The Periodic Table

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

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

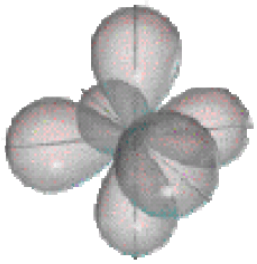
SID | | | | | | | | | Last _____ First _____

Question 1 (6 Points)

Classify each of the following molecules as polar or nonpolar?

1. $BeCl_2$ _____
2. IF_3 _____
3. NH_2Cl _____

Question 2 (5 Points)



There are _____ **hybrid orbitals** represented by the picture on the left. They are composed of* _____ (s) _____ (p) _____ (d) **atomic orbitals**, corresponding to _____ **hybridization**. They have the **electron pair geometry** _____ with **bond angles** of _____.

* - Give the **number** of each of these orbitals that make the hybrid orbital depicted.

Question 3 (6 Points)

A molecule has **sp^3d** hybridization with **2 lone pairs**:

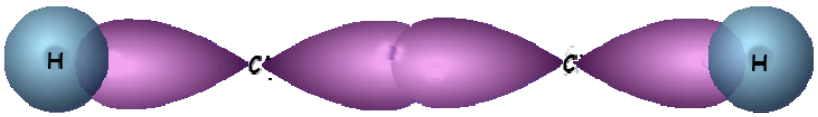
a) The **electron pair geometry** of this molecule is _____

b) The **geometry** of this molecule is _____

c) The **approximate bond angle** in the molecule _____

Question 4 (6 Points)

Depicted below is the sigma bonds HC≡CH.



1. The **sigma** bond formed between the two carbon atoms is best described as being between the overlap of two _____ hybrid orbitals.
2. The **sigma** bond formed between the **hydrogen** and **carbon** is best described as being the overlap of an _____ hybrid orbital on carbon with the _____ orbital on hydrogen.
3. If the **pi** bonds were to be depicted one would see _____ pi bond(s).

Question 5 (4 Points)

The compound **iron(II) sulfate** is a strong electrolyte. Write the reaction when iron(II) sulfate is put into **water**:

_____ = _____

Question 6
4 Points

Consider the reaction when aqueous solutions of **aluminum sulfate** and **cobalt(II) nitrate** are combined. The **net ionic equation** for this reaction is:

_____ = _____

Question 7
4 Points

Consider the reaction when aqueous solutions of **sodium carbonate** and **ammonium nitrate** are combined. The **net ionic equation** for this reaction is:

_____ = _____

Question 8
4 Points

Write a **net ionic equation** for the overall reaction that occurs when aqueous solutions of **potassium hydroxide** and **hydrosulfuric acid** (H_2S) are combined.

_____ = _____

Question 9
4 Points

Write a **net ionic equation** for the reaction that occurs when excess **hydrofluoric acid** (HF) and **calcium carbonate** are combined.

_____ = _____

Question 10
8 Points

A **41.2g** sample of copper at **99.8°C** is dropped into a beaker containing **153g** of **water** at **18.5°C**. What is the **final temperature** when thermal equilibrium is reached? *Assume the beaker neither absorbs nor loses heat.*

Heat Capacities: Cu = 0.385 J/g°C H_2O = 4.184 J/g°C

For full credit you must show work.

_____ ^0C

Question 11
5 Points

A sample of solid **silver** is heated with an electrical coil. If **33.6** Joules of energy are added to a **13.0 gram** sample and the final temperature is **35.2°C**, what is the **initial temperature** of the silver? **Heat Capacity**: Ag = 0.237 J/g°C

For full credit you must show work.

_____ **°C**

Question 12
5 Points

The following thermochemical equation is for the reaction of nitrogen(g) with oxygen(g) to form dinitrogen monoxide(g).

$$2N_2(g) + O_2(g) = 2N_2O(g) \quad \Delta H = 164 \text{ kJ}$$

How many **grams** of $N_2(g)$ would be made to react if **25.0 kJ** of energy were provided?

For full credit you must show work.

_____ **g N_2**

Question 13
5 Points

0.927 grams of benzoic acid is burned completely in a bomb calorimeter. The bomb is surrounded by **1.000 kg** of water. The temperature increases from **25.12** to **29.36** degrees Celsius. If the **heat capacity** of the bomb is **1.60 kJ/°C**, calculate the **heat of combustion** of the benzoic acid **in kJ/gram**. The specific heat of water is **4.184 J/g°C**.

Circle the best answer!

- o -9.2 kJ/gram
- o 18.9 kJ/gram
- o 21.4 kJ/gram
- o -26.5 kJ/gram
- o -32.7 kJ/gram

Question 14
4 Points

Given the **standard enthalpy** changes for the following two reactions:

(1) $N_2(g) + 2\ O_2(g) = N_2O_4(g)$ ..... $\Delta H^\circ = 9.2$ kJ

(2) $2\ N_2O(g) = 2\ N_2(g) + O_2(g)$ ..... $\Delta H^\circ = -164.2$ kJ

what is the **standard enthalpy change** for the reaction:

(3) $2\ N_2O(g) + 3\ O_2(g) = 2\ N_2O_4(g)$ ..... $\Delta H^\circ = ?$

For full credit you must show work.

_____ **kJ**

Question 15
4 Points

Using standard **heats of formation** given, calculate the standard **enthalpy change** for the following reaction:

$4\ NH_3(g) + 5\ O_2(g) = 4\ NO(g) + 6\ H_2O(g)$

[ΔH^0_f: $NH_3(g)$, **-46** kJ/mol $NO(g)$, **90** kJ/mol $H_2O(g)$, **-242** kJ/mol]

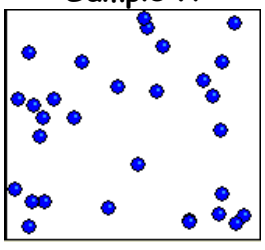
For full credit you must show work.

_____ **kJ**

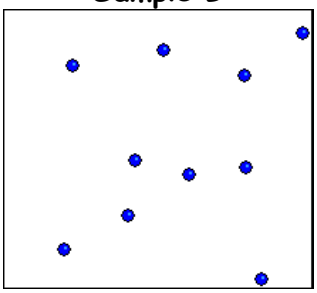
Question 16
4 Points

In the following 2-D illustrations, **assume that the gas molecules are in motion** and that if there is a **larger box it indicates a larger volume** for the container holding the molecules.

Sample A



Sample B



- o A and B are at the **same temperature**.
- o B has the **highest temperature**.
- o A has the **highest temperature**.
- o A has a **smaller average kinetic energy**.

Question 17
8 Points

0.758 moles of **hydrochloric acid** are allowed to react with **0.416** moles of **barium hydroxide**.

hydrochloric acid (aq) + barium hydroxide (aq) = barium chloride (aq) + water (l)

What is the maximum amount in **grams** of **barium chloride** that can be formed?
For full credit you must show work.

_____ g of barium chloride

Question 18
7 Points

For the following reaction, **5.03** grams of water are mixed with excess **sulfur dioxide**. The reaction yields **20.2** grams of **sulfurous acid** (H_2SO_3).

sulfur dioxide (g) + water (l) = sulfurous acid (H_2SO_3) (g)

What is the percent yield for this reaction?
For full credit you must show work.

_____ %

Question 19
7 Points

How many grams of solid **calcium hydroxide** are needed to exactly neutralize **28.2 mL** of a **0.714 M nitric acid** solution ? Assume that the volume remains constant.
For full credit you must show work.

_____ g of calcium hydroxide

Do Not Write Below This

Exam III Score