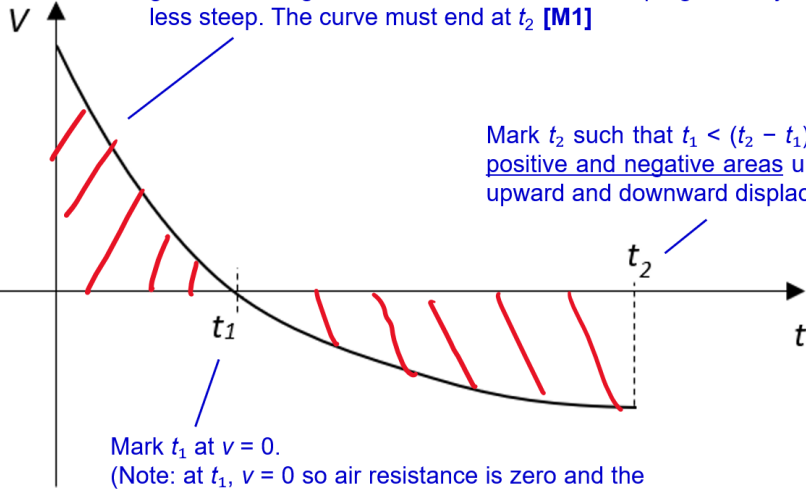


2026 EJC H2 Physics P2 Solutions

Qns	Answer	Marks
1(a)(1)	At $t = 0$, the gradient of the graph is 0. Hence the speed of the ball is 0. Marker's comment: This question was generally well done. However, students should be mindful that this is a distance-time graph and thus, speed should be used instead of velocity when justifying what the gradient represents. A handful of students mentioned that when $t = 0$, $d = 0$ and thus, speed is 0. This is untrue as an object can go at some speed at its initial position. A small minority mentioned that speed $= \frac{d}{t} = \frac{0}{0} = 0$ which is untrue.	A1
1(a)(2)	The <u>gradient of the graph eventually becomes constant after the $t = 0.80$ s mark</u>, indicating that the ball has reached terminal velocity. The acceleration, and thus the resultant force is zero. Since $F_{\text{net}} = mg - F_{\text{air}} = 0$, this shows that <u>air resistance is significant and balances the weight</u> when terminal velocity is reached. Marker's comment: This question was not answered well as students did not refer to Fig. 1.1 to support their explanation. These students were not awarded any marks. A handful of students mentioned that the speed is increasing at an increasing rate which is incorrect. Even though the speed is increasing (as indicated by the gradient of the distance-time graph), it increases at a <u>decreasing rate</u> since the acceleration is getting smaller due to a larger air resistance (that increases with speed).	M1 A1
1(b)	Draw a tangent to Fig. 1.1 at $t = 0.40$ s and determine its gradient. Speed $= (2.8 \pm 0.3) \text{ m s}^{-1}$. Marker's comment: This question was generally well done though students are reminded to draw the tangent at a point in solid line. The tangent should also be long enough for students to easily identify suitable coordinates to find the gradient. Students who did not arrive at the answer either used a ratio $\left(\frac{d}{t}\right)$ or attempted to use the kinematics formula (e.g. $v^2 = u^2 + 2as$) provided in the formula sheet.	M1 A1

