

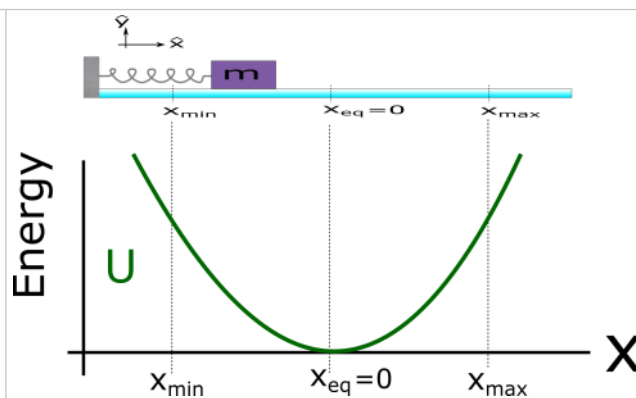
OS.2.L1.5 - Template

Monday, February 25, 2019 1:50 PM

OS.2.L1.5-2:

Problem Statement: For a mass-spring system undergoing SHM, the equilibrium position is

- (1) the point at which the velocity of the oscillator is zero.
- (2) the point at which there is no net force on the oscillator.
- (3) the point at which the oscillator is at a maximum displacement.
- (4) the point at which the oscillator has a maximum acceleration.



OS.2.L1.5-3:

Problem Statement: Complete the energy flow diagram that would best represent a spring-mass oscillator undergoing SHM with no air resistance or friction. The snapshots are taken at the following locations:

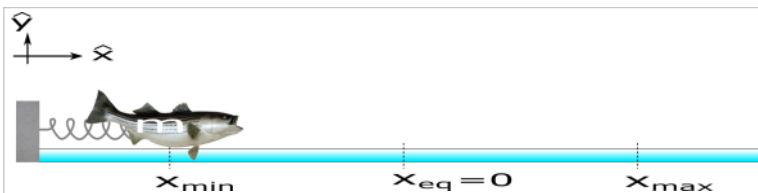
- A : The mass is at the maximum negative displacement;
- B : The mass is moving to the right and at the equilibrium location;
- C : The mass is at the maximum displacement;
- D : The mass is moving to the left and at the equilibrium location;
- E : The mass is at the maximum negative displacement.

System = spring + mass

Environment		Time →				
System	A	B	C	D	E	
E^{Chem}						
KE_T						
KE_R						
U^g						
U^s						
E^{Sound}						
E^{Th}						

OS.2.L1.5-4:

Problem Statement: A 1.0 kg bass is pulled 15 cm in the negative direction from the equilibrium position and released from rest on a frictionless surface. If the spring constant of the spring is 5 N/m, how fast will the bass be moving when it travels through the location at positive 5.0 cm? (Hint: use your energy analysis skills from PH201)



OS.2.L1-5:

Problem Statement: Four different oscillations are plotted below. (the + x direction is considered positive).

(a) Is the velocity at $t = 0$ s positive, negative, or zero for each case?

