**H2 Physics Revision** Topic : Dynamics

Multiple Choice Questions Name: _____

1 An aircraft, powered by a jet engine, is flying at a constant speed of 800 m $s^{-1}$. 20 kg of exhaust gas is ejected from the engine every second, with a velocity of 100 m $s^{-1}$ in the opposite direction relative to the aircraft.

What is the magnitude of the resistive force experienced by the aircraft?

**A** 2 000 N

**B** 14 000 N

**C** 16 000 N

**D** 18 000 N

2 A man of 70 kg stands on a weighing scale in a lift. The lift begins to ascend with an acceleration of 0.80 m $s^{-2}$, before slowing to a stop with a maximum deceleration of 0.30 m $s^{-2}$.

What is the difference between the maximum and minimum reading of his mass observed on the weighing scale?

**A** 2.1 kg **B** 3.6 kg **C** 5.7 kg **D** 7.8 kg

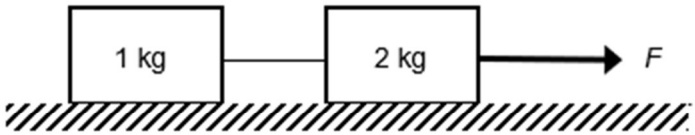
3 A person of mass 60 kg stands on an accurate bathroom scale, placed on the floor of a lift which operates in a tall building.

At a certain instant the bathroom scale reads 58 kg.

Which row could give the person's direction of movement and type of motion?

| | direction | motion |
|---|---|---|
| **A** | downwards | constant speed |
| **B** | downwards | slowing down |
| **C** | upwards | constant speed |
| **D** | upwards | slowing down |

4 The frictionless system shown is accelerated by an applied force of magnitude $F$.




What is the tension in the string between the blocks?

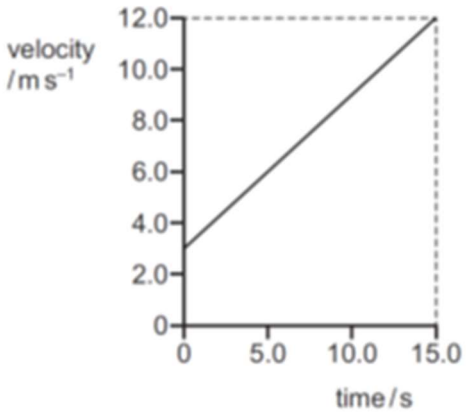
**A** $\frac{1}{3}F$ **B** $\frac{1}{2}F$ **C** $F$ **D** $2F$

5 A molecule of mass $m$ travels with velocity $+u$ directly towards a stationary molecule of mass $4m$ and collides elastically with it.

What is the velocity of the molecule of mass $m$ after the collision?

**A** $+\frac{u}{5}$ **B** $-\frac{3}{5}u$ **C** $-\frac{4}{5}u$ **D** $-u$

6 The velocity-time graph for an object of mass 2.5 kg is shown.

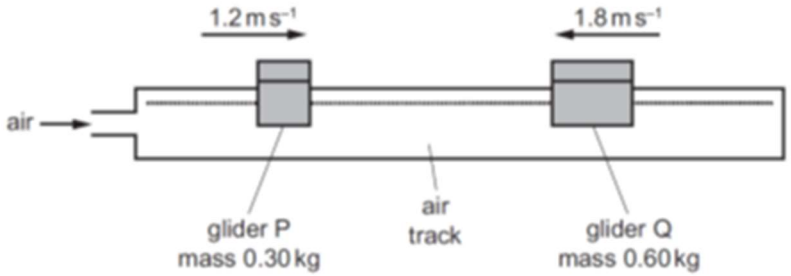



What is the resultant force acting on the object?

**A** 0.60 N **B** 0.80 N **C** 1.5 N **D** 2.0 N

7

Two gliders are travelling towards each other on a horizontal air track. Glider P has mass 0.30 kg and is moving with a constant speed of 1.2 m $s^{-1}$. Glider Q has mass 0.60 kg and is moving with a constant speed of 1.8 m $s^{-1}$.

