Metric Conversion

Distance - Meter - m
Volume - Liter - L
Mass - Gram - G

Prefix
Mega - M - 1000 000
kilo - k - 1000
Hecto - H - 100
Deka - D - 10
deci - d - 1/10, .1
Centi - c - 1/100, .01
milli - m - 1/1000, .001
Micro - μ - 1/1000 000, .000 001
Nano - n - 1/1000000000, .000000001

Relationships

Distance	Volume	Mass
1 Mm = 1000 000 m	1 ML = 1000 000 L	1 MG = 1000 000 G
1 Km = 1000 m	1 KL = 1000 L	1 KG = 1000 G
1 Hm = 100 m	1 HL = 100 L	1 HG = 100 G
1 Dm = 10 m	1 DL = 10 L	1 DG = 10 G
10 dm = 1 m	10 dL = 1 L	10 dG = 1 G
100 cm = 1 m	100 cL = 1 L	100 cG = 1 G
1000 mm = 1 m	1000 mL = 1 L	1000 mG = 1 G
1000000 μm = 1 m	1000000 μL = 1 L	1000000 μG = 1 G

Metric Conversions

Steps for Conversion

1) Pick a path (use known relationships)
2) Write relationships used in path
3) Set up (In such a way the units cancel)
4) Group the numbers and do the math)

Examples

(1) 2000 mL = _____ HL

① mL - L - HL

② 1 L = 1000 mL

1 HL = 100 L

③ $\left(\frac{2000\ mL}{1}\right)\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{1\ HL}{100\ L}\right) =$

④ $\frac{(2000)(1)(1)}{(1)(1000)(100)}$ HL

Ans: .02 HL

Example

(2) 45 km = _____ cm

① km - m - cm

② 1 km = 1000 m

1 m = 100 cm

③ $\left(\frac{4\ km}{1}\right)\left(\frac{1000\ m}{1\ km}\right)\left(\frac{100\ cm}{1\ m}\right)$

④ (4)(1000)(100) cm Ans. 400 000 c

(3) .5 dG = _____ μG

① dG - G - μG

② 1 G = 10 dG

1 G = 1000 000 μG

③ $\left(\frac{.5\ dG}{1}\right)\left(\frac{1\ G}{10\ dG}\right)\left(\frac{1000000\ \mu G}{1\ G}\right)$

④ $\frac{(.5)(1000.000)}{10}$ Ans. 50,000 μG

Problems (Metric Conversions)

1) 120 Km = _____ Dm

2) .65 mG = _____ cG

3) 150 HL = _____ ML

4) .45 dm = _____ mm

5) 175 cG = _____ dG

6) .25 mL = _____ uL

7) 195 Mm = _____ Hm

8) .15 DG = _____ KG

9) 205 dL = _____ mL

10) .12 KG = _____ DG

Standard Conversion

Distance	Volume	Wt.
1 mi = 1760 yd	1 gal = 4 qt	1 Ton = 2000 pd
1 mi = 5280 Ft	1 gal = 8 pt.	1 pd = 16 oz.
1 yd = 3 Ft	1 qt = 2 pt	
1 yd = 36 in	1 qt = 32 oz	
1 Ft = 12 in	1 pt = 16 oz	

Example

(1) 10 mi = _____ in

① mi - yd - in

② 1 mi = 1760 yd
1 yd = 36 in

③ $\left(\frac{10\ \text{mi}}{1}\right)\left(\frac{1760\ \text{yd}}{1\ \text{mi}}\right)\left(\frac{36\ \text{in}}{1\ \text{yd}}\right)$

④ (10)(1760)(36) in Ans. 633600 in

Example

(2) $10\,gal = \_\_\_\_\_\,oz$

① $gal - qt - oz$

② $1\,gal = 4\,qt$

$1\,qt = 32\,oz$

③ $\left(\frac{10\,gal}{1}\right)\left(\frac{4\,qt}{1\,gal}\right)\left(\frac{32\,oz}{1\,qt}\right)$

