Work, Energy and Power – 2019 June

1. 0625/32/M/J/19/No.3

Fig. 3.1 shows a simple pendulum swinging backwards and forwards between P and Q. One complete oscillation of the pendulum is when the bob swings from P to Q and then back to P.

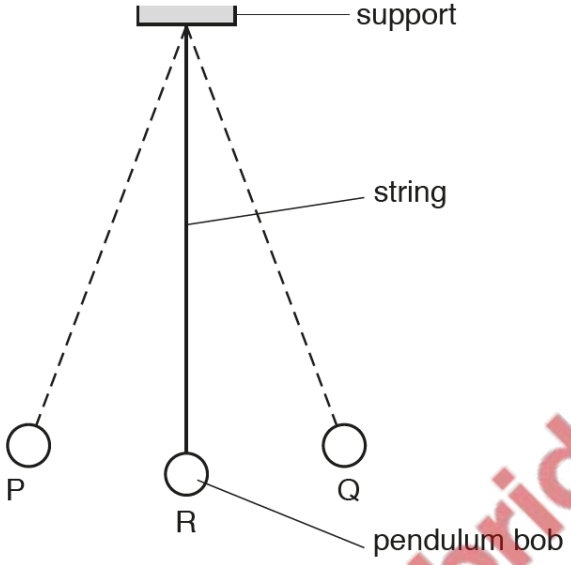

Fig. 3.1

(a) A student starts two stopwatches at the same time while the pendulum bob is swinging.

The student stops one stopwatch when the pendulum bob is at P. He stops the other stopwatch when the pendulum bob next is at Q.

Fig. 3.2 shows the readings on the stopwatches.

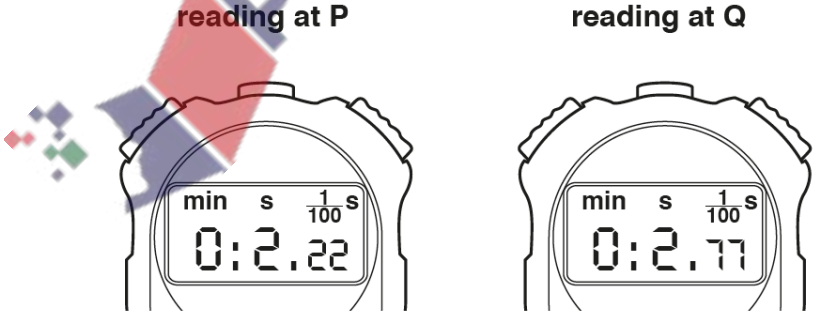

Fig. 3.2

(i) Use readings from Fig. 3.2 to determine the time for one complete oscillation of the pendulum.

time = ... s [2]

(ii) The method described in **(a)** does not give an accurate value for one complete oscillation of the pendulum.

Describe how the student could obtain an accurate value for one complete oscillation of the pendulum.

.....

.....

.....

.....

.....

..... [4]

(b) As the pendulum bob moves from R to Q it gains 0.4 J of gravitational potential energy.

Air resistance can be ignored.

State the value of kinetic energy of the pendulum bob at

1. R ..... J

2. Q ..... J [2]

[Total: 8]

2. 0625/33/M/J/19/No.5

Fig. 5.1 represents part of a roller coaster track.

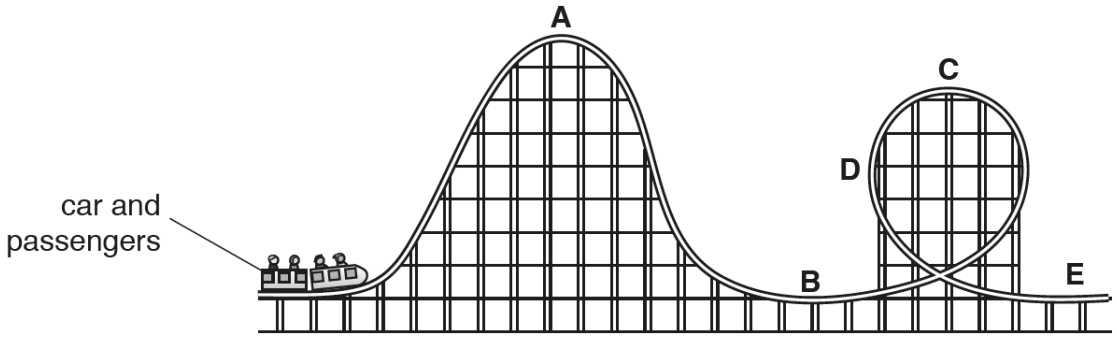

Fig. 5.1

(a) The car is lifted to point **A** and then released. It continues along the track.

Complete the sentences about the energy of the car using letters from Fig. 5.1.

The car has maximum gravitational potential energy at point .....

The car has maximum kinetic energy at point .....

[2]

(b) **(i)** State the principle of conservation of energy.

.....

..... [2]

(ii) A machine lifts the car to point **A**. The machine is **not** 100% efficient.

Suggest why the machine is not 100% efficient. Use your ideas about energy.

.....

..... [1]

[Total: 5]

3. 0625/42/M/J/19/No.3

Fig. 3.1 shows solar cells used to generate electrical energy.

Fig. 3.1

(a) State the main form of energy transferred from the Sun to the solar cells for the generation of electrical energy.

