

4 Forces, density and pressure — Part 2

— Answers

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4.1 The forces are equal in size and opposite in direction, and their lines of action are a (perpendicular) distance apart.

4.2 $\tau = F \times d = 6.0 \times 0.40 = 2.4 \text{ N m}$.

4.3 (1) the resultant force is zero, and (2) the resultant moment about any point is zero.

4.4 $F = \rho g V = 1000 \times 9.8 \times 5.0 \times 10^{-4} = 4.9 \text{ N}$.

4.5 The hull encloses a large volume, so it displaces a large weight of water. It floats once the upthrust (weight of water displaced) equals the ship's weight — the average density of the ship (including the air inside) is less than water.

4.6 Loading adds weight, so the ship must displace *more* water to make the upthrust match its new weight. To displace more water, more of the hull goes below the surface — so it sits lower.