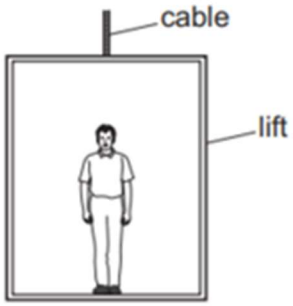



The gliders have a perfectly elastic collision.

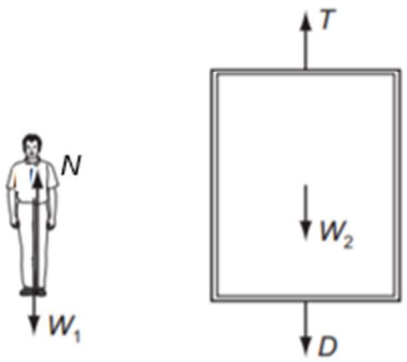
What are the speeds of the two gliders after the collision?

| | speed of P / m $s^{-1}$ | speed of Q / m $s^{-1}$ |
|---|---|---|
| **A** | 1.2 | 0.6 |
| **B** | 2.0 | 1.4 |
| **C** | 2.8 | 0.2 |
| **D** | 3.6 | 0.6 |

8 The diagram shows a man standing in a lift.




The forces acting on the man and the forces acting on the lift are shown below.




*N* is the force from the lift floor on the man.
$W_1$ is the weight of the man.
*T* is the tension in the lift cable.
$W_2$ is the weight of the lift.
*D* is the force from the man on the lift floor.

Which statement is correct?

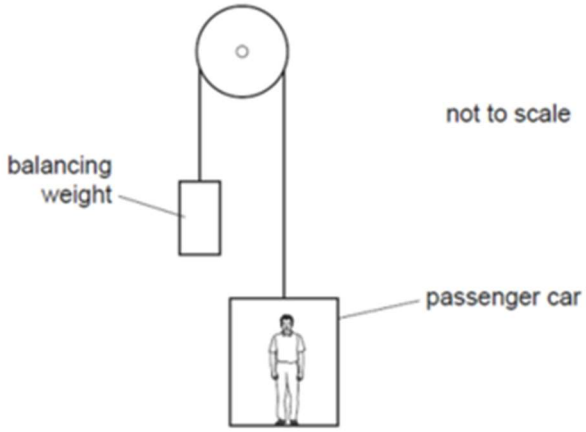
**A** ($W_1 + W_2$) is always equal to *T*.

**B** If $N = W_1$, the lift must be at rest.

**C** *N* and $W_1$ are always equal and opposite.

**D** If $T = (D + W_2)$, the lift must have a constant velocity.

9 A lift consisting of a passenger car supported by a cable runs over a light, frictionless pulley to a balancing weight. The balancing weight falls as the passenger car rises.



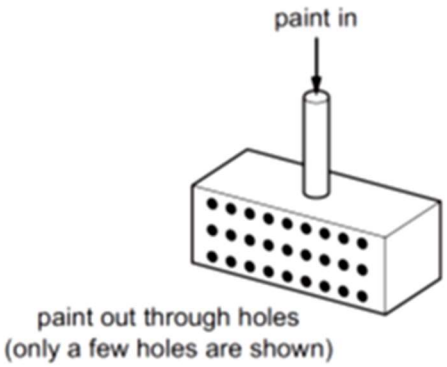

Some masses are shown in the table.

| | mass/ kg |
|---|---|
| Passenger car | 520 |
| Balancing weight | 800 |
| passenger | 80 |

What is the magnitude of the acceleration of the car when carrying just one passenger and when the pulley is free to rotate?

**A** 0.14 m $s^{-2}$ **B** 1.4 m $s^{-2}$ **C** 8.0 m $s^{-2}$ **D** 9.8 m $s^{-2}$

10 A device for spraying paint consists of a box with its axes horizontal and vertical. One of its vertical faces contains small holes. Paint is fed into the box under pressure via a vertical tube and exits through the holes as fine streams moving horizontally.

