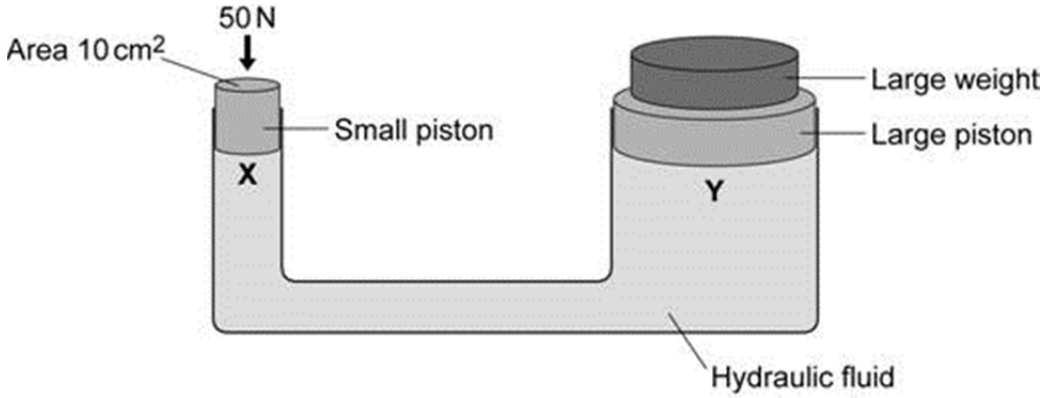
Forces in Action – Past Paper Questions

Q1. The diagram shows a simple hydraulic jack. The jack is designed to lift a large weight using a much smaller force.



(a) Complete the following sentence.

A hydraulic jack is an example of a ..... multiplier.

(1)

(b) Calculate the pressure, in N/cm^2, created on the small piston by the force of 50 N pushing downwards.

Write down the equation you use, and then show clearly how you work out your answer.

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Pressure = ... N/cm^2

(2)

(c) Complete the following sentence.

The pressure at **Y** will be ..... the pressure at **X**.

(1)

(d) Piston Y has an area of 70cm^2. Calculate the force exerted by the hydraulic fluid on piston **Y**. Include the unit.

Force = ……

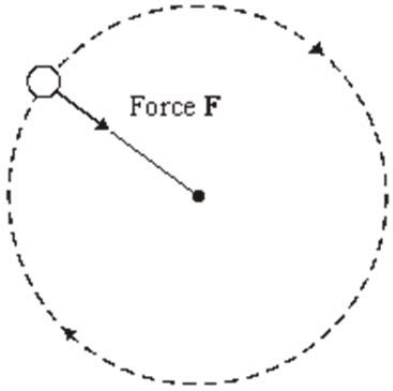
(2)

(Total 6 marks)

Q2. (a) A student has fastened a ball to a piece of string and is swinging it round in a horizontal circle.

(i) The diagram below shows an overhead view of the movement of the ball.

Add an arrow, from the centre of the ball, to show the direction in which the ball would move if the string broke at this instant.



(1)

(ii) Complete the table to show how force **F** changes if the student changes what he is doing. In each case, all the other factors stay the same.

If the student	Force F needs to
uses a ball with a greater mass	.....
swings the ball at a greater speed	.....
swings the ball with a shorter piece of string	.....

(3)

(b) The Moon orbits the Earth in a circular path. Use words from the box to complete the**three** spaces in the sentence.

direction	**resistance**	**speed**	**velocity**

You may use each word once, more than once or not at all.

The Moon's ..... is constant but its ..... changes

because its ..... changes.

(2)

(c) When any object moves in a circular, or nearly circular, path a force must act towards the centre of the circle.

(i) What word is used to describe this force?

.....

(1)

(ii) The Moon orbits the Earth. What provides the force towards the Earth?

.....

(1)

(iii) In an atom, name the particles which are moving in circular paths around the nucleus.

.....

(1)

(iv) In the case of an atom, what word describes the forces which keep these particles moving in circular paths around the nucleus?

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(1)

(Total 10 marks)

Q3. (a) Every object has a *centre of mass*. What is meant by the *centre of mass*?

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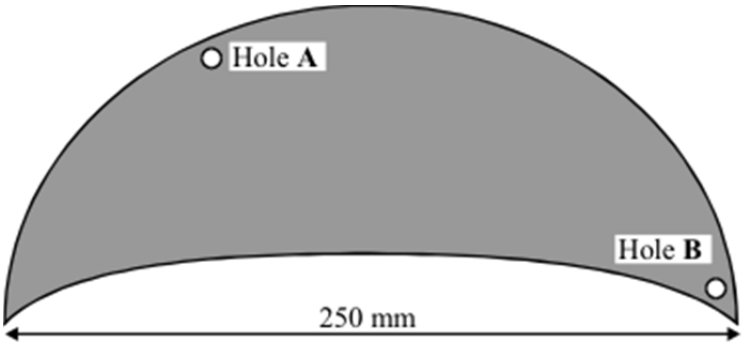
(1)

(b) The drawing shows a thin sheet of plastic. The sheet is 250 mm wide. Two holes, each with a radius of 2 mm, have been drilled through the sheet.



