

Name of the Student: _____

Max. Marks : 21 Marks

Time : 21 Minutes

Mark Schemes

Q1.

Question Number	Acceptable Answer	Additional Guidance	Mark																																																				
*	<p>This question assesses a student's ability to show a coherent and logical structured answer with linkage and fully-sustained reasoning.</p> <p>Indicative content:</p> <p>IC1 Both circuits are suitable because they allow readings of p.d./current for the lamp</p> <p>IC2 For circuit 1 the minimum p.d. across the lamp is 0 V (when the slider is at the left) Or For circuit 2 the minimum p.d. across the lamp is greater than 0V For circuit 1 the maximum p.d. across the lamp is the supply p.d (when the slider is at the right)</p> <p>IC3 For circuit 1 the maximum p.d. across the lamp is the supply p.d</p>	<p>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.</p> <table border="1"> <thead> <tr> <th>Number of indicative marking points seen in answer</th> <th>Number of marks awarded for indicative marking points</th> </tr> </thead> <tbody> <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> </tbody> </table> <table border="1"> <thead> <tr> <th></th> <th>Number of marks awarded for structure of answer and sustained line of reasoning</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>Total marks awarded is the sum of marks for indicative content and the marks for structure and lines of reasoning</p> <table border="1"> <thead> <tr> <th>IC points</th> <th>IC mark</th> <th>Max linkage mark</th> <th>Max final mark</th> </tr> </thead> <tbody> <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> </tbody> </table>	Number of indicative marking points seen in answer	Number of marks awarded for indicative marking points	6	4	5-4	3	3-2	2	1	1	0	0		Number of marks awarded for structure of answer and sustained line of reasoning	Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout	2	Answer is partially structured with some linkages and lines of reasoning	1	Answer has no linkages between points and is unstructured	0	IC points	IC mark	Max linkage mark	Max final mark	6	4	2	6	5	3	2	5	4	3	1	4	3	2	1	3	2	2	0	2	1	1	0	1	0	0	0	0	6
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	<p>(when the slider is at the right)</p> <p>IC4 For circuit 2 adjusting the resistor changes the circuit resistance (so the current is varied) Or for circuit 2 the battery p.d. is shared between lamp and variable resistor</p> <p>IC5 So for circuit 2 the minimum p.d. depends upon the resistance of the variable resistor,</p> <p>IC6 Circuit 1 is better because it allows a bigger range Or Circuit 1 is better because it allows p.d.s down to 0 V to be used</p>		
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Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	<p>EITHER</p> <ul style="list-style-type: none"> • Calculation of mean t (1) • Use of $s = ut$ (1) • Use of $v = \frac{2r^2g(\rho_B - \rho_C)}{9\eta}$ (1) • Cocoa content = 30% Or viscosity at 35% = 4.5 (Pa s) (1) • Conclusion consistent with their graph value (1) OR • Viscosity at 35% = 4.5 (Pa s) (1) • Use of $v = \frac{2r^2g(\rho_B - \rho_C)}{9\eta}$ (1) 	<p><u>Example of calculation</u></p> $t = \frac{(9.6 + 9.9 + 9.6) \text{ s}}{3} = 9.7 \text{ s}$ $v = \frac{0.225 \text{ m}}{9.7 \text{ s}} = 0.0232 \text{ m s}^{-1}$ $\eta = \frac{2 \times (4.25 \times 10^{-3} \text{ m})^2 \times 9.81 \text{ m s}^{-2} \times (7750 - 1330) \text{ kg m}^{-3}}{9 \times 0.0232 \text{ m s}^{-1}}$ <p>$\eta = 10.9 \text{ Pa s}$, so cocoa content is 30% (from graph)</p> <p>Cocoa content is 30% so not consistent Or viscosity value is 4.5 Pa s so not consistent</p> <p>Time taken would be 4.0 s so not consistent with mean time</p>	5
	<ul style="list-style-type: none"> • Use of $s = ut$ to calculate time to fall T_{fall} (1) • Calculation of mean t (1) • Conclusion consistent with calculated value of T_{fall} (1) 		

(ii)	<p>An explanation that makes reference to the following points:</p> <p>EITHER</p> <ul style="list-style-type: none"> The temperature may not have been constant (1) So the viscosity value would have varied (1) <p>OR</p> <ul style="list-style-type: none"> There may have been reaction time error (1) Or There may have been parallax error in reading the distance fallen by the ball (1) So the velocity of the ball may have been inaccurate (1) <p>OR</p> <ul style="list-style-type: none"> There may have been an extra drag force (1) So terminal velocity would have been reduced (1) 	<p>If no other marks scored then allow MAX 1 for reference to ball not falling at terminal velocity</p> <p>Allow a reference to eddies Or turbulent flow</p>	2
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Q3.

Question Number	Acceptable Answer	Additional Guidance	
(i)	<ul style="list-style-type: none"> Wear safety glasses (to protect eyes from breaking wire) Or wear suitable footwear (to protect feet from falling masses) Or place sand tray under masses (to catch them if they fall) 		1

Question Number	Acceptable Answer	Additional Guidance	
(ii)	<ul style="list-style-type: none"> $\lambda = 2L$ substituted into $v = f\lambda$ (1) v substituted into $v = \sqrt{\frac{T}{\mu}}$ (1) Correct re-arrangement into $y = mx + c$ format (1) 	<p>$v = f\lambda$ and $\lambda = 2L$ so $v = 2fL$</p> <p>$v = \sqrt{\frac{T}{\mu}}$, so $4f^2L^2 = \frac{T}{\mu}$</p> <p>$L^2 = \left(\frac{T}{4\mu}\right) \cdot \frac{1}{f^2}$, so gradient is $\frac{T}{4\mu}$</p>	3
(iii)	<ul style="list-style-type: none"> Gradient calculated (1) Use of gradient = $\frac{T}{4\mu}$ (1) $\mu = 1.8 \text{ (g m}^{-1}\text{)}$ (1) SWG consistent with their calculated value of μ (24 swg) (1) 	<p><u>Example of calculation</u></p> <p>gradient = $\frac{(0.043 - 0)\text{m}^2}{(15.0 - 0.0) \times 10^{-6}\text{s}^2} = 2.87 \times 10^3 \text{m}^2\text{s}^{-2}$</p> <p>$\mu = \frac{2.1 \text{ kg} \times 9.81 \text{ m s}^{-2}}{4 \times 2.87 \times 10^3 \text{m}^2\text{s}^{-2}} = 1.79 \times 10^{-3} \text{ kg m}^{-1}$</p> <p>$\therefore \mu = 1.79 \text{ g m}^{-1}$</p>	4