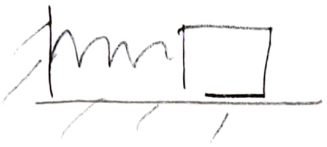
CHAP 10, PROB 21

ROUGH DRAFT
do not hand in!



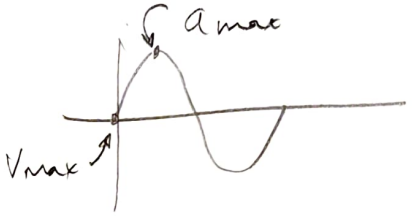
$v_{max} = 1.29$ m/s

$a_{max} = 6.51$ m/s^2

$v_{max} \rightarrow a_{max}$

v_{max} center

a_{max} end



$$t = \frac{1}{4}T$$

$$v_{max} = \omega A \quad ; \quad a_{max} = \omega^2 A$$

$$\Rightarrow a_{max} = \omega v_{max}$$

$$\omega = \frac{a_{max}}{v_{max}} \qquad \omega = \frac{2\pi}{T}$$

$$\frac{2\pi}{T} = \frac{a_{max}}{v_{max}}$$

$$T = 2\pi \frac{v_{max}}{a_{max}}$$

$$= 2\pi \frac{1.29}{6.51} = 1.25$$

$$t = \frac{T}{4} = 0.311 \text{ s}$$

JOHN CUMMINGS ← name

number pages → (1)

PROBLEM 10.21 ← prob. number

← leave space for comments →

AN OBJECT ON SPRING OSILLATES ON A FRICTIONLESS SURFACE. $V_{max} = 1.29$ M/S AND $a_{max} = 6.51\ m/s^2$. WHAT IS t BETWEEN V_{max} AND NEXT a_{max}?

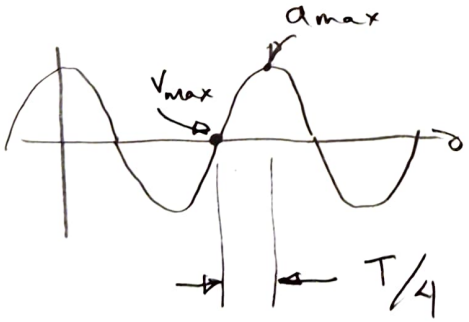
restate prob., but simplified

FIND V_{max} AND a_{max} IN TERMS OF ω & A, THEN SOLVE FOR ω (AND HENCE T). USE FRACTION OF PERIOD BTWN V_{max} & a_{max} TO SOLVE.

explain strategy

V_{max} OCCURS WHEN MASS IS AT THE CENTER (EQUILIBRIUM) POSITION, a_{max} OCCURS WHERE THE FORCE IS LARGEST – AT MAXIMUM DISPLACEMENT.

pictures and graphs may help



$\Rightarrow t = \frac{T}{4}$ (1)

number equations you use later

10.21 (CONT.)

WE KNOW FROM THE TEXT THAT

$$v_{max} = \omega A \qquad (10.8)$$

AND

$$a_{max} = \omega^2 A \qquad (10.10)$$

reference new equations

SO

$$a_{max} = \omega v_{max}$$

$$\omega = \frac{a_{max}}{v_{max}}$$

BUT SINCE $\omega = \frac{2\pi}{T}$

$$\frac{2\pi}{T} = \frac{a_{max}}{v_{max}}$$

NOW WE CAN SOLVE FOR T & DIVIDE BY 4 (EQ (1))

do all algebra first! then evaluate numerically!

$$t = \frac{T}{4} = \frac{\pi}{2}\frac{v_{max}}{a_{max}} = \frac{\pi}{2}\frac{1.29\ m/s}{6.51\ m/s^2}$$

$$\boxed{t = 0.311\ s}$$

box final answer

check units if not trivial