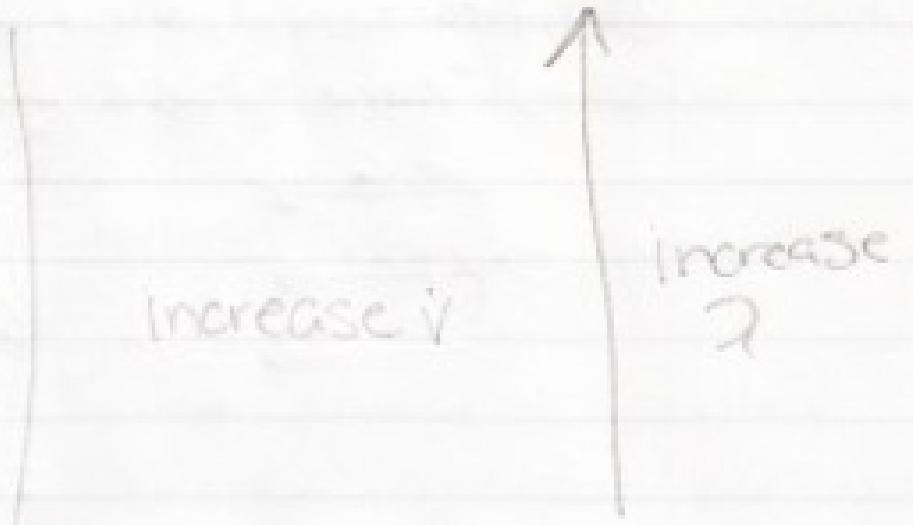
③ Wavelength = color
amplitude = intensity

Electromagnetic Spectrum
- (A) radio waves
- (B) microwaves
- (C) infared (IR)
- (D) visible
- (E) Ultraviolet (UV)
- (F) X-ray
- (G) Gamma rays

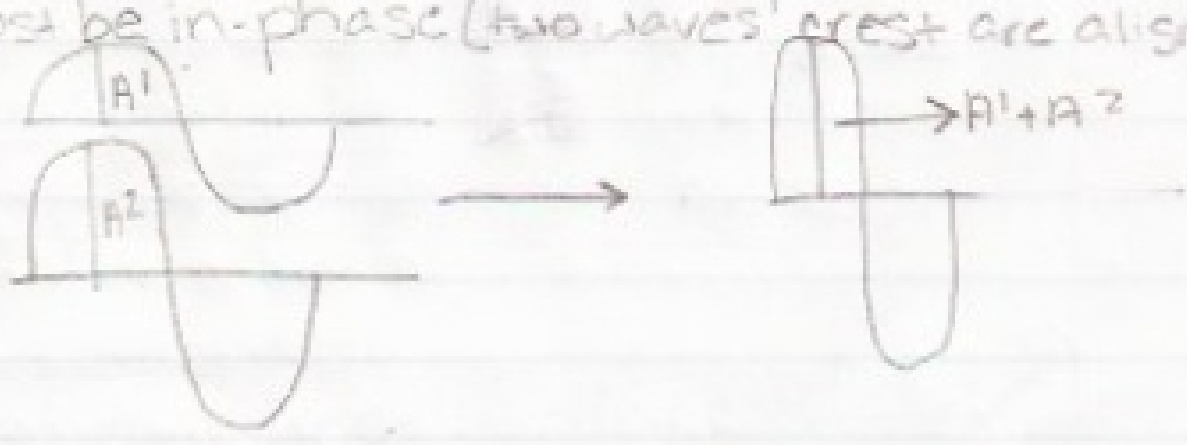


9/3/15

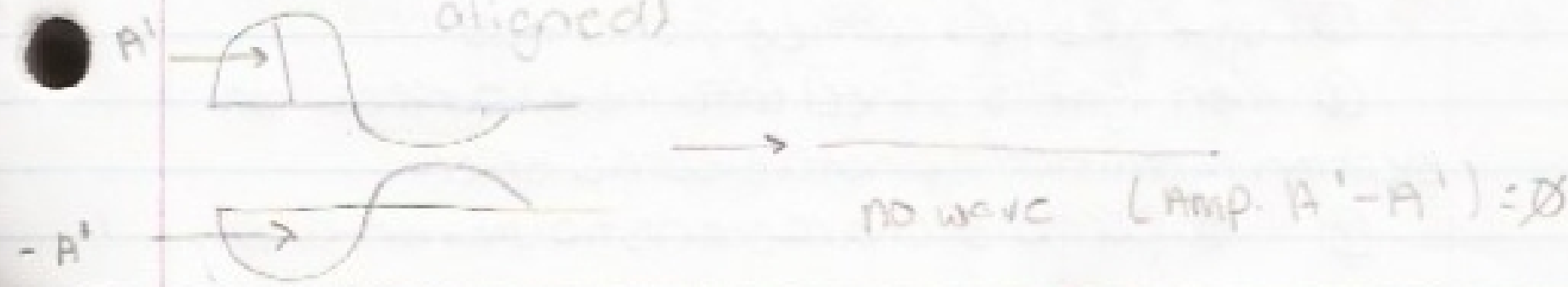
Visible light has the same speed, the speed of light.

① Interference - the interaction of waves
- (A) Constructive - when waves interact so that they add to make a larger wave
  - must be in-phase (two waves' crest are aligned)

Ex.

