6(a)	series charges: $Q_S = Q_1 = Q_2$	**B1**
	series p.d.s: $V_S = V_1 + V_2$	**B1**
	parallel charges: $Q_S = Q_1 + Q_2$	**B1**
	parallel p.d.s: $V_S = V_1 = V_2$	**B1**

6(b)(i)	$E = ½\, CV^2$	**C1**
	p.d. $= [(2 \times 19 \times 10^{-3}) / (470 \times 10^{-6})]^{½}$ $= 9.0$ V	**A1**

6(b)(ii)	$E = Q^2 / 2C$ **or** $C = Q / V$	**C1**
	$Q = (19 \times 10^{-3} \times 2 \times 470 \times 10^{-6})^{½}$ **or** $Q = 470 \times 10^{-6} \times 9.0$ $Q = 4.2 \times 10^{-3}$ C	**A1**

6(b)(iii)	total charge unchanged	**C1**
	total capacitance = $(470 + 180) \times 10^{-6}$ (F)	**C1**
	$E = Q^2 / 2C = (4.23 \times 10^{-3})^2 / (2 \times 650 \times 10^{-6})$ (= 0.014 J) $E = 14$ mJ	**A1**

Question 6

(a) This question highlighted where candidates had a confused understanding of the relationships for charge and for p.d. in the arrangements of series and parallel capacitors. Candidates generally found this question more difficult than the following questions that concerned only a single capacitor.

(b) (i) This question was generally well answered.

(ii) There were a number of ways that candidates could answer this question, depending on the equation they chose to use. Candidates generally performed well on this question.

(iii) Stronger candidates understood that the charge value obtained in **(ii)** was the same for this arrangement of two capacitors. Weaker candidates often believed that the p.d. value obtained in **(i)** was the same for this arrangement, and so attempted to use the same equation as they used in **(i)**.

7(a)	$V_C = V_R$	**B1**

7(b)(i)	$C = Q / V$	**C1**
	$= (7.2 \times 10^{-3}) / 12$ $(= 6.0 \times 10^{-4}$ F) $= 600$ μF	**A1**

7(b)(ii)	$R = V / I$	**C1**
	$= 12 / (1.5 \times 10^{-3})$ $(= 8000\ \Omega)$ $= 8.0$ kΩ	**A1**

7(b)(iii)	$\tau = RC$	**C1**
	$= 8000 \times 6.0 \times 10^{-4}$ $= 4.8$ s	**A1**

7(c)	*Any two points from:* • charge and current are both (directly) proportional to voltage • charge is (directly) proportional to current • current is the rate of change of charge	**B2**
	Q is proportional to the rate of change of *Q* (so exponential variation)	**B1**

Question 7

(a) Many weaker candidates were unable to state that V_C and V_R must be equal to each other.

(b) (i) The majority of the candidates knew the correct starting equation, but some had difficulty with the unit conversion into μF.

(ii) As with **(b)(i)**, most candidates knew the correct starting equation, but some had difficulty with the unit conversion into kΩ.

(iii) Some weaker candidates were unsure how to answer this question, but most candidates knew that time constant is the product of resistance and capacitance and were able to use their answers in the previous two parts correctly.

(c) Candidates found this question difficult. The idea of variations with time that are exponential occurs in two places within the syllabus, in the capacitance topic and the topic of radioactive decay, and candidates should appreciate that exponential variations occur when the rate of change of a quantity is directly proportional to the quantity itself. In the case of capacitor discharge, candidates were expected to make the points that, because the current in the resistor is proportional to V_R and the charge on the capacitor is proportional to V_C, and because $V_C = V_R$, it follows that the current in the circuit is proportional to the charge on the capacitor. And since the current in the circuit is the rate of decrease of charge, it then follows that the rate of decrease of charge is proportional to the charge, hence the variation of charge with time is exponential.

