes cool during summers.

3. Why does our palm feel cold when we put some acetone or petrol or perfume on it?

Answer: Acetone, petrol, and perfume evaporate at low temperatures. When some acetone, petrol, or perfume is dropped on the palm, it takes heat from the palm and evaporates, thereby making the palm cooler.

4. Why are we able to sip hot tea or milk faster from a saucer than a cup?

Answer: A liquid has a larger surface area in a saucer than in a cup. Thus, it evaporates faster and cools faster in a saucer than in a cup. Thus, we are able to sip hot tea or milk faster from a saucer than a cup.

5. What type of clothes should we wear in summers?

Answer: We should wear cotton clothes in summers as cotton is a good sweat absorber. Sweat is absorbed by the cotton and is exposed to the atmosphere making evaporation faster. During this evaporation, particles on the surface of the liquid gain energy from our body surface, making the body cool.

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Excercises

(For Conversion Process we must know,

Kelvin is an SI unit of temperature, where 0°C = 273 K approx.)

1. Convert the following temperatures to Celsius scale.

(a) 300 K

► 300 K = (300 - 273) °C

= 27 °C

(b) 573 K

► 573 K = (573 - 273) °C

= 300 °C

2. Convert the following temperatures to Kelvin scale.

(a) 25°C

►25 °C = (25 + 273) K

= 298 K

(b) 373°C

► 373 °C = (373 + 273) K

= 646 K

3. Give reason for the following observations.

(a) Naphthalene balls disappear with time without leaving any solid.

(b) We can get the smell of perfume sitting several metres away.

Answer:

(a) Naphthalene balls disappear with time without leaving any so

lid because they undegoes sublimation easily i.e., the change of state of naphthalene from solid to gas takes place easily.

(b) Perfumes has high degree of vaporization and its vapour diffuse into air easily. Therefore, we can get the smell of perfume sitting several metres away.

4. Arrange the following substances in increasing order of forces of attraction between particles--water, sugar and oxygen.

Answer: Oxygen, Water, Sugar.

5. What is the physical state of water at-

(a) 25°C

► Liquid State

(b) 0°C

► Solid State can also be in liquid state (conditions required).

(c) 100°C

► Gaseous State can also be in liquid state (conditions required).

6. Give two reasons to justify-

(a) Water at room temperature is a liquid.

(b) An iron almirah is a solid at room temperature.

Answer:

(a) Water at room temperature is a liquid because it has fluidity also it has no shape but has a fixed volume that is, it occupies the shape of the container in which it is kept.

(b) An iron almirah is a solid at room temperature it has rigid and fixed shape.

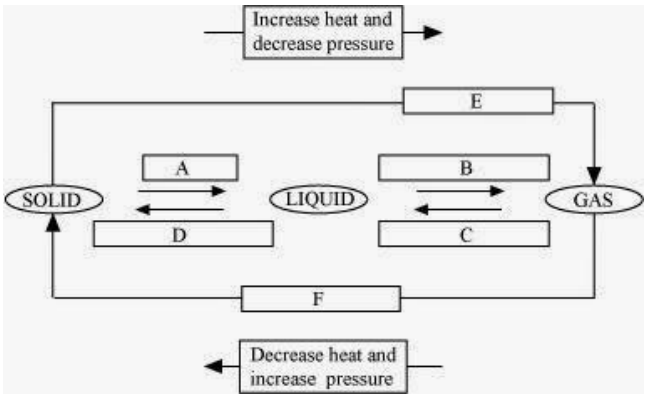
7. Why is ice at 273 K more effective in cooling than water at the same temperature?

Answer: Ice at 273 K has less energy than water (although both are at the same temperature). Water possesses the additional latent heat of fusion. Hence, at 273 K, ice is more effective in cooling than water.

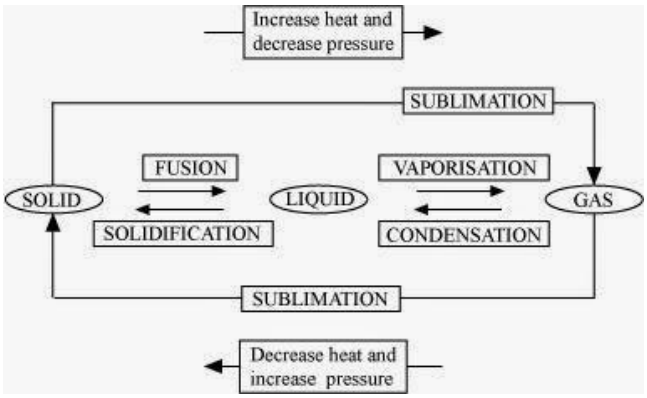
8. What produces more severe burns, boiling water or steam?\

Answer: Steam has more energy than boiling water. It possesses the additional latent heat of vaporization. Therefore, burns produced by steam are more severe than those produced by boiling water.\

9. Name A, B, C, D, E and F in the following diagram showing change in its state.



Answer:



PHYSICS

Chapter: 8 Motion

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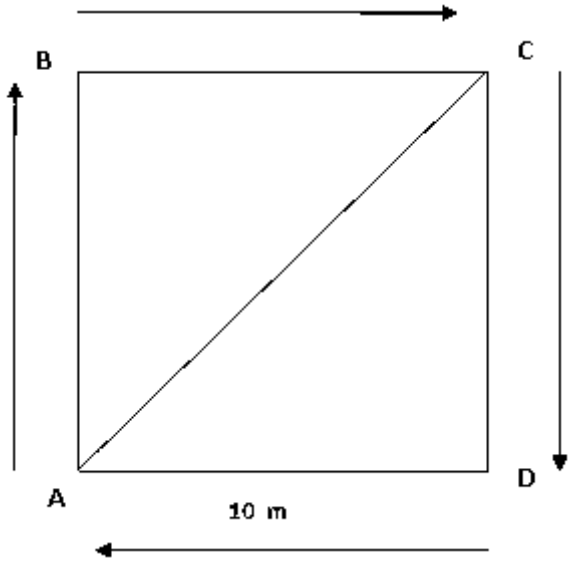
1. An object has moved through a distance. Can it have zero displacement? If yes, support your answer with an example.

Answer: Yes, an object can have zero displacement even when it has moved through a distance. This happens when final position of the object coincides with its initial position. For example, if a person moves around park and stands on place from where he started then here displacement will be zero.

2. A farmer moves along the boundary of a square field of side 10 m in 40 s. What will be the magnitude of displacement of the farmer at the end of 2 minutes 20 seconds from his initial position?

Answer



Given, Side of the square field= 10m

Therefore, perimeter = 10 m x 4 = 40 m

Farmer moves along the boundary in 40s.

Displacement after 2 m 20 s = 2 x 60 s + 20 s = 140 s =?

Since in 40 s farmer moves 40 m

Therefore, in 1s distance covered by farmer = 40 / 40 m = 1m

Therefore, in 140s distance covered by farmer = 1 × 140 m = 140 m Now, number of rotation to cover 140 along the boundary= Total Distance / Perimeter

= 140 m / 40 m = 3.5 round

Thus, after 3.5 round farmer will at point C of the field.

$$\text{Therefore. Displacement AC} = \sqrt{(10m)^2 + (10m)^2}$$
$$= \sqrt{100m^2 + 100m^2}$$
$$= \sqrt{200m^2}$$
$$= 10\sqrt{2}\ \text{m}$$
$$= 10 \times 1.414 = 14.14\ \text{m}$$

Thus, after 2 min 20 seconds the displacement of farmer will be equal to 14.14 m north east from initial position.

3. Which of the following is true for displacement?

(a) It cannot be zero.

(b) Its magnitude is greater than the distance travelled by the object.

Answer:

None of the statement is true for displacement First statement is false because displacement can be zero. Second statement is also false because displacement is less than or equal to the distance travelled by the object.

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1. Distinguish between speed and velocity.

Answer:

Speed	**Velocity**

Speed is the distance travelled by an object in a given interval of time.	Velocity is the displacement of an object in a given interval of time.
Speed = distance / time	Velocity = displacement / time
Speed is scalar quantity i.e. it has only magnitude.	Velocity is vector quantity i.e. it has both magnitude as well as direction.

2. Under what condition(s) is the magnitude of average velocity of an object equal to its average speed?

Answer: The magnitude of average velocity of an object is equal to its average speed, only when an object is moving in a straight line.

3. What does the odometer of an automobile measure?

Answer: The odometer of an automobile measures the distance covered by an automobile.

4. What does the path of an object look like when it is in uniform motion?

Answer: An object having uniform motion has a straight line path.

