NAME ____

CHEMISTRY 101 SPRING 2010

EXAM 3 FORM D SECTION 503 DR. KEENEY-KENNICUTT

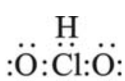
Directions:
(1) Put your name and signature on PART 2 of the exam where indicated.
(2) Sign the Aggie Code on PART 2 of this exam.
(3) Each multiple choice question is actually 2 questions on your scanning sheet. If you are sure of an answer, **put the same answer down for both questions** for 5 pts. If you cannot decide between two answers, put your best answer down for the first (odd) question and the other answer down for the second (even) question. If you get the first one correct you'll get 3 pts; if you get the second one correct you'll get 2 pts. If there is an ambiguous multiple choice question, use the last page to explain your answer.
(4) Do NOT write on the envelope. There is a periodic table on the last page to write on.
(5) When finished, wait to be excused. You can pick up the multiple choice part with the answers outside my office after 2:30pm.
(6) There are a total of 34 questions (18 actual questions). The last question is extra credit.

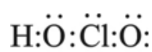
PART 1

1&2. Which one of the following thermodynamic quantities is NOT a state function?

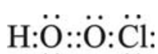
(a) ΔE (b) q (c) (q+w) (d) ΔH (e) T

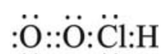
3&4. Which of the following is the CORRECT Lewis structure for chlorous acid showing all the valence electrons?

(a) 

(b) 

(c) 

(d) 

(e) 

5&6. Which of the following is a non-polar covalent bond?

(a) O-F (b) H-Cl (c) C-I (d) Na-Ca (e) Te-I

7&8. Which ground state electronic configuration is <u>**NOT** correct</u>?

(a) Mn [Ar] $3d^5\ 4s^2$
(b) Na $1s^2\ 2s^2\ 2p^6\ 3s^1$
(c) Cu [Ar] $3d^{10}\ 4s^1$
(d) As [Ar] $3d^{10}\ 4s^2\ 4p^3$
(e) Bi [Xe] $6s^2\ 5d^{10}\ 6p^3$

9&10. Which statement is FALSE?

(a) In an electron has the quantum number ℓ=1, it must be in a p energy subshell.

(b) If an electron has the quantum number n=2, the electron could be in a p energy subshell.

(c) Two electrons in the same atom CANNOT have quantum numbers of:

2, 1, –1, –½ and 2, 1, –1, –½.

(d) An electron that has n=1, then it must be in an s orbital.

` (e) A possible set of quantum numbers for an electron in an atom is: n=2, ℓ=–1, m_ℓ=–1, m_s = +½.

11&12. Which of the following statements is or are TRUE?

(1) An excited atom can return to a lower energy level by absorbing light energy.

(2) An atom can be excited by emitting light energy.

(3) As the energy of electromagnetic radiation increases, its frequency increases.

(4) The frequency and wavelength of light are inversely proportional.

(a) 1 & 2 (b) 2 only (c) 2 & 3 (d) 1 & 3 (e) 3 & 4

13&14. Which molecule exhibits resonance?

(a) CO_2 (b) PF_3 (c) H_2S (d) SO_2 (e) $BeBr_2$

15&16. For which of the following reactions would the ΔH^o for the reaction be labeled ΔH_f^o?

(1) $Mg(s) + 1/2\ O_2(g) \rightarrow MgO(s)$

(2) $BaO(s) + SO_3(g) \rightarrow BaSO_4(s)$

(3) $CO(g) + 1/2\ O_2(g) \rightarrow CO_2(g)$

(4) $1/2\ H_2(g) + 1/2\ Br_2(\ell) \rightarrow HBr(g)$

(5) $C_2H_4(g) \rightarrow 2\ C(s,graphite) + 2\ H_2(g)$

(a) 1 only (b) 1 and 2 (c) 1 and 4 (d) 3 and 4 (e) 1 and 5

17&18. Which element is paramagnetic with 1 unpaired electron?

