Name:

Tiverton High School
Honors physics
Summer Assignment- 2017

"It's All Physics!"

Look up the following five articles on the internet: the Wikipedia version is adequate; you may choose a different one .Read the articles. Do #6 (12 problems).Also, do the Chapter 1 Addendum Package (9 problems here) That's what you turn in on the 18 th of August.(*Bring to Main Office*.)

(1) ***Eratosthenes measurement of Earth's Circumference***
(2) ***International System of Units***
(3) ***Dimensional Analysis***
(4) ***Unit Conversions***
(5) ***Significant Figures***
(6) ***Solve the following problems(12 problems)***
(7) ***Solve the Chapter 1 Addendum Package.(9problems)***

Have a great summer!

Mr. Bernardo

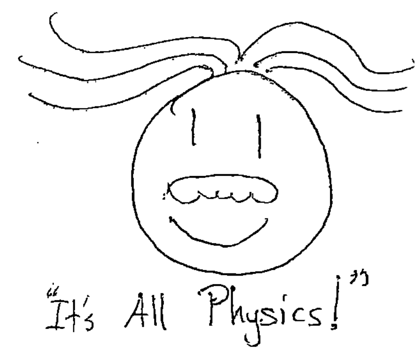
(1) In the British System, 16oz.= 1pt. and 16oz.=1 lb.Is there something wrong here?Explain. Here's an old one: a pound of feathers weighs more than a pound of gold. How can that be?(Hint: look up ounce in the dictionary)
(2) The metric system is a base -10 system and the British system is a base-12 system. Discuss the ramifications if our monetary system was base-12.What would be the possible values of our coins if this were the case?
(3) Use SI unit analysis to show the equation $A=4\Pi r^2$,where A is the area and r is the radius of a sphere is dimensionally correct.
(4) Is the equation $V= \Pi d^3/4$ where V is the volume and d is the diameter of a sphere, dimensionally correct? (Use SI unit analysis to find out).
(5) If $x=gt^2/2$ where x is length and t is time, is dimensionally correct, what are the SI units of the constant g?
(6) Is the equation $v=v_o\sin\theta-gt$ dimensionally correct? Show by using SI unit analysis.(v and vo are velocities , θ is an angle , t is time , and g is the same as in exercise(5).
(7) A professor regularly buys 15 gal of gas , but the gas station has installed new pumps that deliver liters.How many liters of gas (rounded off to a whole number) should she ask for?
(8) A student has a car that gets an average 23.6mpg of gasoline.She gets to spend a year in Europe and gets to take her car with her.(a) What should she expect the car's average gas mileage to be in km/L? (b) During the year there, she drove a total of 8,000 km. With gas costing about $4.00/gal in Europe, how much did she spend on fuel? (Compute to the nearest cent.) ***NEXT PAGE***.

(9) A 25-inch indicates the diagonal length of the TV tube.Assuming the face of the tube to be flat and rectangular, and that the diagonal makes an angle of 37degrees with the base of the tube, what is the area of the screen in (a) in^2, and (b) cm^2?

(10) Using a meterstick, a student measures a length and reports it to be 23.8755m. What is the smallest division on the meterstick scale?

(11) Determine the number of significant figures in the following measured numbers.(a) 1.007m.(b) 8.03cm.(c) 16.272kg.(d) 0.015μs(microseconds).

(12) A circular flower bed has a radius of 4.25m. Compute its (a)circumference, and (b) area.



CHAPTER 1 Addendum Package

Measurement and Problem Solving

I. Chapter Objectives

Upon completion of this chapter, you should be able to:

1. distinguish standard units and systems of units.
2. describe the SI, and specify the references for the three main base quantities of this system.
3. learn to use metric prefixes, and nonstandard metric units.
4. explain the advantages of, and apply, unit analysis.
5. explain conversion-factor relationships, and apply them in converting units within a system or from one system of units to another.
6. determine the number of significant figures in a numerical value, and report the proper number of significant figures after performing simple calculations.
7. establish a general problem-solving procedure, and apply it to typical problems.

II. Chapter Summary and Discussion

1. International System of Units (SI) (Sections 1.1 – 1.3)

Objects and phenomena are measured and described using **standard units**, a group of which make up a **system of units.**

(1) The International System of Units (SI), or the metric system, has only seven base quantities (see Table 1.1 on page 7 in textbook). The base units for the base quantities length, mass, and time are the **meter** (m), the **kilogram** (kg), and the **second** (s), respectively. A derived quantity (unit) is a combination of the base quantity (units). For example, the units of the derived quantity speed, **meters per second**, are a combination of **meter** and **second**. There are many derived units.

(2) The metric system is a base–10 (decimal) system, which is very convenient for changing measurements from one unit to another. Metric multiples are designated by prefixes, the most common of which are **kilo–** (1000), **centi–** (1/100), and **milli–** (1/1000). For example, a centimeter is 1/100 of a meter. A complete list of the metric prefixes is given in Table 1.2 on page 7 in textbook. A unit of volume or capacity is the **liter** (L), and 1 L = 1000 mL = 1000 cm^3 (cubic centimeters).

