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Exam Preparation and Free Resources

Name of the Student:_____
Max. Marks : 20 Marks   **Time : 20 Minutes**

Q1.

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)

Q2.

P and **Q** are two balls of the same diameter. **P** has a greater mass than **Q**.

Both balls are projected at the same time from the top of a tall building that stands on horizontal ground.
Both balls are projected with the same horizontal velocity.
P reaches the ground after time t_P and at a horizontal distance d_P from the building.
Q reaches the ground after time t_Q and at a horizontal distance d_Q from the building.

The air is still and air resistance is **not** negligible.

Which row is correct?

	Time	Horizontal distance	
A	$t_P = t_Q$	$d_P = d_Q$	○
B	$t_P = t_Q$	$d_P > d_Q$	○
C	$t_P < t_Q$	$d_P = d_Q$	○

| D | $t_P < t_Q$ | $d_P > d_Q$ | ⬭ |

Q3.

Object **P** has a mass of 7500 kg and travels at 12 m s^{-1}.
Object **Q** has a mass of 2500 kg and travels at 20 m s^{-1} in the same direction as **P**.
P and **Q** collide and remain together after the collision.

What is the total kinetic energy of **P** and **Q** immediately after the collision?
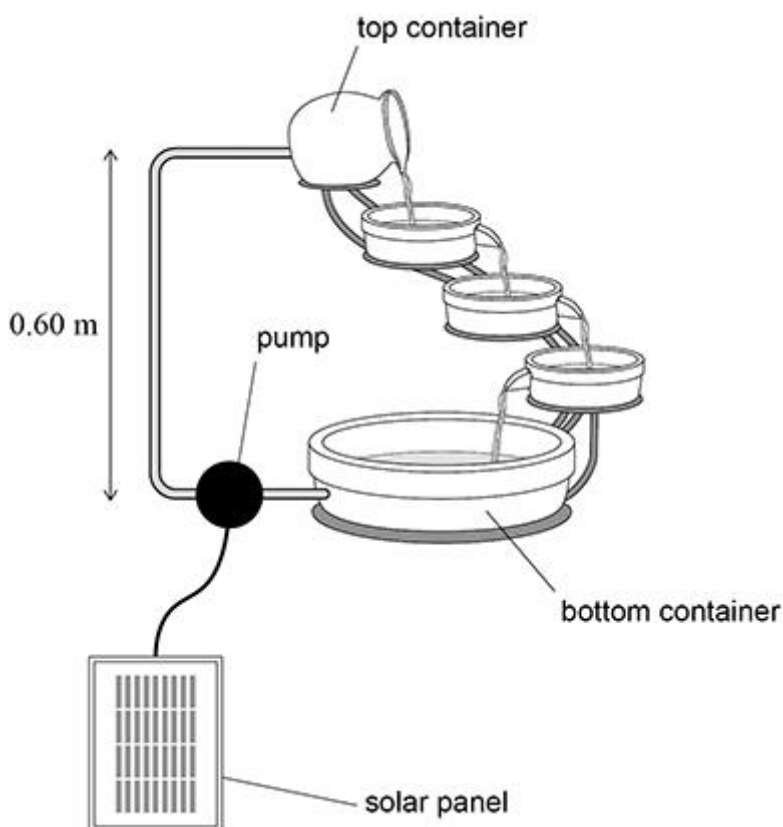
A   70 kJ   ⬭

B   140 kJ   ⬭

C   980 kJ   ⬭

D   2.0 MJ   ⬭

Q4.

A solar panel powers a pump for a water feature.

Solar energy is incident on the solar panel at a rate of 1.5 W.
Water from the bottom container is continually pumped through a vertical height of 0.60 m to the top container.

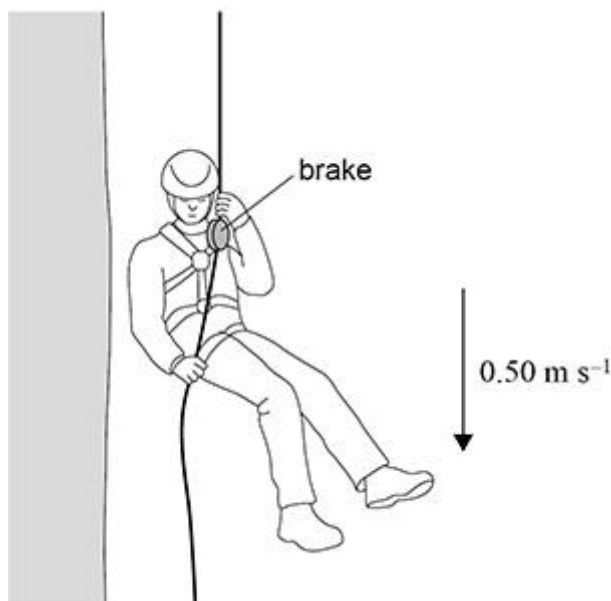The overall efficiency of the solar panel and the pump is 20%.

