



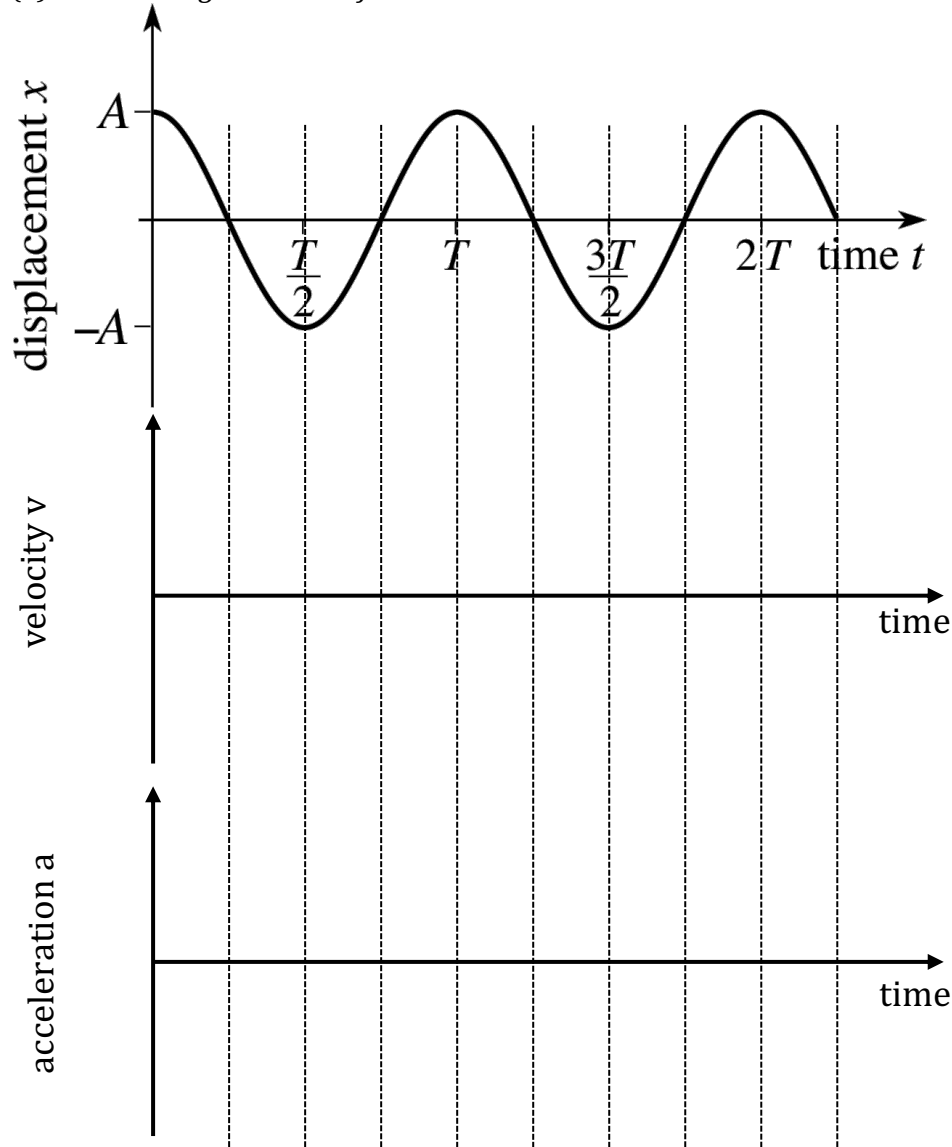
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6.2.2 The principles of simple harmonic motion

Simple Harmonic Motion (SHM) describes the motion of simple oscillating systems (such as pendulums). The motion can be described using trigonometric functions (SINE, COSINE).

Below is a graph of the displacement of a pendulum bob from its equilibrium position. T is the period of the pendulum.

(1) *What trigonometric function describes this motion?*



The gradient of the displacement-time graph gives the velocity of the oscillator.

(2) *Where is the oscillator moving fastest?*

(3) *Where is the oscillator moving slowest?*

(4) *Now sketch the velocity-time graph on the second graph.*

(5) *What trigonometric function describes the velocity-time graph?*

The gradient of the velocity-time graph gives the acceleration of the oscillator.

(6) *Where is the acceleration of the oscillator greatest?*

(7) *Where is the acceleration of the oscillator smallest?*

(8) *Now sketch the acceleration-time graph on the third graph.*

(9) *What trigonometric function describes the acceleration-time graph?*

(10) *What is the phase difference between the displacement-time graph and the acceleration-time graph?*

A defining feature of SHM is that the displacement x is proportional to acceleration a , but in the opposite direction (acceleration is always directed towards the equilibrium position). Mathematically:

$$a \propto -x$$

$$a = \text{constant} \times (-x)$$