C.1

Graphing Simple Harmonic Motion

IB PHYSICS | WAVE RESONANCE

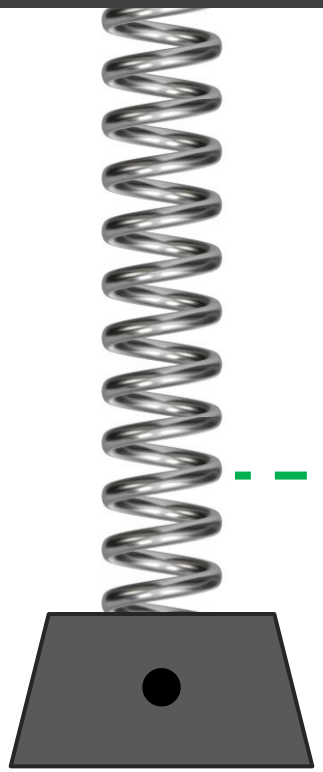
IB Physics Data Booklet

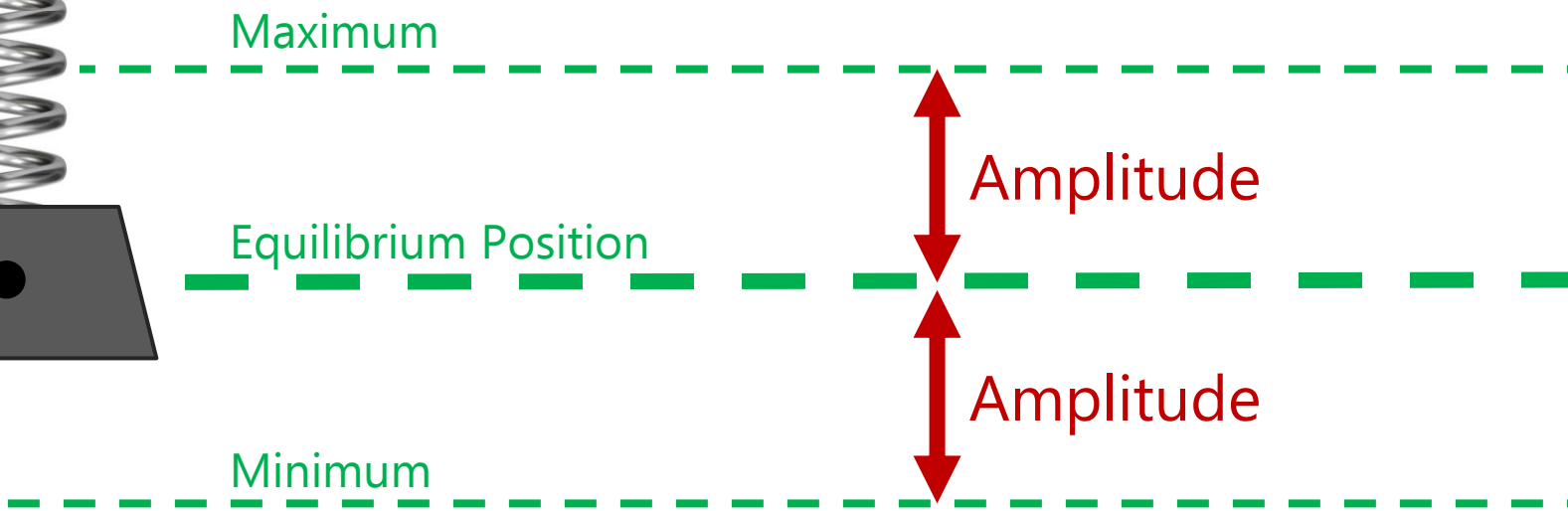
C.1

C.1 Simple harmonic motion	$a = -\omega^2 x$
	$T = \frac{1}{f} = \frac{2\pi}{\omega}$
	$T = 2\pi\sqrt{\frac{m}{k}}$ **Spring**
	$T = 2\pi\sqrt{\frac{l}{g}}$ **Pendulum**

A Mass on a Spring

Simple Harmonic Motion





Where is the Greatest…

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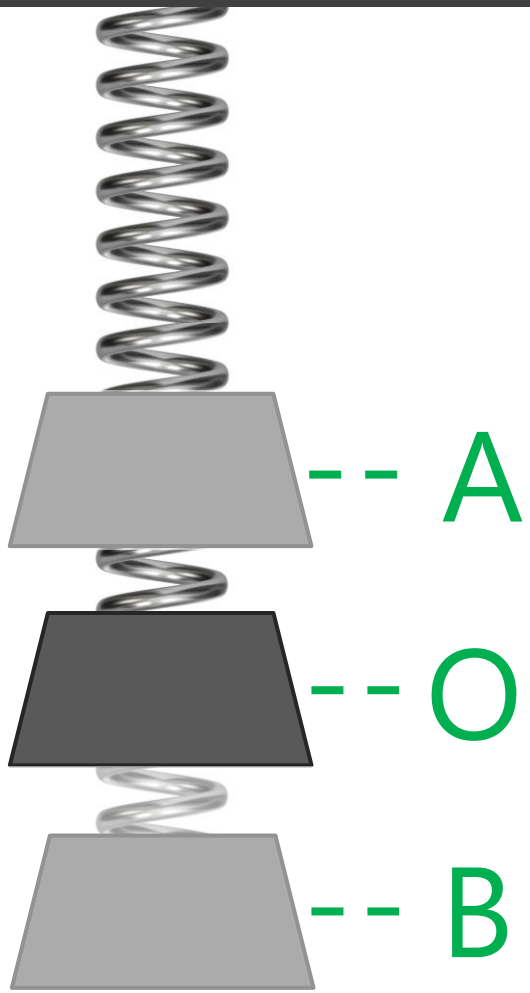

