Work, Energy & Power

Question paper 1

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Work, Energy & Power
Sub Topic	
Paper Type	Theory
Booklet	Question paper 1

Time Allowed: **50 minutes**

Score: **/41**

Percentage: **/100**

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

1 **(a)** Define *power*.

.....

.....[1]

(b) Fig. 3.1 shows a car travelling at a speed of 22 m s^{-1} on a horizontal road.

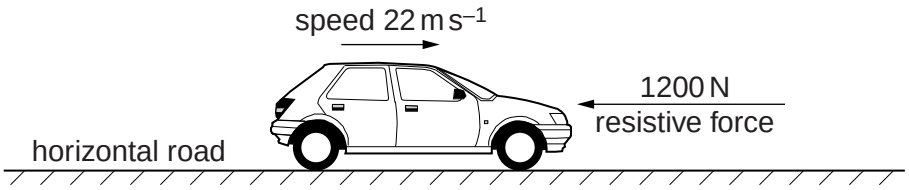

Fig. 3.1

The car has a mass of 1500 kg. A resistive force of 1200 N acts on the car.

Calculate

(i) the force *F* required from the car to produce an acceleration of 0.82 m s^{-2},

F = ... N [3]

(ii) the power required to produce this acceleration.

power = ... W [2]

(c) The resistive force on the car is proportional to v^2, where *v* is the speed of the car.
Suggest why the car has a maximum speed.

.....

.....[1]

2 A motor is used to move bricks vertically upwards, as shown in Fig.

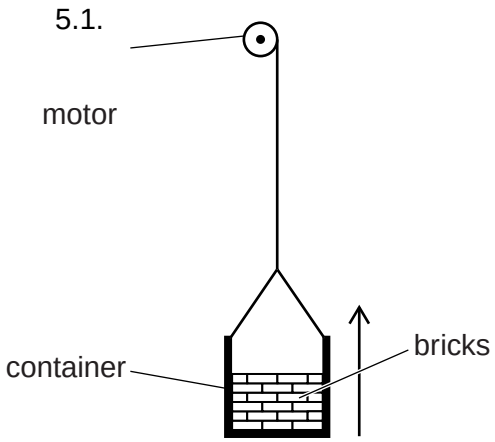

Fig. 5.1

The bricks start from rest and accelerate for 2.0 s. The bricks then travel at a constant speed of 0.64 m s^{-1} for 25 s. Finally the bricks are brought to rest in a further 3.0 s.

The total mass of the bricks is 25 kg.

(a) Determine the change in kinetic energy of the bricks

(i) in the first 2.0 s,

change in kinetic energy = ... J [2]

(ii) in the next 25 s,

change in kinetic energy = ... J [1]

(iii) in the final 3.0 s.

change in kinetic energy = ... J [1]

(b) The bricks are in a container. The weight of the container and bricks is 350 N.

Calculate, for the lifting of the bricks and container when travelling at constant speed,

(i) the gain in potential energy,

energy gain = ... J [3]

(ii) the power required.

power = ... W [2]

3 **(a)** **(i)** Define *power*.

..... [1]

(ii) Use your definition in **(i)** to show that power may also be expressed as the product of force and velocity.

[2]

(b) A lorry moves up a road that is inclined at 9.0° to the horizontal, as shown in Fig. 2.1.

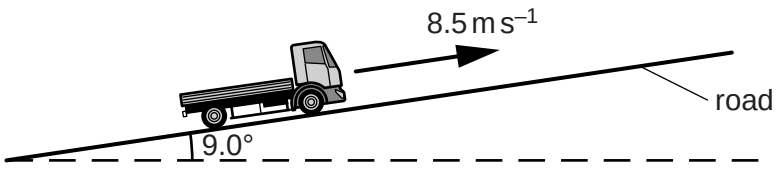

Fig. 2.1

The lorry has mass 2500 kg and is travelling at a constant speed of 8.5 m s^{-1}. The force due to air resistance is negligible.

