q45

1) a — 5 pts all or none

There are seven λ between P1 & P2

$\frac{(15-4.5\text{ cm})}{1.5\text{cm}} = \frac{10.5}{1.5} = 7$

2) 2 pts each
a - R
b - B, D
c - D
d - R
e - D

(Accepted B for 1 pt)
(Accepted R for 1 pt)

3)

1 wrong -2.
2 wrong -4

(The book clearly said "diffraction") accepted "B" for 1 pt

4) $v = f\lambda \quad v = \frac{c}{n} \quad \lambda \to \frac{\lambda}{n}$

$\lambda \to 380/1.58 = 240\text{ nm}$

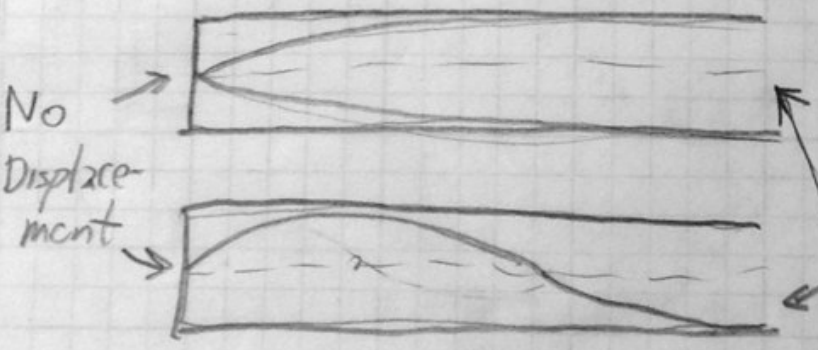
5) $\frac{m\lambda}{4} = L$ m odd $\quad \frac{\lambda}{4} = L \to \lambda_1 = 4L = 8\text{ m}$

$f_1 = \frac{v}{\lambda_1} = \frac{343\text{ m/s}}{8\text{ m}}$ $\quad \frac{3\lambda}{4} = L \to \lambda_2 = \frac{4}{3}L = \frac{8}{3}\text{ m}$

$f_1 = 42.9\text{ Hz}$

$f_2 = 128\text{ Hz}$

10 points for fundamental
5 pts for 1st harmonic
Gave part credit for $\lambda_1 = 4\text{ m}$



EXAM #1

6) $V = \sqrt{\frac{T}{\mu}}$ $\quad (20\,m) = vT$ $\quad v = \frac{20}{2}\ m/s$ $\quad V = \frac{2L}{t}$ $\quad V^2 = \frac{4L^2}{t^2}$

$V^2 = T/\mu$

$\mu = T/v^2 = 5N/100 = .05\ kg/m$

$M = (10)(\mu) = .5kg$ If you got $v = 5\ m/s$ Then $M = 2kg$ -1 for that

7) $\theta_1 = 90 - A = 35°$

$n_1 \sin\theta_1 = (1.5)(\sin 35) = .86 = (1)\sin\theta_2$

$\theta_2 = 59.3°$

Lose pts if $\theta = 55°$ If didn't see TIR If ray bent toward normal

$(1.9)\sin 35 = 1.08 \rightarrow$ TIR

8) Single slit. Broad central max. No secondary maximations 2 pts (All or none)

Slit width $w\sin\theta = m\lambda$

$w = \frac{m\lambda L}{y}$ $\quad w\,y/L = (2)(600nm)$

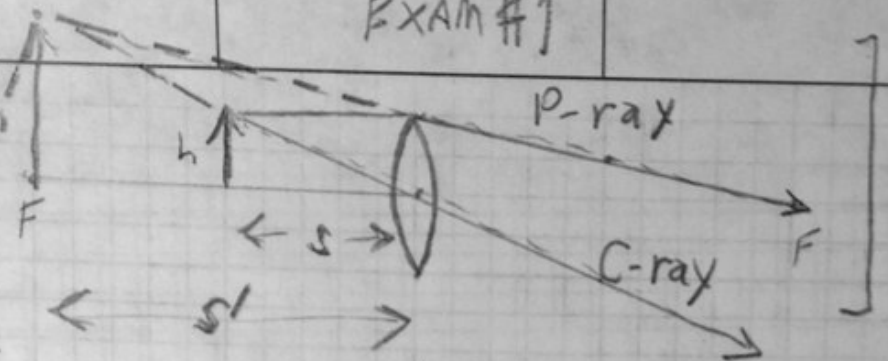
$(w)\frac{(2\times10^{-2})}{3} = (2)(600)$

$w = (3)\frac{6\times10^{-7}}{10^{-2}}$

$= 1.8\times10^{-4}\ m = 180\ \mu m$

8 pts Lose points for swapping L & y or miscounting m or order of magnitude error

EXAM #1

9) 

6 pts for sketch

2 pts [Image is erect and on same side of lens, 6 hrs virtual]

7 pts
$$\frac{1}{s}+\frac{1}{s'}=\frac{1}{f} \qquad \frac{1}{18}-\frac{1}{36}=\frac{1}{36}$$

$h = 7\,mm \quad h' = 14\,mm$

$s' = -36\,cm \quad M = 2$

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10) $D(x) = A\sin(kx+\omega t)$

(a) $k = 42\ /m$ +2

+1 (b) To the left

+1.5 (c) $\omega = 2\pi f \quad f = \frac{\omega}{2\pi} = \quad \omega = 170\ rad/s$

+1.5 (d) $f = \frac{\omega}{2\pi} = \frac{170}{2\pi} = 27\ Hz$

+2 (e) $k = \frac{2\pi}{\lambda} \quad \lambda = \frac{2\pi}{k} = \frac{2\pi}{42} = .149\ m$

+2 (f) $v = f\lambda = 4.0\ m/s$

Units are <u>assumed</u> SI unless otherwise specified

-1/2 per wrong unit (Accepted "Hz" for ω even though it's really wrong)