

All the formulas you'll need in this course, roughly in the order they will be encountered.

$$\text{Circumference of circle} = 2 \cdot \pi \cdot \text{radius}$$

$$\text{Area of circle} = \pi \cdot \text{radius}^2$$

$$\text{Surface area of sphere} = 4 \cdot \pi \cdot \text{radius}^2$$

$$\text{Volume of sphere} = \frac{4}{3} \cdot \pi \cdot \text{radius}^3$$

$$\text{Density} = \text{Mass} / \text{Volume}$$

$$\text{Angular size} / 360^\circ = \text{Distance along circle} / \text{Circumference of circle}$$

$$360^\circ \text{ in a circle}$$

$$60 \text{ arc minutes per degree}$$

$$60 \text{ arcseconds per arcminute}$$

$$\text{Speed} = \text{Distance} / \text{Time}$$

$$\text{Acceleration} = \text{Speed} / \text{Time}$$

$$\text{Kinetic Energy} = 1/2 \cdot \text{Mass} \cdot \text{Speed}^2$$

$$\text{Kepler's third law: Period}^2 = (\text{Semimajor axis})^3 \quad \text{Special Units : Period in years, semimajor axis in AU.}$$

$$\text{Newton's version: Period}^2 = \left[\frac{4\pi^2}{\text{Gravitational constant} \cdot (\text{Mass}_1 + \text{Mass}_2)} \right] \cdot (\text{Semimajor axis})^3$$

$$\text{Perihelion distance} = \text{Semimajor axis} \cdot (1 - \text{Eccentricity})$$

$$\text{Aphelion distance} = \text{Semimajor axis} \cdot (1 + \text{Eccentricity})$$

$$(\text{Escape Speed})^2 = 2 \cdot \text{Gravitational constant} \cdot \text{Mass} / (\text{Radius} + \text{Height})$$

$$\text{Gravitational Acceleration} = \text{Gravitational constant} \cdot \text{Mass} / (\text{Radius} + \text{Height})^2$$

$$\text{Power} = \text{Energy} / \text{Time}$$

$$\text{Speed of wave} = \text{Wavelength} \cdot \text{Frequency}$$

$$\text{Photon energy} = \text{Planck constant} \cdot \text{Frequency}$$

$$\text{Thermal Radiator: Power/Area} = 5.7 \times 10^{-8} \cdot \text{Temperature}^4$$

$$\text{Thermal Radiator: Peak Wavelength} = 2,900,000 / \text{Temperature} \quad \text{in nanometer, } 10^{-9} \text{ m}$$

$$\text{Doppler shift: Speed} = [(\text{Wavelength}_{\text{received}} - \text{Wavelength}_{\text{emitted}}) / \text{Wavelength}_{\text{emitted}}] \cdot \text{Speed of light}$$

$$\text{Diffraction limit} = 250,000 \text{ arcsecond} \cdot (\text{Wavelength} / \text{Diameter})$$

$$\text{Radioactive decay: age} = \text{Half-life} \cdot \log_{10}[\text{Current amount}/\text{Original amount}] / \log_{10}[1/2]$$

$$(\text{Thermal Speed})^2 = 2 \cdot \text{Boltzman constant} \cdot \text{Temperature} / \text{Mass}$$

$$\text{Temperature}_{\text{no greenhouse}} = 280 \cdot \left[\frac{1 - \text{Reflectivity}}{\text{Distance}^2} \right]^{1/4} \text{ Kelvin} \quad \text{Special Units: distance in AU.}$$

$$\text{Mass of exosolar planet} : \text{Mass}_{\text{planet}} = \text{Mass}_{\text{star}} \cdot (\text{Doppler speed}_{\text{star}} / \text{Orbital speed}_{\text{planet}})$$

$$\text{Radius of exosolar planet} : \text{Radius}_{\text{planet}} = \text{Radius}_{\text{star}} \cdot (\text{Fraction of light blocked})^{1/2}$$

$$\text{Mass-Energy equivalence: Energy} = \text{Mass} \cdot (\text{Speed of light})^2$$

$$\pi = 3.14$$

$$c = 3.00 \times 10^8 \text{ m s}^{-1} \text{ Speed of light}$$

$$h = 6.62 \times 10^{-34} \text{ Joule} \cdot \text{s} \text{ Planck constant}$$

$$1 \text{ light-year} = 9.46 \times 10^{15} \text{ m}$$

$$\text{Mass of Sun} = 2.0 \times 10^{30} \text{ kg}$$

$$G = 6.67 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2} \text{ Gravitational constant}$$

$$k = 1.38 \times 10^{-23} \text{ Joule} \cdot \text{K}^{-1} \text{ Boltzmann constant}$$

$$1 \text{ AU} = 1.50 \times 10^{11} \text{ m} \text{ Astronomical Unit}$$

$$\text{Mass of Earth} = 5.97 \times 10^{24} \text{ kg}$$