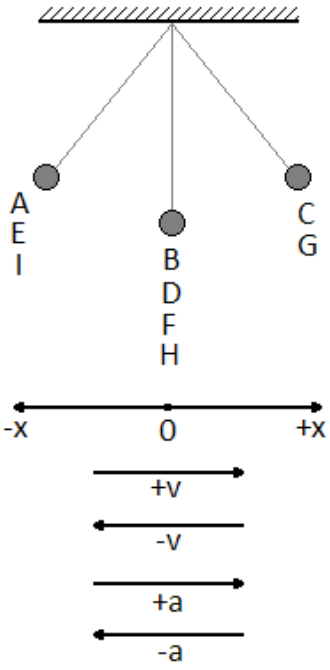
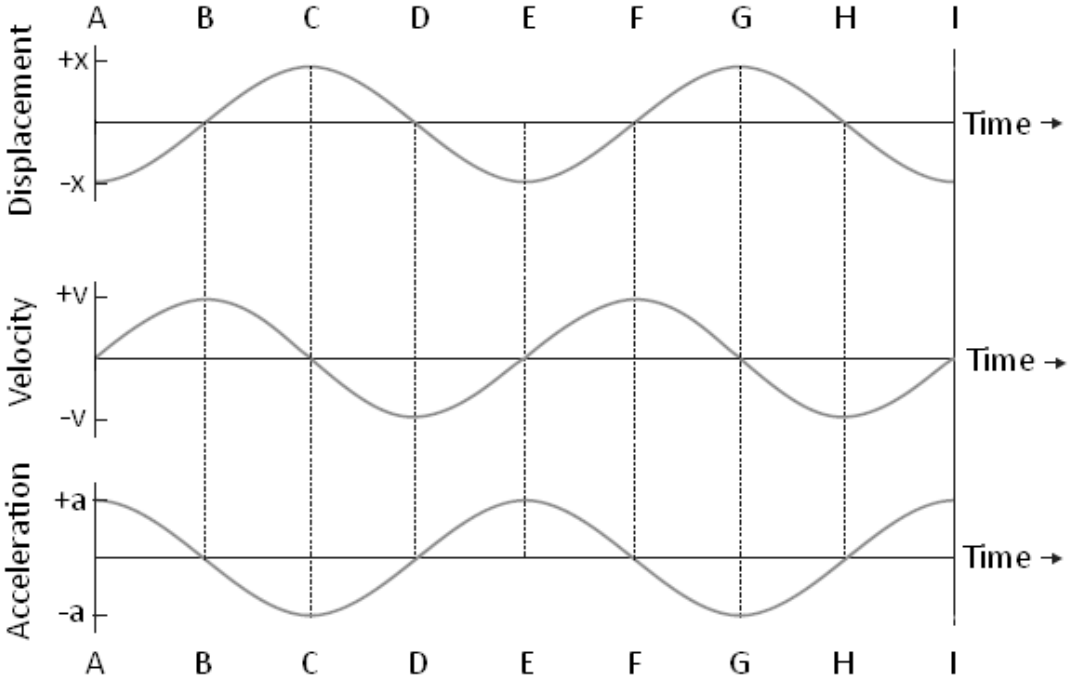
Simple Harmonic Motion Graphs

To be able to sketch the graphs of displacement, velocity and acceleration for a simple pendulum
To be know what the gradients represent
To be able to explain the energy in a full cycle and sketch the graph

Pendulum

Consider the simple pendulum drawn below. When released from A the bob accelerates and moves to the centre point. When it reached B it has reached a maximum velocity in the positive direction and then begins to slow down. At C it has stopped completely so the velocity is zero, it is at a maximum displacement in the positive and accelerates in the negative direction. At D it is back to the centre point and moves at maximum velocity in the negative direction. By E the velocity has dropped to zero, maximum negative displacement and a massive acceleration as it changes direction.
This repeats as the pendulum swings through F, G, H and back to I.
Below are the graphs that represent this:





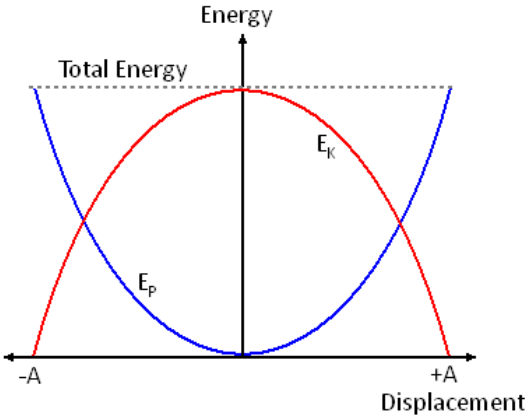
Gradients

Since $v = \frac{\Delta s}{\Delta t}$ the gradient of the displacement graph gives us velocity. At C the gradient is zero and we can see that the velocity is zero.

Also since $a = \frac{\Delta v}{\Delta t}$ the gradient of the velocity graph gives us acceleration. At C the gradient is a maximum in the negative direction and we can see that the acceleration is a maximum in the negative direction.

Energy

In all simple harmonic motion systems there is a conversion between kinetic energy and potential energy. The total energy of the system remains constant. (This is only true for isolated systems)
For a simple pendulum there is a transformation between kinetic energy and gravitational potential energy.
At its lowest point it has minimum gravitational and maximum kinetic, at its highest point (when displacement is a maximum) it has no kinetic but a maximum gravitational. This is shown in the graph.



For a mass on a spring there is a transformation between kinetic energy, gravitational potential energy and the energy stored in the spring (elastic potential). At the top there is maximum elastic and gravitational but minimum kinetic. In the middle there is maximum kinetic, minimum elastic but it still has some gravitational. At its lowest point it has no kinetic, minimum gravitational but maximum elastic.