NAME _____

CHEMISTRY 101 SPRING 2010

EXAM 3 FORM B SECTION 502 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 2 pts extra credit.

PART 1

1&2. The generalized ground state electronic configuration for an element in the IVA Group is:

(a) ns^2 (b) $ns^2\ np^2$ (c) $ns^2\ np^4$ (d) $ns^2\ np^5$ (e) $ns^2\ np^6$

3&4. Which of the following is a non-polar covalent bond?

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

5&6. Which of the following reactions has the same ΔH_{rxn} as ΔH_f for $CaCO_3(s)$?

(a) $2CaCO_3(s) \rightarrow 2Ca(s) + 2C(s,graphite) + 3\ O_2(g)$

(b) $CaCO_3(s) \rightarrow Ca(s) + C(s,graphite) + 3/2\ O_2(g)$

(c) $Ca(s) + C(s,graphite) + 3/2\ O_2(g) \rightarrow CaCO_3(s)$

(d) $2Ca(s) + 2C(s,graphite) + 3\ O_2(g) \rightarrow 2CaCO_3(s)$

(e) $2Ca(s) + 2C(s,diamond) + 3\ O_2(g) \rightarrow 2CaCO_3(s)$

7&8. Which of the following is the CORRECT Lewis structure showing **ALL** the valence electrons?

(a) :N–N: (b) H=H (c) I-I (d) :O=O: (e) $[:C\equiv N:]^-$

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

(a) ℓ = angular momentum (subsidiary or azimuthal) quantum number, . ℓ = 1,2,3,4,….(n+1).

(b) n = principle quantum number, n = 1,2,3,……∞.

(c) m_ℓ = magnetic quantum number, m_ℓ = ($-\ell$) ….0….(+ℓ)

` (d) m_s = spin quantum number, m_s = ±½.

(e) The magnetic quantum number is related to how many orbitals in a given energy subshell there are.

11&12. Which element is paramagnetic with 2 unpaired electrons?

(a) Mg (b) S (c) Na (d) Al (e) Cl

13&14. Which statement is WRONG?

(a) Mg^{2+} is isoelectronic with Ne.

(b) The most stable sodium ion is Na^+.

(c) The first ionization energy for magnesium is less than the first ionization energy for strontium.

(d) An atom of germanium is larger than an atom of bromine.

(e) The atomic radius of strontium is larger than the ionic radius of Sr^{2+}.

15&16. Which ground state electronic configuration is **NOT** correct?

(a) Po [Xe] $6s^2\ 5d^{10}\ 6p^4$

(b) Ni [Ar] $3d^8\ 4s^2$

(c) Cr [Ar] $3d^5\ 4s^1$

(d) Mg $1s^2\ 2s^2\ 2p^6\ 3s^2$

(e) As [Ar] $3d^{10}\ 4s^2\ 4p^3$

17&18. The following set of 4 quantum numbers: n = 5, ℓ = 2, m_ℓ = +2, 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) Kr (c) Sr (d) Sn (e) W

19&20. Which response includes only the molecules below that exhibit resonance?

(1) PF_5 (2) HNO_3 (3) SO_3 (4) CO_2

(a) 1,2 (b) 2,3 (c) 2,4 (d) 2,3,4 (e) another combination

21&22. If a system gains 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. What is the energy of a photon of ultraviolet radiation, wavelength, λ, = 5.00×10^{-8} m?

(a) 1.11×10^{-49} J/atom (b) 1.67×10^{-16} J/atom

(c) 9.95×10^{-33} J/atom (d) 3.98×10^{-18} J/atom

(e) 7.24×10^{-12} J/atom

25&26. A 2.000 g sample of ethanol, CH_3CH_2OH (FW=46.07 g/mol), was completely burned in a bomb calorimeter that was surrounded by 2000. g of water. The temperature of the water increased by 6.003 ^oC. The heat capacity of the calorimeter was 1577 J/^oC. The specific heat of water is 4.184 J/g^oC. Calculate ΔE for the reaction in kJ/mol.

(a) −955 kJ/mol (b) −41.5 kJ/mol (c) −124 kJ/mol (d) −1373 kJ/mol (e) −1515 kJ/mol

27&28. Laughing gas (nitrous oxide or dinitrogen oxide) can be produced by carefully heating ammonium nitrate:

$$NH_4NO_3(s) \rightarrow N_2O(g) + 2H_2O(g)$$

Calculate the standard enthalpy change associated with the decomposition of 40.0 g of $NH_4NO_3(s)$.