Displacement	Velocity	Acceleration
X		X
	X	
X		X

Graphing Displacement vs Time

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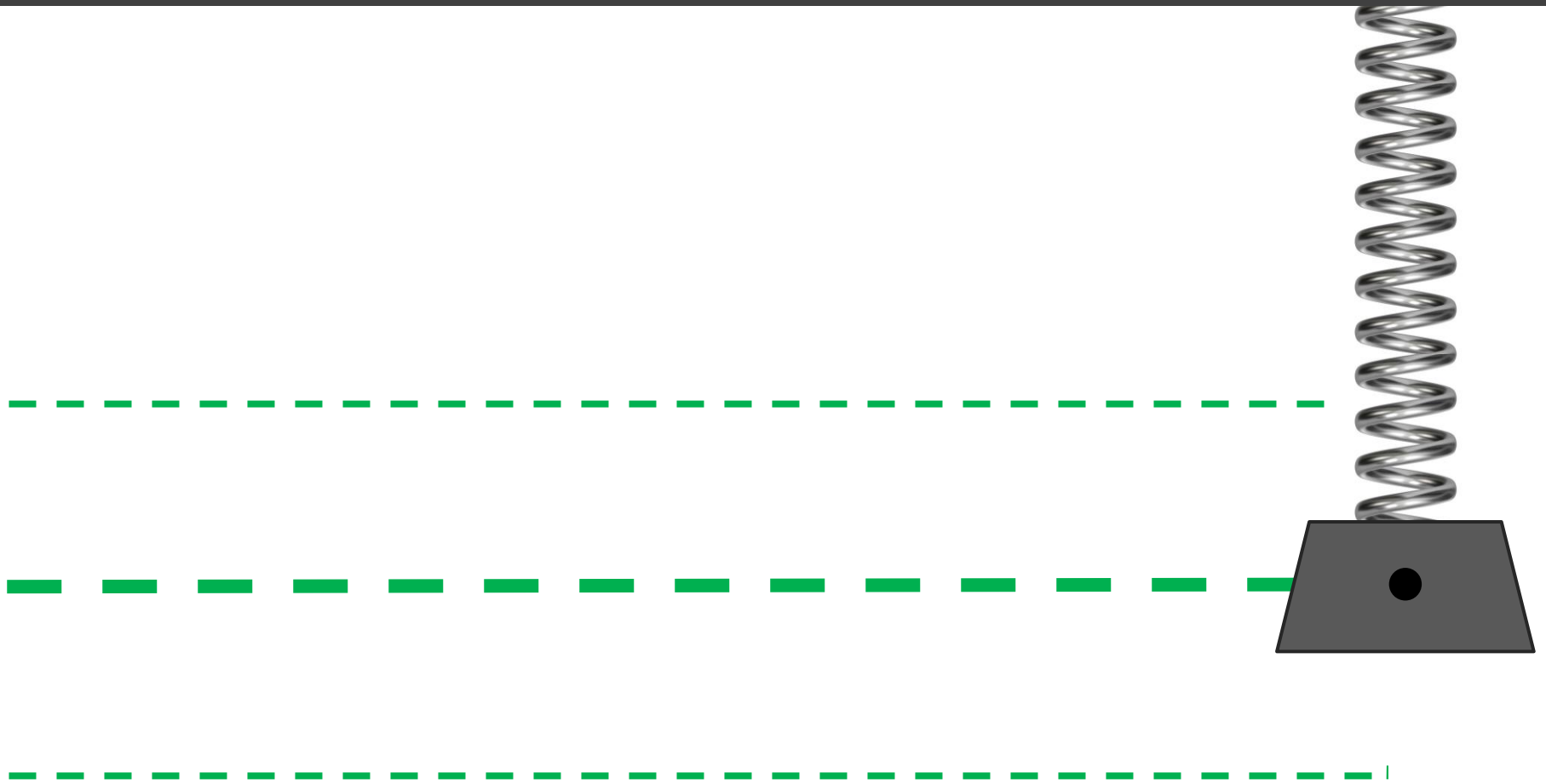

