

A1

- a) 0.251 s
- b) 1 Period. *Displacement* = 0, *Distance* = 4 X = 24cm
- c) 2.90 cm
- d) +131 cm/s
- e) -1812 cm/s²

A2

- a) T ≈ 2.33 s (from graph),
f = 0.429 Hz
- b) Depends on function you chose:
E.g. if you chose cos:

$$x(t) = X \cos(\omega t + \phi) \Rightarrow j = \frac{\rho}{2}, -\frac{3\rho}{2}, \dots$$

- c) Numerous ways of writing. One of them is:

$$x(t) = (2.4 \text{ m}) \cos\left(2.68 \frac{\text{rad}}{\text{s}} t + \frac{\rho}{2}\right)$$

- d) +6.98 m/s²

A3

- a) 0.431 m
- b) 2.43 s
- c) 1.11 m/s
- d) no change of above answers.
Phase constant would have changed, though.

A4

- a) 88.8 N/m
- b) 1.24 s
- c) 0.152 m

A5

- a) 2.00 s
- b) 0.0792 J
- c) 4.32 N
- d) 0.248 m

B1

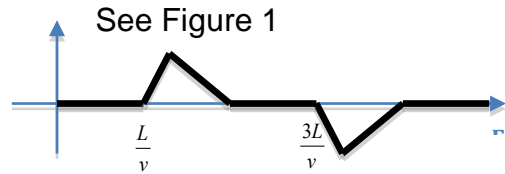


Figure 2: Answer for B1

B2

- a) $A = 2.00 \times 10^{-3} \text{ m}$, $\lambda = 1.60 \text{ m}$,
 $T = 5.56 \times 10^{-2} \text{ s}$, $f = 18.0 \text{ Hz}$, $v = 28.9 \text{ m/s}$
- b) $v_y(x = 3\text{m}, t = 4\text{s}) = 1.55 \text{ m/s}$

B3

- a) See Figure 2
- b) See Figure 3
- c) $9.88 \times 10^{-4} \text{ kg/m}$

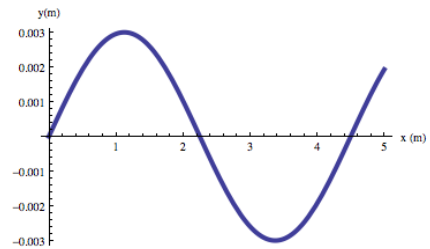


Figure 3 Answer for B3 part a)

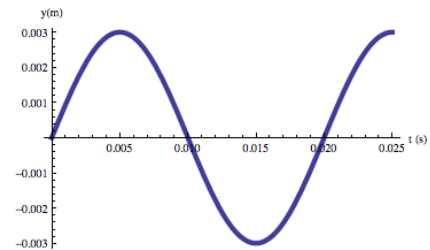


Figure 4: Answer for B3 part b)

NYC Answers to Supplementary Problems

C1

- a) 146 N
- b) 53.1 cm

C2

- a) 1.67 m
- b) 258.1 m/s
- c) 155 Hz
- d) (see equation below)
 $y(x, t) = (4.00 \text{ mm}) \sin[(3.77 \text{ m}^{-1})x] \sin[977 \text{ s}^{-1}t]$
- e) 0.554 m, 1.66 m, 2.77 m

C3

2.96 kHz

C4

- a) 26.7 m/s
- b) 1.11 m
- c) (see equation below)
 $y(x, t) = (2.5 \text{ cm}) \sin[(7.05 \text{ m}^{-1})x] \sin[(188 \text{ s}^{-1})t]$
- d) $A = 1.77 \text{ cm}$, $v_{y\text{-max}} = 0.666 \text{ m/s}$

C5

- a) 342 m/s
- b) 6.53 Hz

C6

875 Hz

D1

113 W

D2

$3.00 \times 10^4 \text{ m}$

D3

- a) 25.2 m/s
- b) 440 Hz

D4

546 Hz

E1

- a) $\pm 9.82^\circ$, $\pm 30.8^\circ$, $\pm 58.5^\circ$
- b) 85.6 m
- c) 363 m
- d) 10.2 rad

E2

589.6 nm

E3

- a) 102 nm
- b) 306 nm

E4

658 nm

E5

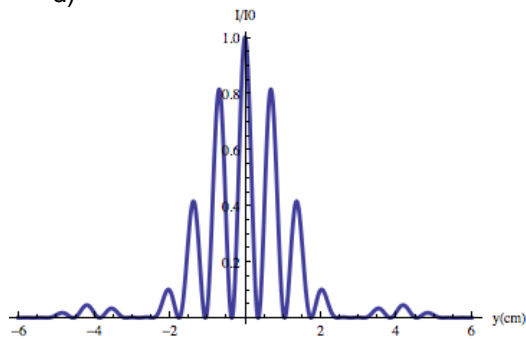
0.0100°

F1

- a) 3.96 cm
- b) 1.98 cm
- c) 40.5%

F2

- a) 420 nm
- b) 4
- c) 7
- d)



F3

- a) 4
- b) $\frac{5\pi}{4}$ rad = 3.92 rad
- c) 0.0125 rad = 0.716°
- d) 8π rad
- e) 0.0801 rad = 4.59°
- f) $I = 0.787 I_{\max}$

F4

15.8 km

G1

- a) 2 complete orders are visible
- b) 2nd and 3rd orders overlap

G2

- a) 0.547 rad = 31.3°
- b) 0.708 rad = 40.5°

H1

- a) 0.604 V
- b) 4.61×10^5 m/s
- c) 1.91×10^{19} 1.91×10^{19}

H2

- a) 4.29×10^{-15} Vs (approximately)
- b) 2.07 eV (approximately)
- c) 622 nm (using values from a and b)
- d) Photons having a wavelength equal to the cutoff wavelength have just enough energy to excite an electron out of the photoelectric surface. Photons with longer wavelength (lower energy) are unable to produce photoelectrons via the photoelectric effect.

H3

- a) 485 nm
- b) -1.51 eV
- c) $\lambda = 1.01 \mu\text{m}$

H4

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Section H continued on next page

NYC Answers to Supplementary Problems

H5

- a) $1.39 \text{ rad} = 79.9^\circ$
- b) 62.0 eV

H6

- a) 9.98 pm
- b) $3.98 \times 10^4 \text{ m/s}$

H7

- a) See figures 4 and 5 below
- b) 206 MeV , 1850 MeV
- c) $7.56 \times 10^{-16} \text{ m } \gamma\text{-rays}$

H8

$1.05 \times 10^3 \text{ m/s}$

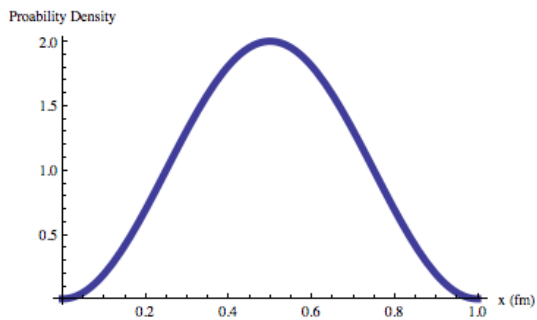


Figure 5: Probability Distribution for $n=1$

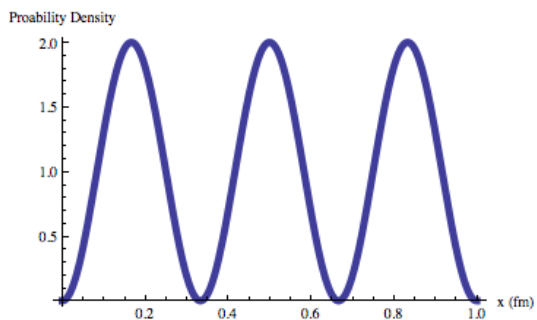


Figure 6: Probability Distribution for $n=3$

I1

- a) $4.33 \times 10^{-8} \text{ s}$
- b) 10.4 m
- c) 6.24 m
- d) $h = 2.00 \text{ m}$, $w = 0.330 \text{ m}$

I2

- a) 28.5 year
- b) 27.4 year

I3

$0.469 c$

I4

- a) 3.12 MeV
- b) 7.81 MeV

I5

1.88 GeV