5(a)	$Q = Q_1 = Q_2$ <u>and</u> $V = V_1 + V_2$	**M1**
	$V = Q / C$ so: $Q / C = Q / C_1 + Q / C_2$ <u>leading to</u> $1 / C = 1 / C_1 + 1 / C_2$	**A1**

5(b)	total capacitance = $C + ½C = (3 / 2)C$	**C1**
	total capacitance = gradient = $400 \times 10^{-6} / 6.0$	**C1**
	either: $C = (2 \times 400 \times 10^{-6}) / (3 \times 6.0) = 4.4 \times 10^{-5}$ F = 44 μF *or*: $C = (2 \times 400) / (3 \times 6.0) = 44$ μF	**A1**

5(c)(i)	$\tau = RC$	**C1**
	$= 54 \times 10^3 \times (3/2) \times 44 \times 10^{-6}$ = 3.6 s	**A1**

5(c)(ii)	$0.15 = \exp(-t / 3.6)$	**C1**
	$t = 6.8$ s	**A1**

Question 5

(a) Many candidates were able to correctly reproduce this textbook derivation required by the syllabus. Some, however, were not able to establish the key principles of physics as the starting point (how the p.d.s and charges relate to each other in a series circuit).

(b) Many candidates did not show clarity of presentation in this question, with many conflicting expressions alleged to all be expressions for '*C*'. Examiners needed to see a clear expression for the total capacitance in terms of *C*, and a clear statement that the total capacitance is given by the gradient of the *Q*-*V* graph. Some benefit of doubt was given to candidates who started incorrectly but then subsequently arrived at correct physics.

(c) (i) Most candidates knew the equation for time constant, but many then incorrectly substituted 44 μF as the capacitance of the circuit. As a result, 2.4 s was a very common incorrect answer. It was also notable that a significant number of candidates appeared to not know that time constant is a time and therefore struggled with indicating the correct unit.

(ii) Generally well-answered by candidates that had a good understanding of the topic of capacitor discharge. Full credit by the error-carried-forward principle was common for candidates that worked through with their 2.4 s time constant from part **(c)(i)**.

7(a)	charge / potential (difference)	**M1**
	charge is charge on one plate, <u>and</u> potential is p.d. between the plates	**A1**

7(b)(i)	straight line starting at the origin	**B1**
	line with positive gradient ending at (V, Q)	**B1**

7(b)(ii)	work done is the area under the graph	**B1**
	$W = \frac{1}{2}QV$	**A1**

<table>
<tr><td>7(c)(i)</td><td>final p.d. shown as $V / 4$ for both capacitors</td><td>B1</td></tr>
<tr><td></td><td>final charges add together to give Q</td><td>B1</td></tr>
<tr><td></td><td>charge on Y = 3 × charge on X (and both charges shown as a multiple of Q)

Fully correct answer:
<table><tr><td></td><td>X</td><td>Y</td></tr><tr><td>final p.d.</td><td>$V / 4$</td><td>$V / 4$</td></tr><tr><td>final charge</td><td>$Q / 4$</td><td>$3Q / 4$</td></tr></table></td><td>B1</td></tr>
</table>

7(c)(ii)	less than	**B1**

Question 7

(a) Most candidates knew that, in general, capacitance is defined as charge per unit potential. Fewer candidates were able to give the extra detail of how these quantities apply to the particular scenario of the parallel-plate capacitor.

(b) (i) Many candidates achieved full credit for drawing a straight line from (0, 0) to (V, Q). Some did not appreciate that charge is proportional to p.d. and drew a curved line.

(ii) This question was generally well answered, with many candidates knowing that the energy stored in a capacitor is given by the area under the charge–p.d. graph, leading to $W = ½QV$.

(c) (i) This was a challenging question that required a good understanding of which quantities are conserved during the process of connecting the capacitors. The mark scheme was structured in such a way that candidates could gain partial credit for getting different aspects of the task right.

It was notable that many candidates gave responses that they must have known could not be correct, because they were dimensionally incorrect. The p.d.s had to have been in terms of V, and the charges had to be in terms of Q, and it is reasonable to expect A Level candidates to realise that answers that were not in terms of V and Q, respectively, could not possibly be correct. Many of the strongest candidates did give a completely correct response.

(ii) Some candidates went to the trouble of actually calculating the energies, but this was not necessary. Candidates were expected to realise that the only possible answer is that the final energy stored must less than the original energy stored, because some energy is dissipated during the charge redistribution.

