Chemistry 142
Winter 2007
Exam 3a

Name:_____

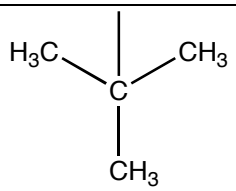
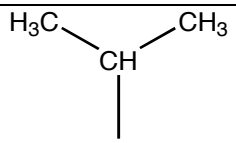
Take a deep breath, and relax! First, answer the questions you know how to do and then work on the more difficult problems. Don't forget to show all your work, so I can give you as much credit as possible.

Good Luck!

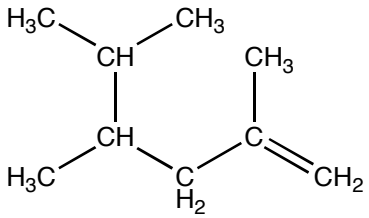
Andy

"I'm on the verge of a major breakthrough, but I'm also at that point where chemistry leaves off and physics begins, so I'll have to drop the whole thing."

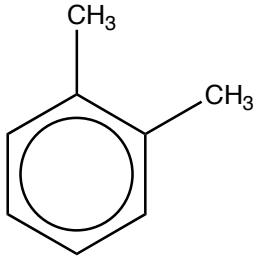
Q1. Fill in the blanks: (10 pts.)

Name of substituent	*Structure*
methyl	
	
	
ethyl	
n-propyl	

Q2. Name the following compound: (6 pts.)

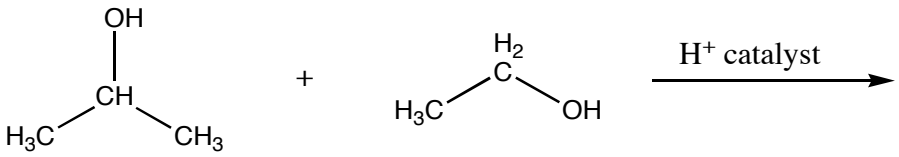


Q3. Name the following compound: (5 pts.)

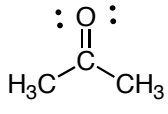


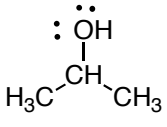
Q4. Draw out the structure of: 3,4-diethyl-1-nonyne (7 pts.)

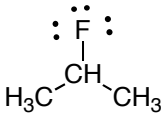
Q5. Write the products of the following reaction: (6 pts.)



Q6. Circle the compound that will have the *largest* vapor pressure. (3 pts.)

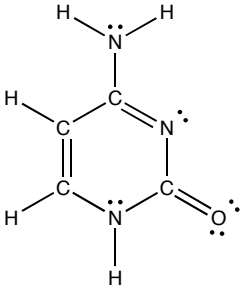
(A) 

(B) 

(C) 

Q7. List the types of intermolecular forces in the previous three compounds (6 pts.)
(A) (B) (C)

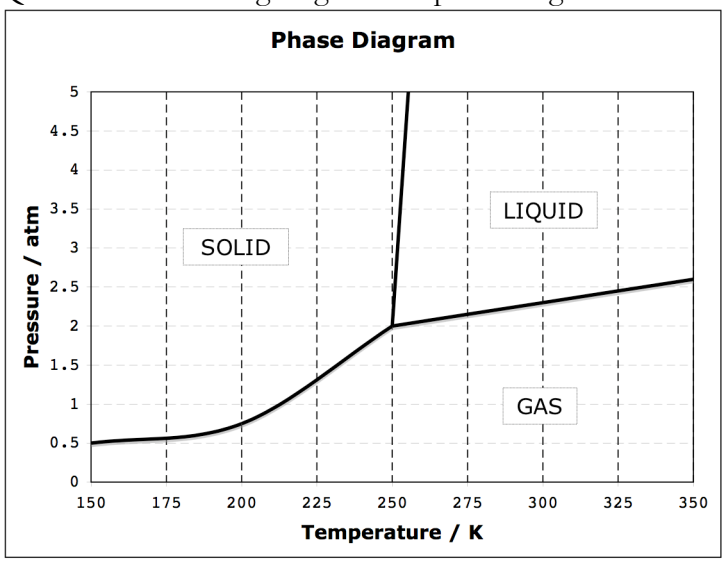
Q8. Cytosine is an organic base, found in molecules of DNA. Draw arrows pointing out the parts of the cytosine molecule that can donate/receive hydrogen bonds. (5 pts.)



Q9. (a) Sketch the body-centered cubic (BCC) unit cell. (4 pts.)

(b) How many atoms are contained within a BCC unit cell. Show how you obtain this number. (4 pts.)

Q10. The following diagram is a phase diagram for an unknown substance (Chemical X)



(a) What is the melting point of this compound at 4 atm? (4 pts.)

(b) At what temperature and pressure is the triple point at? (4 pts.)

(c) At what temperature would chemical X sublime when the pressure was 1 atm? (4 pts.)

Q11. Calculate the molality of a solution composed of 8.30 g CH_3OH and 454 g of CH_3CH_2OH. (6 pts.)

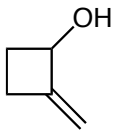
Q12. A solution of $CaCl_2(aq)$ has a molar concentration of 4.54 M, and a density of 1.15 g/mL. Calculate its molal concentration (molality). (12 pts.)

Q13. Calculate the freezing point of a 0.10 m solution of glucose in water, if the normal freezing point of water is 0.000 ºC, and k_f for water is 1.86 ºC/m. (8 pts.)

Q14. Which would you expect to have the lowest freezing point: 0.10 m NaCl, 0.10 m $CaCl_2$, or 0.10 m $Al(NO_3)_3$? (1 pt.) EXPLAIN. (5 pts.)

BONUS:

Is the following alcohol primary, secondary, or tertiary? (3 pts.)



Useful Information

$\Delta T_f = i \cdot k_f \cdot m$ $N_A = 6.022 \times 10^{23}\ \text{mol}^{-1}$ $d = m/V$ $c = kP$

Periodic Table of the Elements

IA	IIA											IIIA	IVA	VA	VIA	VIIA	VIIIA
1																	*18*
1 H 1.01	*2*											*13*	*14*	*15*	*16*	*17*	2 He 4.00
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*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	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 47.87	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 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.90	36 Kr 83.80
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 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba* 137.33	71 Lu 174.97	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.20	83 Bi 208.98	84 Po [210]	85 At [210]	86 Rn [222]
87 Fr [223]	88 Ra** [226]	103 Lr [262]	104 Rf [261]	105 Db [262]	106 Sg [266]	107 Bh [264]	108 Hs [265]	109 Mt [268]	110 [269]	111 [272]	112 [277]	113	114 [285]	115	116 [289]	117	118 [293]

*	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm [145]	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04
**	89 Ac [227]	90 Th 232.04	91 Pa 231.04	92 U 238.03	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]