Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Mark Schemes

Q1.

Question Number	Answer		Mark
(a)	**When illuminated:** Use of the word photon photons/light cause emission of (photo)electrons Idea that (photo) electrons form a current photon energy greater than or equal to work function. **In darkness:** No photons so no photoelectrons released	(1) (1) (1) (1) (1)	5
(b)	Use of $E = hf$ Conversion of eV to J One of the 4 values below correct $f = 5.2 \times 10^{14}$ Hz or $\lambda = 5.8 \times 10^{-7}$ m for caesium $f = 8.8 \times 10^{14}$ Hz or $\lambda = 3.4 \times 10^{-7}$ m for zinc Comment that Cs is in the visible range or Zn is ultraviolet – allow even without supporting calculation **Alternative method** Allow assumed max freq/min wavelength for visible light then, calculation of work function, quoted in eV, comparison with given work functions, conclusion: Use of (1); work fn (1), in eV (1), comparison (1) Example of calculation $f = \varphi \div h = (2.14 \times 1.6 \times 10^{-19})$ J $\div 6.63 \times 10^{-34}$ J s $= 5.2 \times 10^{14}$ Hz for caesium $f = \varphi \div h = (3.63 \times 1.6 \times 10^{-19})$ J $\div 6.63 \times 10^{-34}$ J s $= 8.8 \times 10^{14}$ Hz for zinc	(1) (1) (1) (1)	4
(ci)	Maximum displacement of the wave **Or** maximum displacement from the mean **Or** maximum displacement from equilibrium	(1)	1

(cii)	**Max 3** Size of the gap (in the soundtrack) determines the amount of light **(1)** Amount of light determines number of photons **(1)** Number of photons determines number of (photo) electrons (released by phototube) **(1)** Number of electrons determines size of current (in the circuit) **(1)** (Combining MP 1 and 2 by writing "size of the gap determines number of photons" scores 1 mark. Combining MP 2 and 3 by writing "the amount of light determines number of (photo) electrons" also scores 1 mark)	**3**
	Total for question	**13**

Q2.

Question Number	Acceptable answers	Additional guidance	Mark
(i)	• Use of cross-sectional area = πr^2 **Or** $\frac{\pi d^2}{4}$ **(1)** • Use of $R = \frac{\rho l}{A}$ **(1)** • Correct use of factor of 14 **(1)** • Use of $P = \frac{V^2}{R}$ **(1)** • $P = 52$ W **(1)**	Example of calculation $A = \pi(1.9 \times 10^{-5}\ \text{m})^2 = 1.134 \times 10^{-9}\ \text{m}^2$ $R = \frac{(5.6 \times 10^{-8}\ \Omega\text{m})(1.6\ \text{m})}{1.134 \times 10^{-9}\ \text{m}^2} = 79.01\ \Omega$ $R_{max} = 14 \times 79.01\ \Omega = 1106.2\ \Omega$ $P = = \frac{(240\ V)^2}{1106.2\ \Omega} = 52.1$ W	**5**

Question Number	Acceptable answers	Additional guidance	Mark
(ii)	**Either** • Initially(the resistance is low so) current will be the greatest (1) • As $P = I^2R$, the greatest power is transferred (1) • Change in current has more effect as it is squared (1) • Heating effect greatest when R is lowest, so breaks when switched on. (1) **OR** • p.d. is constant (1) • $P = V^2/R$ (1) • Power is greatest when R is lowest (1) • Heating effect is greatest when R is lowest, so breaks when switched on (1) **OR** • p.d. is constant (1) • Initially (resistance is low so) current will be the greatest (1) • As P=IV the greatest power is transferred • Heating effect is greatest when R is lowest, so breaks when switched on		4