5. During an experiment, a signal from a spaceship reached the ground station in five minutes. What was the distance of the spaceship from the ground station? The signal travels at the speed of light, that is, 3×10^8 m s^{-1}.

Answer:

Speed= 3×10^8 m s^{-1}

Time= 5 min = 5 x 60 = 300 secs.

Distance= Speed x Time

Distance= 3×10^8 m s^{-1} x 300 secs. = 9×10^{10} m

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1. When will you say a body is in (i) uniform acceleration? (ii) Non-uniform acceleration?

Answer:

(i) A body is said to be in uniform acceleration if it travels in a straight line and its velocity increases or decreases by equal amounts in equal intervals of time.

(ii) A body is said to be in non-uniform acceleration if the rate of change of its velocity is not constant.

2. A bus decreases its speed from 80 km h^{-1} to 60 km h^{-1} in 5 s. Find the acceleration of the bus.

Answer:

Initial speed of the bus, u= 80 km/h $= 80 \times \frac{5}{18} = 22.22$ m/s

Final speed of the bus, v= 60 km/h $= 60 \times \frac{5}{18} = 16.66$ m/s

Time take to decrease the speed, t= 5 s

Acceleration, $a = \frac{v-u}{t}$ $= \frac{16.66 - 22.22}{5} = -1.112$ m/s^2

3. A train starting from a railway station and moving with uniform acceleration attains a speed 40 km h^{-1} in 10 minutes. Find its acceleration.

Answer:

Initial velocity of the train, u= 0

Final velocity of the train, v= 40 km/h $= 40 \times \frac{5}{18} = 11.11$ m/s

Time taken, t = 10 min = 10 x 60 = 600 s

Acceleration, $a = \frac{v-u}{t} = \frac{11.11 - 0}{600} = 0.0185$ m/s^2

Hence, the acceleration of the train is 0.0185 m/s^2.

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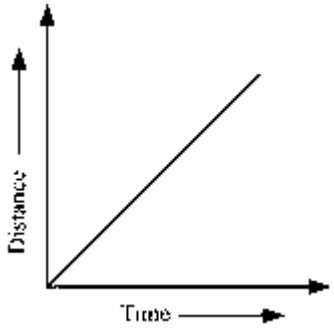
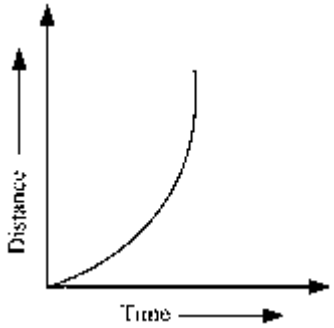
1. What is the nature of the distance - 'time graphs for uniform and non-uniform motion of an object?

Answer:

When the motion is uniform, the distance time graph is a straight line with a slope.



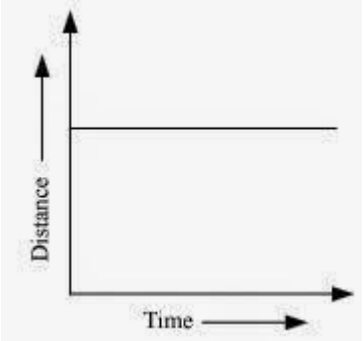
When the motion is non uniform, the distance time graph is not a straight line.It can be any curve.



2. What can you say about the motion of an object whose distance - time graph is a straight line parallel to the time axis?

Answer:

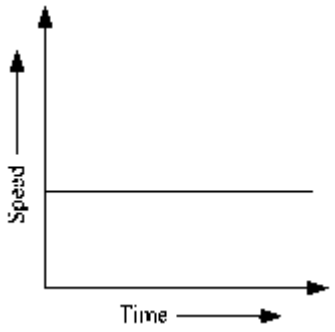
If distance time graph is a straight line parallel to the time axis, the body is at rest.



3. What can you say about the motion of an object if its speed - 'time graph is a straight line parallel to the time axis?

Answer:

If speed time graph is a straight line parallel to the time axis, the object is moving uniformly.



4. What is the quantity which is measured by the area occupied below the velocity -time graph?

Answer: The area below velocity-time graph gives the distance covered by the object.

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1. A bus starting from rest moves with a uniform acceleration of 0.1 m s^{-2} for 2 minutes. Find (a) the speed acquired, (b) the distance travelled.

Answer:

Initial speed of the bus, u= 0

Acceleration, a = 0.1 m/s^2

Time taken, t = 2 minutes = 120 s

(a) v= u + at

v= 0 + 0×1 × 120

v= 12 ms^{-1}

(b) According to the third equation of motion:

$v^2 - u^2 = 2as$

Where, s is the distance covered by the bus

$(12)^2 - (0)^2 = 2(0.1)$ s

s = 720 m

Speed acquired by the bus is 12 m/s.

Distance travelled by the bus is 720 m.

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2. A train is travelling at a speed of 90 km h^{-1}. Brakes are applied so as to produce a uniform acceleration of −0.5 m s^{-2}. Find how far the train will go before it is brought to rest.

Answer:

Initial speed of the train, u= 90 km/h = 25 m/s

Final speed of the train, v = 0 (finally the train comes to rest)

Acceleration = - 0.5 m s^{-2}

According to third equation of motion:

$v^2 = u^2 + 2as$

$(0)^2 = (25)^2 + 2(-0.5)s$

Where, s is the distance covered by the train

$$s = \frac{25^2}{2(0.5)} = 625 \text{ m}$$

The train will cover a distance of 625 m before it comes to rest.

3. A trolley, while going down an inclined plane, has an acceleration of 2 cm s^{-2}. What will be its velocity 3 s after the start?

Answer:

Initial Velocity of trolley, u= 0 cms^{-1}

Acceleration, a= 2 cm s^{-2}

Time, t= 3 s

We know that final velocity, v= u + at = 0 + 2 x 3 cms^{-1}

Therefore, The velocity of train after 3 seconds = 6 cms^{-1}

4. A racing car has a uniform acceleration of 4 m s - '2. What distance will it cover in 10 s after start?

Answer:

Initial Velocity of the car, u=0 ms^{-1}

Acceleration, a= 4 m s^{-2}

Time, t= 10 s

We know Distance, s= ut + (1/2)at^2

Therefore, Distance covered by car in 10 second= 0 × 10 + (1/2) × 4 × 102

= 0 + (1/2) × 4× 10 × 10 m

= (1/2)× 400 m

= 200 m

5. A stone is thrown in a vertically upward direction with a velocity of 5 m s^{-1}. If the acceleration of the stone during its motion is 10 m s^{-2} in the downward direction, what will be the height attained by the stone and how much time will it take to reach there?

Answer:

Given Initial velocity of stone, u=5 m s^{-1}

Downward of negative Acceleration, a= 10 m s^{-2}

We know that 2 as= v^2- u^2

Therefore, Height attained by the stone, s= $\frac{0^2}{5^2}$ x (-10) m

= $\frac{-25}{-20}$ m

= 1.25 m

Also we know that final velocity, v= u + at

or, Time, t= $\frac{v-u}{a}$

Therefore, Time, t taken by stone to attain the height, s= $\frac{0-5}{-10\ s}$

= 0.5 s

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EXCERCISE

1. An athlete completes one round of a circular track of diameter 200 m in 40 s. What will be the distance covered and the displacement at the end of 2 minutes 20 s?

Answer:

Diameter of circular track (D) = 200 m

Radius of circular track (r) = 200 / 2=100 m

Time taken by the athlete for one round (t) = 40 s

Distance covered by athlete in one round (s) = 2π r

= 2 x (22 / 7) x 100

Speed of the athlete (v) = Distance / Time

= (2 x 2200) / (7 x 40)

= 4400 / 7 × 40

Therefore, **Distance covered in 140 s = Speed (s) × Time(t)**

= 4400 / (7 x 40) x (2 x 60 + 20)

= 4400 / (7 x 40) x 140

= 4400 x 140 /7 x 40

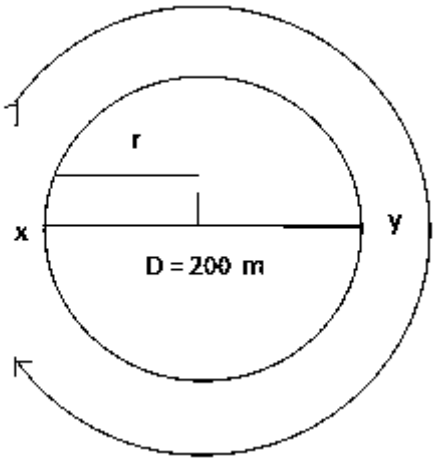
= 2200 m

Number of round in 40 s =1 round

Number of round in 140 s =140/40

=3 $^{1}/_{2}$

After taking start from position X,the athlete will be at postion Y after 3 $^{1}/_{2}$ rounds as shown in figure



Hence, **Displacement of the athlete** with respect to initial position at x= xy

= Diameter of circular track

= 200 m

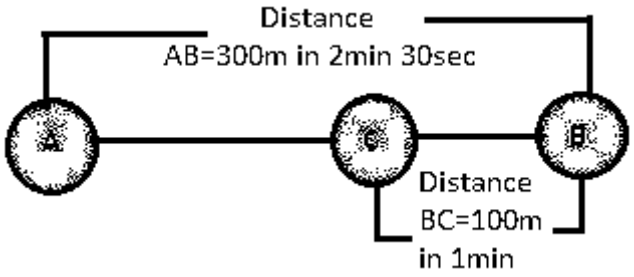
2. Joseph jogs from one end A to the other end B of a straight 300 m road in 2 minutes 30 seconds and then turns around and jogs 100 m back to point C in another 1 minute. What are Joseph's average speeds and velocities in jogging (a) from A to B and (b) from A to C?