2. Unit Analysis (Section 1.4)

The fundamental or base quantities, such as length, mass, and time are called **dimensions.** **Unit analysis** is a procedure by which the dimensional correctness of an equation may be checked or the units of derived quantities can be found. Both sides of an equation must be equal not only in numerical value but also in units. Units can be treated like algebraic quantities. For example, $\text{m} \times \text{m} = \text{m}^2$ and $\frac{\text{m}}{\text{s}^2} \times \text{s} = \text{m/s}$.

Unit analysis can be used to

(1) check whether an equation is **dimensionally correct**, i.e., if an equation has the same units on both sides.

(2) determine the units of derived quantities.

Example 1.1: Check whether the equation $v^2 = ax$ is dimensionally correct, where x is length, a is acceleration, and v is speed.

Example 1.2: Einstein's famous statement of energy–mass equivalence says that the rest energy of a mass is equal to its mass times the speed of light squared. Determine the units of energy.

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3. Unit Conversions (Section 1.5)

A quantity may be expressed in other units through the use of **conversion factors** such as $\frac{1 \text{ mi}}{1609 \text{ m}} = 1$ or $\frac{1609 \text{ m}}{1 \text{ mi}} = 1$. Note that any conversion factor is equal to 1 (because 1 mi = 1609 m, for example) and so they can multiply or divide any quantity without altering the quantity. The appropriate form of a conversion factor is easily determined by unit analysis. The same process can be generalized to multiple conversions, as in the case of converting meters per second (m/s) to miles per hour (mi/h) shown in Example 1.4.

Example 1.3: The official marathon distance established at the 1924 Olympics in Paris is 42 195 m. What is this distance in miles?

Example 1.4: A car travels with a speed of 25 m/s. What is this speed in mi/h (miles per hour)?

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4. **Significant Figures** (Section 1.6)

The number of **significant figures** (sf) in a quantity is the number of reliably known digits it contains. For example, the quantity 15.2 m has 3 sf, 0.052 kg has 2 sf, and 3.0 m/s has 2 sf. In general,

- *the final result of a multiplication and/or division should have the same number of significant figures as the quantity with the least number of significant figures used in the calculation*, and
- *the final result of an addition and/or subtraction should have the same number of decimal places as the quantity with the least number of decimal places used in the calculation.*

The proper number of figures or digits is obtained by rounding off a result. Generally, if the digit to be dropped is 5 or greater, increase the preceding digit by one. For example, round 23.46 to 23.5.

Example 1.5: Perform the following operations, and write the answer with the correct numbers of significant figures.

(a) $0.586 \times 3.4 =$

(b) $13.90 \div 0.580 =$

(c) $(13.59 \times 4.86) \div 2.1 =$

(d) $4.8\times10^{5} \div 4.0\times10^{-3} =$

(e) $(3.2\times10^{8})(4.0\times10^{4}) =$

Example 1.6: Perform the following operations, and write the answers with the correct number of significant figures.

(a) $23.1 + 45 + 0.68 + 100 =$

(b) $157 - 5.689 + 2 =$

(c) $23.5 + 0.567 + 0.85 =$

(d) $4.69 \times 10^{-6} - 2.5 \times 10^{-5} =$

(e) $8.9 \times 10^{4} + 2.5 \times 10^{5} =$

5. Problem Solving (Section 1.7)

Problem solving is a skill that has to be learned gradually over a period of time. You cannot learn this skill in a lecture or overnight. It takes practice—lots of practice—and the exact procedure you adopt will probably be unique to you. The point is to develop one that works for you; however, there are some suggested general problem-solving procedures that can be followed.

(1) *Say it in words.*
Read the problem carefully and analyze it.

(2) *Say it in pictures.*
Where appropriate, draw a diagram as an aid in visualizing and analyzing the physical situation of the problem.

(3) *Say it in numbers.*

Write down the given data and what is to be found. Make sure the data is expressed in the same system of units (usually SI). Perform unit conversions if necessary.

(4) *Pick equation(s).*

Determine which principle(s) and equation(s) are applicable to the situation, and how they can be used to get from the information given to what is to be found.

(5) Calculate.

Substitute the given quantities (data) in the equation(s) and perform calculations.

(6) *Check the answer: is it reasonable?*

Consider whether the results are reasonable.

The details of these procedures can be found on pages 20 and 21 in textbook.

Integrated Example 1.7:

Starting from city A, an airplane flies 250 miles east to city B, then 300 miles north to city C, and finally 700 miles west to city D. (a) Draw a diagram and determine if city D is to the (1) north of east, (2) north of west, or (3) due west of city A. (b) What is the distance from city A to city D and what is the direction of city D relative to city A?

Example 1.8: The density of the metal aluminum is 2700 kg/m^3. Find the mass of a solid aluminum cylinder of radius 10 cm and height 1.0 ft.

In certain problems we may be interested only in the "ballpark" figure, that is, just an estimate of the result. This can be obtained by **order-of-magnitude calculations**. Approximations can be made by rounding off quantities to their nearest power-of-ten notation to make the calculations easier.

Example 1.9: If each student's food intake is 3000 Calories per day, and a college has 12 000 students, what is the approximate total food intake in a semester that last 16 weeks?

III. Mathematical Summary

Density	$\rho = \frac{m}{V} \left(\frac{\text{mass}}{\text{volume}}\right)$ (1.1)	Defines density in terms of mass and volume

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