PHYSICS

BOOKS - CAMBRIDGE PHYSICS (KANNADA ENGLISH)

FORCE AND LAWS OF MOTION

Question Hour

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 rupes coin and a one rupee coin .

2. In the following example, try to identify the number of times the velocity of the ball changes. A foot ball player kicks a football to another player in his team who kicks the foot ball 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 .

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

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

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

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

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

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

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Exercise

1. An object experience a net zero exteranal unbalanced force. Is it possible for the object to be travelling with a non zero velocity ? If yes, state the condition that must be placed on the magnitude and direction of the velocity.

If no, provide reason.

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

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

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4. A batsaman 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.

5. A truck 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 its mass is 7 metric tonnes (Hint : 1 metric tonne = 1000 kg)

6. A stone of 1 kg is thrown with a velocity of $20ms^{-1}$ 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 ?

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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

(c) The force of wagon 1 on wagon 2.

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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 $1.7ms^{-2}$.

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

A. $(mv)^2$

B. mv^2

C. $1/2mv^2$

D. mv

Answer: d

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

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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 $2.5ms^{-1}$ before the collision during which

they stick together. What will be the velocity of the combined object after collision ?

12. According to the third law of motion when 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 road side, it will probably not move. A student justifies this by answering that the two opposite and equal forces cancel each other.

Comment on their logic and explain why the truck does not move .

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

14. A bullet of mass 10 g travelling horizontally with a velocity of $150 ms^{-1}$ strikes a stationary wooden block and comes to rest in 09.03 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.

15. An object of mass 1 kg travelling in a straight line with a velocity of $10ms^{-1}$ collides with, and strikes 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 .

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

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17. Akhtar, kiran an rahul were riding in a motorcar that was moving with a high velocity on an expressway when an insect hit the

windshied and got stuck on the windscreen. Akthar and kiran started pondering over the situation.. Kiran suggested that the inserct 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). Akthar said that since the motor car 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 experieneced the

same force and a change in their momentum comment on these suggestions.

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 $10ms^{-2}$.

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

Time in seconds	Distance in meters
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 ?

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 $0.2ms^{-2}$. With what force does each person push the motor car ?

3. A hammer of mass 500 g, moving at $50ms^{-1}$ strikes a nail.

The nail stops the hammer in a very short time of 0.01s.

what is the force of the nail on the hammer.

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4. A motorcar of mass 1200 kg is moving along a straight line with a uniform velocity of 90km/h. its velocity is slowed down to 18 km/h

in 4 seconds by an unbalanced external force. Calculate the acceleration and change in momentum . Also calculate the magnitude of the force required.

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Additional Questions

1. Define the SI unit of force.

   A. kgm/s

B. kgm/s^2

C. Newton

D. Newton meter

Answer: C

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2. The product of mass and velocity gives a physical quantity.

A. force

B. inertia

C. Momentum

D. newton

Answer: C

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3. The rate of change of momentum of an object is proportioanl to

A. Mass of the body

B. velocity of the body

C. Net force applied on the body

D. None of these

Answer: C

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4. If two balls of different masses are dropped

on sand, the depths of penetration is same if :

A. Heavier ball is dropped faster than lighter ball

B. Lighter ball is droppped faster than heavier ball

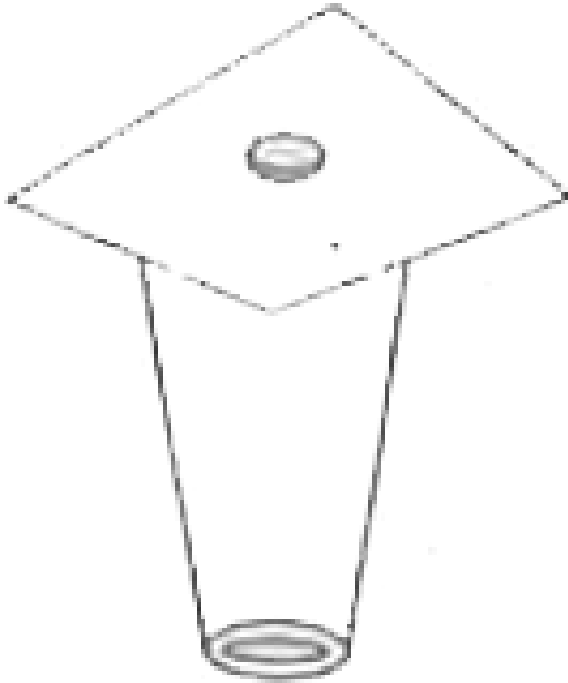C. the product mass is small for both bodies

D. None of these

Answer: C

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5. The coin remain at rest shown in the fig.

This is due to

A. Inertia of rest

B. two forces act on the coin which balance

each other

C. No unbalanced force acts on it

D. all of these

Answer: D

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6. A force of 50 N moves a body

A. Frictional force exerted on the body is

less than 50N

B. Frictional force exerted on the body is

more than 50 N

C. None of these

D. Both a and b

Answer: A

7. Fielder giving a swing while catching a ball is

an example of

A. Inertia of rest

B. Momentum

C. Newton's II law of motion

D. Newton's I law of motion

Answer: C

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8. Action and reaction forces

A. Acts on same body

B. act an different bodies

C. act in same direction

D. Both a and c

Answer: B

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9. When we stop pedaling the bicycle it stops because

A. The earths gravitational force acts on it.

B. it is not acceleration

C. No unbalanced force acts on it

D. Frictional force acts on it.

Answer: D

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10. A football and a stone has same mass

A. Both have same inertia

B. Both have same momentum

C. Both have different inertia

D. Both have different momentum

Answer: A

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11. Define force.

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12. What is inertia ?

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13. State Newton's laws of motion

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14. Name two factors which determine the momentum of a body.

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15. A bullet of mass 20 g is horizontally fired with a velocity 150 m/s from a pistol of mass 2 kg . What is the recoil velocity of the pistol ?

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16. Why are roads on mountains inclined in wards at terms ?

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17. What is law of conservation of momentum .

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18. In an high jump athletic event why are athletes made to fall either on a cushioned bed or on a sand bed ?

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19. State the difference in balanced and unbalanced force.

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20. What is the frictional force ?

III match the folllowing

A	B
Force	$V^2 = u^2 + 2as$
Momentum	ms^{-2}
Equation of motion	Mass x acceleration
Acceleration	$kgms^{-1}$

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