

**Chem 127**  
**Prof. Mark Jensen**  
**Exam #3 (Bonus)**  
**12/5/08**

Name KEY

Pledge:

When you have completed this exam, please consider the following:

*I affirm that I have neither committed nor witnessed a violation of academic integrity in the completion of this exam.*

Signed \_\_\_\_\_

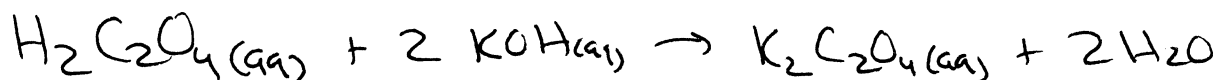
Answer the questions on the following pages, paying strict attention to **significant figures** where applicable. Answers given without supporting work WILL NOT be given full credit.

Some potentially useful information:  $N = 6.022 \times 10^{23}$

I																	18								
IA																	VIIIA								
1 H 1.008	2 He 4.00											13 B 10.81	14 C 12.01	15 N 14.01	16 O 16.00	17 F 19.00	18 Ne 20.18								
3 Li 6.94	4 Be 9.01											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 Na 22.99	12 Mg 24.31	3 Al 26.98	4 Si 28.09	5 P 30.97	6 S 32.06	7 Cl 35.45	8 Ar 39.95	9 K 39.10	10 Ca 40.08	11 Sc 44.96	12 Ti 47.88	13 V 50.94	14 Cr 52.00	15 Mn 54.94	16 Fe 55.85	17 Co 58.93	18 Ni 58.71	19 Cu 63.54	20 Zn 65.37	21 Ga 69.72	22 Ge 72.59	23 As 74.92	24 Se 78.96	25 Br 79.91	26 Kr 83.30
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 98.91	44 Ru 101.07	45 Rh 102.91	46 Pd 106.4	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.30								
55 Cs 132.91	56 Ba 137.34	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 146.92	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04										
87 Fr 223	88 Ra 226.03	103 Lr 262.1	104 Rf 178.49	105 Db 180.95	106 Sg 183.85	107 Bh 186.2	108 Hs 190.2	109 Mt 192.2	110 Ds 195.09	111 Rg 196.97	112 Uu 200.59	113 Fl 204.37	114 Lv 207.19	115 Ts 208.98	116 Og 210										

57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 146.92	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04
89 Ac 227.03	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 239.05	95 Am 241.06	96 Cm 247.07	97 Bk 249.08	98 Cf 251.08	99 Es 254.09	100 Fm 257.10	101 Md 258.10	102 No 255

1. (2 pts) Oxalic acid ( $\text{H}_2\text{C}_2\text{O}_4$ , 90.04 g/mol) is a weak acid with two acidic hydrogen atoms. A 3.50-g sample of oxalic acid is dissolved in 30.00 mL of water and titrated with 0.0255 M KOH. What volume of the KOH solution must be added to completely neutralize the oxalic acid?



$$(3.50 \text{ g H}_2\text{C}_2\text{O}_4) \left( \frac{1 \text{ mol H}_2\text{C}_2\text{O}_4}{90.04 \text{ g}} \right) \left( \frac{2 \text{ mol KOH}}{1 \text{ mol H}_2\text{C}_2\text{O}_4} \right) = .0777 \text{ mol KOH}$$

$$\text{mol} = M \cdot V$$

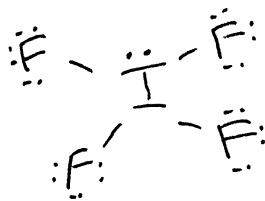
$$.0777 \text{ mol} = (.0255 \text{ M})(V)$$

$$V = 3.05 \text{ L}$$

2. (1 pt) Fill in the following table. Show the Lewis structure in the provided space below.

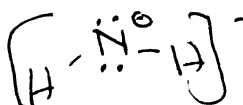
Molecule	Molecular Shape	Hybridization of Central Atom	Polar? (Yes or No)
$\text{IF}_4^+$	see-saw	$\text{sp}^3\text{d}$	yes

$$5(7) - 1 = 34 e^-$$



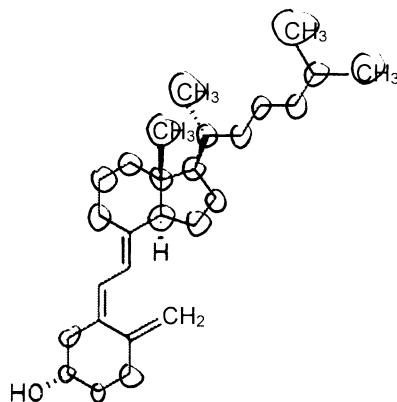
3. (1 pt) The nitrogen atom in  $\text{NH}_2^-$  is  $\text{sp}^3$  hybridized, and each N-H bond is the result of the overlap of a(n)  $\text{sp}^3$  orbital from nitrogen with a(n)  $1s$  orbital from hydrogen.

$$5 + 2 + 1 = 8 e^-$$

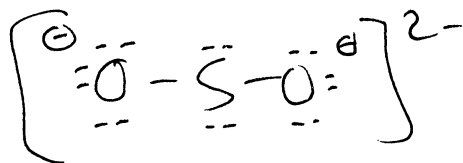


4. (1 pt) Vitamin D<sub>3</sub>, also known as cholecalciferol, has the chemical formula C<sub>27</sub>H<sub>44</sub>O. The shorthand Lewis structure is shown below. (Remember that in such shorthand structures, each point where lines meet represents a carbon atom and many hydrogen atoms are not shown.) How many carbon atoms in this molecule are sp<sup>3</sup> hybridized?

Answer 21



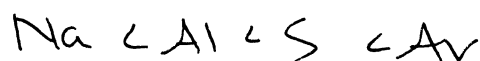
5. (1 pt) Draw the Lewis structure for SO<sub>2</sub><sup>2-</sup>. If appropriate, show all equivalent resonance structures and all non-zero formal charge.



6. (1 pt) Arrange the following in order of **increasing base strength**: IO<sub>2</sub><sup>-</sup> IO<sub>4</sub><sup>-</sup> IO<sub>3</sub><sup>-</sup>



7. (1 pt) Arrange the following atoms in order of **increasing ionization energy**: Ar Na S Al



8. (1 pt) Arrange the following molecules in order of **increasing boiling point**:



9. (1 pt) Arrange the following molecules in order of **increasing vapor pressure**:

