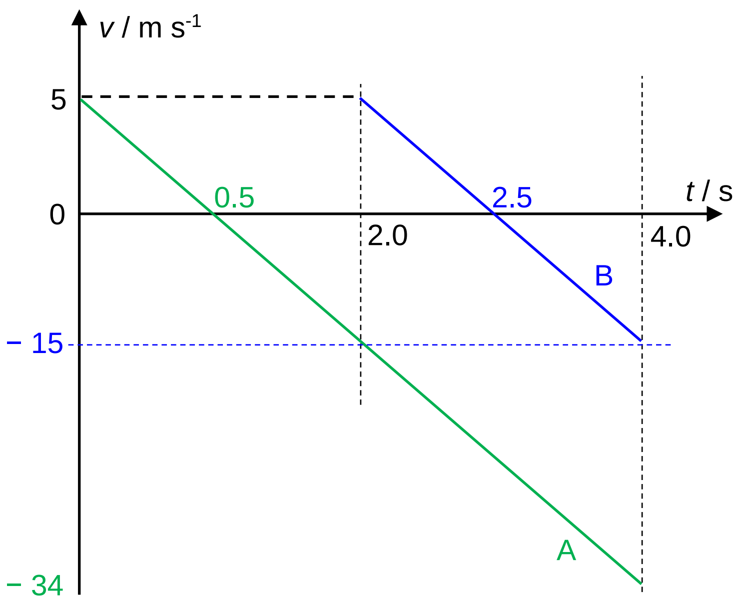
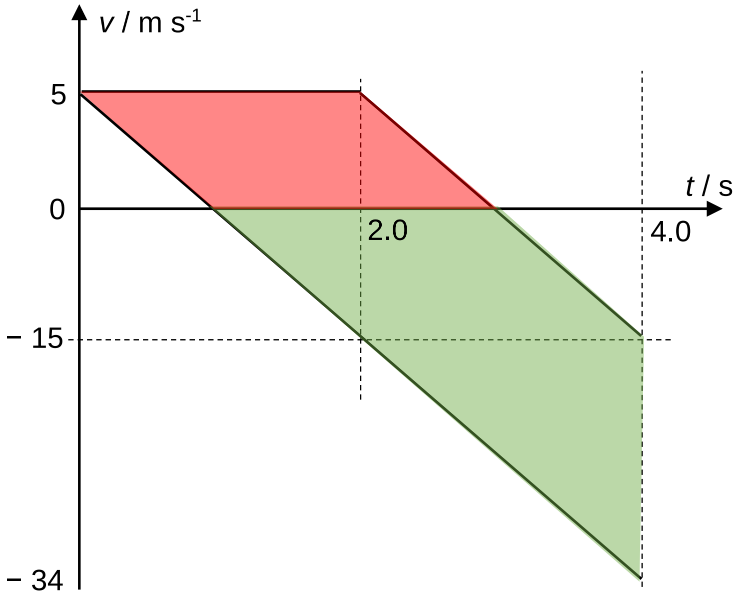
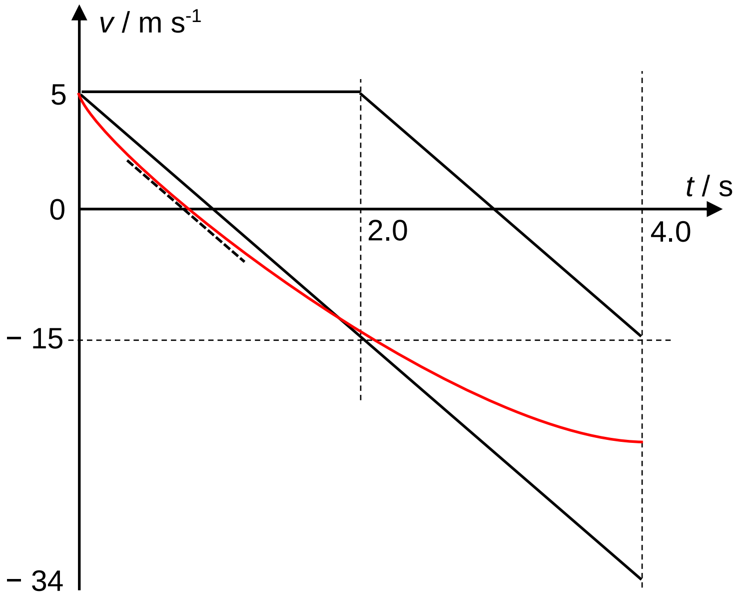
Paper 2
Structured Questions