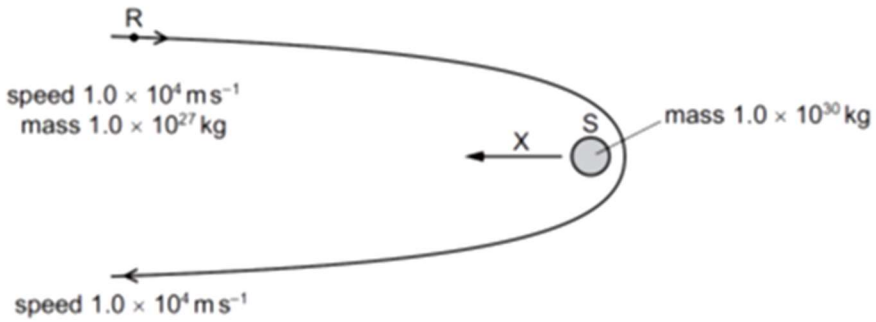



The paint is ejected at a speed of 3.0 m $s^{-1}$ through 27 holes, each of area 0.4 $mm^2$. The density of the paint is 900 kg $m^{-3}$.

What is the horizontal force required to hold the device stationary as it ejects the paint?

**A** 21 mN **B** 29 mN **C** 44 mN **D** 87 mN

11 A rock R of mass $1.0 \times 10^{27}$ kg is at a large distance from a star S and is travelling at a speed of $1.0 \times 10^4$ m $s^{-1}$. The star has mass $1.0 \times 10^{30}$ kg. The rock travels around the star on the path shown so that it reverses its direction of motion and, when finally at a large distance from the star again, has the same speed as initially.




Which statement is correct?

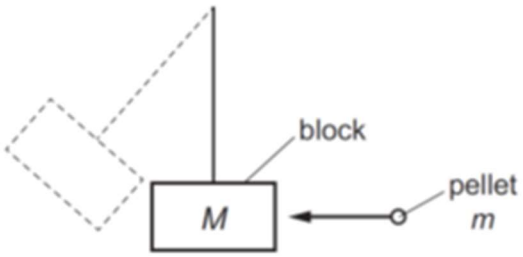
**A** The change in the momentum of S is in the direction of arrow X.

**B** The change in the velocity of S is approximately 20 m $s^{-1}$.

**C** The magnitude of the change of momentum of R is $10^3$ times greater than the magnitude of the change of momentum of S.

**D** The momentum of R does not change.

12 The diagram shows a 'ballistic pendulum'.




A pellet of mass $m$ travelling at a speed $u$ hits a stationary block of mass $M$. The pellet becomes embedded in the block and causes the block to move immediately after the impact.

What is the maximum height gained by the block after impact?