Answer:

Total Distance covered from AB = 300 m

Total time taken = 2 x 60 + 30 s

=150 s



Therefore, Average Speed from AB = Total Distance / Total Time

=300 / 150 m s^{-1}

=2 m s^{-1}

Therefore, Velocity from AB =Displacement AB / Time = 300 / 150 m s^{-1}

=2 m s^{-1}

Total Distance covered from AC =AB + BC

=300 + 200 m

Total time taken from A to C = Time taken for AB + Time taken for BC

= (2 x 60+30)+60 s

= 210 s

Therefore, Average Speed from AC = Total Distance /Total Time

= 400 /210 m s^{-1}

= 1.904 m s^{-1}

Displacement (S) from A to C = AB - BC

= 300-100 m

= 200 m

Time (t) taken for displacement from AC = 210 s

Therefore, Velocity from AC = Displacement (s) / Time(t)

$= 200 / 210 \text{ m s}^{-1}$

$= 0.952 \text{ m s}^{-1}$

3. Abdul, while driving to school, computes the average speed for his trip to be 20 km h^{-1}. On his return trip along the same route, there is less traffic and the average speed is 40 km h^{-1}. What is the average speed for Abdul's trip?

Answer:

The distance Abdul commutes while driving from Home to School = S

Let us assume time taken by Abdul to commutes this distance = t_1

Distance Abdul commutes while driving from School to Home = S

Let us assume time taken by Abdul to commutes this distance = t_2

Average speed from home to school v_{1av} = 20 km h_{-1}

Average speed from school to home v_{2av} = 30 km h^{-1}

Also we know Time taken form Home to School $t_1 = S / v_{1av}$

Similarly Time taken form School to Home $t_2 = S/v_{2av}$

Total distance from home to school and backward = 2 S

Total time taken from home to school and backward (T) = S/20+ S/30

Therefore, Average speed (V_{av}) for covering total distance (2S) = Total Dostance/Total Time

$= 2S / (S/20 + S/30)$

$= 2S / [(30S+20S)/600]$

$= 1200S / 50S$

$= 24 \text{ kmh}^{-1}$

4. A motorboat starting from rest on a lake accelerates in a straight line at a constant rate of 3.0 m s^{-2} for 8.0 s. How far does the boat travel during this time?

Answer:

Given Initial velocity of motorboat, u = 0

Acceleration of motorboat, $a = 3.0 \text{ m s}^{-2}$

Time under consideration, t = 8.0 s

We know that Distance, $s = ut + (1/2)at^2$

Therefore, The distance travel by motorboat = 0 x 8 + (1/2)3.0 x 8 2

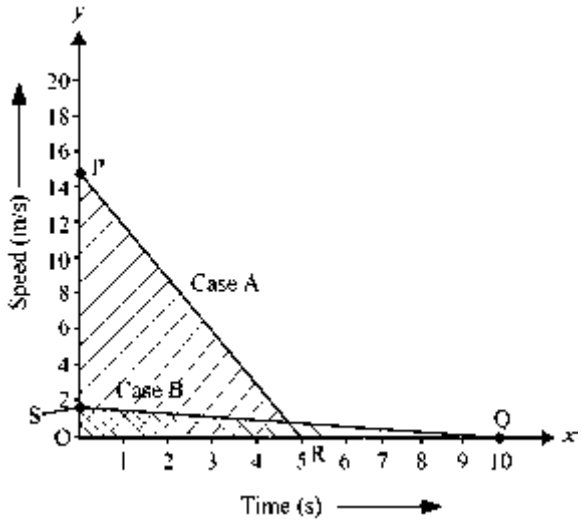
= (1/2) x 3 x 8 x 8 m

= 96 m

5. A driver of a car travelling at 52 km h^{-1} applies the brakes and accelerates uniformly in the opposite direction. The car stops in 5 s. Another driver going at 3 km h^{-1} in another car applies his brakes slowly and stops in 10 s. On the same graph paper, plot the speed versus time graphs for the two cars. Which of the two cars travelled farther after the brakes were applied?

Answer:

As given in the figure below PR and SQ are the Speed-time graph for given two cars with initial speeds 52 kmh-1 and 3 kmh-1 respectively.



Distance Travelled by first car before coming to rest =Area of ∆ OPR

= (1/2) x OR x OP

= (1/2) x 5 s x 52 kmh-1

= (1/2) x 5 x (52 x 1000) / 3600) m

= (1/2) x 5x (130 / 9) m

= 325 / 9 m

= 36.11 m

Distance Travelled by second car before coming to rest =Area of ∆ OSQ

= (1/2) x OQ x OS

= (1/2) x 10 s x 3 kmh-1

= (1/2) x 10 x (3 x 1000) / 3600) m

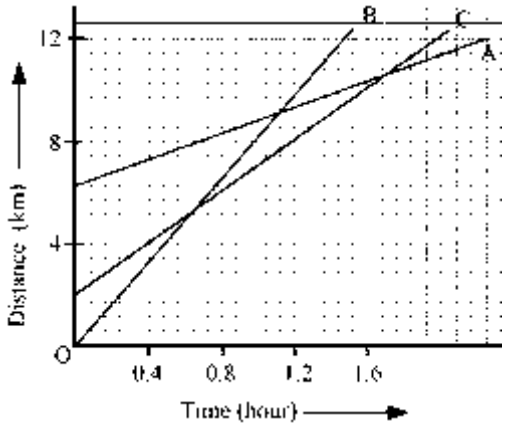
= (1/2) x 10 x (5/6) m

= 5 x (5/6) m

= 25/6 m

= 4.16 m

6. Fig 8.11 shows the distance-time graph of three objects A, B and C. Study the graph and answers the following questions:



(a) Which of the three is travelling the fastest?

(b) Are all three ever at the same point on the road?

(c) How far has C travelled when B passes A?

(d)How far has B travelled by the time it passes C?

Answer:

(a) Object B

(b) No

(c) 5.714 km

(d) 5.143 km

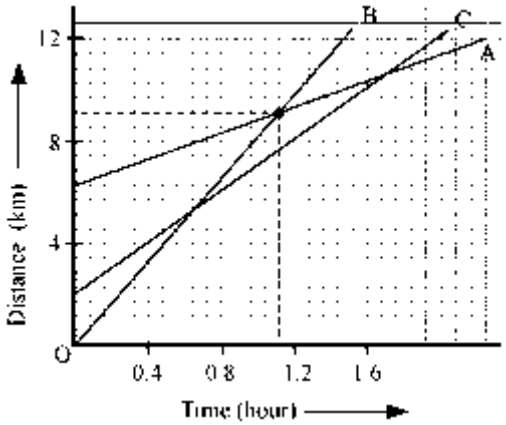
(a) $$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Slope of graph} = \frac{y\text{ - axis}}{x - \text{axis}} = \frac{\text{Distance}}{\text{Time}}$$

Therefore, Speed = slope of the graph

Since slope of object B is greater than objects A and C, it is travelling the fastest.

(b) All three objects A, B and C never meet at a single point. Thus, they were never at the same point on road.



On the distance axis:

7 small boxes = 4 km

Therefore,1 small box = 4 / 7 Km

Initially, object C is 4 blocks away from the origin.

Therefore, Initial distance of object C from origin = 16 / 7 Km

Distance of object C from origin when B passes A = 8 km

Distance covered by C

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7. A ball is gently dropped from a height of 20 m. If its velocity increases uniformly at the rate of 10 m s^{-2}, with what velocity will it strike the ground? After what time will it strike the ground?

