# Access Tuition

# A-Level Physics

## Forces, Energy and Momentum (Multiple Choice)

### Question Paper

**Time available: 20 minutes**
**Marks available: 20 marks**

**1.** Which is a scalar quantity?

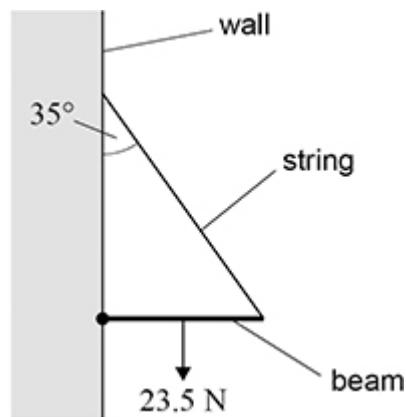**A**    force      ⬭

**B**    kinetic energy      ⬭

**C**    momentum      ⬭

**D**    velocity      ⬭

**(Total 1 mark)**

**2.** A uniform beam of weight $23.5 \text{ N}$ is attached by a hinge to a vertical wall and supported by a string.

The string makes an angle of $35°$ to the wall.



What is the tension in the string?

**A**    $14 \text{ N}$      ⬭

**B**    $21 \text{ N}$      ⬭

**C**    $29 \text{ N}$      ⬭

**D**    $41 \text{ N}$      ⬭

**(Total 1 mark)**

**3.** A firework rocket moves vertically upwards.
The rocket's fuel burns at a steady rate to produce a constant thrust.
The mass of the rocket decreases with time.

Ignore the effects of air resistance on the rocket.

Which row shows the acceleration of the rocket before, and the acceleration immediately after, the fuel has been used up?

| | Acceleration before | Acceleration immediately after | |
|---|---|---|---|
| **A** | increasing upwards | constant downwards | ⬭ |
| **B** | increasing upwards | decreasing upwards | ⬭ |
| **C** | constant upwards | constant downwards | ⬭ |
| **D** | decreasing upwards | constant downwards | ⬭ |

**(Total 1 mark)**

**4.** A climber wears a harness attached to a rope. The rope passes through a brake. There is friction between the rope and the brake.
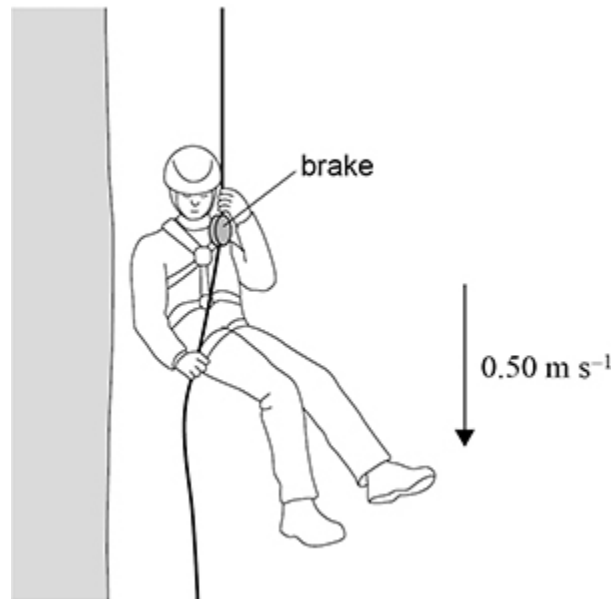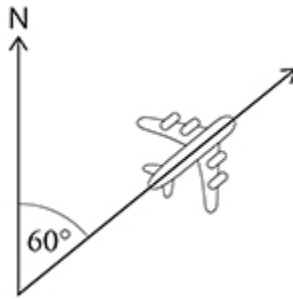


The climber uses the brake to descend at a steady speed of $0.50$ m s$^{-1}$.
The combined mass of the climber, the harness and the brake is $60$ kg.

What is the rate of energy transfer to the brake and rope?

A    15 W      ○

B    29 W      ○

C    150 W      ○

D    290 W      ○

**(Total 1 mark)**

**5.** An aeroplane flies horizontally at $150 \text{ m s}^{-1}$ along a bearing 60° east of north.



How far north from its starting position is the aeroplane after one hour?

**A**   270 km

**B**   470 km

**C**   510 km

**D**   540 km

**(Total 1 mark)**

**6.** A parachutist descends to the ground at a constant speed with the parachute open.



Which force, together with the parachutist's weight, makes a pair according to Newton's third law of motion?

