For Examiner's Use

3 A school bag is pulled along the floor as shown in Fig. 3.1. Fig. 3.2 shows how the acceleration of the school bag changes when the pulling force, *P*, is varied.

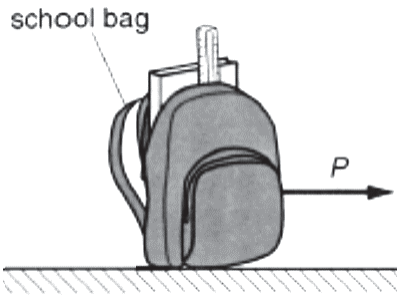


Fig. 3.1

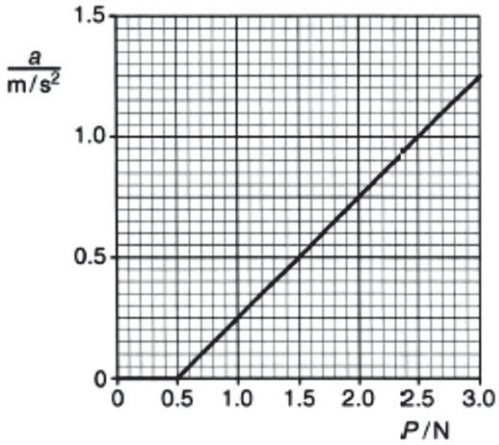


Fig. 3.2

(a) On Fig. 3.1 above, draw and label the direction of friction acting on the school bag. [1]

(b) The school bag only begins to accelerate when *P* is greater than 0.5 N.

(i) Suggest and explain why the school bag does not accelerate when *P* is equal to 0.5 N.

……

……

…….. [2]

(ii) Hence or otherwise, state the magnitude of friction acting on the school bag as it moves.

friction = …… [1]

(c) The school bag now experiences a constant pulling force *P* of 2.5 N.

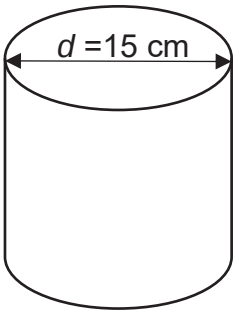
Using Fig. 3.2 or otherwise, determine the mass of the school bag. Take g = 10 N/kg.

mass = …… [3]

For Examiner's Use

4 Brass is an alloy made by melting copper and zinc metal together. A cylinder made from a specific brass alloy is shown in Fig. 4.1.

Density values
Copper: 840 kg/m^3
Zinc: 700 kg/m^3



Masses used
Copper: 840 g
Zinc: 700 g

Fig. 4.1

(a) The brass alloy is said to be under the effects of Earth's gravitational field.

State what is meant by Earth's *gravitational field*.

……...

…….. [1]

(b) By using the information given in Fig. 4.1, determine the density of this brass alloy.

density = …… [3]

(c) Determine the pressure that the cylinder exerts when its circular face is placed on the ground.

[Hint: area of circle = ¼πd^2]

pressure = …… [3]

– **End of Section B** –

For Examiner's Use

Section C: Free Response Questions [10 marks]
Write your answers to all questions in this section on the lines or in the spaces provided.

Answer **only one** of the questions in this section.

1 A typical carpark barrier is shown in Fig. 1.1.

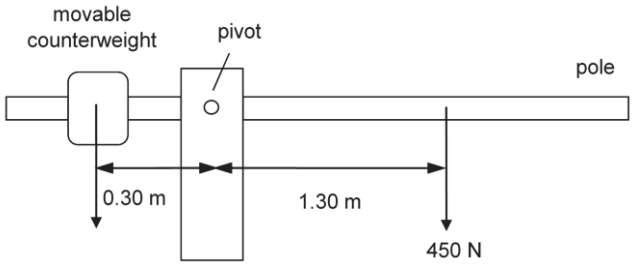


Fig. 1.1

(a) Describe and explain how the barrier can be lifted by adjusting the movable counterweight.

……...

……...

…….. [2]

(b) When the system is in equilibrium, the movable counterweight is at a distance of 0.30 m away from the pivot. The pole has a weight of 450 N and its centre of gravity is 1.30 m away from the pivot

(i) State the *Principle of Moments*.

……

……

…….. [1]

(ii) Hence or otherwise, determine the mass of the movable counterweight. Take g = 10 N/kg.

mass = …… [3]

For Examiner's Use

(c) A martial artist figurine is shown in Fig. 1.2 below.

Fig. 1.2

(i) State and explain how any two features of the figurine help to make it stable.

1. .....

.....

2. .....

.....

[2]

(ii) Explain, in terms of moments, how the toy remains stable and returns to its original position after being tilted to the right slightly when pushed.

.....

.....

.....

.....

..... [2]

For Examiner's Use

2 A playground ride is shown in Fig. 2.1. The vehicle starts from rest at point A, which is at the top of the smooth curved track and then rolls down the track to point X. Beyond point X, the track is horizontal, and it slows down as it passes through a trough containing water, before coming to rest at point B.

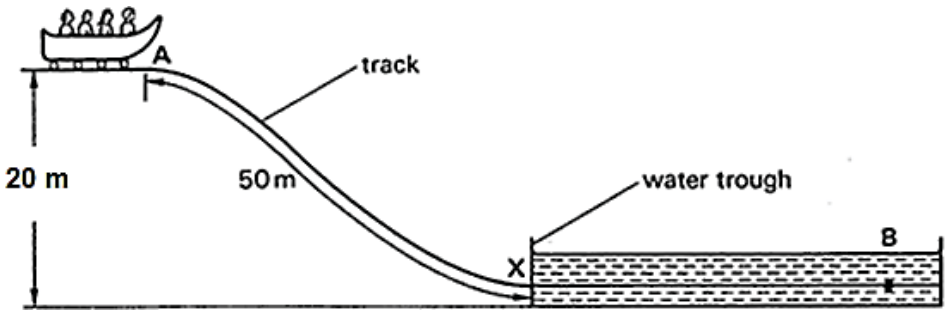


Fig. 2.1

The vehicle has a mass of 100 kg. Take g = 10 N/kg.

(a) Describe the main energy conversions taking place for the vehicle as it moves from

A to X ……...

……...

X to B ……...

……...

[2]

(b) Determine the maximum speed of the vehicle at point X.

speed = …… [3]

(c) Explain, using ideas about energy, why the vehicle will not be able to reach the speed calculated in (b) in real life.

……...

……...

…… [2]

For Examiner's Use

(d) The vehicle takes about 4.0 s to come to a complete stop.

The vehicle enters the trough with the maximum speed at X as calculated in (b).

Assuming that all resistive forces acting on the vehicle remain constant throughout its motion in the trough, determine the

(i) average deceleration of the vehicle;

deceleration = …… [2]

(ii) minimum length of the water trough (from X to B) for the vehicle to stop completely.

length = …… [1]

– **End of Section C** –

– **End of Paper** –