

CHEMISTRY 15
EXAM IV-Version A (White)

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June 26, 2001

An optical scoring machine will grade this examination. The machine is not programmed to accept the correct one of two sensed answers and will not sense answers which are lightly marked. Mark your answer sheet carefully with a No. 2 soft lead pencil and erase any undesired marks **COMPLETELY**. Avoid making any extraneous marks on the answer sheet other than the information asked below.

On the answer sheet:

1. Print your name in the space for **NAME (Last name first, CIRCLE your last name)**.
2. In the space marked **SUBJECT** write **Chem 15**.
3. In the space marked **TEST NO.** write **EXAM #4**.
4. In the space marked **HOOR** write **Summer I' 2001**.
5. Check to see that you have 20 examination questions, periodic table, scratch paper and a scantron with NO mark in the upper right hand corner.

HAND IN ONLY THE ANSWER SHEET.

Useful Conversions

$$c(\text{H}_2\text{O}(l)) = 4.18 \text{ J/g-C}$$

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CHOOSE THE ONE BEST ANSWER

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1. Draw a Lewis structure for SCl_2^{+2} in which the central atom does NOT expand its octet. In this Lewis structure, there are _____ single bonds, _____ double bonds and _____ lone pairs of electrons on the central atom.

	<u>single bonds</u>	<u>double bonds</u>	<u>lone pairs of e-</u>
A.	one	one	one
B.	two	zero	one
C.	zero	two	one
D.	zero	two	zero
E.	two	zero	two

2. Draw Lewis structures for each of the species shown below. Which one has a molecular shape that is **trigonal pyramidal**?

- A. BCl_3
- B. PCl_3
- C. IF_3
- D. All of the above.
- E. Both A and B.

3. Which of the molecules given in the last question (BCl_3 , PCl_3 and IF_3) are **POLAR**?

- A. BCl_3 only
- B. PCl_3 only
- C. IF_3 only
- D. PCl_3 and IF_3
- E. BCl_3 and PCl_3

4. In which of the following **MUST the concept of resonance be invoked** in order to accurately describe the bonding?

- A. PH_3
- B. SO_2
- C. CS_3^{-2}
- D. Both B and C
- E. All of the above.

5. Consider the Lewis structures you drew for PCl_3 , CS_3^{-2} , and IF_3 in the previous questions. Which of the following is written with a **CORRECT hybridization** for the central atom?
- PCl_3 ; sp^2
 - CS_3^{-2} ; sp^3
 - IF_3 ; sp^3d
 - All of the above.
 - None of the above.
6. Draw a Lewis structure for the oxyacid HClO_2 in which the chlorine atom does NOT expand its octet. In this Lewis structure, the **formal charge on the chlorine** is:
- 2
 - 1
 - 0
 - +1
 - +2
7. Draw a Lewis structure and predict the molecular shape for SCl_4^{-2} . The **Cl-S-Cl bond angles** are:
- 120 degrees
 - 109.5 degrees
 - 90 degrees
 - 72 degrees
 - 180 degrees
8. Which one of the atoms shown below **CAN expand its octet** and accommodate more than eight electrons in its valence shell?
- O
 - B
 - Se
 - Be
 - N
9. In the trigonal bipyramidal arrangement, three lone pairs of electrons are always placed in _____ positions because this _____.
- | | | |
|----|-------------------------------|---------------------------------------|
| A. | two axial and one equatorial; | minimizes 90 degree BP-BP repulsions |
| B. | one axial and two equatorial; | minimizes 90 degree LP-BP repulsions |
| C. | all axial | minimizes 180 degree LP-BP repulsions |
| D. | all equatorial; | minimizes 90 degree LP-LP repulsions |
| E. | all equatorial; | minimizes 90 degree BP-BP repulsions |

10. During an **endothermic** reaction
- A. ΔH is negative in value.
 - B. heat is absorbed from the surroundings.
 - C. the temperature of the immediate surroundings increases.
 - D. the temperature of the surroundings remains constant.
 - E. None of the above are correct.
11. A 4.6 kJ quantity of heat must be added to 20. g of silver to increase its temperature from 25 C (room temperature) to 962 C (the melting point of silver). The **specific heat (c_p)** of silver is:
- A. 83 J/g-C
 - B. 0.056 J/g-C
 - C. 0.90 J/g-C
 - D. 2.1 J/g-C
 - E. 0.25 J/g-C
12. In an insulated container, a 5.0 g sample of water at 80. C was added to an unknown mass of cooler water at 30. C. The final temperature of the resulting mixture became 35 C. What **mass of cooler water** was present?
(Assume the container itself adsorbed a negligible amount of heat.)
- A. 45 g
 - B. 10. g
 - C. 2.5 g
 - D. 50. g
 - E. 5.0 g
13. Consider the reaction shown below.



