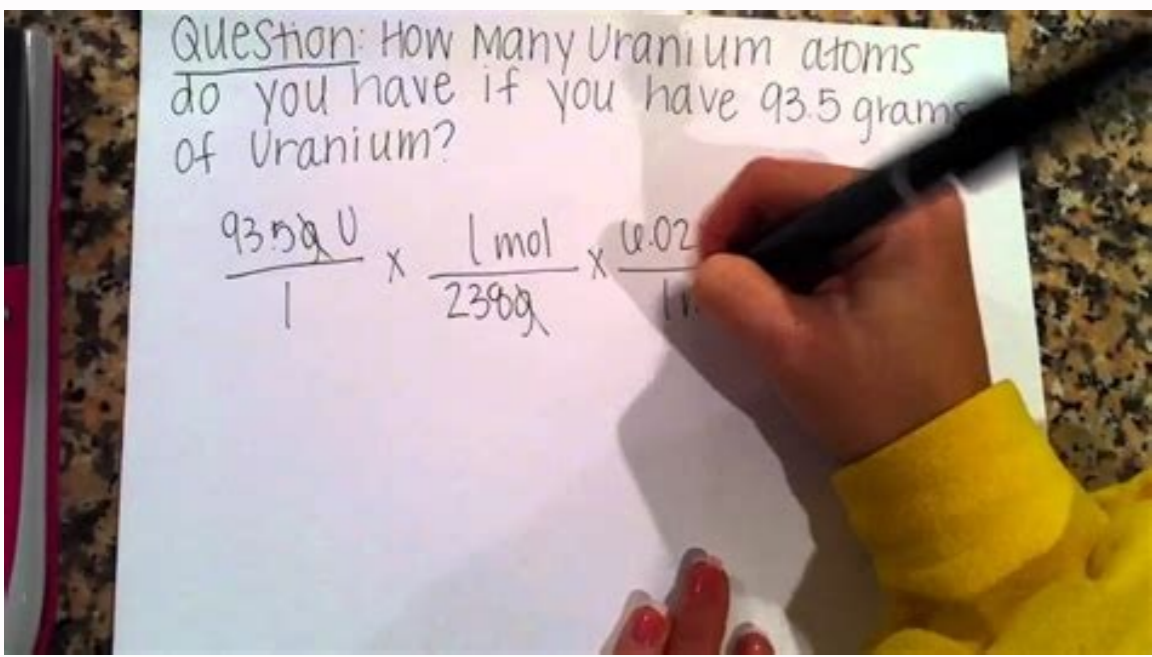


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Table N
Selected Radioisotopes

Nuclide	Half-Life	Decay Mode	Nuclide Name
¹⁹⁸ Au	2.695 d	β ⁻	gold-198
¹⁴ C	5715 y	β ⁻	carbon-14
³⁷ Ca	182 ms	β ⁺	calcium-37
⁶⁰ Co	5.271 y	β ⁻	cobalt-60
¹³⁷ Cs	30.2 y	β ⁻	cesium-137
⁵³ Fe	8.51 min	β ⁺	iron-53
²²⁰ Fr	27.4 s	α	francium-220
³ H	12.31 y	β ⁻	hydrogen-3
¹³¹ I	8.021 d	β ⁻	iodine-131
³⁷ K	1.23 s	β ⁺	potassium-37
⁴² K	12.36 h	β ⁻	potassium-42
⁸⁵ Kr	10.73 y	β ⁻	krypton-85
¹⁶ N	7.13 s	β ⁺	nitrogen-16
¹⁹ Ne	17.22 s	β ⁺	neon-19
³² P	14.28 d	β ⁻	phosphorus-32
²³⁹ Pu	2.410 × 10 ⁴ y	α	plutonium-239
²²⁶ Ra	1599 y	α	radium-226
²²² Rn	3.823 d	α	radon-222
⁹⁰ Sr	29.1 y	β ⁻	strontium-90
⁹⁹ Tc	2.13 × 10 ⁵ y	β ⁻	technetium-99
²³² Th	1.40 × 10 ¹⁰ y	α	thorium-232
²³³ U	1.592 × 10 ⁵ y	α	uranium-233
²³⁵ U	7.04 × 10 ⁸ y	α	uranium-235
²³⁸ U	4.47 × 10 ⁹ y	α	uranium-238

