

**CHEMISTRY 101****EXAM 3 FORM A****SECTION 502****SPRING 2010****DR. KEENEY-KENNICUTT**

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- 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.
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**PART 1**

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**1&2.** Which of the following is a non-polar covalent bond?

- (a) P-As      (b) H-Cl      (c) O-S      (d) Na-Ca      (e) Te-I

**3&4.** Which statement is WRONG?

- (a) The  $\text{Ca}^{2+}$  ion is isoelectronic with Ar.  
(b) Selenium, Se, forms a stable 2- ion.  
(c) An atom of oxygen is smaller than a sulfur atom.  
(d) The iron(II) cation is smaller than the iron atom.  
(e) The first ionization energy for bromine is greater than the first ionization energy for chlorine.

**5&6.** The generalized ground state electronic configuration for an element in the VA Group is:

- (a)  $ns^2$       (b)  $ns^2 np^2$       (c)  $ns^2 np^3$       (d)  $ns^2 np^5$       (e)  $ns^2 np^6$

**7&8.** Which element is paramagnetic with 2 unpaired electrons?

- (a) Mg      (b) F      (c) B      (d) O      (e) Be

**9&10.** Which statement about the four quantum numbers which describe electrons in atoms is INCORRECT?

- (a)  $m_s$  = spin quantum number,  $m_s = \pm\frac{1}{2}$ .
- (b)  $\ell$  = angular momentum (subsidiary or azimuthal) quantum number,  $\ell = 1, 2, 3, 4, \dots, (n-1)$
- (c) The magnetic quantum number is related to how many orbitals in a given energy subshell there are.
- (d)  $m_\ell$  = magnetic quantum number,  $m_\ell = (-\ell) \dots 0 \dots (+\ell)$
- (e)  $n$  = principle quantum number,  $n = 1, 2, 3, \dots, \infty$ .

**11&12.** Which of the following is the CORRECT Lewis structure showing all the valence electrons?

- (a)  $\text{:}\ddot{\text{N}}=\ddot{\text{N}}\text{:}$       (b)  $\text{H}=\text{H}$       (c)  $\text{:C}\equiv\text{N:]}^-$       (d)  $\text{:O}\equiv\text{O:}$       (e)  $\text{F}-\text{F}$

**13&14.** Which of the following reactions has the same  $\Delta H_{\text{rxn}}$  as  $\Delta H_f$  for  $\text{CH}_3\text{OH}(\text{g})$ ?

- (a)  $\text{C}(\text{s, graphite}) + 2\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{CH}_3\text{OH}(\text{g})$
- (b)  $2\text{C}(\text{s, graphite}) + 4\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{CH}_3\text{OH}(\text{g})$
- (c)  $\text{CH}_3\text{OH}(\text{g}) \rightarrow \text{C}(\text{s, graphite}) + 2\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$
- (d)  $2\text{CH}_3\text{OH}(\text{g}) \rightarrow 2\text{C}(\text{s, graphite}) + 4\text{H}_2(\text{g}) + \text{O}_2(\text{g})$
- (e)  $\text{C}(\text{s, diamond}) + 2\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{CH}_3\text{OH}(\text{g})$

**15&16.** Which response includes only the molecules below that exhibit resonance?

- (1)  $\text{CS}_2$       (2)  $\text{PCl}_5$       (3)  $\text{SO}_2$       (4)  $\text{NO}_3^-$
- (a) 1,3      (b) 2,4      (c) 1,4      (d) 3,4      (e) another combination

**17&18.** Which ground state electronic configuration is NOT correct?

- (a) Mg  $1s^2 2s^2 2p^6 3s^2$
- (b) As  $[\text{Ar}] 3d^{10} 4s^2 4p^3$
- (c) Cu  $[\text{Ar}] 3d^{10} 4s^1$
- (d) Po  $[\text{Xe}] 6s^2 5d^{10} 6p^4$
- (e) Ni  $[\text{Ar}] 3d^8 4s^2$

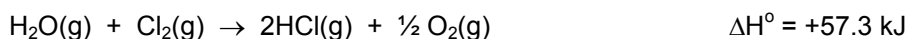
**19&20.** The following set of 4 quantum numbers:  $n = 4$ ,  $\ell = 2$ ,  $m_\ell = -1$ ,  $m_s = -1/2$  could be an appropriate set for the last electron to go into an atom of: (Assume that the element is not an exception to the normal filling rule.)

- (a) Zr
- (b) V
- (c) Ca
- (d) Se
- (e) Kr

**21&22.** If a system loses 20 J of heat and does 30 J of work on the surroundings, the change in internal energy is

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

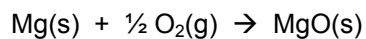
**23&24.** Consider the following equations:



Calculate  $\Delta H^\circ$  for the reaction:  $\text{PbO}_2(\text{s}) + 4\text{HCl(g)} \rightarrow \text{PbCl}_2(\text{s}) + 2\text{H}_2\text{O(g)} + \text{Cl}_2(\text{g})$

- (a) -578.5 kJ
- (b) -25.2 kJ
- (c) -197.2 kJ
- (d) +750.5 kJ
- (e) -139.9 kJ

**25&26.** A 0.1375 g sample of solid magnesium is burned in excess oxygen gas in a constant-volume bomb calorimeter containing 500. g of water. The calorimeter constant is 931 J/°C. The temperature increases by 1.126°C. The specific heat of water = 4.184 J/g°C. What is the  $\Delta E$  for the oxidation of Mg in kJ/mol Mg?



