Chemistry 11 Spring 2008
Examination #1 **ANSWER KEY**

For the first portion of this exam, select the best answer choice for the questions below and mark the answers on your scantron. Then answer the free response questions that follow (100 pts. total; multiple choice 2 pts. each).

1. List the following in order of *increasing* radius: Be^{+2}, Be^{+1}, Be, Be^{-1}.

   A. $Be^{-1} < Be < Be^{+1} < Be^{+2}$
   B. $Be^{+2} < Be^{+1} < Be < Be^{-1}$
   C. $Be < Be^{-1} < Be^{+1} < Be^{+2}$
   D. $Be^{+2} < Be^{-1} < Be < Be^{+1}$
   E. All listed species possess the same size in radii.

2. How much heat (in kJ) is absorbed by 0.652 kg of water in order for the temperature to increase by 7.50 ºC?

   A. 7.50
   B. 2.05×10^{-2}
   C. 2.08×10^{-2}
   D. 20.5
   E. 20.8

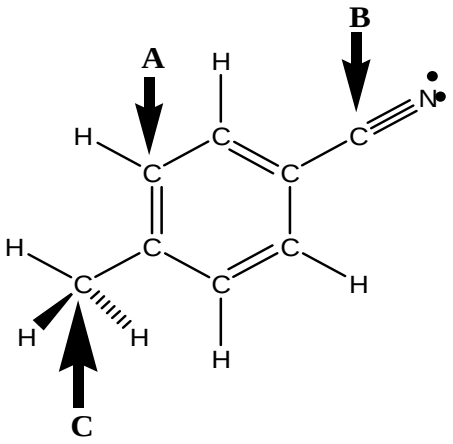
3. Which of the following species contains a triple bond?

   A. PH_3
   B. C_2F_4
   C. NO_3^-
   D. CO_3^{-2}
   E. C_2H_2

4. The total number of neutrons, protons, and electrons in $^{35}Cl^-$ are:

   A. 17 neutrons, 35 protons, and 36 electrons
   B. 35 neutrons, 17 protons, and 18 electrons
   C. 18 neutrons, 17 protons, and 16 electrons
   D. 18 neutrons, 17 protons, and 18 electrons
   E. 17 neutrons, 17 protons, and 17 electrons

For Questions 5 – 8, consider the organic molecule shown below:



5. What is the geometry associated with the carbon labeled “A”?

   A. linear
   B. trigonal planar
   C. trigonal pyramidal
   D. tetrahedral
   E. bent

6. What is the relative bond angle associated with the carbon labeled “B”?

   A. 90º
   B. 109.5º
   C. 120º
   D. 180º
   E. 360º

7. What is the relative bond angle associated with the carbon labeled “C”?

   A. 90º
   B. 109.5º
   C. 120º
   D. 180º
   E. 360º

8. Select “**A**” for True OR “**B**” for False regarding the following statement: *This molecule possesses resonance*.

9. Which of the following is NOT characteristic of most nonmetals?

A. poor conductors of heat and electricity
B. generally possess low melting points
C. do not reflect light
D. can be hammered flat
E. readily reduce to form anions

10. All of the following species are isoelectronic with Ar EXCEPT:

A. S^{-2}
B. Cl^{-}
C. K^{+}
D. Sr^{+2}
E. Ru^{+26}

11. At what temperature does the Fahrenheit reading equal TWICE the Celsius temperature?

A. 160 ºC; 320 ºF
B. 12 ºC; 24 ºF
C. -12 ºC; -24 ºF
D. -288 ºC; -576 ºF
E. 40 ºC; 80 ºF

12. Which of the following correctly describes seawater?

A. pure substance; compound
B. heterogeneous mixture
C. homogeneous mixture
D. diatomic
E. pure substance; element

13. Which of the following molecules is NOT polar?

A. CH_2Br_2
B. NO_2^{-}
C. AsH_3
D. $CH_3CH_2CH_2CH_3$
E. $CH_3CH_2CH_2OH$

For Questions 14 – 15, consider the C, O, and F atoms:

14. Rank the atoms in terms of increasing first ionization energies.

A. C < O < F
B. O < C < F
C. F < O < C
D. F < C < O
E. All the atoms possess equal first ionization energies.

15. Now determine the order of increasing electronegativities for each of the species.

A. C < O < F
B. O < C < F
C. F < O < C
D. F < C < O
E. All the atoms possess equal electronegativities.

16. Sulfur dioxide gas is an example of:

A. a homogeneous mixture
B. a compound
C. an element
D. a heterogeneous mixture
E. a solid at room temperature

17. Which of the following does NOT represent a chemical change?

A. the freezing of water to form ice
B. the burning of paper
C. the decomposition of sugar
D. the reaction of zinc with hydrochloric acid to form zinc chloride
E. the inability of gold to react with water

18. A student measuring the density of a solution (density = 1.233 g/mL) reported the following results: 1.285 g/mL, 1.376 g/mL, 1.123 g/mL, and 1.148 g/mL. Which of the following is the best description of the student's data?

