

Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 13_Oscillations

Name of the Student: _____

Max. Marks : 27 Marks

Time : 27 Minutes

Mark Schemes

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
	- Use of $f = 1 / T$ (1) - Use of $T = 2\pi \sqrt{(m/k)}$ (1) - Correct for mass of platform (1) - Mass of astronaut = 71 kg (1)	<u>Example of calculation</u> $T = 1 / 0.34 \text{ Hz} = 2.94 \text{ s}$ $2.94 \text{ s} = 2\pi \sqrt{(m/350 \text{ N m}^{-1})}$ $m = 76.6 \text{ kg}$ mass of astronaut = $76.6 \text{ kg} - 5.7 \text{ kg}$ $= 70.9 \text{ kg}$	4

Q2.

Question Number	Acceptable answers	Additional guidance	Mark
(i)	- Use of $W = mg$ (1) - Use of $F = kx$ (1) $k = 17700 \text{ (N m}^{-1}\text{)}$ (1)	<u>Example of calculation:</u> $275 \text{ kg} \times 9.81 \text{ N kg}^{-1} = 2700 \text{ N}$ $2700 \text{ N} = k \times 0.152 \text{ m}$ $k = 17748 \text{ N m}^{-1}$	3
(ii)	- Use of $T = 2\pi \sqrt{\frac{m}{k}}$ (1) - Use of $f = 1/T$ (1) $f = 1.3 \text{ Hz}$ (ecf from (b)(i)) (1)	<u>Example of calculation:</u> $T = 2\pi \sqrt{\frac{1100 \text{ kg}}{4 \times 17700 \text{ N m}^{-1}}}$ $f = 1 / 0.783 \text{ s}$ $f = 1.28 \text{ Hz}$	3

Q3.

Question Number	Acceptable Answer	Additional Guidance	Mark
	- Timing a large number of oscillations minimised the percentage uncertainty in the measurement (1) - Repeating each timing measurement and calculating a mean minimised the effect of random errors (1) - Taking a repeat measurement allowed a check for gross timing errors. (1)		3

Q4.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	Ignoring mass of holder / spring when determining the oscillating mass (1)		1
(ii)	- Using a data logger (and light gate) would eliminate reaction time (1) - So the uncertainty in the measurement (of the time) would be reduced (1) - Not easy to measure timings for multiple swings/oscillations with a data logger (1)		3
(iii)	- Identify gradient as $\frac{4\pi^2}{k}$ (1) - Determine gradient of graph (1) $k = 17.8 \text{ N m}^{-1}$ [17.5 → 18.5] (1)	<u>Example of calculation</u> Gradient = $2.21 \text{ s}^2 \text{ kg}^{-1}$ $k = \frac{4\pi^2}{2.21 \text{ s}^2 \text{ kg}^{-1}} = 17.8 \text{ N m}^{-1}$	3

Q5.

Question Number	Acceptable answers	Additional guidance	Mark
	- There is damping Or resistive forces act on the flamingo (1) - Energy is removed from the oscillating system (and the amplitude decreases) (1)		2

Q6.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: - The astronauts are in free fall in the space craft (1) Or The acceleration of the astronauts and the space station are the same - So there is no contact/reaction force acting on them (1)	For MP2, accept a statement that the gravitational force (weight) is the only force acting upon them Or all of their weight is used to provide the centripetal force /acceleration	2

Q7.

Question Number	Acceptable answers	Additional guidance	Mark
	- There is (damping due to) air resistance and this (damping) force is the same for both (since they have the same shape, area and speed initially) (1) - For large mass the force due to air resistance produces a smaller negative acceleration since $a = F/m$ (1) - The speed will decrease less for each swing, so there is less effect on the amplitude Or It will take longer for the (maximum) speed to decrease (to zero) so the pendulum will oscillate for a longer time (1) OR - There is air resistance and the force is the same for both (1) - The work done by air resistance per swing is the same for both masses (1) - Initially the larger mass has greater quantity of energy shared between its kinetic and potential energy stores, so the proportion of KE transferred to the thermal energy store of the sphere and the surroundings is less per swing, so there is less effect on the amplitude Or Larger mass has greater total energy so fraction dissipated per swing is smaller so the pendulum will oscillate for a longer time (1)		3

	OR There is air resistance and this force is the same for both (1) For both masses the change in momentum per swing is the same (1)		
	The larger mass has greater initial momentum so it will take longer for the (maximum) momentum to decrease (to zero) so the pendulum will oscillate for a longer time (1)		