Mass and weight

Question Paper 2

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	General Physics
Sub-Topic	Mass and weight
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 2

Time Allowed: **54 minutes**

Score: **/45**

Percentage: **/100**

1 **(a)** State what is meant by the *centre of mass* of a body.

.....

.....

..... [1]

(b) Fig. 4.1 shows an athlete successfully performing a high jump.

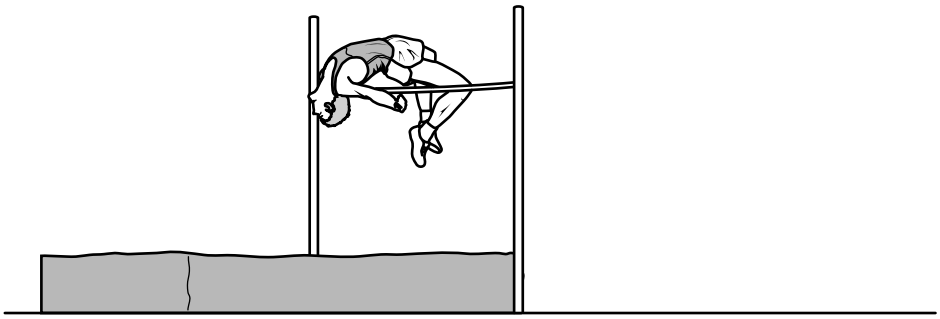

Fig. 4.1

The height of the bar above the ground is 2.0 m. The maximum increase in gravitational potential energy (g.p.e.) of the athlete during the jump is calculated using the expression g.p.e. = *mgh*.

Explain why the value of *h* used in the calculation is much less than 2.0 m.

.....

.....

..... [1]

(c) Fig. 4.2 shows, in order, five stages of an athlete successfully performing a pole-vault.

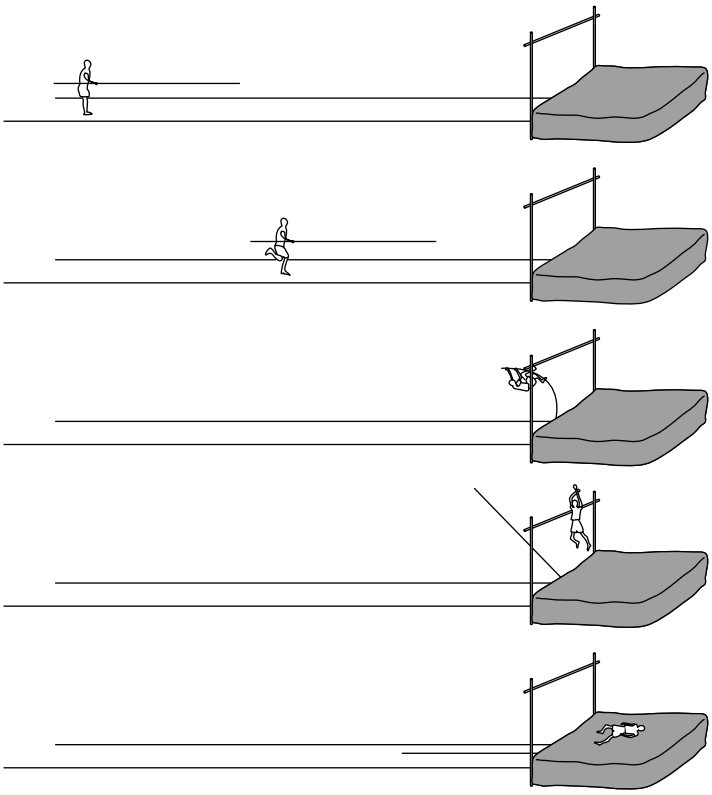

Fig. 4.2

Describe the energy changes which take place during the performance of the pole-vault, from the original stationary position of the pole-vaulter before the run-up, to the final stationary position after the vault.

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..... [6]

[Total: 8]

2 A bucket is full of oil. The total mass of the bucket of oil is 5.4 kg and the gravitational field strength is 10 N / kg.

(a) Calculate the total weight of the bucket of oil.

weight = ... [1]

(b) The bucket of oil is hung from a spring of unstretched length 20 cm. The limit of proportionality of the spring is not exceeded and its length increases to 35 cm.

(i) State what is meant by the *limit of proportionality*.

.....

..... [1]

(ii) The oil is poured into a measuring tank. The empty bucket stretches the spring to a length of 25 cm.

Calculate

1. the force that stretches the spring to a length of 25 cm,

force = ... [3]

2. the mass of the oil in the measuring tank.

mass = ... [2]

(iii) The volume of the oil in the measuring tank is $0.0045\,m^3$. Calculate the density of the oil.

density = ... [2]

(c) Explain, in terms of their molecules, why the density of the oil is greater than that of air.