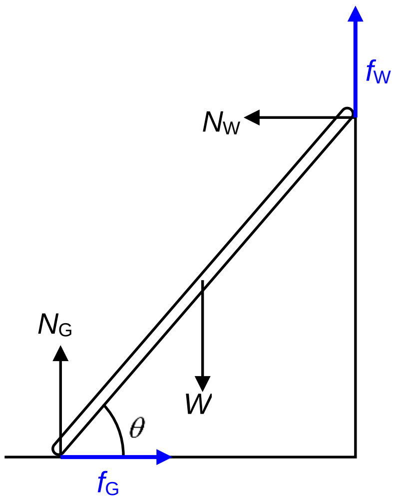
Qns	Answer	Marks
1(a)(i)	straight line from (0, 5) to (4, − 34) or (4, − 34.2)	**B1**
1(a)(ii)	flat portion from (0, 5) to (2, 5) straight portion from (2, 5) to (4, − 15) or (4, − 14.6)	**B1**
		
	Comments: Many candidates failed to indicate values along the axis despite circling or underlining “quantitatively” in the question paper. Quite a number of curves were seen despite the scenario being a free fall with negligible air resistance (and therefore the gradient to the *v*-*t* graph should be constantly g = 9.81 m s^{-2}). A small number of candidates failed to follow the instructions to (i) end their graph at t = 4 s and (ii) label their graphs. Revision pointers: Kinematics H201.1 and H201.2	

Qns	Answer	Marks
1(b)	**Method 1**  area under *v-t* graph gives displacement (for *difference in displacement between the 2 stones,* look at red + green area) = 59 m	**C1** correct area identified **A1**
	Method 2 $s_1 = ut + \frac{1}{2}at^2$ $= 5(4) + \frac{1}{2}(-9.81)(4^2)$ $= -58.5 \text{ m}$ $s_2 = ut\|_{\text{steady ascend}} + \left[ut + \frac{1}{2}at^2\right]_{\text{freefall}}$ $= 5(2) + \left[5(2) + \frac{1}{2}(-9.81)(2^2)\right]$ $= 0.38 \text{ m}$ $s_1 - s_2 = 5(4) + \frac{1}{2}(-9.81)(4^2) - \left\{5(2) + \left[5(2) + \frac{1}{2}(-9.81)(2^2)\right]\right\}$ $= -58.9 \text{ m}$ accept 59 m	**C1** 58.5 **C1** 0.38 *or taking sum of the above 2 numbers* **A1**
	Comments: Most did not realise that Method 1 involving the area of 2 trapeziums will be far easier. Of those who were unsuccessful with using the equations, many neglected the period of constant speed in B. Many candidates were able to solve for the correct distance but failed to draw the proper *v-t* graphs earlier. This is a sign of incomplete understanding and these students should revise.	

Qns	Answer	Marks
1(c)	line starts from (0, 5) decreases at decreasing rate ends at t = 4 s, above (4, − 34.2) gradient at v = 0 demonstrably same as (a)(i) [e.g. via dotted tangent line] 	 **B1** **B1**
	Comments: Revision pointers: H202 Kinematics Notes pg 21- 23.	