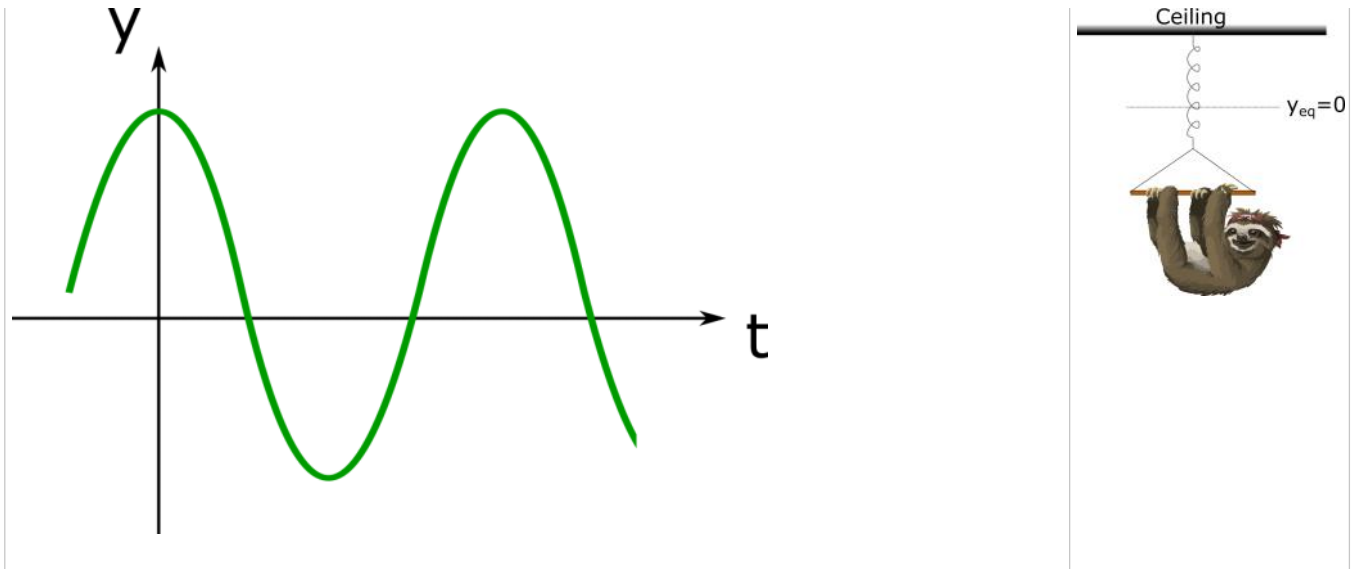
v_A	v_B	v_C	v_D

(b) Is the acceleration at $t = 0$ positive, negative, or zero for each case?

a_A	a_B	a_C	a_D

OS.2.L1-6:

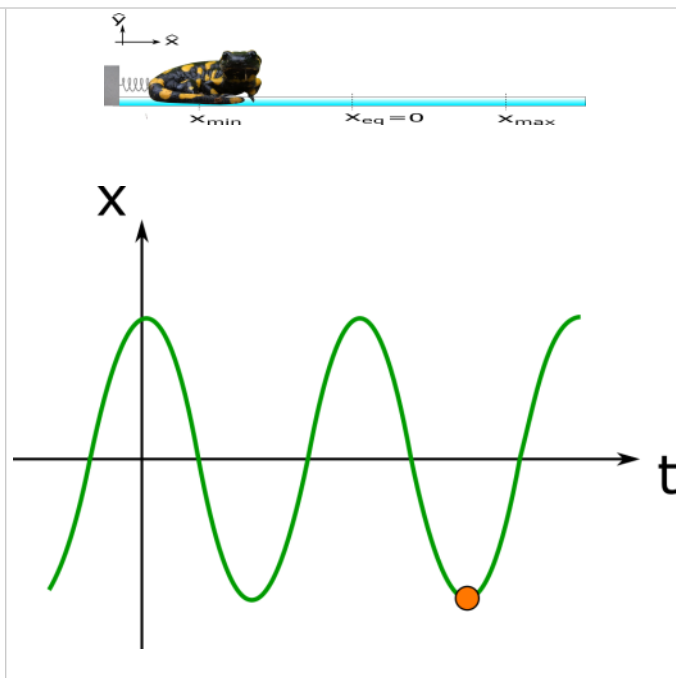
Problem Statement: Sloan the Sloth is suspended from a spring oscillating up and down as indicated in the graph below. Select a point on the graph where v_y is positive and a_y is negative.



OS.2.L1-7:

Problem Statement: Sally the Salamander holds on to a negligible mass spring. The position of Sally as a function of time is plotted below. What can you say about the velocity and the force acting on Sally at the instant indicated by the orange dot?

