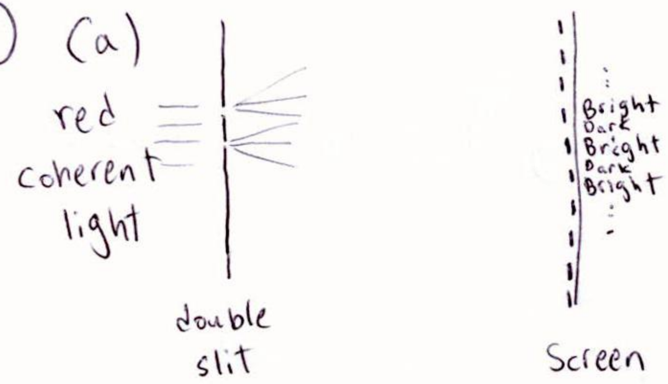
Reading 2/25

① (a)



Pattern of alternating bright and dark spots due to interference of light.

(b) Path-length diff: $\Delta r = d\sin\theta = m\lambda$

$m = 2 \Rightarrow \boxed{\Delta r = 2\lambda} \approx 2(650\,nm) = 1.3\,\mu m$

(c) $\sin\theta = \frac{m\lambda}{d}$ would decrease if λ decreases

(blue light $\lambda \approx 440\,nm$) $\Rightarrow$ $\boxed{\text{Spacing decreases}}$

(d) There would be no more interference pattern. (requires coherent light)

② Interference & Diff. Gratings: light from one slit interferes with light from another slit to produce an "interference pattern"

(single-slit) Diffraction: Light from one part of a slit interferes with light from anothe part of the same slit, producing a "diffraction pattern."

Another diff: $d\sin\theta = m\lambda$ $(m = 0, \pm 1, \pm 2, \ldots)$ gives bright spots

d = slit separation $\longleftrightarrow$ interference

$a\sin\theta = p\lambda$ $(p = \pm 1, \pm 2, \ldots)$ gives dark spots

a = slit width $\longleftrightarrow$ diffraction

③ (a) distance from (p = 1 dark) to (p = 2 dark)

is $\boxed{\frac{1}{2}w} = \Delta y$

(read discussion surrounding Eq. (33.21) & (33.22)

(b) $a \sin\theta \approx \frac{a\,\Delta y}{L} = p\lambda$ gives location

of dark spots $(p = \pm 1, \pm 2, \ldots)$

if $\lambda \to \frac{1}{2}\lambda$, then Δy decreases by a factor of 2. (minima are closer)

$$\frac{a\,\Delta y'}{L} = p\lambda' = p\frac{\lambda}{2} \Rightarrow \Delta y' = \frac{\Delta y}{2}$$

So $\boxed{\Delta y' = \frac{w}{4}}$ (with respect to the width w from part a)