Beckfoot

Subject: A-level Physics	Topic: Further Mechanics	Year Group: 12

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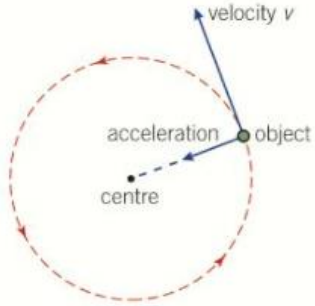
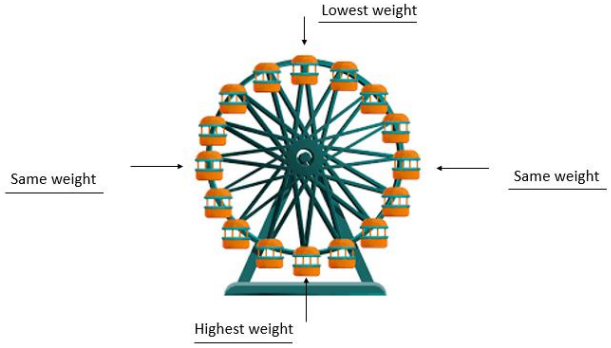
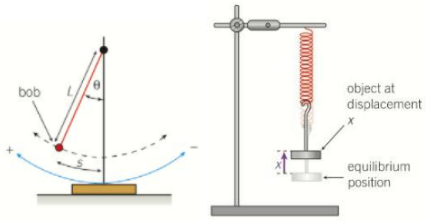
Circular Motion

1	If an object is moving in a circle, there must be an acceleration as the direction is constantly changing	
2	The centripetal force, and acceleration, will always act towards the centre of the circle	
3	Centripetal forces can be provided by:	Gravity, tension in a sting, normal reaction force from a surface, magnetic force, electrostatic force, etc.
4	In a vertical circle, the weight force will affect the centripetal force required by other forces as the object moves:  At the top → $R = \frac{mv^2}{r} - mg$	

Simple Harmonic Motion

1	SHM is defined as an oscillation where the acceleration is…	1 – proportional to the displacement 2 – always in the opposite direction to the displacement
2	SHM required practical:	
3	- Set the oscillator in motion and record 10 oscillations - Change the length of string / mass on spring - Repeat - Plot graph of T^2 against length or T^2 against mass	
4	The effect of damping	Damping reduces the amplitude but does not affect the period time

Forced oscillations

1	If left to oscillate freely, a system will reach its natural frequency
2	Forced vibrations occur when an external periodic force is applied to the system
3	If the driving frequency matches the natural frequency of the system, the oscillator will undergo resonance where the amplitude of vibrations will become very large.
4	Examples of resonance can be seen in Barton's pendulum and bridge design

Key Equations

1	Angular speed	$\omega = \frac{v}{r} = 2\pi f$
2	Centripetal acceleration	$a = \frac{v^2}{r} = \omega^2 r$
3	Centripetal force	$F = \frac{mv^2}{r} = m\omega^2 r$
4	SHM defining equation	$a = -\omega^2 x$
5	Displacement in SHM	$x = A\cos\omega t$
6	Velocity in SHM	$v = \pm\omega\sqrt{(A^2 - x^2)}$
7	Maximum speed	Maximum speed = ωA
8	Maximum acceleration	Maximum acceleration = $\omega^2 A$
9	Mass-spring system	$T = 2\pi\sqrt{\frac{m}{k}}$
10	Pendulum	$T = 2\pi\sqrt{\frac{l}{g}}$

Radians

1	Remember that 360° = 2π radians. 180° = π radians 90° = $\frac{\pi}{2}$ radians.