6(a)	equal charge on both capacitors	B1
	$V_X + V_Y = V$	M1
	$(Q / C_X) + (Q / C_Y) = (Q / C_T)$ <u>leading to</u> $(1 / C_X) + (1 / C_Y) = (1 / C_T)$ **or** $(V_X / Q) + (V_Y / Q) = (V / Q)$ <u>leading to</u> $(1 / C_X) + (1 / C_Y) = (1 / C_T)$	A1

6(b)(i)	$E = ½CV^2$	C1
	$V = \sqrt{[(2 \times 2.5 \times 10^{-3}) / (200 \times 10^{-6})]} = 5.0$ V	A1

6(b)(ii)	total capacitance = 600 μF	C1
	$E = ½ \times 600 \times 10^{-6} \times 5.0^2$ $(= 7.5 \times 10^{-3}$ J)	C1
	= 7.5 mJ	A1

6(b)(iii)	line with positive gradient starting at (0, 2.5)	B1
	straight line passing through (400, 7.5)	B1

Question 6

(a) No credit was available just for unexplained algebra. First, candidates needed to make clear the two principles of physics upon which the derivation is based (that the charges on the capacitors are equal and equal to the total charge, and that the p.d.s across the capacitors and the total p.d. are related by Kirchhoff's second law. Once the physics was made clear, candidates were then able to complete the algebra to show how the equation is derived. Many of the weaker candidates made no attempt to produce the derivation, and instead simply quoted the relevant capacitor combination equation from the formula sheet.

(b) (i) This was generally well answered by most candidates.

(ii) Generally, many candidates arrived at the correct answer and were awarded full credit. Some weaker candidates used the series combination equation rather than the one for capacitors connected in parallel, and were therefore unable to make a start. Some other candidates just calculated the energy of the 400 μF capacitor, rather than the total energy.

(iii) Candidates who obtained the correct answer in **(b)(ii)** were generally able to go on to gain full credit for the graph. Full credit was also possible where **(b)(ii)** was not answered correctly, but generally such candidates found it difficult to meet the requirements of the mark scheme.

6(a)	• p.d. across capacitor proportional to charge on capacitor • p.d. across capacitor = p.d. across resistor • current in resistor proportional to p.d. across resistor • current in resistor = rate of decrease of charge on capacitor *Any two points, 1 mark each*	**B2**
	charge proportional to current so rate of decrease of current decreases as current decreases (therefore exponential shape)	**B1**

6(b)(i)	$R = V / I$ $= 12 / (0.13 \times 10^{-3})$	**C1**
	$= 9.2 \times 10^{4}\ \Omega$	**A1**

6(b)(ii)	correct read-off of at least one pair of values for I and t	**C1**
	attempted read-off of t when I = 0.048 mA **or** substitution of a correct pair of values of I and t into $I = 0.13 \exp(-t / \tau)$	**C1**
	τ = 4.3 s	**A1**

6(c)	$\tau = RC$	**C1**
	$C = \tau / R = 4.3 / (9.2 \times 10^{4})$ $= 4.7 \times 10^{-5}$ F	**A1**

Question 6

(a) This was a challenging question. Most candidates simply gave a description of the graph and of the current reduction, rather than explaining how the exponential fall took place by showing the relationships between charge, potential difference and current. It was often unclear whether the capacitor or the resistor was being referred to, with generic symbols V, I and Q being used.

(b) (i) Incorrect reading of the current value from the graph was a common reason for full credit not to be awarded. This error was seen across the range of abilities, and included a wrong power of ten and a misjudgement of the scale beyond the 0.1 mA point.

(ii) Stronger candidates were able to identify an appropriate point on the line, insert those values into the equation for exponential decay and calculate a time constant. The use of a small time period often increased the error in reading the current, resulting in an incorrect final answer. Weaker candidates unsuccessfully attempted to use the $\tau = RC$ equation.

(c) Most candidates were able to state the $\tau = RC$ equation. The majority of those were then able to use their previous two answers to successfully proceed to a value for the time constant.

4(a)	combined capacitance of parallel capacitors = 30 (μF)	**C1**
	total capacitance $= (1 / 45 + 1 / 30)^{-1}$ $= 18\ \mu F$	**A1**

4(b)	$E = ½CV^2$	**C1**
	$\Delta E = ½ \times 45 \times 10^{-6} (9.6^2 - 8.0^2)$ $= 6.3 \times 10^{-4}$ J	**A1**

4(c)(i)	gaps in circuit closed and correct symbol for capacitor shown in parallel with load resistor	**B1**

