Forces

Question Paper 6

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	General Physics
Sub-Topic	Forces
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 6

Time Allowed: **50 minutes**

Score: **/41**

Percentage: **/100**

1 Fig. 2.1 shows a mobile bird sculpture that has been created by an artist.

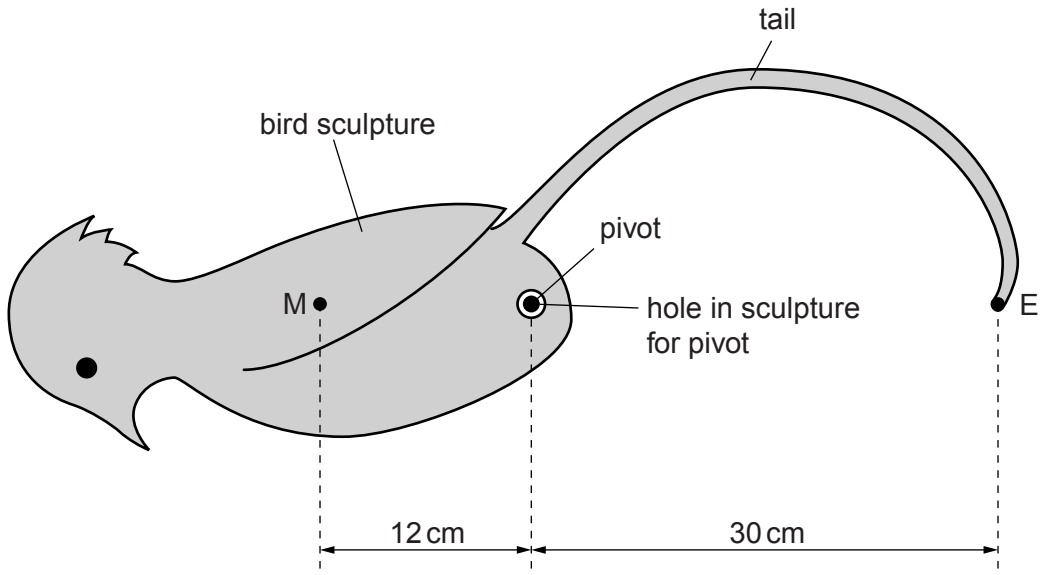

Fig. 2.1

M is the centre of mass of the bird sculpture, including its tail (but not including the counter-weight that will be added later). The mass of the bird and tail is 1.5 kg.

The bird sculpture is placed on a pivot.

The artist adds the counter-weight at the end E of the tail so that the bird remains stationary in the position shown.

(a) Calculate the mass of the counter-weight.

mass = ... [2]

(b) The centre of mass of the sculpture with counter-weight is at the pivot.

Calculate the upward force acting at the pivot.

force = ... [1]

(c) The sculpture is rotated clockwise to the position shown in Fig. 2.2. It is held still, then carefully released.