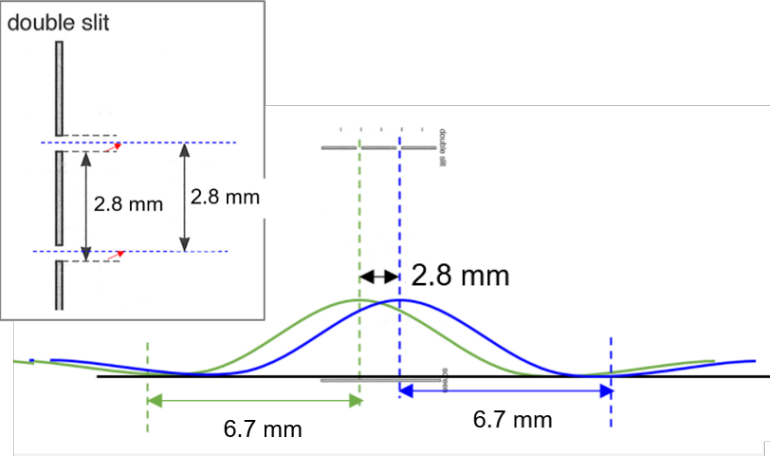
Qns	Answer	Marks
1(c)	Graph shows a curve that has a negative (positive) gradient throughout, and the curve becomes progressively less steep. The curve must end at t_2 [M1] Mark t_2 such that $t_1 < (t_2 - t_1)$, with <u>approximately equal positive and negative areas</u> under the $v - t$ graph for the upward and downward displacements. [A1]  Mark t_1 at $v = 0$. (Note: at t_1, $v = 0$ so air resistance is zero and the only force is weight; therefore $a = g$ at t_1) [A1] Marker's comment: Performance on this question was weak, with most students drawing a straight line that omitted the effect of air resistance. Students who deduced the general shape of the graph often failed to show a curve that becomes progressively less steep, maintaining a gradient at t_2 that was incorrectly steep. *Note: At t_2 the gradient should not be zero because Fig. 1.1 shows that at $d = 2.0$ m the object has not quite reached terminal speed. Students were not penalized for missing this intricacy, but they are reminded to check for such details in future questions.	M1 A1 A1
TOTAL FOR QUESTION 1		8
2(a)	The rate of change of momentum of a body is (directly) proportional to the resultant force acting on the body and is in the same direction as the resultant force. Marker's comment: This question was generally well done. A small minority did not mention that the force is a resultant force, which is crucial when stating Newton's second law of motion. In addition, some students substituted "<i>in the direction of the resultant force</i>" with "<i>in the direction of the change in momentum</i>". Credit was not awarded for this, as explicitly stating the formal is a strict requirement when defining Newton's second law of motion.	B1
2(b)(i)	The sand <u>initially has zero horizontal momentum</u> but accelerates to the speed of the belt. Therefore, the belt exerts a <u>forward horizontal force on the sand to produce this change in momentum</u>. By <u>Newton's third law</u>, the sand exerts an equal and opposite horizontal force on the belt. Marker's comment: This question was not well answered. Students who were not credited often stated that the belt exerts a horizontal force on the sand without explaining how that force came about. Additionally, many wrote that the initial momentum was zero, failing to recognize that the falling sand has vertical momentum. The term <u>horizontal momentum</u> must be specified. Lastly, partial-credit responses identified the force acting on the sand but stopped short of applying Newton's third law to explicitly state the corresponding force acting <u>on the belt</u>.	M1 A1

Qns	Answer	Marks
2(b)(ii)	$\langle F \rangle = \frac{m}{t} \Delta v = (0.100)(0.050)$ $= 0.0050 \text{ N}$ Marker's comment: This question was not well answered. Students who were not credited often provided values without showing the equation. This is incorrect as a show question requires proper workings that lead to the answer. This is a strict requirement by Cambridge. Students are also reminded to leave the final answer in the correct significant figures as required by the question. Marks were not penalized for this mistake this time round.	M1 A0
2(b)(iii)1	$P = Fv = 0.0050 \times 0.050 = 2.5 \times 10^{-4} \text{ W}$ Marker's comment: This question was well answered with full credit given.	B1
2(b)(iii)2	In one second, rate at which sand gains kinetic energy, K: $K = \frac{\frac{1}{2} m \Delta(v^2)}{t} = \frac{1}{2} \left(\frac{m}{t} \right) (v_f^2 - v_i^2)$ $= \frac{1}{2} \left(\frac{100}{1000} \right) \left(\left(\frac{5.0}{100} \right)^2 - 0 \right)$ $= 1.25 \times 10^{-4} \text{ W}$ Marker's comment: This question was not well answered. Students who lost marks often applied the standard formula for kinetic energy ($E_k = \frac{1}{2} mv^2$) without accounting for the fact that the question asked for the <u>rate</u> at which the sand gains kinetic energy. Consequently, the working required an explicit rate term per unit time, for example, using $\frac{m}{t}$ or $\frac{E_k}{t}$. Additionally, some candidates incorrectly assumed that the rate of kinetic energy gain is equal to the rate at which the motor does work. This is incorrect because half of the work done by the motor is dissipated to the internal store of the surroundings.	B1
2(b)(iv)	Perfectly <u>inelastic</u> collision. Energy transferred mechanically via work done <u>by the motor</u> is to the (horizontal) kinetic store of the sand and to the internal store of the system (heating/friction). Marker's comment: This question was not well answered. For the first mark, students were penalized for failing to explicitly state that the collision was <u>perfectly</u> inelastic. Including the word "perfectly" is crucial, as the sand and belt coalesce upon contact. For the second mark, credit was lost when candidates incorrectly claimed that energy was transferred from the belt's kinetic store to the sand. Because the belt moves at a constant horizontal velocity, its kinetic energy remains constant. Thus, the energy gained by the sand originates directly from the work done by the motor. Additionally, some candidates irrelevantly discussed the sand's energy in the gravitational potential store or its kinetic store from falling vertically. This failed to address the core requirement of the question, which strictly concerned accelerating the sand <u>horizontally</u> up to the speed of the belt.	B1 B1