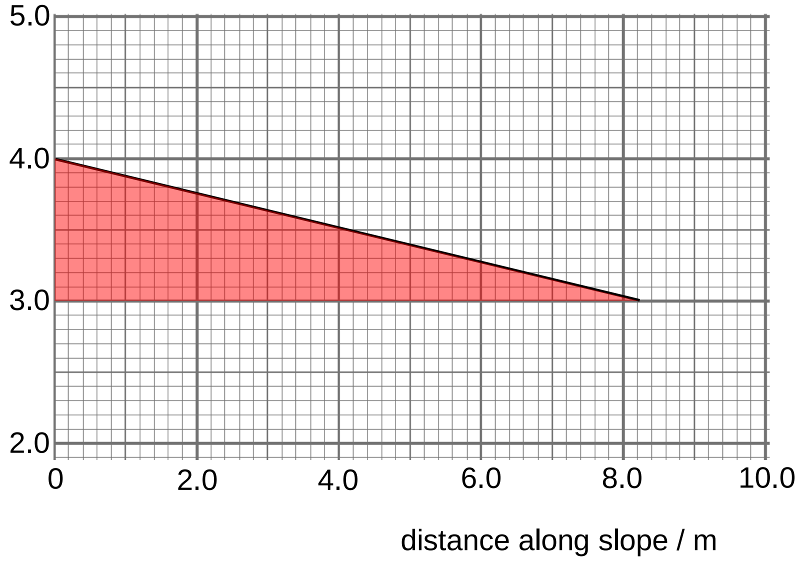
Qns	Answer	Marks
2(a)(i)	total linear momentum of isolated system of interacting bodies before and after collision remains constant if no net external force acts on system	**B1**
	Comments: Candidates need to be precise with definitions. Many failed to mention “isolated”, “system”, and “if no net external force acts on system”. Some candidates unnecessarily limited their definitions to the case of two interacting bodies, which is not accepted as the principle holds even for multiple bodies so long as the conditions are satisfied. Revision pointers: Dynamics Lecture H203.3	
2(a)(ii)	flat line p = 39 kN s	**B1**
	Comments: Generally well-done. question. However, a significant number of students mistakenly sketched a horizontal line in-between the graphs for A and B.	
2(b)(i)	rate of change of momentum of a body is directly proportional to the resultant force acting on it and in the direction of the resultant force	**B1**
	Comments Similar to (a)(i), definitions should be precise. Students need to define rate of change of linear momentum in terms of the resultant force (the order matters) and to also include the direction of this rate of change of linear momentum. Revision pointers: Dynamics Lecture H203.1	
2(b)(ii)	$F_{\text{on A}} = \frac{\Delta p}{\Delta t}$ $= \frac{(17-12)\times 10^3}{1.5}$ or $\frac{(12-17)\times 10^3}{1.5}$ $= 3330$ N	**M1** **A1**
	Comments Careless mistakes include ignoring the fact that the vertical axis is measure in kN s (and not N s) or dividing by 6 seconds, instead of duration during which the lorries’ momenta changed. Other mistakes include assuming that the vertical axis is the velocity measurement of the lorries, instead of its linear momentum. Revision pointers: Dynamics Lecture H203.1	

Qns	Answer	Marks
2(c)	Total initial KE of system $= \left(\dfrac{p_i^{\,2}}{2m}\right)_A + \left(\dfrac{p_i^{\,2}}{2m}\right)_B$ $= \dfrac{(17\times10^3)^2}{2\times1500} + \dfrac{(22\times10^3)^2}{2\times3000}$ $= 1.77\times10^5$ J Total final KE of system $= \left(\dfrac{p_f^{\,2}}{2m}\right)_A + \left(\dfrac{p_f^{\,2}}{2m}\right)_B$ $= \dfrac{(12\times10^3)^2}{2\times1500} + \dfrac{(27\times10^3)^2}{2\times3000}$ $= 1.70\times10^5$ J final total kinetic energy of system not same as initial total kinetic energy, inelastic	 **M1** **A1**
	Comments Marks are not awarded for comparing relative speed of approach with relative speed of separation, as the question specifically requires the candidates to compare energies. Other mistakes include misidentifying the linear momentum as velocities or mistaking the vertical axis as N s instead of kN s. The workings and the values calculated must be correct in order to achieve the M1 mark here. The description needs to specifically mention kinetic energy that was reduced. There were descriptions which incorrectly stated *total* energy was reduced; this would have violated the principle of conservation of energy. Revision pointers: Dynamics Lecture H203.4	

Qns	Answer	Marks
3(a)	no net force in any direction no net torque about any point	B1 B1
	Comments	
	Generally well done. Common mistakes included leaving out either one of the two conditions for equilibrium, not specifying the direction in the case of net force, not specifying pivot for net torque. A worrying number of candidates mistakenly stated the principle of moments as the condition for rotational equilibrium instead. In addition, stating the summation of forces being zero in the vertical and horizontal direction is incomplete, as this definition would only hold along 2D and doesn't hold for 3D (in and out of plane of paper). Revision pointers: Forces Lecture H204.3	
3(b)	 	B1 B1
	Comments	
	Generally well done. The common mistake was indicating the directions wrongly, especially for f_W. Revision pointers: Forces Lecture H204.3	

