Name of the Student:_____

Max. Marks : 20 Marks **Time : 20 Minutes**

Mark Schemes

Q1.

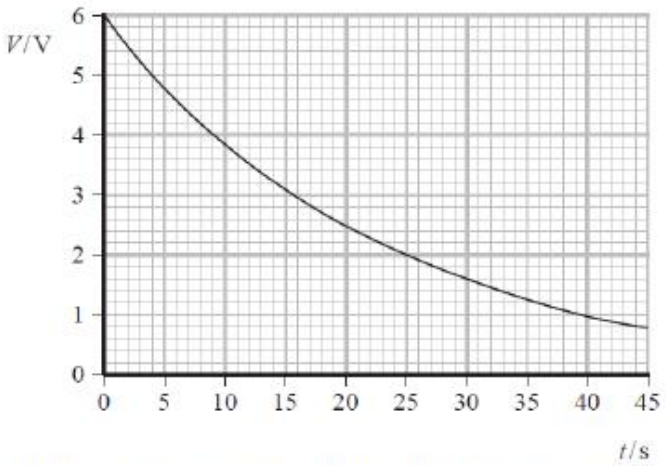
Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: • To bring tubing up to temperature (of steam) (1) • So steam only condenses in the cup (1) **Or** steam doesn't condense in the tubing		2
(ii)	• Thermal energy will be transferred from the steam/tubing to the surroundings (1) • Lagging/insulating/shortening the tubing (1)	Accept: • Thermal energy is transferred to the cup/ probe • These should have a small a heat capacity	2

Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to **max two** of the following points: • The oil drop initially accelerates **Or** it takes time for the oil drop to reach terminal velocity (1) • (Initially) weight of oil drop not balanced by the drag force (+ upthrust) **Or** Weight of oil drop must be balanced by the drag force (+ upthrust) (1) • (If measurements are taken immediately) the calculated velocity will be less than the terminal velocity (1)	Accept use of standard symbols	2

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	• Positions from scale used to determine displacement (1) • Use of $v = \frac{s}{t}$ (1) • $v = 3.4 \times 10^{-5}$ m s^{-1} → 3.5×10^{-5} m s^{-1} (1)	Example of calculation Displacement = 6.65 mm − 2.50 mm = 4.15 mm $v = \frac{4.15 \times 10^{-3}}{2 \times 60\ \text{s}} = 3.46 \times 10^{-5}\ \text{m s}^{-1}$	3

Q3.

Question Number	Acceptable Answer	Additional Guidance	Mark
	• A pair of corresponding V and t values read from graph (1) • Use of $V = V_0 e^{-\frac{t}{RC}}$ **Or** Use of time constant = RC (1) • $C = 270$ μF (1) • Use of ±20% with 220 μF [Largest $C = 264$ μF, smallest $C = 176$ (μF)] (1) • Comparison of 264 (μF) [176 (μF) if their calculated C is too low] with calculated value of C from graph and conclusion consistent with this (1)	 Allow use of tangent at $t = 0$ to determine intercept on x-axis and obtain value for time constant; then calculate C gives MP1, MP2 and MP3 MP3:Value should be correct and have units Example of calculation $1.0 = 6.0e^{\frac{40\ s}{82\times10^{3}\ \Omega \times C}}$ $\therefore \ln\left(\frac{1.0\ \text{V}}{6.0\ \text{V}}\right) = -\frac{40\ \text{s}}{82 \times 10^3\ \Omega \times C}$ $\therefore C = \frac{-40\ \text{s}}{-1.79 \times 82 \times 10^3\ \Omega} = 2.72 \times 10^{-4}\ \text{C}$ Largest value of capacitance = 1.2 × 220 μF = 264 μF	5

Q4.

Question Number	Acceptable Answer		Additional Guidance	Mark
(i)	• Smooth best fit curve drawn on graph • Time for count rate to fall by half once • Time for count rate to fall by half twice and mean time calculated • $t_{1/2}$ = 60 s → 80 s	(1) (1) (1) (1)	Alternative approaches for MP2 and MP3 Read 2 values from graph and use exponential equation **Or** draw tangent to curve at $t = 0$ and read off the time intercept Example of calculation 9.0 s^{-1} → 4.5 s^{-1} t = 75 s 4.5 s^{-1} → 2.25 s^{-1} t = 75 s If background count is taken into consideration, t will be lower	4

Question Number	Acceptable Answer		Additional Guidance	Mark
(ii)	An explanation that makes reference to the following points: • There will be background radiation **Or** decay is exponential and so count rate will "never" reach zero • The data logger output includes counts due to background radiation as well as the source radiation **Or** The count rate can't be corrected automatically	(1) (1)	MP2: accept references to GM-tube	2