**A**   the drag force on the parachutist from the air

**B**   the tension in the strings of the parachute

**C**   the gravitational force of the parachutist on the Earth

**D**   the lift force on the parachute from the air

**(Total 1 mark)**

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**7.** An object of mass $m$ is accelerated from rest to a velocity $v$ by a constant resultant force $F$.

What is the work done on the object during this acceleration?
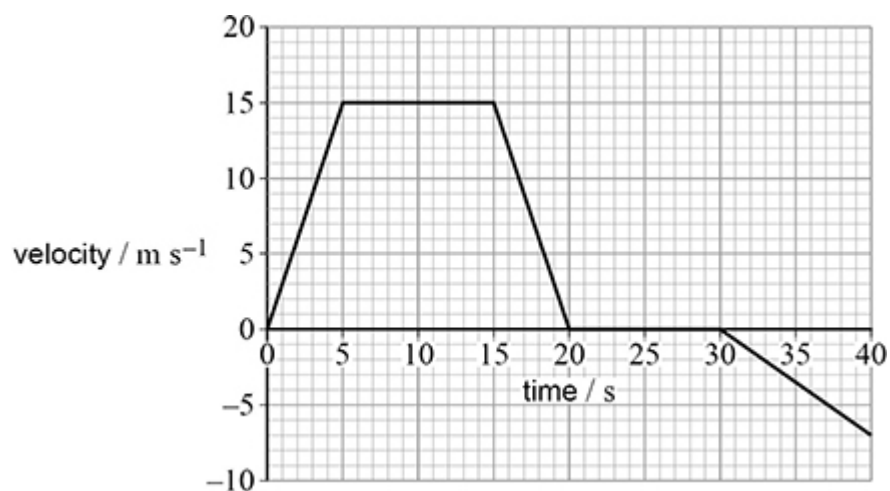
A $\dfrac{Fv}{2}$ ◯

B $Fv$ ◯

C $mv^2$ ◯

D $\dfrac{mv^2}{2}$ ◯

**(Total 1 mark)**

**8.** A vehicle travels on a straight road, starting at time $t = 0$
The graph shows how its velocity varies with time.



What is the distance of the vehicle from its start position when $t = 40$ s?

A 115 m ◯

B 190 m ◯

C 260 m ◯

D 370 m ◯

**(Total 1 mark)**

**9.** Monochromatic light with a photon energy of $4.1 \times 10^{-19}$ J is incident on a metal surface. The maximum speed of the photoelectrons released is $4.2 \times 10^5$ m s$^{-1}$.

What is the work function of the metal?

A   $2.5 \times 10^{-19}$ J     ⬭

B   $3.3 \times 10^{-19}$ J     ⬭

C   $4.1 \times 10^{-19}$ J     ⬭

D   $4.9 \times 10^{-19}$ J     ⬭

**(Total 1 mark)**

**10.** A uniform plank weighs 1200 N and rests on two pillars **P** and **Q**.
**P** and **Q** are 1.80 m apart.
**P** is 0.20 m from one end of the plank. **Q** is 1.40 m from the other end of the plank.
A man weighs 800 N and walks along the plank away from pillar **P**.
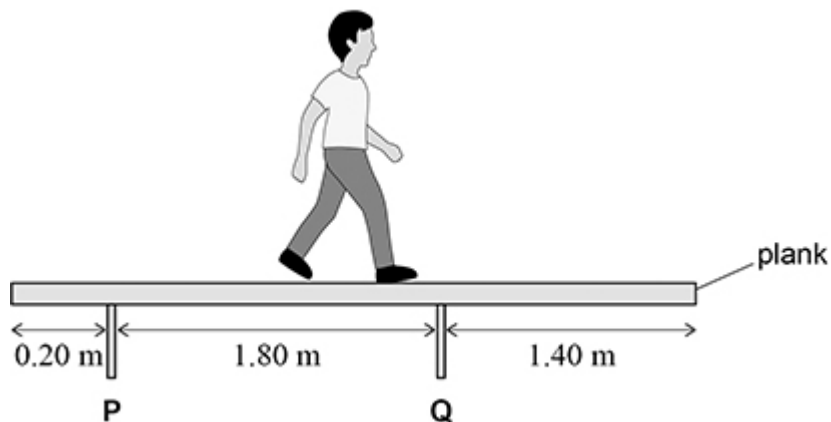


What is the horizontal distance between pillar **P** and the centre of mass of the man when the plank starts to tip?
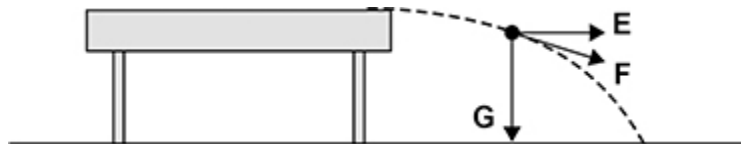
A   0.45 m     ⬭

B   2.25 m     ⬭

C   2.45 m     ⬭

D   3.15 m     ⬭

**(Total 1 mark)**

**11.** A coin is projected horizontally from the top of a desk.

The diagram shows the coin at one point in its path. The air resistance is negligible.