Qns	Answer	Marks
3(c)	Method 1: vertical equilibrium $f_W = W - N_G$ Let ladder by length L by Principle of moments <u>about point of contact with floor</u>, sum of clockwise moments = sum of anticlockwise moments $\left(\frac{L}{2}\cos\theta\right)W = (L\sin\theta)N_W + (L\cos\theta)f_W$ $\frac{W}{2} = N_W\tan\theta + f_W$ $N_W\tan\theta = \frac{W}{2} - f_W$ $= \frac{W}{2} - (W - N_G)$ $= N_G - \frac{W}{2}$	B1 B1
	Method 2: horizontal equilibrium $f_G = N_W$ Let ladder by length L by Principle of moments <u>about point of contact with wall</u>, sum of anticlockwise moments = sum of clockwise moments $\left(\frac{L}{2}\cos\theta\right)W + (L\sin\theta)f_G = (L\cos\theta)N_G$ $\frac{W}{2} + f_G\tan\theta = N_G$ $\frac{W}{2} + N_W\tan\theta = N_G$ $N_W\tan\theta = N_G - \frac{W}{2}$	B1 B1
	Method 3: Let ladder by length L by Principle of moments <u>about point of contact between floor and wall</u>, sum of anticlockwise moments = sum of clockwise moments $\left(\frac{L}{2}\cos\theta\right)W + (L\sin\theta)N_W = (L\cos\theta)N_G$ $\frac{W}{2} + N_W\tan\theta = N_G$ $N_W\tan\theta = N_G - \frac{W}{2}$	B1 B1

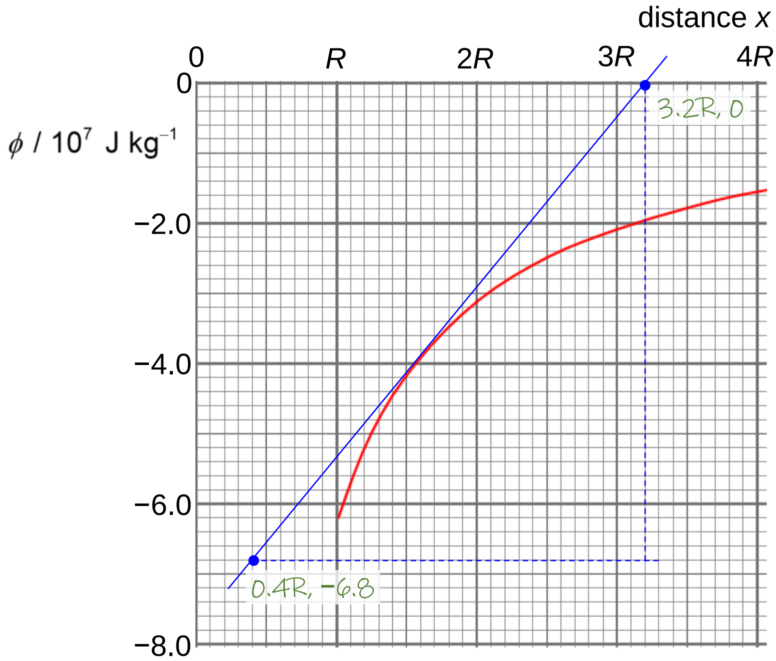
Qns	Answer	Marks
	Method 4: vertical equilibrium $f_W = W - N_G$ horizontal equilibrium $f_G = N_W$ Let ladder by length L by Principle of moments about centre of gravity of ladder, sum of anticlockwise moments = sum of clockwise moments $\left(\frac{L}{2}\sin\theta\right)f_G + \left(\frac{L}{2}\sin\theta\right)N_W + \left(\frac{L}{2}\cos\theta\right)f_W = \left(\frac{L}{2}\cos\theta\right)N_G$ $f_G\tan\theta + N_W\tan\theta + f_W = N_G$ $N_W\tan\theta + N_W\tan\theta + (W - N_G) = N_G$ $N_W\tan\theta = N_G - \frac{W}{2}$	B1 B1
	Comments	
	Many candidates were unable to secure all available marks. There are many methods, candidates should go through all of the variation to understand how flexible the method can be. Common mistakes included • missing moment contributed by f_W or f_G • poor presentation, in particular when applying the principle of moments. • mistaking the angle of tilt for ladder θ to be the same (it isn't) as the angle between resultant force about point of contact with wall / about point of contact with floor Revision pointers: Forces Lecture H204.3 (in particular Eg 15)	
3(d)	horizontal equilibrium: $N_W = f_G$ $N_W\tan\theta = N_G - \frac{W}{2}$ $f_G = \frac{N_G - \frac{W}{2}}{\tan\theta} = \frac{(70) - \frac{100}{2}}{\tan(40°)}$ $= 23.8$ N (accept 24 N)	B1 A1
	Comments	
	Generally well done.	
3(e)	f_W does not change, only maximum (static) friction between wall and ladder changes no change to normal forces	M1 A1
	Comments	
	Badly done. Friction has a limiting characteristic, and actually does not manifest if there are no lateral forces relative to the normal force. Revision pointers: Forces Lecture H204.1 (in particular Eg 4)	