Qns	Answer	Marks
TOTAL FOR QUESTION 2		8
3(a)	Electric potential at a point is the work done per unit charge by an external force in bringing a small positive test charge from infinity to that point. <u>Marker's comment:</u> This question was not well answered. Most common mistakes include the exclusion of "by an external force".	B1
3(b)(i)	$E = -\frac{dV}{dr}$ E = gradient of graph $= \left \frac{2.50 - 0}{(0 - 2.50) \times 10^{-2}} \right \quad \text{[M1]}$ $= 100 \text{ N C}^{-1} \quad \text{[A1]}$ Acceptable range: $88 \leq E \leq 1105$ Direction: in positive x-direction / towards right / from left to right / $\rightarrow$ [B1] <u>Marker's comment:</u> This question was generally well answered. Common mistakes include failure to convert cm to m in the denominator. A handful of students also applied the isolated point charge formula of $E = Q/4\pi\epsilon r^2$ which is not applicable for this case.	M1 A1 B1
3(b)(ii)	The graph is symmetrical. <u>Marker's comment:</u> This question was generally well answered. For those who provided answer such as "the potentials at the surface of each charge are the same", they should also qualify that the radii of the spheres are also the same.	B1
3(b)(iii)	Using a point such as $x = 0.20 \text{ cm}$ where $V \approx 6.0 \text{ V}$: $V = \frac{Q}{4\pi\epsilon_0 x} + \frac{Q}{4\pi\epsilon_0 (0.040 - x)}$ $6.0 = \frac{Q}{4\pi\epsilon_0} \left(\frac{1}{0.002} + \frac{1}{0.040 - 0.002} \right) \quad \text{[M1]}$ $Q = 1.27 \times 10^{-12} \text{ C} \quad \text{[A1]}$ Accept also if student used other suitable points for substitution. <u>Marker's comment:</u>	M1 A1

Qns	Answer	Marks
	This question was not well answered. The most common errors include the consideration of only the potential due to either charge, instead of the scalar sum of both. Some students also thought that the value of r should be considered from the surface instead of centre of charge (so there is no need to subtract r by 0.20cm).	
TOTAL FOR QUESTION 3		7
4(a)	Resistance of a circuit component is the ratio of the potential difference across the component to the current passing through it. <u>Marker's comment:</u> This question was generally well answered.	B1
4(b)	e.m.f. is the energy converted from non-electrical to electrical form per unit charge, while p.d. is the energy converted from electrical to non-electrical form per unit charge. [B1] <u>Marker's comment:</u> Students need to note that the comparison is only valid on per unit charge basis. There were also many awkward phrasing such as "e.m.f involves the conversion from ..." or "e.m.f is when ...". Both of these phrases do not demonstrate that e.m.f is inherently an energy quantity.	B1
4(c)	As R_2 increases, the total resistance of the circuit increases and the current in the cell decreases. The p.d. across the internal resistance therefore decreases. Hence, using $V_{\text{terminal}} = E - Ir$, the terminal p.d. increases. Since R_1 is constant, the current through R_1 increases. <u>Marker's comment:</u> This question was not well answered. - Many candidates made the statement that "since R_1 and R_2 are parallel, their pd are the same (and hence constant)." While the pd across R_1 and R_2 are indeed the same, they are not constant given that the current through cell has decreased. Note: Even for many candidates that only mention same pd, they go on to imply so. - Another common error: Since R- increases, the current through R_2 decreases and hence current through R- decreases. Note: Many candidates made this conclusion even though they had earlier deduced that current through cell decreases so it was clear that no conclusive outcome could be made via this reasoning. - It was particularly concerning to note that some candidates thought R_1 (or R_2) were in series with the cell.	M1 M1 A1
4(d)(i)	p.d. across $r = 1.40 - (0.220 \times 5.50) = 0.19 \text{ V}$. $I_{\text{cell}} = 0.19/0.13$	C1