How much **heat (in kJ)** is released when 6.10 g of solid Mg is reacted with an excess of magnesium nitrate?

- A. 122 kJ
- B. 2910 kJ
- C. 634 kJ
- D. 971 kJ
- E. 15.7 kJ

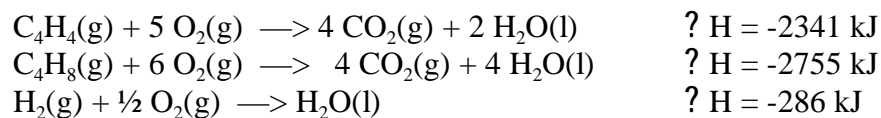
14. Given the balanced equation shown below,



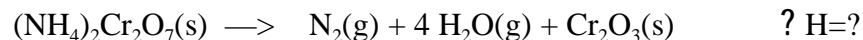
calculate **? H** for the reaction: $\text{H}_3\text{PO}_4(\text{l}) \longrightarrow 1/4 \text{P}_4\text{O}_{10}(\text{s}) + 3/2 \text{H}_2\text{O}(\text{l})$? H = ??

- A. +386 kJ
B. +64.2 kJ
C. -1028 kJ
D. -128 kJ
E. +1028 kJ
15. Calculate **? H** for the reaction: $\text{C}_4\text{H}_4(\text{g}) + 2 \text{H}_2(\text{g}) \longrightarrow \text{C}_4\text{H}_8(\text{g})$? H = ?

Given,



- A. +230 kJ
B. -158 kJ
C. -5382 kJ
D. +1080 kJ
E. None of the above are correct.
16. Calculate the **standard enthalpy change** for the reaction shown below.



Given,

<u>Substance</u>	<u>? H_f (kJ/mol)</u>
(NH ₄) ₂ Cr ₂ O ₇ (s)	-22
Cr ₂ O ₃ (s)	-1128
H ₂ O(l)	-286
H ₂ O(g)	-242

- A. Not enough information given.
B. -1348 kJ
C. -2250 kJ
D. +1980 kJ
E. -2074 kJ

17. Which one of the following bonds to oxygen has the **LONGEST bond length**?
- A. O-S
 - B. O-Cl
 - C. O-As
 - D. O-Br
 - E. No way to tell. More information is needed.
18. As **bond order increases**, **bond length** _____ and **bond energy** _____ .
- A. remains the same; increases
 - B. decreases; decreases
 - C. increases; increases
 - D. increases; decreases
 - E. decreases; increases
19. Draw a Lewis structure for NO^- . The **nitrogen-oxygen bond** consists of :
- A. only one sigma-type bond.
 - B. two sigma-type bonds.
 - C. one sigma-type bond and one pi-type bond.
 - D. one sigma-type bond and two pi-type bonds.
 - E. two pi-type bonds.
20. When a 0.192 mol sample of C_2H_2 was ignited in a 3000. g H_2O calorimeter with a constant of 2.50 kJ/ C, a temperature increase of 16.5 C was observed. Calculate the **heat of combustion (? H_{comb}) of C_2H_2** in units of **kJ/mol C_2H_2** .
 $c(\text{H}_2\text{O}(l)) = 4.18 \text{ J/g-C}$
- A. -215 kJ/mol
 - B. -1.29×10^3 kJ/mol
 - C. -2.07×10^3 kJ/mol
 - D. +248 kJ/mol
 - E. +67.4 kJ/mol

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Answer Key

Summer I' 2001

- | | | | |
|-----|---|-----|---|
| 1. | A | 11. | E |
| 2. | B | 12. | A |
| 3. | D | 13. | A |
| 4. | D | 14. | B |
| 5. | C | 15. | B |
| 6. | D | 16. | E |
| 7. | C | 17. | C |
| 8. | C | 18. | E |
| 9. | D | 19. | C |
| 10. | B | 20. | B |