The arrows **E**, **F** and **G** represent different directions.

Which row gives the direction of the acceleration and the direction of the momentum of the coin at this point?

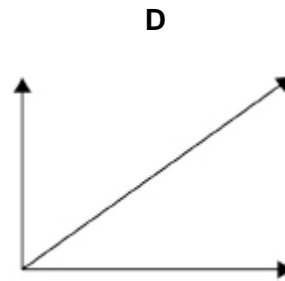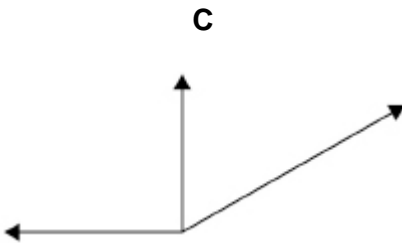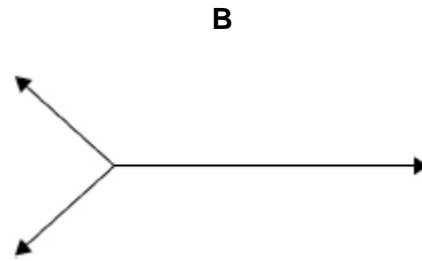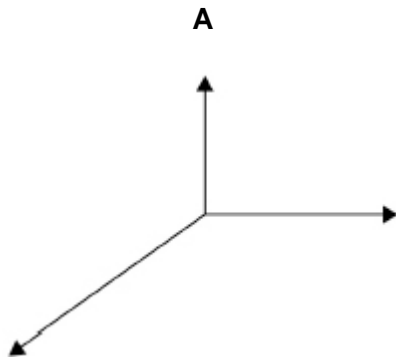|   | Acceleration | Momentum |   |
|---|:---:|:---:|---|
| **A** | F | F | ⬭ |
| **B** | F | E | ⬭ |
| **C** | G | F | ⬭ |
| **D** | G | E | ⬭ |

**(Total 1 mark)**

**12.** An object is in equilibrium when acted on by three coplanar forces.

Which free-body diagram is correct?

Each diagram is drawn to scale.

**A**

**B**

**C**

**D**

A ⬭

B ⬭

C ⬭

D ⬭

**(Total 1 mark)**

**13.** Which row is true for an elastic collision between two objects in an isolated system?

|   | Kinetic energy | Momentum |
|---|----------------|----------|
| **A** | conserved | conserved |
| **B** | not conserved | conserved |
| **C** | conserved | not conserved |
| **D** | not conserved | not conserved |

A ☐  
B ☐  
C ☐  
D ☐  

**(Total 1 mark)**

**14.** The diagram shows the forces acting on a uniform rod.
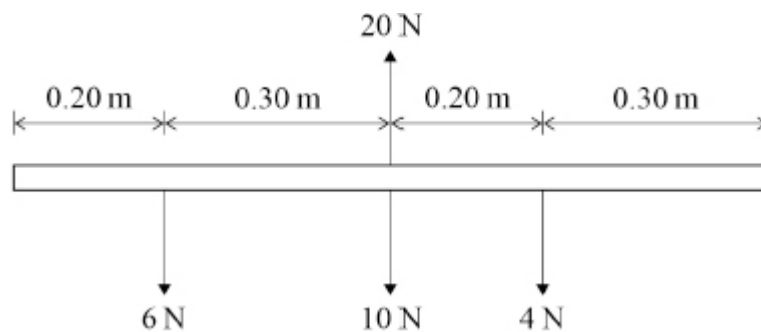


Which statement is correct?

