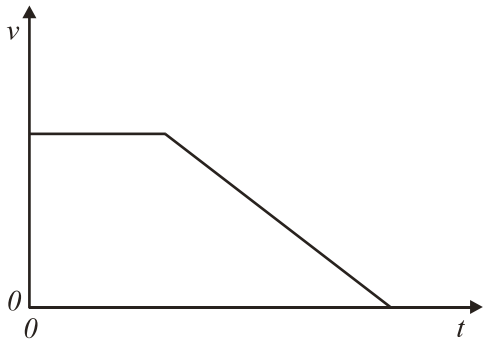
1. The diagram below shows the variation with time t of the velocity v of an object.



The area between the line of the graph and the time-axis represents

A. the average velocity of the object.

B. the displacement of the object.

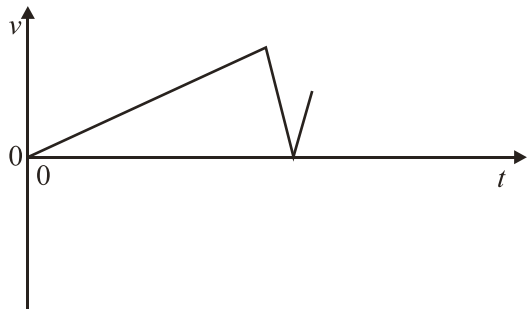
C. the impulse acting on the object.

D. the work done on the object.

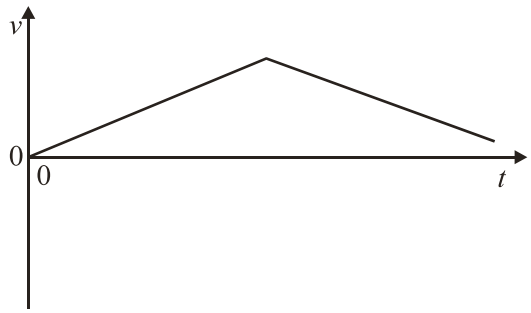
(1)

2. A ball is dropped from rest at time $t = 0$ on to a horizontal surface from which it rebounds. Which **one** of the following graphs best shows the variation of **speed** v of the ball with time t from the time $t = 0$ to the time that the ball leaves the surface?

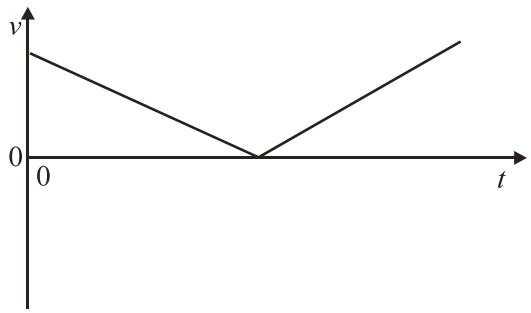
A.



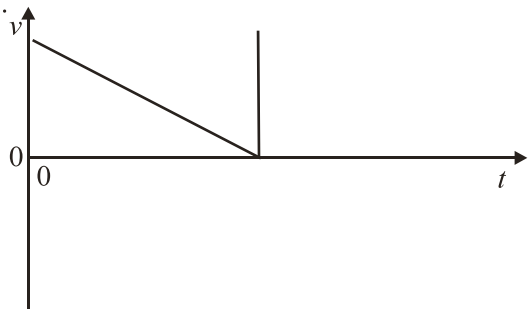
B.



C.