A. precise; average of data is inaccurate
B. precise; average of data is accurate
C. precise, but with occasional error
D. not precise; average of data is inaccurate
E. not precise; average of data is accurate

19. A lead ball has a mass of 55.0 g and a density of 11.4 g/cm^3. What is the volume of the ball?

A. 0.207 mL
B. 0.207 L
C. 4.82 mL
D. 4.82 L
E. 627 mL

20. An isotope is:

A. when atoms of the same element have the same number of neutrons but different number of protons
B. when atoms of the same element have the same number of neutrons
C. when atoms of the same element have different number of electrons
D. when atoms of the same element have different number of neutrons
E. when atoms of the same element have different number of protons

21. How many dm^3 are there in 3.8 gallons? *(<u>NOTE</u>: 4 qt = 1 gal; 1 qt = 946 mL)*

A. 1.4×10^7 dm^3
B. 1.0 dm^3
C. 9.0×10^{-1} dm^3
D. 14 dm^3
E. 16 dm^3

22. Carry out the following calculation: $(7.312 \times 10^{-28}) / (6.85 \times 10^{32})$

A. 1.07×10^{-60}
B. 1.067×10^{-4}
C. 1.07×10^{-4}
D. 5.01×10^5
E. 5.01×10^{61}

23. Determine the accurate electronic configuration for Rf (Z = 104):

A. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 4d^{10}\ 4p^6\ 5s^2\ 5d^{10}\ 5p^6\ 6s^2\ 6f^{14}\ 6d^{10}\ 6p^6\ 7s^2\ 7f^{14}\ 7d^2$
B. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 5f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 6f^{14}\ 6d^2$
C. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 6f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 7f^{14}\ 6d^2$
D. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^2\ 5f^{14}\ 6d^2$
E. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 6f^{14}\ 4d^{10}\ 6p^6\ 7s^2\ 7f^{14}\ 5d^2$

24. Which of the following physical processes involves changing a solid directly into a gas?

A. sublimation
B. deposition
C. condensation
D. evaporation
E. freezing

25. Convert 156 miles/week to meters/hour. *(<u>NOTE</u>: 1 mile = 1.61 km)*

A. 1.50×10^{-3} m/hr
B. 1.50×10^{3} m/hr
C. 5.77×10^{-4} m/hr
D. 1.63×10^{1} m/hr
E. 5.77×10^{3} m/hr

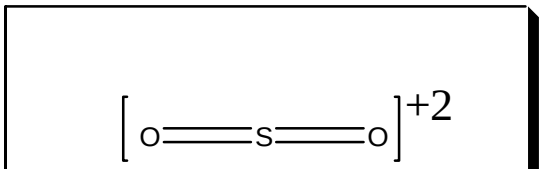
26. (22 pts. total; 2 pts. each) Write the name/chemical formula for each of the following listed below:

A.	CuO	**copper(II) oxide**
B.	$FeSO_3$	**iron(II) sulfite**
C.	silver phosphite	**Ag_3PO_3**
D.	cadmium hydroxide	**$Cd(OH)_2$**
E.	ammonium sulfate	**$(NH_4)_2SO_4$**
F.	zinc cyanide	**$Zn(CN)_2$**
G.	N_2Br_4	**dinitrogen tetrabromide**
H.	ammonia	**NH_3**
I.	P_4O_{10}	**tetraphosphorus decoxide**
J.	gallium nitrate	**$Ga(NO_3)_3$**
K.	NO	**nitrogen monoxide**

27. (28 pts. total; 7 pts. each) **LAST ONE!** Consider each of the following ions/molecules shown below and write your final structures in the boxes provided:

A. Beginning with the best Lewis dot structure, use *VSEPR* theory to draw AND describe the geometry about each CENTRAL atom. Include both electronic and molecular geometries.
B. Give the approximate bond angle(s) around each central atom.
C. Determine whether the overall ion/molecule is polar or nonpolar.

******<u>NOTE</u>: Terminal atoms are assumed to have an octet of electrons (excluding hydrogen)—omitted for the sake of clarity!***



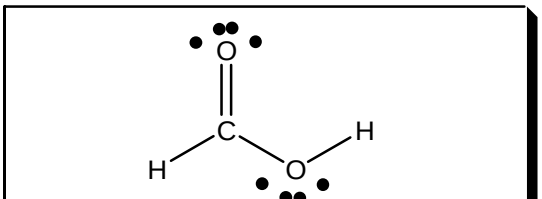
Structure #1

electronic geometry: linear

molecular geometry: linear

approx. bond angle: 180^o

polar or nonpolar? nonpolar



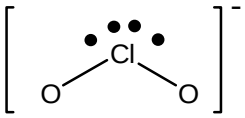
Structure #2

electronic geometry: (C) trigonal planar
(O) tetrahedral

molecular geometry: (C) trigonal planar
(O) bent

approx. bond angle: (C) approx. 120^o
(O) approx. 109.5^o

polar or nonpolar? polar



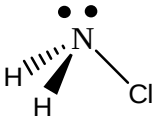
Structure #3

electronic geometry: tetrahedral

molecular geometry: bent

approx. bond angle: approx. 109.5^o

polar or nonpolar? polar



Structure #4

electronic geometry: tetrahedral

molecular geometry: trigonal pyramidal

approx. bond angle: approx. 109.5^o

polar or nonpolar? polar