Qns	Answer	Marks
	$= 1.46 \text{ A} \approx 1.5 \text{ A} \text{ (2 s.f.)}$ <u>Marker's comment:</u> This question was generally well answered.	A1
4(d)(ii)	$I_2 = 1.5 - 0.220 = 1.28 \text{ A}$; $R_2 = (0.220 \times 5.50) / 1.28$ $= 0.945 \Omega$ <u>Marker's comment:</u> This question was generally well answered.	C1 A1
TOTAL FOR QUESTION 4		9
5(a)	For a single-slit diffraction pattern, $\sin \theta = \frac{\lambda}{b} \Rightarrow \theta = \sin^{-1} \left(\frac{\lambda}{b} \right) = \sin^{-1} \left(\frac{670 \times 10^{-9}}{0.12 \times 10^{-3}} \right) = 0.00558336 \text{ rad (6.s.f)}$ Let the distance between the central maxima to first minima for the diffraction pattern be y . Hence, $\tan \theta = \frac{y}{D} \Rightarrow y = D (\tan \theta)$ $= 1.20 (\tan(0.00558336))$ $= 0.00670010 \text{ m (6.s.f)}$ Thus, the width of the central fringe is: $2y = 2 (0.00670010)$ $= 0.0134 \text{ m (3.s.f)}$ $= 13.4 \text{ mm (shown)}$ <u>Note:</u> Deduct 1 mark if students - used small angle approximation without justification - write the angle in degrees without indicating the degree symbol <u>Marker's comment:</u> This question was generally well answered. Most students obtained the correct solution with valid working, though common minor mistakes included using the small-angle approximation without justification and leaving out the degree symbol.	C1 C1 M1 A0
5(b)(i)	The distance from the central bright maximum to first minimum is: $13.4 / 2 = 6.7 \text{ mm}$. However, the central bright maxima are 2.8 mm away from each other. Hence, we cannot distinguish between the two diffraction patterns from each single slit / they cannot be resolved.	M1 A1

Qns	Answer	Marks
	 Marker's comment: This question was poorly answered. Students were unable to apply the Rayleigh criterion to the double-slit experiment, with many simply quoting the definition without answering the prompt. Those who attempted comparisons incorrectly compared the full width of 13.4 mm against the slit separation of 2.8 mm which does not address the Rayleigh criterion. Stronger candidates attempted angular comparisons using the criterion but forgot to convert angles to radians, leading to incorrect conclusions on whether the patterns could be resolved.	
5(b)(ii)	$x = \frac{D\lambda}{a} = \frac{(1.2)(670 \times 10^{-9})}{(2.8 \times 10^{-3})} = 0.000287143 \text{ m (6.s.f)}$ An estimation of the number of fringes, n is $n = \frac{0.0134002}{0.000287143} = 46.66733 = 46 \text{ (round down)}$ Marker's comment: This question was generally well answered. However, a few students incorrectly rounded up the number of fringes to 47. A few students derived an alternative answer by comparing half the width of the diffraction pattern. While credit was given due to proper justification, students are advised to adopt the standard estimation method provided, which was the accepted solution in Cambridge A-Level 2021 Paper 3 Q5.	C1 A1
TOTAL FOR QUESTION 5		
6(a)	Faraday's law of electromagnetism states that the (induced) e.m.f. is directly proportional to the rate of change of magnetic flux linkage. Marker's comment: This question was well answered though a handful missed out the word "linkage".	B1
6(b)(i)	$\varepsilon = \frac{d\phi}{dt} = \frac{\Delta\phi}{\Delta t}$ $\Delta\phi = \varepsilon \times \Delta t$ $= 0.55 \times 14 = 7.7 \text{ Wb}$ Accepted units include: Wb / Vs / Tm² Marker's comment: This question was generally well answered though a handful gave the wrong units. Students	A1 A1