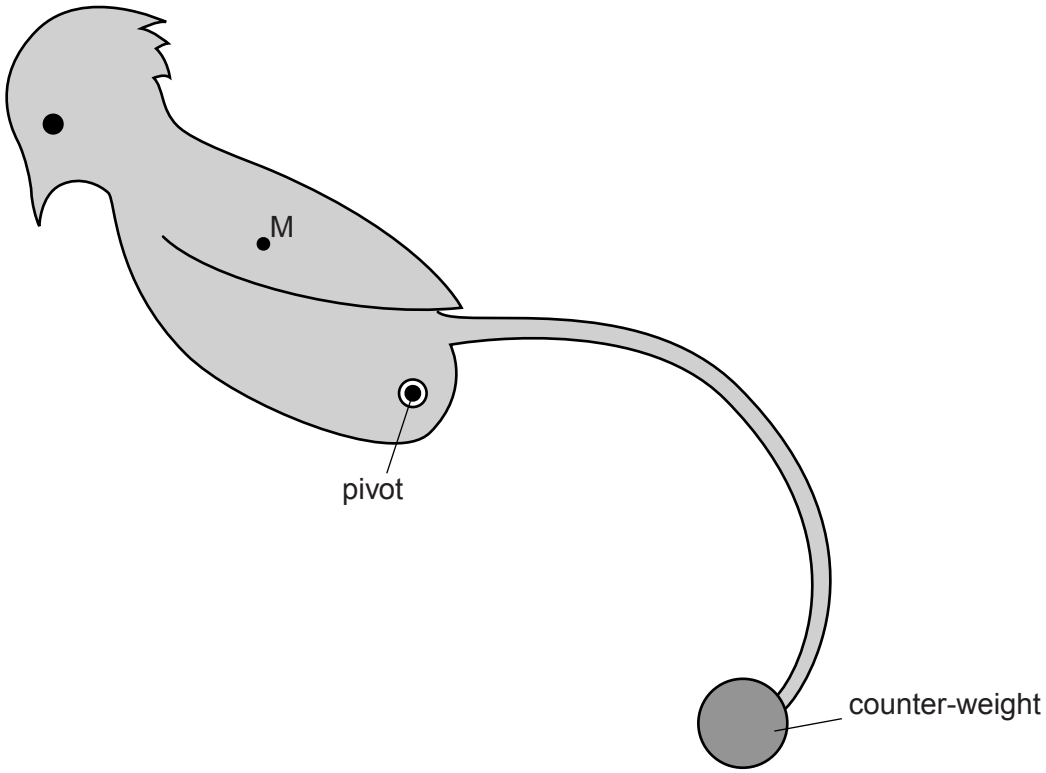

Fig. 2.2

(i) State whether the sculpture will stay in that position, rotate further clockwise or rotate back anticlockwise.

.....

.....

(ii) Explain your answer to **(i)**.

.....

.....

.....

.....

[3]

[Total: 6]