Answer:

Let us assume, the final velocity with which ball will strike the ground be 'v' and time it takes to strike the ground be 't'

Initial Velocity of ball, u =0

Distance or height of fall, s =20 m

Downward acceleration, a =10 m s^{-2}

As we know, $2as = v^2 - u^2$

$v^2 = 2as + u^2$

= 2 x 10 x 20 + 0

= 400

∴ Final velocity of ball, v = 20 ms^{-1}

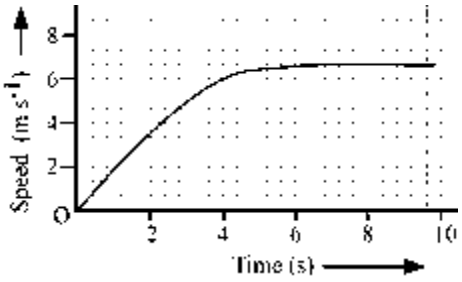
t = (v-u)/a

∴Time taken by the ball to strike = (20-0)/10

= 20/10

= 2 seconds

8. The speed-time graph for a car is shown is Fig. 8.12.

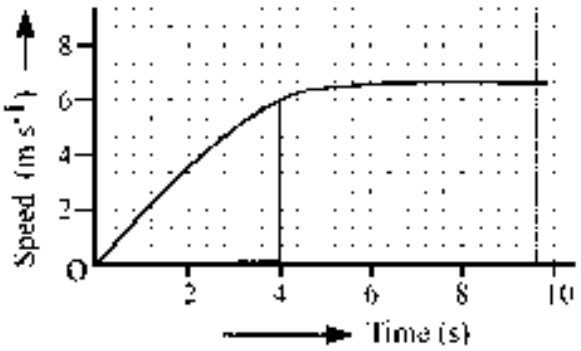


(a) Find out how far the car travels in the first 4 seconds. Shade the area on the graph that represents the distance travelled by the car during the period.

(b) Which part of the graph represents uniform motion of the car?

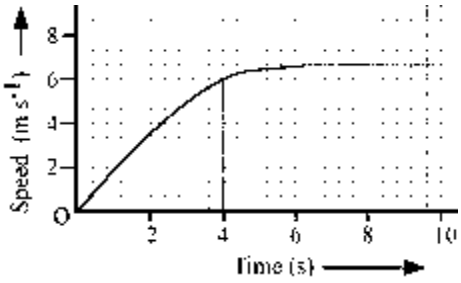
Answer:

(a)



The shaded area which is equal to 1 / 2 x 4 x 6 = 12 m represents the distance travelled by the car in the first 4 s.

(b)



The part of the graph between time 6 s to 10 s represents uniform motion of the car.

10. State which of the following situations are possible and give an example for each of these:

(a) an object with a constant acceleration but with zero velocity.

(b) an object moving in a certain direction with an acceleration in the perpendicular direction.

Answer:

(a) Possible

When a ball is thrown up at maximum height, it has zero velocity, although it will have constant acceleration due to gravity, which is equal to 9.8 m/s2.

(b) Possible

When a car is moving in a circular track, its acceleration is perpendicular to its direction.

11. An artificial satellite is moving in a circular orbit of radius 42250 km. Calculate its speed if it takes 24 hours to revolve around the earth.

Answer:

Radius of the circular orbit, r= 42250 km

Time taken to revolve around the earth, t= 24 h

Speed of a circular moving object, $v= (2\pi r)/t$

$=[2\times (22/7)\times 42250 \times 1000] / (24 \times 60 \times 60)$

$=(2\times 22\times 42250\times 1000) / (7 \times 24 \times 60 \times 60)$ m s^{-1}

$=3073.74$ m s^{-1}

Chapter 9th: Force and Laws of Motion

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1. Which of the following has more inertia: (a) a rubber ball and a stone of the same size? (b) a bicycle and a train? (c) a five-rupees coin and a one-rupee coin?

Answer:

Inertia is the measure of the mass of the body. The greater is the mass of the body; the greater is its inertia and vice-versa.

(a) Mass of a stone is more than the mass of a rubber ball for the same size. Hence, inertia of the stone is greater than that of a rubber ball.

(b) Mass of a train is more than the mass of a bicycle. Hence, inertia of the train is greater than that of the bicycle.

(c) Mass of a five rupee coin is more than that of a one-rupee coin. Hence, inertia of the five rupee coin is greater than that of the one-rupee coin.

2. In the following example, try to identify the number of times the velocity of the ball changes: "A football player kicks a football to another player of his team who kicks the football towards the goal. The goalkeeper of the opposite team collects the football and kicks it towards a player of his own team".

Also identify the agent supplying the force in each case.

Answer:

The velocity of football changes four times.

First, when a football player kicks to another player, second when that player kicks the football to the goalkeeper. Third when the goalkeeper stops the football. Fourth when the goalkeeper kicks the football towards a player of his own team.

Agent supplying the force:

→ First case – First player

→ Second case – Second player

→ Third case – Goalkeeper

→ Fourth case – Goalkeeper

3. Explain why some of the leaves may get detached from a tree if we vigorously shake its branch.

Answer:

Some leaves of a tree get detached when we shake its branches vigorously because branches comes in motion while the leaves tend to remain at rest due to inertia of rest.

4. Why do you fall in the forward direction when a moving bus brakes to a stop and fall backwards when it accelerates from rest?

Answer:

In a moving bus, a passenger moves with the bus due to inertia of motion. As the driver applies brakes, the bus comes to rest. But, the passenger tries to maintain to inertia of motion. As a result, a forward force is exerted on him.

Similarly, the passenger tends to fall backwards when the bus accelerates from rest because when the bus accelerates, the inertia of rest of the passenger tends to oppose the forward motion of the bus. Hence, the passenger tends to fall backwards when the bus accelerates forward.

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1. If action is always equal to the reaction, explain how a horse can pull a cart.

Answer:

A horse pushes the ground in the backward direction. According to Newton's third law of motion, a reaction force is exerted by the Earth on the horse in the forward direction. As a result, the cart moves forward.

2. Explain, why is it difficult for a fireman to hold a hose, which ejects large amounts of water at a high velocity.

Answer:

When a fireman holds a hose, which is ejecting large amounts of water at a high velocity, then a reaction force is exerted on him by the ejecting water in the backward direction. This is because of Newton's third law of motion. As a result of the backward force, the stability of the fireman decreases. Hence, it is difficult for him to remain stable while holding the hose.

3. From a rifle of mass 4 kg, a bullet of mass 50 g is fired with an initial velocity of 35 m s^{-1}. Calculate the initial recoil velocity of the rifle.

Answer:

Mass of the rifle, m_1= 4 kg

Mass of the bullet, m_2= 50g= 0.05 kg

Recoil velocity of the rifle= v_1

Bullet is fired with an initial velocity, v_2= 35m/s

Initially, the rifle is at rest.

Thus, its initial velocity, v= 0

Total initial momentum of the rifle and bullet system= $(m_1+m_2)v$= 0

Total momentum of the rifle and bullet system after firing:

= $m_1v_1 + m_2v_2$= 0.05 × 35= $4v_1$ + 1.75

According to the law of conservation of momentum:

Total momentum after the firing = Total momentum before the firing $4v_1 + 1.75= 0$

v_1= -1.75 / 4= -0.4375 m/s

The negative sign indicates that the rifle recoils backwards with a velocity of 0.4375 m/s.

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4. Two objects of masses 100 g and 200 g are moving along the same line and direction with velocities of 2 m s^{-1} and 1 m s^{-1}, respectively. They collide and after the collision, the first object moves at a velocity of 1.67 m s^{-1}. Determine the velocity of the second object.

Answer:

Mass of one of the objects, m_1 = 100 g = 0.1 kg

Mass of the other object, m_2 = 200 g = 0.2 kg

Velocity of m_1 before collision, v_1= 2 m/s

Velocity of m_2 before collision, v_2= 1 m/s

Velocity of m_1 after collision, v_3= 1.67 m/s

Velocity of m_2 after collision= v_4

According to the law of conservation of momentum:

Total momentum before collision = Total momentum after collision

Therefore, $m_1v_1 + m_2v_2 = m_1v3 + m_2v_4$

$2(0.1) + 1(0.2) = 1.67(0.1) + v_4(0.2)$

$0.4 = 0.167 + 0.2v_4$

v_4= 1.165 m/s

Hence, the velocity of the second object becomes 1.165 m/s after the collision.

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EXCERCISES

1. An object experiences a net zero external unbalanced force. Is it possible for the object to be travelling with a non-zero velocity? If yes, state the conditions that must be placed on the magnitude and direction of the velocity. If no, provide a reason.