Source: CRC Handbook of Chemistry and Physics, 91st ed., 2010-2011, CRC Press



Design of dimensional chain		Copy data from [A]		Clear table	
Component name	Component size [mm]	Distribution	Process capability index	Effective variation	
A Shaft	200,000	Normal	0,250	1,00000	0,000000
B Retainer ring	-1,750	Normal	0,000	1,00000	0,010000
C Bearing	-23,000	Normal	0,000	1,00000	0,020000
D Bearing sleeve	20,000	Normal	0,000	1,00000	0,006667
E Case	-200,000	Normal	0,000	1,00000	0,040000
F Bearing sleeve	20,000	Normal	0,000	1,00000	0,006667
G Bearing	-23,000	Normal	0,000	1,00000	0,020000
H		Normal	1,00000		
I		Normal	1,00000		
J		Normal	1,00000		
Z Closed component	0,250			0,40000	0,056740

Algebra I
HW#2 Dimensional Analysis

Name: Key

DIMENSIONAL ANALYSIS PROBLEMS

Conversions Factors

1 hr = 60 min	1 min = 60 sec	1 ton = 2000 lbs	7 days = 1 week
24 hrs = 1 day	1 kg = 2.2 lbs	1 gal = 3.79 L	264,2 gal = 1 cubic meter
1 mi = 5,280 ft	1 kg = 1000 g	1 lb = 16 oz	20 drops = 1 mL
365 days = 1 yr	52 weeks = 1 yr	2.54 cm = 1 in	1 L = 1000 mL
0.621 mi = 1,00 km	1 yd = 36 inches	1 cc is 1 cm ³	1 mL = 1 cm ³

DIRECTIONS: Solve each problem using dimensional analysis. Every number must have a unit. Work must be shown. Conversion factors are given above.

1.) How many miles will a person run during a 10 kilometer race?

6.2 mi

2.) The moon is 250,000 miles away. How many feet is it from earth?

1,320,000,000 ft

3.) A family pool holds 10,000 gallons of water. How many cubic meters is this?

37.85 m³

4.) The average American student is in class 330 minutes/day. How many hours/day is this?

5.5 hrs/day

How many seconds is this?

19,800 sec

5) How many seconds are there in 1 year?

31,536,000 sec

Convert 1 mile to cm

$$1 \text{ mile} \times \frac{5280 \text{ ft}}{1 \text{ mile}} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{2.54 \text{ cm}}{1 \text{ in}} = \text{cm}$$

$$\left. \begin{array}{l} 1 \text{ mile} = 5280 \text{ ft} \\ 1 \text{ in} = 2.54 \text{ cm} \end{array} \right\} \begin{array}{l} 3 \text{ ft} = 1 \text{ yard} \\ 100 \text{ cm} = 1 \text{ m} \end{array} \left. \begin{array}{l} 1 \text{ ft} = 12 \text{ in} \end{array} \right\}$$

DIMENSIONAL ANALYSIS Dimensional analysis is a critical problem solving technique utilized throughout chemistry. It is a mathematical approach that allows one to convert from one unit to another unit using conversion factors. Below are some examples of basic dimensional analysis:

Example 1: Convert 45.3 cm to its equivalent measurement in mm. Select a conversion factor which will convert the unit "cm" to the unit "mm". The appropriate conversion factor is: 10 mm / 1 cm. Arrange the problem so that the given measurement, when multiplied by the correct unit factor, will yield an answer with the proper label: 45.3 cm X 10 mm = 453 mm

Example 2: Change a speed of 72.4 miles per hour to its equivalent in meters per second. In this example, several conversion factors are needed. One to change the miles into meters and the other to change hours into seconds? $72.4 \text{ mi} \times \frac{1760 \text{ yd}}{1 \text{ mile}} \times \frac{36 \text{ inches}}{1 \text{ meter}} \times \frac{1 \text{ hr}}{3600 \text{ s}} = 32.7 \text{ m/s}$

Example 3: The density of mercury is 13.6 g/mL. What is the mass in kilograms of a 2 L commercial flask of mercury? Set up the problem so that the calculation will yield a result with a mass in grams. $13.6 \text{ g/mL} \times 2 \text{ L} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 27.2 \text{ kg}$

Resource: English (Imperial) - Metric Relationships; units and conversion factors.doc Download File

****You do not have to memorize English-Metric Relationships - if needed, the relationship will be provided in the problem on a quiz or exam. You do need to know the metric prefix relationships. EXCELLENT PRACTICE PROBLEMS (Strongly recommended!):** Use dimensional analysis in solving each of the following problems.

