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 $8\ \Omega$)	**1**
	OR see $E = I(R+r)$	**1**
	Substitution of values into equation	**1**
	$r = 8.2\ \Omega$ (accept $8\ \Omega$)	**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**
	$I = 2.8 \times 10^{6}$ A [C s^{-1}]	**1**
	[omit e gives answer 1.73×10^{25} scores 1]	
	Example of answer	
	$I = (2.6 \times 10^{26} \times 1.6 \times 10^{-19}\ \text{C}) \div 15\ \text{s}$	
	$I = 2.77 \times 10^{6}$ 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

Question number	Answer	Mark
14(a)	Doppler	1
(b)	**MAX 3** **Ambulance moving towards**, higher frequency/pitch (1) Wavelength shorter/waves bunch together (1) **Ambulance moving away**, lower frequency/pitch (1) wavelength increased/waves spread out (1) (wavelength marks may be awarded on a diagram)	
		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 V	**1** **1**
(b)	pd across 30 Ω resistor = 6.0 V ecf their answer (a) I_2 = 6.0/30 = 0.20 A	**1** **1**
(c)	I_1 = 0.60 – 0.20 = 0.40 A R = 15 Ω full ecf their answer for I_2 and their V across 30 Ω	**1** **1**
	Total for question	**6**

Question Number	Answer	Mark
16	The answer must be clear and organised in a logical sequence • 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)	A statement which implies only certain energies are allowed e.g. Allowed/possible energy of atom/electron (in an atom) Discrete energy of an atom/electron One of the energies of the atom/electron Energy an atom/electron can have	**1**
(b)	Photon is a (discrete) package/packet/quantum of (electromagnetic) energy/particle of light	**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 $E = hf$ $E = 3.14 \times 10^{-19}$ J or 1.96 eV **Example of answer** $E = (6.63 \times 10^{-34}$ Js $\times 3 \times 10^{8}) \div 6.33 \times 10^{-7}$ m $E = 3.14 \times 10^{-19}$ 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^{o}	**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)	The answer must be clear, organised in a logical sequence and uses specialist vocabulary	
	Interference (pattern) produced / superposition occurs/ standing wave formed	**1**
	Maxima related to constructive interference/antinode **and/or** minima related to destructive interference/node	**1**
	Maxima/antinode formed where the waves are in phase / path difference nλ	**1**
	Minima/node formed where the waves are in antiphase / path difference = (n+½)λ	**1**
	[out of phase is not sufficient]	
(b)(i)	Distance between adjacent maxima = λ/2	**1**
	Wavelength = 0.1 m	**1**
(b)(ii)	Use of $v = f\lambda$ with their λ from (b)(i)	**1**
	Speed = 330 m s^{-1} ecf their λ	**1**
	Example of answer	
	$v = 3300 \times 0.1$	
	$v = 330$ m s^{-1}	
(c)(i) and (ii)	(mark (i) and (ii) as one section	
	(minima never zero) because there is not complete cancellation/overall displacement is not zero/ not total destructive interference	**1**
	Because the waves have different amplitudes/amplitude decreases with distance	
	OR	
	energy loss due to reflection or spreading out	

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

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

	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**