Qns	Answer	Marks									
	If Lenz's law was used, students needed to state that the opposing force acts <u>leftward</u> to keep the resultant force zero. Using Fleming's left-hand rule, this requires the positive charges to flow to wingtip P and thus P is at a higher potential. <u>Note:</u> While this explanation is valid, students are strongly discouraged from tackling this question in this manner as the question only specifies the use of Fleming's left-hand rule.										
6(c)(i)	<table border="1"> <thead> <tr> <th>Resistor</th><th>r.m.s. voltage, $V_{\text{r.m.s.}} / \text{V}$</th><th>peak voltage, V_0 / V</th></tr> </thead> <tbody> <tr> <td>R_1</td><td>$\frac{16}{\sqrt{2}} = 11 \text{ (or 11.3)}$</td><td>16</td></tr> <tr> <td>R_2</td><td>$\frac{16}{2} = 8.0$</td><td>16</td></tr> </tbody> </table> Marker's comment: This question was surprisingly poorly answered. Students who did not obtain the answer are strongly advised to revisit this topic.	Resistor	r.m.s. voltage, $V_{\text{r.m.s.}} / \text{V}$	peak voltage, V_0 / V	R_1	$\frac{16}{\sqrt{2}} = 11 \text{ (or 11.3)}$	16	R_2	$\frac{16}{2} = 8.0$	16	A1
Resistor	r.m.s. voltage, $V_{\text{r.m.s.}} / \text{V}$	peak voltage, V_0 / V									
R_1	$\frac{16}{\sqrt{2}} = 11 \text{ (or 11.3)}$	16									
R_2	$\frac{16}{2} = 8.0$	16									
6(c)(ii)	The peak voltages are the same because when the diode is forward-biased, its <u>resistance is close to zero</u>, giving both resistors the same peak potential difference. The r.m.s. voltages for both resistors are different because the branch with resistor R_2 and the diode undergoes <u>half-wave rectification</u>, unlike the branch with only resistor R_1. Marker's comment: This question was poorly answered. For the first mark, students did not explicitly state that the forward-bias resistance of the diode is zero. Hence, for half the cycle, the potential difference across both resistors is the same. Simply stating that they share the same power source was insufficient for credit. For the second mark, candidates needed to explicitly recognize that the process represents half-wave rectification. Stating that current passes in forward bias and is blocked in reverse bias did not receive full credit unless the candidate also indicated that this occurs for half of the time/cycle (for which the benefit of the doubt was given).	B1 B1									
TOTAL FOR QUESTION 6		11									
7(a)	Half-life is the <u>average</u> time taken for half the original <u>number</u> of radioactive <u>nuclei</u> to decay. Marker's comment: This question was poorly answered. Most common missing key word included "average". Another common mistake included the incorrect reference of "substance/ concentration" instead of "nuclei/ isotopes".	B1									
7(b)(i)	$A = \lambda N$ $1.6 \times 10^{14} = \frac{\ln 2}{3.6 \times 24 \times 3600} N \quad [\text{M1}]$ $N = 7.18 \times 10^{19}$ Mass = $7.18 \times 10^{19} \times 224 \times 1.66 \times 10^{-27} \quad [\text{M1}]$ $= 2.67 \times 10^{-5} \text{ kg}$ $= 27 \text{ mg} \quad [\text{A0}]$	M1 M1 A0									

Qns	Answer	Marks
	Marker's comment: This question was generally well answered. Students are to note that for value of unified atomic mass u, they should use $1.66 \times 10^{-27} \text{ kg}$ instead of $1.67 \times 10^{-27} \text{ kg}$ (which is in fact that mass of proton).	
7(b)(ii)	Consider activity of 5.0mg of the fresh sample $A_o = \frac{5.0}{2.67} \times 1.6 \times 10^{14}$ $= 2.996 \times 10^{13} \text{ Bq}$ $\frac{A}{A_o} = \left(\frac{1}{2}\right)^{\frac{t}{t_{1/2}}}$ $\frac{2.1 \times 10^{10}}{2.996 \times 10^{13}} = \left(\frac{1}{2}\right)^{\frac{t}{3.6}}$ $t = 38 \text{ days}$ Marker's comment: This question was not well answered. Students need to realise that in order to apply any version of decay law for this question, both the initial and final values must be referenced to the full sample in (bi), or both referenced to the extracted sample in (bii), and not a mix. Another common error included the wrong conversion of 5.0mg to $5.0 \times 10^{-3} \text{ kg}$.	M1 M1 A1
TOTAL FOR QUESTION 7		6

