

University Physics I

Homework Set 1

- How many inches are in 30.7484 *miles*?
- The distance from the center of the Moon to the center of the Earth ranges from approximately 356,000 *km* to 407,000 *km*.
 - What is the minimum distance to the Moon in *miles*?
 - What is the maximum distance to the Moon in *miles*?
- A solid piece of lead has a mass of 23.94 *g* and a volume of 2.10 cm^3 . From these data, calculate the density of lead in SI units (kg/m^3).
- One cubic meter (1.00 m^3) of aluminum has a mass of $2.70 \times 10^3 \text{ kg}$, and the same volume of iron has a mass of $7.86 \times 10^3 \text{ kg}$. Find the radius of a solid aluminum sphere (*in cm*) that will balance a solid iron sphere of radius 2.00 *cm* on an equal-arm balance.
- An auditorium measures 40.0 *m* x 20.0 *m* x 12.0 *m*. The density of air is 1.20 kg/m^3 . What is:
 - The volume of the room in cubic feet (ft^3)?
 - The weight of the air in the room in *lbs*?
- The consumption of natural gas by a company satisfies the empirical equation:
$$V = 1.50t + 0.00800t^2,$$
where *V* is the volume of the gas in millions of cubic feet and *t* is the time in months. Express this equation in units of cubic feet and seconds. Assume a month is 30.0 days.
- Consider the following:
 - The recommended daily allowance (RDA) of the trace metal magnesium is 410 *mg/day* for males. Express this quantity in $\mu\text{g}/\text{day}$.
 - For adults, the RDA of the amino acid lysine is 12 *mg* per *kg* of body weight. How many grams (*g*) per day should a 75-*kg* adult receive?
 - A typical vitamin supplement tablet can contain 2.0 *mg* of vitamin B₂ (riboflavin), and the RDA is 0.0030 *g/day*. How many complete tablets of this supplement should a person take each day to get the proper amount of this vitamin, assuming they get B₂ from no other sources?
- **A middle-aged man in good health is in the hospital for a routine check-up. The nurse writes "200" on the patient's medical chart, but forgets to include the units. Justify which one of the following quantities could the 200 plausibly represent. The patient's
 - mass in kilograms
 - height in meters
 - height in centimeters
 - height in millimeters
 - age in months
- ** Give a simple proof as to how many times a typical person blinks their eyes in a lifetime.

10. ** Perform a simple calculation to estimate the order of magnitude for the number of ping pong balls that would fit into a typical sized room (*without being crushed*).
11. The diameter of our disk-shaped galaxy, the Milky Way, is about 1.0×10^5 light-years (*ly*). The distance to the Andromeda galaxy, which is the spiral galaxy nearest to the Milky Way, is about 2.5 million *ly*. If we represented both galaxies as dinner plates with a diameter of 25 *cm*, determine how far apart the centers of the two plates would be (*in m*).
12. ** (*Spreadsheet*) In physics, it is important to use mathematical approximations. Use a spreadsheet to
- Demonstrate that for small angles ($< 10^\circ$)

$$\tan \alpha \approx \sin \alpha \approx \alpha = \frac{\pi \alpha'}{180^\circ},$$

where α is in radians and α' is in degrees. (*Use degree increases of 1° from 1 to 35*)

- Find the largest angle for which **tan α** may be approximated by **α** with a percent error less than 10.0%.

HINT: Set up a spreadsheet with the following headers. The first line should look *something* like:

α (deg)	α (rad)	$\tan(\alpha)$	$\sin(\alpha)$	% error
1	0.017453	0.017455	0.017452	0.011458

$$\% \text{ Error} = \left| \frac{\text{calculated} - \text{actual}}{\text{actual}} \right| \times 100\%$$

For this problem use α (in radians) as the calculated value and $\tan(\alpha)$ as the actual value.