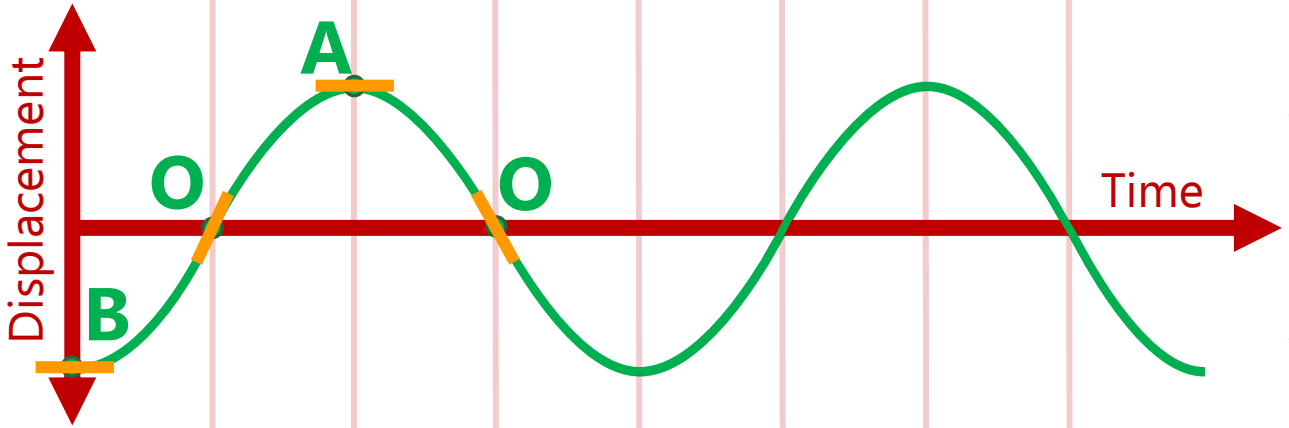

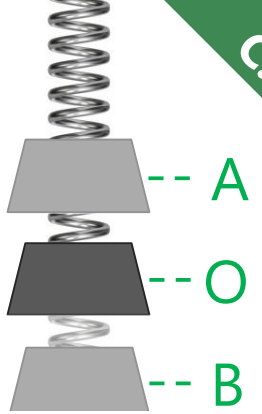

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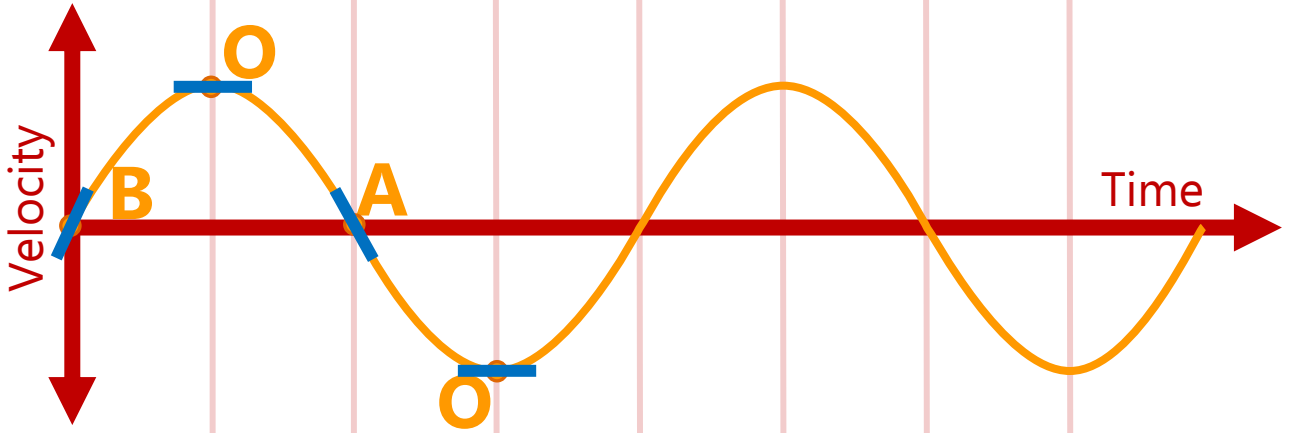
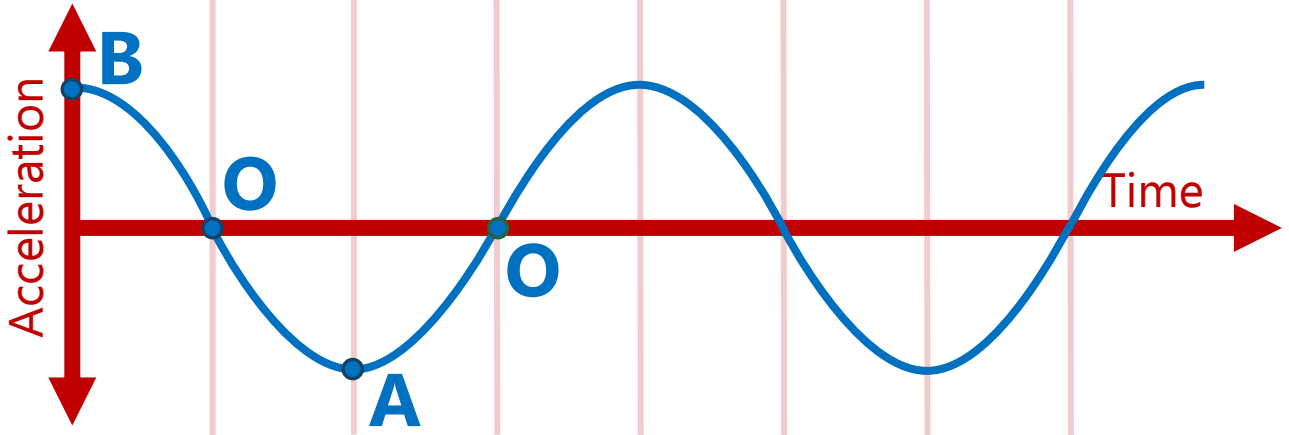