.....

..... [1]

[Total: 10]

3 An astronaut has a mass of 65 kg on Earth, where the gravitational field strength is 10 N / kg.

(a) Calculate the astronaut's weight on Earth.

weight on Earth = ...[2]

(b) Complete the following sentence.

The astronaut's weight on Earth is the ..... force

between the astronaut and ..... . [1]

(c) The astronaut undertakes a Moon landing. On the Moon the gravitational field strength is 1.6 N / kg.

(i) State the astronaut's mass on the Moon.

mass = ...

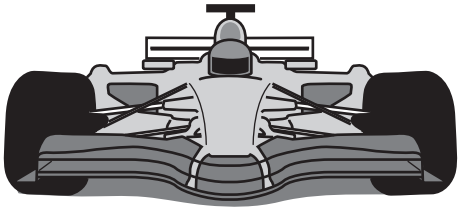
(ii) Calculate the weight of the astronaut on the Moon.

weight on Moon = ...
[2]

[Total: 5]

4 The front views of two cars are shown in Fig. 5.1, to the same scale.

family car



racing car

Fig. 5.1

(a) Suggest which car has the greater stability, and give two reasons.

car .....

reason 1 .....

.....

reason 2 .....

..... [2]

(b) The cars have the same weight.

Study Fig. 5.1 and suggest why the stationary racing car exerts less pressure on the ground.

.....

..... [1]

(c) The family car's tyres each have an area of $0.012\,m^2$ in contact with the ground.

The weight of the car and its contents is 9600 N.

Calculate the pressure exerted by the car on the ground.

pressure = ... [2]

[Total: 5]

5 **(a)** State what is meant by the terms

(i) *weight,* .....

..... [1]

(ii) *density.* .....

..... [1]

(b) A student is given a spring balance that has a scale in newtons. The student is told that the acceleration of free-fall is 10 m/s^2.

(i) Describe how the student could find the mass of an irregular solid object.

.....

.....

..... [2]

(ii) Describe how the student could go on to find the density of the object.

.....

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.....

..... [2]

(c) Fig. 1.1 shows three forces acting on an object of mass 0.5 kg. All three forces act through the centre of mass of the object.

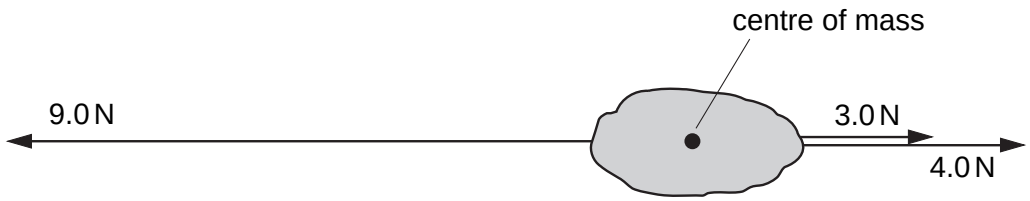

Fig. 1.1

Calculate

(i) the magnitude and direction of the resultant force on the object,

magnitude = …… direction ..... [2]

(ii) the magnitude of the acceleration of the object.

acceleration =…… [2]

[Total : 10]

6 Fig. 2.1 shows a rock that is falling from the top of a cliff into the river below.

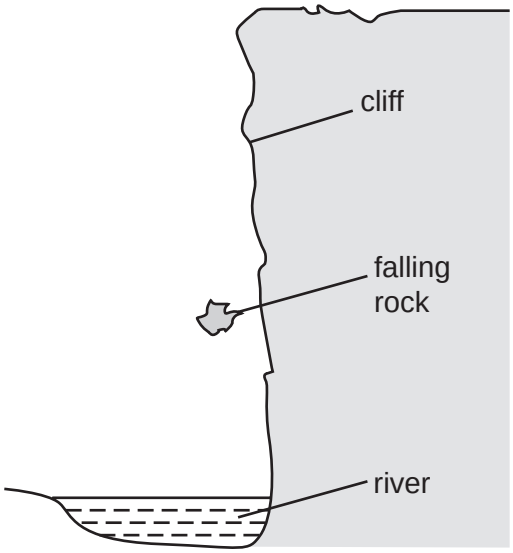

Fig. 2.1

(a) The mass of the rock is 75 kg. The acceleration of free fall is 10 m/s^2.
Calculate the weight of the rock.

weight = ……[1]

(b) The rock falls from rest through a distance of 15 m before it hits the water.
Calculate its kinetic energy just before hitting the water. Show your working.

kinetic energy = ……[3]

(c) The rock hits the water. Suggest what happens to the kinetic energy of the rock during the impact.

.....

.....

.....[3]

[Total : 7]