④ $(10)(4)(32)$

(3) $10\,Ton = \_\_\_\_\_\,oz$

① $Ton - pd - oz$

② $1\,Ton = 2000\,pd$

$1\,pd = 16\,oz$

③ $\left(\frac{10\,Ton}{1}\right)\left(\frac{2000\,pd}{1\,Ton}\right)\left(\frac{16\,oz}{1\,pd}\right)$

④ $(10)(2000)(16)\,oz$ Ans 320000. oz

Problems (Standard Conversions)

1) 150 Ft = _____ in

2) .25 gt = _____ oz

3) 145 pd = _____ oz

4) 2500 Ft = _____ Mi

5) .35 pt = _____ gal

6) 30,000 Ft = _____ yd

7) 20,000 oz = _____ Ton

8) .45 yd = _____ in

9) 50,000 in = _____ Mi

10) 50,000 pt = _____ gt

English - Metric Conversions

Breakdown

Distance

Metric	English
Mm	Mi
Km	yd
Hm	Ft
Dm	in
m	
dm	
cm	
mm	
μm	

2.54 cm = 1 in

Volume

Metric	English
ML	gal
kL	qt
HL	pt
DL	oz
L	
dL	
cL	
mL	
μL	

1 L = 1.06 qt

Mass

Metric	English
Mg	Ton
Kg	pd
Hg	oz
Dg	
g	
dg	
cg	
mg	
μg	

28.35 g = 1 oz

English-Metric Problems

1) Pick a path
2) Write the relationships
3) Do the set up
4) Group the numbers and do the math

1) 10 mi = _____ km

① mi - yd - in - cm - m - km

② 1 mi = 1760 yd
1 yd = 36 in
1 in = 2.54 cm
1 m = 100 cm
1 Km = 1000 m

③ $\left(\frac{10\text{ mi}}{1}\right)\left(\frac{1760\text{ yd}}{1\text{ mi}}\right)\left(\frac{36\text{ in}}{1\text{ yd}}\right)\left(\frac{2.54\text{ cm}}{1\text{ in}}\right)\left(\frac{1\text{ m}}{100\text{ cm}}\right)\left(\frac{1\text{ Km}}{1000\text{ m}}\right) =$

④ $\frac{(10)(1760)(36)(2.54)}{(100)(1000)}$ Km

---

2) 10 gal = _____ mL

① gal - qt - L - mL

② 1 gal = 4 qt
1 L = 1.06 qt
1 L = 1000 mL

③ $\left(\frac{10\text{ gal}}{1}\right)\left(\frac{4\text{ qt}}{1\text{ gal}}\right)\left(\frac{1\text{ L}}{1.06\text{ qt}}\right)\left(\frac{1000\text{ mL}}{1\text{ L}}\right)$

④ $\frac{(10)(4)(1000)}{1.06}$

3) $10\ pd = \_\_\_\_\_\ Hg$

① pd – oz – g – Hg

② $1\ pd = 16\ oz$

$1\ oz = 28.35\ g$

$1\ Hg = 100\ g$

③ $\left(\frac{10\ pd}{1}\right)\left(\frac{16\ oz}{1\ pd}\right)\left(\frac{28.35\ g}{1\ oz}\right)\left(\frac{1\ Hg}{100\ g}\right) =$

④ $\frac{(10)(16)(28.35)}{100}$ Hg

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4) $200\ m = \_\_\_\_\_\ yd$

① m – cm – in – yd

② $1\ m = 100\ cm$

$1\ in = 2.54\ cm$

$1\ yd = 36\ in$

③ $\left(\frac{200\ m}{1}\right)\left(\frac{100\ cm}{1\ m}\right)\left(\frac{1\ in}{2.54\ cm}\right)\left(\frac{1\ yd}{36\ in}\right)$

④ $\frac{(200)(100)}{(2.54)(36)}$ yd

HW (English - Metric)

1) 1000 Km = _____ mi

2) 500 pt = _____ KL

3) 100 MG = _____ Ton

4) 50 yd = _____ m

5) 10 oz = _____ mL

6) 5 mG = _____ oz

7) 1 Ft = _____ Hm

8) .5 gal = _____ dL

9) .25 pd = _____ KG

10) .15 mi = _____ Dm

Dimensional Calculations

Area (Calculations) (2 dimensions)