..... [1]

(b) Consider the generation of electrical energy by a large number of solar cells, as shown in Fig. 3.1.

(i) State **one** environmental advantage and **one** environmental disadvantage.

advantage .....

.....

disadvantage .....

.....

[2]

(ii) State and explain whether this source of electrical energy is renewable.

.....

..... [1]

(c) Each group of solar cells is arranged in a rectangle 1.2 m × 2.8 m. The solar cells are situated in a region where 260 W of solar energy is received per square metre of the cells. The electrical output of each group of solar cells is a current of 2.5 A with a potential difference of 86 V.

Calculate the efficiency of the solar cells.

efficiency = ... % [4]

[Total: 8]

4. 0625/43/M/J/19/No.2

Fig. 2.1 is the top view of a small ship of mass 1.2×10^6 kg. The ship is moving slowly sideways at 0.040 m/s as it comes in to dock.

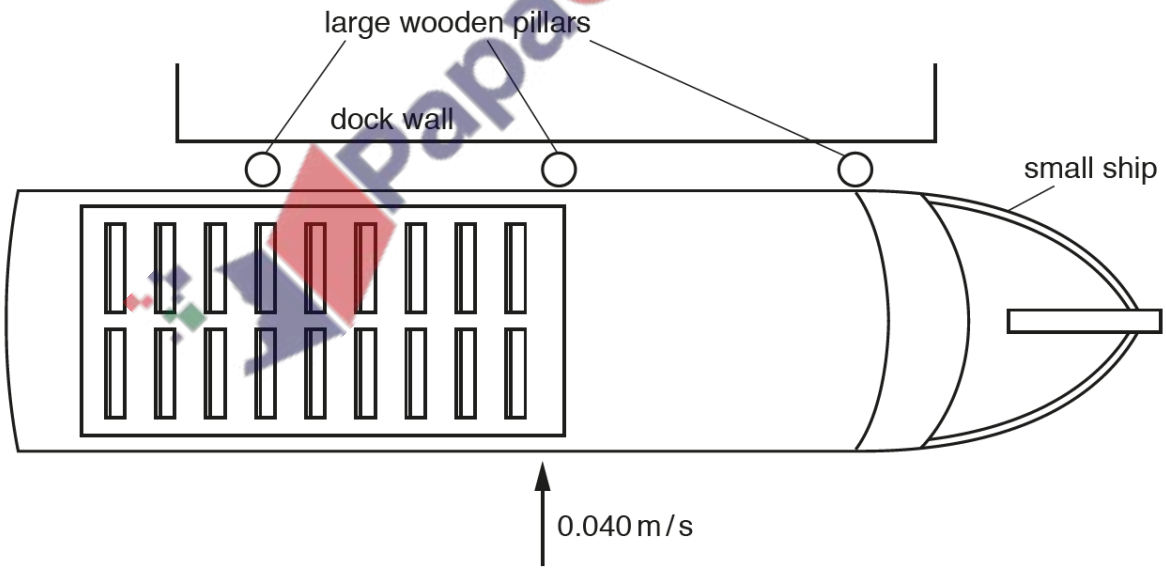

Fig. 2.1

The ship hits the wooden pillars which move towards the dock wall.

(a) Calculate the kinetic energy of the ship before it hits the pillars.

kinetic energy = ... [2]

(b) The ship is in contact with the pillars for 0.30 s as it comes to rest.

Calculate the average force exerted on the side of the ship.

force = ... [4]

(c) Assume that the kinetic energy calculated in **(a)** is used to do work moving the pillars.

Calculate the distance moved by the pillars.

distance = ... [2]

(d) Dock walls sometimes have the pillars replaced with rubber car tyres.

Explain how this reduces the possibility of damage when a boat docks.

.....

.....

..... [1]

[Total: 9]

5. 0625/32/F/M/19/No.3

A load is attached to a spring, as shown in Fig. 3.1. Two arrows indicate the vertical forces acting on the load. The spring and the load are stationary.

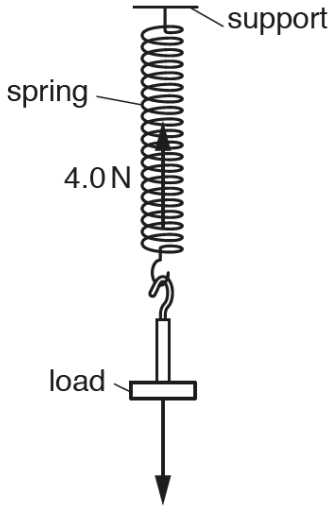

Fig. 3.1

(a) **(i)** State the name of the force acting vertically downwards.

..... [1]

(ii) The vertical force that acts upwards is 4.0 N.

State the value of the force acting vertically downwards.

force = ... N [1]

(b) The load is pulled downwards and then released. The load moves up and down.

Fig. 3.2 represents the vertical forces acting on the load at some time after it is released.

Fig. 3.2

Calculate the resultant force on the load and state its direction.

resultant force = ... N

direction = ...
[2]

(c) **(i)** State the principle of conservation of energy.

.....

..... [1]

(ii) Eventually the load stops moving up and down.

Describe and explain why the load stops moving. Use your ideas about conservation of energy.

.....

.....

.....

..... [2]

[Total: 7]