(a) Ca (b) S (c) Si (d) Cl (e) P

19&20. The following set of 4 quantum numbers: $n = 5$, $\ell = 2$, $m_\ell = +2$, $m_s = +1/2$ could be an appropriate set for the last electron to go into an element of: (Assume that the element is not an exception to the normal filling rule.)

(a) Sr (b) Kr (c) Zr (d) W (e) Sn

21&22. Which statement is WRONG?

(a) Br^- and Cl^- are isoelectronic with each other.
(b) Oxygen has a more negative electron affinity than carbon.
(c) The most stable ion of calcium is Ca^{2+}.
(d) A magnesium cation is smaller than a magnesium atom.
(e) A carbon atom is smaller than a silicon atom.

23&24. If a system gains 10 J of heat and has 40 J of work done on it by the surroundings, the change in internal energy is

(a) –10 J (b) +10 J (c) –50 J (d) +50 J (e) 0 J

25&26. Which is the correct order of bond length?

(a) double bond > single bond > triple bond

(b) single bond > double bond > triple bond

(c) triple bond > double bond > single bond

(d) triple bond > single bond > double bond

(e) single bond > triple bond > double bond

27&28. Given the heats of reaction below, calculate ΔH^o for the reaction: $2NO(g) + 1/2\ O_2(g) \rightarrow N_2O_3(g)$

$N_2(g) + O_2(g) \rightarrow 2NO(g)$ $\Delta H^o = +180.5$ kJ

$2N_2(g) + 3O_2(g) \rightarrow 2N_2O_3(g)$ $\Delta H^o = +167.4$ kJ

(a) +91.8 kJ (b) –264.2 kJ (c) +264.2 kJ (d) –6.55 kJ (e) –96.8 kJ

29&30. A 1.800 g sample of isopentane, C_5H_{12}, was completely burned in a bomb calorimeter that was surrounded by 5100. g of water. The temperature of the water rose from 24.200°C to 28.126°C. The heat capacity of the calorimeter was 840. J/°C. The specific heat of water is 4.184 J/g°C. Calculate ΔE for the reaction in kJ/mol.

(a) +3840 kJ/mol (b) –6280 kJ/mol (c) –3490 kJ/mol (d) –48.5 kJ/mol (e) –2210 kJ/mol

31&32. In 1947 a ship loaded with ammonium nitrate exploded in the harbor of Texas City. Calculate the standard enthalpy change associated with the reaction of 240. grams of NH_4NO_3, according to the equation:

$$2\,NH_4NO_3(s) \rightarrow 2N_2(g) + O_2(g) + 4H_2O(g)$$

Compound	ΔH^o_f (kJ/mol)
Ammonium nitrate (s)	–366
Water (g)	–242

(a) –354 kJ (b) –262 kJ (c) –5104 kJ (d) –717 kJ (e) +372 kJ

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EXAM 3 S 503

Form D

PART 2

Please read and sign: "On my honor, as an Aggie, I have neither given nor received unauthorized aid on this exam." ______________________________________

(16 pts) **33.** For each of species, draw the Lewis dot structure (3 pts and don't forget all the electrons). For the central atom, give the electronic geometry (2 pts), the molecular (or ionic) geometry (2 pts), and say if the species has a dipole moment (is polar) or not (1pt).

(a) BBr_3 (b) BrF_4^-

	BBr_3	BrF_4^-
Electronic Geometry		
Molecular/Ionic Geometry		
Has dipole moment (yes/no) (is polar)		

(4 pts) Draw a 3-dimensional representation of these 2 species using wedges and dotted lines. **Show ALL lone pairs of electrons. Show and state the bond angles.**

OVER ⇒

EXTRA CREDIT:

(2 pts) **34.** Sketch the pictures of the following orbitals :

