

# Forces, density and pressure

Cambridge International AS &amp; A Level Physics

Unlike IGCSE, 9702 gives you a data sheet: it is page 2 of Papers 1, 2 and 4, with more formulae on page 3 of Paper 4. Everything marked GIVEN is printed for you; everything else you must recall. Compiled by GioPhysics from the published syllabus. This is an independent study aid, not a Cambridge document; the official syllabus is the authority.

## 4.1 Turning effects of forces

AS **Moment of a force**  
**moment =  $F \times d$**

$F$  — force (N)

$d$  — perpendicular distance from the pivot (m)

AS **Torque of a couple**  
**torque =  $F \times d$**

$F$  — one of the two equal and opposite forces (N)

$d$  — perpendicular separation of the forces (m)

## 4.2 Equilibrium of forces

AS **Conditions for equilibrium**  
**resultant force = 0 · resultant moment = 0**

about — any point, for the moment condition

*The principle of moments, plus a closed vector triangle for three coplanar forces.*

## 4.3 Density and pressure

AS **Density**

$$\rho = m / V$$

$\rho$  — density ( $\text{kg m}^{-3}$ )

$m$  — mass (kg)

$V$  — volume ( $\text{m}^3$ )

AS **Pressure**

$$p = F / A$$

$p$  — pressure (Pa)

$F$  — force normal to the surface (N)

$A$  — area ( $\text{m}^2$ )

AS **Hydrostatic pressure**

$$p = \rho gh$$

$p$  — pressure due to the column (Pa)

$\rho$  — density of the fluid ( $\text{kg m}^{-3}$ )

$g$  — acceleration of free fall ( $\text{m s}^{-2}$ )

$h$  — depth (m)

*The syllabus also asks you to derive it from the definitions of pressure and density.*

**Upthrust (Archimedes' principle)**

**$$F = \rho g V$$**

F — upthrust (N)

 $\rho$  — density of the fluid ( $\text{kg m}^{-3}$ )V — volume of fluid displaced ( $\text{m}^3$ )