



Mark Scheme

Mock Question Paper

Physics (9PH0)  
Set 2

Question Number	Answer	Additional Guidance	Mark
1(a)	<ul style="list-style-type: none"> <li>Equates <math>mgh</math> and (1)</li> <li><math>31 \text{ m s}^{-1}</math> (1)</li> </ul>	<p>Use of equations of linear accelerated motion does not gain credit</p> <p><u>Example of calculation</u></p> <p><math>31.3 \text{ m s}^{-1}</math></p>	(2)
1 (b)	<ul style="list-style-type: none"> <li>Any parabolic curve from bottom of slope to ground</li> </ul>	Judge by eye, do not accept if path goes up from B	(1)

<p><b>* 1 (c)</b></p>	<p>This question assesses a student’s ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning.</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><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> <p>The following table shows how the marks should be awarded for</p>	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	<p>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).</p>
Number of indicative marking points seen in answer	Number of marks awarded for indicative marking points													
6	4													
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3 - 2	2													
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0	0													

	structure and lines of reasoning.		
		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	
	<b>Indicative content</b> <ul style="list-style-type: none"><li>• The position shown increases the vertical component of the air resistance</li><li>• Low density materials give a lower weight</li><li>• The resultant downward force/acceleration is reduced <b>or</b> reduces terminal velocity</li><li>• Increasing the time in the air</li><li>• The position of the jumper also provides a minimum horizontal component of air resistance</li><li>• Which increases the horizontal displacement by preventing large horizontal deceleration <b>or</b> keeping horizontal velocity to a maximum</li></ul>	Answers that do not refer to horizontal and/or vertical components of air resistance will not gain credit. One linkage mark can be made for an explanation of either vertical or horizontal motion. Two linkage marks can only be awarded for an explanation that refers to both horizontal and vertical motion.	
			(6)

Total for Question 1 = 9 marks

Question Number	Answer	Additional Guidance	Mark
2	<ul style="list-style-type: none"> <li>equate and (1)</li> <li>use of (1)</li> <li>0.075 (m s<sup>-1</sup>) (1)</li> <li>use of (1)</li> <li>use of (1)</li> <li>9.4 m<sup>3</sup> (s<sup>-1</sup>) (1)</li> </ul>	<p><u>Example of calculation</u></p> <p>= 0.075 (m s<sup>-1</sup>)</p> <p>0.075 m s<sup>-1</sup> = 9.4 m<sup>3</sup></p> <p>s<sup>-1</sup></p> <p>Accept m<sup>3</sup> for the units because of how the question is worded.</p> <p>Use of diameter instead of radius means that MP4 &amp; 6 cannot be awarded.</p>	(6)

Total for Question 2 = 6 marks

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	<ul style="list-style-type: none"> <li>there is an equilibrium position with no resultant force (1)</li> <li>so force is proportional to separation/displacement (from the equilibrium position) (1)</li> <li>the gradient is negative so the force is in the opposite direction to separation/displacement,( so it is SHM) (1)</li> </ul>		(3)
3(a)(ii)	<ul style="list-style-type: none"> <li>use of gradient (1)</li> <li><math>k = 1820 \text{ (N m}^{-1}\text{)}</math> (1)</li> </ul>	<p>Any gradient calculation even if not the full graph scores MP1 MP2 only awarded for answer that rounds to 1820</p> <p><u>Example calculation</u>  <math>\text{Gdt} = (-2.00 \times 10^{-8} \text{ N} - 2.00 \times 10^{-8} \text{ N}) \div (1.24 \times 10^{-10} \text{ m} - 1.02 \times 10^{-10} \text{ m})</math>  <math>k = 1818 \text{ N m}^{-1}</math></p>	(2)
3(a)(iii)	<ul style="list-style-type: none"> <li>use of (1)</li> <li>use of <math>f = 1/T</math> (1)</li> <li><math>f = 4.2 \times 10^{13} \text{ Hz}</math> (1)</li> </ul>	<p>Ecf candidate's answer from (a)(ii)</p> <p><u>Example calculation</u>  <math>f = (1/2\pi) \sqrt{(1860 \text{ N m}^{-1}/2.66 \times 10^{-26} \text{ kg})}</math>  <math>f = 4.2 \times 10^{13} \text{ Hz}</math></p>	(3)

Total for Question 3 = 8 marks

Question Number	Answer	Additional Guidance	Mark												
4	<p>This question assesses a student’s ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning.</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><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>	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		
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		<p>For an answer in a sensible order scoring 2 or 3 content points award 1 linkage mark</p> <p>To score 2 linkage marks, more detail is needed and the sequence of events must be correct.</p>									
			(6)								

