

A-Level Physics Escape Room: Facility X-17

You regain consciousness inside Facility X-17. A synthetic AI voice activates: Intruder detected. System integrity unstable. Escape only possible through sequential physical verification.

RULE: Each section gives a code. Use them to unlock the system.

SECTION 1: GRAVITY CORE CALIBRATION

A 2.0 kg mass is dropped from 5.0 m. 90% of gravitational potential energy becomes kinetic energy.
 $g = 9.8 \text{ m/s}^2$.

Q1: Find kinetic energy just before impact.

Q2: Find speed before impact.

CODE A: KE (rounded) and speed x10 (rounded).

SECTION 2: POWER GRID STABILISATION

6Ω and 3Ω in parallel, in series with 4Ω . Internal resistance 1Ω . Voltage 12V.

Q3: Find total resistance.

Q4: Find total current.

CODE B: resistance x10 + current x10.

SECTION 3: RESONANCE CHAMBER

Frequency 72 Hz, wavelength 0.45 m, amplitude doubles.

Q5: Wave speed.

Q6: Energy change factor.

CODE C: speed + energy factor.

SECTION 4: MAGNETIC CONTAINMENT

$q = 3.2 \times 10^{-6} \text{ C}$, $v = 4.5 \times 10^5 \text{ m/s}$, $B = 0.60 \text{ T}$.

Q7: Magnetic force.

Q8: Effect on radius if velocity doubles.

CODE D: force x100 + radius factor.

FINAL SYSTEM:

Energy loss 15%, split 3:2, efficiency 80%, resistance 5Ω .

Determine final current and whether energy is conserved.

Final answer determines escape verdict.