1) Square $A = L^2$ Length of both sides are the same

Example

$A =$ _____ $L = 10\,cm$

$A = L^2$

$= (10\,cm)^2$

$= 100\,cm^2$

$A =$ _____ $L = 5\,yd$

$A = L^2$

$= (5\,yd)^2$

$= 25\,yd^2$

2) Rectangle $A = L\,W$ L = length W = width

Example

$A =$ _____ $L = 10\,cm$ $W = 5\,cm$

$A = L\,W$

$= (10\,cm)(5\,cm)$

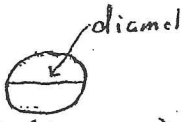
$= 50\,cm^2$

$A =$ _____ $L = 40\,Ft$ $W = 10\,Ft$

$A = L\,W$

$= (40\,Ft)(10\,Ft)$

$= 400\,Ft^2$



3) Circle $A = \pi r^2$ $\pi = 3.14$ r = radius = $\frac{1}{2}$(diameter)

Example

$A =$ _____ diameter = $10\,cm$

$r = 5\,cm$

$A = \pi r^2$

$= (3.14)(5\,cm)^2$

$= (3.14)(25\,cm^2)$

$= 78.5\,cm^2$

$A =$ _____ $d = 30\,in$

$r = 15\,in$

$A = \pi r^2$

$= (3.14)(15\,in)^2$

$= (3.14)(225\,in^2)$

$= 706.5\,in^2$

Problems

1) (Square) L = 100 cm A: _____

2) (Rectangle) L = 900 cm W = 100 cm A: _____

3) (Circle) Diameter = 20 cm A: _____

4) L = 80 Ft W = 40 Ft A: _____

5) Dia = 40 yd A: _____

Volume (Calculations) (3 dimensions)

1) Cube $V = L^3$ (all side are the same length)

example

$V =$ ____ $L = 10\,cm$

$V = L^3$

$= (10\,cm)^3$

$= 1000\,cm^3$

$V =$ ____ $L = 5\,yd$

$V = L^3$

$= (5\,yd)^3$

$= 125\,yd^3$

2) Rectangle $V = L\,W\,H$ L=Length W=Width H=height

example

$V =$ ____ $L = 10\,cm$ $W = 5\,cm$ $H = 2\,cm$

$V = L\,W\,H$

$= (10\,cm)(5\,cm)(2\,cm)$

$= 100\,cm^3$

$V =$ ____ $L = 10\,Ft$ $W = 4\,Ft$ $H = 3\,Ft$

$V = L\,W\,H$

$= (10\,Ft)(4\,Ft)(3\,Ft)$

$= 120\,Ft^3$

3) Cylinder $V = \pi r^2 H$ $\pi = 3.14$ r = radius H = height

$r = \frac{1}{2}$(diameter)