Total for Question 4 = 6 marks



Question Number	Answer	Additional Guidance	Mark
5(a)	<ul style="list-style-type: none"> <li><math>\frac{hc}{\lambda} = \phi + eV_s \quad \therefore V_s = \frac{hc}{e\lambda} - \frac{\phi}{e} \quad (1)</math></li> <li>comparison of <math>V_s</math> equation with <math>y = mx + c \quad (1)</math></li> </ul>	A separation of $hc/e$ and $1/\lambda$ with brackets around either is sufficient for the comparison with $y = mx + c$ for MP2	(2)
5(b)	<ul style="list-style-type: none"> <li>..... gradient = <math>\frac{hc}{e} \quad (1)</math></li> <li>..... attempt at gradient calculation (1)</li> <li>..... large triangle used (1)</li> <li><math>h = 6.6 \times 10^{-34} \text{ J s} \quad (1)</math></li> </ul>	<p>Example of calculation:</p> $\text{gradient} = \frac{(2.8 - (-0.7))\text{V}}{(2.85 \times 10^6 - 0)\text{m}^{-1}} = 1.23 \times 10^{-6} \text{ V m}$ $\text{gradient} = \frac{hc}{e}$ $h = \frac{e}{c} \times \text{gradient} = \frac{1.6 \times 10^{-19} \text{ C}}{3.0 \times 10^8 \text{ ms}^{-1}} \times 1.23 \times 10^{-6} \text{ V m} = 6.55 \times 10^{-34} \text{ J s}$	(4)

Total for Question 5 = 6 marks

Question Number	Answer	Additional Guidance	Mark
6	<p>An explanation that makes reference to the following points:</p> <ul style="list-style-type: none"> <li>• electrons are repelled off spheres to earth leaving net positive charge(1)</li> <li>• the spheres are identical so (positive) charge shared equally between them (1)</li> </ul>		(2)

Total for Question 6 = 2 marks

Question Number	Answer	Additional Guidance	Mark
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7

- see  $\therefore \ln(p) = -Kh + \ln(p_0)$  (1)
- comparison of  $\ln(p)$  equation with  $y = m x + c$  (1)
- $\ln(p)$  calculated for each height (1)
- all values to 3 sf (1)
- labelled axes and suitable scales (1)
- all points plotted correctly (1)
- best fit line drawn (1)
- Suggestion is valid since graph is a straight line **and** all the points lie on the line of best fit (1)

Accept use of  $\ln(p/p_0) = -Kh$  throughout

MP3 can be assumed from graph plotted

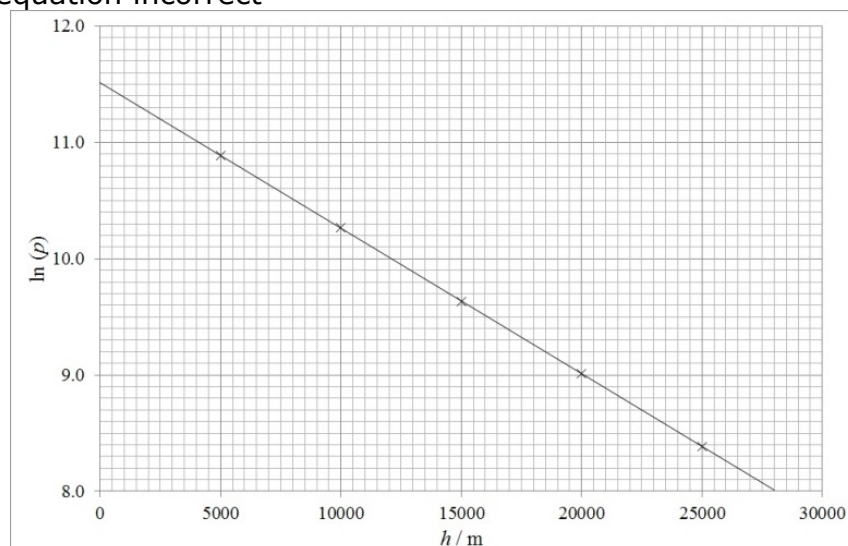
Example of calculation:

$$p = p_0 e^{-Kh}$$

$$\therefore \ln(p) = -Kh + \ln(p_0)$$

Height $h$ / m	Pressure $p$ /	$\ln(p)$
5000	53500	10.9
10000	28700	10.3
15000	15300	9.64
20000	8210	9.01
25000	4390	8.39

Marking points 5, 6, 7, 8 can be scored even if initial log equation incorrect



(8)

Total for Question 7 = 8 marks