Forces

Question Paper 2

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

Time Allowed: **50 minutes**

Score: **/42**

Percentage: **/100**

1 (a) State the two conditions required for the equilibrium of a body acted upon by a number of forces.

1. ....

....

2. ....

....[2]

(b) Fig. 3.1 shows a diagram of an arm with the hand holding a weight of 120 N.

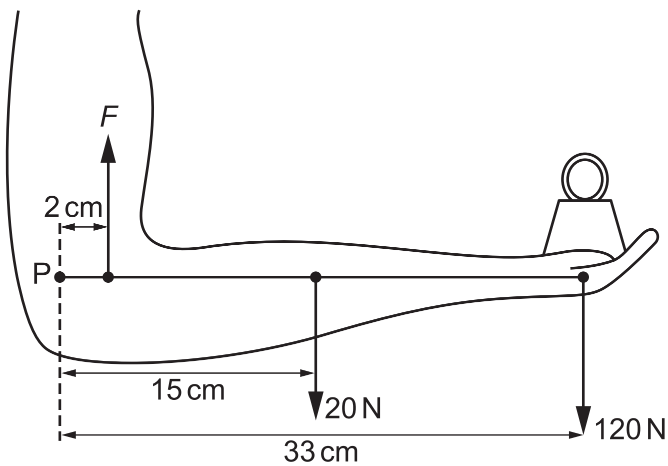

Fig. 3.1

The 20 N force is the weight of the forearm, acting at its centre of mass. *F* is the force in the muscle of the upper arm. P is the point in the elbow about which the arm pivots. The distances of the forces from point P are shown.

(i) By taking moments about point P, calculate the force *F*.

force *F* = ...[3]

(ii) A force acts on the forearm at point P. Calculate this force and state its direction.

force = ...

direction = ...[2]

[Total: 7]

2 **(a)** **(i)** State the difference between a scalar quantity and a vector quantity.

....

....

(ii) State one example of a vector quantity.

....
[2]

(b) Fig. 3.1 shows the top of a flagpole.

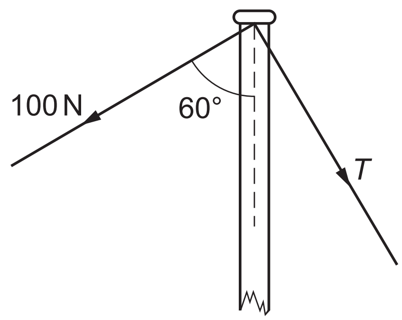

Fig. 3.1

The flagpole is held vertical by two ropes. The first of these ropes has a tension in it of 100 N and is at an angle of 60° to the flagpole. The other rope has a tension *T*, as shown.

The resultant force is down the pole and of magnitude 200 N.

In the space below, using a scale of 1 cm = 20 N, draw a scale drawing to find the value of the tension *T*. Clearly label 100 N, 200 N and *T* on your drawing.

tension *T* = ...[3]

[Total: 5]

3 Two students make the statements about acceleration that are given below.

Student A: For a given mass the acceleration of an object is proportional to the resultant force applied to the object.

Student B: For a given force the acceleration of an object is proportional to the mass of the object.

(a) One statement is correct and one is incorrect.

Re-write the incorrect statement, making changes so that it is now correct.

For a given .... the acceleration of an object is ....

.... [1]

(b) State the equation which links acceleration *a*, resultant force *F* and mass *m*.

[1]

(c) Describe what happens to the motion of a moving object when

(i) there is no resultant force acting on it,

.... [1]

(ii) a resultant force is applied to it in the opposite direction to the motion,

.... [1]

(iii) a resultant force is applied to it in a perpendicular direction to the motion.

.... [1]

[Total: 5]

4 Four students, A, B, C and D, each have a spring. They measure the lengths of their springs when the springs are stretched by different loads.

Their results are shown in Fig. 2.1.

	student A	student B	student C	student D
load / N	spring length / cm	spring length / cm	spring length / cm	spring length / cm
0.5	6.7	9.2	9.1	10.0
1.0	7.7	10.0	9.9	11.1
1.5	8.7	10.8	10.7	12.2
2.0	9.7	11.6	11.5	13.3
2.5	10.7	12.6	12.3	14.4
3.0	11.7	13.8	13.1	15.5
3.5	12.7	15.2	13.9	16.6
4.0	13.7	16.8	14.7	17.7

Fig. 2.1

(a) **(i)** State which student had loaded the spring beyond the limit of proportionality.

.... [1]

(ii) Explain how you obtained your answer to **(a)(i)**.

....

....

