

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.