Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable Answers	Additional guidance	Mark
	• Use of $n = \frac{c}{v}$ (1) • Use of $n_1 sin\theta_1 = n_2 sin\theta_2$ (1) • Uses $\sin C = \frac{1}{n}$ (1) • Comparison of $C = 50°$ with 30° and conclusion (1)	Example of Calculation $n_{\text{(air-water)}} = \frac{3.0 \times 10^8}{2.25 \times 10^8} = 1.33$ $\sin 40 = 1.33 \sin\theta_2$ $\theta_2 = 29°$ At X: $\sin C = \frac{1}{1.33}$ $C = 49° > 29°$ so refracted	4

Q2.

Question Number	Acceptable Answers	Additional guidance	Mark
	• Use of $m = \frac{v}{u}$ (1) • Use of $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ (1) • Use of $P = \frac{1}{f}$ (1) • Use of $P = P_1 + P_2 = 5\text{D}$ therefore use one lens with power of 2 (D) and one with power of 3 (D) (1)	Example of Calculation $v = 0.5 \text{ x } 0.6 \text{ m} = 0.3 \text{ m}$ $\frac{1}{f} = \frac{1}{0.6 \text{ m}} + \frac{1}{0.3 \text{ m}}$ $f = 0.2 \text{ m}$ $P = 1/0.2 \text{ m} = 5\text{D}$	4

Q3.

Question Number	Acceptable answers	Additional guidance	Mark
	• One electron absorbs one photon (1) • Photon energy is proportional to frequency **Or** Photon energy is equal to hf (1) • The (photon) energy is less than the work function of the metal (if frequency is below the threshold) **Or** electron gains insufficient energy to be released (if frequency is below a certain value) (1)		3

Q4.

Question Number	Acceptable answers	Additional guidance	Mark
(i)	• Use of $E = \frac{1}{2}mv^2$ with $E = 2.9 - 3.0 \times 10^{-19}$ J (1) • $v = 8 \times 10^5$ m s^{-1} (1)	Example of calculation $v = \sqrt{\frac{2 \times 2.9 \times 10^{-19}\ \text{J}}{9.11 \times 10^{-31}\ \text{kg}}} = 7.98 \times 10^5$ m s^{-1}	2
(ii)	• Use of $hf_0 = \emptyset$ *with* $f_0 = 5.4 - 5.6 \times 10^{14}$ Hz **Or** Extrapolates graph to y axis (1) • Conversion between J and eV (1) • $\emptyset = 2.1$ to 2.4 eV **and** the metal was caesium (1)	Example of calculation $\emptyset = 3.6 \times 10^{-19}$ J $= (3.6 \times 10^{-19}\ \text{J}) / (1.6 \times 10^{-19}\ \text{C})$ $= 2.3$ eV	3

Q5.

Question Number	Acceptable answers	Additional guidance	Mark
	EITHER • Equates $v = f\lambda$ and $v = \sqrt{\frac{T}{\mu}}$ **(1)** • Uses $\lambda = 2l$ **(1)** • $l = 0.27$ m **(1)** • Comparison of their value of l to 0.21 and 0.63 m **and** conclusion consistent with their answer **(1)** **OR** • Equates $v = f\lambda$ and $v = \sqrt{\frac{T}{\mu}}$ **(1)** • Uses $\lambda = 2l$ **(1)** • $f = 84$ Hz **and** 252 Hz **(1)** • Comparison of 196 Hz to their values of f **and** a conclusion consistent with their answer **(1)**	Example of calculation $l = \frac{1}{2\times 196\ \text{Hz}}\sqrt{\frac{56\ \text{N}}{5\times 10^{-3}\ \text{Kg m}^{-3}}} = 0.27\ \text{m}$	**4**