**A**   The rod is in equilibrium.   ☐

**B**   For equilibrium, an anticlockwise moment of 1.0 N m is needed.   ☐

**C**   For equilibrium, a clockwise moment of 1.0 N m is needed.   ☐

**D**   For equilibrium, the 10 N force should be increased to 20 N.   ☐

**(Total 1 mark)**

**15.** A uniform picture is suspended from a string which passes over a smooth nail. The tension in the string is $T$ and the weight of the picture is 20 N.
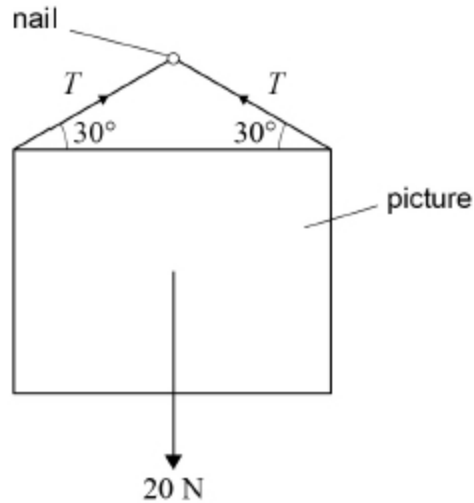


What is $T$?

**A**   10 N

**B**   12 N

**C**   20 N

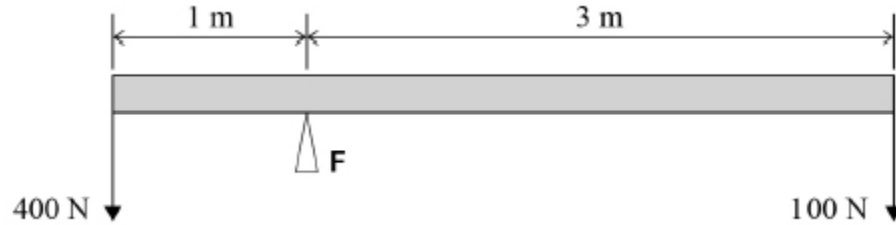**D**   40 N

**(Total 1 mark)**

**16.** Which row contains vector quantities only?

| | | |
|---|---|---|
| **A** | acceleration | mass |
| **B** | displacement | momentum |
| **C** | energy | force |
| **D** | distance | speed |

**(Total 1 mark)**

**17.** A uniform rod is balanced horizontally about a support **F**. Forces of 400 N and 100 N act at the ends of the rod, as shown.



What is the reaction force acting on the rod at support **F**?

A   100 N

B   500 N

C   550 N

D   600 N

**(Total 1 mark)**

**18.** An electric vehicle is driven by a motor which produces a constant driving force.
The vehicle travels from rest along a straight horizontal road.
Friction and air resistance are negligible.

Which statement describes the variation with time of the power developed by the motor?

A   It stays constant.

B   It increases linearly from zero.

C   It increases non-linearly from zero.

D   It increases from zero to a maximum and then decreases.

**(Total 1 mark)**

**19.** An electric motor lifts a load of weight $W$ through a vertical height $h$ in time $t$.
The potential difference across the motor is $V$ and the current through it is $I$.

What is the efficiency of the motor?

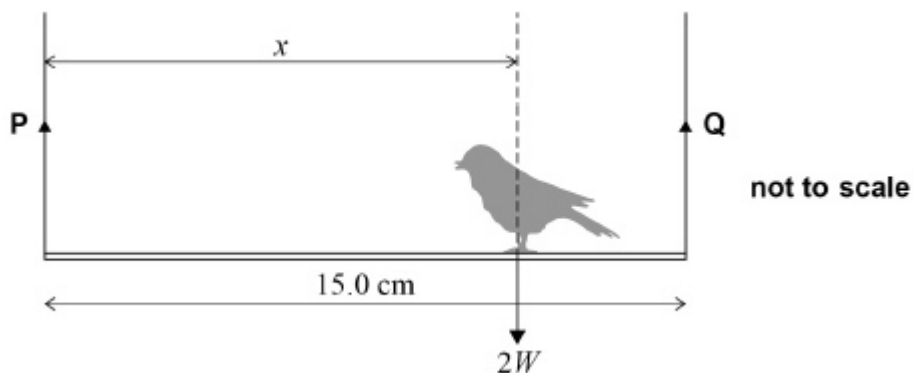A  $\dfrac{Wht}{VI}$    ▢

B  $\dfrac{VI}{Wht}$    ▢

C  $\dfrac{Wh}{VIt}$    ▢

D  $\dfrac{VIt}{Wh}$    ▢

**(Total 1 mark)**

**20.** A bird sits on a uniform rod suspended from vertical wires **P** and **Q**.



The rod has a weight $W$ and is 15.0 cm long.
The weight of the bird is $2W$ and acts at a distance $x$ from **P**.

What is the value of $x$ when the tension in **P** is half the tension in **Q**?

A  7.50 cm    ▢

B  10.0 cm    ▢

C  11.3 cm    ▢

D  15.0 cm    ▢

**(Total 1 mark)**