(a) -431 kJ/mol Mg

(b) -355 kJ/mol Mg

(c) -547 kJ/mol Mg

(d) -257 kJ/mol Mg

(e) -602 kJ/mol Mg

**27&28.** Which species has a  $\Delta H_f^\circ$ , standard enthalpy of formation, that is equal to 0 kJ/mol?

(a)  $\text{H}_2\text{O}(\ell)$

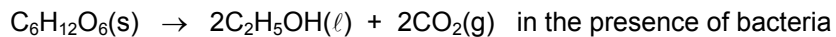
(b)  $\text{H}(\text{g})$

(c)  $\text{Fe}(\text{g})$

(d)  $\text{Hg}(\ell)$

(e)  $\text{Br}_2(\text{g})$

**29&30.** The microorganisms causing "gas gangrene" produce the gas by fermenting "muscle sugar":



What would be the standard enthalpy change for the fermentation of 80.5 g of the sugar?

Compound	$\Delta H_f^\circ$ (kJ/mol)
$\text{C}_6\text{H}_{12}\text{O}_6(\text{s})$	-1255
$\text{C}_2\text{H}_5\text{OH}(\ell)$	-278
$\text{CO}_2(\text{g})$	-393

- (a) -17 kJ      (b) -39 kJ      (c) +26 kJ      (d) -13 kJ      (e) +5.9 kJ

**31&32.** The emission spectrum of gold shows a line of wavelength  $2.676 \times 10^{-7}$  m. How much energy is emitted as the excited electron falls to a lower energy level?

- (a)  $7.43 \times 10^{-19}$  J/atom      (b)  $1.07 \times 10^{-20}$  J/atom  
(c)  $6.05 \times 10^{-19}$  J/atom      (d)  $3.60 \times 10^{-20}$  J/atom  
(e)  $5.16 \times 10^{-20}$  J/atom



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**PART 2**

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

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(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)  $\text{BF}_3$

(b)  $\text{SF}_3^-$

	$\text{BF}_3$	$\text{SF}_3^-$
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)  $p_x$

(b)  $d_{xz}$



# SCRAP PAPER OR COMMENTS ON EXAM

**CHEMISTRY 101**  
EXAM 3 Form A

**Spring 2010**  
S 502

NAME \_\_\_\_\_

## Periodic Table of Elements

	IA (1)																		VIIA (17)	0 (18)				
1	H 1.008																		H 1.008	He 4.003				
2	Li 6.941	IIA (2)	Be 9.012																B 10.81	C 12.01	N 14.01	O 16.00	F 19.00	Ne 20.18
3	Na 22.99	Mg 24.31	IIIB (3)																Al 26.98	Si 28.09	P 30.97	S 32.07	Cl 35.45	Ar 39.95
4	K 39.10	Ca 40.08	Sc 44.96	IVB (4)	VB (5)	VIB (6)	VIIIB (7)	VIIIB (8)	VIIIB (9)	VIIIB (10)	IB (11)	IIB (12)							Ga 69.72	Ge 72.61	As 74.92	Se 78.96	Br 79.90	Kr 83.80
5	Rb 85.47	Sr 87.62	Y 88.91	Zr 91.22	Nb 92.91	Mo 95.94	Tc (98)	Ru 101.07	Rh 102.91	Pd 106.42	Ag 107.87	Cd 112.41							In 114.82	Sn 118.71	Sb 121.75	Te 127.60	I 126.90	Xe 131.29
6	Cs 132.91	Ba 137.33	La 138.91	Hf 178.49	Ta 180.95	W 183.85	Re 186.21	Os 190.2	Ir 192.22	Pt 195.08	Au 196.97	Hg 200.59							Tl 204.38	Pb 207.2	Bi 208.98	Po (209)	At (210)	Rn (222)
7	Fr (223)	Ra (226)	Ac (227)	Rf (261)	Db (262)	Sg (266)	Bh (264)	Hs (277)	Mt (268)	Uun (281)	Uuu (272)	Uub (285)							Uuq (289)					

Pauling Electronegativity →

2.1	1
H	
1.008	

\* Lanthanide Series

1.1	58	1.1	59	1.1	60	1.1	61	1.1	62	1.1	63	1.1	64	1.1	65	1.1	66	1.1	67	1.1	68	1.1	69	1.0	70	1.2	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu														
140.12	140.91	144.24	(145)	150.36	151.97	157.25	158.93	162.50	164.93	167.26	168.93	173.04	174.97														

\*\* Actinide Series

1.2	90	1.3	91	1.5	92	1.3	93	1.3	94	1.3	95	1.3	96	1.3	97	1.3	98	1.3	99	1.3	100	1.3	101	1.3	102	1.5	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr														
232.04	231.04	238.03	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(260)														