<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>15(a)</td><td>
• Use of $W = F_{ave} \times x$ (1)
• $W = 0.47$ J (1)

Example of calculation
$W = 0.5(2.6\text{ N} + 9.6\text{ N}) \times 0.5 \times \pi \times 0.049\text{ m}$
$W = 0.47$ J
</td><td>2</td></tr>
<tr><td>*15(b) (i)</td><td>
This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning.

Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.

The following table shows how the marks should be awarded for indicative content.

<table>
<tr><th>Number of indicative marking points seen in answer</th><th>Number of marks awarded for indicative marking points</th><th>Max linkage mark available</th><th>Max final mark</th></tr>
<tr><td>6</td><td>4</td><td>2</td><td>6</td></tr>
<tr><td>5</td><td>3</td><td>2</td><td>5</td></tr>
<tr><td>4</td><td>3</td><td>1</td><td>4</td></tr>
<tr><td>3</td><td>2</td><td>1</td><td>3</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>2</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>

The following table shows how the marks should be awarded for structure and lines of reasoning.
</td><td>6</td></tr>
</table>

	<table><tr><td></td><td>Number of marks awarded for structure of answer and sustained line of reasoning</td></tr><tr><td>Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout</td><td>2</td></tr><tr><td>Answer is partially structured with some linkages and lines of reasoning</td><td>1</td></tr><tr><td>Answer has no linkages between points and is unstructured</td><td>0</td></tr></table> Guidance on how the mark scheme should be applied: The mark for indicative content should be added to the mark for lines of reasoning. For example, an answer with five indicative marking points which is partially structured with some linkages and lines of reasoning scores 4 marks (3 marks for indicative content and 1 mark for partial structure and some linkages and lines of reasoning). If there are no linkages between points, the same five indicative marking points would yield an overall score of 3 marks (3 marks for indicative content and no marks for linkages). Indicative content: • (Aternating p.d. produces) alternating current in input coil • (Alternating/varying current produces) a varying magnetic field in core **Or** (Alternating/varying current produces) a varying magnetic field in second coil • There is a change in magnetic flux linkage with (second) coil • E.m.f. induced • Complete circuit, so current in capacitor circuit • Diode produces direct current		
15(b)(ii)	• Evidence of attempt to determine maximum gradient of graph • Use of emf = NA dB/dt • Max emf = 610 V Example of calculation Gradient = 1030 T s^{-1} Emf = 1030 T s^{-1} × 1700 × 3.5 × 10^{-4} m^2 = 613 V	**(1)** **(1)** **(1)**	**3**
15 (c)	• Calculate V_0 / e • Read time constant from graph = (4.5 s) • Use of time constant = RC • Use of W = ½ CV^2 • W = 270 J which is greater than 0.47 J, so the electrical method stores the most energy **OR** • Draws tangent to line at t = 0 s	**(1)** **(1)** **(1)** **(1)** **(1)**	**5**

	• Read time constant value off graph (= 4.5 s) • Use of time constant = RC • Use of $W = ½ CV^2$ • W = 270 J which is greater than 0.47 J, so the electrical method stores the most energy **OR** • record a pair of values of V and t from graph • Use of $V = V_0 e^{-\frac{t}{RC}}$ • Convert to correct logarithmic form • Use of $W = ½ CV^2$ • W = 270 J which is greater than 0.47 J, so the electrical method stores the most energy **OR** • $V_0 / 2 = V_0 e^{-t½/RC}$ • $RC = t_{½} / \ln 2$ • Records time for V to decrease to ½ (= 3.1 s) • Use of $W = ½ CV^2$ • W = 270 J which is greater than 0.47 J, so the electrical method stores the most energy <u>Example of calculation</u> V_0 / e = 600 V / e = 221 V Time constant = 4.5 s 4.5 s = 3000 Ω × C $C = 1.5 \times 10^{-3}$ F $W = ½ \times 1.5 \times 10^{-3}$ F × (600 V)^2 = 270 J	
	Total for Question 15	**16**