Work, Energy & Power

Question paper 2

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Work, Energy & Power
Sub Topic	
Paper Type	Theory
Booklet	Question paper 2

Time Allowed: **63 minutes**

Score: **/52**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a)** Explain what is meant by *work done*.

.....

.....[1]

(b) A boy on a board B slides down a slope, as shown in Fig. 3.1.

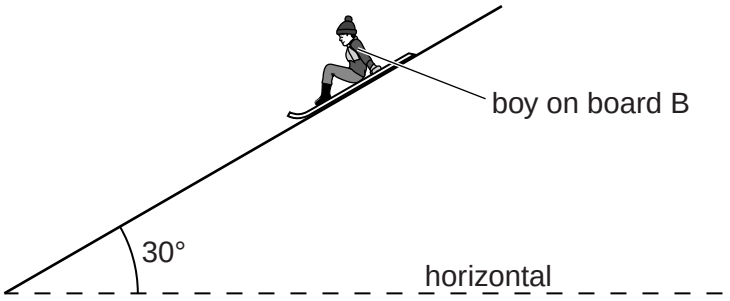

Fig. 3.1

The angle of the slope to the horizontal is 30°. The total resistive force *F* acting on B is constant.

(i) State a word equation that links the work done by the force *F* on B to the changes in potential and kinetic energy.

.....

.....[1]

(ii) The boy on the board B moves with velocity *v* down the slope. The variation with time *t* of *v* is shown in Fig. 3.2.

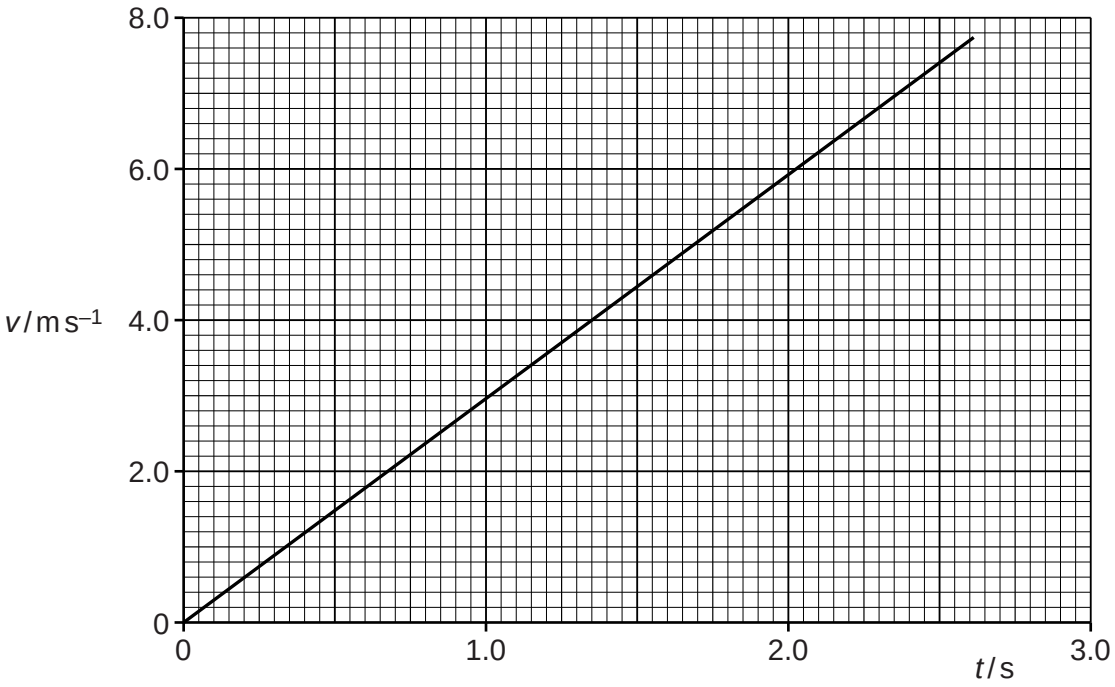

Fig. 3.2

The total mass of B is 75 kg.
For B, from $t = 0$ to $t = 2.5$ s,

1. show that the distance moved down the slope is 9.3 m,

[2]

2. calculate the gain in kinetic energy,

gain in kinetic energy = ... J [3]

3. calculate the loss in potential energy,

loss in potential energy = ... J [3]

4. calculate the resistive force *F*.

F = ... N [3]

2 **(a)** State what is meant by *work done*.

.....

..... [1]

(b) A trolley of mass 400 g is moving at a constant velocity of 2.5 m s^{-1} to the right as shown in Fig. 3.1.

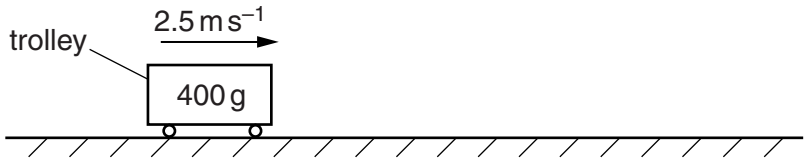

Fig. 3.1

Show that the kinetic energy of the trolley is 1.3 J.

[2]

(c) The trolley in **(b)** moves to point P as shown in Fig. 3.2.