Answer:

Yes, an object may travel with a non-zero velocity even when the net external force on it is zero. A rain drop falls down with a constant velocity. The weight of the drop is balanced by the up thrust and the velocity of air. The net force on the drop is zero.

2. When a carpet is beaten with a stick, dust comes out of it. Explain.

Answer:

When the carpet is beaten, it is suddenly set into motion. The dust particles tend to remain at rest due to inertia of rest, therefore the dust comes out of it.

3. Why is it advised to tie any luggage kept on the roof of a bus with a rope?

Answer:

When a bust starts suddenly, the lower part of the luggage kept on the roof being in contact with the bus begins to move forward with the speed of bus, but the upper part tends to remain at rest due to inertia of rest. Therefore, the upper part is left behind and hence luggage falls backward. So, it is advised to tie any luggage kept on the roof of a bus with a rope.

4. A batsman hits a cricket ball which then rolls on a level ground. After covering a short distance, the ball comes to rest. The ball slows to a stop because

(a) the batsman did not hit the ball hard enough.

(b) velocity is proportional to the force exerted on the ball.

(c) there is a force on the ball opposing the motion.

(d) there is no unbalanced force on the ball, so the ball would want to come to rest.

Answer:

The ball slows down and comes to rest due to opposing forces of air resistance and frictional force on the ball opposing its motion. Therefore the choice (c) there is a force on the ball opposing the motion is correct.

5. A truck starts from rest and rolls down a hill with a constant acceleration. It travels a distance of 400 m in 20 s. Find its acceleration. Find the force acting on it if its mass is 7 metric tonnes (*Hint*: 1 metric tonne = 1000 kg).

Answer:

Initial velocity, $u = 0$

Distance travelled, $s = 400$ m

Time taken, $t = 20$ s

We know, $s = ut + ½ at^2$

Or, $400 = 0 + ½ a (20)^2$

Or, $a = 2\ ms^{-2}$

Now, $m = 7$ MT $= 7000$ kg, $a = 2\ ms^{-2}$

Or, $F = ma = 7000 \times 2 = 14000$ N Ans.

6. A stone of 1 kg is thrown with a velocity of 20 m s^{-1} across the frozen surface of a lake and comes to rest after travelling a distance of 50 m. What is the force of friction between the stone and the ice?

Answer:

Initial velocity of the stone, $u = 20$ m/s

Final velocity of the stone, $v = 0$

Distance covered by the stone, $s = 50$ m

Since, $v_2 - u_2$

$2 = 2as$,

Or, $0 - 20^2 = 2a \times 50$,

Or, $a = -4\ ms^{-2}$

Force of friction, $F = ma = -4$N

7. A 8000 kg engine pulls a train of 5 wagons, each of 2000 kg, along a horizontal track. If the engine exerts a force of 40000 N and the track offers a friction force of 5000 N, then calculate:

(a) the net accelerating force;

(b) the acceleration of the train; and

(c) the force of wagon 1 on wagon 2.\

Answer:

(a) Force exerted by the engine, $F = 40000$ N

Frictional force offered by the track, $F_f = 5000$ N

Net accelerating force, $F_a = F - F_f = 40000 - 5000 = 35000$ N

Hence, the net accelerating force is 35000 N.

(b) Acceleration of the train = a

The engine exerts a force of 40000 N on all the five wagons.

Net accelerating force on the wagons, F_a = 35000 N

Mass of the wagons, m = Mass of a wagon x Number of wagons

Mass of a wagon = 2000 kg

Number of wagons = 5

$\therefore m = 2000 \times 5 = 10000$ kg

Total mass, M = m = 10000 kg

From Newton's second law of motion:

$F_a = Ma$

a=Fam = 35000 10000 = 3.5 ms-2

Hence, the acceleration of the wagons and the train is 3.5 m/s^2.

(c) Mass of all the wagons except wagon 1 is $4 \times 2000 = 8000$ kg

Acceleration of the wagons = 3.5 m/s^2

Thus, force exerted on all the wagons except wagon 1

$= 8000 \times 3.5 = 28000$ N

Therefore, the force exerted by wagon 1 on the remaining four wagons is 28000 N.

Hence, the force exerted by wagon 1 on wagon 2 is 28000 N.

8. An automobile vehicle has a mass of 1500 kg. What must be the force between the vehicle and road if the vehicle is to be stopped with a negative acceleration of 1.7 m s^{-2}?

Answer:

Mass of the automobile vehicle, m= 1500 kg

Final velocity, v= 0 (finally the automobile stops)

Acceleration of the automobile, $a = -1.7$ ms^{-2}

From Newton's second law of motion:

Force = Mass x Acceleration = 1500 x (−1.7) = −2550 N

Hence, the force between the automobile and the road is −2550 N, in the direction opposite to the motion of the automobile.

9. What is the momentum of an object of mass m, moving with a velocity v?

(a) $(mv)^2$ (b) mv^2 (c) $\frac{1}{2} mv^2$ (d) mv

Answer:

(d) mv

Mass of the object = m

Velocity = v

Momentum = Mass x Velocity

Momentum = mv

10. Using a horizontal force of 200 N, we intend to move a wooden cabinet across a floor at a constant velocity. What is the friction force that will be exerted on the cabinet?

Answer:

The cabinet will move with constant velocity only when the net force on it is zero.

Therefore, force of friction on the cabinet = 200 N, in a direction opposite to the direction of motion of the cabinet.

11. Two objects, each of mass 1.5 kg are moving in the same straight line but in opposite directions. The velocity of each object is 2.5 ms^{-1} before the collision during which they stick together. What will be the velocity of the combined object after collision?

Answer:

Mass of one of the objects, m_1 = 1.5 kg

Mass of the other object, m_2 = 1.5 kg

Velocity of m_1 before collision, u_1 = 2.5 m/s

Velocity of m_2, moving in opposite direction before collision, $u_2 = -2.5$ m/s

Let v be the velocity of the combined object after collision. By the law of conservation of momentum,

Total momentum after collision = Total momentum before collision,

Or, $(m_1 + m_2)\, v = m_1u_1 + m_2u_2$

Or, $(1.5 + 1.5)\, v = 1.5 \times 2.5 + 1.5 \times (-2.5)$ [negative sign as moving in opposite direction]

Or, $v = 0\ ms^{-1}$

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12. According to the third law of motion when we push on an object, the object pushes back on us with an equal and opposite force. If the object is a massive truck parked along the roadside, it will probably not move. A student justifies this by answering that the two opposite and equal forces cancel each other. Comment on this logic and explain why the truck does not move.

Answer:

The logic is that Action and Reaction always act on different bodies, so they can not cancel each other. When we push a massive truck, the force of friction between its tyres and the road is very large and so the truck does not move.

13. A hockey ball of mass 200 g travelling at 10 m s^{-1} is struck by a hockey stick so as to return it along its original path with a velocity at 5 m s^{-1}. Calculate the change of momentum occurred in the motion of the hockey ball by the force applied by the hockey stick.

Answer:

Mass of the hockey ball, m = 200 g = 0.2 kg

Hockey ball travels with velocity, v_1 = 10 m/s

Initial momentum = mv_1

Hockey ball travels in the opposite direction with velocity, $v_2 = -5$ m/s

Final momentum = mv_2

Change in momentum = $mv_1 - mv_2 = 0.2\ [10 - (-5)] = 0.2\ (15) = 3$ kg m s^{-1}

Hence, the change in momentum of the hockey ball is 3 kg m s^{-1}.

14. A bullet of mass 10 g travelling horizontally with a velocity of 150 m s^{-1} strikes a stationary wooden block and comes to rest in 0.03 s. Calculate the distance of penetration of the bullet into the block. Also calculate the magnitude of the force exerted by the wooden block on the bullet.

Answer:

Initial velocity, u= 150 m/s

Final velocity, v= 0 (since the bullet finally comes to rest)

Time taken to come to rest, t= 0.03 s

According to the first equation of motion, $v = u + at$

Acceleration of the bullet, a

$0 = 150 + (a \times 0.03\ s)$a = -150 / 0.03 = -5000 m/s2

(Negative sign indicates that the velocity of the bullet is decreasing.)

According to the third equation of motion:

$v_2 = u_2 + 2as$

$0 = (150)^2 + 2\ (-5000)$

= 22500 / 10000

= 2.25 m

Hence, the distance of penetration of the bullet into the block is 2.25 m.

From Newton's second law of motion:

Force, F = Mass × Acceleration

Mass of the bullet, m = 10 g = 0.01 kg

Acceleration of the bullet, a = 5000 m/s^2

$F = ma = 0.01 \times 5000 = 50$ N

Hence, the magnitude of force exerted by the wooden block on the bullet is 50 N.

