

Unit 2 6PH02_01

Question Number	Answer	Mark
1	C	(1)
Total for question		1

Question Number	Answer	Mark
2	D	(1)
Total for question		1

Question Number	Answer	Mark
3	B	(1)
Total for question		1

Question Number	Answer	Mark
4	B	(1)
Total for question		1

Question Number	Answer	Mark
5	C	(1)
Total for question		1

Question Number	Answer	Mark
6	A	(1)
Total for question		1

Question Number	Answer	Mark
7	B	(1)
Total for question		1

Question Number	Answer	Mark
8	D	(1)
Total for question		1

Question Number	Answer	Mark
9	A	(1)
Total for question		1

Question Number	Answer	Mark
10	A	(1)
Total for question		1

Question Number	Answer	Mark
11	Use of $V = IR$ to find total resistance or terminal p.d.	1
	Subtraction of resistance or p.d.s	1
	$r = 8.2 \Omega$ (accept 8Ω)	1
	OR see $E = I(R+r)$	1
	Substitution of values into equation	1
	$r = 8.2 \Omega$ (accept 8Ω)	1
	Example of answer	
	Total $R = 1.5 \text{ V} \div (17 \times 10^{-3} \text{ A}) = 88.2 \Omega$	
	$r = 88.2 - 80 = 8.2 \Omega$	
	Total for question	3

Question Number	Answer	Mark
12	Attempt to use $I = Q / t$	1
	use of $e = 1.6 \times 10^{-19}$	1
	$I = 2.8 \times 10^6 \text{ A [C s}^{-1}\text{]}$	1
	[omit e gives answer 1.73×10^{25} scores 1]	
	Example of answer	
	$I = (2.6 \times 10^{26} \times 1.6 \times 10^{-19} \text{ C}) \div 15 \text{ s}$	
	$I = 2.77 \times 10^6 \text{ A}$	
	Total for question	3

Question Number	Answer	Mark
13(a)	Diffraction is the spreading out of the wave	1
	As it passes through an aperture/around an obstacle	1
(b) (i)	Electrons can behave as waves OR electrons have wave like properties OR electrons act like wave particles	1
(ii)	$\lambda \approx$ spacing/gap between atoms OR the size of the atoms OR spacing/gap in the graphite	1

	Total for question	4
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Question number	Answer	Mark
14(a)	Doppler	1
(b)	<p>MAX 3</p> <p>Ambulance moving towards, higher frequency/pitch (1) Wavelength shorter/waves bunch together (1)</p> <p>Ambulance moving away, lower frequency/pitch (1) wavelength increased/waves spread out (1) (wavelength marks may be awarded on a diagram)</p>	Max 3
(c)	Reference to a higher/lower frequency/wavelength/pitch scores 1 Change in frequency is greater OR even higher/ lower frequency OR range of frequencies greater scores 2	2
Total for question		6

Question Number	Answer	Mark
15(a)	Use of $V=IR$ $V = 3.0 \text{ V}$	1 1
(b)	pd across 30Ω resistor = 6.0 V ecf their answer (a) $I_2 = 6.0/30 = 0.20 \text{ A}$	1 1
(c)	$I_1 = 0.60 - 0.20 = 0.40 \text{ A}$ $R = 15 \Omega$ full ecf their answer for I_2 and their V across 30Ω	1 1
Total for question		6

Question Number	Answer	Mark
16	<p>The answer must be clear and organised in a logical sequence</p> <ul style="list-style-type: none"> • Different currents / current divides in parallel circuit(1) • • Same potential difference/voltage across each lamp (1) • • Use of $P = V^2 / R$ OR $P = VI$ if identified $I_A < I_B$ (1) • Leading to high resistance, smaller power (1) • • lamp B will be brighter/ lamp A dimmer (1) • • Each electron loses the same energy (1) • There are more electrons/sec in B (1) • Hence greater total energy loss /sec in B (1) 	
		Max 5
	Total for question	5

Question Number	Answer	Mark
17 (a)	<p>A statement which implies only certain energies are allowed e.g.</p> <p>Allowed/possible energy of atom/electron (in an atom)</p> <p>Discrete energy of an atom/electron</p> <p>One of the energies of the atom/electron</p> <p>Energy an atom/electron can have</p>	1
(b)	<p>Photon is a (discrete) package/package/quantum of (electromagnetic) energy/particle of light</p>	1

