Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	• (For linear section of graph) area under graph = $\frac{1}{2}$ stress × strain (1) • Use of stress = F/A and strain = $\Delta x/x$ to show that area = $\frac{1}{2}\times\frac{F}{A}\times\frac{\Delta x}{x}=\frac{F_{av}.\Delta x}{V}=\frac{E}{V}$ (1)	Candidates who only use the graph to show that the area has units J m^{-3} can score a maximum 1 mark Accept F_{av} for $\frac{1}{2}F$	2
(ii)	• Area under graph up to 0.075 calculated (1) • Energy per unit volume = 7.1×10^5 J m^{-3} (1) • This is much less than the value given in (a), and so belt does not absorb all the KE. (1) **OR** • Graph used to determine stress when strain is 0.075 and $\sigma=\frac{F}{A}$ used to calculate force (1) • $\epsilon=\frac{\Delta x}{x}$ used to calculate extension and $W=\frac{1}{2}F\Delta x$ used to calculate energy (1) • Statement that this energy is much less than the value in (a), and so belt does not absorb all the kinetic energy (1)	Example of calculation: When strain is 0.075 Area = $\frac{1}{2}\times19\times10^6\text{Pa}\times0.075=7.13\times10^5$ J m^{-3}	3

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Q2.

<table>
<tr><th>Question Number</th><th>Acceptable Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>*</td><td>This question assesses a student's ability to show a coherent and logical structured answer with linkage and fully-sustained reasoning.

Indicative content:

IC1 Before closing S2, bulb 1 and bulb 2 have the same p.d./current so both bulbs have equal brightness

IC2 Closing switch S2 allows current to flow in bulb 3 Or Closing switch S2 places the same p.d. across bulb 3 as bulb 1.

IC3 Bulb 1 and bulb 3 are in parallel, so the resistance of the combination decreases</td><td>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.

Total marks awarded is the sum of marks for indicative content and the marks for structure and lines of reasoning

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



<table>
<tr><th>IC points</th><th>IC mark</th><th>Max linkage mark</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>
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</table>
</td><td>6</td></tr>
</table>

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	IC4 The p.d. across bulb 1 (and bulb 3) decreases **Or** The p.d. across bulb 2 increases IC5 The current in circuit/bulb 2 increases so the brightness /power of bulb 2 increases **Or** current in bulb 1 decreases so the brightness/ power of bulb 1 decreases **Or** $P = \frac{V^2}{R}$; so power of bulb 2 increases [power of bulb 1 decreases] IC6 (When S2 closed) bulb 1 is not as bright as bulb 2.		

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Q3.

<table>
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<tr><td>*</td><td>This question assesses a student's ability to show a coherent and logical structured answer with linkage and fully-sustained reasoning.

Indicative content:

IC1 The electric current is a movement of electrons (between the electrodes)
[Accept "charge carriers" for "electrons"]

IC2 The electrons collide with neon atoms
[Accept "interact" for "collide"]

IC3 Energy is transferred to the neon atoms (in the collisions)

IC4 Electrons in the neon (atoms) are promoted to higher energy states
Or electrons in neon (atoms) are excited

IC5 (After a short time) electrons in the neon (atoms) return to their normal/ground state
Or electrons in neon (atoms) de-excite

IC6 When an electron returns to a lower energy state it emits a <u>photon</u> (of electromagnetic radiation)</td><td>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.

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<table><tr><th></th><th>Number of marks awarded for structure of answer and sustained line of reasoning</th></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>
Total marks awarded is the sum of marks for indicative content and the marks for structure and lines of reasoning

<table><tr><th>IC points</th><th>IC mark</th><th>Max linkage mark</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></td><td>6</td></tr>
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