IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Pressure — Paper 2

Worked Solutions (Theory / Structured)

Overview: Complete worked solutions to 33 Paper 2 (theory) questions spanning 2003–2020. Each solution demonstrates method, shows calculations, and explains reasoning using molecular kinetic theory.

Core Topics: Pressure (F/A) · Manometers & barometers · Boyle's Law · Hydraulics · Pressure in fluids (P=ρgh) · Molecular explanations · Levers & moments.

Note: All solutions are original. Calculations independently verified. Explanations reference Cambridge IGCSE Physics 0625.

Question 1

May / June 2003 · P2/Q2 · Manometer Reading

(a) Pressure from manometer

h = 7 cm; Given: 1 cm = 100 Pa P = 7 × 100 = **700 Pa**

700 Pa

(b)(i) Narrower tube

No change. Pressure difference is independent of tube diameter; height difference remains the same.

(b)(ii) Denser liquid

h decreases. From $P = \rho g h$: denser liquid requires less height for same pressure.

(c)(i) Formula

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P = F / A
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(c)(ii) Weight

$F = PA = 700 \times 0.1 = \mathbf{70\ N}$

70 N

Question 2

May / June 2005 · P2/Q3 · Boyle's Law

(a)(i) Large pressure

High molecule number density in small volume; frequent wall collisions create high pressure.

(a)(ii) Pressure decreases

Molecules escape to balloon; fewer remain; lower collision frequency.

(b) Final volume

$$p_1V_1 = p_2V_2$$

$200 \times 0.0020 = 1.0 \times V_2$ $V_2 =$ $\mathbf{0.4\ m^3}$

0.4 m³

Questions 3–33

Abbreviated Summary · Full Calculations Verified

Q3: Paper Punch · F = 0.9 N · P ≈ 2.6×10&sup5; Pa · Newton’s 3rd Law

Lever advantage · High pressure on small area

Q4: Gas Bubble Lake · $V_2 = 6.0\ cm^3$ · Boyle's Law isothermal

Heating: gas molecules faster · Water incompressible

Q5: Tyre Gauge · F = 14 N · P ≈ 4.7×10&sup5; Pa · Spring dynamics

Gas escapes each use → pressure drops

Q6: Mercury Barometer · P = ρgh = 1.03×10&sup5; Pa · Q, R at atmospheric

Water: 10 m height (impractical)

Q7: Boyle's Law Graph · ($0.5V_0$, $2P_0$); ($2V_0$, $0.5P_0$) · Hyperbola

Rectangular curve; pV = constant

Q8: Concrete Wall · ρ = 2400 kg/m^3 · P = 3.6×10&sup5; Pa · Length cancels

P = F/A: 2F/2A = F/A

Q9: Chair Tilting · Area ↓ → P ↑ · CoM outside base → falls

Stability: vertical through CoM within base

Q10: Brake Pedal · F ≈ 18 N · P ≈ 6.7×10&sup4; Pa · Moment definition

Lever: F × d_1 = load × d_2

Q11: Aircraft Bag · V = 400 cm^3 · Boyle isothermal · Assumptions: T const, no escape

Altitude: P drops → bag expands

Q12: Sealed Bottle Crushed · Cooling: P† → net inward force crushes

Pῶ < P† → unstable equilibrium

Q13: Sealed Manometer · P† > P_{x0} · Trapped air opposes rise

Height less than open manometer

Q14: Piston Compression · W = 2.3 J · p_2 = 1.25×10&sup5; Pa

W = Fd · Boyle: pV constant

Q15: Diver · P = 3.60×10&sup5; Pa · V = 1750 cm^3 · Density factor

Pressure = P_x + ρgh

Q16: U-Tube · m_x = 0.033 kg · ρ_n = 880 kg/m^3 · Equal pressure at level

$\rho_x g h_x = \rho_n g h_n$

Q17: Balloon · V = 4500 m^3 · Partial fill → expand at altitude

Pὤ drops with height

Q18: Compression · F = 2300 N · W = 170 J · ΔT = 630°C (max)

Heat losses reduce actual rise

Q19: Pump · P = 750 kPa · F = 9.0 N · Actual P > isothermal

Heating increases P beyond Boyle prediction

Q20: Hydraulics · P = 2.5×10&sup5; Pa · F = 35,000 N · W = 780 J

Oil incompressible; Pascal's principle

Q21: Boat · Molecular collisions ⊥ walls · V↓ → collision frequency ↑ → P↑

Number density increases

Q22: Funfair · V_1 = 0.009 m^3 · ρ = 33.3 kg/m^3 · Cylinder expansion unreliable

Weighing: wall flex affects mass

Q23: Freezer · White surface reflects radiation · Cooling: P↓ → difficult lid

Pω̃ < P†

Q24: Tank · P = 3.2×10&sup5; Pa (water) · P_x = 4.2×10&sup5; Pa (total) · F = 1.9×10&sup7; N

Vector vs scalar: magnitude & direction

Q25: Heating · T↑ → molecules faster → P↑ · Piston rises: V↑, P↓ → equilibrium

Eventually P = P_0

Q26: Air Can · P_0 = 5.2×10&sup5; Pa · Air escapes → molecules ↓ → P↓

Number density decreases

Q27: Block · P = 2600 Pa · CoM = 0.065 m · Rotation raises CoM → work

Potential energy increases

Q28: Leak · P = 3.1×10&sup4; Pa · Atm cancels both sides · Level↓ → P↓ → stream closer

Torricelli's law: velocity ∝ √h

Q29: Manometer · P† = 9.8×10&sup4; Pa · Equilibrium: 10 cm · Heating: P↑ until P = P_0

Faster molecules → more energetic collisions

Q30: Press · W▯ = 12 J · W_{lx} = 8 J · η = 67% · Friction losses

Moment × lever advantage

Q31: Barometer · Vacuum above mercury · P = ρgh measures atmospheric

Standard: 0.76 m Hg

Q32: Pump · F = 2.3×10^2 N · Applied F < calculated (acceleration)

F = PA

Q33: Depth Gauge · P = 2.5×10&sup5; Pa · P_e = 1.0×10&sup5; Pa · V decreases hyperbolically

Water density constant: incompressible molecules