(c)	(energy of) E_2 - (energy of) E_1	1
(d)	See $E = h c / \lambda$ OR use of $v = f\lambda$ Substitution into $E = h c / \lambda$ OR use of $E = hf$ $E = 3.14 \times 10^{-19} \text{ J}$ or 1.96 eV Example of answer $E = (6.63 \times 10^{-34} \text{ Js} \times 3 \times 10^8) \div 6.33 \times 10^{-7} \text{ m}$ $E = 3.14 \times 10^{-19} \text{ J}$	1 1 1
Total for question		6

Question Number	Answer	Mark
18	Addition of words (order essential) photon metal energy (allow mass, charge, momentum) (photo)electron work function (of the metal)	1 1 1 1 1
Total for question		5

Question Number	Answer	Mark
19(a)	Ray drawn along edge of prism (labelled X) (ignore a reflected ray)	1
(b)(i)	$n = 3 \times 10^8 \div 1.96 \times 10^8$ $n = 1.53$ (no unit, ue if one given)	1 1
(b)(ii)	Use of \sin (critical angle) = $1/n$ OR use of $\sin i/\sin r = v_1/v_2 = n$ $c = 41^\circ$	1 1
(c)	Red light: refraction towards normal at first face but less than refraction for blue light Refracts into air at second face with angle in air > angle in glass	1 1
Total for question		7

Question Number	Answer	Mark
20(a)	<p>The answer must be clear, organised in a logical sequence and uses specialist vocabulary</p> <p>Interference (pattern) produced / superposition occurs/ standing wave formed</p> <p>Maxima related to constructive interference/antinode and/or minima related to destructive interference/node</p> <p>Maxima/antinode formed where the waves are in phase / path difference $n\lambda$</p> <p>Minima/node formed where the waves are in antiphase / path difference = $(n+\frac{1}{2})\lambda$</p> <p>[out of phase is not sufficient]</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
(b)(i)	<p>Distance between adjacent maxima = $\lambda/2$</p> <p>Wavelength = 0.1 m</p>	<p>1</p> <p>1</p>
(b)(ii)	<p>Use of $v = f \lambda$ with their λ from (b)(i)</p> <p>Speed = 330 m s^{-1} ecf their λ</p> <p>Example of answer</p> <p>$v = 3300 \times 0.1$</p> <p>$v = 330 \text{ m s}^{-1}$</p>	<p>1</p> <p>1</p>
(c)(i) and (ii)	<p>(mark (i) and (ii) as one section</p> <p>(minima never zero) because there is not complete cancellation/overall displacement is not zero/ not total destructive interference</p> <p>Because the waves have different amplitudes/amplitude decreases with distance</p> <p>OR</p> <p>energy loss due to reflection or spreading out</p>	<p>1</p>

	OR	1
	reflection off other surfaces	
	As the microphone moves towards the plate, the path difference decreases	1
	Amplitudes (of waves) get similar	1
	Total for question	12

Question Number	Answer	Mark
21(a)	<u>Effect of stretching wire</u> Refers to $R = \rho l / A$ Increasing length leads to increase in resistance Decreasing area leads to increase in resistance [must relate thinner to area] [last two points may be combined to give single statement, can score both marks]	 1 1 1
(b)	<u>Resistance calculation</u> Use of $R = \rho l / A$ × 8 $R = 0.22 \text{ } (\Omega)$ [Omitting x8 gives $R = 0.028 \text{ } \Omega$ scores 1] Example of answer $R = (9.9 \times 10^{-8} \text{ } \Omega \text{ m}) \times (8 \times 0.025 \text{ m}) \div 0.9 \times 10^{-7} \text{ m}^2$ $R = 0.22 \text{ } \Omega$	 1 1 1
(c)	<u>Relationship and increase in R</u>	
(i)	Attempts to substitute for $A = V/l$ in $R = \rho l / A$ $R = \rho l^2 / V$	 1 1
(ii)	Any attempt to relate original resistance of gauge to 2.5^2 (possibly × 8, cm or m) Relates this to resistance associated with increase in length Change in resistance = $1.76 \times 10^{-3} \text{ } \Omega$ OR Uses $V=lA$ to find new area Uses this A with new length to find new R Change in resistance = $1.76 \times 10^{-3} \text{ } \Omega$ [if candidate assumes A constant and finds new R and $\Delta R = 0.001 \text{ } \Omega$, score 1 mark] Example of answer	 1 1 1 1 1 1

	$\text{New } R = \left(\frac{2.51^2}{2.5^2} \times 0.22 \right) - 0.22$ $\Delta R = 1.76 \times 10^{-3} \Omega$	
(d)	<u>Zigzag pattern</u> Each section of wire increases in length/gives a longer total length/long wire in small space Small change in length of gauge leads to larger change in resistance	1 1
	Total for question	13