example

$V =$ ____ dia = 10 cm $H = 4\,cm$

$r = 5\,cm$

$V = \pi r^2 H$

$= (3.14)(5\,cm)^2(4\,cm)$

$= (3.14)(25\,cm^2)(4\,cm)$

$= 314\,cm^3$

$V =$ ____ dia = 100 yd $H = 10\,yd$

$r = 50\,yd$

$V = \pi r^2 H$

$= (3.14)(50\,yd)^2(10\,yd)$

$= (3.14)(2500\,yd^2)(10\,yd)$

$= 785{,}000\,yd^3$

Problems

1) (Cube) L = 20 cm V = ____

2) (Rectangle) L = 40 cm W = 30 cm H = 5 cm V = ____

3) (Cylinder) Diameter = 8 cm H = 5 cm V = ____

4) L = 100 Ft W = 90 Ft H = 5 Ft V = ____

5) Diameter = 30 Ft H = 15 Ft V = ____

Sphere Volume $= \frac{4}{3}\pi r^3$

example

(1) $V =$ _____ dia = 100cm

$r = 50\,cm$

$V = \frac{4}{3}\pi r^3 = \frac{4}{3}(3.14)(50\,cm)^3$

$= \frac{4}{3}(3.14)(125000\,cm^3)$

$= 523333.3\,cm^3$

(2) $V =$ _____ dia = 10 Ft

$r = 5\,Ft$

$V = \frac{4}{3}\pi r^3 = \frac{4}{3}(3.14)(5\,Ft)^3$

$= \frac{4}{3}(3.14)(125\,Ft^3)$

$= 523.3\,Ft^3$

Problems

1) dia = 60 m V = _____
2) dia = 25 Ft V = _____
3) dia = 80 cm V = _____
4) dia = 90 yd V = _____
5) dia = 500 mm V = _____

(page 16)

Deriving Equations

Steps:

1) Get what you're looking for on top.
2) Get what you're looking for by itself.
3) Get what you're looking for on the left side of equal.
4) Make your units compatible.
5) Plug in and do the math.

Note: ① Whenever you do something to an equation, you must do the same thing on both sides.

② The way you get rid of something in an equation work in opposites.

example: add opposite is subtract
multiply " " Divide.
square " " square root.

example: You are looking for m in this equation $\left(D = \frac{m}{V}\right)$

$VD = \frac{m}{V}V$ 1) It is on Top (no work needed)

2) By itself (Get rid of V) (opposite of divide is multi.)

$VD = m$ 3) left side of equal (spin it on equal)

$m = VD$

example: You're looking for $t =$ ___ $\left(P = \frac{Fd}{t}\right)$

① $tP = \frac{Fd}{t}t$ 1) on Top (Work in opposites)

② $\frac{tP}{P} = \frac{Fd}{P}$ 2) By itself (")

③ $t = \frac{Fd}{P}$ 3) it is on left side.

Word Problems

Steps

1) Read the question carefully.
2) Label the information given.
3) Label what they are asking for.
4) Based on #2 & #3 pick a method for working it.
   A) Conversion
   B) Formula
   C) Draw a picture and label it

Example

A 2000 cm^3 box is 20 cm long and 10 cm wide, how deep is it?

1) Read (Cm^3 is a Volume unit)
2) Label information $V = 2000\,cm^3$ $L = 20cm$ $W = 10cm$ $H =$ ____
3) Label what you're looking for
4) Method (Formula)

$V = L\,W\,H$ I must derive it

$$\frac{V}{LW} = \frac{L\,W\,H}{L\,W}$$

$$H = \frac{V}{LW} = \frac{2000\,cm^3}{(20\,cm)(10\,cm)} = \frac{2000\,cm^3}{200\,cm^2} = \boxed{10\,cm}$$

H.W. (Word Problems)

1) What is the area of a circle 2 meters in diameter?

2) What is the volume of an object 3 meters on all sides?

3) What is the width of an $6 meter^2$ area having a length of 2 meters?

4) What is the diameter of a $10 cm^2$ place in a parking lot?

5) What is the depth of a $100 Ft^3$ object that is 5 yd long and 3 Ft wide?

6) What is the volume of a ball with a diameter of 5 cm^3?

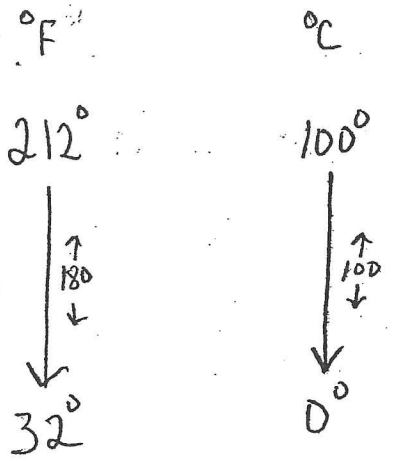
7) What is the length of a $8 Ft^2$ square?

8) What is the length of a $1000 yd^3$ Cube?

9) What is the length of a $30 m^3$ pipe that has a diameter 3 m?

10) What is the diameter of a $20 Ft^3$ pipe that has a length of 1.5 Ft?