Slope of d vs t



Slope of v vs t

Opposite of disp

$a \propto -x$

Energy for SHM

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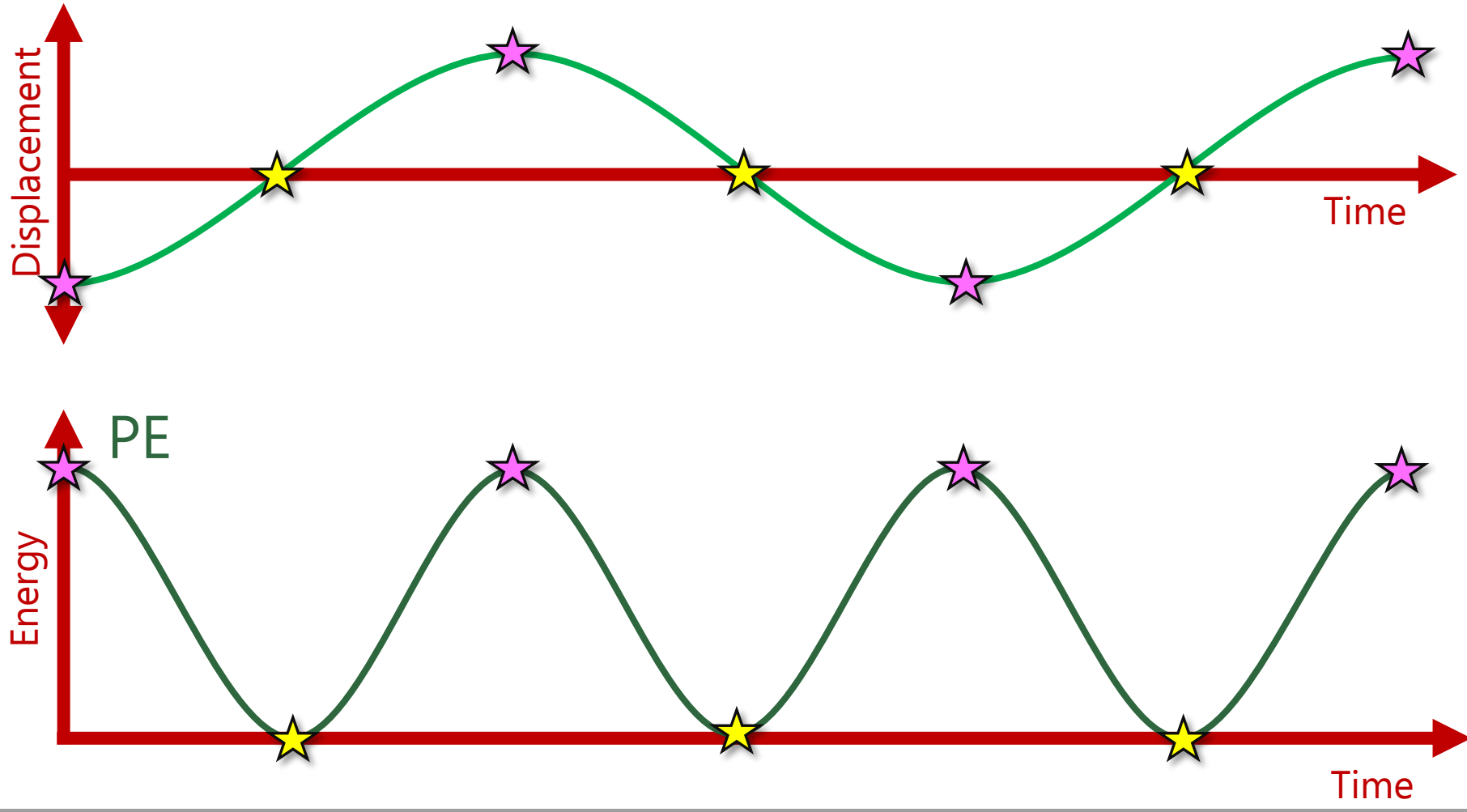
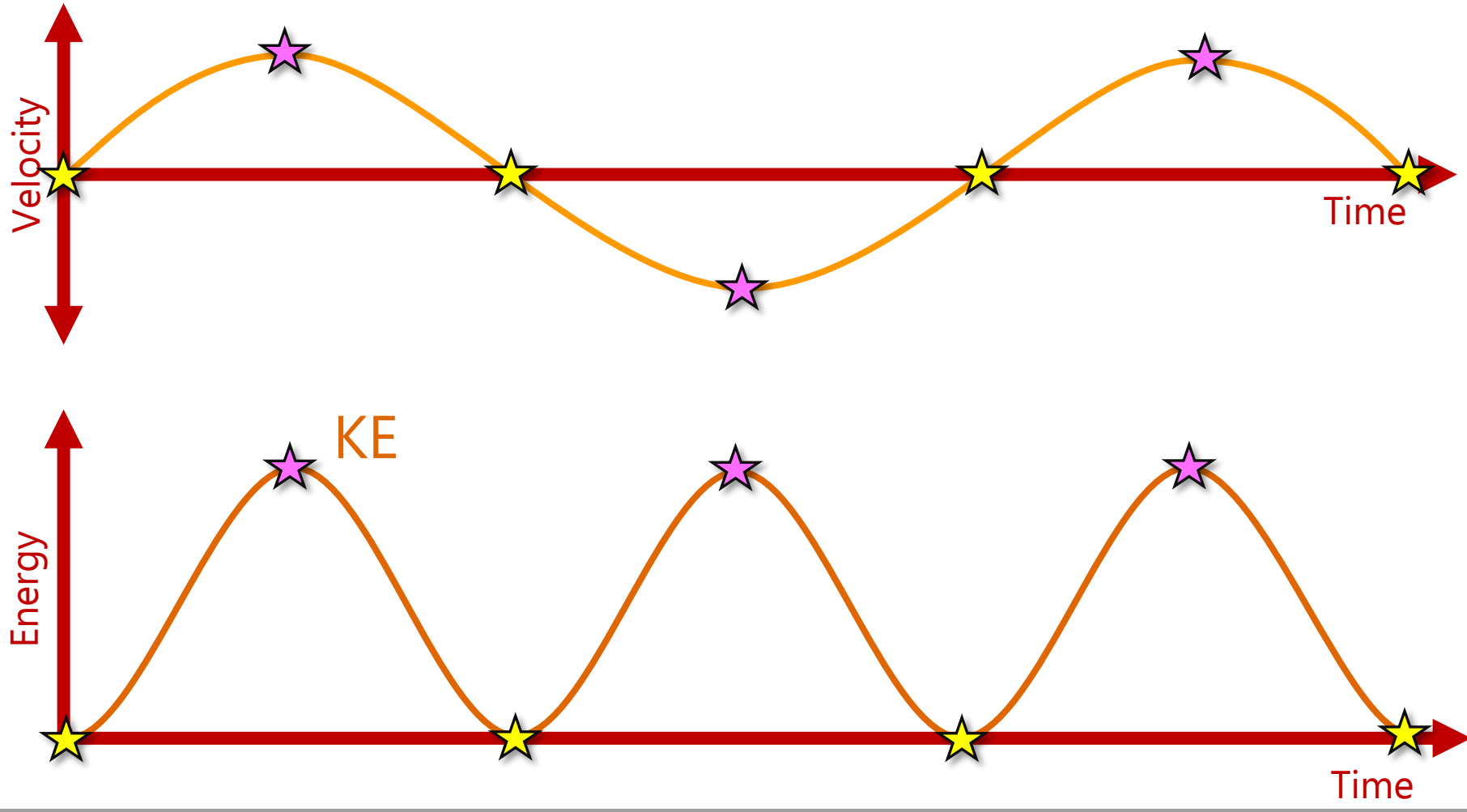
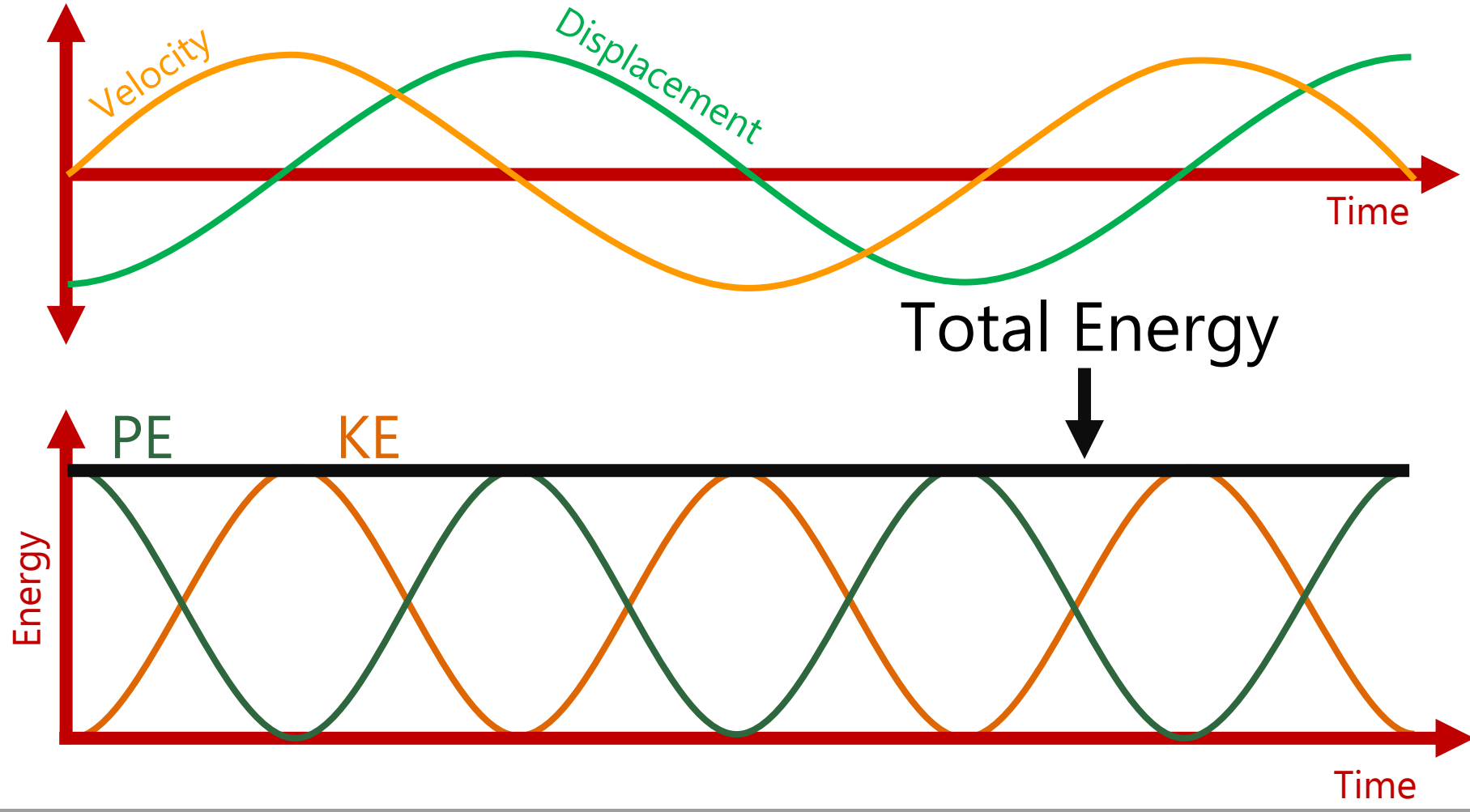


