Crack the OAT

Crack Notes [Physics 8]
Lights & Optics

Electromagnetic Waves
Have an oscillating electric/magnetic field, travels at speed c = E/B
Visible light: wavelengths 390 nm (violet)-700 nm (red), backwards it's ROYGBIV
Ultraviolet: wavelength < 390 nm
Infrared: wavelength > 700 nm
Speed: $c = f\lambda$
Refractive index: $n = c / v$, higher *n* = slower light = shorter wavelength (but same freq)
Polarized light: electric field of all light oriented in same direction
Energy of photon: $E = hf$

Reflection
ANGLE OF INCIDENCE = ANGLE OF REFLECTION

Refraction
Snell's law $n_1 \sin\theta_1 = n_2 \sin\theta_2$, so higher *n* means light is closer to perpendicular axis

When going from high *n1* to low *n2*: *critical angle* $\theta = \sin^{-1}\left(\frac{n_2}{n_1}\right)$, if angle of incidence is larger than the critical angle then there will be no refraction (TOTAL INTERNAL REFLECTION)

Dispersion: shorter wavelengths usually refract MORE

Diffraction
Waves passing through small openings will become circular and can interfere, forming a light/dark *diffraction pattern* on the opposite side

Mirrors
CONCAVE mirror bends towards observer (from perspective of observer, looks like a CAVE)
CONVEX mirror bends away from observer
CONCAVE mirror will CONVERGE light, CONVEX mirror will DIVERGE light

Lenses
CONCAVE lens bends towards observer (aka CAVE)
CONVEX lens bends away from observer
CONCAVE lens will DIVERGE light, CONVEX lens will CONVERGE light (opposite of mirrors)

Focal length = 1/2 * (Radius of Curvature)

Crack the OAT

Crack Notes [Physics 8]
Lights & Optics

How to Deal with Optics

1. Draw lens/mirror
2. Draw eye on LEFT side
3. If lens, draw object on RIGHT side, if mirror, draw object on LEFT side
4. Draw HORIZONTAL line from object to mirror/lens, then either reflect (mirror) or refract (lens) towards focal point. Might have to draw dotted line to focal point.
5. Draw DIAGONAL line from object through focal point, then reflect (mirror) or refract (lens) horizontally. Might have to draw dotted lines again.
6. If image is on RIGHT side, it's VIRTUAL AND UPRIGHT
   If image is on LEFT side, it's REAL AND INVERTED

Formulas:

$$P = \frac{1}{f} = \frac{1}{d_{image}} + \frac{1}{d_{object}}$$

$$M = -\frac{d_{image}}{d_{object}} = \frac{h_{image}}{h_{object}}$$

For two lenses, MULTIPLY magnifications, ADD powers