4(c)(ii)	two correct pairs of values of t and V read off from within same discharge cycle, e.g. (5.0, 4.0) and (13.0, 3.2)	**C1**
	correct substitution of values of V, V_0 and Δt into $V = V_0 \exp(-\Delta t / \tau)$ e.g. $3.2 = 4.0 \exp(-8.0 / \tau)$	**C1**
	$\tau = 36$ ms	**A1**

4(d)(i)	8.0 W	**A1**

4(d)(ii)	4.0 W	**A1**

NOT FOUND:

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6(a)(i)	energy stored = area under graph	**C1**
	$= \frac{1}{2} \times 450 \times 10^{-6} \times 8.0 = 1.8 \times 10^{-3}$ J **or** 1.8 mJ	**A1**

6(a)(ii)	$C = Q / V$ **or** $E = \frac{1}{2}CV^2$	**C1**
	$C = (450 \times 10^{-6}) / 8.0$ **or** $(2 \times 1.8 \times 10^{-3}) / 8.0^2$ $= 5.6 \times 10^{-5}$ F	**A1**

6(b)(i)	$V = V_0 \exp(-t / RC)$ **and** $\tau = RC$	**C1**
	$V = V_0 \exp(-t / \tau)$ $V_0 = 8.0$ V, and at one time constant, $t = \tau$ $V / 8.0 = \exp(-\tau / \tau)$, so $\ln(V / 8.0) = -1.0$ **or** $-\ln(V / 8.0) = 1.0$	**A1**

6(b)(ii)	[t read from graph at $-\ln(V / 8.0) = 1.0$]: $\tau = 3.2$ s	**A1**

6(b)(iii)	$\tau = RC$	**C1**
	$R = 3.2 / (5.6 \times 10^{-5})$ $= 5.7 \times 10^4\ \Omega$	**A1**

Question 6

(a) (i) This question was generally well answered, with most candidates realising that the energy stored in the capacitor is given by the area under the graph. Candidates needed to be careful with the unit conversions in this 'show that' question, with the μC to C and J to mJ conversions both needing to be clear.

(ii) This question was also generally well answered.

(b) (i) This was a challenging question that the weaker candidates found difficult. Many candidates did get to the equation $V = V_0 \exp(-t / \tau)$, but then attempted to substitute numbers from the graph rather than realising that they just needed to put $t = \tau$ and then take natural logarithms.

(ii) Many candidates were able to correctly read off the time of 3.2 s at the point where $-\ln(V / 8\,\text{V})$ is equal to 1.0. A common incorrect answer was 6.4 s.

(iii) This question was generally well answered by candidates that offered a response.

5(a)(i)	$Q_A = CV$	**A1**

5(a)(ii)	$E_A = ½CV^2$	**A1**

5(b)(i)	some of the charge transfers to (the plates of) capacitor B	**B1**
	transfer is because the p.d.s across the capacitors are not equal **or** transfer stops when the p.d.s across the capacitors become equal	**B1**

5(b)(ii)	$V_A = V_B$	**M1**
	charge on A + charge on B = CV	**M1**
	$CV_B + 3CV_B = CV$ leading to $V_B = V / 4$	**A1**
	or	
	$C_T = 4C$	**(M1)**
	$Q_T = CV$	**(M1)**
	$V_B = CV / 4C = V / 4$	**(A1)**

5(b)(iii)	$\Delta E = \frac{1}{2}CV^2 - nCV^2$, where n is a multiple that is less than ½ **or** total final energy $= \frac{1}{2} \times 4C \times (V/4)^2$ $= \frac{1}{8}CV^2$	**C1**
	$\Delta E = \frac{1}{2}CV^2 - \frac{1}{8}CV^2$ $= \frac{3}{8}CV^2$	**A1**

Question 5

(a) Both **(i)** and **(ii)** were generally well answered by most candidates who read the question. Expressions for Q_A and E_A were asked for in terms of C and V, and credit was only awarded for correct responses given in terms of these symbols.

(b) (i) Many candidates found this question difficult. Some did not discuss charge transfer at all, but instead wrote about energy. For credit, candidates needed to explain that some (but not all) of the charge on capacitor A moves across to capacitor B, as a result of an initial difference in the p.d. across the two capacitors, and that this process stops when the p.d.s across them become equal. The most common incorrect answer was that capacitor A fully discharges (often with no discussion of where the charge goes).

(ii) Many candidates found it difficult to give a coherent answer to this question, with responses often containing unexplained algebra. In questions asking candidates to prove an equation, explaining their reasoning, it is important that they understand the need to make clear the principles of physics on which the answer is based.