Temperature Conversion



$^{\circ}F = \frac{9}{5}(^{\circ}C) + 32$ $\qquad$ $^{\circ}C = \frac{5}{9}(^{\circ}F - 32)$

Addition Rules For signs

Rule 1) When you add like signs, you add and the sign carries.

example

$2 + 4 = 6$ $\qquad$ $-2 + -4 = -6$

Rule 2) When you add unlike signs, you subtract and take the sign of the larger #

example

$2 + -4 = -2$ $\qquad$ $-2 + 4 = 2$

Rule 3) When you see a minus change it to a plus an take opposite sign of the number to the right. Then apply rule #1 or #2

example $\quad 2 - 4 =$ $\qquad$ $2 - -4 =$ $\qquad$ $-2 - -4 =$

$2 + -4 =$ $\qquad$ $2 + 4 =$ $\qquad$ $-2 + 4 =$

-2 $\qquad$ 6 $\qquad$ 2

Multiple or Division rules For Signs

Rule 1 When you multiple or Divide like signs your answer is alway positive.

example	
$(2)(4)=8$	$(-2)(-4)=8$
$\frac{4}{2}=2$	$\frac{-4}{-2}=2$

Rule 2 When you multiple or Divide unlike signs your answer is alway negative.

$(-2)(4)=-8$	$(2)(-4)=-8$
$\frac{4}{-2}=-2$	$\frac{-4}{2}=-2$

Order of Operations

PEMDAS

1) Parenthesis
2) Exponents
3) Multiple or Divide
4) Add or subtract

$^{o}F = \frac{9}{5}(^{o}C) + 32$

$30^{o}C = \_\_\_\_ ^{o}F$

$^{o}F = \frac{9}{5}(^{o}C) + 32$

$= \frac{9}{5}(30) + 32$

$= 54 + 32$

$= 86$

$-40^{o}C = \_\_\_\_ ^{o}F$

$^{o}F = \frac{9}{5}(^{o}C) + 32$

$= \frac{9}{5}(-40) + 32$

$= -72 + 32$

$= -40$

$^{o}C = \frac{5}{9}(^{o}F - 32)$

$30^{o}F = \_\_\_\_ ^{o}C$

$^{o}C = \frac{5}{9}(^{o}F - 32)$

$= \frac{5}{9}(30 - 32)$

$= \frac{5}{9}(30 + -32)$

$= \frac{5}{9}(-2)$

$= -1.11$

$-40^{o}F = \_\_\_\_ ^{o}C$

$^{o}C = \frac{5}{9}(^{o}F - 32)$

$= \frac{5}{9}(-40 - 32)$

$= \frac{5}{9}(-40 + -32)$

$= \frac{5}{9}(-72)$

$= -40$

HW (Temperature)