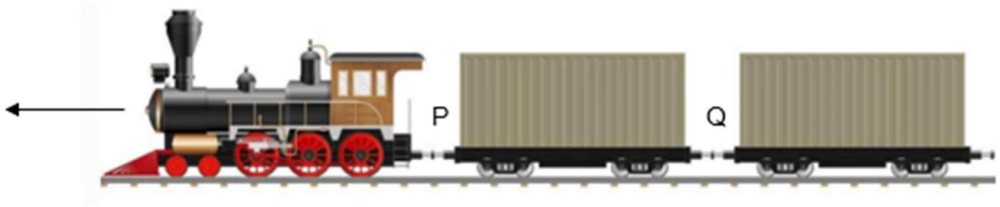
**A** $\frac{1}{2g}mu^2$

**B** $\frac{1}{2g}(M+m)u^2$

**C** $\frac{1}{2g}\left(\frac{m}{M+m}\right)u^2$

**D** $\frac{1}{2g}\left(\frac{mu}{M+m}\right)^2$

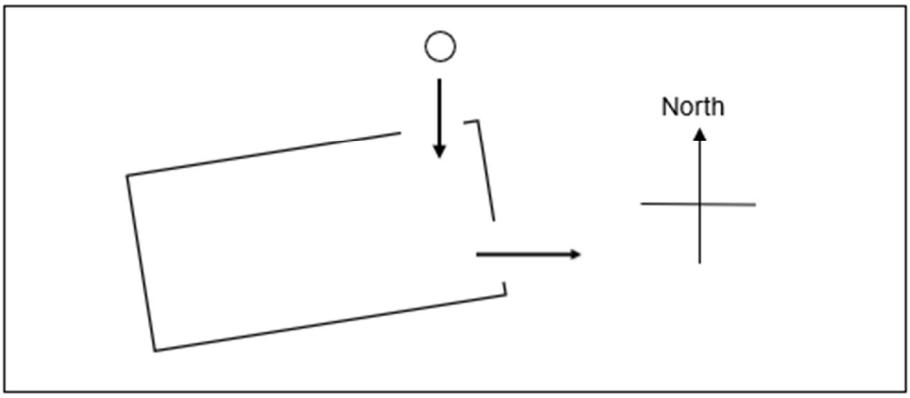
13 The diagram shows an engine and carriages accelerating as they leave the station.




The engine has a mass of $2M$, and each carriage has a mass $M$. Assume that resistive force is negligible. If the tension in the coupling P is $F$, then the tension in the coupling Q is

**A** $F$ **B** $F/2$ **C** $F/3$ **D** $F/4$

14 The figure below shows the top view of an empty box resting on a smooth horizontal surface. A ball moving in a southward direction, enters the box and makes multiple elastic collisions with the box before exiting in an eastward direction.




top view

Which of the following statements best describes the motion of the box after the ball exits from it?

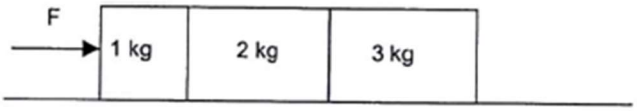
**A** The box moves in a westward direction.

**B** The box moves in a southward direction.

**C** The velocity of the box has both southward and eastward components.

**D** The velocity of the box has both southward and westward components.

15 Three boxes are pushed along a smooth surface by a force F as shown below. What is the force exerted by the 2 kg mass on the 1 kg mass?




**A** $\frac{1}{3}F$ **B** $\frac{1}{2}F$ **C** $\frac{3}{4}F$ **D** $\frac{5}{6}F$

16 A steel ball of mass *m* is dropped vertically onto a steel table. The ball is in contact with the table for a very short duration and it rebounds with very little loss in kinetic energy.

Which one of the following statements concerning the average force *F* exerted on the ball by the table during the collision is correct?

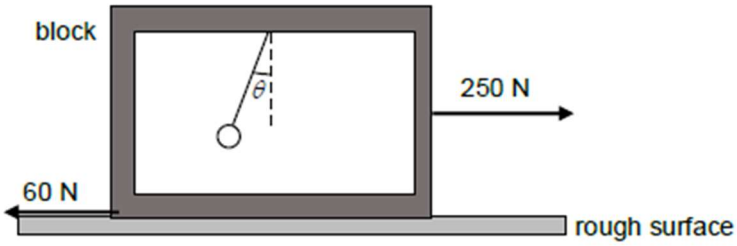
**A** *F* is smaller than *mg*.

**B** *F* is greater than *mg*.

**C** *F* is greater than the force that the ball exerted on the table during the collision.

**D** *F* is smaller than the force that the ball exerted on the table during the collision.

17 A block with a pendulum bob hanging lies on a rough surface. The total mass of the block and the pendulum bob is 100 kg. A force of 250 N is applied to the block and the pendulum bob makes an angle θ to the vertical axis.




What is the magnitude of θ if a constant frictional force of 60 N is acting on the block?

**A** 11° **B** 14° **C** 76° **D** 79°

18 Which one of the following pair of forces is **not** an example of Newton's third law action and reaction pair?

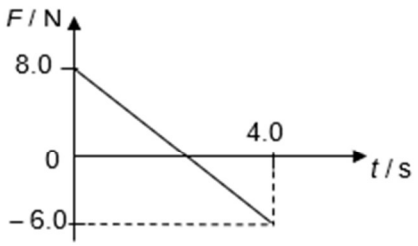
**A** The thrust on the rocket and expulsion of hot air due to the burning of fuel.