(a) p_y (b) $d_{x^2-y^2}$

SCRAP PAPER OR COMMENTS ON EXAM

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EXAM 3 Form D S 503

Periodic Table of Elements

Pauling Electronegativity → 2.1 | 1 | H | 1.008

	IA (1)	IIA (2)	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VIIB (7)	VIIIB (8)	(9)	(10)	IB (11)	IIB (12)	IIIA (13)	IVA (14)	VA (15)	VIA (16)	VIIA (17)	0 (18)
1	1 H 2.1 1.008																1 H 2.1 1.008	2 He 4.003
2	3 Li 1.0 6.941	4 Be 1.5 9.012											5 B 2.0 10.81	6 C 2.5 12.01	7 N 3.0 14.01	8 O 3.5 16.00	9 F 4.0 19.00	10 Ne 20.18
3	11 Na 1.0 22.99	12 Mg 1.2 24.31											13 Al 1.5 26.98	14 Si 1.8 28.09	15 P 2.1 30.97	16 S 2.5 32.07	17 Cl 3.0 35.45	18 Ar 39.95
4	19 K 0.9 39.10	20 Ca 1.0 40.08	21 Sc 1.3 44.96	22 Ti 1.4 47.88	23 V 1.5 50.94	24 Cr 1.6 52.00	25 Mn 1.6 54.94	26 Fe 1.7 55.85	27 Co 1.7 58.93	28 Ni 1.8 58.69	29 Cu 1.8 63.55	30 Zn 1.6 65.39	31 Ga 1.7 69.72	32 Ge 1.9 72.61	33 As 2.1 74.92	34 Se 2.4 78.96	35 Br 2.8 79.90	36 Kr 83.80
5	37 Rb 0.9 85.47	38 Sr 1.0 87.62	39 Y 1.2 88.91	40 Zr 1.3 91.22	41 Nb 1.5 92.91	42 Mo 1.6 95.94	43 Tc 1.7 (98)	44 Ru 1.8 101.07	45 Rh 1.8 102.91	46 Pd 1.8 106.42	47 Ag 1.6 107.87	48 Cd 1.6 112.41	49 In 1.6 114.82	50 Sn 1.8 118.71	51 Sb 1.9 121.75	52 Te 2.1 127.60	53 I 2.5 126.90	54 Xe 131.29
6	55 Cs 0.8 132.91	56 Ba 1.0 137.33	57 La 1.1 138.91 *	72 Hf 1.3 178.49	73 Ta 1.4 180.95	74 W 1.5 183.85	75 Re 1.7 186.21	76 Os 1.9 190.2	77 Ir 1.9 192.22	78 Pt 1.8 195.08	79 Au 1.9 196.97	80 Hg 1.7 200.59	81 Tl 1.6 204.38	82 Pb 1.7 207.2	83 Bi 1.8 208.98	84 Po 1.9 (209)	85 At 2.1 (210)	86 Rn (222)
7	87 Fr 0.8 (223)	88 Ra 1.0 (226)	89 Ac 1.1 (227) **	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Uun (281)	111 Uuu (272)	112 Uub (285)		114 Uuq (289)				

* Lanthanide Series	58 Ce 1.1 140.12	59 Pr 1.1 140.91	60 Nd 1.1 144.24	61 Pm 1.1 (145)	62 Sm 1.1 150.36	63 Eu 1.1 151.97	64 Gd 1.1 157.25	65 Tb 1.1 158.93	66 Dy 1.1 162.50	67 Ho 1.1 164.93	68 Er 1.1 167.26	69 Tm 1.1 168.93	70 Yb 1.0 173.04	71 Lu 1.2 174.97
** Actinide Series	90 Th 1.2 232.04	91 Pa 1.3 231.04	92 U 1.5 238.03	93 Np 1.3 (237)	94 Pu 1.3 (244)	95 Am 1.3 (243)	96 Cm 1.3 (247)	97 Bk 1.3 (247)	98 Cf 1.3 (251)	99 Es 1.3 (252)	100 Fm 1.3 (257)	101 Md 1.3 (258)	102 No 1.3 (259)	103 Lr 1.5 (260)

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