Qns	Answer	Marks
4(a)(i)		**B1**
	Comments Most candidates had done poorly in this question. They failed to realise that > speed is zero at highest height > so 3 kN is the force down the ramp $(mg\ \sin\theta)$ > so any additional force above 3 kN is due to air resistance Revision pointers: Dynamics Lecture H203.2 & Forces Lecture H204.1	
4(a)(ii)	Method 1 initial KE $=$ final GPE $+$ w.d. against air resistance $=(mg)h+$ area of shaded triangle $=\left(\frac{F_{\text{down slope}}}{\sin\theta}\right)(h)+$ area of shaded triangle $=\left(\frac{3\times10^3}{\sin(30^\circ)}\right)(4.1)+\frac{1}{2}(8.2)\left((4-3)\times10^3\right)$ $=28700$ J (accept 29 000 J)	**B1** **A1**
	Method 2 initial KE $=$ area under graph $=\frac{(4+3)\times10^3}{2}(8.2)$ $=28700$ J (accept 29 000 J)	**B1** **A1**
	Comments Most candidates had done poorly in this question. Candidates had also demonstrated the presentation for this question poorly as they did not write the initial statement. Some of them had also written the wrong statement by stating that “initial KE = w.d. against air resistance only”. A number of candidates did not pay attention to the units used for the y-axis. Revision pointers: Work Energy Power Lecture H205.2	

Qns	Answer	Marks
4(b)	$N = m_A g \ \cos\theta$ $= (50)(9.81)(\cos(37°))$ $(= 392 \text{ N} \quad \text{or } 390 \text{ N})$	C1 award on substitution *or* value
	w.d. against friction $= f.s$ $= 0.25Ns = 0.25(m_A g \ \cos\theta)(s)$ $= 0.25(50)(9.81)(\cos(37°))(20)$ $= 1959 \text{ N} \qquad (\text{accept } 1960 \text{ N or } 2000 \text{ N})$	C1 award on substitution *or* value
	gain in GPE of A $= m_A g(h \ \sin\theta)$ $= (50)(9.81)(20 \ \sin(37°))$ $(= 5904 \text{ J} \quad (\text{accept } 5900 \text{ N}))$	C1 award on substitution *or* value
	loss in GPE of B = w.d. against friction + gain in GPE of A + gain in KE of A & B	C1
	gain in KE of A $= \dfrac{m_A}{m_A + m_B}$(gain in KE of A & B) $= \dfrac{m_A}{m_A + m_B}$(loss in GPE of B − w.d. against friction − gain in GPE of A) $= \dfrac{50}{50+100}((100)(9.81)(20) - 1959 - 5904)$ $= 3919 \text{ J} \qquad (\text{accept } 3920 \text{ J or } 3900 \text{ J or } 3910 \text{ J})$	A1
	Comments	
	Most candidates had done poorly in this question. Some candidates did not find the normal contact force correctly (e.g. using $m_A g \ \sin\theta$ or $\dfrac{m_A g}{\cos\theta}$). A number of candidates also use the value of friction only instead of work done against friction in the energy equation. A number of candidates had also demonstrated the presentation for this question poorly as they did not write the statement for conservation of energy. Some of them had also written the wrong statement by missing out one or more of the terms stated. Revision pointers: Work Energy Power Lecture H205.2	
4(c)	power $= \dfrac{mgh}{t} = \dfrac{(74)(9.81)(0.23 \times 131)}{2 \times 60}$	C1
	$= 182 \text{ W}$	A1
	Comments	
	Most candidates had well done in this question. A few candidates did not pay attention to the units used (i.e. 0.23 m). Revision pointers: Work Energy Power Lecture H205.2	

Qns	Answer	Marks
5(a)(i)	elastic force provides centripetal force on both balls spring is constantly extended	B1 B1
	Comments	
	Most of the candidates did not state that elastic force provides centripetal force on both balls. Some candidates simply state a force provides the centripetal force without explicitly stating what type of force, while others mentioned, “the spring provides centripetal force”. Quite a number of candidates left this question blank. Revision pointers: Motion in a Circle Lecture H206.1	
5(a)(ii)1.	$m_A r_A = m_B r_B$ $r_B = \frac{m_A}{m_B} r_A = \frac{50}{30}(6)$ $= 10$ cm	M1 A0
	Comments Majority of the candidates had done well for this question.	
5(a)(ii)2.	elastic force provides centripetal force on both balls $m_A r_A \omega^2 = k[L_{total} - L_{natural}]$ $\omega = \sqrt{\frac{k[L_{total} - L_{natural}]}{m_A r_A}}$ $= \sqrt{\frac{(4)[(10+6-12)\times 10^{-2}]}{(50\times 10^{-3})(6\times 10^{-2})}}$ $= 7.30$ rad s^{-1}	 C1 A1
	Comments	
	This question was not very well done. Some candidates neglected to convert length to its SI unit to find the elastic force due to the spring. A number of candidates mistook $\frac{1}{2}kx^2$ as the elastic force. Many candidates calculated the extension wrongly. Revision pointers: Work Energy Power Lecture H205.1	
5(b)(i)	loss in GPE = gain in KE $\cancel{m}g(r\sin\theta) = \frac{1}{2}\cancel{m}v^2$ $v = \sqrt{2gr\sin\theta}$	M1 A0
	Comments	
	Worryingly, some candidates used the kinematics while others mis-regarded the sandbag to be in static equilibrium. There were also those who omitted additional force component due to weight when considering the contribution of tension in finding the centripetal force without realising the missing component due to the weight of the sandbag. Revision pointers: Motion in a Circle Lecture H206.2	

Qns	Answer	Marks
5(b)(ii)	vector sum of tension and weight (or words to that effect) provides centripetal force $v^2 = 2gr\ \sin\theta$ centripetal force $F_c = \dfrac{mv^2}{r}$ $F_c = 2mg\ \sin\theta$ $= 2(20)(9.81)\ \sin(45°)$ $(= 278\text{ N} \quad (\text{accept } 280\text{ N}))$ $F_c = T - mg\ \sin\theta$ $T = F_c + mg\ \sin\theta$ $= (2mg\ \sin\theta) + mg\ \sin\theta$ $= 3mg\ \sin\theta$ $= 416\text{ N} \quad (\text{accept } 420\text{ N})$	**M1** **C1** substitution or value **C1** successful vector resolution **A1**
	Comments	
	Most candidates left this question blank. Candidates who had attempted did not do well because they did not realised the vector sum of tension and weight provides centripetal force. A number of candidates had written *mg* cos θ when resolving the weight of the sandbag along the tension of the rope. Revision pointers: Motion in a Circle Lecture H206.2	

Qns	Answer	Marks
6(a)(i)	 $g=-\frac{d\phi}{dr}=-\frac{0-(-6.8\times10^{7})}{(3.2-0.4)(6.4\times10^{6})}$ $=-3.79\ \text{N kg}^{-1}$	**B1** visible tangent **B1** read-offs correct to half-square
	Comments	
	Poorly attempted. Many candidates did not draw a tangent at $x = 1.6R$ to show that $g = 3.8\ \text{N kg}^{-1}$. A number of candidates found g using $\frac{\phi}{r}$ which is conceptually incorrect (it should be $g=-\frac{d\phi}{dr}$). Revision pointers: Gravitational Field Lecture H207.2	
6(a)(ii)	$F = mg = (2)(3.8) = 7.6\ \text{N}$	**A1**
6(b)(i)	(see table below)	**B1** **B1** **B1**
	Comments	
	Poorly attempted. Majority of students state that the total energy decreases which is incorrect. There is no change in the total energy as energy is conserved. Revision pointers: Gravitational Field Lecture H207.3	

6(b)(i):

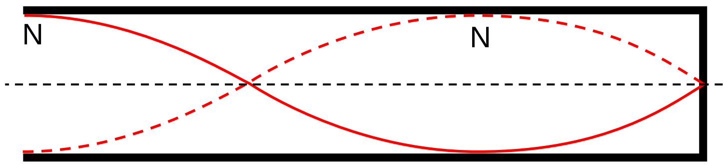
	type of energy	change
1.	total	no change
2.	GPE	decrease
3.	KE	increase

