

**The Periodic Table**

<i>IA</i> <b>H</b> 1 1.01																	<i>VIIIA</i> <b>He</b> 2 4.00
<b>Li</b> 3 6.94	<i>IIA</i> <b>Be</b> 4 9.01											<i>IIIA</i> <b>B</b> 5 10.81	<i>IVA</i> <b>C</b> 6 12.01	<i>VA</i> <b>N</b> 7 14.01	<i>VIA</i> <b>O</b> 8 16.00	<i>VIIA</i> <b>F</b> 9 19.00	<b>Ne</b> 10 20.18
<b>Na</b> 11 22.99	<b>Mg</b> 12 24.31											<b>Al</b> 13 26.98	<b>Si</b> 14 28.09	<b>P</b> 15 30.97	<b>S</b> 16 32.07	<b>Cl</b> 17 35.45	<b>Ar</b> 18 39.95
<b>K</b> 19 39.10	<b>Ca</b> 20 40.08	<i>IIIB</i> <b>Sc</b> 21 44.96	<i>IVB</i> <b>Ti</b> 22 47.88	<i>VB</i> <b>V</b> 23 50.94	<i>VIB</i> <b>Cr</b> 24 52.00	<i>VII B</i> <b>Mn</b> 25 54.94	<i>VIII B</i> <b>Fe</b> 26 55.85	<i>VIII B</i> <b>Co</b> 27 58.93	<i>VIII B</i> <b>Ni</b> 28 58.69	<i>IB</i> <b>Cu</b> 29 63.55	<i>IIB</i> <b>Zn</b> 30 65.39	<b>Ga</b> 31 69.72	<b>Ge</b> 32 72.61	<b>As</b> 33 74.92	<b>Se</b> 34 78.96	<b>Br</b> 35 79.90	<b>Kr</b> 36 83.80
<b>Rb</b> 37 85.47	<b>Sr</b> 38 87.62	<b>Y</b> 39 88.91	<b>Zr</b> 40 91.22	<b>Nb</b> 41 92.91	<b>Mo</b> 42 95.94	<b>Tc</b> 43 (97.9)	<b>Ru</b> 44 101.07	<b>Rh</b> 45 102.91	<b>Pd</b> 46 106.42	<b>Ag</b> 47 107.87	<b>Cd</b> 48 112.41	<b>In</b> 49 114.82	<b>Sn</b> 50 118.71	<b>Sb</b> 51 121.76	<b>Te</b> 52 127.60	<b>I</b> 53 126.90	<b>Xe</b> 54 131.29
<b>Cs</b> 55 132.91	<b>Ba</b> 56 137.33	<b>La</b> 57 138.91	<b>Hf</b> 72 178.49	<b>Ta</b> 73 180.95	<b>W</b> 74 183.85	<b>Re</b> 75 186.21	<b>Os</b> 76 190.2	<b>Ir</b> 77 192.22	<b>Pt</b> 78 195.08	<b>Au</b> 79 197.97	<b>Hg</b> 80 200.59	<b>Tl</b> 81 204.38	<b>Pb</b> 82 207.2	<b>Bi</b> 83 208.98	<b>Po</b> 84 (209)	<b>At</b> 85 (210)	<b>Rn</b> 86 (222)
<b>Fr</b> 87 223.02	<b>Ra</b> 88 226.03	<b>Ac</b> 89 227.03	<b>Rf</b> 104 (261)	<b>Db</b> 105 (262)	<b>Sg</b> 106 263	<b>Bh</b> 107 (262)	<b>Hs</b> 108 (265)	<b>Mt</b> 109 (266)	<b>Ds</b> 110 (271)	<b>Rg</b> 111 (272)	<b>Uub</b> 112 (285)	<b>Uut</b> 113 (284)	<b>Uuq</b> 114 (289)	<b>Uup</b> 115 (288)			

