For each of the ionic and molecular compounds listed below, show how the compound dissociates or ionizes when placed in water. In the middle column, show the dissociation or ionization reaction and in the last column show the best representation of that compound in water. If the compound is insoluble, write insoluble in the middle column. When you are finished, circle all of the compounds that are acids and bases.

Compound	Dissociation or Ionization Reaction	How Substance Exists in Water
hypochlorous acid	$HClO(aq) + H_2O(l) \iff H_3O^+(aq) + ClO^-(aq)$	HClO(aq)
sodium chloride	Na Cl (s) Hace Natag) + Cl cap	Nataq), (laq)
hydroiodic acid	HI (ag) + H2 O(L) -> H30 (ag) + I (ag)	H30t card), I Tag)
silver chloride	Ageles Hade Ageles NOT SOLUBLE	Ag CL(S)
sodium carbonate	Na2 (03(5) H20(2) 2Nat cage1 + (03 cage)	Nataq), (03 (aq)
zinc nitrate	En(NO3)2(5) H20(2) Zn2+ 2NO3 cog)	Zn2+ (ag), NOscaq)
ammonia (NH ₃)	NH3 caq) + H2 O(e) = NH4 (aq) + OH (aq)	NH3 (ag)
potassium hydroxide	KOH(S) H20(2) > Kt (ag) + OH (ag)	Kt (ag), CH (ag)
strontium acetate	Sr (CH3(00)2(5) H20(2) Sr(ag) + 2 (H3(00 cog)	Sr ZtD, CH3COO(aq)
$HC_2H_2ClO_2$	HC2H2 Clo2 (ag7 + H2O(1) => H3O (ag) + C2H2Clo	DZ (ag) HC2H2CLOZ(ag
iron(III) sulfate	Fez(304)3(5) H20(2) 2Fe capt 3504 (aq)	Fe dag), SO4 dags
perchloric acid	HCeOt (ag) + H2O(2) -> H3O(ag) + Cloq(aq)	H30tag), Clog (ag)
mercury(I) sulfide	Hgz S(s) HzO(2) Hgz S(s) NOT SOLUBLE	HgzS(s)
HCN	$HCN(aq) + H_2O(1) \implies H_3O_{(aq)}^+ + CN_{(aq)}$	HCN (aq)
ammonium perchlorate	NH4 CO4(S) H20(2) NH4 (aq) + CO4(caq)	NH4 tagy, Cl04 (ag)
sodium hydroxide	NaOH(S) H20(2) Nationagy + OH Tag)	Nataq), OH (aq)
potassium oxalate	K2 C204(5) H20(2) 2Ktag) + (204 (aq)	Kt (aq), C204 (aq)
H ₂ SO ₄	H2SO4(ag) + H2O(1) -> H3Otag) + HSO 4(aq)	H3 O (ag), HSOY (aq)
aluminum perchlorate	AI (CLO4)3(S) H20(2) AI (ag) + 3 CLO4(ag)	All (ag), Cloy(ag)
potassium dihydrogen phosphite	KH2PO3(S) H20(2) Kt cap) + H2PO3 (aq)	Ktag), H2PO3 (ag)
HC ₂ H ₃ O ₂	H2 C HC2 H302 ag) + H20(1) => H30 ag + C2H302	cay) HC2H3 O2 (aq)
CH ₃ COOH	CH3COOH(aq) + H2O(2) = H3Otaq) + CH3COO(aq)	CH3 COOH(aq)
both acetic acid	V	V

CHEM 130

Spring 2020

Convert each statement below into a balanced chemical equation. If the products are not given, you must predict what the products will be. Most of the reactions in which you have to predict the products are double displacement reactions, the others are combustion reactions. In your balanced chemical equation, make sure you include the physical states of the reactants and products.

1) Potassium metal reacts with fluorine gas to produce potassium fluoride.

2K(s) + F2(g) -> 2KF(s)

 Nitrogen gas reacts with hydrogen gas under high temperature to form ammonia gas.

NZ(q) + 3HZ(q) ~> ZNHZ(q)

3) Sulfur trioxide gas dissolves in water to form sulfuric acid.

503(g) + H20(1) -> H2504(ag)

4) Solid calcium carbonate is heated to form solid calcium oxide & carbon dioxide gas.

CaCO3(s) ~> CaO(s) + CO2(g)

5) Water undergoes electrolysis to form oxygen gas & hydrogen gas.

2H20(2) electric 2H2(q) + O2(q)

CHEM 130

Spring 2020

6) Aluminum metal is placed in aqueous hydrocloric acid and forms aqueous aluminum chloride and hydrogen gas.

2 Alcs) + GHClag) -> ZALCl3 (ag) + 3H2(g)

 Copper metal is immersed in a silver chlorite solution, aqueous copper(II) chlorite and solid silver are formed.

(u(s) + 2Ag (lozcag) -> Cu(cloz)2(aq)+2Ag(s)

- 8) Aqueous barium bromate is mixed with aqueous lithium phosphate. $3Ba(BrO_3)_{2(e_{p})} + 2Li_3PO_{4(e_{p})} \longrightarrow Ba_3(PO_4)_{2(s)} + 6LiBrO_3(a_{p})$
- 9) Hydrochloric acid reacts with solid magnesium hydroxide. 2HClags + Mg(OH)2(s) -> 2H2O(l) + Mg(l2(aq))
- 10) Aqueous manganese(V) perchlorate is mixed with aqueous sodium sulfide. $2Mn(Clo_4)_5(aq) + 5Na_2S_{caq} \rightarrow 10NaClo_4(aq) + Mn_2S_5(s)$
 - 11) Propane gas, C_3H_8 , is burned (combusted). $C_3H_8(g) + 50_2(g) \longrightarrow 3CO_2(g) + 4'H_2O(g)$
 - 12) Liquid MTBE, $C_5H_{12}O$, is burned(combusted). $2\left(C_5H_{12}O(u) + \frac{15}{2}O_2(g) \longrightarrow 5CO_2(g) + GH_2O_g\right)$ $2C_5H_{12}O(u) + 15O_2(g) \longrightarrow 10CO_2(g) + 12H_2O(g)$

CHEM 130

Spring 2020

Convert each of the statements below into a balanced chemical equation. After balancing each reaction, write the complete ionic equation and the net-ionic equation. Place a box around the net-ionic equation and list the spectator ions below this equation. You can predict the products of these reactions by noting that they are double displacement reactions.

1) An aqueous solution of lead(II) nitrate is mixed with an aqueous solution of potassium iodide. Pb(NO3)2(ap) +2KIcap) -> 2KNO3(ap) + PbI2(s) ME? TIE: Pb2tag) + 2N03 cag) + 2Ktag) + 2I (aq) -> 2Ktag) + 2N03 (aq) + PbI2(S) spectator ions under lined Pb2+(aq)+2Icaq) -> PbI2(s) NIE 2) Aqueous calcium chloride is mixed with aqueous ammonium phosphate. ME: 3 Ca Cl2(ag) +2(NH4)3 804 (ag) -> Ca3(804)215) + GNH4 Cl(ag) TIE: 3 Ca (aq) + 6 ((aq) + 6 NH4 (aq) + 2PO2 (aq) -> Ca3 (PO4)2(5) + 6 NH4 (aq) (aq) 3 (a 2 tag) + 2 PO4 tag) -> (a3 (PO4)2(S) NIF . 3) Aqueous platinum(III) bromide reacts with aqueous sodium sulfide. ME: 2Pt Bracagi + 3Na2 Scaqi -> Pt2 S3(S) + GNaBr (aq) TIE: 2Pt (ag) + 6Br cap + 6Nat (ag) + 352 cap) -> Pt 2S3(5) + 6Nat (ag) + 6Br cap) 2 Pt dags + 3 S dags -> Pt2S3(S) NIE: Aqueous hypochlorous acid is mixed with aqueous calcium hydroxide. Assume the 4) product, calcium hypochlorite, is soluble in water. ZHCeOcaq) + Ca(OH)2caq) -> ZH2O(1) + Ca(UO)2(aq) ME. 2Helo(aq) + Ca (aq) + 20H (aq) > 2H2O(1) + Ca (aq) + 2 clo (aq) TIE: 2HCLO (aq) + 20H (aq) -> 2H2O(2) + 2 CLO (aq) NIE: HCLO is not ionized as a reactant because it is a weak acid. Aqueous hydrobromic acid is mixed with aqueous sodium hydroxide. 5) HBr (aq) + NaOH (aq) -> H2O(1) + NaBr (aq) ME: H30⁺(aq) + Br caq) + Na (aq) + OH (aq) -> 2H2O(2) + Na (aq) + Br caq) TIE? H30+ (aq) + OH (aq) -> 2H2O(1) (water added to keep balance d NIE : HBr is a strong acid and ionizes in water to form H30⁺and Br.

* Hasoy ionizes twice, first as a strong acid, then a weak acid.		
CHEM 130 $H_{SO4}(aq) + H_{2O}(l) \rightleftharpoons H_{SO4}(aq) + SO4(aq)$ Spring 2020		
6) Aqueous potassium chioride is combined with aqueous magnesium acetate. $MF^{*} = 2K (1) + M_{2}(CH_{3}COO) = 0 + M_{2}(2 + 2K CH_{2}COO) = 0$		
rice all deag) right start start and start all all all all all all all all all al		
TIE: 2Kt 2(ling) + Mg(aq) + 2cH3(00rag) -> Mg rag) + 2(l rag) + 2h rag) +		
All ions are spectatorions!		
NIE: NO RXN		
F' Hospital to 2KOHan \rightarrow 2Hop(1) to KoSOH(ag)		
The 11 of $1/2 = 1/2$ is the set of $1/2$ is a first of $1/2$ is		
TIE: H3 (ag) + HSO4(ag) + 2K (ag) + 20H (ag) -> 3H2O(2) + 21 (ag) + SO4 (ag)		
NIE: H30+(aq) + HS04(aq) + 20H(aq) -> 3H20(1) + S04(aq)		
8) Aqueous sulfurous acid is mixed with aqueous potassium hydroxide.		
ME: H2SO3(ag) + 2 KOH(ag) -> 2H2O(1) + K2SO3(ag)		
TIE: Hasoscap + 2Kt (ap) + 20H (ap) -> 2H2O(1) + 2K(ap) + SO3 (ap)		
NIE: HaSO3 (aq) + 20H caq) -> 2H2O(1) + SO32 (aq)		
9) Aqueous copper(II) sulfate is mixed with a solution of cesium phosphate.		
ME: 3CUS04(aq) + 2C33PO4(aq) -> CU3(PO4)2(S) + 3 CS2 SO4(aq)		
TIE: $3Cu^{24}_{caq} + 3S0^{2-}_{4caq} + 6SG(s^{t}_{caq}) + 2P0^{3-}_{4caq} \rightarrow Cu_3(P04)_2(s)$		
+ 6 Cs tag) + 3 SO4 (a4)		
NIE: $3Cu^{2}_{caq} + 2P0_{4caq} \rightarrow Cu_{3}(P0_{4})_{2}(s)$		
The following reactions are oxidation-reduction reactions. You only need to predict the products and write the balanced equation.		
10) A solid magnesium ribbon is burned in air to give the solid metal evide		
$2 M_{q(s)} + O_{q(s)} \longrightarrow 2 M_{q}O_{(s)}$		
11) The high temperature of engines cause the nitrogen & oxygen in air to react to form		
nitrogen monoxide (a reaction that plays a role in the formation of smog).		
N2(g) + 02(g) 2 2NO(g)		
 Solid copper(II) chloride reacts with hydrogen gas to produce gaseous hydrochloric acid and copper metal. 		
Culla(s) + Harg) -> 2HCl(g) + Cu(s)		
13) Solid carbon is heated with fluorine gas to give gaseous carbon tetrafluoride.		
C(s) + 2Fz(g) ~> CF4(g)		

Molar Mass Worksheet

Molar Mass:

The molar mass is the term used for the mass in grams of one mole of any substance, except for atoms. Older terms for molar mass are molecular weight or formula weight. It could also be expressed as the mass in amu of one unit of that substance (i.e.: one molecule, one formula unit for ionic compounds, etc.).

Since the chemical formula of a compound tells the number of atoms (or moles of atoms) of each element, the molar mass is simply the sum of all atomic masses, as shown below:

To calculate the molar mass of CCl₃F (CFC-13)

 $1 \mod C \ \text{atoms} = 1 \ (12.01 \ \text{g}) =$ 12.01 g 1 mol F atoms = 1 (19.00 g) = 19.00 g3 mol Cl atoms = 3(35.45 g) = +106.35 g

137.36 g/mol or amu/molecule

1

Problems:

Calculate the molar mass of the following compounds:

1) TNT = $C_7H_5N_3O_6$:

2) Copper(II) oxide, CuO:

$$(G_{3.55g}) + 1(1G_{.00g}) = 79.55g/mol$$

3) Hydrogen, H₂:

$$2(1.00g) = 2.016 g/mo$$

4) Sulfur dioxide, SO₂:

$$1(32.07g) + 2(16.00g) = 64.07g/mol$$

5) Potassium nitrate, KNO3:

$$1(39.10g) + 1(14.01g) + 3(16.00g) = 101.11g/mol$$

6) Ammonium hydroxide, NH_4OH :

$$1(14.01g) + 5(1.008g) + 1(16.00g) = 35.05g \text{(mol})$$

Acetic acid. CH_COOH:

7) Acetic acid, CH₃COOH:

$$2(12.0lg) + 4(1.008g) + 2(16.00g) = 60.05i2 g [mol]$$

8) Sodium sulfate, Na₂SO₄:

$$2(22.99g) + 1(32.07g) + 4(16.00g) = 142.05g \text{ [mol}$$

9) Potassium dichromate, $K_2Cr_2O_7$:

$$2(39.10g) + 2(52.00g) + 7(16.00g) = 294.20g/mol$$

10) Copper(II) sulfate pentahydrate, CuSO₄·5 H₂O:
try cromming every thing together! CuSOq Hio
1(63.55g) + 1(32.07g) + 9(16.00g) + 10(1.008g) = 249.70g/mol

Remember: amu = U Worksheet: The Mole

1) What is the mass (in amu) of 2500. atoms of Carbon?

$$(2500. \text{ Catoms}) \left(\frac{12.01 \text{ amu}}{\text{Catom}}\right) = 3002[5 \text{ amu} = 30020 \text{ amu}]$$
2) How many Zine atoms are there in 5.00 x 10¹⁹ amu?
$$(5.00 \times 10^{19} \text{ amu}) \left(\frac{2 \text{ n atom}}{65.38 \text{ amu}}\right) = 7.64!76 \text{ Znatoms} = 7.65 \times 10^{17} \text{ cmu}$$

Znatoms

3) How many moles of He atoms are there in 221,000 He atoms?

$$(221000 \text{ He atoms}) \left(\frac{\text{mol}}{6.022 \times 10^{23} \text{ atoms}}\right) = 3.66 \frac{99 \times 10^{-19}}{10^{-19}} \text{ mol He}$$

many atoms are there in 0.98 moles of iron

$$(0.98 \text{ mol} \text{Fe}) \left(\frac{G.022 \times 10^{23} \text{ atoms}}{\text{mol}} \right) = 5.9!02 \text{ Fe} \times 10^{23} \text{ Fe} \text{ atoms}$$

= 5.9 × 10²³ Fe atoms

5) How many moles of cesium are in 66.45 g Cs?

$$(GG.45 gCs)(\frac{mol}{132.9 g}) = 0.5000; molCs = 0.5000 molCs$$

6) What is the mass in g of 6.52×10^{18} atoms of gold? $(6.52 \times 10^{18} \text{Au atoms}) (\frac{\text{mol}}{6.022 \times 10^{23} \text{ atoms}} (\frac{197.09}{\text{mol}}) = 2.13 29 \times 10^{3} \text{g} \text{Au}$

7) How many moles of CCl₃F are there given 435.2 g? Molar Mass = 137.36 g/mol $(435.2 \text{ g} CCl_3F) \left(\frac{\text{mol}}{137.36 \text{ g}}\right) = 3.168!32 \text{ mol} CCl_3F = 3.168 \text{ mol} CCl_3F$

8) How many grams of TNT (TNT = $C_7H_5N_3O_6$) are there given 0.665 moles? Molar Mass = 227.14g(mol $(0.665 \text{ mol} \text{TNT}) \left(\frac{227.14g}{\text{mol}} \right) = 151.05 \text{ g} \text{TNT} = 151 \text{ g} \text{TNT}$

9) How many moles are in 57.2 g of octane (C8H18)? Molar Mass = 114. 22;4 g (mol $(57.2q \text{ (8H18)} \left(\frac{\text{mol}}{114.22!4q} \right) = 0.500!77 \text{ mol} \text{ (8H18} = 0.501 \text{ mol} \text{ (8H18})$

10) How many moles are in 0.44 g of nitric acid (HNO3)? Molar Mass = 63.01 8g/mol $(0.44 \text{ g} \text{HNO}_3) \left(\frac{\text{mol}}{\text{G3.01}; 8 \text{ g}} \right) = 0.00 \text{ G} \frac{9}{82} \text{ mol} \text{HNO}_3 = 7.0 \text{ x} 10^{-3} \text{ mol} \text{HNO}_3$