.... [2]

(b) For the spring used by student A, calculate

(i) the extra extension caused by each additional 0.5 N,

extra extension = ... [1]

(ii) the unloaded length of the spring.

unloaded length = ... [1]

(c) Student A obtains a second spring that is identical to his first spring. He hangs the two springs side by side, as shown in Fig. 2.2.

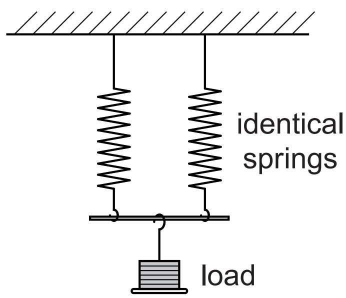

Fig. 2.2

Use the table to calculate the length of each of the springs when a load of 2.5 N is hung as shown in Fig. 2.2. Show your working.

length = ... [2]

[Total: 7]

5 An object of weight *W* is suspended by two ropes from a beam, as shown in Fig. 1.1.

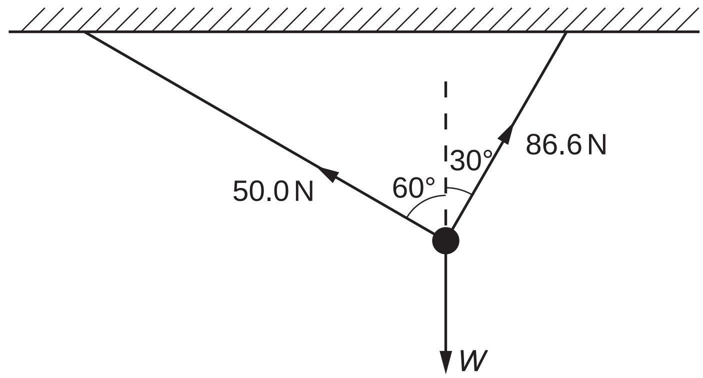

Fig. 1.1

The tensions in the ropes are 50.0 N and 86.6 N, as shown.

(a) In the space below, draw a scale diagram to find the resultant of the two tensions.

Use a scale of 1.0 cm = 10 N.

Clearly label the resultant. [3]

(b) From your diagram, find the value of the resultant.

resultant = ... [1]

(c) State the direction in which the resultant is acting.

.... [1]

(d) State the value of *W*. *W* = ... [1]

[Total: 6]

6 A car travels around a circular track at constant speed.

(a) Why is it incorrect to describe the circular motion as having constant velocity?

.... [1]

(b) A force is required to maintain the circular motion.

(i) Explain why a force is required.

....

....

.... [2]

(ii) In which direction does this force act?

.... [1]

(iii) Suggest what provides this force.

.... [1]

[Total: 5]

7 **(a)** A uniform metre rule is pivoted at its centre, which is also the position of its centre of mass.

Three loads, 2.0 N, *F* and 3.0 N are positioned on the rule at the 20 cm, 30 cm and 90 cm marks respectively, as shown in Fig. 3.1.

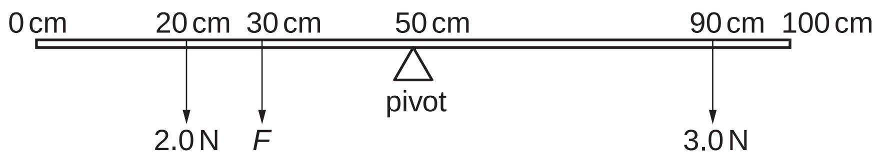

Fig. 3.1

(i) Calculate the moment of the 3.0 N load about the pivot.

moment = ... [1]

(ii) Calculate the moment of the 2.0 N load about the pivot.

moment = ... [1]

(iii) The force *F* maintains the metre rule in equilibrium on the pivot.

Calculate the value of *F*.

F = ... [3]

(b) The weight of the metre rule is 1.2 N and can be considered to act at the 50 cm mark.

All the weights in **(a)** are removed. The pivot is positioned under the 30 cm mark and the 2.0 N load is placed on the rule as shown in Fig. 3.2.

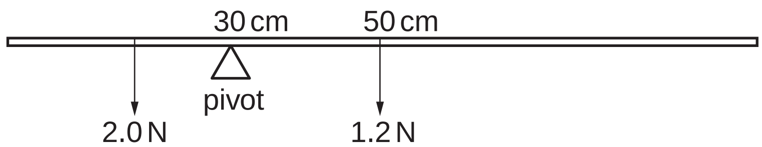

Fig. 3.2

The position of the 2.0 N load is adjusted until the metre rule is again in equilibrium.

Determine the position of the 2.0 N load.

2.0 N load is at the .... cm mark [3]

[Total: 8]