Energy for SHM

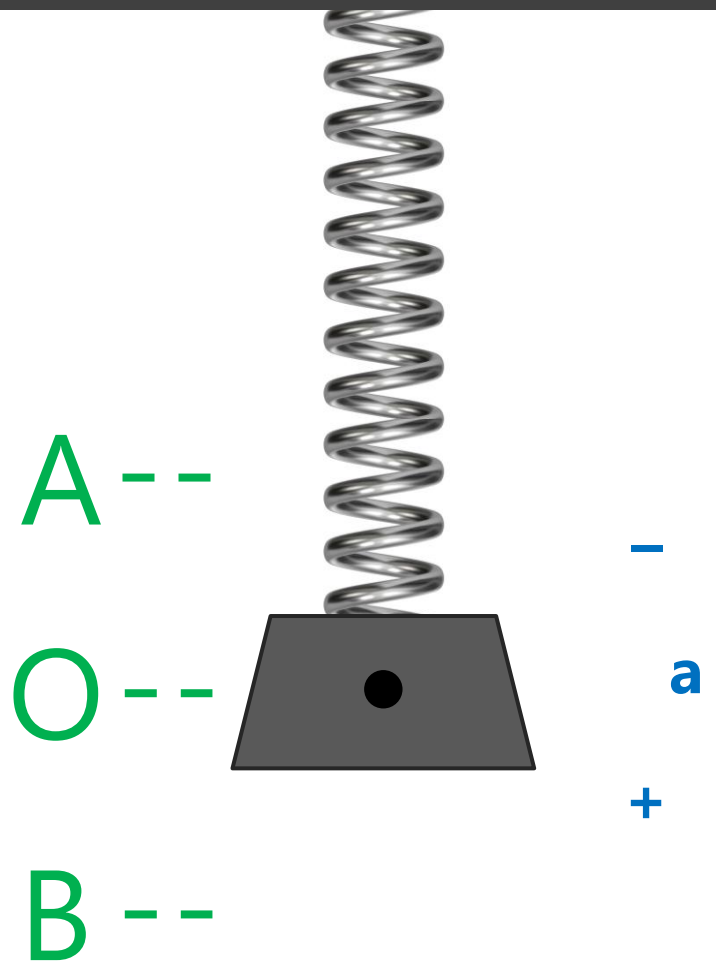
C.1

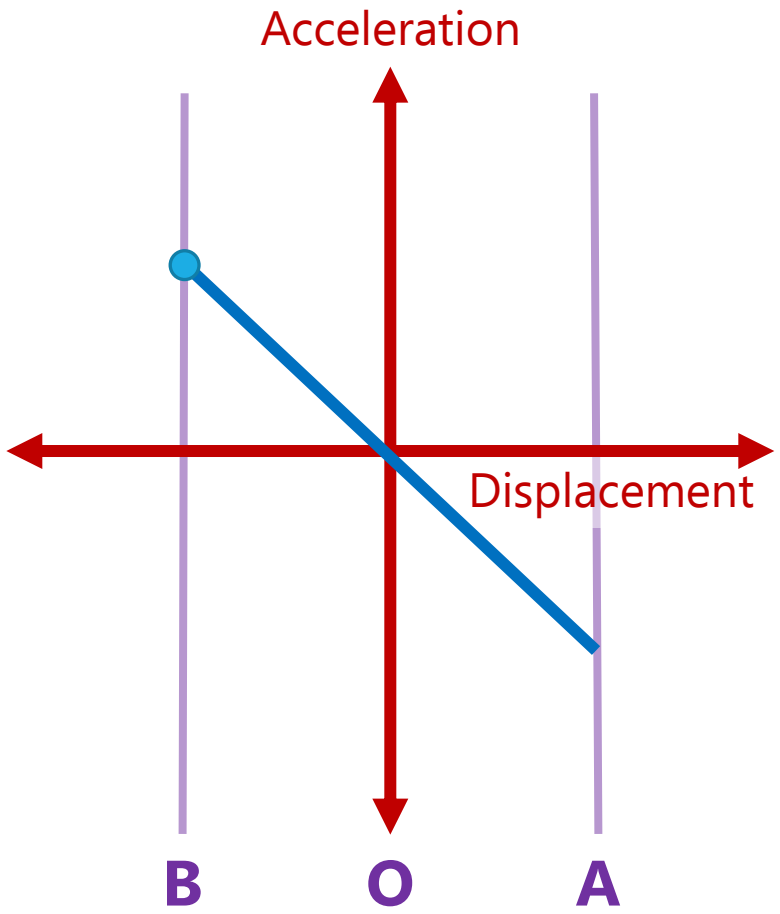


Energy for SHM

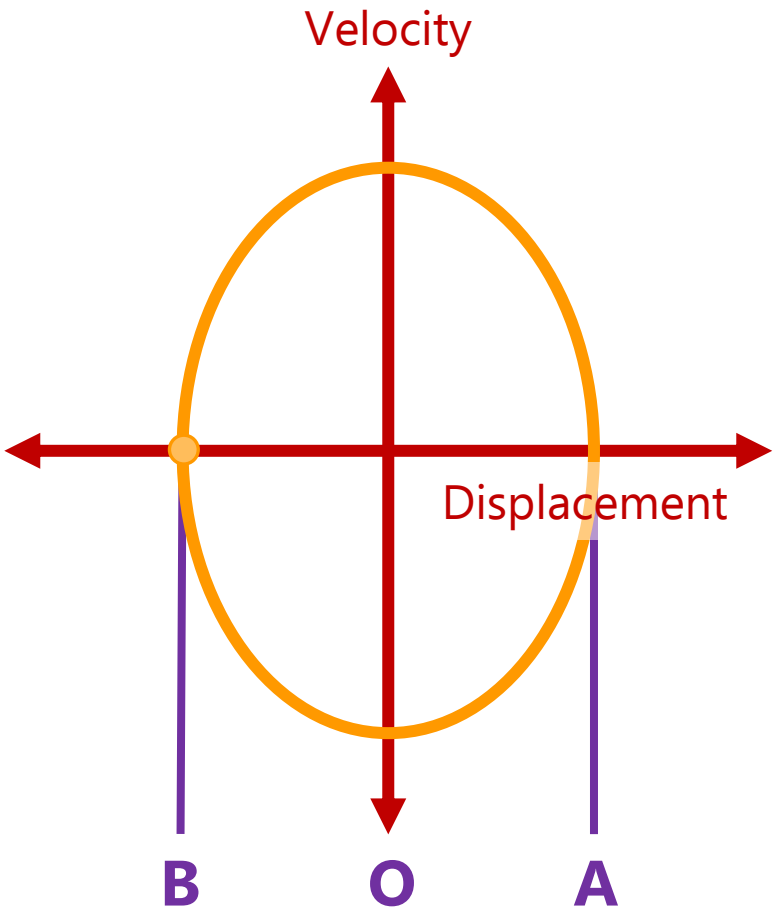


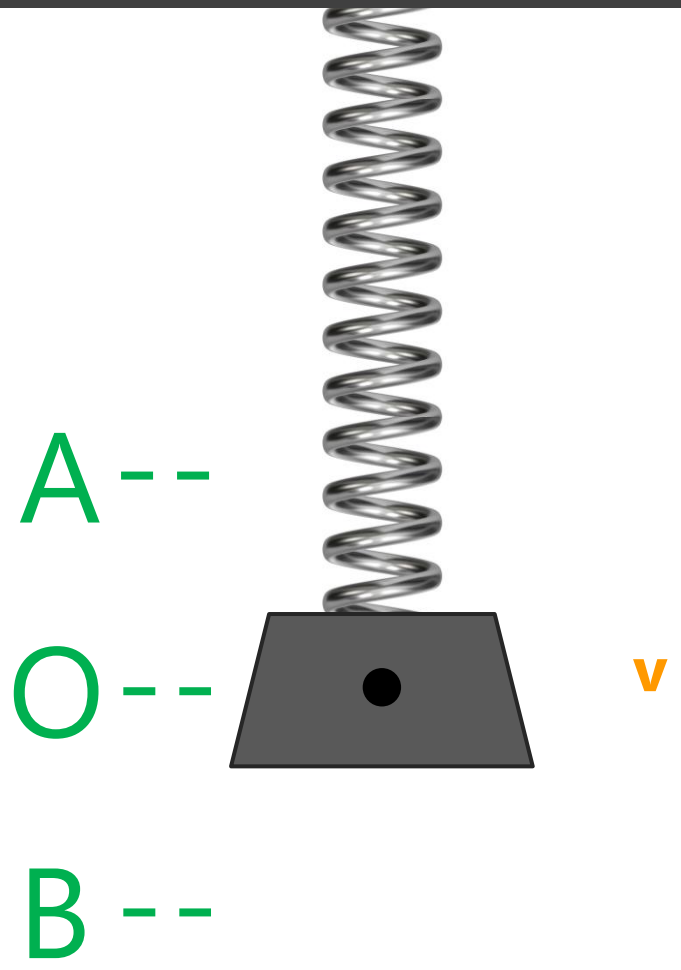
Acceleration vs Displacement



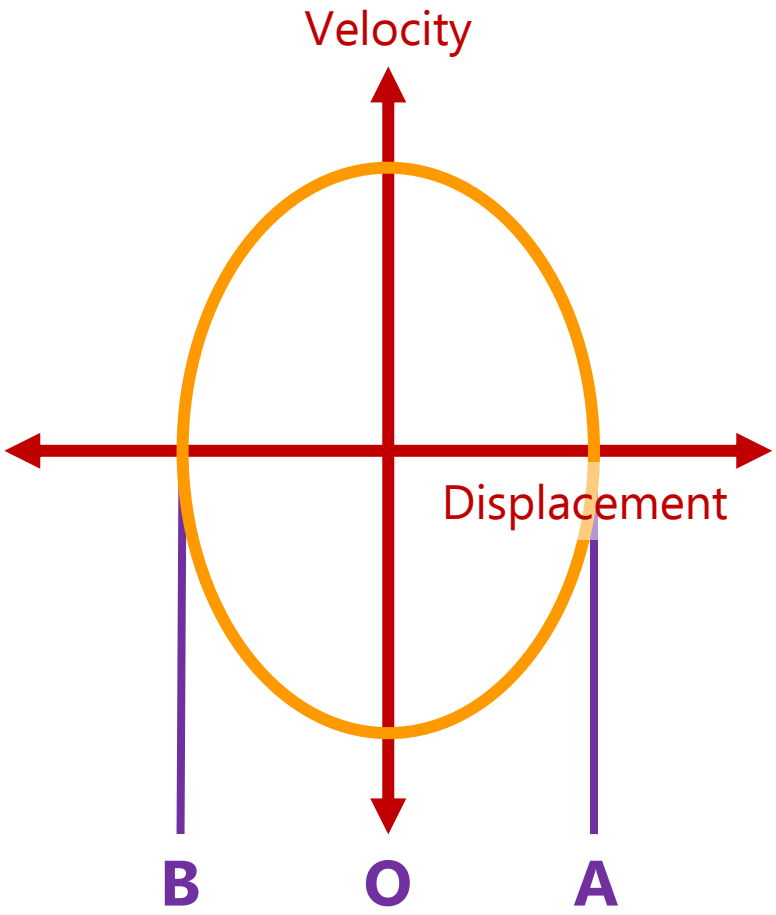


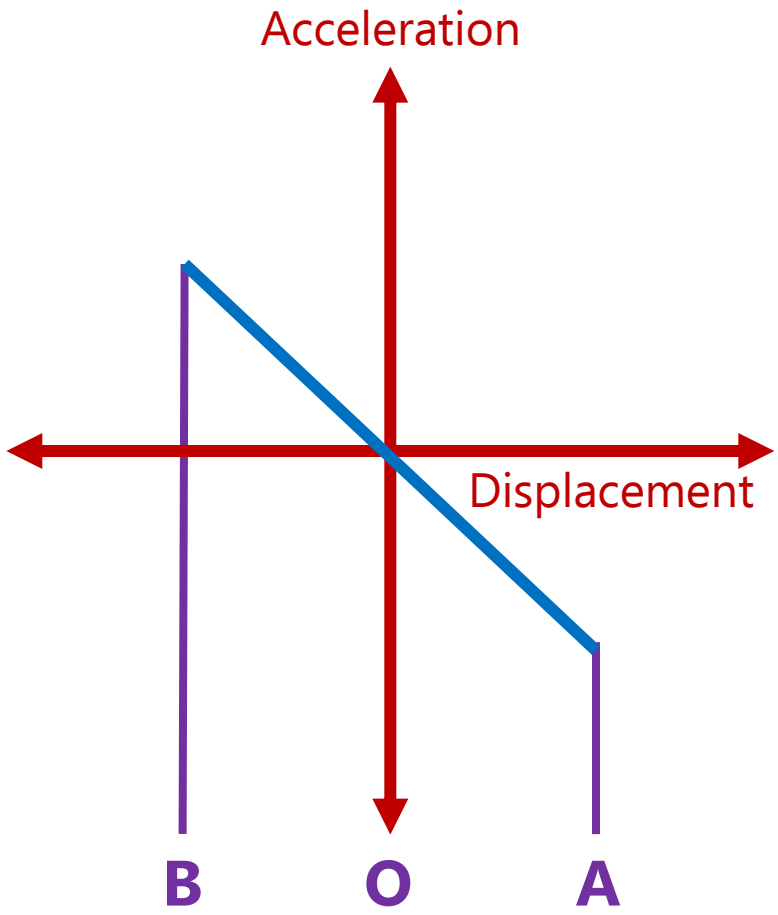
Velocity vs Displacement