Qns	Answer	Marks
6(b)(ii)	loss in GPE = gain in KE $\frac{1}{2}\cancel{m}v^2 = \lvert\cancel{m}\Delta\phi\rvert$ $v = \sqrt{2\lvert\phi_{\text{final}} - \phi_{\text{initial}}\rvert}$ $= \sqrt{2\lvert(-2.1\times10^7) - 0\rvert}$ $= 6480$ m s^{-1} (Accept 6500 m s^{-1})	B1 C1 B1 A1
	Comments	
	Poorly attempted. A number of candidates had also demonstrated the presentation for this question poorly as they did not write the statement for conservation of energy. Majority of students found ϕ using the distance of 2R instead of 3R (2R above the *surface*). Many students also misunderstood that gravitational force provides centripetal force – the meteorite is **not** orbiting round the Earth. Revision pointers: Gravitational Field Lecture H207.3	

Qns	Answer	Marks
7(a)	oscillatory motion where acceleration is directly proportional to displacement from the equilibrium position and directed opposite to displacement	 B1 B1
	Comments Generally well-done. A number of candidates failed to describe displacement with reference to the equilibrium position. Revision pointers: Simple Harmonic Motion Lecture H210.1	
7(b)	time taken for 3 complete oscillation = 6.5 s $\omega = \frac{\theta}{t} = \frac{3(2\pi)}{6.5} = 2.9 \text{ rad s}^{-1}$	M1 A0
	Comments This is a “show” question with the final answer already given so the emphasis for such question will be elsewhere. In this case, it is the awareness that 3 complete oscillations have been given and thus the need to demonstrate how to obtain the value of 1 period from it. Revision pointers: Simple Harmonic Motion Lecture H210.1	
7(c)(i)	$\omega^2 = \frac{g}{R}$ $R = \frac{g}{\omega^2} = \frac{9.81}{2.9^2} = 1.17 \text{ m} \quad (\text{accept } 1.2 \text{ m})$	C1 A1
	Comments Some mistakes involving squaring/square-root of the values were seen. Revision pointers: Simple Harmonic Motion Lecture H210.2	
7(c)(ii)	$\lvert v \rvert = \omega\sqrt{x_0^2 - x^2} = \omega x_0$ $= (2.9)(3 \times 10^{-2})$ $= 0.087 \text{ m s}^{-1}$	C1 substitution A1
	Comments The most common mistake was not converting 3 cm into metres. Revision pointers: Simple Harmonic Motion Lecture H210.2	
7(d)(i)	amplitude (of oscillations) decreases exponentially with time due to continuous loss of energy to surrounding as negative work is done against resistive forces so total energy in system decreases with time	 B1
	Comments Poorly attempted. This is a simple recall of definition, many candidates were not able to give the precise definition. Marking was lenient, so candidates are advised to learn this up carefully in preparation for JC2. Revision pointers: Simple Harmonic Motion Lecture H210.4	

Qns	Answer	Marks
7(d)(ii)	same period (accept slightly longer period) decreasing amplitude	 **B1**
	Comments Generally well done. Some confused lower frequencies with shorter periods and incorrectly sketched oscillations with shorter periods. Revision pointers: Simple Harmonic Motion Lecture H210.4	

