

Show all of your work. Make use of the conversion factor method (factor label method, dimensional analysis) throughout and express answers in scientific notation with the appropriate number of significant figures.

1. Give one example of an element. _____
2. Give one example of a compound. _____
3. Circle the physical properties below:
 - (a) The normal color of elemental bromine is orange.
 - (b) Iron turns to rust in the presence of air and water.
 - (c) Hydrogen can explode when ignited in air.
 - (d) The density of titanium metal is 4.5 g/cm³.
 - (e) Tin metal melts at 505 K.
 - (f) Chlorophyll, a plant pigment, is green.
4. Circle the chemical changes below:
 - (a) Methane burns in air to produce carbon dioxide and water..
 - (b) Water vapor in your exhaled breath condenses in the air on a cold day.
 - (c) Plants use carbon dioxide in the air to make sugar.
 - (d) Butter melts when placed in the sun.
5. Small iron chips are mixed with sand (see the following photograph).



- (a) Is this a HOMOGENEOUS or HETEROGENEOUS mixture? (circle one word)
- (b) Suggest a way to separate the iron from the sand.

6. Choose the pure substance from the list below.
 - (a) sea water
 - (b) sugar
 - (c) air
 - (d) lemonade
 - (e) milk
7. The mass of aspirin in a standard tablet is 325 mg. Calculate this mass in grams.

8. What is the mass from problem 7 in kilograms?

9. The following photo shows copper balls, immersed in water, floating on top of mercury. Label the liquids and solids in this photo. Which substance is most dense? Which is least dense?



10. Diamond has a density of 3.513 g/cm^3 . The mass of diamonds is often measured in carats, 1 carat equaling 0.300 g. What is the volume (in cubic centimeters) of a 1.00 carat diamond?
11. The coldest ever temperature recorded on the surface of the Earth was -89°C , the warmest ever temperature recorded was 58°C .
- (a) Write down an equation used for converting $^\circ \text{C}$ to $^\circ \text{F}$.
- (b) Express these temperatures in $^\circ \text{F}$.

Directions: Convert each of the following metric units as indicated. (1 point each)

12. $3.5 \text{ Km}^2 = \underline{\hspace{2cm}} \text{ m}^2$
13. $775.5 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$
14. $92.0 \mu\text{L} = \underline{\hspace{2cm}} \text{ mL}$
15. $0.6565 \text{ mL} = \underline{\hspace{2cm}} \mu\text{L}$
16. $18 \text{ mL} = \underline{\hspace{2cm}} \text{ cm}^3$
17. $33 \text{ cm}^2 = \underline{\hspace{2cm}} \text{ mm}^2$
18. $9.6 \text{ mL} = \underline{\hspace{2cm}} \mu\text{L}$
19. $0.0722 \text{ Mg} = \underline{\hspace{2cm}} \text{ lbs}$
20. $3676 \text{ s} = \underline{\hspace{2cm}} \text{ ns}$
21. $5.55 \times 10^5 \text{ mL} = \underline{\hspace{2cm}} \text{ L}$

22. What is the basic unit of length in the metric system?

- a) liter
- b) kilogram
- c) meter
- d) centimeter
- e) foot

23. The measurement 0.00000077 m, expressed correctly using scientific notation, is

- a) 7.7×10^{-7} m.
- b) 7.7×10^{-6} m.
- c) 7.7×10^6 m.
- d) 0.77×10^{-5} m.
- a) 4.3 m.

24. If the following calculation were carried out in order to determine the mass of a sample (in g) the correct answer with the appropriate number of significant figures would be

$$\text{Volume} = \frac{9.58}{1.12+0.546}$$

- a) 11.72 b) 11.75 c) 2.023 d) 11.7 e) 1.036

26. The number of significant figures in the measurement of 8.850 mm is

- a) none b) three c) four d) five e) six

27. The density of a solution is 7.85 g/cm^3 , if the mass of this solution is 35 g, what is the volume of the solution?

28. What is the mass of 8.4 mL of ethylene glycol, which has a density of 1.114 g/mL ?

29. (a) What are the three fundamental particles from which atoms are built?
(b) What are their electric charges?
(c) Which of the particles constitute the nucleus of the atom?
(d) Which is the least massive of the three?
(e) How many of each of the fundamental particles are there in an atom of ^{24}Mg ?

25. (a) Write down the molar mass of aluminum in g/mol.
(b) Calculate the mass in grams of one atom of aluminum metal.
(Avogadro's number = 6.022×10^{23} atoms/mole).

26. In each case, decide which represents more mass: (circle your answer)

- (a) 0.5 mol Na or 0.5 mol Si
- (b) 9.0 g Na or 0.50 mol Na
- (c) 10 atoms of Fe or 10 atoms of K

27. (a) How many electrons are in a calcium atom (Ca)?
(b) Does an atom of Ca gain or lose electrons when forming an ion?
(c) How many electrons are gained or lost by the atom?
(d) When Ca forms an ion, the ion has the same number of electrons as which one of the noble gases?

28. Lithium has two stable isotopes: ${}^6\text{Li}$ and ${}^7\text{Li}$. One of them has an abundance of 92.5 %, and the other has an abundance of 7.5 %. Knowing that the atomic mass of lithium is 6.941 which is the more abundant isotope? (circle your answer)

29. Gallium has two naturally occurring isotopes, ${}^{69}\text{Ga}$ (isotopic mass 68.9256 amu, abundance 60.11 %) and ${}^{71}\text{Ga}$ (isotopic mass 70.9247 amu, abundance 39.89 %). Calculate the atomic mass of gallium.

30. The compound $(\text{NH}_4)_2\text{SO}_4$ consists of two different polyatomic ions.

- (a) What are the names and electric charges of these ions?
(b) What is the molar mass of this compound?

31. Give the symbol, including the correct charge for each of the following ions:

- (a) barium ion
(b) titanium (IV) ion
(c) sulfide ion
(d) sulfate ion

32. Which of the following are not the correct formulas for ionic compounds? For those that are not, give the correct formula.

- (a) Ca_2O
(b) SrBr_2
(c) Fe_2O_5
(d) Li_2O

33. Name the following molecular compounds:

- (a) NF_3 _____
(b) $\text{HCl}(\text{aq})$ _____
(c) CO _____
(d) SO_2 _____
(e) N_2O_5 _____
(f) SF_6 _____

34. Name the following compounds:

- (a) $\text{Pb}(\text{CO}_3)_2$ _____
(b) NaNO_3 _____
(c) HNO_3 _____
(d) $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ _____

35. Percent Composition: Calculate the percent composition by mass of HNO_3 .

36. Write a balanced reaction for the combustion of $\text{C}_3\text{H}_8(\text{g})$

37. Butyric acid, whose empirical formula is $\text{C}_2\text{H}_4\text{O}$, is the acid responsible for the odor of rancid butter. If the molecular weight of Butyric acid is 88.1 g/mol, what is the molecular formula of butyric acid?

38. Reaction Balancing: **Balance each “equation” below by inspection.**