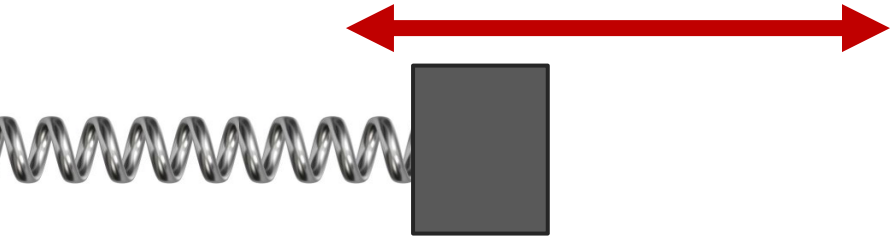


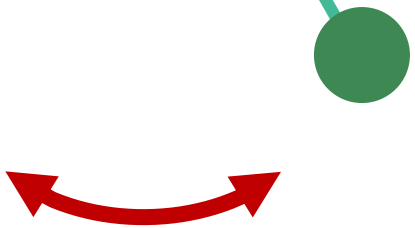
_____ vs Displacement





Resonance





$$T = 2\pi\sqrt{\frac{m}{k}}$$

$$T = 2\pi\sqrt{\frac{l}{g}}$$

Every object that can oscillate has a **natural frequency** that it is "tuned" to

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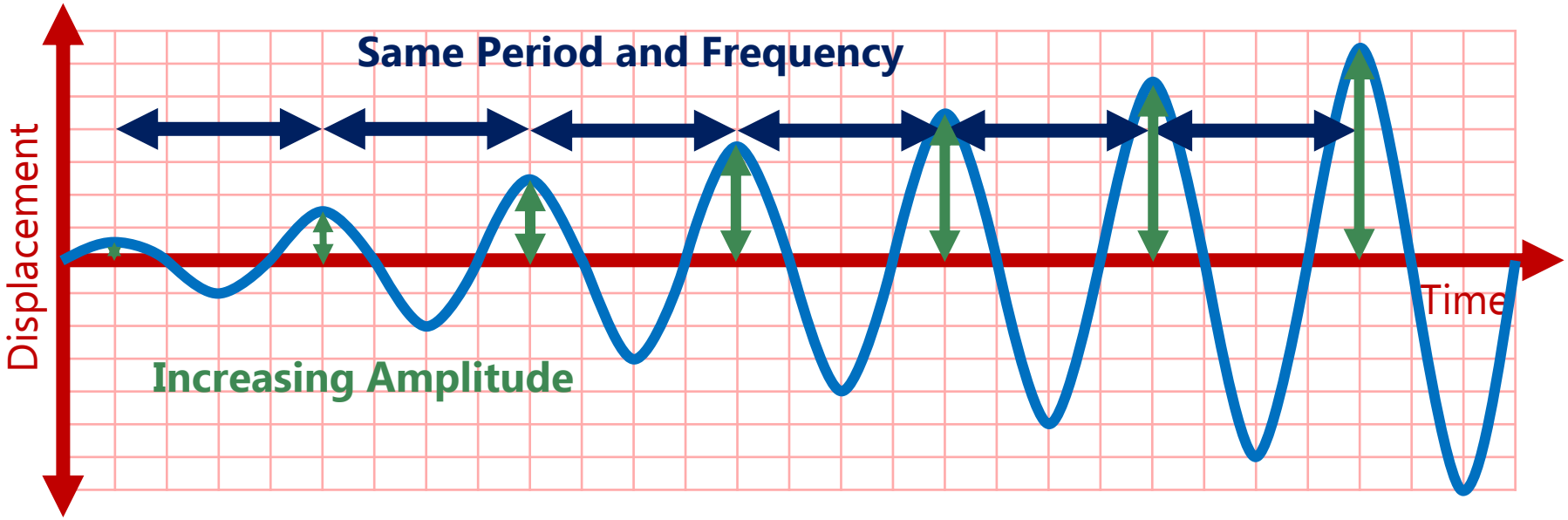
Resonance

