AP Chem summer assignment 2021

**This is due on the first day of school. There will be a quiz over this content and polyatomic ions (see last page) the first week. School devices must be returned by July 26, so plan accordingly if you are using a school device.**

**Answer the following questions/problems. If performing calculations, show your work and round appropriately based on significant figures.**

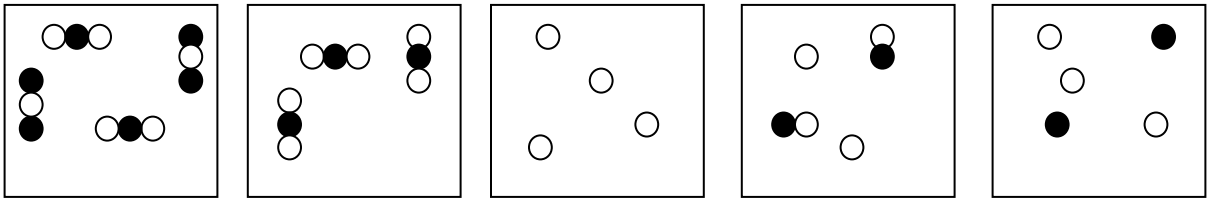
**Density/calculations (sig figs), classification of matter, particle pics**

1) What is the density of a substance with a mass of 63290 g and a volume of $7.2 \times 10^6$ mL? Will this substance sink or float in water? (density of water = 1.00 g/cm$^3$)

2) If a sample has a density of 6.35 g/mL and a mass of 45.5 g, what is its volume?

3) Label each of the following as a pure substance or a mixture. If it is a pure substance, is it an element or a compound? If it is a mixture, is it homogeneous or heterogeneous?
   a) Iron
   b) Lemonade
   c) Calcium carbonate
   d) Salt water

4) Match each diagram with its correct description. Diagrams will be used once.

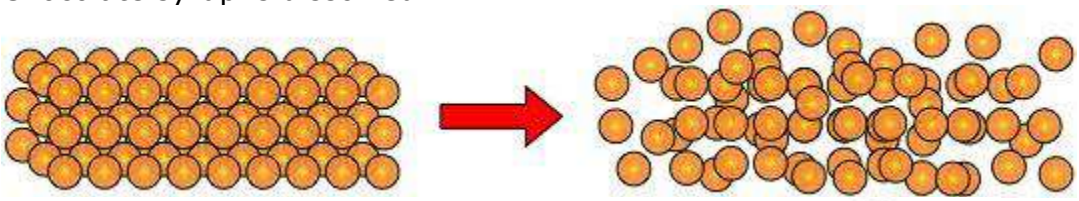


A B C D E

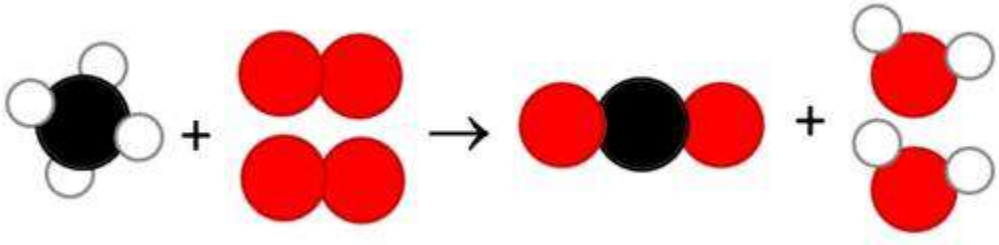
   a) Pure element: only one type of atom present.
   b) Mixture of two elements: two types of uncombined atoms present.
   c) Pure compound: only one type of compound present.
   d) Mixture of two compounds: two types of compounds present.
   e) Mixture of a compound and an element.

5) Decide if each is a physical or chemical change.
   a) An ice cube is placed in the sun. Later there is a puddle of water. Later still the puddle is gone.
   b) A marshmallow is toasted over a campfire.
   c) Chocolate syrup is dissolved in milk.

d)



e)



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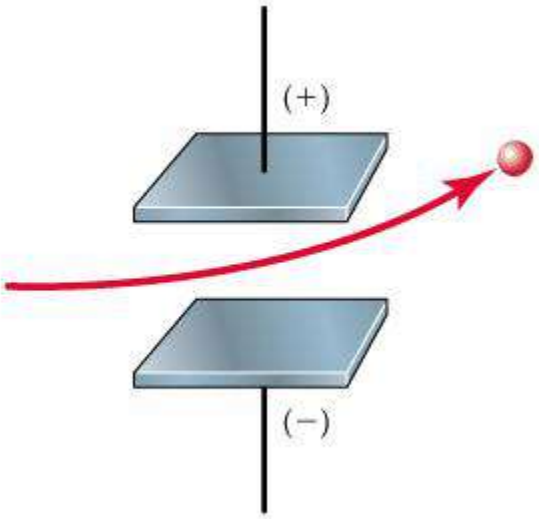
**Atoms, ions, periodic table**

6) A charged particle moves between two electrically charged plates, as shown below.




a) Why does the path of the charged particle bend?
b) What is the sign of the electrical charge on the particle?
c) As the charge on the plates is increased, would you expect the bending to increase, decrease, or stay the same?
d) As the mass of the particles is increased while the speed of the particle remains the same, would you expect the bending to increase, decrease, or stay the same?

7) How many protons, neutrons, and electrons are in $^{88}_{38}Sr^{2+}$?

8) Complete the chart. Assume each atom is neutral.

| Element | Symbol | Atomic Number | Mass Number | $p^+$ | $n^0$ | $e^-$ |
|---|---|---|---|---|---|---|
| Carbon | | 6 | 14 | | | |
| | O | 8 | | | 10 | |
| Potassium | | | | 19 | 20 | |
| | | | 41 | | | 19 |

9) For each group on the periodic table, give its name and its common ion charge.

| Group # | Name | Common charge |
|---|---|---|
| 1/1A | | |
| 2/2A | | |
| 17/7A | | |
| | Noble gases | 0 (does not form ions) |

**Chemical formulas and names, molar mass, percent composition, molecular formulas**

10) Write the formula for the following compounds:

a) magnesium phosphide
b) copper (I) sulfite
c) aluminum hydroxide
d) tetrasulfur hexaoxide

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11) Name the following compounds:
    a) $BaF_2$
    b) $Na_2O$
    c) $N_2Br_5$
    d) $Ga_2(SO_4)_3$
    e) $NH_4NO_3$

12) What is the charge of each metal ion in the following compounds?
    a) $Fe_2O_3$
    b) $SnCO_3$
    c) $CrPO_4$
    d) $Au_2S$

13) What is the molar mass of $Ga(OH)_3$?

14) What is the percent composition of $(NH_4)_3PO_4$? What do all the percentages have to add up to?

15) What is the molecular formula of a compound that has a molecular molar mass of roughly 84 g/mol and it made of 83.6% C and 16.4% H?

**Equations, moles, and stoichiometry**

16) Balance the following equations.
    a) $KClO_3 \rightarrow KCl + O_2$
    b) Lithium metal and iron (III) chloride react to make lithium chloride and iron metal
    c) $Na_2CO_3 + HNO_3 \rightarrow NaNO_3 + H_2CO_3$
    d) $CH_4 + O_2 \rightarrow CO_2 + H_2O$
    e) $Mg + O_2 \rightarrow MgO$

17) How many grams are there in $5.19 \times 10^{20}$ molecules of HCl?

18) What mass does 25.2 cL of $NH_3$ gas at STP have?

19) Given the equation $3\ Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$ at STP
    a) How many mole of hydrogen gas are released if 20 moles of $Fe_3O_4$ are made?
    b) What mass of iron is needed to make 2.05 mol of $Fe_3O_4$?
    c) What mass of water is need to make 156 g of $Fe_3O_4$?
    d) How many atoms of hydrogen can be made from 32 mol of $H_2O$?

**Solutions**

20) Calculate the mass percentage of $Na_2SO_4$ in a solution containing 10.6 g $Na_2SO_4$ in 483 g of water.

21) What is the mass percentage of iodine ($I_2$) in a solution containing 0.045 mol $I_2$ in 115 g $CCl_4$?

22) A solution is made of 25.5 g phenol ($C_6H_5OH$) and 495 g ethanol ($C_2H_5OH$).
    a) Calculate the mole fraction of phenol.
    b) Calculate the mole fraction of ethanol.
    c) How are the mole fractions (and all mole fractions) related to each other?

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| **Name** | **Formula** | **Charge** |
|---|---|---|
| Ammonium | $NH_4$ | 1+ |
| | | |
| Acetate | $CH_3COO$ or $C_2H_3O_2$ | 1- |
| Bicarbonate | $HCO_3$ | 1- |
| Bromate | $BrO_3$ | 1- |
| Chlorate | $ClO_3$ | 1- |
| Cyanide | $CN$ | 1- |
| Hydroxide | $OH$ | 1- |
| Iodate | $IO_3$ | 1- |
| Nitrate | $NO_3$ | 1- |
| Permanganate | $MnO_4$ | 1- |
| | | |
| Carbonate | $CO_3$ | 2- |
| Chromate | $CrO_4$ | 2- |
| Dichromate | $Cr_2O_7$ | 2- |
| Peroxide | $O_2$ | 2- |
| Sulfate | $SO_4$ | 2- |
| | | |
| Phosphate | $PO_4$ | 3- |

One more oxygen than -ate = per…ate
One less oxygen than -ate = -ite
Two less oxygen than -ate = hypo…ite
E.g., $ClO_3^-$ = chlorate, $ClO_4^-$ = perchlorate, $ClO_2^-$ = chlorite, $ClO^-$ = hypochlorite