Qns	Answer	Marks
8(a)(i)	$P_{\text{received}} = \dfrac{\text{area}_{\text{receiver}}}{4\pi r^2} P_{\text{source}}$ $= \dfrac{2.5}{4\pi(6.7)^2}\left[15\times(10^{-2})^2\right]$ $= 6.65\times10^{-6}\text{ W} \quad (\text{accept } 6.7\times10^{-6}\text{ W})$	**C1** substitution **A1**
	Comments	
	Few candidates were awarded marks for this question. Most did not realise that the power received by the microphone at a distance of 6.7 m away from the source is a fraction of the power produced at the source. Revision pointers: Simple Harmonic Motion Lecture H211.3	
8(a)(ii)	$I = kx_0^2$ $I_{\text{new}} = k(3x_0)^2 = 9I$ **Intensity** of wave is **9 times original** OR **Power** of wave is **9 times original**. For power received to be the same (while keeping area of microphone to be the same), the **intensity** of the wave at the new distance have to be the same. $I = \dfrac{P_{\text{source}}}{4\pi r^2}$ $\dfrac{P_{\text{source, new}}}{r_{\text{new}}^2} = \dfrac{P_{\text{source, old}}}{r_{\text{old}}^2}$ $r_{\text{new}} = \sqrt{\dfrac{P_{\text{source, new}} r_{\text{old}}^2}{P_{\text{source, old}}}}$ $= \sqrt{9(6.7)^2}$ $= 20.1\text{ m} \quad (\text{accept } 20\text{ m})$	**C1** **A1**
	Comments	
	Many candidates demonstrated understanding that triple the displacement amplitude resulted in triple the intensity of the sound wave, but failed to extend their analysis to the relationship between intensity, power and distance from source. Revision pointers: Simple Harmonic Motion Lecture H211.3	
8(b)(i)	when two or more waves **meet and overlap**, **resultant displacement** is **vector sum of displacement** of **each individual wave**	**B1**
	Comments	
	Well done. Marks were not awarded for careless use of words/phases like 'amplitude' instead of 'displacement', 'vector sum of wave' rather than 'vector sum of displacement'. The root word of 'superpose' should not be re-hashed, instead 'meet and overlap' should be used to describe the phenomenon. Revision pointers: Superposition Lecture H212.1	

Qns	Answer	Marks
8(b)(ii)	Progressive longitudinal waves travels/propagates down/along/into pipe,	B0
	and **reflects** at the closed end to form a wave of **same type, amplitude,** ***frequency, wavelength, speed*** (2 out of 3 mentioned for the last 3)	B1
	The reflected wave travels in **opposite direction** along pipe to the incident wave (towards each other).	B1
	The reflected wave **meets and overlaps** with the incident wave to form stationary wave.	B1
	Comments	
	Well done.	
8(b)(iii)		**B1** shape of stationary wave **B1** position of 2 pressure nodes
	Comments	
	The sketches were not well done. Candidates were expected to draw one side of the stationary wave boundary with a solid line, and the other end with a dotted line. However, many could correctly indicate the displacement antinodes as the pressure nodes. Revision pointers: Superposition Lecture H212.6	
8(b)(iv)	$\frac{3}{4}\lambda = 54$ $\lambda = 72$ cm $v = f\lambda$ $= (470)(72\times10^{-2})$ $= 338$ m s^{-1} (accept 340 m s^{-1})	A1
	Comments	
	Candidates are reminded to give their final answers to 2 or 3 significant figures. Several candidates were penalised for this in this question. No ecf was allowed here as well as part of the intent of (b)(iii) was to aid in the answering of (b)(iv). Revision pointers: Superposition Lecture H212.5	

Qns	Answer	Marks
8(b)(v)	It represents the **speed of source wave** OR **speed of reflected wave**	**B1**
	Comments	
	Candidates were expected to state their interpretations of the speed in (b)(iv) referred to. Those who stated that the speed refers to the speed of sound in the pipe was not awarded marks because they were repeating the question in (b)(iv).	
8(c)(i)1.	$d\ \sin\theta = n\lambda$ $\theta_3 = \sin^{-1}\left(\frac{3\lambda}{L/N}\right) = \sin^{-1}\left(\frac{3\left(750\times10^{-9}\right)}{10^{-3}/290}\right)$ $= 40.7°\quad$ (accept $41°$)	**A1**
8(c)(i)2.	let $\sin\theta \to 1$ $d\ \sin\theta = n\lambda$ $n = \frac{d}{\lambda} = \frac{L}{\lambda N}$ $= \frac{10^{-3}}{\left(750\times10^{-9}\right)(290)}$ $= 4.6$ $n_{max} = 4$	**C1** **A1**
	Comments	
	The most common mistake made by students is to neglect the word 'complete'. To find the complete spectrum, candidates have to use the largest wavelength to find the smallest order that can be seen. This will determine the largest order of 'complete spectrum' that can be observed. Revision pointers: Superposition Lecture H212.4	
8(c)(ii)	The effect of regular spacing between pixels is similar to that of a **diffraction grating.**	**B1**
	Hence light entering the camera are **diffracted** OR **spread into geometric shadow** as they pass through each spacing	**B1**
	Comments	
	A good proportion of candidates were able to state that the halo effect is due to the process of 'diffraction'. However, few could explain that the reason for the diffraction was the transparent area in between the smaller pixels having the same effect as a diffraction grating on light.	