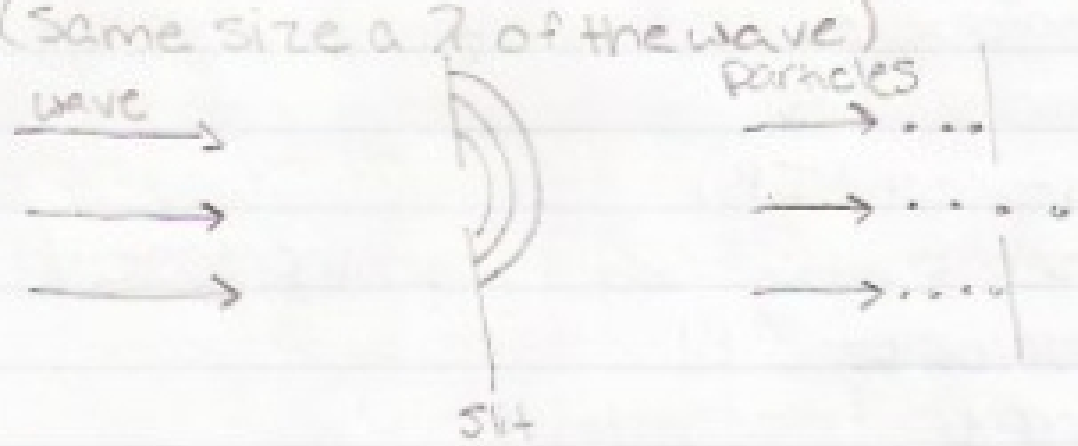


- (B) Destructive - when two waves interact to cancel each other out.
  - must be out-of-phase (crest + trough are aligned)

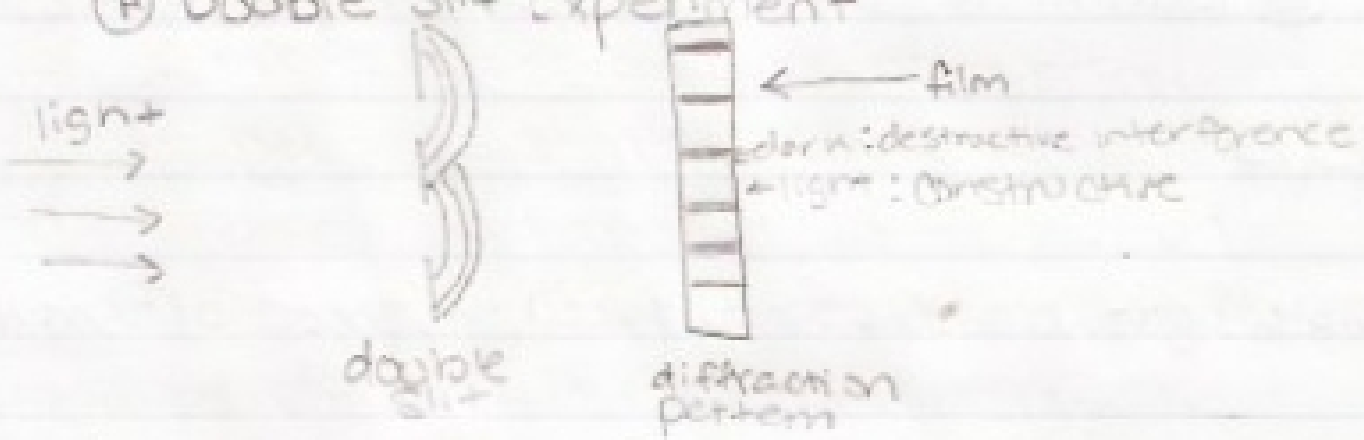


③ waves slightly out of phase will have a combination of constructive + destructive interference

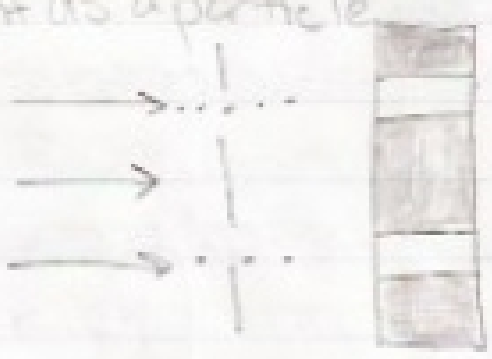
② diffraction - waves bend around obstacles or slits (same size as λ of the wave)



④ Double Slit Experiment



light as a particle



Since this experiment showed light directly behind the slit, the light must have diffracted (bent) and formed 2 sources of light to form the diffraction pattern (constructive destructive)

- Only waves can diffract and interference. Possibly proving that light must be a wave. or have properties of waves

Particle:

① Light also has particle properties

② When light is shined onto metal surface, an electron is emitted - photoelectric effect

④ particle characteristic (matter-like)

③ There is a minimum frequency/wavelength of light is required to dislodge e^-

Ⓐ known as threshold frequency

Ⓑ does not matter the duration or intensity (amplitude), if the light was below the threshold frequency, no e^- was dislodged

④ Einstein proposed that light is made of photons/quanta - particles that carry the energy from the light

③ $E_{photon} = h\nu$

E_{photon} = energy of 1 photon

h = Planck's constant = 6.6626×10^{-34} J·s

ν = frequency (1/s)

- $c = \nu \cdot \lambda$

$\nu = c/\lambda$

- $E_{photon} = \frac{hc}{\lambda}$

- $E \propto \nu$ (directly proportional)

$E \propto 1/\lambda$ (inversely proportional)

⑤ Electromagnetic Spectrum

Radiowaves microwaves ..... Gamma Rays

increase ν →

increase E →

① Example: What is the energy (in J) of a photon w/ frequency of radiation of 1.5×10^{35} Hz?

Given: $\nu = 1.5 \times 10^{35}$ Hz Hz = 1/s

$E_{photon} = h \cdot \nu = 6.626 \times 10^{-34}$ J·s $\cdot 1.5 \times 10^{35}$ 1/s

$= 99.39$ J = **99 J**