(i) Calculate the useful power from the engine to move the lorry up the road.

power = ... kW [3]

(ii) State two reasons why the rate of change of potential energy of the lorry is equal to the power calculated in **(i)**.

1. .....

.....

2. .....

.....

[2]

4 A metal ball of mass 40 g falls vertically onto a spring, as shown in Fig. 4.1.

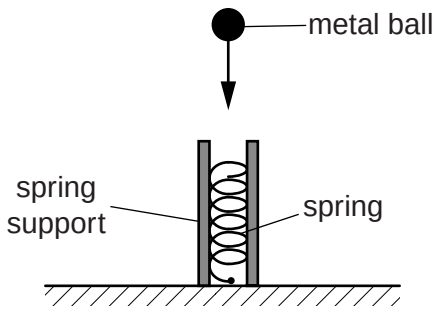

Fig. 4.1 (not to scale)

The spring is supported and stands vertically. The ball has a speed of 2.8 m s^{-1} as it makes contact with the spring. The ball is brought to rest as the spring is compressed.

(a) Show that the kinetic energy of the ball as it makes contact with the spring is 0.16 J.

[2]

(b) The variation of the force F acting on the spring with the compression x of the spring is shown in Fig. 4.2.

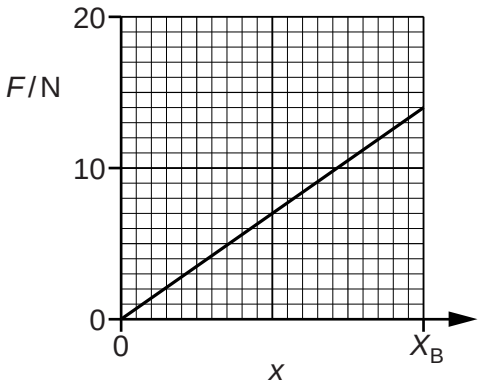

Fig. 4.2

The ball produces a maximum compression X_B when it comes to rest. The spring has a spring constant of 800 N m^{-1}.
Use Fig. 4.2 to

(i) calculate the compression X_B,

X_B = ... m [2]

(ii) show that not all the kinetic energy in **(a)** is converted into elastic potential energy in the spring.

[2]

5 **(a)** Explain what is meant by *gravitational potential* energy and *kinetic* energy.

gravitational potential energy: .....

.....

kinetic energy: .....

.....

[2]

(b) A ball of mass 400 g is thrown with an initial velocity of 30.0 m s^{-1} at an angle of 45.0° to the horizontal, as shown in Fig. 4.1.

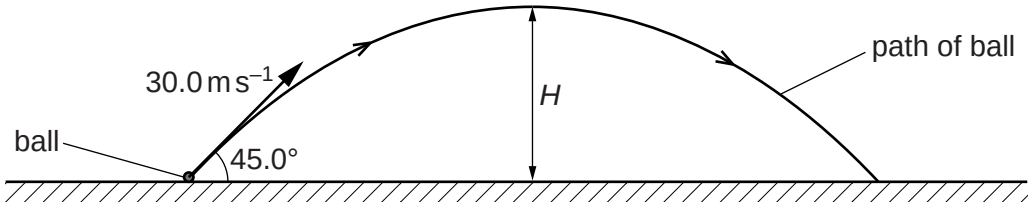

Fig. 4.1

Air resistance is negligible. The ball reaches a maximum height *H* after a time of 2.16 s.

(i) Calculate

1. the initial kinetic energy of the ball,

kinetic energy = ... J [3]

2. the maximum height *H* of the ball,

H = ... m [2]

3. the gravitational potential energy of the ball at height *H*.

potential energy = ... J [2]

(ii) **1.** Determine the kinetic energy of the ball at its maximum height.

kinetic energy = ... J [1]

2. Explain why the kinetic energy of the ball at maximum height is not zero.

.....

..... [1]