<b>Ce</b> 58 140.12	<b>Pr</b> 59 140.91	<b>Nd</b> 60 144.24	<b>Pm</b> 61 (145)	<b>Sm</b> 62 150.36	<b>Eu</b> 63 152.97	<b>Gd</b> 64 157.25	<b>Tb</b> 65 158.93	<b>Dy</b> 66 162.50	<b>Ho</b> 67 164.93	<b>Er</b> 68 167.26	<b>Tm</b> 69 168.93	<b>Yb</b> 70 173.04	<b>Lu</b> 71 174.97
<b>Th</b> 90 232.04	<b>Pa</b> 91 231.04	<b>U</b> 92 238.03	<b>Np</b> 93 237.05	<b>Pu</b> 94 (240)	<b>Am</b> 95 243.06	<b>Cm</b> 96 (247)	<b>Bk</b> 97 (248)	<b>Cf</b> 98 (251)	<b>Es</b> 99 252.08	<b>Fm</b> 100 257.10	<b>Md</b> 101 (257)	<b>No</b> 102 259.10	<b>Lr</b> 103 262.11

**Solubility Guidelines:**

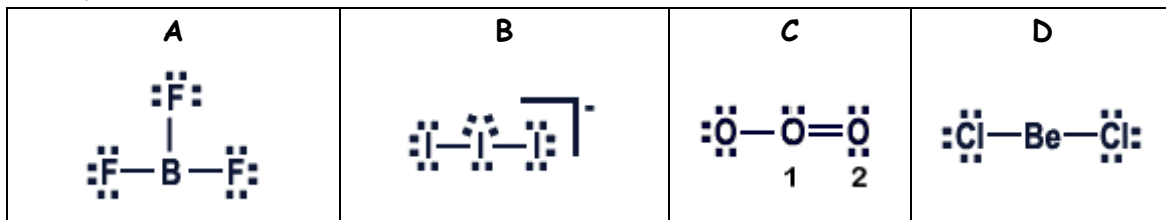
Soluble Ionic Compounds	
1.	All sodium, potassium and ammonium salts are soluble.
2.	All nitrate, acetate, chlorate and perchlorate salts are soluble
3.	All chloride, bromide and iodide salts are soluble. Except those that contain: lead, silver or mercury(I) ( $\text{Hg}_2^{2+}$ ).
4.	All fluoride salts are soluble. Except those that contain: magnesium, calcium, strontium, barium or lead.
5.	All sulfate salts are soluble. Except those that contain: calcium, silver, mercury(I), strontium, barium or lead.
Not Soluble Ionic Compounds	
1.	All hydroxide and oxide salts are not soluble. Except those that contain: sodium, potassium or barium.
2.	All sulfide salts are not soluble. Except those that contain: sodium, potassium ammonium or barium.
3.	All carbonate and phosphate salts are not soluble. Except those that contain: sodium, potassium or ammonium.



## Question 1

16 Points

The following questions refer to the molecules whose Lewis Dot Structure are depicted below.



- The **number** of molecules whose sigma bonding about the central atom is best described by **sp** hybridization? \_\_\_\_\_
- The **molecule(s)** whose bonding about the central atom is best described using **sp<sup>2</sup>** hybrid orbitals? \_\_\_\_\_
- The bonding about the central **I** atom in **B** is best described using what type of **hybridization**? \_\_\_\_\_
- The molecule with the **greatest** number of **pi** bonds? \_\_\_\_\_
- The molecule with the **greatest** number of **sigma** bonds? \_\_\_\_\_

The following questions refer to the O<sub>3</sub> (**Molecule C**)

- The lone pair on the central oxygen atom is best described as being in what **type** of **orbital**? \_\_\_\_\_
- The **O=O** bond is best described: as a sigma bond formed from the overlap of a(n) \_\_\_\_\_ on **O1** with a(n) \_\_\_\_\_ on **O2**; and a pi bond formed by the overlap of a(n) \_\_\_\_\_ orbital on **O1** with a(n) \_\_\_\_\_ orbital on **O2**.

