Name of the Student:_____
Max. Marks : 27 Marks **Time : 27 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
	• States $P = IV$ (1) • any two corresponding values of I and V used to calculate a value of P (1) • observation that at different times P is negative or positive (1) • Overall power dissipated by capacitor is zero (1)	Graph could be marked with values/lines/power curve Alternative MP2: recognise the symmetry of either quarter or half cycles of the graphs	4

Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	• The alpha particles ionise the air (inside the chamber) (1) • This produces (moving) electrons inside the chamber (1)	If no other marks scored, allow MAX 1 for alpha particles are charged and attracted to (negative) electrode and current produced	2

(ii)	• Use of $\lambda = \frac{ln\,2}{t_{1/2}}$ • Use of $A = A_0e^{-\lambda t}$ **(1)** • % activity remaining = 0.4 % (<1%), so claim is correct **Or** time to decay to 1% = 370 s (<450 s), so claim is correct **(1)**	Allow application of constant ratio rule Example of calculation $\lambda = \frac{\ln 2}{55.6\ s} = 0.0125\ s{-}1$ % activity remaining $= 100e^{-0.0125\ s^{-1} \times 450\ s} = 0.37$	**3**

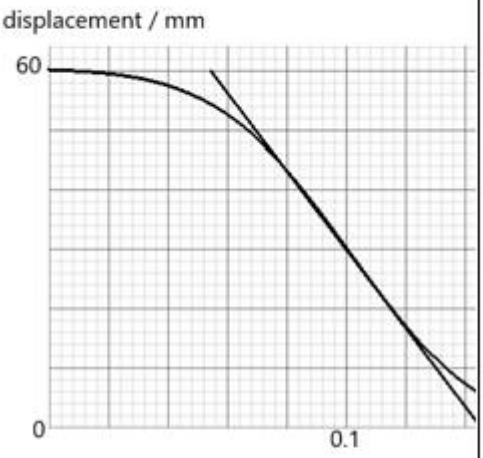
Q3.

Question Number	Acceptable Answer	Additional Guidance	Mark
*	This question assesses a student's ability to show a coherent and logical structured answer with linkage and fully-sustained reasoning. Indicative content: IC1 Both circuits are suitable because they allow readings of p.d./current for the lamp IC2 For circuit 1 the minimum p.d. across the lamp is 0 V (when the slider is at the left) **Or** For circuit 2 the minimum p.d. across the lamp is greater than 0V For circuit 1 the maximum p.d. across the lamp is the supply p.d (when the slider is at the right) IC3 For circuit 1 the maximum p.d. across the lamp is the supply p.d	Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning. The following table shows how the marks should be awarded for indicative content. Number of indicative marking points seen in answer / Number of marks awarded for indicative marking points 6 / 4 5–4 / 3 3–2 / 2 1 / 1 0 / 0 Number of marks awarded for structure of answer and sustained line of reasoning Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout / 2 Answer is partially structured with some linkages and lines of reasoning / 1 Answer has no linkages between points and is unstructured / 0 Total marks awarded is the sum of marks for indicative content and the marks for structure and lines of reasoning IC points / IC mark / Max linkage mark / Max final mark 6 / 4 / 2 / 6 5 / 3 / 2 / 5 4 / 3 / 1 / 4 3 / 2 / 1 / 3 2 / 2 / 0 / 2 1 / 1 / 0 / 1 0 / 0 / 0 / 0	**6**

	(when the slider is at the right) IC4 For circuit 2 adjusting the resistor changes the circuit resistance (so the current is varied) **Or** for circuit 2 the battery p.d. is shared between lamp and variable resistor IC5 So for circuit 2 the minimum p.d. depends upon the resistance of the variable resistor, IC6 Circuit 1 is better because it allows a bigger range **Or** Circuit 1 is better because it allows p.d.s down to 0 V to be used		

Q4.

Question Number	Acceptable answers	Additional guidance	Mark
(i)	• uses ratio of lengths to determine p.d. across potentiometer **(1)** • V = 9.6 (V) **(1)**	Example of calculation: p.d. across potentiometer = $\frac{115\text{ mm}}{60\text{ mm}} \times 5\text{ V} = 9.6\text{ V}$	**2**

(ii)	• determines p.d. across R • apply $V = IR$ to potentiometer to determine current **Or** uses ratio of resistances = ratio of p.d.s • $R = 3000\ \Omega$	**(1)** **(1)** **(1)**	<u>Example of calculation:</u> current in circuit $= \frac{9.6\ \text{V}}{12000\ \Omega} = 8.0 \times 10^{-4}$ A p.d. across $R = 12 - 9.6 = 2.4$ V $R = {}^{2.4\ \text{V}}/_{8.0 \times 10^{-4}\text{A}}$ R = 3000 Ω (show that value gives 2400 Ω)	**3**
(iii)	• A battery has internal resistance • There is a p.d. across the internal resistance • Terminal p.d. less (than e.m.f.) **Or** refers to $V = E - Ir$	**(1)** **(1)** **(1)**	Accept "lost volts" for MP2 V must be the subject	**3**
(iv)	• tangent drawn on the curve • uses a triangle base of at least 0.06 s • attempt to find a gradient • velocity = 0.68 m s^{-1} so velocity not exceeded allow range from to 0.60 m s^{-1} to 0.80 m s^{-1}	**(1)** **(1)** **(1)** **(1)**	MP2 dependent on MP1  $v = \text{gradient} = \frac{60\ \text{mm}}{0.144 - 0.056}$ $v = 682$ mm s^{-1}	**4**