

6. Your job pays you \$6.50 per hour. You need \$35.75 to buy a new shirt. How many hours do you need to work to pay for the shirt?
7. On your first Chemistry lab quiz, you get 22 points correct out of 25 possible points. Did you pass? What's your percentage?
8. You score a 75% on your second chemistry lab quiz. 44 points were possible. How many points did you get correct?
9. A metal bar contains 48.0 grams of silver. The bar is 80.0 % silver. What is the total mass of the bar?

Metric system introduction: p. 63-67, your handout

10. List these *volume* units from largest to smallest (some are the same size):

a. cm^3 b. L c. μL d. mL e. dL f. dm^3

11. Complete this table of metric units

Type of measurement	Metric unit name	Symbol	Measuring tool
a. _____	gram	_____	_____
b. length (give base unit)	_____	_____	_____
c. _____	_____	kJ	_____
d. _____	_____	mL	_____

12. Match the approximate size with each item.

Volumes		Lengths	
a. an orange	(1) 12 m^3	a. a paper clip	(1) 20 cm
b. a basketball	(2) 100 cm^3	b. a football field	(2) 20 mm
c. a van	(3) 7 L	c. a pencil	(3) 1.8 m
d. an aspirin tablet	(4) 200 mm^3	d. an average person	(4) 90 m

13. Which would be the most convenient unit to use to measure each of the following?

a. the mass of a brick:	gram	kg	mg	μg
b. the volume of a drop of water:	mm	m^3	μL	cm
c. the temperature of an ice bath:	Joule	cal	mL	$^{\circ}\text{C}$
d. the thickness of a penny:	cm^2	μm	mm	cm
e. the surface area of a dollar bill:	nm^2	cm^2	m^2	mm^3

6) 5.50 hrs; 7) 88%; 8) 33 pts; 9) 60.0 g; 10) b&f,e, a&d, c;; 12) Vol: a-2, b-3, c-1, d-4; Len: a-2, b-4, c-1, d-3; 13a) g or kg; b) μL ; c) $^{\circ}\text{C}$; d) mm; e) cm^2)

Name _____

Mods _____ L3 Page 3

Chemistry Worksheet: Sig figs and Olympic Measurements

p. 54-62

How many sig figs are in the numbers in these examples? Remember *counted* numbers are considered "exact" or with *unlimited* sig figs.

1. The length of a standard athletic track is verified by 28 measurements (____). It must be at least 400.00 m (____) long, but can be up to 0.04 m (____), or 4 cm (____) longer.
2. The women's 400 m race was won by Ohuruogu of Great Britain in 49.62 sec (____), with Williams of Jamaica taking silver at 49.69 sec (____), only 0.07 sec (____) off the pace. The favorite Sanya Richards won bronze with 49.93 sec (____). Next was Gushchina of Russia at 50.01 sec (____). 8 women (____) qualified for the final.
3. It took me 5 minutes (____) to walk all the way to school today because I parked my car about 400 meters (____) down the street.
4. Jamaica swept the women's 100 m race, all in less than 11 sec (____). Shelly-Ann Fraser won with 10.78 sec (____), Simpson and Stewart tied at 10.98 sec (____). American Tori Edwards was last with 11.20 sec (____). Fraser ran 11.00 sec (____) in the semi for the race.
5. The length of an olympic sized swimming pool is 50.00 m, (____) +0.03 m, (____) - 0.01 m (____). So it can be up to 3 cm (____) too long, but not even 1 mm (____) too short. It takes about 2500000 liters (____) { 2.5×10^6 L} (____) of water to fill the pool.
6. Michael Phelps won 8 medals (____). He won the 100 m butterfly with a time of 50.58 sec (____), just beating Milorad Cavic, 50.59 sec (____) by 0.01 sec (____). The 3rd medal (____) was the 200 m freestyle with 1:42.96 or 102.96 sec (____), nearly 2 sec (____), {or 1.89 sec (____)} faster than Hwan of South Korea, 104.85 sec. (____).
7. In the 100 m women's backstroke heats, top qualifier Coventry of Zimbabwe swam 59.00 sec (____). The slowest qualifier was Moskvina of Russia at 60.70 sec (____), but Molina of Brazil failed to qualify at 61.00 sec. Natalie Coughlin eventually won gold in the finals with 58.96 sec (____). She won 6 medals (____) in the games, most ever by an American woman in one games.
8. In the qualifying round for the shot put, the top 12 men (____) advanced to the finals. The best throw was 21.04 m (____) by Majewski of Poland. Yushkov of Russia, the last qualifier, had throws of about 20 m (____): 19.83 m (____), 20.00 m (____) and 20.02 m (____). Sack of Germany just missed qualifying with a throw of 20.01 m (____), just 1 cm (____) too short.
9. How many sig figs are in the following?
 - a. 1×10^2 m ____ 1.00×10^2 m ____ 1.0000×10^2 m ____
 - b. 0.001 m ____ 0.00100 m ____ 1×10^{-3} m ____ 1.00×10^{-3} m ____ 1 mm ____ 1.00 mm ____
 - c. "100 gold medals" ____ In "100 cm" in the expression $1 \text{ m} = 100 \text{ cm}$? ____
 - d. How would you write "100 m" to indicate 6 sig figs? ____
 - e. How would you write "100 m" to show the measurement is good to 1 cm? ____

