# Moments Levers Gears

GCSE Physics · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

## 1. Worked example

**A force of 40 N is applied at right angles to the end of a 0.30 m spanner. Calculate the moment. (2 marks)**

Step 1 · Write the equation

moment = force × perpendicular distance from the pivot, $M = F\,d$

Step 2 · Substitute and calculate

$M = 40 \times 0.30 = 12$ N m

**Answer: 12 N m**

Check: Distance must be perpendicular to the line of the force.

## 2. Now try one with the steps

**Leah (weight 300 N) sits 2.0 m from the pivot of a see-saw. Where must Tom (weight 400 N) sit to balance it? (3 marks)**

Step 1 · Principle of moments

Step 2 · Substitute

Step 3 · Calculate

**Answer:**

## 3. Practice

Show your working. The marks tell you how much is expected.

1. Describe what is meant by the moment of a force. [1]

2. Write the equation for the moment of a force. [1]

3. State the unit of a moment. [1]

**4.** A 20 N force acts 0.50 m from a pivot, at right angles. Calculate the moment in N m. [2]

**5.** State the principle of moments. [2]

**6.** Explain why door handles are fitted on the side of the door furthest from the hinges. [1]

**7.** A child weighing 300 N sits 2.0 m from a see-saw pivot. Calculate the force needed 1.5 m from the pivot on the other side to balance it. [3]

**8.** Explain why it is easier to undo a tight nut with a long spanner than a short one. [2]

**9.** A wheelbarrow carries a 600 N load 0.40 m from the wheel. The handles are 1.2 m from the wheel. Calculate the force needed to lift the handles. [3]

**10.** A nut needs a moment of 25 N m to loosen it. The spanner is 0.25 m long. Calculate the minimum force needed at the end. [2]

**11.** A metre rule balances at its centre. A 4.0 N weight hangs 30 cm to the left. Calculate where a 6.0 N weight must hang on the right to balance it, in cm from the centre. [2]

**12.** A small gear with 10 teeth drives a larger gear with 30 teeth. State how the speed and moment of the larger gear compare with the small gear. [2]

**13.** The small gear in question 12 exerts a moment of 2.0 N m. Calculate the moment of the larger gear in N m. [2]

**14.** Explain why a tower crane has a heavy counterweight on the short arm opposite the load. [2]

## 4. Before you hand it in

**Using the distance along a slanted spanner, not the perpendicular distance**
Use the perpendicular distance from the pivot to the line of action of the force.

**Mixing cm and m in the same moments equation**
Either is fine if both sides use the same unit; for N m, convert to metres.

**"A lever makes energy."**
A smaller effort moves a larger distance; the work done is the same (or slightly more, because of friction).

**"A big gear driven by a small gear turns faster."**
Small driving big: slower but bigger moment. Big driving small: faster but smaller moment.