

Name of the Student: _____

Max. Marks : 26 Marks

Time : 26 Minutes

Mark Schemes

Q1.

Question number	Acceptable answers	Additional guidance	Mark
	<ul style="list-style-type: none"> Sensible estimate of uncertainties from readings given (1) Adds percentage uncertainties (1) Hence calculates uncertainty in speed (1) Candidate's conclusion must be supported by their estimate of the uncertainties (1) 	<p>Example of calculation:</p> <p>%U in L is $(0.1/25.6) \times 100 \% = 0.4 \%$</p> <p>%U in F is $(1/320) \times 100 \% = 0.3 \%$</p> <p>%U in speed is 0.7 %</p> <p>$328 \times 0.007 = 2$</p> <p>Speed = 328 ± 2</p> <p>All three results are within the calculated uncertainty so concludes student B is correct</p>	4

Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
	<p>Use of $V = \pi r^2 t$ (1)</p> <p>Use of $\rho = \frac{m}{V}$ to find m (1)</p> <p>Use of 0.5% to find total mass needed (1)</p> <p>Number of discs = 10 (1)</p>	<p><u>Example of calculation</u></p> <p>$V = \pi r^2 t = \pi \left(\frac{1.3 \times 10^{-2} \text{ m}}{2} \right)^2 \times 2 \times 10^{-3} \text{ m}$</p> <p>$\therefore V = 2.65 \times 10^{-7} \text{ m}^3$</p> <p>$m = \rho V = 7900 \text{ kg m}^{-3} \times 2.65 \times 10^{-7} \text{ m}^3$</p> <p>$\therefore m = 2.10 \times 10^{-3} \text{ kg}$</p> <p>$\frac{0.1 \text{ g}}{M} = 0.5\%$</p> <p>$\therefore M = \frac{0.1 \text{ g}}{0.5/100} = 20 \text{ g}$</p> <p>$\therefore \text{number of discs} = \frac{20 \text{ g}}{2.10 \text{ g}} = 9.5$</p>	4

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 There is a fixed probability (λ) of an individual nucleus undergoing decay (in the next second)</p> <p>IC2 For a sample with large number of unstable nuclei there is a predictable pattern</p> <p>IC3 The fraction of nuclei decaying in the next second is equal to the decay constant (λ)</p>	<p>Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.</p> <p>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>IC4 Hence the number of nuclei decaying (in the next second) depends on the number of (unstable) nuclei Or activity = λN</p> <p>IC5 The number of unstable nuclei decreases</p>		
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	<p>exponentially (with time) Or number of (unstable) nuclei = $N_0 e^{-\lambda t}$</p> <p>IC6 So the rate of decay decreases exponentially (with time) Or rate of decay = $A_0 e^{-\lambda t}$</p>		
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Q4.

Question Number	Acceptable answers	Additional guidance	Mark
	D In the dark the resistance of the LDR will be very large so practically all the potential difference of 6V will be across it.	a little below 6 V	1
	A assumes the resistance of the LDR decreases to almost zero B assumes the resistance of the LDR decreases a little C assumes the resistance of the LDR increases a little		

Q5.

Question Number	Acceptable answers	Additional guidance		Mark
	B The induced emf in the coil will oppose the cell emf and cause a delay in the current to lamp Y	Lights after a delay with a final brightness the same as X		1
	A assumes the resistance of the coil is more than the resistor C ignores the magnetic effect of the coil and assumes the resistance of the coil is more than the resistor D ignores the magnetic effect of the coil			

Q6.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	<ul style="list-style-type: none"> • A standing wave is set up in the tube Or interference (of sound waves) takes place in the tube (1) • Where constructive interference occurs the amplitude is a maximum Or at antinodes the amplitude is a maximum (1) • Where destructive interference occurs the amplitude is a minimum Or at nodes the amplitude is zero/minimum (1) • Sand is displaced from points of max amplitude to points of min amplitude Or sand is displaced from antinodes to nodes (1) 		4
(ii)	<ul style="list-style-type: none"> • Measure over at least 3 heaps (1) • Divide by the number of gaps between the heaps (1) • Repeat measurement and calculate average (1) 	i.e at least 2 gaps	3

(iii)	<ul style="list-style-type: none"> • Use of $d = \frac{\lambda}{2}$ (1) • Use of $v = f\lambda$ (1) • $v = 330 \text{ (m s}^{-1}\text{)}$ and a comment on consistency with 340 m s^{-1} (1) 	<p><u>Example of calculation:</u></p> $\lambda = 2d = 2 \times 5.1 \times 10^{-2} \text{ m} = 0.102 \text{ m}$ $v = 3.25 \times 10^3 \text{ Hz} \times 0.102 \text{ m} = 332 \text{ m s}^{-1}$	3
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