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| **Category** | Optics |
| **Subcategory** | Geometric Optics |
| **Concept Name** | The Law of Reflection |
| **Description** | The **Law of Reflection** is where if a ray of light could be observed approaching and reflecting off a flat mirror |
| **Formula** |  |
| **Drawing/Animation** | <http://www.physicsclassroom.com/mmedia/optics/lr.cfm>: create an animation of where one ray of light reflects off a flat surface |
| **Relevant Tags** | #reflection #light #mirror #rays |

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| **Category** | Optics |
| **Subcategory** | Geometric Optics |
| **Concept Name** | The Law of Refraction (Snell’s law) |
| **Description** | **Refraction** is the bending of the path of a light wave as it passes across the boundary separating two media. |
| **Formula** | where **Θi** ("theta i") = angle of incidence  **Θr** ("theta r") = angle of refraction  **ni** = index of refraction of the incident medium  **nr** = index of refraction of the refractive medium |
| **Drawing/Animation** |  |
| **Relevant Tags** | #refraction #light #rays #incidence #angle |

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| **Category** | Optics |
| **Subcategory** | Geometric Optics |
| **Concept Name** | Reflection on a spherical mirrors |
| **Description** | **Spherical mirrors** can thought of as a portion of a sphere that was sliced away then silvered on one of the sides to form a reflecting surface.  **Concave** mirrors silvered on the inside of the sphere and **convex** mirror are silvered on the outside of the sphere |
| **Formula** | Mirror equation:  do is object distance, di is image distance and f is focal length  Magnification equation:  where the image height (hi) and object height (ho) |
| **Drawing/Animation** | An animation where light is reflected off a concave and convex mirrors  Concave mirror:<http://www.physicsclassroom.com/mmedia/optics/rdcma.cfm>  Convex mirrors: <http://www.physicsclassroom.com/class/refln/Lesson-4/Ray-Diagrams-Convex-Mirrors> |
| **Relevant Tags** | #Spherical #mirrors #Convex #Concave #magnification #image |

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| **Category** | Optics |
| **Subcategory** | Geometric optics |
| **Concept Name** | Type of Lenses |
| **Description** | A **converging lens** is a lens that converges rays of light that are traveling parallel to its principal axis. They can be identified by being relatively thick across their middle and thin at their upper and lower edges.  A **diverging lens** is a lens that diverges rays of light that are travelling parallel to its principal axis. They are identified by being relatively thin across their middle and thick at their upper lower edges. |
| **Formula** | Lens equation where f=focal length, do object distance and di image distance  magnification equation |
| **Drawing/Animation** | <http://www.physicsclassroom.com/class/refrn/Lesson-5/Converging-Lenses-Ray-Diagrams> for converging lens ray diagrams  <http://www.physicsclassroom.com/class/refrn/Lesson-5/Diverging-Lenses-Ray-Diagrams> for diverging lens ray diagrams |
| **Relevant Tags** | #lens #converging #diverging #light #rays |

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| **Category** | Optics |
| **Subcategory** | Nature of Light |
| **Concept Name** |  |
| **Description** | Light behaves like waves in its propagation and in the phenomena of interference and diffraction; however, it exhibits particle-like behaviour when exchanging energy with matter as in the Compton and photoelectric effects |
| **Formula** | Photon Energy Formula: E=h/v  Where   * E= Photon energy * h=6.626 x 10 -34 J⋅s the Planck Constant * v= frequency of the Photon   Relations between Wavelength, Frequency and speed  In air: C=λ\*v  In media: u=c/n. λ=c/(n\*v)  Where   * c=speed of light(3.0 x 10 8 m/s) * λ=wavelength * v=frequency |
| **Drawing/Animation** |  |
| **Relevant Tags** | #light #waves #diffraction #particle #wavelength #frequency |