**B** The gravitational force by Earth on man standing on Earth and the gravitational force on Earth by man.

**C** The upthrust on a piece of wood in water and the weight of the wood.

**D** The magnetic force on a magnet by a long wire carrying current and the magnetic force on the wire by the magnet.

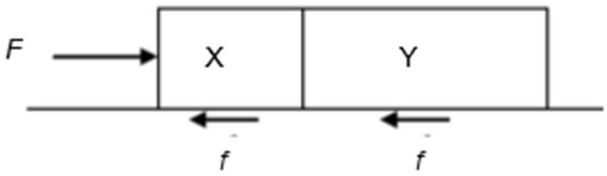
19 A body is acted upon by a resultant force $F$ for a duration of 4.0 s. The graph below shows the variation with time $t$ of $F$.




Assuming that the body is moving in a straight line, what is the change in momentum of the body?

**A** 2.0 N s **B** 2.8 N s **C** 4.0 N s **D** 14 N s

20 Two blocks, X and Y, of masses $m$ and $2m$ respectively, are accelerated along a rough surface by a force $F$ applied to block X. The magnitude of the frictional force experienced by each of the block is $f$.

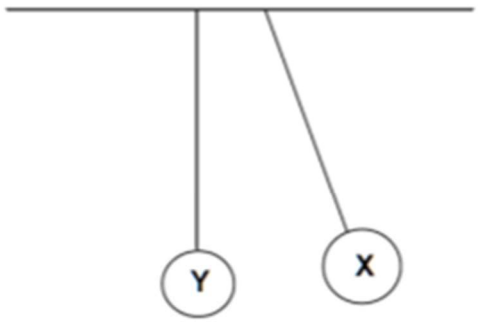



What is the magnitude of the force exerted by block Y on block X?

**A** $\frac{1}{3}(F-2f)$ **B** $\frac{1}{3}(F-f)$

**C** $\frac{1}{3}(2F-f)$ **D** $\frac{2}{3}(F-f)$

21 Two steel balls X and Y are suspended on strings. Ball X is pulled to one side as shown.




After ball X is released, the balls collide.

Which quantities must be conserved in the collision?

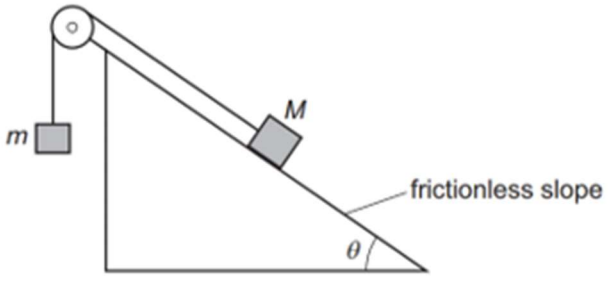
**A** kinetic energy, total energy and momentum

**B** kinetic energy and momentum only

**C** kinetic energy and total energy only

**D** total energy and momentum only

22 Two masses, $M$ and $m$, are connected by an inextensible string which passes over a frictionless pulley. Mass $M$ rests on a frictionless slope, as shown.




The slope is at an angle $\theta$ to the horizontal.

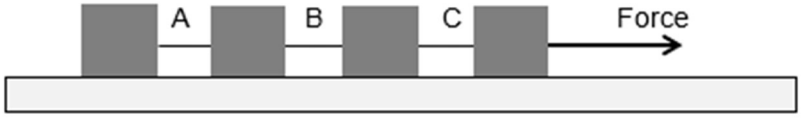
The two masses are initially held stationary and then released. Mass $M$ accelerates down the slope.

Which expression must be correct?

**A** $\sin\theta < \frac{m}{M}$ **B** $\cos\theta < \frac{m}{M}$ **C** $\sin\theta > \frac{m}{M}$ **D** $\cos\theta > \frac{m}{M}$

23 The diagram below shows 4 identical wooden blocks connected by inelastic strings, A, B and C.

A constant force accelerates the blocks to the right on a horizontal frictionless table.

