AQA A-Level Physics

Topic 6.1 Further mechanics

Flashcards

What kind of force is required to keep an object moving in a circle at constant speed?

What kind of force is required to keep an object moving in a circle at constant speed?

A constant centripetal force (A force applied always towards the centre of that circle).

An object moving in a circle at a constant speed is accelerating. True or False?

An object moving in a circle at a constant speed is accelerating. True or False?

True.

The direction is always changing hence the velocity always changing, where acceleration is defined as the change in velocity over time.

What equation(s) can you use to calculate the magnitude of angular speed (ω)?

What equation(s) can you use to calculate the magnitude of angular speed (ω)?

$$\omega = v/r \text{ or } \omega = 2\pi f$$

ω - s^-1

v - ms^-1

r - m

f - Hz

What is angular acceleration in terms of angular velocity?

What is angular acceleration in terms of angular velocity?

$$A = \omega^2 r$$

ω - s^-1

a - ms^-2

r - m

What is angular acceleration in terms of velocity?

What is angular acceleration in terms of velocity?

$$a = v^2 / r$$

a - ms^-2
v - ms^-1
r - m

What are the equations for centripetal force?

What are the equations for centripetal force?

$$F = mv^2/r \text{ or } F = m\omega^2 r$$

ω - s^-1
v - ms^-1
r - m
F - N
m - kg

What is a radian?

What is a radian?

The angle of a circle sector such that the radius is equal to the arc length.

Radians are usually written in terms of π

Ie 2π radians = 360 degrees

What are the conditions for SHM?

What are the conditions for SHM?

- Acceleration must be proportional to its displacement from the equilibrium point.
- It must act towards the equilibrium point.
- $a \propto -x$

What is the constant of proportionality linking acceleration and x?

What is the constant of proportionality linking acceleration and x?

- ω^2 or - k/m

What is x as a trig function of t and ω?

What is x as a trig function of t and ω?

x=Acos(ωt) or x=Asin(ωt)

ω - s^-1
A - m
x - m
t - s

How can you calculate the maximum speed using ω and A?

How can you calculate the maximum speed using ω and A?

$$Max\ speed = \omega A$$

ω - s^-1

A - m

How can you calculate the maximum acceleration using ω and A?

How can you calculate the maximum acceleration using ω and A?

$$Max\ acceleration = \omega^2 A$$

ω - s^-1

A - m

What is the equation for the time period of a mass - spring simple harmonic system?

What is the equation for the time period of a mass - spring simple harmonic system?

$$T = 2\pi\sqrt{(m/k)}$$

m - kg
k - Nm-1
T - s

What is the equation for the time period of a simple harmonic pendulum?

What is the equation for the time period of a simple harmonic pendulum?

$$T = 2\pi\sqrt{(l/g)}$$

g - ms^-2
l - m
T - s

What is the small angle approximation for $\sin x$?

What is the small angle approximation for $\sin x$?

$$\sin x \approx x$$

Valid in radians

What is the small angle approximation for $\cos x$?

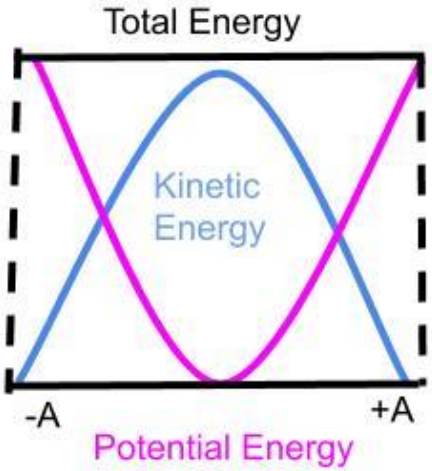
What is the small angle approximation for $\cos x$?

$$\cos x \approx 1 - x^2/2$$

Valid in radians.

Draw the graph for potential energy and kinetic energy against displacement, for a SHM system?

Draw the graph for potential energy and kinetic energy against displacement, for a SHM system?



Define Free vibrations.

Define Free vibrations.

The frequency a system tends to vibrate at in a free vibration is called the natural frequency.

Define Forced vibrations.

Define Forced vibrations.

A driving force causes the system to vibrate at a different frequency. For higher driving frequencies, the phase difference between the driver and the oscillations rises to π radians. For lower frequencies, the oscillations are in phase with the driving force. When resonance occurs, which is when it most efficiently transfers energy to the system, the phase difference will be π/2 radians.

Define damping and explain what is critical damping, overdamping and underdamping.

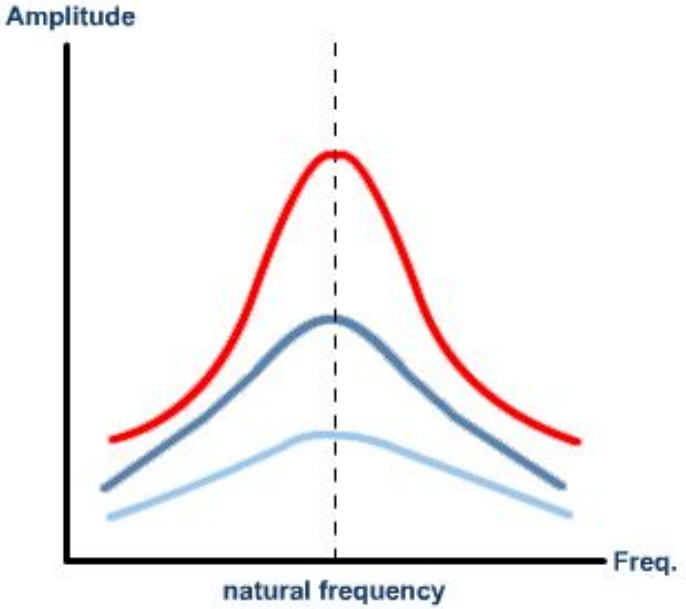
Define damping and explain what is critical damping, overdamping and underdamping.

Damping occurs when an opposing force dissipates energy to the surroundings.
Critical damping reduces the amplitude to zero in the quickest time.
Overdamping is when the damping force is too strong and it returns to equilibrium slowly without oscillation.
Underdamping is when the damping force is too weak and it oscillates with exponentially decreasing amplitude.

What happens to a vibration with greater damping?

What happens to a vibration with greater damping?

For a vibration with greater damping, the amplitude is lower at all frequencies due to greater energy losses from the system. The resonant peak is also broader because of the damping.



What are some implications of resonance in real life?

What are some implications of resonance in real life?

Implications of resonance include that soldiers must break stop when crossing bridges and vehicles must be designed so there are no unwanted vibrations.