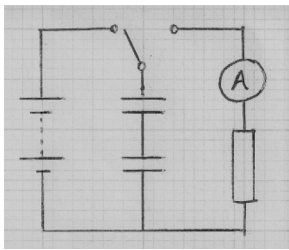


Question number	Answer		Mark
2(a)	Capacitors connected in series with a d.c. power supply Circuit to discharge capacitors through resistor and ammeter Method of switching between charging and discharging <u>Example of circuit diagram</u> 	(1) (1) (1)	(3)
2(b)	Ensure the working p.d. is not exceeded Or Ensure the capacitors are fully discharged after the experiment [Accept any other appropriate precaution] [Accept reference to electrolytic capacitors]	(1)	(1)
2(c)	<u>Graphical Method</u> Any SIX from: 1. Choose the value of resistor to give a reasonable discharge time 2. Measure the resistance of the resistor (using a multimeter) 3. Charge the capacitors to the initial p.d. 4. Ensure that the ammeter and stopwatch are close together Or use the lap timer on the stopwatch 5. Start the stopwatch at the same time as changing the switch Or (Change the switch) and start the stopwatch at the initial current 6. Record the current (from the ammeter) at times determined using the stopwatch 7. Record measurements over at least one half-life Or time constant Or Take many measurements <u>Alternative graphs</u> 8. Plot a graph of $\ln I$ against t 9. Gradient = $-1/RC$ Or	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	[dependent on MP8]

	8. Determine the time for I to halve from a graph of I against t	(1)	
	9. $t_{1/2} = RC \ln 2$ [dependent on MP8]	(1)	
	Or		
	8. Determine the time for I to fall to 37% from a graph of I against t	(1)	
	9. $\tau = RC$ [dependent on MP8]	(1)	
	<u>Non-graphical Method</u>		
	Any SIX from:		
	1. Choose the value of resistor to give a reasonable discharge time	(1)	
	2. Measure the resistance of the resistor using a multimeter	(1)	
	3. Charge the capacitors to the initial p.d.	(1)	
	4. Ensure that the ammeter and stopwatch are close together		
	Or		
	use the lap timer on the stopwatch	(1)	
	5. Start the stopwatch at the same time as changing the switch		
	Or		
	(Change the switch) and start the stopwatch at the initial current	(1)	
	6. Charge to the same initial p.d. each time	(1)	
	7. Obtain minimum of 3 measurements and calculate a mean	(1)	
	8. Record the time taken for the initial current to halve	(1)	
	9. $t_{1/2} = RC \ln 2$ [dependent on MP8]	(1)	
	Or		
	8. Record the time taken for the initial current to reach 37%	(1)	
	9. $\tau = RC$ [dependent on MP8]	(1)	(6)
2(d)	Readings (of current and time) can be taken simultaneously	(1)	
	Many readings can be taken in a short time	(1)	(2)
Total mark for Question 2 = 12			