Describe how you could use:

- a clamp and stand
- a steel rod 100 mm long and with a radius of I mm
- a weight on a thin piece of string (= a plumb line)
- a ruler
- a pen which will write on the plastic sheet

to find the centre of mass of the plastic sheet.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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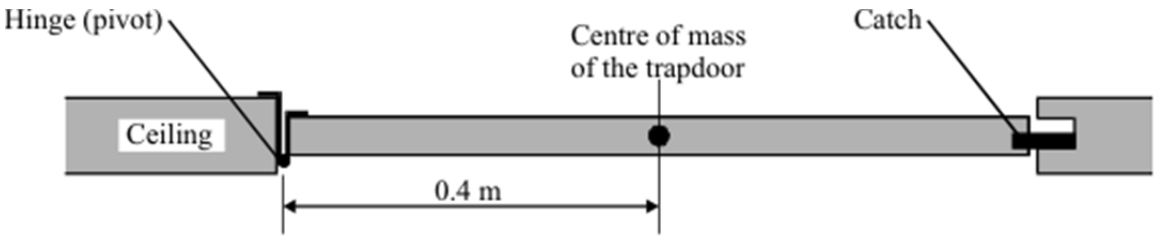
(5)

(c) There is a trapdoor in the ceiling of a house.The trapdoor weighs 44 N and is 0.8m wide.The drawing shows a side view of the trapdoor.



(i) Complete the **three** spaces to give the equation which is used to calculate the turning effect of a force.

..... = ... × perpendicular ..... between line of action and pivot

(1)

(ii) Calculate the turning effect, about the hinge, due to the weight of the trapdoor.

Show clearly how you work out your final answer and give the unit.

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Turning effect = ...

(3)

(iii) The catch exerts an upward force on the trapdoor so that it remains in equilibrium. Calculate the size of the upward force of the catch on the trapdoor, and give the unit.

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Force = ...

(3)

(iv) The trapdoor is in equilibrium, so the resultant force on it is zero. In addition to the weight of the trapdoor and the upward force from the catch, there is also an upward force on the trapdoor from the hinge. Calculate the size of the force from the hinge.

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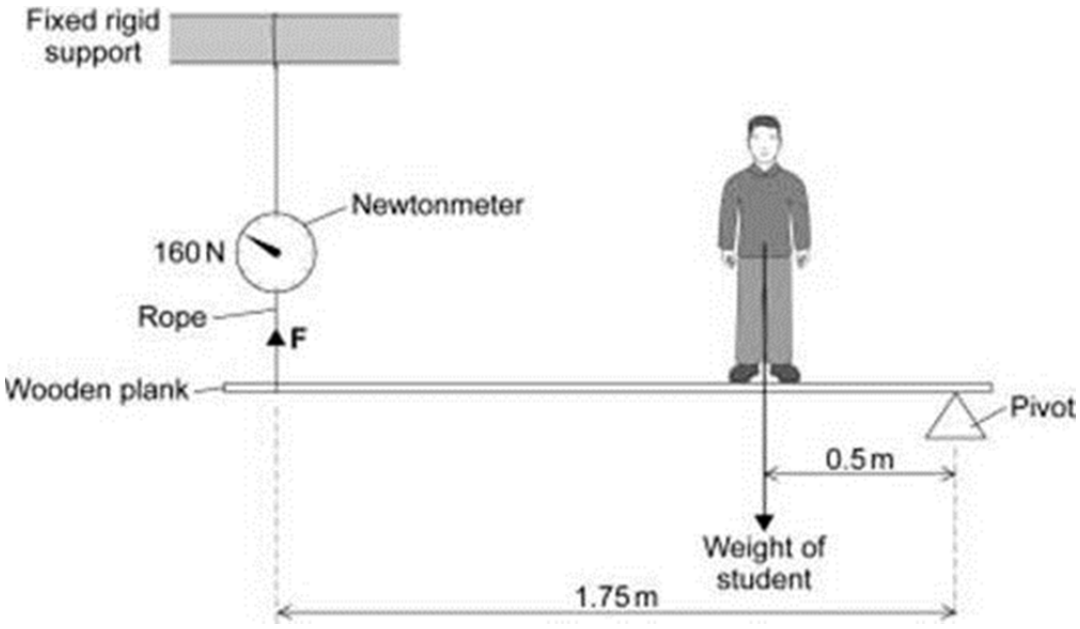
Force = ...

(2)

(Total 15 marks)

Q4. A student wants to weigh himself but the only balance available is a newtonmeter that measures up to 200 newtons.
The diagram shows how the student solved the problem using moments.



(a) Use the information in the diagram to calculate the weight of the student given by this method. Write down the equation you use, and then show clearly how you work out your answer and give the unit.

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Weight = ...

(5)

(c) Even though all the measurements are accurate the student's weight obtained by this method is inaccurate.

Explain why.

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(2)
(Total 7 marks)