2 Fig. 1.1 shows the graph of speed v against time t for a train as it travels from one station to the next.

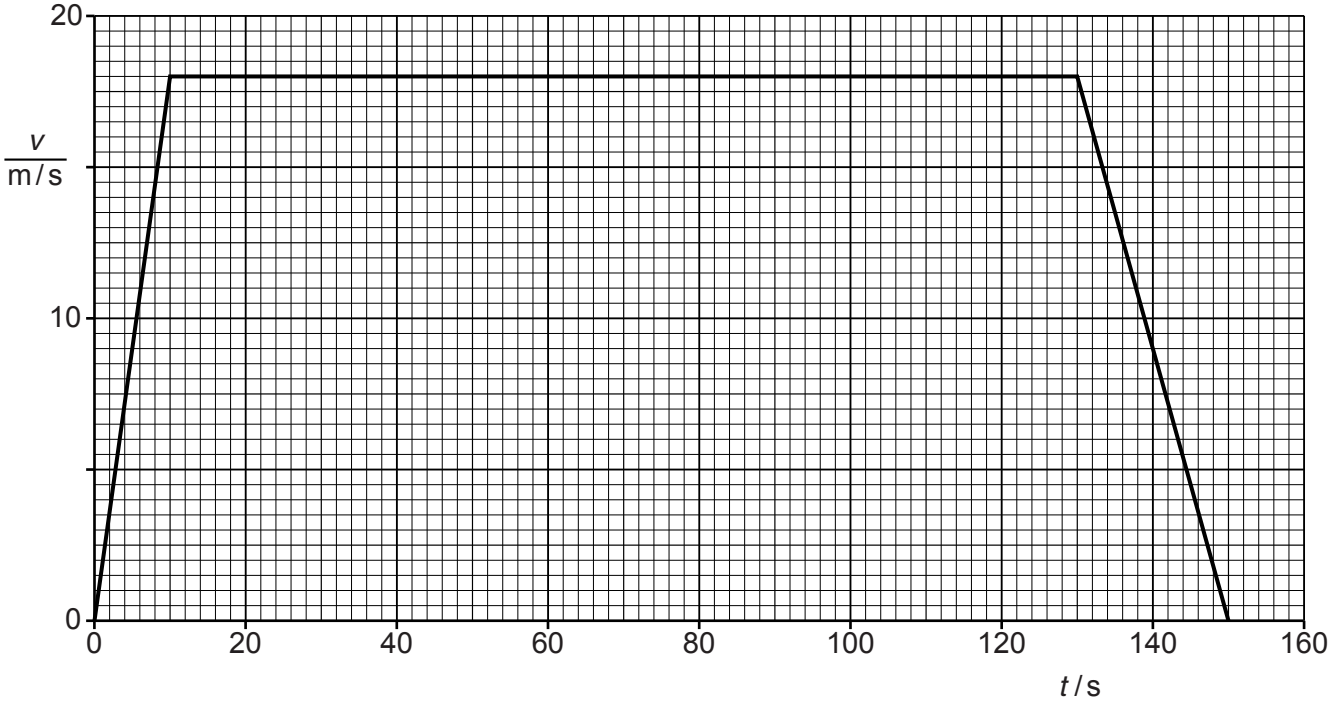

Fig. 1.1

(a) Use Fig. 1.1 to calculate

(i) the distance between the two stations,

distance = ... [4]

(ii) the acceleration of the train in the first 10 s.

acceleration = ... [2]

(b) The mass of the train is 1.1×10^5 kg.

Calculate the resultant force acting on the train in the first 10 s.

resultant force = ... [2]

(c) The force generated by the engine of the train is called the driving force.

Write down, in words, an equation relating the driving force to any other forces acting on the train during the period t = 10 s to t = 130 s.

..... [1]

[Total: 9]

3 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]

4 **(a)** A truck of mass 12 kg is rolling down a very slight incline as shown in Fig. 1.1.

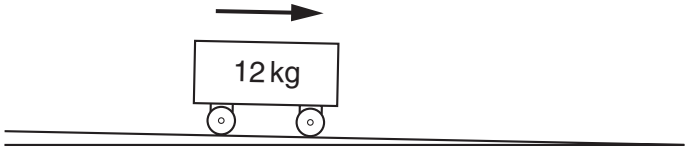

Fig. 1.1

The truck travels at constant speed.

Explain why, although the truck is on an incline, it nevertheless does not accelerate.

.....

..... [1]

(b) The slope of the incline is increased. As a result of this, the truck now accelerates.

(i) Explain why there is now acceleration.

.....

..... [1]

(ii) Write down an equation linking the resultant force on the truck and the acceleration of the truck.

[1]

(iii) The truck's acceleration is 2.0 m/s^2.

Calculate the resultant force on the truck.

resultant force = ... [2]

(c) The friction force up the slope in **(b)(iii)** was 14.0 N.

By suitable lubrication, the friction force is now almost totally removed.

(i) Calculate the new acceleration of the truck.

acceleration = ... [3]

(ii) The lubricated truck travels down the incline, starting from rest at the top of the incline. It takes 2.5 s to reach the bottom of the incline.

Calculate its speed as it reaches the bottom of the incline.

speed = ... [2]

(d) The incline is reduced to the original value and the lubricated truck is placed on it.

Describe the motion of the truck when it is released.

.....

.....

.....

..... [1]

[Total: 11]

5 Fig. 3.1 shows a simple see-saw. One child A sits near to end X and another child B sits near to end Y. The feet of the children do not touch the ground when the see-saw is balanced.

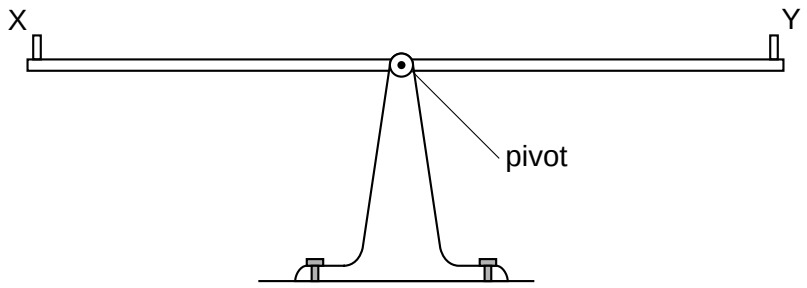

Fig. 3.1

(a) Child A has a mass of 18.0 kg and child B has a mass of 20.0 kg.

Without calculation, indicate where the children could sit so that the see-saw balances horizontally. You may draw on Fig. 3.1 if you wish.

.....

.....

..... [2]

(b) State the relationship between the moment caused by child A and that caused by child B.

.....

..... [1]

(c) Child A is 2.50 m from the pivot. Calculate the distance of child B from the pivot.

distance = ... [2]

[Total :5]