1) 50 °C = _____ °F

2) −50 °C = _____ °F

3) 20 °F = _____ °C

4) −20 °F = _____ °C

5) 120 °C = _____ °F

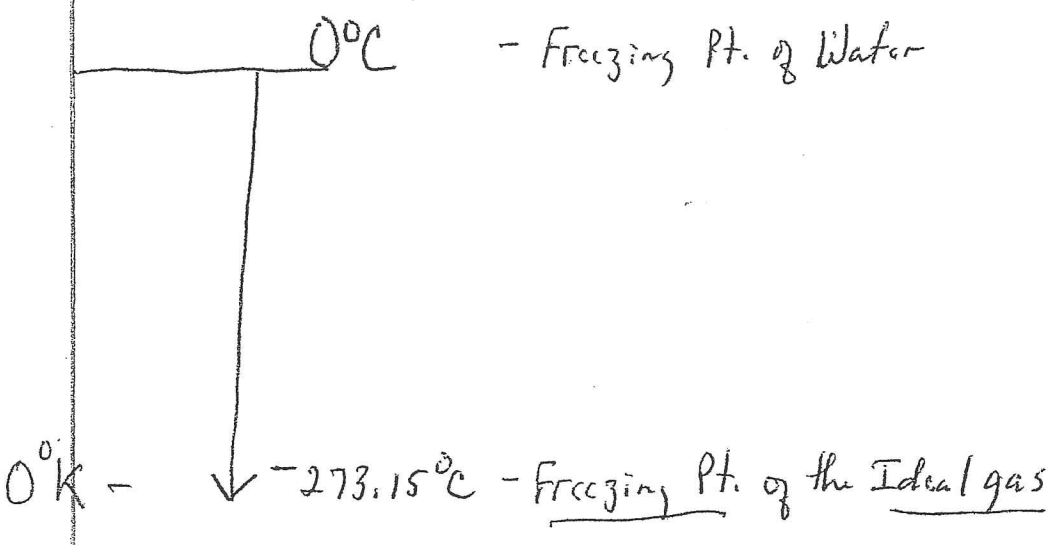
6) −120 °C = _____ °F

7) 400 °F = _____ °C

8) −400 °F = _____ °C

Temperature °Kelvin

This temperature scale is needed in gas laws.



$°K = °C + 273.15$

$20°C = \_\_\_\_ °K$

$°K = °C + 273.15$

$= 20 + 273.15$

$= 293.15$

$-40°C = \_\_\_\_ °K$

$°K = °C + 273.15$

$= -40 + 273.15$

$= 233.15$

HW (Temp)

1) $60°C = \_\_\_\_ °K$

2) $-60°C = \_\_\_\_ °K$

3) $60°K = \_\_\_\_ °C$

4) $-60°K = \_\_\_\_ °C$

Number form vs Scientific Notation

Powers of 10

$10^0 = 1$

$10^1 = 10$

$10^2 = (10)(10) = 100$

$10^3 = (10)(10)(10) = 1000$

$10^{-1} = \frac{1}{10} = .1$

$10^{-2} = \frac{1}{(10)(10)} = .01$

$10^{-3} = \frac{1}{(10)(10)(10)} = \frac{1}{1000} = .001$

1) Correct Scientific Notation - decimal is moved to the right of the first non zero number at the extreme left. Whatever you do (increase or decrease) to the number you do the opposite to the power.

Example #1 10012.

$10012. = 1.0012 \times 10^4$

(1 at nonzero extreme left; decreased number 4 places; increased power by 4)

Example #2 $.00642 = 6.42 \times 10^{-4}$

Example #3 $496.1 \times 10^5 = 4.961 \times 10^{5+2} = 4.961 \times 10^7$

Example #4 $.00984 \times 10^8 = 9.84 \times 10^{8+-3} = 9.84 \times 10^5$

2) Change Sc. Notation to number form

Example #1 $6.00 \times 10^{2} = 600 \times 10^{0} = 600$

(power decreases from 10^2 to 10^0; Number increases; 10^0 equal to 1)

Example #2 $6.00 \times 10^{-2} = .06.00 \times 10^{0} = .0600$

(power increases from 10^{-2} to 10^0; Number decreases)

Example #3 $948.9 \times 10^{6} = 948900000 \times 10^{0} = 948900000$

Example #4 $948.9 \times 10^{-6} = .0009489 \times 10^{0} = .0009489$

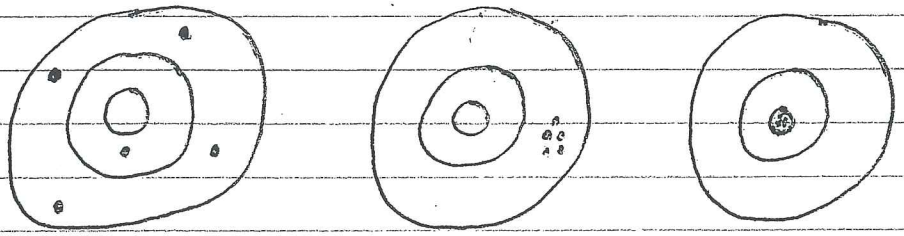
Problems

Change to Correct Sc. Notation	Change to Number Form
1) 10000	1) 1.0×10^{6}
2) .00048	2) 1.0×10^{-6}
3) 9468.1	3) 494.2×10^{5}
4) .00992	4) 494.2×10^{-5}
5) 648.2×10^{-7}	5) $.00943 \times 10^{-3}$

Standard of Measurements

1) Precision - describes how closely measurements are to each other.