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| **Category** | Optics |
| **Subcategory** | Optical Instrumentation |
| **Concept Name** | Stops, Pupils, and Window apertures |
| **Description** | An aperture is an opening or hole where light travels through. Apertures are used to control Image brightness and limit a Field of View. There are three general types of apertures.   * Stops * Pupils * Windows   From the general apertures, there are specific subtypes of apertures designed for different roles.  To control Image brightness, you would use Stops and Pupils. More specifically:   * Aperture stop (AS) - The real element which limits the amount of light rays passing through an optical system * Entrance Pupil (EnP) - the optical image formed by the aperture stop, as 'seen' before hitting the stop itself * Exit Pupil (ExP) - the optical image formed by the aperture stop, as 'seen' after hitting the stop.   Before we continue, we must introduce the concept of Chief Rays/Principle rays. Chief rays is a ray that start at the edge of the object, and passes through the centers of the Entrance pupil, Aperture stop, and the exit pupil.  To control Field of View, you would use Stops and windows. More specifically:   * Field stop (FS) - The real element which reduces the angular field of view formed from an optical system. * Entrance Window (EnW) - the optical image formed by the fieldstop, as 'seen' before hitting the stop itself * Exit Window (ExW) - the optical image formed by the aperture stop, as 'seen' after hitting the stop . |
| **Formula** | N/A |
| **Drawing/Animation** | Limiting brightness: |
| **Relevant Tags** | Apertures, Stops, Windows, Pupils, Chief |

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| **Category** | Optics |
| **Subcategory** | Optical Instrumentation |
| **Concept Name** | Prisms |
| **Description** | Condition of Minimum deviations: The ray for which the deviation is a minimum traverses the prism symmetrically, that is, parallel to its base |
| **Formula** | Deviation Angle  δ =θ +θ − (θ ′+θ ′) =θ +θ − A  δ =θ + sin− n − sin θ sin A− sinθ cos A − A  Dispersion  (dn/dλ)=-(2B)/(λ^3)  Resolving Power  R=(λ /(Δλ)min)=b((dn)/(dλ)) |
| **Drawing/Animation** |  |
| **Relevant Tags** | #prism #minimum #deviations #ray #parallel |

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| **Category** | Optics |
| **Subcategory** | Optical Instrumentation |
| **Concept Name** | Cameras |
| **Description** | ??? |
| **Formula** |  |
| **Drawing/Animation** |  |
| **Relevant Tags** | Camera |

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| **Category** | Optics |
| **Subcategory** | Optical Instrumentation |
| **Concept Name** | Simple Magnifiers and Eyepieces |
| **Description** | Angular magnification M: the ratio of the retinal image as seen through the instrument over the size of the retinal image as seen by the unaided eye at normal viewing distance  Eyepieces or Oculars: To reduce transverse chromatic aberration, two lense are most often used. |
| **Formula** |  |
| **Drawing/Animation** |  |
| **Relevant Tags** | #image #magnification #eyepieces #lenses |

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| **Category** | Optics |
| **Subcategory** | Optical Instrumentation |
| **Concept Name** | Microscopes |
| **Description** | Compound microscope: Objective + Eyepiece  Objective: form a real, inverted, magnified image-> Lateral magnification - Mo  Eyepiece: Further magnify the intermediate image-> Angular magnification - Me  The intermediate image is at or just inside of the 1st focal point fe of the eyepiece |
| **Formula** | The separation of the two lens  d=fo + L + fe |
| **Drawing/Animation** |  |
| **Relevant Tags** | #lens #objective #compound #microscope #eyepiece |

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| **Category** | Optics |
| **Subcategory** | Optical Instrumentation |
| **Concept Name** | Telescopes |
| **Description** | Eyepiece is located so that 1st focus overlaps the 2nd focus of objective  Nearly parallel rays of light from a distant object are collected by a positive lens--objective formed a real inverted image in its focal plane  Then the intermediate image, located at or near the focal point of eyepiece, serves as a real object for the ocular |
| **Formula** | Angular Magnification:  M=-(fo/fe) |
| **Drawing/Animation** |  |
| **Relevant Tags** | #magnification #image #parallel #rays #light #object #eyepiece |

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| **Category** | Optics |
| **Subcategory** | Coherence |
| **Concept Name** |  |
| **Description** | Coherence: For light to be coherent the phase difference must be constant. One way of achieving coherence is the pass the light through a single slit.  Incoherent: If the phase difference is not constant then the light is incoherent. An example of which is the sun’s light, which is mostly incoherent. |
| **Formula** |  |
| **Drawing/Animation** |  |
| **Relevant Tags** | #light #constant #sun |