**Name of the Student**:_____

**Max. Marks : 25 Marks** **Time : 25 Minutes**

Mark Schemes

**Q1.**

<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.<br><br>Indicative content:<br><br>IC1 The electric current is a movement of electrons (between the electrodes)<br>[Accept "charge carriers" for "electrons"]<br><br>IC2 The electrons collide with neon atoms<br>[Accept "interact" for "collide"]<br><br>IC3 Energy is transferred to the neon atoms (in the collisions)<br><br>IC4 Electrons in the neon (atoms) are promoted to higher energy states<br>Or electrons in neon (atoms) are excited<br><br>IC5 (After a short time) electrons in the neon (atoms) return to their normal/ground state<br>Or electrons in neon (atoms) de-excite</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.<br><br><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><br><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><br>Total marks awarded is the sum of marks for indicative content and the marks for structure and lines of reasoning<br><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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|---|---|---|---|
| | IC6 When an electron returns to a lower energy state it emits a photon (of electromagnetic radiation) | | |

**Q2.**

| Question Number | Acceptable answers | | Additional guidance | Mark |
|---|---|---|---|---|
| | • Measures angle at 52° +/- 2 ° | (1) | Accept angle calculate from measured dimensions and trigonometry. | 5 |
| | • Uses $F = ma$ horizontally | (1) | Example of calculation | |
| | • Resolves forces vertically | (1) | $T\sin\theta = \frac{mv^2}{r}$ | |
| | • Uses $a = v^2 / r$ **Or** $a = r\omega^2$ | (1) | $T\cos\theta = mg$ | |
| | • Calculates the 51° and reaches a consistent conclusion | (1) | $\tan\theta = \frac{v^2}{rg}$ | |
| | | | $\tan\theta = (3.8)^2$ (m s$^{-1}$)$^2$ / 1.2 m ×9.81 m s$^{-2}$ | |
| | | | $\theta = 50.8°$ | |

**Q3.**

| Question Number | Acceptable answers | | Additional guidance | Mark |
|---|---|---|---|---|
| (i) | • Use of momentum = $mv$ | (1) | Example of calculation: | |
| | • See component(s) in x direction | (1) | $7.1(g)u = 7.1(g) \times 0.9(ms^{-1}) \times cos\ 8 + 3.6(g) \times 1.4(ms^{-1}) \times cos\ 10$ | |
| | • Uses momentum conservation | (1) | $u = \frac{(6.33 + 4.96)}{7.1}$ | |
| | • $u$ = 1.6 (m s$^{-1}$) | (1) | $u = 1.59 ms^{-1}$ | (4) |

| Question Number | Acceptable answers | | Additional guidance | Mark |
|---|---|---|---|---|
| (ii) | • Use of $E_k = ½ mv^2$ | (1) | Allow ecf from b(i) | |
| | • Value of Initial $E_k = 9.0\times10^{-3}$ (J) and Final $E_k = 6.4\times10^{-3}$ (J) (Show that value gives Initial $E_k = 1.42 \times10^{-2}$ (J) allow ecf from (b)(i)) | (1) | Example of calculation: Initial $E_k = ½ \times 7.1\times10^{-3}$(kg)$\times 1.59^2$(ms$^{-1}$)$^2 = 9.0\times10^{-3}$ J Final $E_k = ½ \times 7.1\times10^{-3} \times 0.9^2 + ½ \times 3.6\times10^{-3} \times 1.4^2 = 6.4\times10^{-3}$ J | (2) |

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**Q4.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| (i) | • Attempt to determine an area **(1)**<br>• Uses area = change of momentum **(1)**<br>• velocity in range 28 – 33 ($m\,s^{-1}$) **(1)** | eg markings on the graph<br><br>Example of calculation:<br><br>Approximates area = triangle<br>= (0.0005 s × 5500 N) / 2<br>Area = 1.375 Ns<br>Velocity = 1.375 Ns / 0.046 kg<br>= 29.1 $ms^{-1}$ | 3 |
| (ii) | • Use of $s = ut + \frac{1}{2}at^2$ in vertical direction **(1)**<br>• if $s$ + then $ut$ + and $at^2$ negative **(1)**<br>**Or** if $s$ – then $ut$ – and $at^2$ positive<br>• Use of velocity = distance / time in horizontal direction **(1)**<br>• Correct component of velocity in each direction **(1)**<br>• Distance = 76 m and comment such as yes it reaches the green. (ECF from bi) **(1)**<br><br>Range of distance 70.5 m for b(i) $v$ = 28 $m\,s^{-1}$ to 93.6 m for $v$ = 33 $m\,s^{-1}$ | Alt: Use of pythagorus to find resultant velocity<br><br>Also accept conclusion based on a comparison of velocity values from (i) and (ii)<br><br>Example of calculation:<br>$7.5m = 29m\,s^{-1}\sin\theta 3.5s - \frac{1}{2} 9.81m\,s^{-2}3.5^2s^2$<br><br>$7.5m = 101.5\sin\theta - 60.1$<br>$\sin\theta = 67.6 / 101.5$<br>$\theta = 41.8°$<br><br>$29\ ms^{-1}\cos 41.8 = x / 3.5\ s$<br>$x = 75.7$ m<br><br>Using the "show that" value:<br>$7.5m = 30m\,s^{-1}\sin\theta 3.5s - \frac{1}{2}9.81m\,s^{-2}3.5^2s^2$<br>$7.5m = 105\sin\theta - 60.1$<br>$\sin\theta = 67.6 / 105$<br>$\theta = 40.1°$<br><br>$30\ ms^{-1}\cos 40.1 = x / 3.5\ s$<br>$x = 80.3$ m | 5 |

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