Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable answers		Additional guidance	Mark
(a)	• (UV radiation consists of) photons • One photon interacts with one electron **Or** energy of photon depends on frequency • Electrons released if energy (of photon) greater than work function **Or** frequency is greater than threshold frequency **Or** energy supplied is sufficient to remove electron	(1) (1) (1)	Accept quanta/packets of energy	3

Question Number	Acceptable answers		Additional guidance	Mark
(b)(i)	• when slider at the bottom - reading on voltmeter is zero **Or** minimum resistance - reading on voltmeter is zero • When slider at the top – reading on voltmeter is 1.5 V **Or** maximum resistance - reading on voltmeter is 1.5 V • Potential difference split between top and bottom part of resistor (either side of slider) **Or** reading on voltmeter depends on the ratio of resistances (either side of slider) **Or** moving the slider changes the resistance that the voltmeter is across	(1) (1) (1)		3

Question Number	Acceptable answers		Additional guidance	Mark
(b)(ii)	Maximum Kinetic Energy of electron = 0.6 (eV)	(1)		1

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Question Number	Acceptable answers		Additional guidance	Mark
(c)	**Max 4** Valid because: • Moon and photocell both have vacuum • Both demonstration and theory use photoelectric effect Not valid because: • Different wavelengths in each case • On the moon there is dust not metal • Dust is free to move but the metal plate is fixed • On the moon UV removes electrons from (individual) <u>atoms</u> **and** in the demo light removes electrons from metal <u>surface</u> • Demonstration is based on photoelectric effect but effect on moon could be ionisation	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)**	Full marks can only be scored if a correct link is made between at least one physics point and the demonstration being valid or not valid Accept the same concept for photoelectric effect Accept one uses light the other UV Accept different materials for MP4	**4**

Q2.

Question Number	Acceptable answers		Additional guidance	Mark
(i)	• Use of $V = {}^{Q}/_{4\pi\varepsilon_0 r}$ • Identifies number of (positive) charges for alpha or gold nucleus • Use of $W = VQ$ • $r = 5 \times 10^{-14}$ m so textbook statement is correct **Or** $V = 7.27 \times 10^{-13}$ J so textbook statement is correct (MP4 dependent on MP1)	**(1)** **(1)** **(1)** **(1)**	<u>Example of calculation</u> 7.30×10^{-13} J = $\left(\frac{8.99\times10^{9}\text{Nm}^2\text{C}^{-2}\times79\times1.6\times10^{-19}\text{C}}{r}\right)\times2\times1.6\times10^{-19}\text{C}$ $r = 4.98 \times 10^{-14}$ m	**4**

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(ii)	• Use of $E_k = \frac{p^2}{2m}$ • Converts atomic mass to kg • $p = 9.9 \times 10^{-20}$ kg m s^{-1}	(1) (1) (1)	Accept Use of $Ek = \frac{1}{2}mv^2$ and $p = mv$ Example of calculation 7.30×10^{-13} J $= p^2/2 \times 4 \times 1.66 \times 10^{-27}$kg $p = 9.9 \times 10^{-20}$ kg m s^{-1}	3

Q3.

Question Number	Answer		Mark
(a)(i)	Determines width of at least 9 coils Use of half of their diameter in πr^2 Area = (1.96 to 2.42) × 10^{-7} (m^2) Example of calculation 18 coils = 1.00 cm Diameter = 0.0100 m ÷ 18 = 5.56×10^{-4} m Area = $\pi \times (5.56 \times 10^{-4} \div 2)^2$ Area = 2.42×10^{-7} m^2	(1) (1) (1)	3
(a)(ii)	Use of $R=\rho l/A$ Resistivity magnitude = 4.4×10^{-7} (show that value gives 3.7×10^{-7}) Unit Ωm Example of calculation $\rho=RA / l$ = 22 Ω x 2.4×10^{-7} m^2 / 12 m = 4.4×10^{-7} Ωm	(1) (1) (1)	3
(a)(iii)	A sensible response with some detail, e.g. • Avoid difficulty in reading a small scale while holding it and counting turns • it can be enlarged and done more accurately • compare with unravelling and using a micrometer • remains stationary, so easier to measure accurately • you can mark the coils as you go so you don't lose count (treat parallax as neutral and)	(1)	1
(b)	Use of ratio of lengths × pd V = 8.2 V Example of calculation V = (7.0 cm / 10.2 cm) × 12 V = 8.2 V	(1) (1)	2
	Total for question		9

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