- Convert 32.5 oz to its equivalent in cg.
- Convert 3.55 yd to its equivalent in cm.
- Convert 143.55 mL to its equivalent in pints.
- Convert a speed of 35.8 mi/hr to its equivalent in m/s.
- Convert a density of 13.6 g/mL to its equivalent in lb/ft³.
- A mole of hydrogen atoms contains 6.02 X 10²³ atoms and occupies 22.4 L. How many hydrogen atoms are contained in 25.00 mL of this gas?
- What volume of hydrogen would contain 4.5 X 10¹⁸ hydrogen atoms? How many moles of hydrogen would this be?
- *1.0 mole of gas (at STP) occupies 22.414 L.
- A molecule of hydrogen moves at a speed of 115 cm/s. How long will it take to travel the length of a football field (100 yd long)?
- The speed of light is 3.0 X 10¹⁰ cm/s. Express this in mi/hr.
- A sample of sea water contains 0.075 g of sodium chloride per mL of solution. How many moles of sodium chloride are there per L of this solution? A mole of sodium chloride is equivalent to 58.5 g of sodium chloride.
- A doctor orders that a patient receive 1.5 X 10⁻³ mole of sodium chloride. The only solution available contains 1.00 g per 100 mL of solution. A mole of sodium chloride is equivalent to 58.5 g of sodium chloride. How much of this solution should the nurse give the patient?
- A sample of air contains 2.33 X 10⁻⁴ mg of lead per mL of gas. This air passes through an office, the volume of which is 3.25 X 10⁴ L. Seven people normally work in this office. How many µg of lead will each person in the office receive from this sample of air?

ANSWERS/ANSWER KEY (with work shown) BELOW ARE TUTORIALS CREATED TO ASSIST WITH DIMENSIONAL ANALYSIS (includes problem solving tips, comments on sig. figs., etc.). More AP Chem Dimensional Analysis SAMPLE PROBLEMS Key (answers and work) Live worksheets > English Finish! Please allow access to the microphone Look at the top of your web browser. If you see a message asking for permission to access the microphone, please allow. Close Name: _____ Section: _____ Student ID#: _____

Work in groups on these problems. You should try to answer the questions without referring to your textbook. If you get stuck, try asking another group for help. In this workshop, we will use a group problem-solving method called a round robin. The round robin method helps people to work together and feel comfortable with group problem solving. Round Robin Instructions Each group member will be assigned a number, starting with #1 and ending with the number of people in the group. Student #1 will read the question aloud and define the information needed to solve the problem, Sep #1 in the outline. When the group agrees that the necessary information is complete, student number two will do the first mathematical step, Step #2 in the outline. When the group agrees that the step is correct, student number three will do the next step. Continue this way until the group agrees that the given unit has been correctly converted to the wanted unit. Student #2 will start the next question by reading it aloud as in #1. Follow this pattern for all of the questions in the workshop. Use dimensional analysis and the group Round Robin to answer each question. Record your solutions and notes in the spaces provided on this worksheet. Turn-in the worksheet when completed.

- Use the dimensional analysis (unit conversion, factor label) problem-solving method to answer the following questions. a. How many nickels would you get for a twenty dollar bill? b. How many hours are in a week? c. How many revolutions does the hour hand on a clock make in a year? 2. Find the number of centimeters in 1.00 x 10² yards. 3. Determine the number of meters in 1.00 mile. 4. The speed of light is 1.86 x 10⁵ miles per second. How many meters will light travel in 1.0 second? 5. Calculate the number of seconds in a year. 6. A light year is the distance that light travels in one year. Determine the number of miles, meters, and kilometers in one light year. 7. A single layer of gold atoms forms a surface whose dimensions are 1.0 x 10³ angstroms by 1.0 x 10³ angstroms. 1 angstrom = 10⁻¹⁰ meter. a) What is the area of this surface in square angstroms? b) What is the surface area in square centimeters? 8. The units of the chain system of measure, used by surveyors, are as follows: 7.92 inches = 1 link 100 links = 1 chain 10 chains = 1 furlong 80 chains = 1 mile The distance of the Kentucky Derby, a classic horse race, is 1.25 miles. How is this distance expressed in furlongs? 9. A cube that has a length of 1 cm on each side has a volume of 1 cm³. How many cubic centimeters are in 1 cubic meter? (Hint: The answer is not 100.)

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