15. An object of mass 1 kg travelling in a straight line with a velocity of 10 m s^{-1} collides with, and sticks to, a stationary wooden block of mass 5 kg. Then they both move off together in the same straight line. Calculate the total momentum just before the impact and just after the impact. Also, calculate the velocity of the combined object.

Answer:

Mass of the object, m_1 = 1 kg

Velocity of the object before collision, v_1 = 10 m/s

Mass of the stationary wooden block, m_2 = 5 kg

Velocity of the wooden block before collision, v_2 = 0 m/s

∴ Total momentum before collision = $m_1 v_1 + m_2 v_2$

= 1 (10) + 5 (0) = 10 kg m s^{-1}

It is given that after collision, the object and the wooden block stick together.

Total mass of the combined system = $m_1 + m_2$

Velocity of the combined object = v

According to the law of conservation of momentum:

Total momentum before collision = Total momentum after collision

$m_1 v_1 + m_2 v_2 = (m_1 + m_2) v$

$1 (10) + 5 (0) = (1 + 5) v$

$v = 10 / 6$

$= 5 / 3$

The total momentum after collision is also 10 kg m/s.

Total momentum just before the impact = 10 kg m s^{-1}

Total momentum just after the impact = $(m_1 + m_2) v = 6 \times 5 / 3 = 10$ kg ms^{-1}

Hence, velocity of the combined object after collision = 5 / 3 ms^{-1}

16. An object of mass 100 kg is accelerated uniformly from a velocity of 5 m s^{-1} to 8 m s^{-1} in 6 s. Calculate the initial and final momentum of the object. Also, find the magnitude of the force exerted on the object.

Answer:

Initial velocity of the object, $u = 5$ m/s

Final velocity of the object, $v = 8$ m/s

Mass of the object, $m = 100$ kg

Time take by the object to accelerate, $t = 6$ s

Initial momentum = $mu = 100 \times 5 = 500$ kg m s^{-1}

Final momentum = $mv = 100 \times 8 = 800$ kg m s^{-1}

Force exerted on the object, $F = mv - mu / t$

= m (v-u) / t

= 800 - 500

= 300 / 6

= 50 N

Initial momentum of the object is 500 kg m s^{-1}.

Final momentum of the object is 800 kg m s^{-1}.

Force exerted on the object is 50 N.

17. Akhtar, Kiran and Rahul were riding in a motorcar that was moving with a high velocity on an expressway when an insect hit the windshield and got stuck on the windscreen. Akhtar and Kiran started pondering over the situation. Kiran suggested that the insect suffered a greater change in momentum as compared to the change in momentum of the motorcar (because the change in the velocity of the insect was much more than that of the motorcar). Akhtar said that since the motorcar was moving with a larger velocity, it exerted a larger force on the insect. And as a result the insect died. Rahul while putting an entirely new explanation said that both the motorcar and the insect experienced the same force and a change in their momentum. Comment on these suggestions.

Answer:

The suggestion made by Kiran that the insect suffered a greater change in momentum as compared to the change in momentum of the motor car is wrong.

The suggestion made by Akhtar that the motor car exerted a larger force on the insect because of large velocity of motor car is also wrong. The explanation put forward by Rahul is correct. On collision of insect with motor car, both experience the same force as action and reaction are always equal and opposite. Further, changes in their momenta are also the same. Only the signs of changes in momenta are opposite, i.e., change in momenta of the two occur in opposite directions, though magnitude of change in momentum of each is the same.

18. How much momentum will a dumbbell of mass 10 kg transfer to the floor if it falls from a height of 80 cm? Take its downward acceleration to be 10 m s^{-2}.

Answer:

Mass of the dumbbell, m = 10 kg

Distance covered by the dumbbell, s = 80 cm = 0.8 m

Acceleration in the downward direction, a = 10 m/s^2

Initial velocity of the dumbbell, u = 0

Final velocity of the dumbbell (when it was about to hit the floor) = v

According to the third equation of motion:

$v^2 = u^2 + 2as$

$v^2 = 0 + 2\ (10)\ 0.8$

v = 4 m/s

Hence, the momentum with which the dumbbell hits the floor is

$= mv = 10 \times 4 = 40$ kg m s^{-1}

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ADDITIONAL EXCERCISES

1. The following is the distance-time table of an object in motion:

Time in seconds	Distance in metres
0	0
1	1
2	8
3	27
4	64
5	125
6	216
7	343

(a) What conclusion can you draw about the acceleration? Is it constant, increasing, decreasing, or zero?

(b)What do you infer about the forces acting on the object?

Answer:

(a) There is an unequal change of distance in an equal interval of time.

Thus, the given object is having a non - uniform motion. Since the velocity of the object increases with time, the acceleration is increasing.

(b) The object is in accelerated condition. According to Newton's second law of motion, the

force acting on an object is directly proportional to the acceleration produced in the object. So, we can say unbalanced force is acting on the object.

2. Two persons manage to push a motorcar of mass 1200 kg at a uniform velocity along a level road. The same motorcar can be pushed by three persons to produce an acceleration of 0.2 m s^{-2}. With what force does each person push the motorcar?
(Assume that all persons push the motorcar with the same muscular effort)
Answer:
Mass of the motor car = 1200 kg
Only two persons manage to push the car. Hence, the acceleration acquired by the car is given by the third person alone.
Acceleration produced by the car, when it is pushed by the third person,
a = 0.2 m/s^2
Let the force applied by the third person be F.
From Newton's second law of motion:
Force = Mass × Acceleration
F = 1200 × 0.2 = 240 N
Thus, the third person applies a force of magnitude 240 N.
Hence, each person applies a force of 240 N to push the motor car.

3. A hammer of mass 500 g, moving at 50 m s^{-1}, strikes a nail. The nail stops the hammer in a very short time of 0.01 s. What is the force of the nail on the hammer?
Answer:
Mass of the hammer, m = 500 g = 0.5 kg
Initial velocity of the hammer, u = 50 m/s
Time taken by the nail to the stop the hammer, t = 0.01 s
Velocity of the hammer, v = 0 (since the hammer finally comes to rest)
From Newton's second law of motion:
Force, $f = m(v-u) / t$
= 0.5(0-50) / 0.01
= -2500 N

The hammer strikes the nail with a force of −2500 N. Hence, from Newton's third law of motion, the force of the nail on the hammer is equal and opposite, i.e., +2500 N.

4. A motorcar of mass 1200 kg is moving along a straight line with a uniform velocity of 90 km/h. Its velocity is slowed down to 18 km/h in 4 s by an unbalanced external force. Calculate the acceleration and change in momentum. Also calculate the magnitude of the force required.

Answer:

Mass of the motor car, m = 1200 kg

Initial velocity of the motor car, u = 90 km/h = 25 m/s

Final velocity of the motor car, v = 18 km/h = 5 m/s

Time taken, t = 4 s

According to the first equation of motion:

$v = u + at$

$5 = 25 + a\ (4)$

$a = -5\ m/s^2$

Negative sign indicates that its a retarding motion i.e. velocity is decreasing.

Change in momentum = $mv - mu = m\ (v-u)$

$= 1200\ (5 - 25) = -24000\ kg\ m\ s^{-1}$

Force = Mass × Acceleration

$= 1200 \times -5 = -6000\ N$

Acceleration of the motor car = $-5\ m/s^2$

Change in momentum of the motor car = $-24000\ kg\ m\ s^{-1}$

Hence, the force required to decrease the velocity is 6000 N.

(Negative sign indicates retardation, decrease in momentum and retarding force)

BIOLOGY

CHAPTER 5: THE FUNDAMENTAL UNIT OF LIFE

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1. Who discovered cells and how?
Answer: An English Botanist, Robert Hooke discovered cells. In 1665, he used self-designed microscope to observe cells in a cork slice.

2. Why cell is called the structural and functional unit of life?
Answer: Cells are called the structural and functional unit of life because all the living organisms are made up of cells and also all the functions taking place inside the body of organisms are performed by cells.

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1. How do substances like CO_2 and water move in and out of the cell? Discuss.
Answer: The substances like $CO_2$and water move in and out of a cell by diffusion from the region of high concentration to low concentration.
When the concentration of $CO_2$and water is higher in external environment than that inside the cell, $CO_2$and water moves inside the cell. When the concentration outside the cell becomes low and it is high inside the cell, they move out.

2. Why is the plasma membrane called a selectively permeable membrane?
Answer: Plasma membrane called a selectively permeable membrane because it regulates the movement of substances in and out of the cell. This means that the plasma membrane allows the entry of only some substances and prevents the movement of some other materials.

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1. Fill in the gaps in the following table illustrating differences between prokaryotic and eukaryotic cells.

