

Name Key

Exam #1 – 100 points

Directions: Answer each question below to the best of your ability. Show all work where calculations are required. An information sheet with a periodic table is attached to the back of the exam; you may remove it if you wish.

1. (2 each) Provide the correct formula for each compound named below.

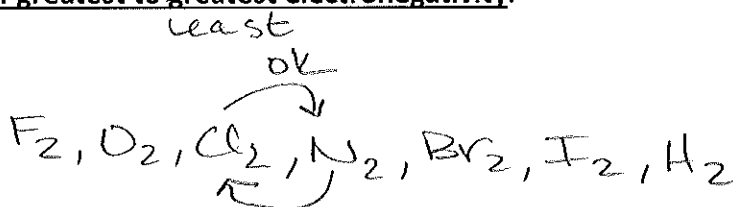
2. (2 each) For each formula below, provide the correct name of the compound. Only provide one name where more than one is possible.

manganese (IV) nitride Mn_3N_4	$HC_2H_3O_2(aq)$ acetic acid
perbromic acid (aq) $HBrO_4(aq)$	SO_2 sulfur dioxide
lithium bicarbonate $LiHCO_3$	$Cu_2(Cr_2O_7)_3$ cupric dichromate copper (III) dichromate
sodium phosphate Na_3PO_4	N_4Se_9 Tetranitrogen nonaselenide
barium hypochlorite $Ba(ClO)_2$	NH_4IO_4 ammonium periodate
phosphine PH_3	$HCl(g)$ hydrogen chloride
tetranitrogen hexafluoride N_4F_6	$SnCl_4$ stannic chloride Tin (IV) chloride
boron tribromide BBr_3	I_3O_7 Triiodine heptoxide
Hydrosulfic acid $H_2S(aq)$	$H_3PO_4(aq)$ phosphoric acid

3. (3) Provide the chemical formula for following pairs:

- a. magnesium and peroxide ion: MgO₂
- b. mercurous ion and thiocyanate ion: Hg₂(SCN)₂
- c. three nitrogen atoms and one sulfur atoms: N₃S

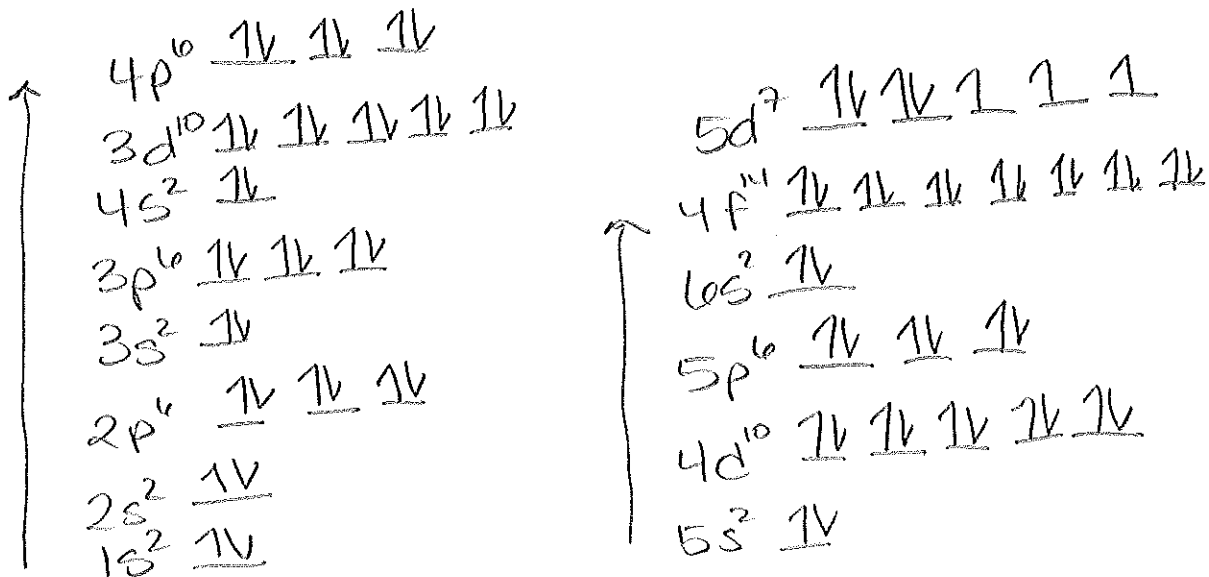
4. (4) List the formulas of the seven elements that occur as diatomic molecules in order of greatest to greatest electronegativity.



5. (7) Provide an electron configuration for each element below. You may use the Nobel Gas core if you prefer.

- a. As [Ar] 4s² 3d¹⁰ 4p³
- b. Ir [Xe] 6s² 4f¹⁴ 5d⁷
- c. Cu²⁺ [Ar] 4s² 3d⁷

6. (5) Draw the atomic orbital diagram in the correct format for the ion in the 6th period with Z = 79 and 77 electrons



7. (10) A leak in the air conditioning system of an office building releases 12 kg of CHF_2Cl per month. How many kilograms of Cl will be emitted into the atmosphere each year?

$$\text{C: } 12.01 \text{ g/mol} \times 1 = 12.01$$

$$\text{H: } 1.01 \text{ g/mol} \times 1 = 1.01$$

$$\text{F: } 19.00 \text{ g/mol} \times 2 = 38.00$$

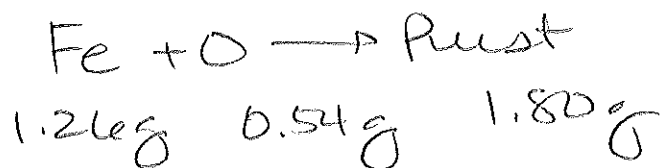
$$\text{Cl: } 35.45 \text{ g/mol} \times 1 = 35.45 +$$

$$\hline 86.47 \text{ g/mol}$$

$$\frac{12 \text{ kg } \text{CHF}_2\text{Cl}}{1 \text{ month}} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ mol}}{86.47 \text{ g}} \times \frac{1 \text{ mol Cl}}{1 \text{ mol } \text{CHF}_2\text{Cl}} \times \frac{35.45 \text{ g Cl}}{1 \text{ mol Cl}}$$

$$\times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{12 \text{ month}}{1 \text{ yr}} = 59.036 \text{ kg/yr} \rightarrow \boxed{59 \text{ kg/yr}}$$