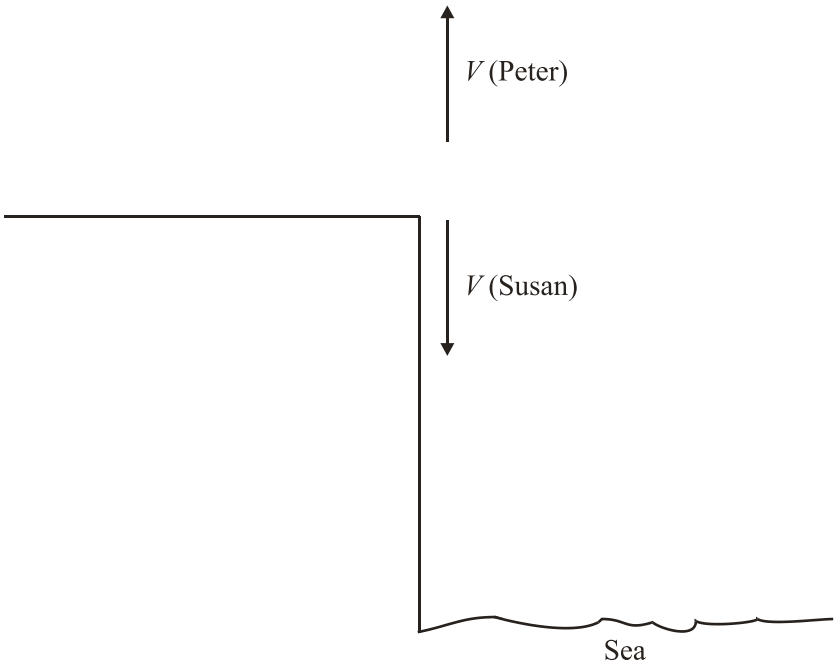


D.



(1)

3. Peter and Susan both stand on the edge of a vertical cliff.



Susan throws a stone vertically downwards and, at the same time, Peter throws a stone vertically upwards. The speed V with which both stones are thrown is the same. Neglecting air resistance, which **one** of the following statements is true?

A. The stone thrown by Susan will hit the sea with a greater speed than the stone thrown by Peter.

B. Both stones will hit the sea with the same speed no matter what the height of the cliff.

C. In order to determine which stone hits the sea first, the height of the cliff must be known.

D. In order to determine which stone hits the sea first both the height of the cliff and the mass of each stone must be known.

(1)

4. An electric motor, with an input power of 250 W, produces 200 W of mechanical power. The efficiency of the motor is

A. 20%.

B. 25%.

C. 55%.

D. 80%.

(1)

5. Engine X is stated to be more **powerful** than engine Y.

Which of the following is the correct comparison of the engines?

A. Engine X produces a larger force than engine Y.

B. Engine X produces more useful energy than engine Y.

C. Engine X produces more useful energy per unit time than engine Y.

D. Engine X produces more power for a longer time than engine Y.

(1)

6. An object of weight 50 N is dragged up an inclined plane at constant speed, through a vertical height of 12 m. The total work done is 1500 J.

The work done against friction is

A. 2100 J.

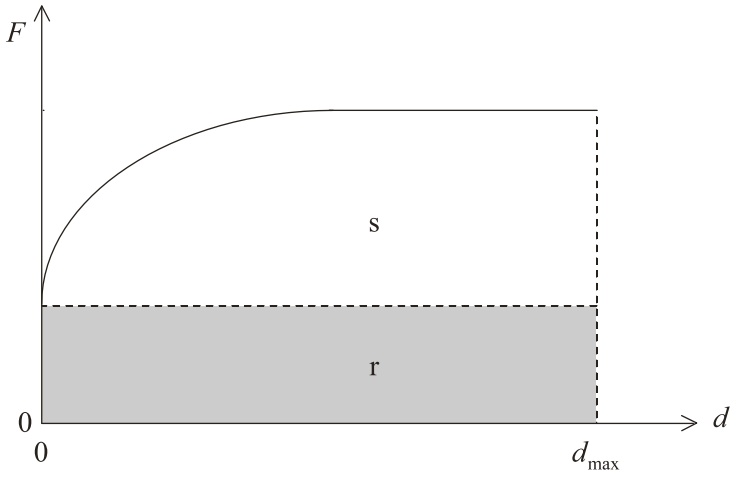
B. 1500 J.