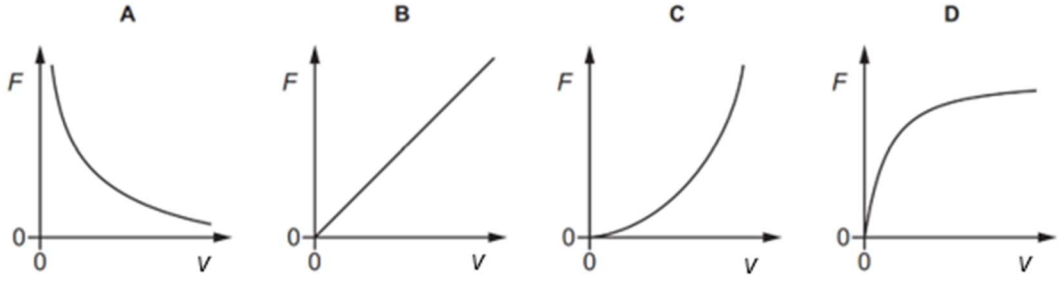



Which string has the greatest tension?

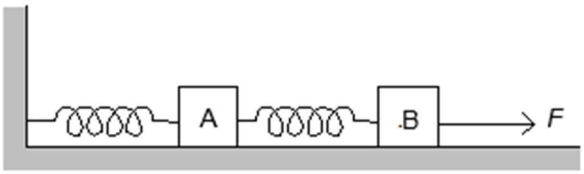
**A** String A
**B** String B
**C** String C
**D** All have the same tension

24 A body of mass m undergoes uniform circular motion with speed *v*.

Which graph represents the relationship between the force *F* acting on the body and *v*?



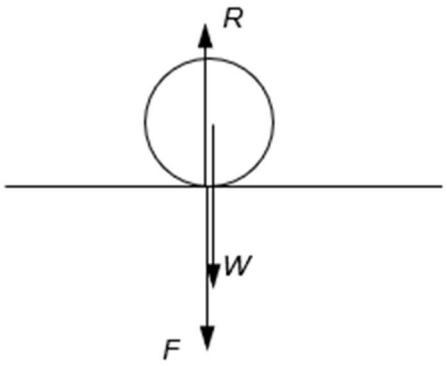
25 Two boxes A and B of equal mass $m$ are connected by two identical light springs and are placed on a horizontal smooth surface. A horizontal force $F$ is applied to box B so that the system is in equilibrium.




If the applied force $F$ is suddenly removed, what are the magnitudes of the acceleration of each box at the instant when force $F$ is removed?

| | acceleration of box A | acceleration of box B |
|---|---|---|
| **A** | zero | $\frac{F}{m}$ |
| **B** | zero | $\frac{F}{2m}$ |
| **C** | $\frac{F}{2m}$ | $\frac{F}{m}$ |
| **D** | $\frac{F}{m}$ | $\frac{F}{2m}$ |

26 A ball is at rest on the ground. The diagram shows three forces of equal magnitude.

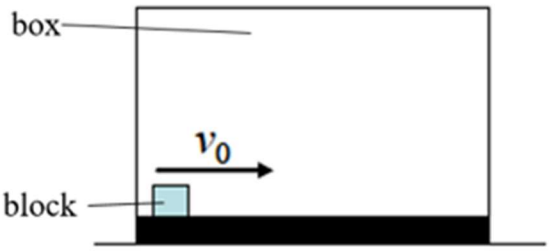



The forces represented in the diagram are
*W* = weight of ball
*F* = force by ball on ground
*R* = normal contact force by ground on ball

Which row in the table shows Newton's first and third laws being applied correctly?

| | Newton's first law | Newton's third law |
|---|---|---|
| **A** | $F = W$ | $R = F$ |
| **B** | $R = F$ | $W = R$ |
| **C** | $W = R$ | $F = W$ |
| **D** | $W = R$ | $R = F$ |

27




A big box of mass $M$ is resting on a horizontal smooth floor. On the bottom of the box, there is a small block of mass $m$. The block is given an initial speed $v_0$ relative to the floor, and starts to bounce back and forth between the two walls of the box. What is the final speed of the box when the block has finally come to rest in the box?

**A** 0 **B** $v_0$ **C** $\frac{M}{M+m}v_0$ **D** $\frac{m}{M+m}v_0$

28

A cup of water is placed in a car under constant acceleration to the left, as shown. The following figures show four shapes of the water . Which one is correct?