OCR A Physics: Rearranging equations - solutions

Matching solutions and review cues | Total: 25 marks

Equations practised

$v = u + at$ | $W = Fs$ | $W = QV$ | $p = F/A$ | $\rho = m/V$ | $E = Pt$ | $f = 1/T$ | $F = B I \ell$ | $V = IR$ | $P = IV$ | $E = mc\Delta\theta$ | $v^2 = u^2 + 2as$ | $pV = nRT$ | $T = 2\pi\sqrt{(m/k)}$

For the review, reveal the algebraic route before numerical substitution. Ask pupils to name the operation that must be undone at each stage.

1. The motion relationship is $v = u + at$. Make t the subject. [1 mark]

Answer / mark points: $t = (v - u) / a$.

Review cue: Subtract u before dividing by a.

2. The work done relationship is $W = Fs$. Make F the subject. [1 mark]

Answer / mark points: $F = W / s$.

Review cue: Force equals work done divided by distance.

3. The electrical work relationship is $W = QV$. Make Q the subject. [1 mark]

Answer / mark points: $Q = W / V$.

Review cue: Charge is work done per volt.

4. The pressure relationship is $p = F/A$. Make A the subject. [1 mark]

Answer / mark points: $A = F / p$.

Review cue: Divide force by pressure.

5. The density relationship is $\rho = m/V$. Make V the subject. [1 mark]

Answer / mark points: $V = m / \rho$.

Review cue: Volume is mass divided by density.

6. The energy relationship is $E = Pt$. Make t the subject. [1 mark]

Answer / mark points: $t = E / P$.

Review cue: Time is energy divided by power.

7. The frequency relationship is f = 1/T. Make T the subject. [1 mark]

Answer / mark points: T = 1 / f.
Review cue: This is a reciprocal relationship.

8. The motor-effect relationship is F = B I ℓ. Make I the subject. [1 mark]

Answer / mark points: I = F / (B ℓ).
Review cue: Keep B and ℓ together in the denominator.

9. A sensor has a potential difference of 1.80 V across it and a current of 0.0750 A through it. Use V = IR to calculate its resistance. [2 marks]

Answer / mark points: R = V / I = 1.80 / 0.0750 = 24.0 Ω.
Review cue: Rearrange first and give the resistance unit.

10. A 12.0 V heater transfers energy at a rate of 48.0 W. Use P = IV to calculate the current through the heater. [2 marks]

Answer / mark points: I = P / V = 48.0 / 12.0 = 4.00 A.
Review cue: Power is divided by potential difference.

11. A 250 g aluminium block absorbs 3.78×10^4 J of energy. The specific heat capacity of aluminium is 840 J kg^{-1} K^{-1}. Use E = mcΔθ to calculate the temperature rise of the block. [3 marks]

Answer / mark points: m = 0.250 kg. Δθ = E / (mc) = 3.78×10^4 / (0.250 × 840) = 180 K (or 180 °C rise).
Review cue: Convert grams to kilograms before substituting.

12. A test trolley increases its speed from 4.00 m s^{-1} to 16.0 m s^{-1} over a distance of 120 m. Use $v^2 = u^2 + 2as$ to calculate its acceleration. [3 marks]

Answer / mark points: $a = (v^2 - u^2) / (2s) = (16.0^2 - 4.00^2) / (2 \times 120) = 1.00$ m s^{-2}.
Review cue: Square both speeds before subtracting.

13. A gas sample has a pressure of 1.20×10^5 Pa, a volume of 4.00×10^{-3} m^3 and an amount of 0.200 mol. Use $pV = nRT$, where $R = 8.31$ J mol^{-1} K^{-1}, to calculate its temperature. [3 marks]

Answer / mark points: $T = pV / (nR) = (1.20 \times 10^5 \times 4.00 \times 10^{-3}) / (0.200 \times 8.31) = 289$ K (3 s.f.).
Review cue: Keep p in Pa and V in m^3.

14. A 0.400 kg mass oscillates on a spring with a period of 1.60 s. Use $T = 2\pi\sqrt{(m/k)}$ to calculate the spring constant k. [4 marks]

Answer / mark points: $T^2 = 4\pi^2 m / k$, so $k = 4\pi^2 m / T^2 = (4\pi^2 \times 0.400) / 1.60^2 = 6.17$ N m^{-1}.
Review cue: Square T to remove the square root before isolating k.