C. 900 J.

D. 50 J.

(1)

7. The graph below shows the variation with displacement d of the force F acting on a particle.



The area that represents the work done by the force between $d = 0$ and $d = d_{max}$ is

A. s − r.

B. r.

C. s.

D. s + r.

(1)

8. A body of mass m and speed v has kinetic energy E_K. A second body of mass $\frac{m}{2}$ moves at speed $2v$. The kinetic energy of this second body is

A. $\frac{E_K}{2}$.

B. E_K.

C. $2E_K$.

D. $4E_K$.

(1)

9. A stone of mass m is attached to a string and moves round in a horizontal circle of radius R at constant speed V. The work done by the pull of the string on the stone in one complete revolution is

A. zero.

B. $2\pi mV^2$.

C. $\frac{2\pi mV^2}{R}$.

D. $\frac{2\pi mV}{R}$.

(1)

10. An electric train develops a power of 1.0 MW when travelling at a constant speed of 50 ms^{-1}. The net resistive force acting on the train is

A. 50 MN.

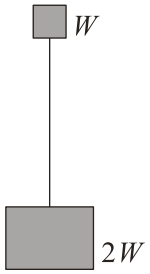
B. 200 kN.

C. 20 kN.

D. 200 N.

(1)

11. A body of weight $2W$ hangs vertically from a string attached to a body of weight W. Weight W is released and both bodies fall vertically.



Air resistance may be neglected. What is the tension in the string during the fall?

A. Zero

B. W

C. $2W$

D. $3W$

(1)

12. A frictionless trolley of mass m moves down a slope with a constant acceleration a. A second similar frictionless trolley has mass $2m$. The acceleration of the second trolley as it moves down the slope is

A. $\frac{1}{2}a.$

B. $a.$

C. $2a.$

D. $4a.$

(1)

13. Three forces of magnitude $F_1 = 3.0$ N, $F_2 = 4.0$ N and $F_3 = 6.0$ N act at a point. The point is in equilibrium. The magnitude of the resultant of F_1 and F_2 is

A. 1.0 N.

B. 5.0 N.

C. 6.0 N.

D. 7.0 N.

(1)

14. The velocity of a particle is changing. The rate of change of the momentum of the particle is equal to the

A. acceleration of the particle.

B. net force acting on the particle.

C. work done on the particle.

D. change in kinetic energy of the particle.

(1)

15. A truck collides head on with a less massive car moving in the opposite direction to the truck. During the collision, the average force exerted by the truck on the car is F_T and the average force exerted by the car on the truck is F_C. Which **one** of the following statements is correct?

A. F_T will always be greater in magnitude than F_C.

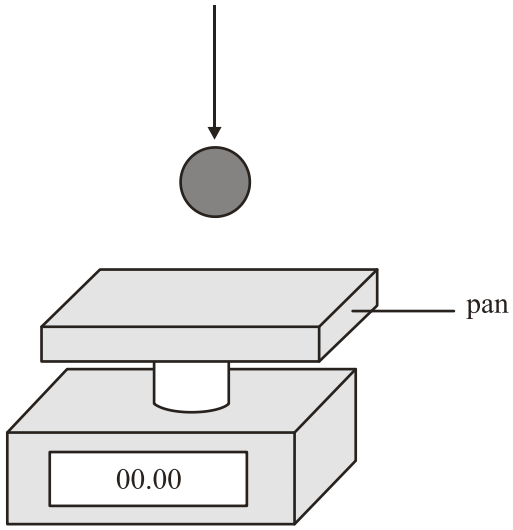
B. F_T will always be equal in magnitude to F_C.

C. F_T will be greater in magnitude than F_C only when the speed of the car is less than the speed of the truck.

D. F_T will be equal in magnitude to F_C only when the speed of the truck is equal to the speed of the car.

(1)

16. A ball of weight W is dropped on to the pan of a top pan weighing balance and rebounds off the pan.



At the instant that the ball has zero velocity when in contact with the pan, the scale will read

A. zero.

B. a value less than W but greater than zero.

C. W.

D. a value greater than W.

(1)

17. A small ball P moves with speed v towards another identical ball Q along a line joining the centres of the two balls. Ball Q is at rest. Kinetic energy is conserved in the collision.

Which **one** of the following situations is a possible outcome of the collision between the balls?

A. 

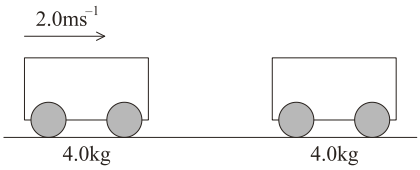
B. 

C. 