What mass of water can be pumped into the top container each second?

A   5 g   ⬭

B   50 g   ⬭

C   100 g   ⬭

D   250 g   ⬭

(Total 1 mark)

Q5.

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)

Q6.

A wire is made from a material of Young modulus E.
The wire obeys Hooke's law.
The wire has an unstretched length L and a cross-sectional area A.
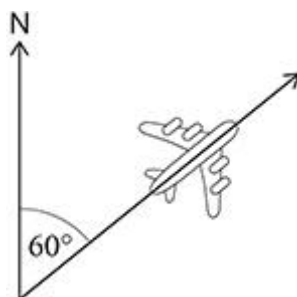When a force is applied to the wire, the extension of the wire is e.

What is the elastic strain energy stored in the wire?

A $\dfrac{AEe^2}{2L}$ ⬭

B $\dfrac{L}{2Ae}$ ⬭

C $\dfrac{Ae^2}{2EL}$ ⬭

D $\dfrac{AEL}{2e}$ ⬭

(Total 1 mark)

Q7.

An aeroplane flies horizontally at 150 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)

Q8.

A car travels at 100 km h^{-1} on a motorway.

What is an estimate of its kinetic energy?

A 10^4 J ⬭

B 10^6 J ⬭

C 10^8 J ⬭

D 10^{10} J ⬭

(Total 1 mark)

Q9.

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)

Q10.

A truck of mass 2.1×10^3 kg tows a car of mass 1.3×10^3 kg along a horizontal road.
The total resistive force on the car is 1100 N.
The acceleration of the car and truck is 2.3 m s^{-2}.

What is the tension in the tow rope?

A   3000 N

B   4100 N

C   7800 N

D   8900 N

(Total 1 mark)

Q11.

A ball is thrown vertically upwards and returns to its original position 2.4 s later. The effect of air resistance is negligible.

What is the total distance travelled by the ball?

A   5.9 m

B   7.1 m   ◯

C   14 m   ◯

D   28 m   ◯

(Total 1 mark)

Q12.

A mass M is suspended from a spring. When the mass is at rest at the equilibrium position, the elastic potential energy stored is E.
An extra mass of $2M$ is added to the spring and the spring extends while still obeying Hooke's law.

What is the total elastic energy stored when the system is at rest at the new equilibrium position?

A $2E$ ◯

B $3E$ ◯

C $4E$ ◯

D $9E$ ◯

(Total 1 mark)

Q13.

A tennis ball has a mass of 58 g.
The ball is dropped from rest from a height of 1.8 m above the ground and falls vertically.
The ball rebounds vertically to a height of 1.1 m.
The effect of air resistance is negligible.

What is the change in momentum of the ball during its collision with the ground?

A   0.040 N s   ◯

B   0.075 N s   ◯

C   0.215 N s   ◯

D   0.614 N s   ◯

(Total 1 mark)

Q14.

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)

Q15.

An electron has speed v. The electron's kinetic energy is doubled.

What is the new speed of the electron?

A $\dfrac{v}{\sqrt{2}}$ ⬭

B $\sqrt{2}v$ ⬭

C $2v$ ⬭

D $4v$ ⬭

(Total 1 mark)

Q16.

Two wires P and Q are made of the same material and have the same cross-sectional area.
P has an original length L and is subject to a tensile force F. P extends a distance x.
Q has an original length $2L$ and is subject to a tensile force $2F$.

Which statement is correct?

A The stress in P and the stress in Q are the same.   ⬭

B The extension of Q is $2x$.   ⬭

C The strain of Q is double the strain of P.   ⬭

D The value of $\dfrac{\text{stress}}{\text{strain}}$ for P is half that of Q.   ⬭

(Total 1 mark)

Q17.

What is true for an inelastic collision between two isolated objects?

A Both total momentum and total kinetic energy are conserved.   ⬭

B Neither total momentum nor total kinetic energy is conserved.   ⬭

C Only total kinetic energy is conserved.   ⬭

D Only total momentum is conserved.   ⬭

(Total 1 mark)

Q18.

