A-Level Physics: **w25 11**

Question 32 (Answer: **C**)

- Charge is quantised: any charge must be a whole-number multiple of $e = 1.60 \times 10^{-19}$ C.
- Divide each option by e: A gives 0.4, B gives 2.5 and D gives 56.9.
- Only C gives a whole number, exactly 7.0.

A-Level Physics: **w25 14**

Question 35 (Answer: **D**)

- $Q = It = 5.6 \times 20 = 112$ C.
- $N = Q/e = 112/(1.60 \times 10^{-19})$.
- $= 7.0 \times 10^{20}$ electrons.

A-Level Physics: **s25 12**

Question 34 (Answer: **C**)

- $I = V/R = 4.00/200 = 0.0200$ A.
- $Q = It = 0.0200 \times 4.00 = 0.0800$ C.
- $N = Q/e = 0.0800/(1.60 \times 10^{-19}) = 5.00 \times 10^{17}$.

A-Level Physics: **s25 13**

Question 4 (Answer: **B**)

- Rearranged, $k = (Q/t)L/(A\,\Delta T)$.
- Q/t is a power, kg m^2 s^{-3}; multiplying by m and dividing by m^2 leaves kg m s^{-3}.
- A temperature difference in SI *base* units is the kelvin, so k is kg m s^{-3} K^{-1} – the degree Celsius is not a base unit.

Question 32 (Answer: **C**)

- In $I = nAve$ the product Av is a volume swept out per second.
- Multiplying by n must give a number of electrons per second, so n counts electrons per unit volume.
- "Density" on its own would suggest mass per unit volume, a different quantity.

A-Level Physics: **s25 14**

Question 29 (Answer: **D**)

- $I = V/R = 6.0/10 = 0.60$ A.
- $t = 24 \times 3600 = 86\,400$ s, so $Q = It = 51\,840$ C.
- $N = Q/e = 51\,840/(1.60 \times 10^{-19}) = 3.2 \times 10^{23}$.

A-Level Physics: **m25 12**

Question 30 (Answer: **D**)

- They are in series, so the current is the same in both – the same number of carriers passes each second.
- $I = nAve$, and n is the same because the material is the same.
- Y has the smaller area, so its drift speed must be *higher* to carry that same current.

A-Level Physics: **m25 22**

6(a)	$V = IR$ $= 0.85 \times 3.3 \times 10^{-3}$
	$= 2.8 \times 10^{-3}$ V
6(b)(i)	($A =$) $\rho L / R$
	$= 1.8 \times 10^{-8} \times 0.24 / 3.3 \times 10^{-3} = 1.3 \times 10^{-6}$ (m^2)
6(b)(ii)	(n =) $2.6 \times 10^{22} / (1.3 \times 10^{-6} \times 0.24) = 8.3 \times 10^{28}$ (m^{-3})
6(b)(iii)	$v = I / nAq$ $= 0.85 / (8.3 \times 10^{28} \times 1.3 \times 10^{-6} \times 1.6 \times 10^{-19})$
	$= 4.9 \times 10^{-5}$ m s^{-1}
	OR $v = IL / Nq$ $= 0.85 \times 0.24 / (2.6 \times 10^{22} \times 1.6 \times 10^{-19})$
	$= 4.9 \times 10^{-5}$ m s^{-1}
6(c)(i)	Length (of Q) is greater (than P)
	(Average cross-sectional) area (of Q) is less (than P)
	Resistance is proportional to length / (cross-sectional) area
	(so) the resistance (of Q) is greater (than P)
6(c)(ii)	A line starting from a non-zero value of drift speed at distance = 0
	A line with an increasing positive gradient