If an object's natural frequency is matched with a periodic driving force, it can start to resonate with large amplitudes



Damping

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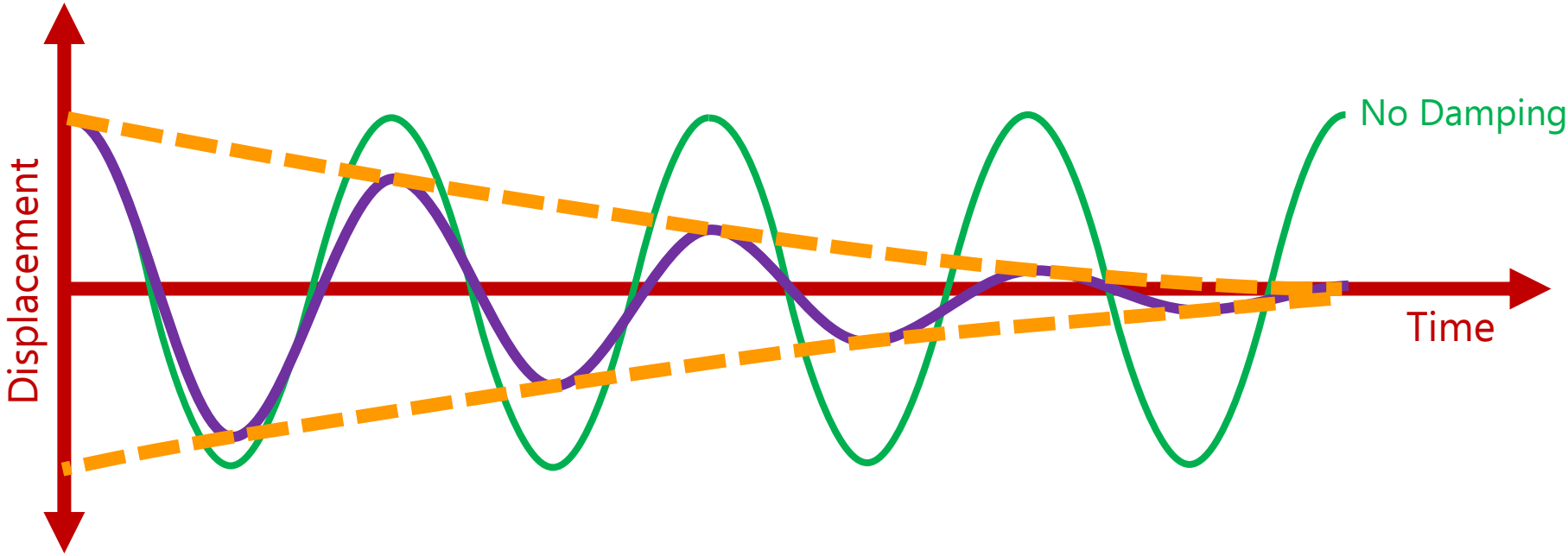
For an oscillating object in real life there are forces opposing motion and removing energy from the system over time



Classes of Damping

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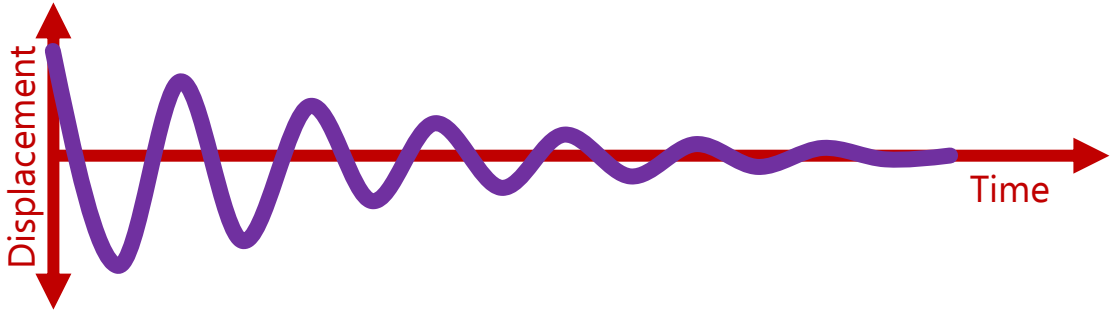
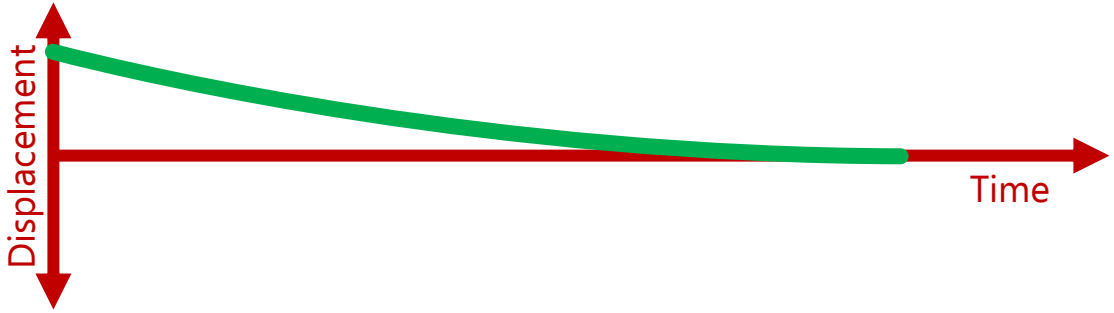


Underdamped

Continued Bouncing

Critically Damped



Overdamped

Bumps Hurt
"No Shocks"

Lesson Takeaways

C.1

- ❑ I can graph displacement, velocity, and acceleration vs time for simple harmonic motion
- ❑ I can graph kinetic and potential energy vs time for SHM
- ❑ I can graph acceleration and velocity vs displacement for simple harmonic motion
- ❑ I can describe the phenomenon of resonance
- ❑ I can describe the effect of damping and recognize scenarios where an oscillation is underdamped, overdamped, or critically damped