8. (6) A chemist determines that 1.26 g of iron reacts with 0.54 g of oxygen to form rust. What is the percent composition by mass of each element in the new compound?



$$\% \text{ Fe} = \frac{1.26}{1.80} \times 100 = 70\%$$

$$\% \text{ O} = \frac{0.54}{1.80} \times 100 = 30\%$$

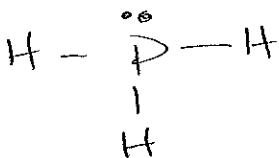
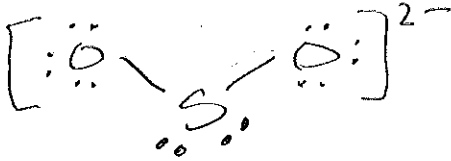
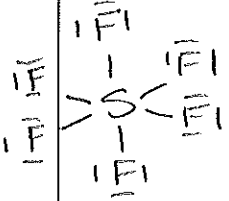
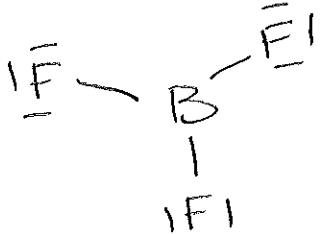
8. For each box below

a. (2) Draw the Lewis Structure for the given formula. There is only one central atom in each compound.

b. (1) Provide the name of the shape/molecular geometry of the molecule.

c. (1) Provide the approximate bond angle about the central atom.

d. (1) Determine whether or not the molecule has a molecular dipole, then circle "yes" or "no" to indicate your choice.

PH_3 	SO_2^{2-} 
Shape: <u>Trigonal pyramidal</u>	Shape: <u>bent / V shape</u>
Bond Angle(s): <u>120°</u>	Bond Angle(s): <u><109.5°</u>
Dipole? <input checked="" type="radio"/> Yes <input type="radio"/> No	Dipole? <input checked="" type="radio"/> Yes <input type="radio"/> No
SF_6  <u>Octahedral</u>	BF_3 
Shape: <u>pentagonal bipyramidal</u>	Shape: <u>trigonal planar</u>
Bond Angle(s): <u>90°, 120° / 90°, 72°</u>	Bond Angle(s): <u>120°</u>
Dipole? Yes <input type="radio"/> <input checked="" type="radio"/> No	Dipole? Yes <input type="radio"/> <input checked="" type="radio"/> No

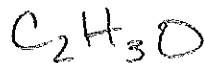
9. (9) Butanedione, a component of butter and body odor, has a cheesy smell. Elemental analysis of butanedione gave the mass percent composition: C, 55.80%; H, 7.03%; O, 37.17%. The molar mass of butanedione is 86.09 g/mol. Determine the molecular formula of butanedione.

$$\text{C: } 55.80\% \rightarrow \text{g} \times \frac{1 \text{ mol C}}{12.01 \text{ g}} = 4.65 \text{ mol C}$$

$$\text{H: } 7.03\% \rightarrow \text{g} \times \frac{1 \text{ mol H}}{1.01 \text{ g}} = 6.96 \text{ mol H}$$

$$\text{O: } 37.17\% \rightarrow \text{g} \times \frac{1 \text{ mol O}}{16.00 \text{ g}} = 2.32 \text{ mol O}$$

$$\text{Empirical: } \text{C} \frac{4.65}{2.32} \text{H} \frac{6.96}{2.32} \text{O} \frac{2.32}{2.32}$$



$$\text{mwt: } 43.05 \text{ g/mol}$$

Molecular:

$$\frac{86.09 \text{ g/mol}}{43.05 \text{ g/mol}} = 2$$



$\therefore \text{C}_4\text{H}_6\text{O}_2$ is the molecular formula

Conversion Factors & Useful Constants:

Avogadro's Number: 6.022×10^{23}

Periodic Table

1	1A 1 H 1.008	2 2A 2 He 4.003	3A 3 Li 6.941	4 4A 4 Be 9.012	5 5A 5 B 10.81	6 6A 6 C 12.01	7 7A 7 N 14.01	8 8A 8 O 16.00	9 9A 9 F 19.00	10 10A 10 Ne 20.18																									
2	3 Li 6.941	4 Be 9.012	5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18	11 11A 11 Na 22.99	12 12A 12 Mg 24.31	13 13A 13 Al 26.98	14 14A 14 Si 28.09	15 15A 15 P 30.97	16 16A 16 S 32.07	17 17A 17 Cl 35.45	18 18A 18 Ar 39.95																			
3	11 Na 22.99	12 Mg 24.31	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80									
4	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3	55 Cs 132.9	56 Ba 137.3	57 La 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3	55 Cs 132.9	56 Ba 137.3	57 La 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
6	55 Cs 132.9	56 Ba 137.3	57 La 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)			
7	87 Fr (223)	88 Ra (226)	89 Ac (227)	90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (269)	109 Mt (268)	110 Ds (272)	111 Rg (272)	112 Cn (285)	113 Nh (286)	114 Fl (289)	115 Mc (290)	116 Lv (293)	117 Ts (294)	118 Og (294)			