Exam: Ch 6 – 9 & 25 **Name:** KEY
AP Chem (75 pts) ***I have not given, received, nor will give any aid on this exam.***
Version I **Period: 5 6 7** **November 18, 2004**

MC: (_____ - _____ / 4)(3 pts each) = ____	FR:____	Overall: ____

SECTION I: Multiple Choice (3 pts each): Choose the option that is the best answer or completes each question or statement. Write your answers in the blanks provided and erase mistakes completely. In this section, as a correction for haphazard guessing, one-fourth of the number of questions you answer incorrectly will be subtracted from the number of questions you answer correctly.

1. In order for two samples to be made up of identical elements
   a. The emission spectra must be similar.
   (b.) The emission spectra must be identical.
   c. The samples must be heated to excite the electrons. electricity
   d. The lines on one emission spectrum must have the same average wavelength as the lines on the other spectrum.
   e. Not enough information given or none of the above Ans: b

2. Which of the following atoms has electrons in an excited state?
   a. $1s^2\,2s^2\,2p^1$
   b. $1s^2\,2s^2\,2p^4$
   (c.) $1s^2\,2s^2\,2p^5\,3s^1$
   d. $1s^2\,2s^2\,2p^6\,3s^2$
   e. Not enough information given or none of the above Ans: c

3. All of the orbitals in a given subshell have the same value of the:
   (I.) Angular quantum number (l)
   II. Magnetic quantum number (m_l) 3d _ _ _ _ _
   (III.) Principal quantum number
   IV. Spin quantum number

   a. I and II only
   (b.) I and III only
   c. I, II and III only
   d. I, II, III, and IV
   e. Not enough information given or none of the above Ans: b

4. Which of the following has the smallest radius?
   a. O^{1-}
   b. O
   (c.) O^{1+} greater eff. nuc. charge
   d. N
   e. Not enough information given or none of the above Ans: c

5. Which series is ranked in order from smallest to largest electron affinity (becoming more negative)?
   a. Ar, Cl, S
   b. S, Cl, Ar
   c. Br, Cl, F
   d. F, Cl, Br
   e. Not enough information given or none of the above Ans: e

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6. Which of the following should require the smallest energy?
   a. 2nd ionization energy of Al $3s^2 3p^1$
   b. 3rd ionization energy of Al $3s^2$
   c. 2nd ionization energy of Si $3s^2 3p^2$
   d. 3rd ionization energy of Si $3s^2 3p^1$
   e. Not enough information given or none of the above

Ans: a

7. When compared with NaF, the compound KF:
   a. Has a greater lattice energy (smaller) — bigger ions
   b. Has a stronger bond — smaller, ΔEN — Has a lower final weight
   c. Has a smaller difference of electronegativity
   d. Has a smaller difference of metallic character
   e. Not enough information given or none of the above

Ans: b a

8. Which of the following should display the greatest level of paramagnetism?
   a. K $4s^1$ 1
   b. V^{2+} $3d^3$ 3
   c. Ni $4s^2 3d^8$ 2
   d. Cu^{1+} $3d^{10}$ 0
   e. Not enough information given or none of the above

Ans: a a b

9. The number of delocalized electrons in ClO_3^{1-} is:
   a. 0
   b. 2
   c. 3
   d. 4
   e. Not enough information given or none of the above

7 + 18 − 1 = 24

Ans: d a d

10. The hybridization present in the IF_4^{1-} compound is:
   a. sp^3
   b. sp^3d
   c. sp^3d^2
   d. sp^2d^2
   e. Not enough information given or none of the above

7 + 28 + 1 = 36

Ans: c

11. In N_2H_2, there are 3 sigma bonds and 1 pi bonds.
   a. 3 sigma and 1 pi.
   b. 3 sigma and 2 pi.
   c. 4 sigma and 0 pi.
   d. 2 sigma and 2 pi.
   e. Not enough information given or none of the above

5 + 5 + 2 = 12

Ans: a

12. Which series lists the compounds in order of decreasing bond order?
   a. N_2, O_2, F_2 3, 2, 1
   b. F_2, O_2, N_2 1, 2, 3
   c. O_2^{2-}, O_2, O_2^{2+} 1, 2, 3
   d. Br_2, Cl_2, F_2 1, 1, 1
   e. Not enough information given or none of the above

Ans: a

13. The octet rule is not violated by the central atom in:
   a. SF_4
   b. KrF_2
   c. CF_4
   d. XeF_4
   e. Not enough information given or none of the above

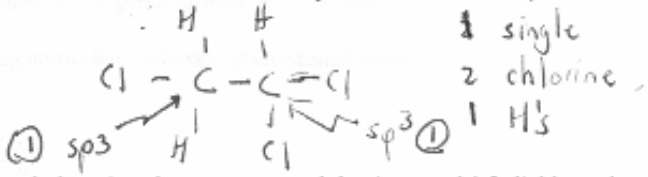
Ans: c

14. In the process of hybrid orbital formation, the purpose of promoting one or more electrons is to:
   a. Increase the number of atomic orbitals
   b. Increase the number of unpaired electrons
   c. Make sure that every atomic orbital is occupied prior to hybridization
   d. Make sure that all electrons in atomic orbitals are unpaired prior to hybridization
   e. Not enough information given or none of the above Ans: b

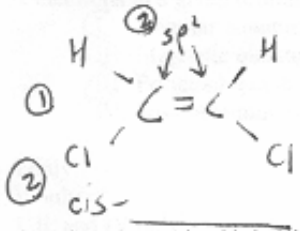
15. Which of the following compounds does not contain a C=O (double) bond?
   a. Aldehyde
   b. Ester
   c. Ether
   d. Ketone
   e. Not enough information given or none of the above Ans: c

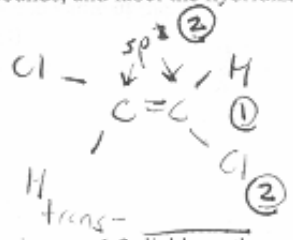
SECTION II: Free Response

16. (22 pts) Consider 1,2-dichloroethane.
   a. (6 pts) Draw the Lewis structure for this compound and label the hybridization of each carbon.



   b. (10 pts) Although there is only one compound that is named 1,2-dichloroethane, there are two compounds that can be named 1,2-dichloroethene. Explain. Be sure to draw Lewis structures, name the two 1,2-dichloroethene compounds, and label the hybridization of each carbon.





   c. (6 pts) Estimate the Cl-C-C bond angles in: 1,2-dichloroethane: 109.5 (2)
   1,2-dichloroethene: 120° (2)
   dichloroethyne: 180° (2)

17. (8 pts) Using the following information: $N_2(g) \rightarrow 2\,N(g)$ $\Delta H = 941$ kJ/mol

   a. Determine what is the maximum wavelength of light necessary to decompose nitrogen gas to atomic nitrogen.

$E = \frac{hc}{\lambda}$

$941 \times 10^3 = \frac{6.63 \times 10^{-34} \cdot 3E^8}{\lambda}$ (2)

$\lambda = 2.11 \times 10^{-31}\ m \cdot mol \times 6.02E^{23} = 1.27 \times 10^{-7}\ m$ (2)

$= 2.11 \times 10^{-22}\ nm \cdot mol$ (2) $127\ nm = 130\ nm$

   b. In what band ("section") of the electromagnetic spectrum can this radiation be found? (Sorry, no guessing without justification.)

UV (2)

Exam: Ch 6 – 9 & 25
AP Chem (75 pts)
Version J

Name: KEY
I have not given, received, nor will give any aid on this exam.
Period: 5 6 7 November 18, 2004

MC: (_____ - _____ / 4)(3 pts each) = ____ FR:____ Overall: ____

SECTION I: Multiple Choice (3 pts each): Choose the option that is the best answer or completes each question or statement. Write your answers in the blanks provided and erase mistakes completely. In this section, as a correction for haphazard guessing, one-fourth of the number of questions you answer incorrectly will be subtracted from the number of questions you answer correctly.

1. Two samples with the same emission spectra:
   a. Are made up of identical elements.
   b. Have the same chemical formula.
   c. Have been heated to excite the electrons.
   d. Are emitting visible light
   e. Not enough information given or none of the above

   Ans: b

2. Which of the following atoms has electrons in an excited state?
   a. $1s^2 2s^2 2p^2$
   b. $1s^2 2s^2 2p^6 3s^1$
   c. $1s^2 2s^2 2p^6 3s^2 3p^5$
   d. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^1$
   e. Not enough information given or none of the above

   Ans: d

3. All of the electrons in a given orbital have the same value of the:
   I. Angular quantum number (l)
   II. Magnetic quantum number (m_l)
   III. Principal quantum number
   IV. Spin quantum number

   3d ↑↓ – – – –

   a. I only
   b. II only
   c. I, II, and IV only
   d. I, II, III, and IV
   e. Not enough information given or none of the above

   Ans: e

4. Which of the following has the largest radius?
   a. S^{1-}
   b. S
   c. S^{1+}
   d. Cl
   e. Not enough information given or none of the above

   Ans: a

5. Which series is ranked in order from largest to smallest electron affinity (becoming less negative)?
   a. Cl, S, P
   b. S, Cl, Ar
   c. Sc, S, O
   d. F, Cl, Br
   e. Not enough information given or none of the above

   Ans: a

6. Which of the following should require the smallest energy?
   a. 1st ionization energy of Mg $3s^2$
   b. 2nd ionization energy of Mg $3s^1$
   c. 1st ionization energy of Al $3s^2 3p^1$
   d. 2nd ionization energy of Al $3s^2$
   e. Not enough information given or none of the above

Ans: c

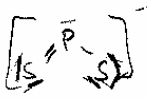
7. When compared with CaS, the compound CaO:
   a. Has a lower lattice energy
   b. ~~Has a weaker bond~~ has greater formula weight
   c. Has a greater difference of electronegativity
   d. Has a smaller difference of metallic character
   e. Not enough information given or none of the above

Ans: c

8. Which of the following should display the lowest level of paramagnetism?
   a. Ca $4s^2$ 0
   b. V^{3+} $3d^2$ 2
   c. Ni^{2+} $3d^8$ 2
   d. Cu $4s^1 3d^{10}$ 1
   e. Not enough information given or none of the above

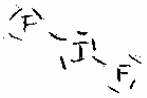
Ans: d

9. The number of delocalized electrons in PS_2^{1-} is:
   a. 0 $5+12+1 = 18$
   b. 1
   c. 2
   d. 3
   e. Not enough information given or none of the above



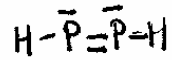
Ans: d

10. The hybridization present in the IF_2^- compound is:
   a. sp^3 $7+14+1 = 22$
   b. sp^3d
   c. sp^3d^2
   d. sp^2d^2
   e. Not enough information given or none of the above



Ans: b

11. In P_2H_2, there are __ sigma bonds and __ pi bonds. 12
   a. 3 sigma and 1 pi.
   b. 3 sigma and 2 pi.
   c. 4 sigma and 0 pi.
   d. 2 sigma and 2 pi.
   e. Not enough information given or none of the above



Ans: 9

12. Which series lists the compounds in order of increasing bond order?
   a. N_2, O_2, F_2 3, 2, 1
   b. F_2, O_2, N_2 1, 2, 3
   c. O_2^{2-}, O_2^{2+}, O_2 1, 3, 2
   d. Br_2, Cl_2, F_2 1, 1, 1
   e. Not enough information given or none of the above

Ans: b

13. The octet rule is not violated by the central atom in:
   a. XeF_4
   b. SF_4
   c. KrF_2
   d. PF_3
   e. Not enough information given or none of the above

Ans: d

14. In the process of hybrid orbital formation, the purpose of promoting one or more electrons is to:
   a. Make sure that all electrons have the same spin prior to hybridization
   b. Make sure that all electrons in atomic orbitals are unpaired prior to hybridization
   c. Increase the potential number of molecular orbitals
   d. Increase the number of unpaired electrons
   e. Not enough information given or none of the above

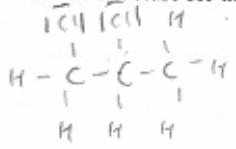
Ans: d

15. Which of the following compounds does not contain a C—O (single) bond?
   a. Alcohol
   b. Ester
   c. Ether
   d. Ketone
   e. Not enough information given or none of the above

Ans: d

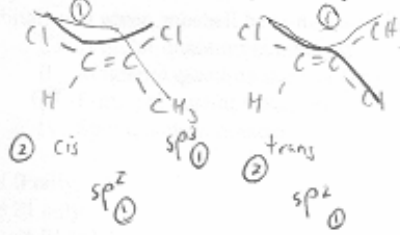
SECTION II: Free Response

16. (22 pts) Consider 1,2-dichloropropane.
   a. (6 pts) Draw the Lewis structure for this compound and label the hybridization of each carbon.



① H's
① lone pairs
① Cl's
② sp^3

   b. (10 pts) Although there is only one compound that is named 1,2-dichloropropane, there are two compounds that can be named 1,2-dichloropropene. Explain. Be sure to draw Lewis structures, name the two 1,2-dichloropropene compounds, and label the hybridization of each carbon.



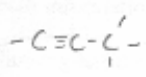
② cis sp^2 ① sp^3 ① trans sp^2 ①

IF OR

1,2-1-ene 1,2-2-ene

-4

   c. (6 pts) Estimate the Cl-C-C bond angles in:



1,2-dichloropropane: 109.5° ②

1,2-dichloropropene: 120° ② (109.5 ok)

1,3-dichloropropyne: 180° ② (109.5 ok)

17. (8 pts) Using the following information: $O_2(g) \rightarrow 2\,O(g)$ $\Delta H = 495$ kJ/mol

   a. Determine what is the maximum wavelength of light necessary to decompose nitrogen gas to atomic ~~nitrogen~~.

② ox ox

$$495{,}000\ J = \frac{hc}{\lambda} = \frac{6.6340^{-34} \cdot 3.0\times10^{8}}{\lambda}$$

$$\lambda = \frac{4.0\times10^{-31}\ m}{1\ mol} \times \frac{1\times10^{9}\ nm}{1\ m} \times \frac{6.022\times10^{23}}{14} = 241.97\ nm$$

② ≈ 240 nm = 2.4×10^{-7} m

   b. In what band ("section") of the electromagnetic spectrum can this radiation be found? (Sorry, no guessing without justification.)

UV ②

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