- (1) Velocity is zero ; force is to the right.
- (2) Velocity is zero ; force is to the left.
- (3) Velocity is negative ; force is to the right.
- (4) Velocity is negative ; force is to the left.
- (5) Velocity is positive ; force is to the right.
- (6) Velocity is positive ; force is to the left.

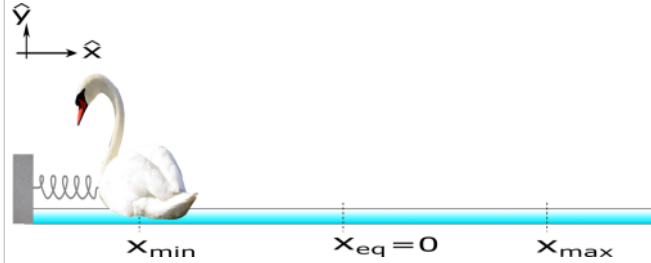


OS.2.L1-8:

Problem Statement: Sean the Swan is resting on a frictionless surface and attached to a spring which is initially pulled back 15 cm and released from rest as seen in the image below. Sean proceeds to make 20 oscillations in 30 seconds.

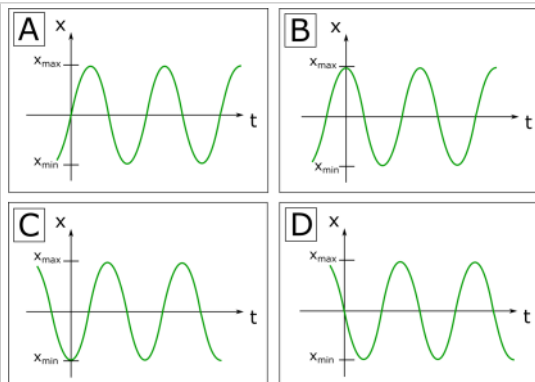
(a) What is the period of oscillation?

(b) What is the frequency of oscillation?



Sean the Swan is resting on a frictionless surface and attached to a spring which is initially pulled back 15 cm and released from rest as seen in the image below. Sean proceeds to make 20 oscillations in 30 seconds.

(c) Which of the following plots could represent Sean's position as a function of time?



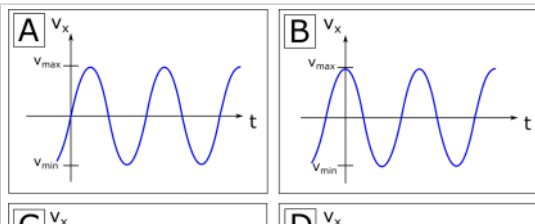
(d) Which of the following equations could represent Sean's position as a function of time?

- (1) $x(t) = x_{\max} \sin(\omega t)$
- (2) $x(t) = -x_{\max} \sin(\omega t)$
- (3) $x(t) = x_{\max} \cos(\omega t)$
- (4) $x(t) = -x_{\max} \cos(\omega t)$

(e) What is Sean's position at $t = 0.80$ s?

Sean the Swan is resting on a frictionless surface and attached to a spring which is initially pulled back 15 cm and released from rest as seen in the image below. Sean proceeds to make 20 oscillations in 30 seconds.

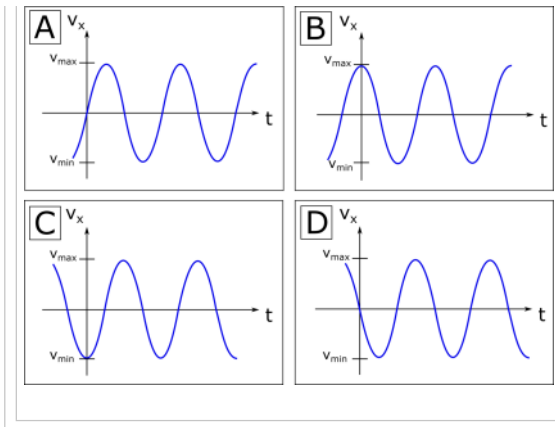
(f) Which of the following plots could represent Sean's velocity as a function of time?