Compound	ΔH^o_f (kJ/mol)
Ammonium nitrate (s)	−366
Nitrous oxide (g)	+82
Water (g)	−242

(a) −46 kJ (b) −384 kJ (c) +103 kJ (d) +46 kJ (e) −18 kJ

29&30. Consider the following equations:

$2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell)$ $\quad \Delta H^o = -573$ kJ

$N_2O_5(g) + H_2O(\ell) \rightarrow 2HNO_3(\ell)$ $\quad \Delta H^o = -75$ kJ

$H_2(g) + N_2(g) + 3O_2(g) \rightarrow 2HNO_3(\ell)$ $\quad \Delta H^o = -347$ kJ

Calculate ΔH^o for the reaction: $2N_2(g) + 5O_2(g) \rightarrow 2N_2O_5(g)$

(a) −996 kJ (b) +29 kJ (c) +301 kJ (d) −144 kJ (e) −151 kJ

31&32. Which species has a ΔH^o_f , standard enthalpy of formation, that is equal to 0 kJ/mol?

(a) Fe(g) (b) H(g) (c) $H_2O(\ell)$ (d) $Br_2(g)$ (e) $Hg(\ell)$

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Form B

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) SiF_4 (b) BrF_4^+

	SiF_4	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) s

(b) d_{z^2}

SCRAP PAPER OR COMMENTS ON EXAM

CHEMISTRY 101 **Spring 2010** NAME _____
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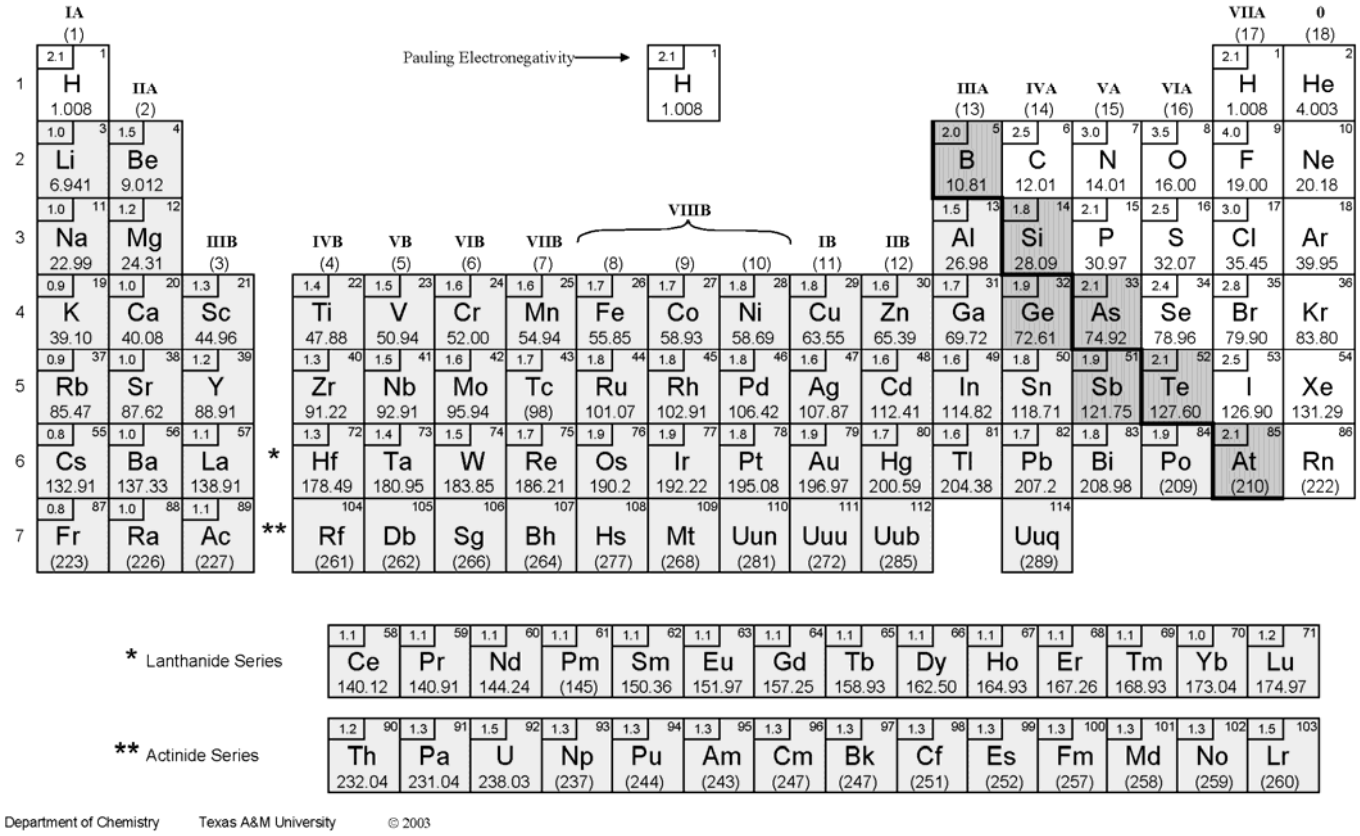
Periodic Table of Elements



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