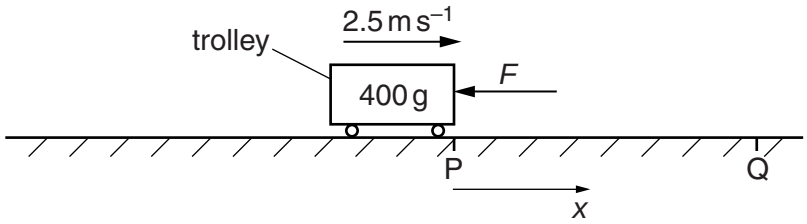

Fig. 3.2

At point P the speed of the trolley is 2.5 m s^{-1}.
A variable force *F* acts to the left on the trolley as it moves between points P and Q.
The variation of *F* with displacement *x* from P is shown in Fig. 3.3.

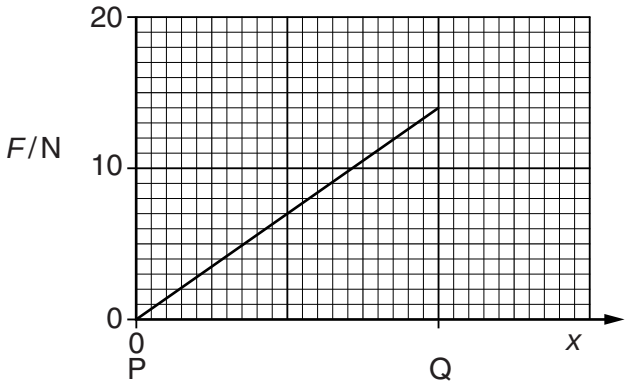

Fig. 3.3

The trolley comes to rest at point Q.

(i) Calculate the distance PQ.

distance PQ = ... m [3]

(ii) On Fig. 3.4, sketch the variation with *x* of velocity *v* for the trolley moving between P and Q.

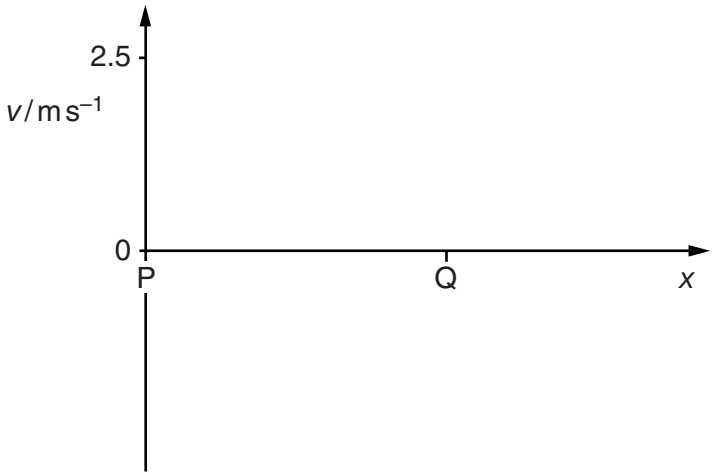

Fig. 3.4

[2]

3 **(a)** Distinguish between gravitational potential energy and elastic potential energy.

.....

.....

..... [2]

(b) A ball of mass 65 g is thrown vertically upwards from ground level with a speed of 16 m s^{-1}. Air resistance is negligible.

(i) Calculate, for the ball,

1. the initial kinetic energy,

kinetic energy = ... J [2]

2. the maximum height reached.

maximum height = ... m [2]

(ii) The ball takes time t to reach maximum height. For time $\frac{t}{2}$ after the ball has been thrown, calculate the ratio

$$\frac{\text{potential energy of ball}}{\text{kinetic energy of ball}}.$$

ratio = ... [3]

(iii) State and explain the effect of air resistance on the time taken for the ball to reach maximum height.

.....

.....

..... [1]

4 **(a)** An object falls vertically from rest through air. State and explain the energy conversions that occur as the object falls.

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..... [3]

(b) A ball of mass 150 g is thrown vertically upwards with an initial speed of 25 m s^{-1}.

(i) Calculate the initial kinetic energy of the ball.

kinetic energy = ... J [3]

(ii) The ball reaches a height of 21 m above the point of release.

For the ball rising to this height, calculate

1. the loss of energy of the ball to air resistance,

energy loss = ... J [3]

2. the average force due to the air resistance.

force = ... N [2]

5 Two planks of wood AB and BC are inclined at an angle of 15° to the horizontal. The two wooden planks are joined at point B, as shown in Fig. 2.1.

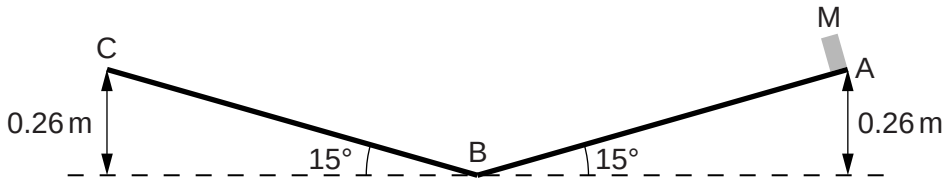

Fig. 2.1

A small block of metal M is released from rest at point A. It slides down the slope to B and up the opposite side to C. Points A and C are 0.26 m above B. Assume frictional forces are negligible.

(a) **(i)** Describe and explain the acceleration of M as it travels from A to B and from B to C.

.....

.....

.....

..... [3]

(ii) Calculate the time taken for M to travel from A to B.

time = ... s [3]

(iii) Calculate the speed of M at B.

speed = ... $m\,s^{-1}$ [2]

(b) The plank BC is adjusted so that the angle it makes with the horizontal is 30°. M is released from rest at point A and slides down the slope to B. It then slides a distance along the plank from B towards C.

Use the law of conservation of energy to calculate this distance. Explain your working.

distance = ... m [2]