

6	<p>C is the correct answer as $\mathcal{E} = I(R + r)$</p> <p>A is not the correct answer as this does not include the effect of r B is not the correct answer as this does not include the effect of R D is not the correct answer as the two resistances are subtracted instead of added.</p>	(1)
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1	<p>B is the correct answer</p> <p>A is not correct the resistance of a metal increases with temperature C is not correct because resistance of a thermistor decreases with temperature and resistance of a metal increases with temperature D is not correct because resistance of a thermistor decreases with temperature</p>	1
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2	<p>C is the correct answer</p> <p>A is not correct because the number of conduction electrons should increase B is not correct because the number of conduction electrons should increase and the resistance should decrease D is not correct because the resistance should decrease</p>	
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7	<p>D is the correct answer as coherence can only occur if the waves have the same frequency</p> <p>A is not the correct answer as coherence does not require waves to be in antiphase, they just need a constant phase difference B is not the correct answer as coherence does not require waves to be in phase, they just need a constant phase difference C is not the correct answer as waves can still be coherent, even if their amplitudes are different.</p>	(1)
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Question Number	Answer	Mark
17a	Use of $V = W / Q$ or $W = VIt$ (1) $\epsilon = 1.56$ (V) (1) Use of $V = IR$ (1) Sum of e.m.f.s = Sum of p.d.s Or see $\epsilon = V + Ir$ (1) $r = 2.6 \Omega$ (1) OR Use of $W = Pt$ With $P = I^2R$ (1) with $R = r + 12$ (1) All other data correctly substituted ($50 = (0.107)^2 (r + 12) 300$) (1) $r = 2.6 \Omega$ (1) <u>Example of calculation</u> $\epsilon = W / Q = (50 \text{ J}) / (0.107 \text{ A})(300 \text{ s}) = 1.56 \text{ V}$ $\epsilon = IR + Ir, 1.56 \text{ V} = (0.107 \text{ A}) (12 \Omega) + (0.107 \text{ A}) r,$ $r = 2.56 \Omega$ (1)	5
17b	(Increasing R) decreases I Or (Increasing R) gives R a greater share of the total resistance in the circuit (1) Less p.d. across internal resistance Or Ir becomes less (1) (Accept decrease in 'lost volts')	2
17c	Take readings for p.d. and current (1) Change resistance / R (1) Plot a graph of V against I (1) Gradient is $-r$. (1) (MP4 conditional on MP3) (Allow MP3/4 for graph of I - V with gradient $-1/r$) (A sketch graph of V - I with the gradient labelled $-r$ can achieve MP3/4)	4
Total for question 17		11

12	Use of $R = \frac{V}{I}$	(1)	3
	Use of $I = \frac{\Delta Q}{\Delta t}$	(1)	
	Time taken = 4.2 s	(1)	
	Or		
	Use of $P = \frac{V^2}{R}$	(1)	
	Use of $P = \frac{W}{t}$ and $V = \frac{W}{Q}$	(1)	
	Time taken = 4.2 s	(1)	
<u>Example calculation</u>			
$I = \frac{8.9 \text{ V}}{7.5 \Omega} = 1.19 \text{ A}$			
$\Delta t = \frac{5.0 \text{ C}}{1.19 \text{ A}} = 4.20 \text{ s}$			
Total for question 12			3

Question Number	Acceptable Answer	Additional Guidance	Mark
11	Use of $R = \frac{\rho l}{A}$	(1)	3
	calculates $A = \pi r^2$	(1)	
	Diameter = $5.2 \times 10^{-4} \text{ m}$	(1)	
		<u>Example of calculation</u> $A = \frac{5.6 \times 10^{-8} \Omega \text{ m} \times 0.25 \text{ m}}{65 \times 10^{-3} \Omega} = 2.15 \times 10^{-7} \text{ m}^2$ $d = \sqrt{\frac{4 \times 2.15 \times 10^{-7} \text{ m}^2}{\pi}} = 5.24 \times 10^{-4} \text{ m}$	

(Total for Question 11 = 3 marks)