(g) Which of the following equations could represent Sean's velocity as a function of time?

- (1) $v_x(t) = v_{\max} \sin(\omega t)$
- (2) $v_x(t) = -v_{\max} \sin(\omega t)$
- (3) $v_x(t) = v_{\max} \cos(\omega t)$
- (4) $v_x(t) = -v_{\max} \cos(\omega t)$

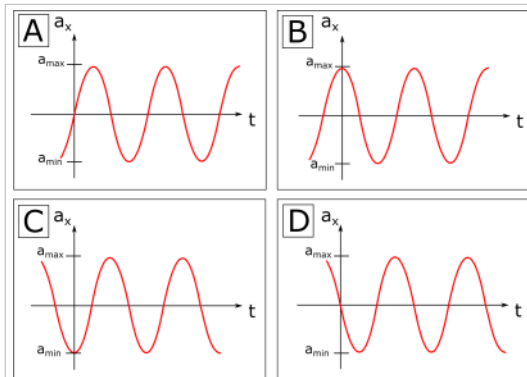
(h) What is Sean's velocity at $t = 0.80$ s?
(Hint: $v_{\max} = x_{\max} \omega$)



- (1) $v_x(t) = v_{\max} \sin(\omega t)$
- (2) $v_x(t) = -v_{\max} \sin(\omega t)$
- (3) $v_x(t) = v_{\max} \cos(\omega t)$
- (4) $v_x(t) = -v_{\max} \cos(\omega t)$

Sean the Swan is resting on a frictionless surface and attached to a spring which is initially pulled back 15 cm and released from rest as seen in the image below. Sean proceeds to make 20 oscillations in 30 seconds.

(i) Which of the following plots could represent Sean's acceleration as a function of time?



(j) Which of the following equations could represent Sean's acceleration as a function of time?

- (1) $a_x(t) = a_{\max} \sin(\omega t)$
- (2) $a_x(t) = -a_{\max} \sin(\omega t)$
- (3) $a_x(t) = a_{\max} \cos(\omega t)$
- (4) $a_x(t) = -a_{\max} \cos(\omega t)$

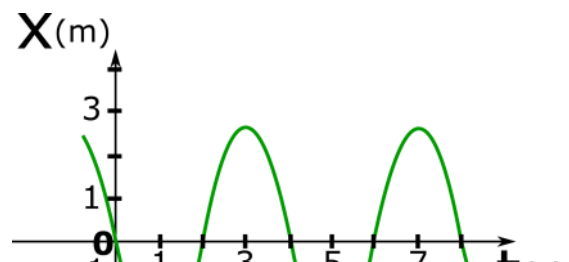
(k) What is Sean's acceleration at $t = 0.80$ s? (Hint: $a_{\max} = v_{\max} \omega$)

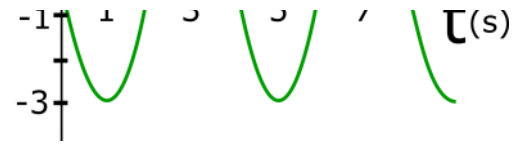
OS.2.L2-9:

Problem Statement: A plot of displacement from equilibrium vs time for a spring-mass system is shown below. The mass attached to the ideal spring has a mass of 7 kg.

(a) What is the period of oscillation?

(b) What is the maximum speed the mass reaches?





(c) What is the spring constant of the spring?

(e) Construct the mathematical equation that represents the displacement of this system as a function of time. USE SI units.

(d) What is the total energy of this system?

OS.2.L2-10:

Problem Statement: A simple pendulum shown in case **A** consists of a mass **M** attached to a massless string of length **L**. If the mass is pulled to one side a small distance and released, it will swing back and forth undergoing SHM. Cases **B**, **C**, and **D** are variations of this system. Rank the oscillation frequency of each case.