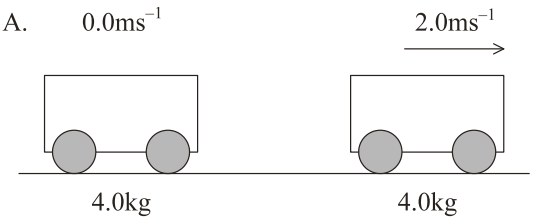
D. 

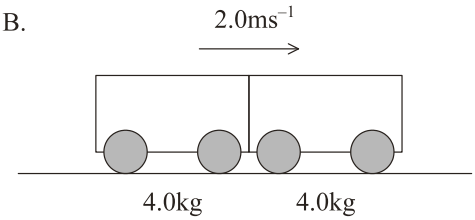
(1)

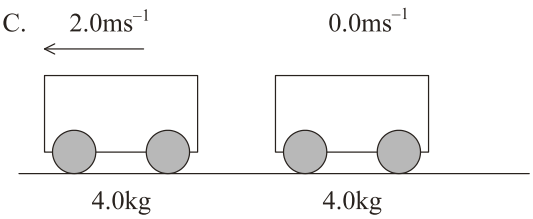
18. The diagram below shows a trolley of mass 4.0 kg moving on a frictionless horizontal table with a speed of 2.0 m s^{-1}. It collides with a stationary trolley also of mass 4.0 kg.

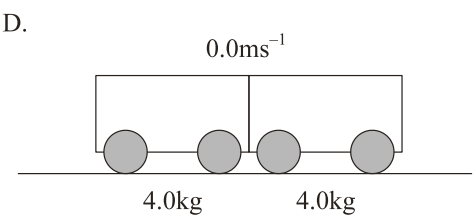


Which of the following diagrams shows a possible outcome?

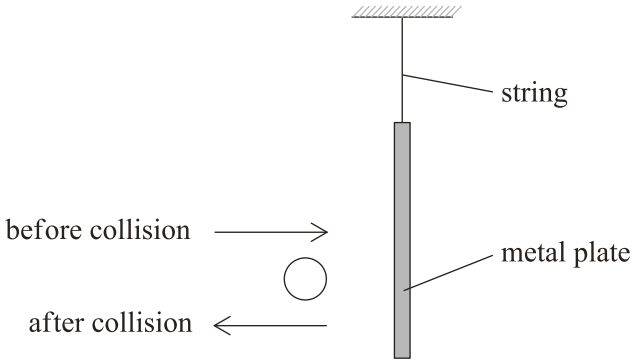
A. 

B. 

C. 

D. 

19. A stationary metal plate is hanging freely on a string. A steel ball, travelling horizontally, hits the plate. The speed of the ball after the collision is less than before, but still in a horizontal direction, as shown below.

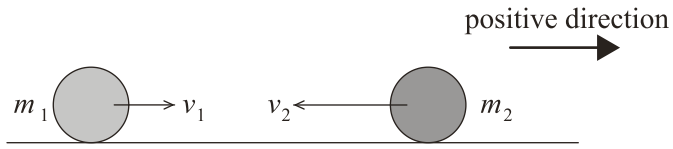


Which **one** of the following gives a correct statement, with a valid reason, about the type of collision between the ball and the plate?

	Type of collision	Reason
A.	inelastic	The sphere has changed its momentum during the collision.
B.	inelastic	The sphere has lost kinetic energy during the collision.
C.	unknown	The change in momentum of the plate during the collision is unknown.
D.	unknown	The kinetic energy of the plate after the collision is unknown.

(1)

20. Two spheres of masses m_1 and m_2 are moving towards each other along the same straight-line with speeds v_1 and v_2 as shown.



The spheres collide. Which of the following gives the total change in linear momentum of the spheres as a result of the collision?

