

**Chem 1010 5th Sample for Hour Exam 3 (Modules 7A, 7B, & 8A) Updated by SJB, 4/2002**

You should study your test, study your Handbook modules, and review your drill quizzes BEFORE taking this exam. When taking it you should do so under exam conditions, i.e. alone, using only a calculator and periodic table, and waiting until you have completely finished before checking your answers.

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1: **K-TYPE answer format:** Mark *a* if A,B,C are correct; *b* if A, C; *c* if B, D; *d* if D only; *e* otherwise.

- A: The first ionization energy of Ga is greater than that of As.
- B: The first ionization energy of Ba is greater than the second ionization energy of Ba.
- C: The first ionization energy of Ge is greater than that of C.
- D: Ionization energy is the energy which must be gained in order to cause an atom to lose an electron.

2: **(CHALLENGE)** Suppose the universe were different than it is and that the magnetic quantum number could have values of 0 and 1 for each value of the angular quantum number. Assuming that the Pauli Principle still held and that the values of the other quantum numbers were the same, which atomic numbers would correspond to the "noble gases" (i.e. the elements with special chemical stability) in this universe?

- A: 1, 5, 9, ...      B: 4, 8, 12, ...      C: 4, 12, 20, ...      D: 2, 18, 36, ...      E: 3, 15, 27, ...

3: **K-TYPE answer format:** Mark *a* if A,B,C are correct; *b* if A, C; *c* if B, D; *d* if D only; *e* otherwise.

- A: The formal charge of Cl in HCl is 0.
- B: Electronegativity is defined as the tendency of an atom to attract electrons when bonded to another atom.
- C: The electronegativity of S is less than that of Al.
- D: The electronegativity of Sb is greater than that of P.

4: **K-TYPE answer format:** Mark *a* if A,B,C are correct; *b* if A, C; *c* if B, D; *d* if D only; *e* otherwise.

- A: A P atom would be paramagnetic.
- B:  $\text{Ca}^{2+}$  and  $\text{P}^{3-}$  are isoelectronic.
- C: The elements with atomic numbers 5 and 13 would have similar chemical properties.
- D: An atom with all electrons paired would be paramagnetic.

5: **K-TYPE answer format:** Mark *a* if A,B,C are correct; *b* if A, C; *c* if B, D; *d* if D only; *e* otherwise.

- A: An electron in a 3s orbital is closer to the nucleus than one in a 4s orbital.
- B: An electron in the 2s orbital has less energy than one in the 3s orbital.
- C: The principal quantum number  $n$  is related to the orbital's distance from the nucleus.
- D: Energy is absorbed if an electron moves from the  $n = 4$  to  $n = 1$  levels in an atom.

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- 6: (CHALLENGE) The energy of an electron in a one-electron system can be calculated using the equation

$$E_n = \frac{-2.18 \cdot 10^{-11} Z^2}{n^2} \text{ ergs}$$

where  $E_n$  = energy of the electron if in the  $n$  level

$Z$  = charge on the nucleus of the species

$n$  = level in which the electron exists.

Which of the following correctly expresses the relationship between the  $n = 2$  and the  $n = 6$  energy levels of a hydrogen atom?

- A:  $E_2 = \frac{4E_6}{36}$       B:  $E_2 = \frac{36E_6}{4}$       C:  $E_2 = \frac{6E_6}{2}$       D:  $E_2 = \frac{2E_6}{6}$       E:  $E_2 = E_6$

- 7: Which of the following represents the best Lewis structure for  $\text{NO}_2^-$ ?

- A:  $\left[ \begin{array}{c} \overline{\text{O}} - \underline{\text{N}} = \underline{\text{O}} \\ \updownarrow \\ \underline{\text{O}} = \underline{\text{N}} - \overline{\text{O}} \end{array} \right]^-$       B:  $\left[ \underline{\text{O}} = \underline{\text{N}} = \underline{\text{O}} \right]^-$       C:  $\left[ \overline{\text{O}} = \text{N} = \underline{\text{O}} \right]^-$
- D:  $\left[ \overline{\text{O}} - \underline{\text{N}} = \underline{\text{O}} \right]^-$       E:  $\left[ \overline{\text{O}} - \underline{\text{N}} - \overline{\text{O}} \right]^-$

- 8: What is the correct electronic configuration of As?

- A:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$       B:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2$   
C:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$       D:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$   
E:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$

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9: **K-TYPE** answer format: Mark **a** if A,B,C are correct; **b** if A, C; **c** if B, D; **d** if D only; **e** otherwise.

A: The general electron configuration of the nitrogen group elements is  $ns^2 np^3$ .

B: A  $3d$  subshell can contain a maximum of 2 electrons.

C: An element with an electronic configuration of  $1s^2 2s^2 2p^5$  would be in the same group as chlorine.

D: A bromine atom needs to lose two electrons to have a filled outer shell.