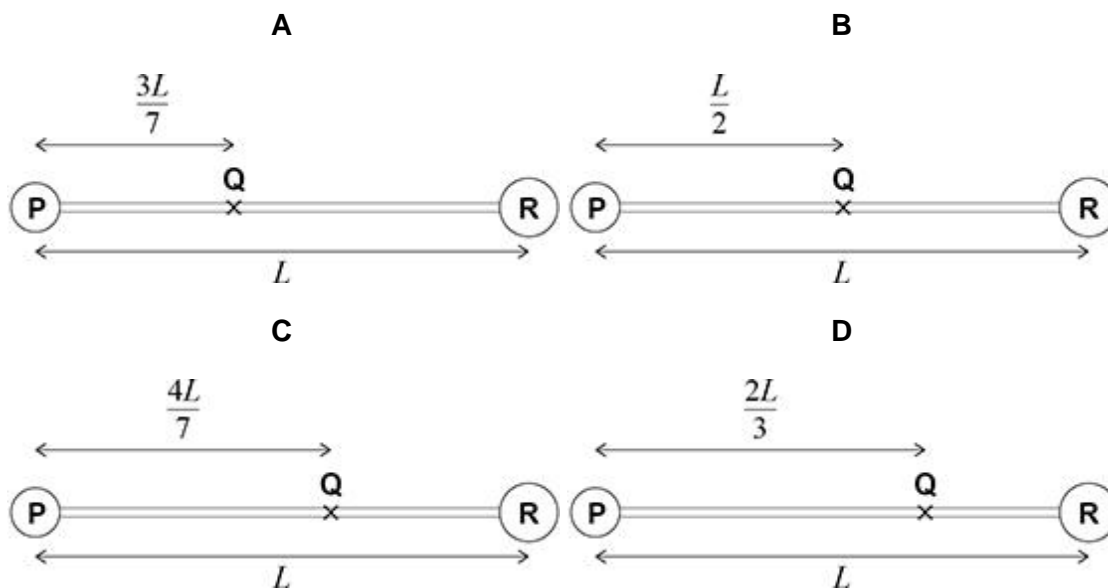P and R are uniform spheres of mass 3 kg and 4 kg respectively.
P and R are joined by a rod of negligible mass.
The distance between their centres is L.
The centre of mass of this system is at **Q**.

Which diagram shows the position of the centre of mass?

A

$$\frac{3L}{7}$$

Q

P ———— R

L

B

$$\frac{L}{2}$$

Q

P ———— R

L

C

$$\frac{4L}{7}$$

Q

P ———— R

L

D

$$\frac{2L}{3}$$

Q

P ———— R

L

A ◯

B ◯

C ◯

D ◯

(Total 1 mark)

Q19.

A suitcase weighing 200 N is placed on a weighing scale in a lift.
The scale reads 180 N when the lift is moving.
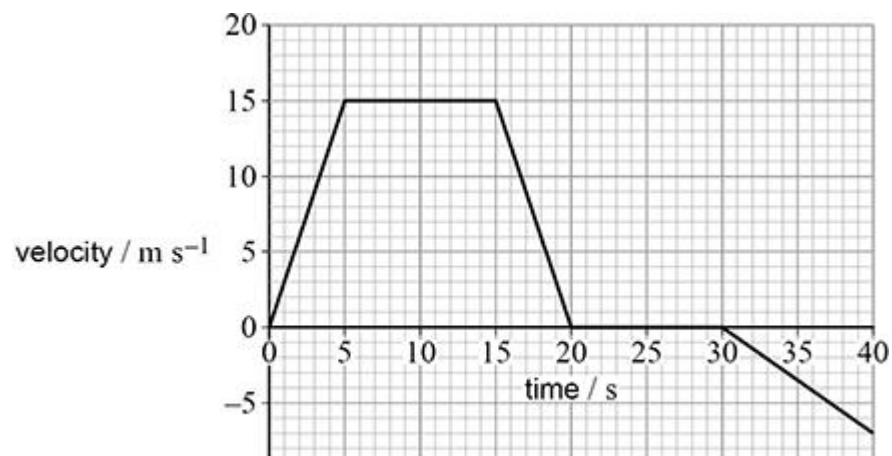
The lift is

A   moving down at a constant velocity.   ◯

B   moving down with a decreasing velocity.   ◯

C   moving up at a constant velocity.   ◯

D   moving up with a decreasing velocity.   ◯

(Total 1 mark)

Q20.

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)