	Prokaryotic cell		Eukaryotic cell
1.	Size: generally small (1-10 µm) 1 µm== 10^{-6} m	1.	Size: generally large (5-100 µm)
2.	Nuclear region: _____ and is known as _____.	2.	Nuclear region: well-defined and surrounded by a nuclear membrane
3.	Chromosome: single	3.	More than one chromosome
4.	Membrane-bound cell organelles are absent	4.	_____

Answer

	Prokaryotic cell		Eukaryotic cell
1.	Size: generally small (1-10 µm) 1 µm== 10^{-6} m	1.	Size: generally large (5-100 µm)
2.	Nuclear region: poorly defined because of the absence of a nuclear membrane, and is known as nucleoid	2.	Nuclear region: well-defined and surrounded by a nuclear membrane
3.	Chromosome: single	3.	More than one chromosome

4.	Membrane-bound cell organelles are absent	4.	Membrane-bound cell organelles such as mitochondria, plastids, etc., are present

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1. Can you name the two organelles we have studied that contain their own genetic material?

Answer: Mitochondria and plastids

2. If the organization of a cell is destroyed due to some physical or chemical influence, what will happen?

Answer: If the organization of a cell is destroyed due to some physical or chemical influence then cell will not be able to perform the basic functions like respiration, nutrition, excretion etc. This may stop all the life activities and may result in its death.

3. Why are lysosomes known as suicide bags?

Answer: Lysosomes are called suicide bags because in case of disturbance of their cellular metabolism they digest their own cell by releasing own enzymes.

4. Where are proteins synthesized inside the cell?

Answer: The proteins are synthesized in the Ribosome inside the cell.

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EXERCISE

1. Make a comparison and write down ways in which plant cells are different from animal cells.

Answer:

Animal cell	Plant cell
The do not have cell wall.	They have cell wall made up of cellulose.

They do not have chloroplast.	They contain chloroplast.
They have centrosome.	They do not have centrosome.
Vacuoles are smaller in size.	Vacuoles are larger in size.
Lysosomes are larger in number.	Lysosomes are absent or very few in number
Prominent Golgi bodies are present.	Subunits of Golgi bodies known as dictyosomes are present.

2. How is a prokaryotic cell different from a eukaryotic cell?

Answer:

Prokaryotic cell	Eukaryotic cell
Most prokaryotes are unicellular.	Most eukaryotes are multicellular.
Size of the cell is generally small (0.5- 5 µm).	Size of the cell is generally large (50- 100 µm).
Nuclear region is poorly defined due to the absence of a nuclear membrane or the cell lacks true nucleus.	Nuclear region is well-defined and is surrounded by a nuclear membrane, or true nucleus bound by a nuclear membrane is present in the cell.
It contains a single chromosome.	It contains more than one chromosome.
Nucleolus is absent.	Nucleolus is present.

Membrane-bound cell organelles such as plastids, mitochondria, endoplasmic reticulum, Golgi apparatus, etc. are absent.	Cell organelles such as mitochondria, plastids, endoplasmic reticulum, Golgi apparatus, lysosomes, etc. are present.
Cell division occurs through binary fission	Cell division occurs by mitosis.
Prokaryotic cells are found in bacteria and blue-green algae.	Eukaryotic cells are found in fungi, plants, and animal cells.

3. What would happen if the plasma membrane ruptures or breaks down?
Answer: If the plasma membrane ruptures or breakdown then the cell will not be able to exchange material from it's surrounding by diffusion or osmosis. Thereafter the protoplasmic material will be disappeared and the cell will die.

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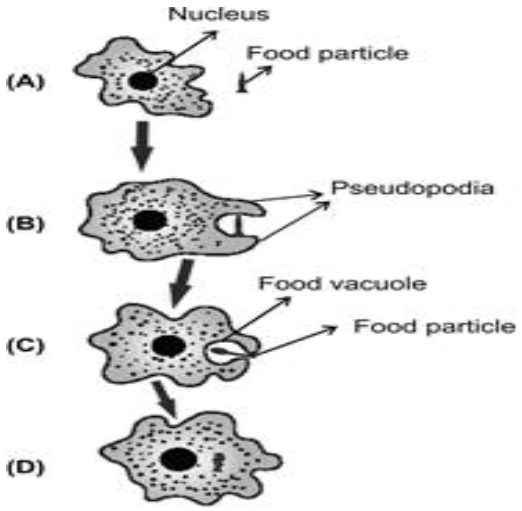
4. What would happen to the life of a cell if there was no Golgi apparatus?
Answer: Golgi apparatus has the function of storage modification and packaging of the products. If there is no Golgi apparatus then the packaging and transporting of materials synthesized by cell will not happen.

5. Which organelle is known as the powerhouse of the cell? Why?
Answer: Mitochondria are known as the powerhouse of cells because energy required for various chemical activities needed for life is released by mitochondria in the form of ATP (Adenosine triphosphate) molecules.

6. Where do the lipids and proteins constituting the cell membrane get synthesized?
Answer: Lipids are synthesized in Smooth endoplasmic reticulum (SER) and the proteins are synthesized in rough endoplasmic reticulum (RER).

7. How does an Amoeba obtain its food?

Answer: Amoeba takes in food using temporary finger-like extensions of the cell surface which fuse over the food particle forming a food-vacuole as shown in figure. Inside the food vacuole, Complex substances are broken down into simpler ones which then diffuse into the cytoplasm. The remaining undigested material is moved to the surface of the cell and thrown out.



(Nutrition in Amoeba)

8. What is osmosis?

Answer: Osmosis is the process in which water molecules moves from the region of high concentration to a region of low concentration through a semi permeable membrane.

9. Carry out the following osmosis experiment:

Take four peeled potato halves and scoop each one out to make potato cups. One of these potato cups should be made from a boiled potato. Put each potato cup in a trough containing water. Now,

(a) Keep cup A empty

(b) Put one teaspoon sugar in cup B

(c) Put one teaspoon salt in cup C

(d) Put one teaspoon sugar in the boiled potato cup D.

Keep these for two hours. Then observe the four potato cups and answer the following:

(i) Explain why water gathers in the hollowed portion of B and C.

(ii) Why is potato A necessary for this experiment?

(iii) Explain why water does not gather in the hollowed out portions of A and D.

Answer:

(i) Water gathers in the hollowed portions of set-up B and C because water enters the potato as a result of osmosis. Since the medium surrounding the cell has a higher water concentration than the cell, the water moves inside by osmosis. Hence, water gathers in the hollowed portions of the potato cup.

(ii) Potato A in the experiment acts as a control set-up. No water gathers in the hollowed portions of potato A.

(iii) Water does not gather in the hollowed portions of potato A because potato cup A is empty. It is a control set-up in the experiment.

Water is not able to enter potato D because the potato used here is boiled. Boiling denatures the proteins present in the cell membrane and thus, disrupts the cell membrane. For osmosis, a semi-permeable membrane is required, which is disrupted in this case. Therefore, osmosis will not occur. Hence, water does not enter the boiled potato cup.

Chapter 6: Tissues

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1. What is a tissue?

Answer:

Tissue is a group of cells that are similar in structure and are organized together to perform a specific task.

2. What is the utility of tissues in multi-cellular organisms?

Answer:

In multicellular organisms, the different types of tissues perform different functions. Since a particular group of cells carry out only a particular function, they do it very efficiently. So, multicellular organisms possess a definite division of labour.

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1. Name types of simple tissues.

Answer:

Simple permanent tissues are of three types:→ Parenchyma

→ Collenchyma

→ Sclerenchyma

Parenchyma tissue is of further two types:

• Aerenchyma

• Chlorenchyma

2. Where is apical meristem found?

Answer:

Apical meristem is present at the growing tips of stems and roots.

3. Which tissue makes up the husk of coconut?

Answer:

Sclerenchyma tissue makes up the husk of coconut.

4. What are the constituents of phloem?

Answer:

The constituents of phloem are:

→ Sieve tubes

→ Companion cells

→ Phloem parenchyma

→ Phloem fibres

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1. Name the tissue responsible for movement in our body.

► Muscular tissue

2. What does a neuron look like?

Answer:

Neuron look like a star shaped cell with a tail.

3. Give three features of cardiac muscles.

Answer:

Three features of cardiac muscles are:

→ Cardiac muscles are involuntary muscles that contract rapidly, but do not get fatigued.

→ The cells of cardiac muscles are cylindrical, branched, and uninucleate.

→ They control the contraction and relaxation of the heart.

4. What are the functions of areolar tissue?

Answer:

Functions of areolar tissue:

→ It helps in supporting internal organs.