2) Accuracy - compares a measurement to the accepted value.



Not Precise
Not Accurate

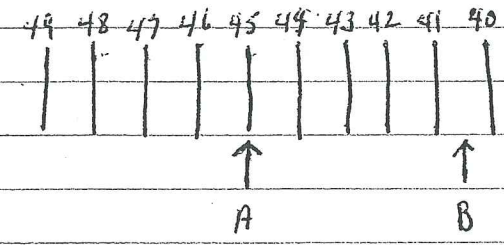
Very Precise
Not Accurate

Very Precise
Very Accurate

3) Significant Figures - In a measurement all places measured with certainty plus the first uncertain place.

Example (A) 45.0 Ft
↑
uncertain

Ruler measures to the Ones place and you guess at the tenth's place.



(B) 40.5 Ft
↑
uncertain

4) Correct Significant Figures – Final values in calculations can be no better than the least number of significant figure in the calculation.

Example #1 $4.5\ Ft + .2\ Ft = 4.7\ Ft = 5\ Ft$

↑ least Sign. Fig. 1 ↑ Round off

Example #2 $(3.25\ Ft)(.25\ Ft)(425\ Ft) = 350\ Ft^3 = 3.5 \times 10^2\ Ft^3$

↑ 3 Sign. Figs. ↑ 2 Sign. Figs ↑ 3 Sign Figs. ↑ 2 Sign ↑ 2 Sign Figs

Significant Figures – consist all the digits known with certainty plus the 1st uncertain digit.

Table 1-7
ZEROS IN MEASUREMENT EXPRESSIONS

Rule	Measurement expression	Significant figures
1. All nonzero digits are significant.	127.34 g	5
2. All zeros between two nonzero digits are significant.	120.007 m	6
3. Zeros to the right of a nonzero digit, but to the left of an understood decimal point, are not significant unless specifically indicated as significant by a bar placed above the rightmost such zero that is significant.	109,000 km 109,000 km 109,000 km 109,000 km	3 4 5 6
4. All zeros to the right of a decimal point but to the left of a nonzero digit are not significant.*	0.00406 kg	3
5. All zeros to the right of a decimal point and to the right of a nonzero digit are significant.	0.04060 cm 30.0000 s	4 6

International System of Units

1) SI base units

1) Length	meter	m
2) Mass	kilogram	kg
3) Time	second	s
4) Electric Current	Ampere	A
5) Temperature	Kelvin	K
6) amount of Substance	mole	mol
7) Intensity of light	candela	cd
8) Energy	Joule	J

2) Volume - amount of space occupied by an object.

$V = L\,W\,H = (1\text{ cm})(1\text{ cm})(1\text{ cm}) = 1\text{ cm}^3$ dimensional Volume

$1\text{ mL} = 1\text{ cm}^3$

↑ displacement Volume

3) Mass = amount of matter an object has.

4) Density - ratio of the mass of a substance to how much volume that mass has.

Example: $D = \_\_\_\_$ $m = 60.0\text{ G}$ $V = 20.0\text{ mL}$

$$D = \frac{m}{V} = \frac{60.0\text{ G}}{20.0\text{ mL}} = \frac{3.00\text{ G}}{\text{mL}}$$

5) Time – measurement of how long something takes to do.

1 yr = 365.25 da
1 da = 24 hr
1 hr = 60 min.
1 min = 60 s

Example 4.54 yr = _____ s

$$(4.54\text{ yr})\left(\frac{365.25\text{ da}}{1\text{ yr}}\right)\left(\frac{24\text{ hr}}{1\text{ da}}\right)\left(\frac{60\text{ min}}{1\text{ hr}}\right)\left(\frac{60\text{ sec}}{1\text{ min}}\right) = 1.4 \times 10^{8}\text{ s}$$

Problems

1) D = _____ m = 65.1 G V = 10.5 mL

2) D = 5.7 G/mL m = _____ V = 40.0 mL

3) 6.5 da = _____ s

4) 14001 sec = _____ hr

5) 28.5 s = _____ yr.