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 $R = 1.5\ V \div (17 \times 10^{-3}\ A) = 88.2\ \Omega$	
	$r = 88.2 - 80 = 8.2\ \Omega$	
	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	
	$I = (2.6 \times 10^{26} \times 1.6 \times 10^{-19}\ C) \div 15\ s$	
	$I = 2.77 \times 10^{6}$ 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 [out of phase is not sufficient]	**1**
(b)(i)	Distance between adjacent maxima = λ/2 Wavelength = 0.1 m	**1** **1**
(b)(ii)	Use of $v = f\lambda$ with their λ from (b)(i) Speed = 330 m s^{-1} ecf their λ **Example of answer** $v = 3300 \times 0.1$ $v = 330$ m s^{-1}	**1** **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)	<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 (Ω) [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	 **1** **1** **1**
(c) **(i)**	<u>Relationship and increase in R</u> Attempts to substitute for $A = V/I$ 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 = 1.76×10^{-3} Ω **OR** Uses $V=IA$ to find new area Uses this A with new length to find new R Change in resistance = 1.76×10^{-3} Ω [if candidate assumes A constant and finds new R and ΔR = 0.001 Ω, score 1 mark] **Example of answer**	**1** **1** **1** **1** **1** **1**

	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**