10: What is the correct electronic configuration of  $Y^{2+}$  ?

A:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5 5s^2$

B:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^1$

C:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 4d^1$

D:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^3$

E:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1$

11: **K-TYPE** answer format: Mark **a** if A,B,C are correct; **b** if A, C; **c** if B, D; **d** if D only; **e** otherwise.

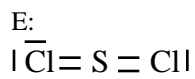
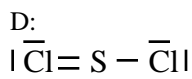
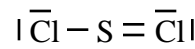
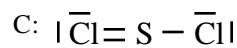
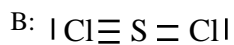
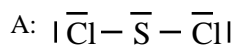
A:  $P^-$  ion is larger than a P atom.

B: Rb atom is smaller than a Li atom.

C: Al atom is larger than a Cl atom.

D:  $Na^+$  ion is larger than a Na atom.

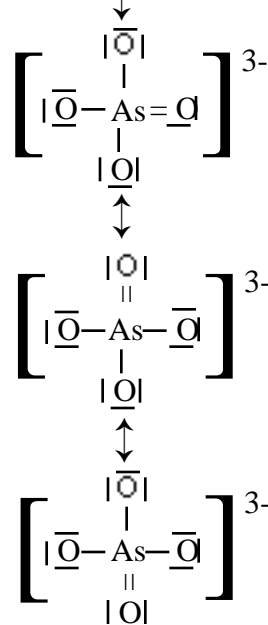
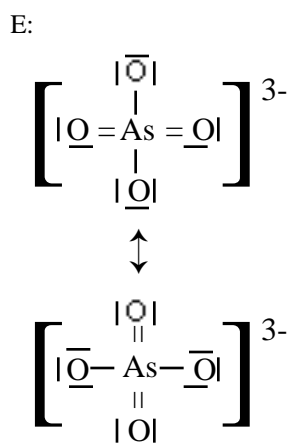
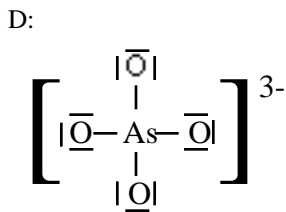
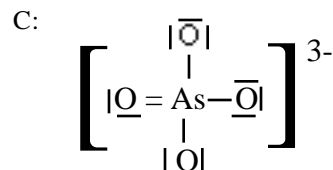
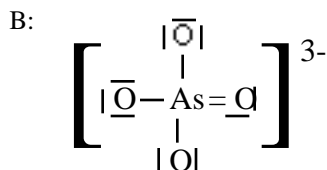
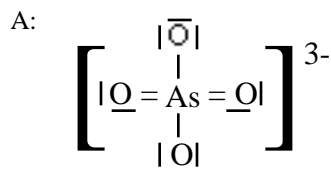
12: Which of the following is the best Lewis structure of  $SCl_2$ ?



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13: What is the best Lewis structure of  $\text{AsO}_4^{3-}$ ?



14: Choose the correct statements from the following concerning  $\text{CN}^{3-}$  and  $\text{CN}^{5-}$  using **K-TYPE answer format**:  
Mark **a** if A,B,C are correct; **b** if A, C; **c** if B, D; **d** if D only; **e** otherwise.

- A: The distance between the atoms is greater in  $\text{CN}^{3-}$  than in  $\text{CN}^{5-}$ .
- B:  $\text{CN}^{5-}$  would be easier to break (would require less energy to break) than  $\text{CN}^{3-}$ .
- C:  $\text{CN}^{5-}$  is held together by a triple bond.
- D:  $\text{CN}^{3-}$  is held together by a double bond.

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15: **K-TYPE answer format:** *Mark a if A,B,C are correct; b if A, C; c if B, D; d if D only; e otherwise.*

- A: A bond formed by the attraction of oppositely charged ions is called an ionic bond.
- B: If calcium were to react with oxygen, the resulting compound would be held together by ionic bonding.
- C: Ionic substances tend to have high melting points.
- D: If magnesium were to react with chlorine, the formula of the resulting compound would probably be MgCl.

16: **K-TYPE answer format:** *Mark a if A,B,C are correct; b if A, C; c if B, D; d if D only; e otherwise.*

- A: The typical atom can emit only certain types of energy.
- B: The frequency of electromagnetic radiation is inversely proportional to its wavelength.
- C: The frequency of radio waves is greater than that of infrared radiation.
- D: Two electrons with the same spin cannot occupy the same region of space.

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No. in Q-Bank	No. on Test	Correct Answer	
34	1	1	D
47	1	2	C
33	1	3	E
40	1	4	A
36	1	5	A
48	1	6	B
46	1	7	A
42	1	8	A
39	1	9	B
43	1	10	C
38	1	11	B
44	1	12	A
45	1	13	C
37	1	14	C
41	1	15	A
35	1	16	E