

# Q1

## Turning Forces and Centre of Mass

Workbook Pages 104-105



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Q1 a) Fill in the blanks in the following passage, using the words supplied.

pivot      perpendicular      moment      force

The turning effect of a **force** is called its **moment**.  
It can be found by multiplying the force by the **perpendicular** distance from the line of action of the force to the **pivot**.

b) What are the units in which moments are measured? **newton metres (Nm)**



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In A and C the force makes an angle of other than 90° with the handle - you therefore have to resolve it and find the component that is perpendicular to the handle - that is the force that is perpendicular to the distance line from the pivot

# Q2

In B and D the force is already perpendicular to the handle - so the whole force produces the turning moment

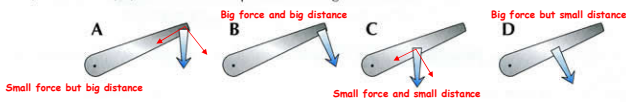
Q2 To open a door, its handle needs to be **rotated clockwise**.



a) A force of 45 N is exerted vertically downwards on the door-handle at a distance of 0.1 m from the pivot. What is the **moment** of the force?

**Moment = force x perpendicular distance = 45 N x 0.1 m = 4.5 Nm**

b) Pictures A, B, C and D show equal forces being exerted on the handle.



Which of the forces shown (A, B, C or D) exerts:

i) the largest moment? **B**      ii) the smallest moment? **C**

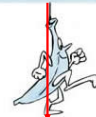
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# Q3

Q3 A baby's pram toy consists of a toy banana hanging from a bar over the pram.

a) The banana is hanging **at rest**, as shown. Draw a line on which the centre of mass **must** fall.

The line is **vertically down** from the point of suspension



b) Complete the following sentences by choosing from the words and phrases below:

level with    vertically below    perpendicular    moment    centre of mass    horizontal

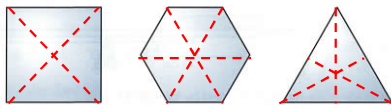
When a suspended object's **centre of mass** is **vertically below** the pivot, the **perpendicular** distance between the line of action of the gravitational force and the pivot is zero. This means that there is no **moment** due to the object's weight.

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# Q4

Q4 You can think of the **centre of mass** as the point where all the weight of an object acts.

a) Using lines of symmetry, find the centre of mass of each of these shapes:



b) Circle the correct answer to complete this sentence. The centre of mass of a raindrop is:

- A at the top      **D** near the bottom  
B near the top      E at the bottom  
C midway down

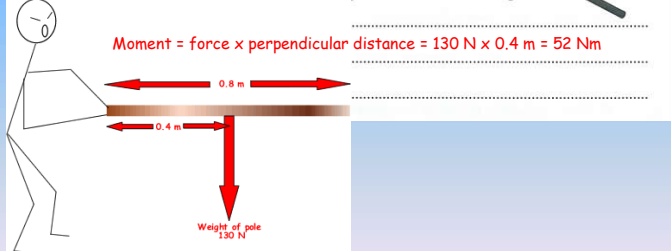


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# Q5

Q5 Two men, one at each end, hold a 0.8 m long metal pole weighing 130 N so that it is in a **horizontal** position. One man accidentally lets go of his end.

What is the moment on the pole due to its weight an instant after he lets go?



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## Q6

**Q6** Some pupils want to find the centre of mass of an **irregularly shaped** piece of cardboard. They are equipped with a stand to hang the card from, a plumb line and a pencil. They make a hole near one edge of the card and hang it from the stand.

a) What steps should they take next in order to find the centre of mass?

**They need to:**

- suspend the plumb line from the same point as they hung the card shape from.
- mark the position of the plumb line with THREE crosses
- remove the card and draw a line (using a ruler through the three crosses across the whole of the card
- repeat this process from at least one different suspension point
- The centre of mass will be at the point the lines cross



b) How could they make their result more reliable?

Repeating the process three times will show whether they have drawn the lines accurately enough - two lines will always cross at a point, but to get three to cross at the same point is more difficult - you have to be correct with all three lines!