## Question 2

10 Points

Complete the following chemical reactions: (Give the **formula** for the **products**)

- Iron(III) perchlorate + sodium hydroxide = \_\_\_\_\_
- Hydrofluoric acid (HF) + potassium hydroxide = \_\_\_\_\_
- Cobalt(II) carbonate + hydrochloric acid = \_\_\_\_\_

With respect to the above reactions, which one is:

- An **acid base** reaction: \_\_\_\_\_
- A **gas forming** reaction: \_\_\_\_\_
- A **precipitation** reaction: \_\_\_\_\_

## Question 3

12 Points

1. Consider the reaction when aqueous solutions of **calcium nitrate** and **potassium hydroxide** are combined. The net ionic equation for this reaction is:

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2. Write a net ionic equation for the reaction that occurs when aqueous solutions of **lithium hydroxide** and **hydrocyanic acid** (HCN) are combined.

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3. Write a net ionic equation for the reaction that occurs when aqueous solutions of **sodium carbonate** and **hydroiodic acid** are combined.

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## Question 4

8 Points

A sample of ethylene glycol with a mass of **74.0g** at **6°C** is placed into a perfectly insulated container together with **93.0g** of glass at **76°C**. Calculate the final temperature of the sample when thermal equilibrium is reached?

Heat capacities:      Glass = **0.84 J/g°C**

Ethylene glycol = **2.41 J/g°C**

°C

## Question 5

8 Points

**21.19 g** of **LiCl** are dissolved in **170.0g** of **water** in a calorimeter the following data was collected:

Initial Temperature:      **24.4°C**

Final Temperature:      **42.5°C**

Solution Heat Capacity:      **4.184 J/g°C**

Calorimeter constant:      **63.9 J/°C**

What is the **heat of solution** for this compound in **J/mol**?

J/mol

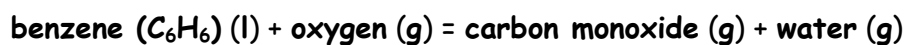
Question 6  
7 Points

How many grams of solid **barium hydroxide** are needed to exactly neutralize **12.1 mL** of a **0.562 M nitric acid** solution? Assume that the volume remains constant.

g

Question 7  
12 Points

For the following reaction, **4.34 grams** of **benzene (C<sub>6</sub>H<sub>6</sub>)** are allowed to react with **5.6 grams** of **oxygen gas**.



1. What is the maximum amount in **moles** of **carbon monoxide** that can be formed?

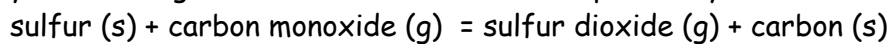
mol CO

2. What is the **FORMULA** for the limiting reagent? \_\_\_\_\_
3. What amount in **grams** of the excess reagent remains after the reaction is complete? Grams

g

Question 8  
7 Points

For the following reaction, **5.61** grams of sulfur are mixed with excess carbon monoxide. The reaction yields **3.16** grams of **carbon**. What is the percent yield?



%

Question 9  
6 Points

After a **533 g** block of **copper** absorbs **1,700 J** of heat it reaches a temperature of **44.6 °C**. If the heat capacity of copper is **0.385 J/g.°C**, what was the initial temperature of the piece of copper?

°C

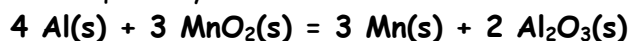
Question 10  
8 Points

Given the following thermodynamic data:

$$\Delta H_f^\circ \text{MnO}_2(\text{s}) = -504.0 \text{ kJ/mol}$$

$$\Delta H_f^\circ \text{Al}_2\text{O}_3(\text{s}) = -1675.7 \text{ kJ/mol}$$

What quantity of heat is absorbed or evolved upon the production of **25.49g** of **Al<sub>2</sub>O<sub>3</sub>**:



kJ \_\_\_\_\_ (Released/Absprbed)

Question 11  
4 Points

The Ideal Gas equation,  $PV = nRT$ , breaks down at **high pressures** and **low temperatures**. Why is this?

Do Not Write Below This Line

Exam III Score