A. 0

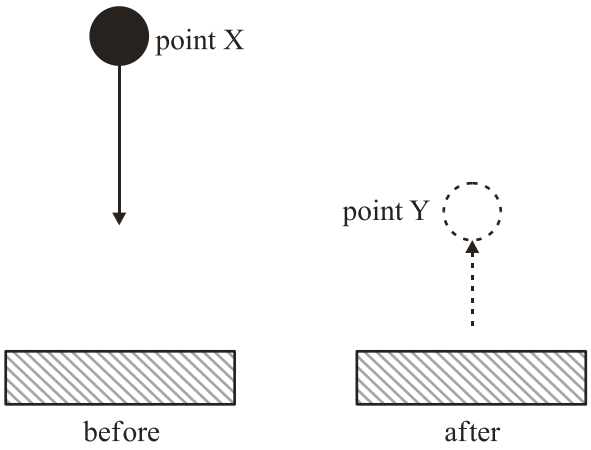
B. $m_1v_1 + m_2v_2$

C. $m_1v_1 - m_2v_2$

D. $m_2v_2 - m_1v_1$

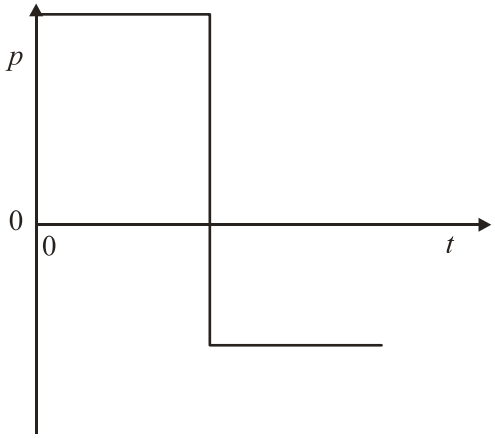
(1)

21. A ball is held at rest at point X and is then released. It drops on to a flat horizontal surface and rebounds to a maximum height at point Y.

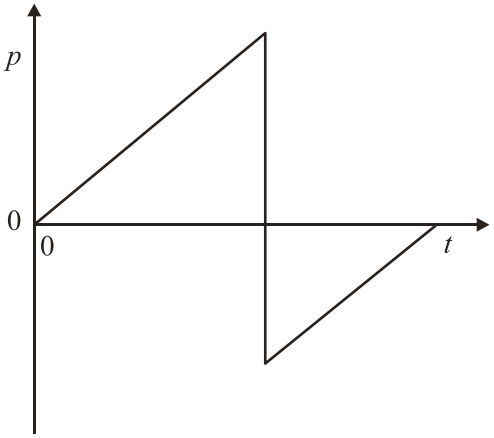


Which **one** of the following graphs best shows the variation with time t of the momentum p of the ball as it moves between point X and point Y?

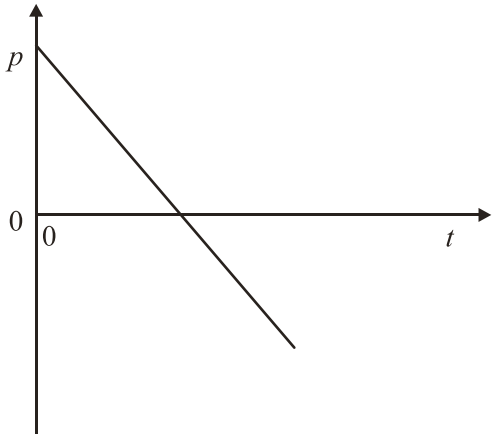
A.



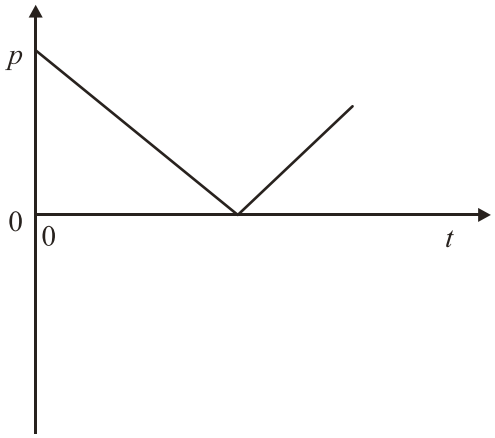
B.



C.

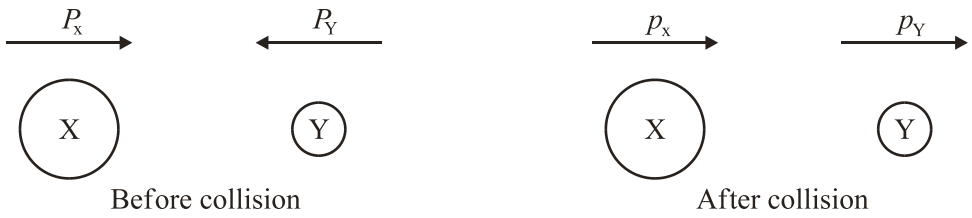


D.