1) unlim, 5,1, 1; 2) 4, 4, 1, 4, 4, unlim; 3) 1, 1; 4) 2, 4, 4, 4, 4; 5) 4, 1, 1, 1, 1, 2, 2; 6) unlim, 4, 4, 1, unlim, 5, 1, 3, 5; 7) 4, 4, 4, 4, unlim; 8) unlim, 4, 1 or 2, 4, 4, 4, 4, 1; 9 a) 1, 3, 5; b) 1, 3, 1, 3, 1, 3 ; c) unlim, unlim; d) 100.000 m; e) 100.00 m

1. Four students made multiple weighings of a copper cylinder, each using a different balance. The *accepted* mass of the cylinder had been previously determined to be 47.432 g.

	Mass of cylinder (g)			
	Jim	Susan	Bob	Jen
Weighing 1	46.43	47.45	47.95	46.90
Weighing 2	48.54	47.39	47.91	47.88
Weighing 3	47.19	47.42	47.89	48.10
Weighing 4	47.47	47.41	47.93	49.23

a. For each student, is he/she accurate, precise, both, or neither? Explain your answer!! (Just think about the data. Don't calculate % errors or differences.)

b. Calculate the % error for Jim's Weighing 1 and Jen's Weighing 4.

$$\% \text{ error} = \frac{|\text{accepted value} - \text{experimental value}|}{\text{accepted value}} \times 100$$

2. How many significant figures are in each of the following measurements?

- | | | | | | |
|-------------------------|-------|-----------------------------|-------|-----------------------------|-------|
| a. 14 g | _____ | e. 0.0071 kg | _____ | i. about 400000 km | _____ |
| b. 14.00 g | _____ | f. 0.007100 kg | _____ | j. exactly 400000 km | _____ |
| c. 14.00307 g | _____ | g. 7.10×10^{-3} kg | _____ | k. 4.00×10^5 km | _____ |
| d. 1.40×10^1 g | _____ | h. 7.10 g | _____ | l. 3.84403×10^5 km | _____ |

3. Write these measurements to show 3 sig figs. Also express c and d in scientific notation.

- | | | | |
|----------|-------|----------------|-------|
| a. 2 cm | _____ | c. 0.05 Liters | _____ |
| b. 4.5 g | _____ | d. 60 mL | _____ |

4. You put a rock on a balance and it reads "6.00 g" How many sig figs are in the measurement? _____ How do you write this mass on your data table? _____

5. For Multiplication and Division: Round these answers to the *least* number of sig figs.

example: $6.2 \text{ m} \times 25 \text{ m} \times 51.25 \text{ m} = 7943.75 \text{ m}$ rounds to 7900 m (2 sig figs = least)

