Houston Community College System HCCS

Spring Semester 2018

General Chemistry I (CHEM 1411)

Exam II Time: 2 Hours

Student Name: _____ Student ID #_____

Instructor: Dr. Emad Akeer 100 Points

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Which one of the following conditions would always result in an increase in the internal energy of a system? 1) _____
   A) The system gains heat and does work on the surroundings.
   B) The system gains heat and has work done on it by the surroundings.
   C) The system loses heat and does work on the surroundings.
   D) The system loses heat and has work done on it by the surroundings.
   E) None of the above is correct.

2) At what velocity (m/s) must a 20.0 g object be moving in order to possess a kinetic energy of 1.00 J? 2) _____
   A) 10.0 B) 1.00×10^3 C) 50.0 D) 1.00 E) 100×10^2

3) Which one of the following is an endothermic process? 3) _____
   A) boiling soup
   B) water freezing
   C) Hydrochloric acid and barium hydroxide are mixed at 25 °C: the temperature increases.
   D) ice melting
   E) Both A and C

4) A _____ ΔH corresponds to an _____ process. 4) _____
   A) zero, endothermic
   B) positive, endothermic
   C) negative, endothermic
   D) positive, exothermic
   E) zero, exothermic

5) The reaction 5) _____

$$4Al\ (s) + 3O_2\ (g) \rightarrow 2Al_2O_3\ (s) \qquad \Delta H^\circ = -3351\ kJ$$

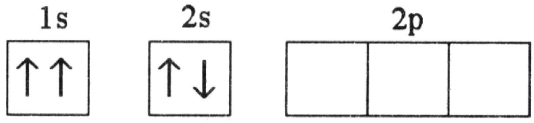
   is _____, and therefore heat is _____ by the reaction.
   A) exothermic, absorbed
   B) endothermic, released
   C) exothermic, released
   D) endothermic, absorbed
   E) thermoneutral, neither released nor absorbed

6) Which of the subshells below do not exist due to the constraints upon the angular momentum quantum number? 6) _____

A) 2s
B) 2p
C) 2d
D) all of the above
E) none of the above

7) Which electron configuration represents a violation of the Pauli exclusion principle? 7) _____

A)



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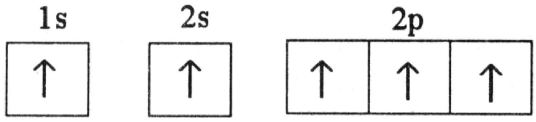

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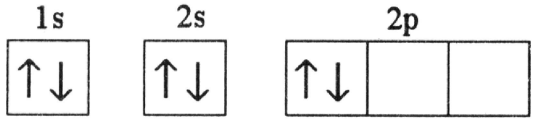

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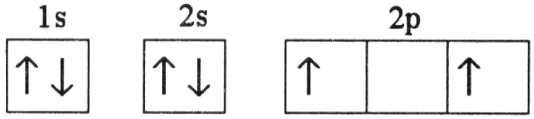

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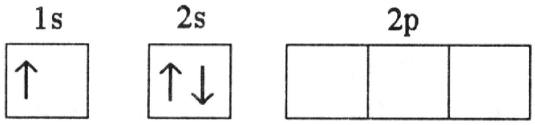


8) The ground-state electron configuration of the element _____ is $[Kr]5s^14d^5$. 8) _____

A) Tc B) Nb C) Cr D) Mn E) Mo

9) The ground state configuration of tungsten is _____. 9) _____

A) $[Xe]6s^24f^7$
B) $[Kr]5s^24d^{10}5p^5$
C) $[Xe]6s^24f^{14}5d^4$
D) $[Ar]4s^23d^3$
E) $[Ne]3s^1$

10) The valence shell of the element X contains 2 electrons in a 5s subshell. Below that shell, element X has a partially filled 4d subshell. What type of element is X? 10) _____

A) transition metal
B) halogen
C) main group element
D) chalcogen
E) alkali metal