In this derivation, there were two possible approaches that candidates could take. For each approach, there were two principles of physics that needed to be made clear. In the first method, which was based on considering the two capacitors separately, it had to be clear that the final p.d.s across the two capacitors are equal, and that the sum of the charges on the two of them is still equal to CV. In the second method, which was based on considering the pair of capacitors as a single combined capacitor, it had to be clear that the <u>total</u> capacitance is $4C$ and that the <u>total</u> charge is still equal to CV. Once the points of physics were clear, access was then available to credit for completing the algebra correctly to arrive at the required equation.

(iii) This was a demanding question, aimed at discriminating between the higher-ability candidates, and many of them did successfully arrive at the correct answer. Many other candidates were able to obtain partial credit, either for correctly identifying the final energy as $\frac{1}{8}CV^2$ or for the method of subtracting a plausible final energy from $\frac{1}{2}CV^2$.

5(a)	from graph ln $Q = 2.9$ (so $Q = 18.2\ \mu C$)	**B1**
	$C = Q / V$	**C1**
	$= 18.2 / 12 = 1.5\ \mu F$	**A1**

5(b)	gradient = –0.25	**C1**
	gradient = $-1 / RC$	**C1**
	$R = 1 / (0.25 \times 1.5 \times 10^{-6})$ $= 2.7 \times 10^{6}\ \Omega$	**A1**
	or $\dfrac{Q}{Q_0} = e^{-t/CR}$ **or** $\ln Q - \ln Q_0 = \dfrac{-t}{CR}$	**(C1)**
	e.g. $\dfrac{4.95}{18.2} = e^{-5.2/(1.5 \times 10^{-6} R)}$ **or** $1.6 - 2.9 = 5.2 / (1.5 \times 10^{-6} R)$	**(C1)**
	$R = 2.7 \times 10^{6}\ \Omega$	**(A1)**

5(c)	$W = \frac{1}{2} QV$	**C1**
	$= \frac{1}{2} \times 18.2 \times 10^{-6} \times 12$ $= 1.1 \times 10^{-4}$ J	**A1**
	or $W = \frac{1}{2} CV^2$	**(C1)**
	$= \frac{1}{2} \times 1.5 \times 10^{-6} \times 12^2$ $= 1.1 \times 10^{-4}$ J	**(A1)**
	or $W = \frac{1}{2} Q^2 / C$	**(C1)**
	$= \frac{1}{2} \times (18.2 \times 10^{-6})^2 / 1.5 \times 10^{-6}$ $= 1.1 \times 10^{-4}$ J	**(A1)**

5(d)	straight line with different negative gradient starting from (0, 2.9)	**M1**
	straight line between $t = 0$ and at least $t = 5.0$ s with twice the gradient of the original line	**A1**

Question 5

(a) Candidates struggled with the use of the logarithmic graph to present data. However, a good number were able to clearly show how the capacitance of the capacitor is found from the data.

(b) There was much confusion between log and non-log values. Many candidates substituted values of ln Q as Q in the exponential equation. Only the strongest candidates were able to correctly determine the resistance of *R*.

(c) The majority of candidates were able to calculate the correct answer here.

(d) Most candidates realised that a straight line from the same initial value of ln Q was required, but only the strongest candidates correctly deduced the quantitative effect of the parallel resistor on the gradient of the line.

6(a)	• p.d. across resistor = p.d. across capacitor • current (in resistor) proportional to p.d. across it • current causes capacitor to lose charge • charge (on capacitor) proportional to p.d. so p.d. decreases *Any two points, 1 mark each*	**B2**
	rate of change of p.d. decreases as p.d. decreases	**B1**

6(b)	Q_0 = 0.90 mC **and** at t = one time constant, $Q = Q_0 \exp(-1)$	**B1**
	at t = one time constant, $Q = 0.90 \exp(-1) = 0.33$ mC	**M1**
	evidence of graph reading: when Q = 0.33 mC, t = 5.5 s	**A1**
	or	
	evidence of two correct sets of readings for Q and t from the graph	**(B1)**
	correct substitution of Q and t values into $Q_2 = Q_1 \exp[(t_1 - t_2) / \tau]$	**(M1)**
	calculation to give τ = 5.5 s	**(A1)**
	or	
	read-off of half-life as 3.75 s	**(B1)**
	use of $Q = Q_0 \exp(-t / \tau)$ to show that τ = half-life / ln 2	**(M1)**
	τ = 3.75 / ln 2 = 5.4 s	**(A1)**