- | | |
|---|--|
| a. $4.31 \text{ cm} \times 15.7 \text{ cm} = 67.667 \text{ cm}^2 =$ _____ | d. $2.00 \text{ g} / 84.0 \text{ g} = 0.02380952 =$ _____ |
| b. $15.5 \text{ g} / 3.7 \text{ cm}^3 = 4.1892 \text{ g} / \text{cm}^3 =$ _____ | e. $15.5 \text{ g} / 3.70 \text{ cm}^3 = 4.1892 \text{ g} / \text{cm}^3 =$ _____ |
| c. $6.3 \text{ cm} \times 0.12 \text{ cm} \times 0.012 \text{ cm} = 0.0090720 \text{ cm}^3 =$ _____ | |

6. For Addition and Subtraction: Round these answers to the *least* number of decimal places

example: $6.2 \text{ m} + 5 \text{ m} + 51.25 \text{ m} = 62.45 \text{ m}$ rounds to 62 m (no decimal places = least)

- | | |
|---|---|
| a. $8.7 \text{ g} + 0.0131 \text{ g} + 4.2 \text{ g} = 12.9131 \text{ g} =$ _____ | b. $867 \text{ L} - 0.001 \text{ L} - 12.2 \text{ L} = 854.799 \text{ L} =$ _____ |
|---|---|

7. "Counted" numbers have unlimited sig figs. Don't consider them in rounding:

example: 10 people x \$15.25 each = \$152.50 (don't round)

- | | |
|--|---|
| a. $567 \text{ cm} \times 1 \text{ m} / 100 \text{ cm} = 5.67 \text{ m} =$ _____ | b. $5 \text{ beakers} \times 16.35 \text{ g} = 81.75 \text{ g} =$ _____ |
|--|---|

1. a. Jim, Jen neither, Susan both, Bob prec, not Acc; b. 2.1 %, 3.8 % ; 2a. 2, b. 4, c. 7, d. 3, e. 2, f. 4, g. 3, h. 3, i. 1, j. 6, k. 3, l. 6 ; 3a. 2.00 cm, b. 4.50 g, c. 0.0500 L, 5.00×10^{-2} L, d. 60.0 mL, 6.00×10^1 mL ; 4. 3 sig figs, 6.00 g ; 5a. 67.7 cm^2 , b. $4.2 \text{ g} / \text{cm}^3$, c. 0.0091 cm^3 , d. 0.0238, e. $4.19 \text{ g} / \text{cm}^3$; 6a. 12.9 g, b. 855 L ; 7a. 5.67 m, b. 81.75 g

Chemistry Worksheet: Metric Conversion problems : p. 89-95

Counted Conversion factors are considered to have an unlimited number of sig figs. For example, 100 cm = 1 m, is considered to be "exactly 100." These are not considered in rounding. For example: 782.346 cm x 1 m/100 cm = 7.82346 m (still 6 sig figs)

1. Convert the following (hint: use your conversion factors in scientific notation for e-h)

ex. 635 mg to g $635 \text{ mg} \times \frac{1 \text{ g}}{1000 \text{ mg}} = 0.635 \text{ g}$ (remember 1 cal = 4.18 J)

- a. 82 m to cm _____ (8200 cm)
- b. 957 J to kJ _____ (0.957 kJ)
- c. 957 Joules to calories _____ (229 cal)
- d. 0.0612 L to mL _____ (61.2 mL)
- e. 1.5×10^{11} m to km _____ (1.5×10^8 km)
- f. 7.7×10^{-11} m to nm _____ (7.7×10^{-2} nm)
- g. 5.78×10^3 cal to J _____ (2.42×10^4 J)
- h. 5×10^{-5} g to μg _____ ($5 \times 10^1 \mu\text{g}$)

2. Convert the following 2 step conversions. (hint: use your conversion factors in scientific notation for d-e) : p. 97-98

- a. 0.05 km to cm _____ (5000 cm)
- b. 33000 mg to kg _____ (0.033 kg)
- c. 1620 Joules to kcal _____ (0.388 kcal)
- d. 6.3×10^{-3} mL to μL _____ ($6.3 \mu\text{L}$)
- e. 8.25×10^3 nm to cm _____ (8.25×10^{-4} cm)

4. Usain Bolt of Jamaica won the Olympic 100 meter race with an incredible time of 9.69 sec. Convert this speed to *miles per hour*. (hint: this is a multistep conversion! change m to miles, and sec to hours, then divide. 1.00 mile = 1.61 km) (23.1 mph)

5. A drop of water is about 50 μL . How many drops of water are in a cup (about 250 mL) of water? (about 5000)

6. It's 1350 miles to Disney World, Your car gets 25.0 miles per gallon, you plan on driving 65 miles per hour, and gas costs \$3.91 per gallon. How much does it cost you to get there *and back* just for the gas? (\$422)

Word problems: Density**SHOW YOUR WORK!****Page 6**p.68-71, 86-88, 94-95 You can find the **density** of elements on your Periodic Table.NOTE: Answers are rounded to three sig figs!!!

$$\text{Density} = \frac{\text{mass}}{\text{volume}} \quad \text{or} \quad \frac{\text{grams}}{\text{cm}^3} \quad \text{or} \quad \frac{\text{grams}}{\text{mL}} \quad \text{or} \quad \frac{\text{grams}}{\text{L}}$$

7. 20.0 mL of water is placed in a graduate cylinder. A piece of iron is added and the water rises to 25.3 mL. The mass of the piece of iron is determined to be 40.52 g.
- What is the volume of the piece of iron? How many sig figs should you use for this measurement? Write the answer to the correct number of sig figs.
 - How many sig figs are in the mass measurement? _____
 - Calculate the experimental density of the iron. How many sig figs should you use to report your density? Why?
 - Calculate your % error for the density of the iron. Is your measurement acceptable?

(a.5.3 mL, 2 sig figs; b. 4 sig figs c. 7.6 g/mL, 2, least number of sig figs, d. 3.4 %, acceptable)

8. What is the mass in g of exactly 500 cm³ of mercury? (6750 g)
9. Calculate the *volume* of exactly 100 g of mercury. (7.41 cm³)
10. A weather balloon is inflated to a volume of 2.20 x 10³ L with 374 g of helium. What is the density of Helium in grams per Liter? (0.170 g/L)
11. A silver colored bar has a mass of 780 g. Its dimensions are 0.250 m wide by 10.0 cm long by 2.40 mm high. a. What is the volume of the bar in cm³ (hint: change *all* to cm first). b. Is the bar pure silver? (a. 60.0 cm³, b. no)
12. A flask is filled to the top with water. The mass of the water in the flask is 158 g. The water is emptied out and the flask is filled to the top with ethyl alcohol. The mass of the ethyl alcohol in the flask is 127 g.
- What is the volume of the flask? Why do you know this? (158 mL)
 - What is the density of ethyl alcohol? (0.804 g/ml)

Review sheet for Unit 1: Chemical Measurements : Chapters 3 and 4

Show work for any problems!!!! (The answers are on the back. Don't peek until done!)

1. You need to know the volume of water to buy to fill a swimming pool. What would be easier: a) measuring length, height and width in cm and converting liters or b) measuring length, height, width in inches and changing to gallons? Why?

2. You expect about 10,000 people to attend a concert. It's your job to buy water bottles for each person attending. The morning of the event a friend calls and says she found a dozen more people to go with her to the concert. Do you stop at the store to buy another dozen water bottles? Explain.

3. a. Devise a method to estimate the thickness of a piece of paper in your book.

 b. Sam's estimate of the thickness of the paper is 3.5×10^{-3} cm. Sally's is 34 μm . Are these estimates close to each other? Explain. (Hint: Change both to meters)

4. John says his car can go 150 km in 5 minutes. Should you believe him? Explain why. (1.61 km = 1.00 mile)

5. How many significant figures are in the following measurements?
 a. 450.0 g _____ b. 0.00056 m _____ c. about 75000 mL _____ d. 0.0470 g _____
6. Express each number from the previous question in scientific notation.
 a. _____ b. _____ c. _____ d. _____

7. You place 24.0 mL of water in a graduate cylinder. Then you add a copper bar to the water and the water rises to 28.2 mL. When you place the copper bar on a balance it reads 34.82 g.

- a. Fill in the data table at right.
 **Use the *correct number of sig figs* in your answers. Include your units!
- b. Calculate your experimental density of the copper bar. Show Your work!!!
 (How many sig figs should you use for your density value _____?)

Mass of bar	
Initial volume of water	
Final volume of water + bar	
Volume of bar	

- c. Calculate your percent error for the density. Show work! Should you redo your measurements? Why?

8. Express these answers to the correct number of sig figs.

a. $4.27 \text{ cm} \times 3.65 \text{ cm} =$ _____ b. $61.7 \text{ mL} + 4.214 \text{ mL} =$

9. Katie obtained the following mass and volume data for a metal bar on two different days.

Day 1: Mass = 26.86 g (on white balance) Volume = 18 mL (by water displacement)

Day 2: Mass = 26.84 g (on black balance) Volume = 3.5 cm^3 (by $l \times h \times w$)

Which measurement is more *precise* (mass or volume)? Which is more *accurate* (mass or Volume)? Are there any measurements she should redo? Which one(s)? What are some examples of what Katie may have done wrong?

10. You are planning a mission to the planet Drelock IV, where there are oceans of liquid mercury. If you land in one of the oceans, you want to make sure your ship floats. Should you make your ship out of Aluminum or Osmium? Explain.

11. Convert the following.

a. 45 cm to m _____ b. 0.67 kg to g _____

c. $1.95 \times 10^2 \text{ L}$ to mL _____ d. 14.0 J to cal _____

e. $5.9 \times 10^4 \text{ ng}$ to μg _____ ($5.9 \times 10^1 \mu\text{g}$)

f. $2.35 \times 10^4 \text{ nm}$ to cm _____ ($2.35 \times 10^{-3} \text{ cm}$)

12. What is the volume of 60.0 g of lead? (5.26 cm^3)

13. A spherical balloon of radius 10.0 cm contains 0.750 g of an elemental gas. What element is it? If you were to light the balloon on fire, what would happen? Hint 1: The *density* of gases is in $\frac{\text{g}}{\text{Liter}}$ on your Periodic Table. Hint 2: The *Volume* of a sphere is $\frac{4}{3} \pi r^3$

14. Slick Vinny works at a jeweler's. By shaving gold rings, he steals 10 mg of gold a day. Assume he works 210 days a year, for 20 years. If gold costs \$26 a gram, how much is the gold he stole worth? Is it enough to retire on? (\$1092)

(1. a easier, volume and length relate in metric sys; 2. No, not significant ; 3b. yes, $3.5 \times 10^{-5} \text{ m}$ and $3.4 \times 10^{-5} \text{ m}$; 4. about 1100 miles per hour, I don't think so!; 5 a. 4, b. 2, c. 2, d. 3; 6a. $4.500 \times 10^2 \text{ g}$, b. $5.6 \times 10^{-4} \text{ m}$, c. $7.5 \times 10^4 \text{ m}$, d. $4.70 \times 10^{-2} \text{ g}$; 7. density= 8.3 g/mL, 2 SF, 7.4 % error, redo; 8a. 15.6 cm^2 , b. 65.9 mL ; 9. Mass more precise, can't tell accurate, redo both volumes ; 10. Al, it's less dense than Mercury; 11a. 0.45 m, b. 670 g, c. $1.95 \times 10^5 \text{ mL}$, d. 3.35 cal; 14. Density = 0.179 g/L, so it's He, not much)