PH 220 Homework Assignment Chapter on Vectors and Introductory Math Concepts – 23 Problems Total

1. How many significant figures do each of the following numerical values possess?

(a) 314
(b) 92.45
(c) 8.12
(d) 0.04
(e) 0.00120
(f) 4546
(g) 9800

Solution for Problem 1

2. Write the following numbers in powers of ten notation:

(a) 2.976
(b) 78.02
(c) 0.0027
(d) 546.21
(e) 0.1204
(f) 8235.

Solution for Problem 2

3. Write out the following numbers in full with the correct number of zeros:

(a) $2.97\ x\ 10^{4}$
(b) $8.2\ x\ 10^{1}$
(c) $9.7\ x\ 10^{-3}$
(d) $546.21\ x\ 10^{-5}$
(e) $0.1204\ x\ 10^{5}$

Solution for Problem 3

4. What is the percent uncertainty in the measurement $8.13\ \pm 0.25\ \mathrm{m}$?

Solution for Problem 4

5. Time intervals measured with a stopwatch typically have an uncertainty due to human reaction at the starting and stopping of the stop watch. Assume this uncertainty is 0.20 s. What is the percent uncertainty of the hand-time measurements of :

(a) 4 s
(b) 40 s
(c) 4 min

Solution for Problem 5

6. Add $(4.5 \text{ x } 10^3 \text{ s}) + (9.80 \text{ x } 10^4 \text{ s}) + (0.0060 \text{ x } 10^6 \text{ s})$

Solution for Problem 6

7.Multiply $2.054 \text{ x } 10^2\ m$ by $0.067 \text{ x } 10^{-1}$ taking into account significant figures.

Solution for Problem 7

8. Write the following values as full (decimal) numbers with standard SI units:

(a) 486.7 mm
(b) 78 μV
(c) 950 mg
(d) 20.0 ps
(e) 8740 fm
(f) 10.40 giga volts

Solution for Problem 8

9.The average distance between the Earth and the Moon is $238{,}900$ miles. How many meters is this? Express this

(a) Using powers of ten, and
(b) Using a metric prefix.

Solution for Problem 9

10. Express the following sum with the correct number of significant figures.

$$\mathbf{6.80}\ \boldsymbol{m} + \mathbf{234.89}\ \boldsymbol{cm} + \mathbf{1.356}\ \boldsymbol{x}\ \mathbf{10^5}\ \boldsymbol{\mu m}$$

Solution for Problem 10

11. A lightyear is the distance that light travels in one year (at speed $= 2.998 \text{ x } 10^8 \, {}^{\text{m}}/_{\text{s}}$).

(**a**) How many meters are there in 4.25 light years (the distance to Proxima Centauri, the nearest star to our Sun.)?

(**b**) An astronomical unit (AU) is the average distance between the Earth and the Sun $(1.50 \text{ x } 10^{11} \text{ m})$. How many AU ae there in 4.25 light years?

(**c**) What is the speed of light in ${}^{\text{AU}}/_{\text{hr}}$?

Solution for Problem 11

12. To get a better understanding of how much data we move around a computer without thinking too much, let's do this calculation. How many years would it take to fill a $2.00 \text{ TB} = 2.00 \text{ x } 10^{12}$ bytes hard drive if you use a keyboard and enter 1 key at a time. Use that you will work a standard 8.00 hour day, 5.00 work days a week and 50.0 work weeks a year. You can type 180 characters per minute. One character takes up 1 byte of storage space.

Solution for Problem 12

13. Estimate the time in hours for a person to go from New York to San Francisco (approximately 2,901.6 miles along I-80). Assume the person can jog $10 \ {}^{\text{km}}/_{\text{hr}}$.

Solution for Problem 13

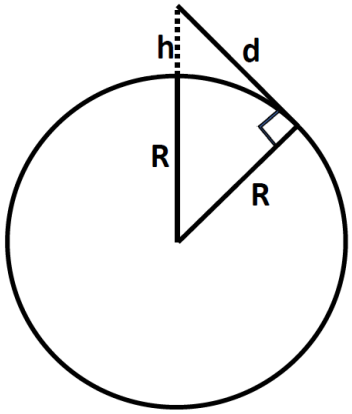
14. Estimate the number of liters of water a human drinks in a lifetime. A current recommendation is 3.7 liters for a man and 2.7 for women. Use 3.0 liters per day. Average lifetime for a person in the US is around 77 years.

