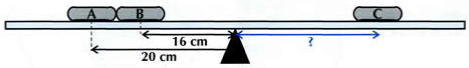
Balanced Moments and Stability

Workbook page 106

Q1 A 2 N weight (Weight A) sits 20 cm to the left of the pivot of a balance. A 5 N weight (Weight B) is placed 16 cm to the left of the pivot.



a) What is the moment exerted by **Weight A**? Moment = Fd = 2N x 20cm = 40 Ncm

b) What is the moment exerted by **Weight B**? Moment = Fd = 5N x 16cm = 80 Ncm

c) How far to the right of the pivot should Weight C (8 N) be placed to **balance** A and B?

Moment = Fd = 8N x Xcm = (40 + 80) Ncm = 120 Ncm

X = 120/8 = 15cm

d) If all three of the weights were exactly **twice as far** away from the pivot, would the balance tip over to one side? Explain your answer.

No, because all of the individual moments would be doubled and that would still balance

Q2 The top drawer of a two-drawer filing cabinet is full of heavy files, but the bottom drawer is empty.

Why is the cabinet in danger of falling over if the top drawer is fully pulled out?

A lot of mass is in the top drawer. When it is closed the centre of that mass is over the centre of the base of the cabinet. When it is pulled out that mass centre is outside the base of the cabinet and forms a weight that acts as a moment turning the cabinet over its front edge. It becomes unstable.

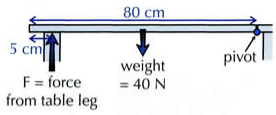
Q3 The pictures show three different designs for **vases**.

Which vase will be **most stable**? Explain your answer.

C because it has a wider base and a lower centre of mass than the other two.

Q4 One side of a drop-leaf table is pivoted on a hinge and supported 5 cm from its edge by a table leg. The table leaf is 80 cm long and weighs 40 N.

Find the force, F, exerted by the table leg (when the table leaf is fully extended).



Clockwise Moment = Fd = F x (80 – 5) cm = 75F Ncm

Anticlockwise Moment = Fd = 40N x 40 cm = 1600 Ncm

At equilibrium Σ clockwise moments = Σanticlockwise moments

75F = 1600

F = 21.3N