

ave. = 6.7
 $\sigma = 2.1$

Name Answer Key

Lab: early late (please circle one)

Quiz #9: Simple Harmonic Motion

Problem 1 (2 points)

A leaky faucet drips 40 times in 30.0 s. What is the frequency of the dripping?

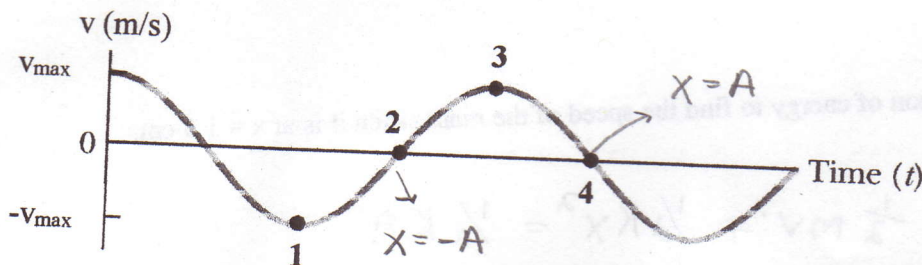
- a) 1.3 Hz
b) 0.75 Hz
c) 1.6 Hz
d) 0.63 Hz
e) none of the above

$$f = \frac{40}{30.00} = \underline{1.3 \text{ Hz}}$$

A

Problem 2 (4 points)

A mass connected to a horizontal spring is oscillating on a frictionless surface in simple harmonic motion. The figure below shows the velocity of the mass versus time as a function of time. Answer the questions below with *one or more* of the four points indicated on the plot.



- a) When is the displacement of the object equal to $x = \pm A$? 2 + 4 (when $\vec{v} = 0$)
- b) When is the acceleration positive? 2 (when slope of \vec{v} vs. t is positive)
- c) When is the potential energy a maximum? 2 + 4 (when $x = \pm A$)
- d) When is the kinetic energy a maximum? 1 + 3 (when speed is a maximum)

Problem 3 (4 points)

A 0.475 kg mass is attached to a horizontal spring ($k = 25.5 \text{ N/m}$) on a frictionless surface. The mass is released from rest a distance of 4.00 cm from the equilibrium position of the spring.

a) What is the period of the mass?

$$m = 0.475 \text{ kg}$$

$$k = 25.5 \text{ N/m}$$

$$A = 4.00 \text{ cm}$$

$$= 0.0400 \text{ m}$$

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

$$T = 2\pi \sqrt{\frac{(0.475 \text{ kg})}{25.5 \text{ N/m}}}$$

$$T = 0.858 \text{ s}$$

b) Use conservation of energy to find the speed of the mass when it is at $x = 1.5 \text{ cm}$.

$$E = \frac{1}{2} m v^2 + \frac{1}{2} k x^2 = \frac{1}{2} k A^2$$

$$\frac{1}{2} m v^2 = \frac{1}{2} k A^2 - \frac{1}{2} k x^2$$

$$v^2 = \frac{k}{m} (A^2 - x^2)$$

$$v = \sqrt{\frac{25.5 \text{ N/m}}{0.475 \text{ kg}} [(0.0400 \text{ m})^2 - (0.015 \text{ m})^2]}$$

$$v = 0.27 \text{ m/s}$$