

Question	Answer	Marks
5(a)	charge / potential (difference)	M1
	charge is charge on one plate, <u>and</u> potential is p.d. across the plates	A1
5(b)	p.d. across both capacitors = E	B1
	$Q_T = Q_1 + Q_2$	B1
	$C_T E = C_1 E + C_2 E$ hence $C_T = C_1 + C_2$	B1
5(c)(i)	$[(1/22) + (1/47)]^{-1} = 15 \mu\text{F}$	A1
5(c)(ii)	energy = $\frac{1}{2}CV^2$	C1
	$= \frac{1}{2} \times 15 \times 10^{-6} \times 12^2$	A1
	$= 1.1 \times 10^{-3} \text{ J}$	
5(c)(iii)	initial p.d. (across $22 \mu\text{F}$) = $12 \times (15/22)$ $= 8.2 \text{ V}$	C1
	or final p.d. across both capacitors = $6.0 \times (22/15)$ $= 8.8 \text{ V}$	
	$V = V_0 \exp[-t/(2.7 \times 10^6 \times 15 \times 10^{-6})]$	C1
	$6.0 = 8.2 \exp[-t/(2.7 \times 10^6 \times 15 \times 10^{-6})]$ or $8.8 = 12 \exp[-t/(2.7 \times 10^6 \times 15 \times 10^{-6})]$ $t = 13 \text{ s}$	A1

9702/42

Cambridge International AS & A Level – Mark Scheme
PUBLISHED

February/March 2022

Question	Answer	Marks
5(a)	(energy stored =) area under line or $\frac{1}{2} QV$	C1
	$= \frac{1}{2} \times 8.0 \times 1.2 \times 10^{-4}$	
	$= 4.8 \times 10^{-4} \text{ J}$	A1
5(b)(i)	$(\tau =) RC$	C1
	$(\tau =) 220 \times 10^3 \times (1.2 \times 10^{-4}/8.0) = 3.3 \text{ s}$	A1
5(b)(ii)	$E \propto V^2$	C1
	(so time to) $V_0/3$ $V = V_0 e^{-t/RC}$	C1
	$\frac{V_0}{3} = V_0 e^{-t/3.3}$	C1
	$\frac{1}{3} = e^{-t/3.3}$	
	$t = 3.6 \text{ s}$	A1
5(c)	(total) capacitance is doubled	M1
	time constant is doubled	A1