Chem 111 2:30p section Evening Exam #2

This exam is composed of 25 questions, 1 of which requires mathematics that *might* require a calculator. Go initially through the exam and answer the questions you can answer *quickly*. Then go back and try the ones that are more challenging to you and/or that require calculations.

As discussed in the course syllabus, honesty and integrity are absolute essentials for this class. In fairness to others, dishonest behavior will be dealt with to the full extent of University regulations.

I hereby state that all answers on this exam are my own and that I have neither gained unfairly from others nor have I assisted others in obtaining an unfair advantage on this exam.

_____.
Signature

$E = h\nu = \frac{hc}{\lambda}$ $E_n^{H-atom} = -\frac{R_H hc}{n^2}$ 1 mL = 1 cm^3	**Some common ions:** PO_4^{3-} CN^- $CH_3CO_2^-$ NO_2^- NO_3^- CO_3^{2-} SO_3^{2-} SO_4^{2-}	$h = 6.626x10^{-34}\ J\ s$ $c = 2.9998x10^8\ m\ s^{-1}$ $N = 6.022x10^{23}\ mol^{-1}$ $R_H = 1.097x10^7\ m^{-1}$

PERIODIC TABLE OF THE ELEMENTS

1A	2A	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	3A	4A	5A	6A	7A	8A
1 H 1.008																	2 He 4.003
3 Li 6.939	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 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 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.71	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	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 (99)	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	72 Hf 178.5	73 Ta 181.0	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)
87 Fr (223)	88 Ra 226.0	89 Ac 227.0	104 Unq (261)	105 Unp (262)	106 Unh (263)	107 Uns (262)	108 Uno (265)	109 Une (266)									

1. Which atom or ion below is most paramagnetic?

   1) B 2) C 3) N 4) O 5) F

2. Which element is represented by: $\mathbf{1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^4}$

   1) Ge 2) Sb 3) As 4) Se 5) Te

3. Which of the following has the shortest bond length?

   1) H_2O 2) NH_3 3) HF 4) CH_4 5) BH_3

4. Consider the molecule AsO_4^{x}, where x is the charge on the molecule. Three bonds are single bonds, one is a double bond. Which value of x yields the stable molecule? (Hint: draw Lewis structures to figure this one out)

   1) +2 2) 0 3) -1 4) –2 5) –3

5. For the AsO_4^{x} molecule above, how many equal-energy resonance structures can you draw?

   1) 1 2) 2 3) 3 4) 4 5) 6

6. Consider the molecule ClF_2^- How many lone pairs are on the central atom?

   1) 1 2) 2 3) 3 4) 4 5) 0

7. Consider the molecule ClF_5 What is the electron pair geometry?

   1) Trigonal bipyramidal 2) Octahedral 3) linear
   4) Trigonal planer 5) Tetrahedral

8. Consider the molecule ClF_4^- What is the molecular geometry?

   1) Square planar 2) Octahedral 3) linear
   4) Trigonal planer 5) Tetrahedral

9. Which of the following has the shortest bond length?

   1) None 2) SiF_4 3) $SiCl_4$ 4) $SiBr_4$ 5) SiI_4

10. Which of the following has the lowest bond energy?

    1) None 2) CF_4 3) CCl_4 4) CBr_4 5) CI_4

11. Which of the following has the shortest bond length?

    1) B_2 2) C_2 3) N_2 4) O_2 5) F_2

12. The electron pair geometry centered at the O atom in CH_3OCH_3 is:

    1) Trigonal bipyramidal 2) Octahedral 3) linear
    4) Trigonal planer 5) Tetrahedral

13. In the symmetrical molecule **hydrogen peroxide** HOOH, what is the approximate HOO bond angle?

1) 180° 2) 90° 3) 109° 4) 120° 5) 60°

14. What is the molecular geometry of IF_5?

1) trigonal bipyramidal 2) Octahedral 3) square pyramidal
4) trigonal pyramidal 5) Seesaw

Bond Dissociation Energies (kJ mol^{-1}) (gas phase)

Bond	D	Bond	D	Bond	D
H-H	436	C-C	346	N-N	163
C-H	413	C=C	610	N=N	418
N-H	391	O-O	146	C-O	358
O-H	463	O=O	498	C=O	745
C-F	485	F-F	155		

15. Consider the reaction: CH_3CHCH_2 (g) + H_2 (g) → $CH_3CH_2CH_3$ (g)

What is the energy ($\Delta H°$, in kJ mol^{-1}) for this reaction?

1) –220 2) +220 3) –126 4) –205 5) –551

16. Which of the following has the highest effective nuclear charge as seen by its outermost valence electrons?

1) Br 2) Ne 3) S 4) F 5) N

17. Which of the following has the highest effective nuclear charge as seen by its outermost valence electrons?

1) Cl^- 2) Ar 3) K^+ 4) Ca^{2+} 5) Ca

18. Which of the following has the highest electron affinity?

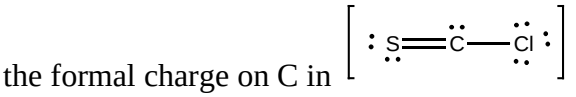
1) Al 2) Si 3) P 4) S 5) Cl

19. From which species below is it easiest to remove an electron?

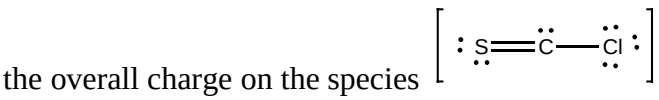
1) O^{2-} 2) F^- 3) Ne 4) Na^+ 5) Mg^{2+}

20. Which ion has the largest radius?

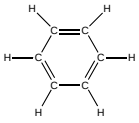
1) Al^{3+} 2) Ca^{2+} 3) In^{3+} 4) Cs^+ 5) Tl^{3+}

21. What is the formal charge on C in  ?

1) –2 2) –1 3) 0 4) +1 5) +2

22. What is the overall charge on the species  ?

1) –2 2) –1 3) 0 4) +1 5) +2

23. Consider benzene  in all of its resonance forms. What is the C-C bond order?

1) 0 2) 0.5 3) 1.0 4) 1.5 5) 2

24. Which of the following molecules is most polar?

1) CF_4 2) CH_4 3) CF_3H 4) CBr_4 5) CBr_3H

25. What is the catalog number for this class?

1) 111 2) 123 3) 222 4) 3.14159 5) 68.6 g