8(a)(i)	$T = RC \ln \left(\frac{\mathcal{E} - V_s}{\mathcal{E} - V_b} \right)$ $= 18 \times 10^3 \times 33 \times 10^{-6} \ln \left(\frac{5.4 - 0.9}{5.4 - 4.5} \right) \quad [\text{C1}]$ $= 0.956 \text{ s}$ $f = \frac{1}{T} = 1.046 \text{ s}^{-1} = 1.05 \text{ Hz} \quad [\text{M1}]$ Comment: Passage mentioned: steady heart rate is 60 beats per minute, the frequency of 1.046 s^{-1} is about 62 beats per min which is close to steady heart rate. Hence it is appropriate. [A1] <i>Candidate <u>must</u> compare current frequency with steady heart rate from passage to gain this mark.</i> Award [B1] for any <u>one physiologically valid situation</u> where a fixed pacing rate is inappropriate, with a <u>brief explanation of why</u>. Examples: Physical activity: cannot increase rate during exercise leading to insufficient cardiac output during exertion Sleep: healthy hearts slow to 40–50 bpm during deep sleep hence fixed rate may be unnecessarily high, consuming more battery Emotional stress/anxiety: heart rate naturally rises and fixed rate cannot respond Illness/fever: body may require higher heart rate and fixed rate cannot adapt Individual variation: 60 bpm may not be the optimal resting rate for every patient but there is no way to adjust without surgery to replace resistor Competing with intrinsic rhythm: if patient's own heart occasionally fires, fixed-rate pacemaker may deliver a pulse at the wrong moment in the cardiac cycle, potentially dangerous p.s. this is actually the most clinically serious one, known as "R-on-T phenomenon"	C1 M1 A1 B1
	Marker's comment: A small number of candidates forgot to do "ln" in their working. <i>No marks will be awarded for the comment based on a wrongly calculated frequency.</i> Some students interpreted frequency as "beats per min" instead of s^{-1} and got 63 bpm. This is accepted. Comment that simply says "it is appropriate" without any elaboration or comparison with the 60-100 bpm from passage is an incomplete answer. Limitation must come with both a physiologically valid situation <u>and</u> a brief explanation why in order to be awarded marks.	
8(a)(ii)	$\tau_{\text{charging}} = RC = 18 \times 10^3 \times 33 \times 10^{-6} = 0.594 \text{ s}$ $\tau_{\text{discharge}} = R_{\text{L}} C = 500 \times 33 \times 10^{-6} = 0.0165 \text{ s} \quad [\text{M1 for both calculations}]$ $\tau_{\text{discharge}}$ is 36× smaller than τ_{charging} (or compare and say about 2% only) ; since discharge time $\ll$ charging time $\ll T$, the assumption that discharge is almost instantaneous is well justified. [A1]	M1 A1
	Marker's comment: A significant number of students either only found the time constant for charging or the time constant for discharging not both as required by the question. A comparison between the two requires candidates to state a specific numerical relationship e.g. $\tau_{\text{discharge}}$ is 36 times smaller than τ_{charging} or that it represents about 2% of the charging time.	

	Simply stating that one was “significantly smaller / larger” than the other without quantifying evidence will not be sufficient.	
8(b)(i)	The energy U stored in a capacitor of capacitance C charged to potential difference V is: $U = \frac{1}{2} CV^2$ Since the capacitor charges to V_b before each discharge and retains charge at V_s after each discharge, the energy ΔU delivered to the heart per pulse is: $\Delta U = \frac{1}{2} C (V_b^2 - V_s^2)$ $= \frac{1}{2} (33 \times 10^{-6})(4.5^2 - 0.9^2)$ $= 3.21 \times 10^{-4} \text{ J}$	C1 M1 for correct working + substitution A0
	Marker's comment: Candidates should realise that the equation for U can be found in the data and formula sheet. The first C1 mark is easy to obtain. However a significant number of students made the mistake of writing $(\Delta V)^2$ instead of $\Delta(V^2)$. They are not the same thing.	
8(b)(ii)	Power = energy / time = energy x frequency $P = 3.21 \times 10^{-4} \times 1.046$ $= 0.0003357$ $= 3.36 \times 10^{-4} \text{ W}$	M1 A1
	Marker's comment: Mostly well done.	
8(b)(iii)	Each pulse is said to be almost “instantaneous” which means the <u>power is delivered only during the discharging process</u> [B1] <u>and during the charging process, no energy is delivered to the heart tissue</u> [B1]; hence the time-averaged power is much lower than the power during each pulse	B1 B1
	Marker's comment: Most students simply rephrased the question, stating that spreading the same energy over a longer time results in lower power, without explaining the core physics: power is delivered <u>only during the discharging phase</u>, while <u>no energy</u> is delivered to the heart tissue <u>during charging</u>. As a result, the time-averaged power over the full cycle is significantly lower than the peak power delivered during each pulse. Additionally, some students incorrectly attempted to frame their answer around energy losses, which misses the intent of the question.	
8(c)(i)	Converts capacity to coulombs: $Q = 1.2 \times 3600 = 4320 \text{ C}$ [C1] Energy = $VQ = 5.4 \times 4320 = 23328 \text{ J} = 23.3 \text{ kJ}$ (3sf) [A1]	C1 A1
	Marker's comment: Although the question explicitly defined battery capacity, a significant number of candidates incorrectly referred to 4320 C as the battery's "capacitance," demonstrating a fundamental lack of understanding. Furthermore, many students mistakenly used the energy equation for capacitors ($E = \frac{1}{2} VQ$)	

	rather than the correct equation for a constant-voltage supply/battery ($E = VQ$).	
8(c)(ii)	Lifespan = $E_{\text{batt}} / P_{\text{avg}} = 23328 / (3.36 \times 10^{-4}) = 6.94 \times 10^7 \text{ s} = 2.2 \text{ years}$ Very short lifespan, will require operation every 2.2 years to change battery. OR 2.2 years is an <u>overestimate</u> because the calculation assumes all stored battery energy is ultimately delivered to the heart and neglects losses/other circuit consumption.	M1 A1
	Marker's comment: Ecf was awarded provided students showed clear and correct working to obtain lifespan by dividing the total battery energy by the average power. Some students incorrectly concluded that 2 years is sufficiently long for a pacemaker, failing to realise that this represents a very short duration requiring frequent surgical interventions to replace the battery. Alternatively, candidates could earn marks by pointing out that 2.2 years is an <u>overestimate</u> because the calculation assumes 100% efficiency and neglects energy losses or power consumed by other circuit components.	
8(d)(i)	Increase in C → increase in T calculated from (a)(i)/ time constant → <u>longer charging time and longer period T</u> → lower pacing frequency since $f = 1/T$. [1]	B1
	Marker's comment: Mostly well done. However, a small number of candidates lost the mark because they failed to make the explicit final connection linking the increased period (T) to a lower pacing frequency via $f = \frac{1}{T}$.	
8(d)(ii)	A patient with complete heart block is <u>entirely dependent on the pacemaker for ventricular stimulation</u>; if the pacing rate drops, their heart rate drops correspondingly. [B1] <u>If the pacing rate falls below ~40 bpm (as stated in passage), the patient risks fainting / cardiac arrest.</u> [B1] A <u>slow gradual drift may go unnoticed without regular monitoring</u>, person's health may deteriorate slowly, making it potentially life-threatening / dangerous. [B1] Award max 2 points for any 2 points.	B1 B1
	Marker's comment: Most candidates successfully recognized that a patient with complete heart block is entirely dependent on the pacemaker, meaning a drop in pacing rate leads to a corresponding drop in heart rate. However, to secure full marks, candidates needed to extract key details from the passage - specifically identifying that the risk of fainting or cardiac arrest becomes critical when the pacing rate <u>falls below approximately 40 bpm</u>.	

	Additionally, a number of candidates incorrectly claimed that a slow decline in pacing rate poses no health risk, wrongly assuming that routine medical check-ups would automatically catch the drift before any danger arises. Candidates must realize that a gradual, unnoticed drop can cause a slow deterioration in health that is potentially life-threatening.	
TOTAL FOR QUESTION 8		19