Moments

Have a go at the following exam questions.

OCR, G481, June 2016

4 Fig. 4.1 shows a cyclist.

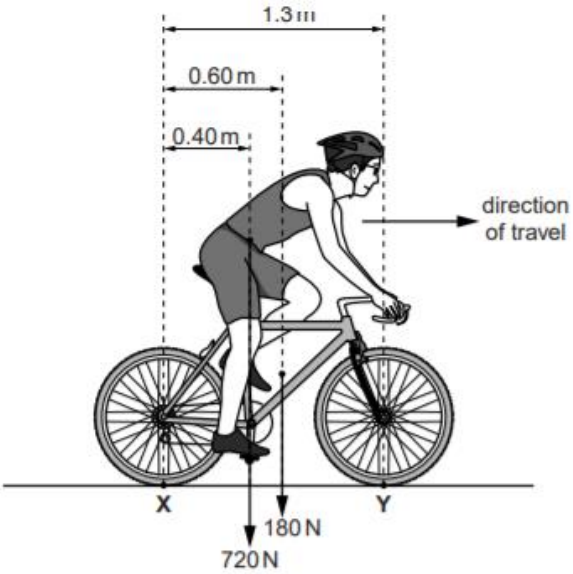

Fig. 4.1

The bicycle tyres are in contact with the road at **X** and **Y**. The cyclist is travelling at **constant** velocity on a level road. The weight of the bicycle is 180 N and the weight of the cyclist is 720 N.

(a) State the magnitude of the resultant force acting on the cyclist. Explain your answer.

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..... **[2]**

(b) Define *moment of a force*.

In your answer, you should use appropriate technical terms, spelled correctly.

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..... **[1]**

(c) Explain why the two vertical forces acting on the tyres at **X** and **Y** do not form a couple.

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..... **[1]**

(d) Take moments about **X** to determine the size of the vertical force *F* acting **on** the tyre at **Y**.

F = ... N **[3]**

(e) The cyclist leans further forward. How does this affect the force on the tyre at **X**? Explain your answer.

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..... **[2]**

2 Fig. 2.1 shows an object held horizontally by a string.

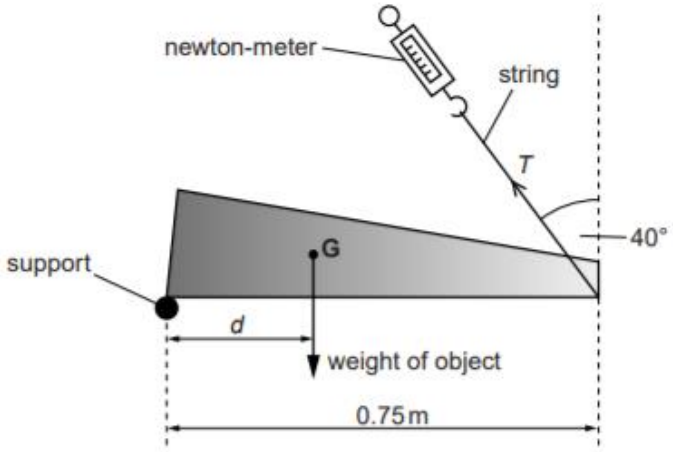

Fig. 2.1

One end of the object rests on a support and the other end is held by the string. The object is in equilibrium. Point **G** is the centre of gravity of the object. The mass of the object is 1.2 kg. The tension *T* in the string is 5.1 N. The string makes an angle of 40° with the vertical.

(a) Take moments about the support and calculate the distance *d*.

d = ... m **[3]**

(b) Explain why the force at the support cannot be vertically upwards.

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..... **[1]**

[Total: 4]

5 **(a)** Fig. 5.1 shows a wooden block motionless on an inclined ramp.

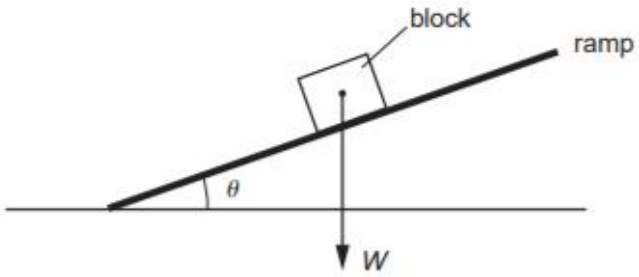

Fig. 5.1

The angle between the ramp and the horizontal is θ.

(i) The weight W of the block is already shown on Fig. 5.1. Complete the diagram by showing the normal contact (reaction) force N and the frictional force F acting on the block. **[2]**

(ii) Write an equation to show how F is related to W and θ.

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..... **[1]**

(b) Fig. 5.2 shows a kitchen cupboard securely mounted to a vertical wall. The cupboard rests on a support at **A**.

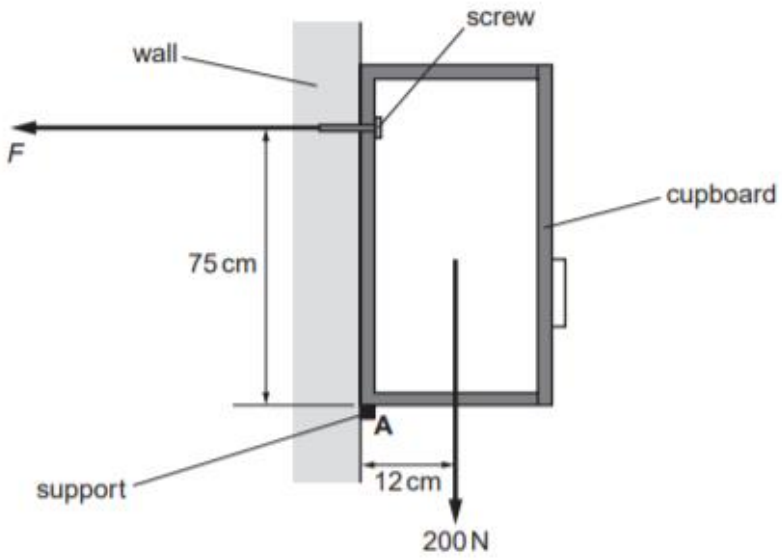

Fig. 5.2

The total weight of the cupboard and its contents is 200 N. The line of action of its weight is at a distance of 12 cm from **A**. The screw securing the cupboard to the wall is at a vertical distance of 75 cm from **A**.

(i) State the principle of moments.

In your answer, you should use appropriate technical terms, spelled correctly.

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..... **[2]**

(ii) The direction of the force *F* provided by the screw on the cupboard is horizontal as shown in Fig. 5.2. Take moments about **A**. Determine the value of *F*.

F = ...N **[2]**

(iii) The cross-sectional area under the head of the screw in contact with the cupboard is $6.0 \times 10^{-5} m^2$. Calculate the pressure on the cupboard under the screw head.

pressure = ...Pa **[2]**

(iv) State and explain how your answer to **(iii)** would change, if at all, if the same screw was secured much closer to **A**.

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..... **[2]**

[Total: 11]