# Forces, Moments and Equilibrium

Mechanics · 4 questions · step-by-step answers at the end

Name: Date: Score: / 4

**USEFUL EQUATIONS**

$\Sigma F = 0$ and $\Sigma$ moments $= 0$ moment $= Fd$ torque of a couple $= Fd$ $\Delta p = \rho g \Delta h$

## Questions

Show your working in the space under each question.

**1.** Two equal and opposite 12 N forces act on the rim of a wheel of diameter 0.40 m. Find the torque of the couple.

**2.** A uniform 4.0 m beam of weight 200 N rests on supports at each end. A 600 N load hangs 1.0 m from the left end. Find the force from each support.

**3.** What fraction of an iceberg (917 kg $m^{-3}$) is below the surface of sea water (1025 kg $m^{-3}$)?

**4.** Find the upthrust on a $2.0 \times 10^{-3}$ $m^3$ block fully under water.

## Step-by-step answers

Forces, Moments and Equilibrium

**1.** $12 \times 0.40 = \mathbf{4.8\ N\ m}$.

**2.** 1. Take moments about the left support: $R \times 4.0 = 200 \times 2.0 + 600 \times 1.0 = 1000$ N m.
2. Right support: $R = \mathbf{250\ N}$.
3. Vertical forces: $L + 250 = 800$, so the left support gives **550 N**.

**Answer: Left 550 N; right 250 N**

**3.** Floating: weight = upthrust, so the fraction = 917/1025 = **0.89**.

**4.** $\rho V g = 1000 \times 2.0 \times 10^{-3} \times 9.81 = \mathbf{19.6\ N}$.