Solution for Problem 14

15. Estimate how many days it would take to walk around the world, assuming you could. Assume 12 hours a day walking and your pace is 4 km/hr. The circumference around the Equator is $40{,}212. \text{ km}$.

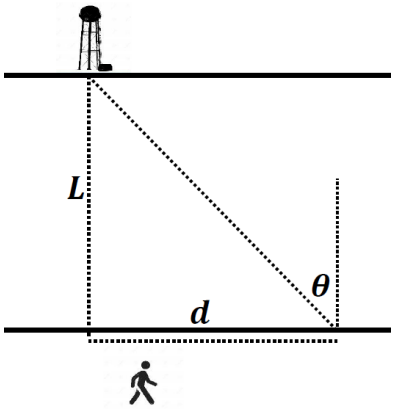
Solution for Problem 15

16. You are on a tower $\mathrm{h} = 350.0\ \mathrm{m}$ above the ground. The land around is very flat. You can see to the horizon. The horizon is the distance until the Earth's surface curves away. In the picture below, it is the distance d from you until you make a right angle with the Earth's radius. How far is the horizon from you? Assume the Earth's radius is $6400\ \mathrm{km}$.



Solution for Problem 16

17. Pictured below, Sam is walking along an edge of a ravine. On the far side of the ravine is a water tower which is $23.0\ \mathrm{m}$ tall. Sam counts his steps from the time he is directly across from the water tower until when he looks at the tower he finds he has to turn his body by an angle $\theta = 27.0°$. To reach this point Sam took 157 steps. When measured his step provides a stride of $0.87\ \mathrm{m}$. How wide (L) is the ravine?



Solution for Problem 17

18.A "Nautical"mile is the distance that subtends an angle of $1.00\ \mathrm{minute}$ along a line of longitude. There are $60\ \mathrm{minutes\ in\ 1.00\ degree}$. How far would you travel in kilometers to cover one "Nautical" mile? How far would you travel in kilometers to cover one mile?

You will find it useful to use $\mathrm{R_{Earth}} = 6400\ \mathrm{km}$

Solution for Problem 18

19. The speed of an object is given by the equation :

$$v = \frac{A}{t^2} + Bt^2 - C$$

(a) What are the dimensions of the constants A, B, and C?
(b) What are the SI units for the Constants A, B, and C?

Solution for Problem 19

20. Three groups of students attempt to determine a relationship between distance displaced (x), the speed traveled (v), the acceleration (a) and the time elapsed (t). A subscript of 0 indicates the quantity at time t = 0. Consider each group's proposed equation and check for dimensional consistency and indicate if the relationship has the proper dimensions or not.

(a) $x = \frac{v}{t} - \frac{1}{2}at^3$

(b) $x = v_0 t - \frac{1}{2}at^2$

(c) $x = 2v_0 t + 3at^2$

Solution for Problem 20

21. There is a combination of fundamental constants the is grouped together and called the Planck Time. The Planck Time is the considered the earliest time after the "Big Bang" at which the currently accepted laws of Physics can be applied. The Planck Time is given by:

$$\tau_P = \sqrt{\frac{Gh}{c^5}}$$

Where the universal gravitational constant is $G = 6.67 \text{ x } 10^{-11} \, {}^{Nm^2}/_{kg^2}$. Planck's constant is $h = 6.626 \text{ x } 10^{-34}$ J s. The speed of light in a vacuum is $c = 2.998 \text{ x } 10^8 \, {}^{m}/_{s}$. Show the expression given has units of time.

Solution for Problem 21

22. The American Lung Association gives the following formula for an average person's expected lung capacity:

$$V = 4.1H - 0.018A - 2.69$$

V is volume in units of liters $(1\ L = \ 10^3 cm^3)$, H is height in units of meters and A is a person's age in years. What are the units for the three numerical values 4.1, 0.018, and 2.69?

Solution for Problem 22

23. It has been suggested that the observable universe can be modelled as a sphere of radius $R_{Univ} = 13.7\ x\ 10^9\ LY$. LY is a light year $(1\ LY = 9.46\ x\ 10^{15}\ m)$. The average mass density of the universe appears to be $\rho_{Univ} = 1\ x\ 10^{-26}\ {}^{kg}/_{m^3}$. In our current view, only about 4% of the total mass of the universe is due to ordinary matter (Protons, electrons, neutrons, etc.). Estimate the total mass of the Observable Universe.

Solution for Problem 23

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Please send any comments or questions about this page to ddonovan@nmu.edu

This page last updated on October 17, 2023