

1.4 Work, Energy & Power

MCQ

Easy

1



1 mark

A crane lifts a container of weight $4.0 \times 10^5 \text{ N}$ through a height of 25m.

Which of the following gives the gravitational potential energy gained by the container in joules?

A. $4.0 \times 10^5 \times 9.81 \times 25$

B. $4.0 \times 10^5 \times 25$

C. $4.0 \times 10^5 \times 25 \div 9.81$

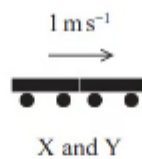
D. $4.0 \times 10^5 \div 9.81$

Medium

The diagram shows the momentum of two trolleys, X and Y, before a collision. The mass of each trolley is 0.25 kg .



The two trolleys join together after the collision and move on with a velocity of 1 m s^{-1} .



Which of the following is the kinetic energy of trolley X before the collision?

- A. 0.5 J
- B. 1 J
- C. 2 J
- D. 4 J

2



1 mark

A hydroelectric power station has an efficiency of 32%. In one hour the useful energy output of the power station is 1.2×10^{13} J.

Which of the following expressions gives the total power input to the power station in watts?

A. $1.2 \times 10^{13} \times 0.32$

B. $\frac{1.2 \times 10^{13}}{0.32 \times 3600}$

C. $\frac{1.2 \times 10^{13} \times 0.32}{3600}$

D. $\frac{1.2 \times 10^{13}}{0.32}$

3



1 mark

A tractor pulls a trailer a distance s in time t . The useful power output of the tractor is P .

Which of the following equations gives the force F of the tractor on the trailer?

A. $F = Pts$

B. $F = \frac{Pt}{s}$

C. $F = \frac{Ps}{t}$

D. $F = \frac{st}{P}$

Structured Questions

1a



2 marks

A toy car is released from rest and rolls down a slope, as shown.



mass of car = 0.160 kg

speed of car at bottom of slope = 2.6 m s^{-1} .

Calculate the increase in kinetic energy of the car as it accelerates down the slope.

Increase in kinetic energy =

1b



2 marks

As the car accelerates down the slope, the work done against frictional forces is 0.26 J .

Calculate the vertical displacement of the car.

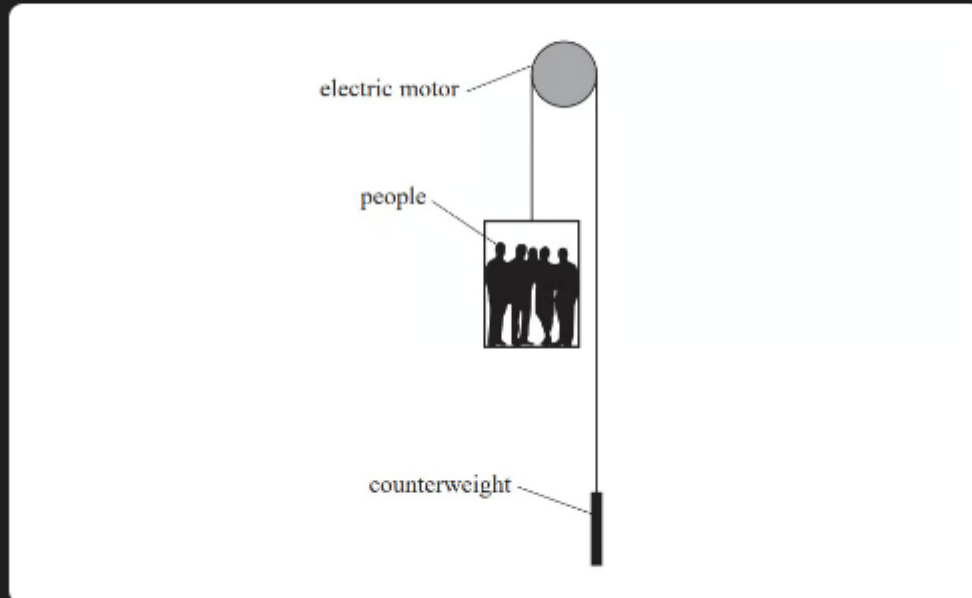
Vertical displacement of car =

2a



2 marks

The diagram shows a lift system for moving people up and down a tall building. There is a counterweight to balance the weight of the lift. An electric motor is used to raise and lower the lift.



Explain how the counterweight affects the amount of work required from the electric motor to raise the lift.

2b



4 marks

The electric motor raises the lift through a height of 40.0 m in a time of 30.0 s.

Show that the output power of the electric motor is about 12 kW.

total mass of lift and people = 2250 kg

mass of counterweight = 1300 kg

2c



2 marks

The electric motor dissipates energy to the surroundings at a rate of 3600 W.

Determine the efficiency of the electric motor.

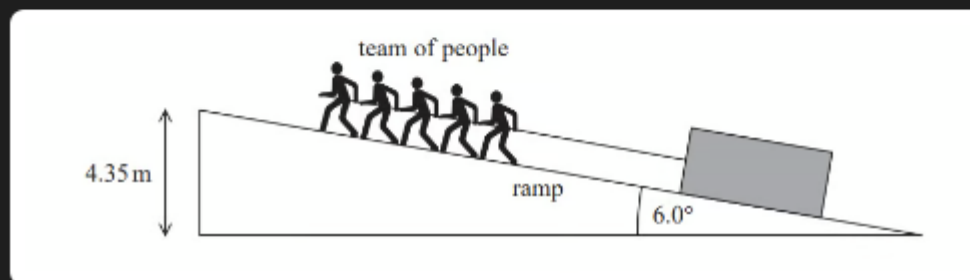
Efficiency =

3a



2 marks

The diagram shows a system used to move a stone block up a ramp. A team of people uses a rope to pull the block at a constant speed.



height of ramp = 4.35 m

angle of ramp to horizontal = 6.0°

mass of block = 2.10×10^3 kg

speed of block up ramp = 0.450 m s^{-1}

total power of team = 6.25 kW

Show that the total force that the team exerts on the block is about 14 kN.

3b



3 marks

Determine the total work done by the team.

Total work done =

3c



2 marks

Show that the useful work done on the block is about 90 kJ.

3d



2 marks

Determine the efficiency of the system.

Efficiency =