Physics 141
Kaul

Lecture Supplement 1: Math Review, Units, Measures, and Intro to Motion

1. Calculate the quantities given below and write your answer with the appropriate number of significant figures.

a) $(23.035) \div (0.03)$

b) $4.023 - 3.9$

c) $(12.15 \times 10^{-7}) + (4.01 \times 10^{6})$

d) $(3.01 \times 10^{-4})(9.23 \times 10^{3})$

2. What is the purpose behind having SI standards? List and define the three SI standards for length, mass, and time.

3. The mass of a proton, m_p, is estimated to be $1.67 \times 10^{-27} kg$, and the mass of an electron, m_e, is estimated to be $9.109 \times 10^{-31} kg$. How many protons would it take to make a mass of 1g? 5g? 1kg? How many electrons would it take to make a mass of 1g? 5g? 1kg?

4. Given the measurements below, assign the appropriate SI prefix.

a) 0.0025 m

b) 1357.2 g

c) 365,000,000 s

d) 0.0002385 μm

5. Convert $62 km/hr$ to:

a) m/s

b) ft/s

c) mi/hr

6. Convert $3.8 kg/m^3$ to:

a) g/m^3

b) g/cm^3

7. How long does it approximately take sunlight that leaves the surface of the sun to reach the earth at perihelion (closest distance to the sun) and aphelion (furthest distance from the sun)?

8. The distance to the nearest star, Proxima Centauri, is approximately 4.2 light-years. A light-year (ly) is the distance light travels in a year (light stick) and is used in extremely large distance measures such as the distance to stars and galaxies. Given Proxima Centauri's distance, find it's approximate distance to Earth in meters.

9. Rewrite the expressions below in the specified form:
a) Express the circumference of a circle as a function of its diameter. Is this a linear relation? If so, what is the slope of the line?
b) Express the circumference of a circle as a function of its radius.
c) If the velocity of an object in m/s doubles every second, express the velocity of this object as a function of its time. Is this a linear relation? If so, what is the slope of the line?

10. Do the following:

a) Given $s(t) = 3t^2 - 4t - 8$, find $\frac{ds}{dt}$.

b) Evaluate $\int_0^3 (6t - 4)dt$.

11. Define and give an example of a scalar and a vector. How do they differ?

12. Define and provide an example of each of the quantities below and discuss their differences.

a) Total distance traveled
b) Displacement
c) Average speed
d) Average velocity
e) Instantaneous speed
f) Instantaneous velocity
g) Average acceleration
h) Instantaneous acceleration

13. An object changing its position in a lab experiment was recorded to have the following positions (x) at the recorded times (t) as shown in the data table below.
a) Plot the data points and do a linear regression.

Time (s)	Position (m)
0	2.1
1	4.0
2	5.9
3	8.2
4	10.1
5	11.8

b) Based on the position versus time data in the linear model, what could you conclude about the position, displacement, and velocity of the object?

14. Provide an example of a moving object that changes its position over a period of time at a linear rate.