National University

of Computer & Emerging Sciences

Applied Physics (NS-1001) **Quiz # 3A** **Fall 2025**

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Section: BCS-B **CLO2** **Date: 03-11-2025**

Q.1: A 0.500-kg object attached to a spring with a force constant of 8.00 N/m vibrates in simple harmonic motion with an amplitude of 10.0 cm. Calculate (a) the maximum value of its speed and acceleration, (b) the speed and acceleration when the object is 6.00 cm from the equilibrium position, and (c) the time interval required for the object to move from x=0to x=8.00cm. (7M)

Solution:

(a) $\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{8.00\ \text{N/m}}{0.500\ \text{kg}}} = 4.00\ \text{s}^{-1}$ so position is given by $x = 10.0\sin(4.00t)\ \text{cm}$.

From this we find that $v = 40.0\cos(4.00t)\ \text{cm/s}$ $v_{\max} = \boxed{40.0\ \text{cm/s}}$

$a = -160\sin(4.00t)\ \text{cm/s}^2$ $a_{\max} = \boxed{160\ \text{cm/s}^2}$.

(b) $t = \left(\frac{1}{4.00}\right)\sin^{-1}\left(\frac{x}{10.0}\right)$ and when $x = 6.00\ \text{cm}$, $t = 0.161\ \text{s}$.

We find $v = 40.0\cos\left[4.00(0.161)\right] = \boxed{32.0\ \text{cm/s}}$

$a = -160\sin\left[4.00(0.161)\right] = \boxed{-96.0\ \text{cm/s}^2}$.

(c) Using $t = \left(\frac{1}{4.00}\right)\sin^{-1}\left(\frac{x}{10.0}\right)$

when $x = 0$, $t = 0$ and when $x = 8.00\ \text{cm}$, $t = 0.232\ \text{s}$.

Therefore, $\Delta t = \boxed{0.232\ \text{s}}$.