11) Electrons in the 1s subshell are much closer to the nucleus in Ar than in He due to the larger _____ in Ar. 11) _____

A) Hund's rule
B) nuclear charge
C) paramagnetism
D) azimuthal quantum number
E) diamagnetism

12) Atomic radius generally increases as we move _____. 12) _____

A) down a group and from left to right across a period
B) up a group and from left to right across a period
C) down a group; the period position has no effect
D) down a group and from right to left across a period
E) up a group and from right to left across a period

13) Which of the following correctly represents the second ionization of calcium? 13) _____

A) $Ca^{+}(g) + e^{-} \rightarrow Ca^{2+}(g)$
B) $Ca^{-}(g) + e^{-} \rightarrow Ca^{2-}(g)$
C) $Ca^{+}(g) + e^{-} \rightarrow Ca(g)$
D) $Ca(g) \rightarrow Ca^{+}(g) + e^{-}$
E) $Ca^{+}(g) \rightarrow Ca^{2+}(g) + e^{-}$

14) Sodium is much more apt to exist as a cation than is chlorine. This is because _____. 14) _____

A) chlorine is more metallic than sodium
B) chlorine has a greater electron affinity than sodium does
C) chlorine is bigger than sodium
D) chlorine is a gas and sodium is a solid
E) chlorine has a greater ionization energy than sodium does

15) All of the halogens _____. 15) _____

A) exist under ambient conditions as diatomic gases
B) form salts with alkali metals with the formula MX
C) tend to form negative ions of several different charges
D) exhibit metallic character
E) tend to form positive ions of several different charges

For the questions that follow, consider the BEST Lewis structures of the following oxyanions:

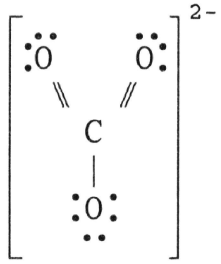
(i) NO_2^- (ii) NO_3^- (iii) SO_3^{2-} (iv) SO_4^{2-} (v) BrO_3^-

16) There can be four equivalent best resonance structures of _____. 16) _____

A) (i) B) (ii) C) (iii) D) (iv) E) (v)

17) The Lewis structure of the CO_3^{2-} ion is _____. 17) _____

A)



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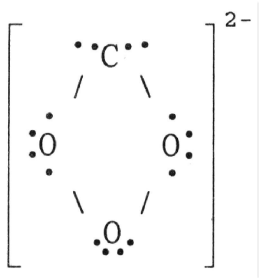

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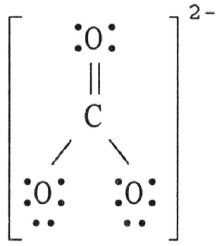

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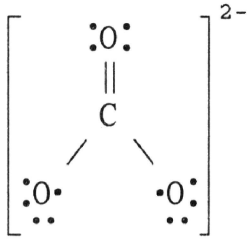

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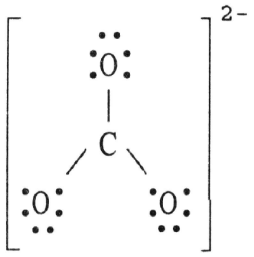

18) Of the bonds C–N, C═N, and C≡N, the C–N bond is _____. 18) _____

A) strongest/shortest
B) weakest/longest
C) strongest/longest
D) intermediate in both strength and length
E) weakest/shortest

19) Given that the average bond energies for C–H and C–Br bonds are 413 and 276 kJ/mol, respectively, the heat of atomization of bromoform ($CHBr_3$) is _____ kJ/mol. 19) _____

A) 1378 B) 689 C) –689 D) 1241 E) –1378

Answer Key
Testname: CHEM1411 EXAM 2 SPRING 2018

1) B
2) A
3) E
4) B
5) C
6) C
7) A
8) E
9) C
10) A
11) B
12) D
13) E
14) E
15) B
16) D
17) C
18) B
19) D