Cumulative test Unit 1. Worked solutions to the multiple choice questions.

Q	Ans	Explanation
1	D	They collide elastically because if they didn't there would be loss of energy with each collision and they would eventually stop moving and exert no pressure on the walls of the container. This obviously doesn't happen as a can of spray paint will stay pressurised for a long time. Option (A) is wrong as the KE changes with every collision. Option (B) is wrong as explained above. Lastly, Option (C) is wrong as the molecules have a range of speeds at a given temperature but the average speed is constant at a given temperature.
2	B	Here's the calculation. Personally, I'd cancel down a lot more earlier on in the calculation but I've left it in case you are having trouble. The trick is to get the negative correct on the left hand side. $$\begin{aligned} -Q_{lost} &= Q_{gained} \\ -m_{Al}c_{Al}\Delta T_{Al} &= m_w c_w \Delta T_w \\ -100\times10^{-3}\times c_{Al}\times(T_f - T_i) &= 50\times10^{-3}\times4180\times(T_f - T_i) \\ -100\times900\times(T_f - 100.0) &= 50\times4180\times(T_f - 10) \\ -90000T_f + 9000000 &= 209000T_f - 2090000 \\ 9000000 + 2090000 &= 209000T_f + 90000T_f \\ 11090000 &= 299000T_f \\ T_f &= \frac{11090000}{299000} \\ &= 37.1^\circ C \end{aligned}$$
3	B	During a phase change (liquid to vapour) the temperature doesn't change even as energy is added. That's because the microscopic potential energy is increasing as the particles break away from each other, but their microscopic kinetic energy is not increasing. They are not vibrating or moving around any faster. Because their KE remains constant their temperature doesn't rise.
4	A	The work done by your arms pushing down increases the temperature and increases the KE of the particles. That is the best answer. Admittedly, they do increase the rate of collisions with each other and with the walls of the container but that is a result of them moving faster, not a cause of them moving faster. Pushing down and doing work on the gas is the cause.
5	B	To get a balanced equation you need to have an electron (beta negative particle, β^-) on the product side: ${}^{32}_{15}P \rightarrow {}^{32}_{16}S + {}^{0}_{-1}e + \overline{\nu}_e$. You should know that associated with the production of a beta negative particle is an electron antineutrino (see NCPQ U1&2 page 167).
6	C	You can see that the product ${}^{4}_{2}He$ is larger than either of the two reactants. So we have two light nuclei fusing to form a heavier nucleus. This is the essence of 'nuclear fusion'.
7	B	V = W/q = 60/15 = 4 V
8	A	Twice the length means twice (2 ×) the resistance. Twice the diameter means ¼ of the old resistance. Thus 2 × ¼ = ½ $R_{old.}$

Explanations for Unit 1 Cumulative Test MCQ in Oxford University Press *New Century Physics for Queensland* Units 1 & 2 Teacher obook assess ISBN 9780190310202.

		$R_{old} = \frac{\rho L_{old}}{A_{old}} = \frac{\rho L_{old}}{\pi r_{old}^{\ 2}}$ $R_{new} = \frac{\rho \times (2 \times L_{old})}{\pi \times (2r_{old})^2}$ [twice the diameter also means twice the radius] $R_{new} = \frac{2}{4} \times \frac{\rho L_{old}}{\pi r_{old}^{\ 2}}$ $R_{new} = \frac{1}{2} R_{old}$
9	D	Ohm's law says that $I = \frac{V}{R}$ so that if you keep the resistance the same and increase the voltage the current will increase proportionally. This applies to most metals such as copper, gold, aluminium and nichrome. However, it doesn't apply to semiconductors such as that found in diodes. You may have done an experiment with diodes and found that the V/I graph was not directly proportional (or even linear). See NCPQ U1&2 page 234-236 for a description.
10	C	Firstly, determine the total resistance of the circuit by working out the effective resistance of the two 4Ω bulbs in parallel. Use the parallel resistance formula: $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$ $R_T = 2\Omega$ Now work out the total current (flowing through A_1 or A_2): V = IR I = V/R = 24/2 = 12 A Now work out the current through each of A_2 and A_3. The 12 A current will split in two equal currents of 6 A each as the resistances of the two bulbs are equal. So 6 A will flow through A_2 and A_3 each. Hence: 12, 6, 6, 12 A