(1)

22. Two spheres X and Y are moving towards each other along the same straight line with momenta of magnitude P_X and P_Y respectively. The spheres collide and move off with momenta p_X and p_Y respectively, as illustrated below.



Which **one** of the following is a correct statement of the law of conservation of momentum for this collision?

A. $P_X + P_Y = p_X + p_Y$

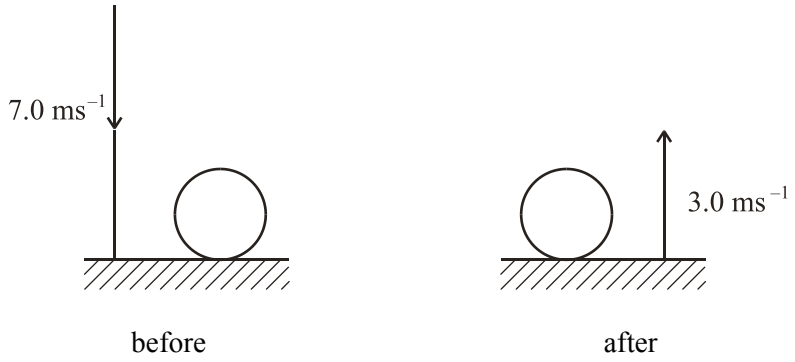
B. $P_X - P_Y = p_X + p_Y$

C. $P_X - P_Y = p_X - p_Y$

D. $P_X + P_Y = p_X - p_Y$

(1)

23. A ball of mass 2.0 kg falls vertically and hits the ground with speed 7.0 ms^{-1} as shown below.



The ball leaves the ground with a vertical speed 3.0 ms^{-1}.

The magnitude of the change in momentum of the ball is

A. zero.

B. 8.0 Ns.

C. 10 Ns.

D. 20 Ns.

(1)

24. When a body is accelerating, the resultant force acting on it is equal to its

A. change of momentum.

B. rate of change of momentum.

C. acceleration per unit of mass.

D. rate of change of kinetic energy.

(1)

25. An impulse I acts on a body of mass m that is initially at rest. What is the distance moved by the body in a time t after the impulse has been delivered?

A. $\frac{It}{m}$

B. $\frac{Im}{t}$

C. $\frac{I}{m}$

D. It

(1)

26. Joe is standing on the surface of a frozen pond and he throws a ball horizontally. Considering Joe and the ball together, which **one** of the following correctly describes the change in the magnitude of the momentum and the change in the kinetic energy of Joe and the ball immediately after the ball is thrown?

	Magnitude of momentum of Joe and ball	**Kinetic energy of Joe and ball**
A.	No change	Increases
B.	Increases	Increases
C.	No change	No change
D.	Increases	No change

(1)

27. Which of the following quantities are conserved in an **inelastic** collision between two bodies?

	Total linear momentum of the bodies	**Total kinetic energy of the bodies**
A.	yes	yes
B.	yes	no
C.	no	yes
D.	no	no

(1)

28. A constant force is applied to a ball of mass m. The velocity of the ball changes from v_1 to v_2. The impulse received by the ball is

A. $m(v_2 + v_1)$.

B. $m(v_2 - v_1)$.

C. $m(v_2^2 + v_1^2)$.

D. $m(v_2^2 - v_1^2)$.

(1)

29. A rocket is fired vertically. At its highest point, it explodes. Which **one** of the following describes what happens to its total momentum and total kinetic energy as a result of the explosion?

	Total momentum	**Total kinetic energy**
A.	unchanged	increased
B.	unchanged	unchanged
C.	increased	increased
D.	increased	unchanged

(1)

30. An object of mass m is initially at rest. An impulse I acts on the object. The change in kinetic energy of the object is

A. $\frac{I^2}{2m}$.

B. $\frac{I^2}{m}$.

C. I^2m.

D. $2I^2m$.

(1)