→ It helps in repairing the tissues of the skin and muscles.

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EXCERCISE

1. Define the term "tissue".

Answer:

Tissue is a group of cells that are similar in structure and are organized together to perform a specific task.

2. How many types of elements together make up the xylem tissue? Name them.

Answer:

Xylem is composed of following elements:

→ Tracheids

→ Vessels

→ Xylem parenchyma

→ Xylem fibres

3. How are simple tissues different from complex tissues in plants?

Answer:

Simple tissue	Complex tissue
These tissues consist of only one type of cells.	These tissues are made up of more than one type of cells.
The cells are more or less similar in structure and perform similar functions.	Different types of cells perform different functions. For example, in the xylem tissue, tracheids help in water transport, whereas parenchyma stores food.
Three types of simple tissues in plants are parenchyma, collenchyma, and sclerenchyma.	Two types of complex permanent tissues in plants are xylem and phloem.

4. Differentiate between parenchyma, collenchyma and sclerenchyma, on the basis of their cell wall.

Answer:

Parenchyma	Collenchyma	Sclerenchyma

Cell walls are relatively thin, and the cells in parenchyma tissues are loosely packed.	The cell wall is irregularly thickened at the corners, and there is very little space between the cells.	The cell walls are uniformly thickened, and there are no intercellular spaces.
The cell wall in this tissue is made up of cellulose.	Pectin and hemicellulose are the major constituents of the cell wall.	An additional layer of the cell wall composed mainly of lignin is found.

5. What are the functions of the stomata?

Answer:

The functions of stomata are:

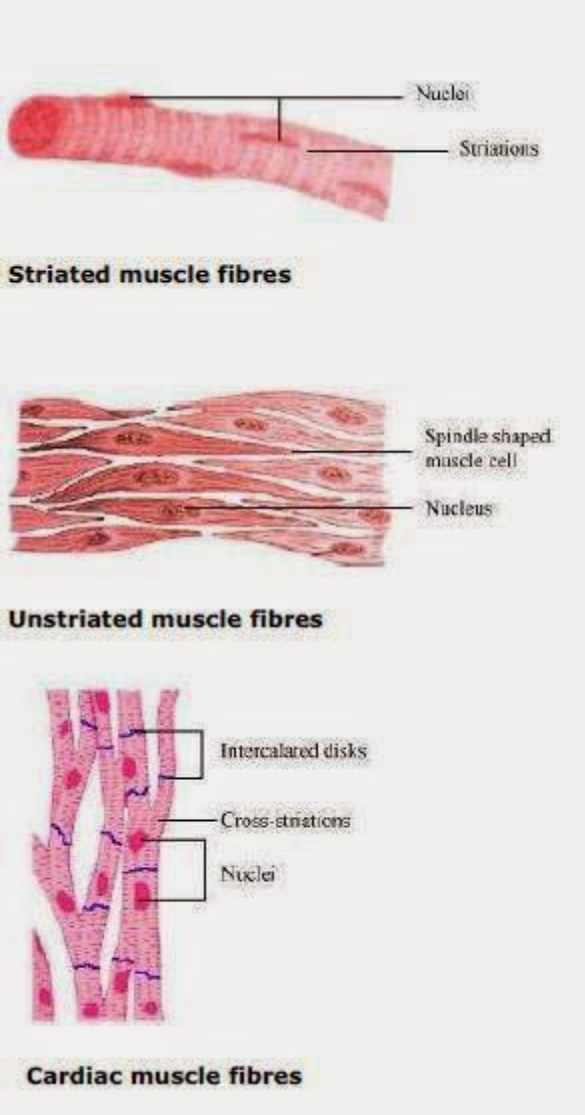
→ The exchange of gases (CO_2 and O_2) with the atmosphere.

→ The loss of excess water in the form of water vapour which is known as transpiration.

6. Diagrammatically show the difference between the three types of muscle fibres.

Answer:

The three types of muscle fibres are: Striated muscles, smooth muscles (unstriated muscle fibre), and cardiac muscles.



7. What is the specific function of the cardiac muscle?

Answer:

The specific function of the cardiac muscle is to control the contraction and relaxation of the heart.

8. Differentiate between striated, unstriated and cardiac muscles on the basis of their structure and site/location in the body.

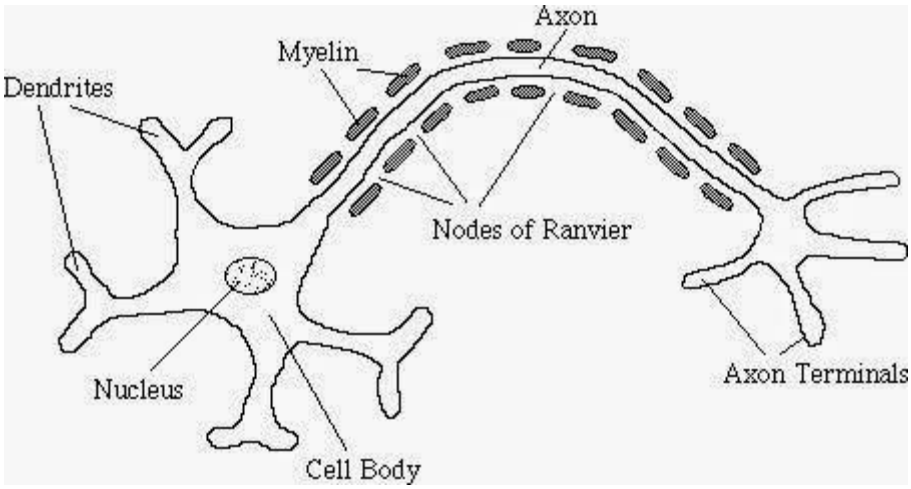
Answer:

Striated muscle	Unstriated muscle	Cardiac muscle

On the basis of structure:		
Cells are cylindrical	Cells are long	Cells are cylindrical
Cells are not branched	Cells are not branched	Cells are branched
Cells are multinucleate	Cells are uninucleate	Cells are uninucleate
Alternate light and dark bands are present	There are no bands present	Faint bands are present
Its ends are blunt	Its ends are tapering	Its ends are flat and wavy
On the basis of location:		
These muscles are present in body parts such as hands, legs, tongue, etc.	These muscles control the movement of food in the alimentary canal, the contraction and relaxation of blood vessels, etc.	These muscles control the contraction and relaxation of the heart

9. Draw a labelled diagram of a neuron.

Answer:



10. Name the following:

(a) Tissue that forms the inner lining of our mouth.

► Epithelial tissue

(b) Tissue that connects muscle to bone in humans.

► Tendon

(c) Tissue that transports food in plants.

► Phloem

(d) Tissue that stores fat in our body.

► Adipose tissue

(e) Connective tissue with a fluid matrix.

► Blood

(f) Tissue present in the brain.

► Nervous tissue

11. Identify the type of tissue in the following: skin, bark of tree, bone, lining of kidney tubule, vascular bundle.

Answer:

→ Skin: Stratified squamous epithelial tissue

→ Bark of tree: Simple permanent tissue

→ Bone: Connective tissue

→ Lining of kidney tubule: Cuboidal epithelial tissue

→ Vascular bundle: Complex permanent tissue

12. Name the regions in which parenchyma tissue is present.

Answer:

Leaves, fruits, and flowers are the regions where the parenchyma tissue is present.

13. What is the role of epidermis in plants?

Answer:

Epidermisis present on the outer surface of the entire plant body which perform following role:

→ It is a protective tissue of the plant body.

→ It protects the plant against mechanical injury.

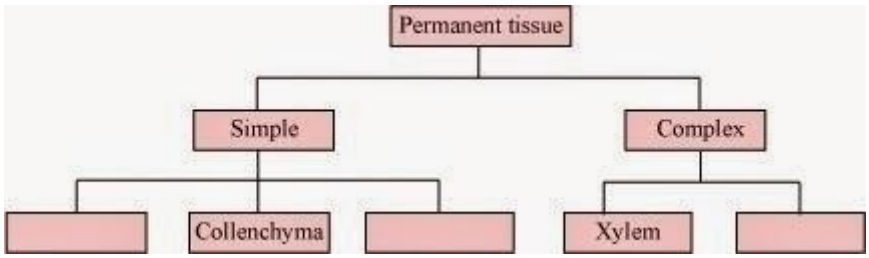
→ It allows exchange of gases through the stomata.

14. How does the cork act as a protective tissue?

Answer:

The outer protective layer or bark of a tree is known as the cork. It is made up of dead cells. Therefore, it protects the plant against mechanical injury, temperature extremes, etc. It also prevents the loss of water by evaporation.

15. Complete the table:



Answer: