**Station #1: Physical Properties of Bonds**

1. List 5 unique physical properties of:

* 1. Ionic compounds
  2. Covalent compounds
  3. Metallic compounds

2. Identify the type of bond present in each substance below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Substance** | **Melting Point** | **Boiling Point** | **Conductivity** |
| *A* | -80 | -20 | None |
| *B* | 20 | 190 | None |
| *C* | 320 | 770 | as solid |
| *D* | 800 | 1250 | in solution |

**Station #2: Chemical Properties of Bonds**

1. When atoms bond, the arrangement of their valence electrons changes. Describe how the electrons change in each of the following bond types:

Ionic compounds

Covalent compounds

Metallic compounds

2. Ionic compounds must be composed of 2 ions, one cation and one anion. How are cations and anions formed? Where on the periodic table are elements that form cations? Anions? Draw a rough sketch of the periodic table to indicate where these ions are formed.

3. A covalent bond is created between which types of elements? Where on the periodic table are these elements?

4. Two atoms have an electronegativity difference of 2.4. What is the bond type?

**Station #3: Molecular Shapes (VSEPR) Theory**

Draw the Lewis Dot structure for H2O, CO2, and PH3

Name and describe the shapes for those 3 compounds.

Read further ONLY if you do not remember how to draw Lewis Structures.

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Steps for drawing Lewis structures:

1. Determine the chemical formula for the substance.
2. Add up the total number of valence electrons for all elements. **These must all be used**.
3. Determine which at is the central atom.
4. Oftentimes the element written first in the formula is the central atom.
5. The least electronegative atom is the central atom.
6. If carbon is present it is always the central atom.
7. If hydrogen is present, it is NEVER the central atom.
8. Draw the symbols for the elements and connect them by single bonds. A single bond represents two electrons.
9. Once all atoms are connected by single bonds, complete the octet of every atom with lone pair electrons.
10. If all the valence electrons are used and the octet configuration is not achieved (is lacking electrons), then one or more multiple bonds must exist. For every two electrons that are needed that do not exist, a multiple bond is needed. If four electrons are needed, either two double bonds may be needed, or a triple bond may be needed.

**Station #4: Intermolecular Forces & Bond Polarity**

1. Determine the intermolecular forces (IMFs) in the following compounds: OF2, NH3, CO2

2. Rank the forces from strongest to weakest.

3. Determine the polarity (polar or nonpolar) of these molecules.

**Station #5: Mole Conversions**

1. Calculate the molar mass of the following compounds:

Mg(OH)2, H2O, CO2, and PH3

2. How many moles of magnesium is 3.01 x 1022 atoms of magnesium?

3. How many molecules are there in 4.00 moles of glucose, C6H12O6?

4. How many moles are 1.20 x 1025 atoms of phosphorous?

5. How many moles in 28 grams of CO2 ?

6. What is the mass of 5 moles of Fe2O3 ?

7. Determine the volume in liters occupied by 14 g of nitrogen gas at STP.

8. How many oxygen molecules are in 3.36 L of oxygen gas at STP?

**Station #6: Mole Formulas**

1. Analysis of a compound is found to be 85.31 % Phosphorus and 14.69 % Oxygen. Find the empirical formula.

2. What is the molecular formula for a compound whose empirical formula is CH4 and has a molecular mass of 32 g?

3. Analysis of a compound is found to be 74.83% carbon and 25.17% hydrogen. The molecular mass is 64.2 grams per mole. Find the empirical and the molecular formula of the compound.

4. Rubbing alcohol was found to contain 60.0 % carbon, 13.4 % hydrogen, and the remaining percentage was due to oxygen. What is the empirical formula of rubbing alcohol?

**Station #7: Percent Compositions**

1. Show all work. Given the compound Ca(ClO3)2:

a. Calculate the molar mass.

b. Calculate the percent composition of Ca.

c. Calculate the percent composition of Cl.

d. Calculate the percent composition of O.

2. Show all work. Given the compound Ba(ClO4)2 :

a. Calculate the molar mass

b. Calculate the percent composition of Ba:

c. Calculate the percent composition of Cl:

d. Calculate the percent composition of O:

**Station #8: Gas Laws**

1. What is standard temperature and pressure defined as?

*For all math problems, show all work, including equations, variables, and units:*

2. What is the total pressure for a mixture of gases that contains four gases with partial pressures of 5.00 kPa, 4.56 kPa, 3.02 kPa, and 1.20 kPa.

3. A sample of a gas has a volume of 2.0 liters at a pressure of 1.0 atm. When the volume increases to 4.0 liters, at constant temperature, the pressure will be?

4. A sample of gas occupies a volume of 0.050 Liters in a cylinder with a movable piston. The pressure of the sample is 0.90 atmosphere and the temperature is 298 K. What is the volume of the sample at STP?

5. Two moles of an unknown gas has a pressure of 1.5 atm and temperature of 300K, at what volume will this gas occupy?

**Station #9: States of Matter**

1. Read the chart and fill out the remaining spaces on the table. When you are finished, erase only what you wrote in:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Solid | Liquid | Gas |
| Shape | fixed | Not fixed; takes the shape of the container |  |
| Volume | Fixed Volume |  | No fixed volume |
| Space Between Particles |  | medium | large |
| Movement Between Particles | Cannot move freely, fixed locations |  | Can move quickly and freely in all directions in the container |

2. Draw a Heating and Cooling Curve Graph. Label all potential and kinetic energies, label all states of matter, label heat (q) equations.

3. Draw and Label a Phase Diagram (Solid, Liquid, Gas, Triple Point, Critical Point, and phase changes)

4. Solve: What is the specific heat of silver if a 93.9 g sample cools from 2150C to 1960C with the loss of 428 J of energy?

5. Solve: What is the total number of Joules that would need to be removed in order to condense 100 grams of water at 1000C?

6. Solve: What was the total number of Joules of heat needed to change 10.0g of ice to water?

**Station #10: Balancing Chemical Reactions**

Balance the following reactions:

a. \_\_\_\_\_HCl + \_\_\_\_\_Al2O3 → \_\_\_\_\_AlCl3 + \_\_\_\_\_H2O

b. \_\_\_\_\_H2 + \_\_\_\_\_Cl2 → \_\_\_\_\_HCl

c. \_\_\_\_\_C2H2 + \_\_\_\_\_O2 → \_\_\_\_\_CO2 + \_\_\_\_\_ H2O

d. \_\_\_\_\_AgNO3 + \_\_\_\_\_H2S → \_\_\_\_\_Ag2S + \_\_\_\_\_HNO3

e. \_\_\_\_\_P2S5 + \_\_\_\_\_O2 → \_\_\_\_\_P4O10 + \_\_\_\_\_S

f. \_\_\_\_\_Hg(NO3)2 + \_\_\_\_\_FeCl3 → \_\_\_\_\_HgCl2 + \_\_\_\_\_ Fe(NO3)3

g. \_\_\_\_\_NaOH + \_\_\_\_\_H3PO4 → \_\_\_\_\_Na3PO4 + \_\_\_\_\_ H2O\*

h. \_\_\_\_\_SO3 + \_\_\_\_\_ H2O → \_\_\_\_\_H2SO4

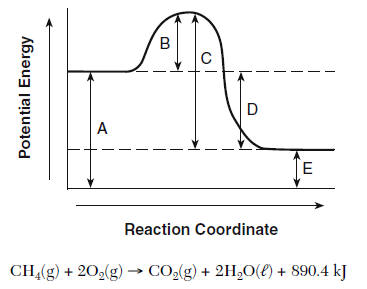
i. \_\_\_\_\_NH3 → \_\_\_\_\_N2 + \_\_\_\_\_H2

j. \_\_\_\_\_BaF2 + \_\_\_\_\_ H2SO4 → \_\_\_\_\_Ba(HSO4)2 + \_\_\_\_\_HF

h. \_\_\_\_\_H2 + \_\_\_\_\_O2 🡪 \_\_\_\_\_H2O

i. \_\_\_\_\_NH3 🡪 \_\_\_\_\_N2 + \_\_\_\_\_H2

**Station #11: Potential Energy Diagrams & Collision Theory**



1. Is the overall reaction as shown exothermic or endothermic? How do you know?

2. What is the activation energy for the forward reaction?

3. What is the activation energy for the reverse reaction?

4. What is the enthalpy change for for the forward reaction?

5. What is the for the reverse reaction?

6. Is the reverse reaction exothermic or endothermic?

7. Which species is the activated complex?

8. Which species or group of species has the highest potential energy?

9. Collision Theory states that chemical reactions occur when molecules collide to form new products. What two criteria must be true about these collisions in order for the reaction to happen?

**Station #12: Predicting Products**

1. C4H8 + O2 →

2. Rb + P →

3. AlI3 →

4. Li + FeBr2 →

5. Ca(OH)2 + KCl →

6. Al + O2 →

7. BaSO4 + MgCl2 →

8. Cu(ClO3)2 →

9. Fe2(CO3)3 →

10. Ba + S →

11. Co + O2 →

12. Ni + Mn(OH)6 →

13. KCl + Mg(NO3)2 →

14. H2 + Br2 →

15. Ba + H3PO4 →

16. Sn(OH)4 + Al(NO3)3 →

17. PbSO4 →

18. Mn2O7 →