6(b)	**or**	
	tangent drawn on Q–t graph and value of Q at exact same time as tangent read from graph	**(M1)**
	gradient of tangent correctly calculated	**(A1)**
	$\tau = Q$ / gradient used to correctly calculate a value for τ as 5.5 s	**(A1)**

6(c)(i)	$C = Q / V$	**C1**
	$= [(0.90 \times 10^{-3}) / 7.5] = 1.2 \times 10^{-4}$ C $= 120\ \mu$F	**A1**

6(c)(ii)	$R = \tau / C$	**C1**
	$= 5.5 / (1.2 \times 10^{-4})$ (= 45 800 Ω) $= 46$ kΩ	**A1**

Question 6

(a) Candidates found it difficult to demonstrate understanding of why the discharge of a capacitor through a resistor is exponential. Most responses were only attempts to describe the shape of the line, often incorrectly as an inverse proportionality relationship. Candidates are expected to appreciate that an exponential relationship occurs when the rate of change of a quantity is proportional to the magnitude of the quantity itself. Within the syllabus, this applies to the rate of decrease of undecayed nuclei in radioactive decay. In the case of a discharging capacitor, the rate of decrease of V is proportional to V because V is proportional to both the charge on the capacitor and the discharge current (rate of decrease of charge) in the resistor. Only the strongest candidates were able to give a complete explanation.

(b) Several different methods for deducing the value of the time constant from the graph were accommodated within the mark scheme. All of the methods were seen in candidate responses, though the most obvious first two methods were the most common. Many candidates were able to answer this question well, and most were at least able to make a start for partial credit.

(c) (i) Most candidates were able to be awarded credit for recall of the defining equation for capacitance. Further credit required accurate read-off from a suitable part of the graphs of a set of values for Q and V, and correctly dealing with two power-of-ten conversions when performing the calculation. Examiners did not consider that a suitable part of the graph to use was the t = 15 s end, where the values of Q and V were so low that the read-offs inevitably involved an uncertainty of at least 10% in each value and therefore led to an answer that was not correct. Despite the many aspects to this marking point that needed to be considered, many candidates were generally able to arrive at the correct answer.

(ii) Many candidates were able to arrive at the correct answer for full credit. The final power-of-ten conversion from Ω to kΩ here proved to be less difficult than the conversions in the previous part.

5(a)(i)	$Q = CV$	**C1**
	$Q_0 = 24 \times 470 \times 10^{-6}$ $= 0.011$ C	**A1**

5(a)(ii)	$I_0 = 24 / 5600$ $= 4.3 \times 10^{-3}$ A	**A1**

5(a)(iii)	$\tau = RC$	**C1**
	$= 5600 \times 470 \times 10^{-6}$ $= 2.6$ s	**A1**

5(a)(iv)	line with negative gradient throughout passing through (0, I_0)	**B1**
	exponential decay curve asymptotic to t-axis	**B1**

5(b)(i)	current in wire P gives rise to a magnetic field	**B1**
	as current (in P) changes, wire Q cuts (magnetic) flux (of wire P)	**B1**
	cutting magnetic flux causes induced e.m.f. (across Q)	**B1**

5(b)(ii)	sketch shows line with a negative gradient throughout	**B1**

Question 5

(a) (i) Most candidates were able to calculate the charge on the capacitor.

(ii) Most candidates were able to calculate the current in the wire at time $t = 0$. The most common misconception was that the current was 0 because the time was 0.

(iii) The calculation proved to be more challenging than the previous two calculations. A significant number of candidates used the current in place of the capacitance, being unsure of the meaning of the symbol C in $\tau = RC$.

(iv) There were many correct lines sketched here, but some candidates do not realise that an exponential decay curve neither touches the time axis nor becomes horizontal.

(b) (i) This explanation proved to be challenging. Many candidates realised that there was a magnetic field around P due to the current in it. However, the fact that the current was not constant, and that therefore the flux was changing, giving a changing flux in Q and an e.m.f. induced in Q, was often missed. Many candidates went straight to describing an induced current in Q, rather than an induced e.m.f. which then causes an induced current if a circuit is complete.

(ii) Many candidates gained credit.