

**CHEMISTRY 15**  
**EXAM III-Version A (White)**

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**June 18, 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 #3**.
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**

$$c = 2.998 \times 10^8 \text{ m/sec}$$

$$h = 6.626 \times 10^{-34} \text{ J-sec}$$

$$R = 1.097 \times 10^{-2} \text{ nm}^{-1}$$

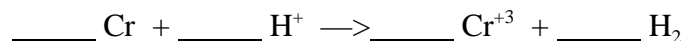
## CHEM 15

## EXAM III-Version A (White)

CHOOSE THE ONE BEST ANSWER

Summer I' 2001

1. Which of the following half-reactions specifies an **OXIDATION**?
- A.  $\text{ClO}_2^- \rightarrow \text{Cl}_2$   
 B.  $\text{NH}_3 \rightarrow \text{NO}_2^-$   
 C.  $\text{Br}_2 \rightarrow \text{Br}^-$   
 D.  $\text{MnO}_2 \rightarrow \text{Mn}^{+2}$   
 E. None of the above.
2. In the species  $\text{C}_2\text{H}_6$ ,  $\text{C}_2\text{O}_4^{2-}$  and  $\text{Al}_4\text{C}_3$ , the oxidation number of carbon is \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_, respectively.
- A. -3, +3 and -4  
 B. -6, +4 and -2  
 C. +2, -2, and -3  
 D. +3, -3 and +4  
 E. None of the above are correct.
3. Balance the redox reaction shown below. When balanced, the **coefficients in front of the Cr and  $\text{H}^+$**  are \_\_\_\_\_ and \_\_\_\_\_, respectively. (Be careful!!)



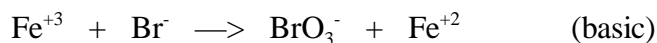
- A. two; three  
 B. three; two  
 C. two; six  
 D. one; two  
 E. one; three

4. Balance the half-reaction shown below for **acidic solution**. When balanced, the coefficients in front of the  $\text{H}^+$  and  $\text{e}^-$  are \_\_\_\_\_ and \_\_\_\_\_, respectively.

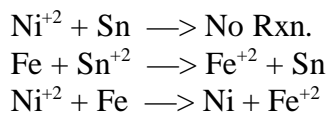


- A. four; three  
 B. two; two  
 C. one; four  
 D. three; two  
 E. three; three

5. Balance the redox reaction shown below for **basic solution**. When balanced, the **coefficients of the OH<sup>-</sup>, Fe<sup>+3</sup> and Br<sup>-</sup> ADD/SUM** to:



- A. thirteen  
B. eight  
C. five  
D. twenty  
E. eighteen
6. Which of the following reactions between non-metals **WILL proceed spontaneously** in the forward direction?
- A.  $\text{Cl}^- + \text{I}_2 \longrightarrow$   
B.  $\text{I}_2 + \text{Br}^- \longrightarrow$   
C.  $\text{I}^- + \text{F}_2 \longrightarrow$   
D.  $\text{S} + \text{F}^- \longrightarrow$   
E. All of the above.
7. The following set of reactions between the metals iron, tin, and nickel are found to occur. A list of the metals in order **of their reactivity to act as reducing agents** is: (i.e. list the best reducing agent first and the worst reducing agent last)



- A. Sn > Fe > Ni  
B. Ni > Fe > Sn  
C. Sn > Ni > Fe  
D. Fe > Sn > Ni  
E. Fe > Ni > Sn
8. The red color emitted by highway safety flares is due to the burning of strontium salts. When excited, strontium emits light with an energy of  $3.12 \times 10^{-19}$  J per photon. What **wavelength (in nm)** does this correspond to: (1 m =  $10^9$  nm)
- A.  $1.06 \times 10^5$  nm  
B. 637 nm  
C.  $6.20 \times 10^{-4}$  nm  
D. 798 nm  
E. 471 nm

9. A **discrete line spectrum** is obtained from excited state atoms. This indicates .....
- A. that electrons can sit at any of a continuous range of energies within the atom.
  - B. that a redox reaction is occurring.
  - C. that electrons are being excited from energy levels close to the nucleus to energy levels far from the nucleus.
  - D. that electrons can only sit at specific energies within the atom.
  - E. that white light is present.
10. Which one of the following statements is **TRUE**?
- A. An electron in an “s” subshell travels in a circular path about the nucleus.
  - B. In order to theoretically predict the orbital shapes, the electron must be treated as a particle.
  - C. The wavenature of a heavy, macroscopic object (like a baseball) is important.
  - D. The orbital shapes correspond to the region wherein the electron can be found 95% of the time.
  - E. A  $3p_y$  orbital has a different energy than a  $3p_x$  orbital.
11. In hydrogen, an electron moves from the **first shell (n=1)** to the **fifth shell (n=5)**. During this transition a photon of light with a wavelength of \_\_\_\_\_ is \_\_\_\_\_.  
( $R=1.097 \times 10^{-2} \text{ nm}^{-1}$ )
- A. 438.8 nm; emitted
  - B. 714.6 nm; emitted
  - C. 94.96 nm; absorbed
  - D. 2098 nm; emitted
  - E. 113.1 nm; absorbed
12. A complete list of ALL possible subshells for the **fifth shell** is:
- A. s, p
  - B. s, p, d
  - C. s, p, d, f
  - D. s, p, d, f, g
  - E. s, p, d, f, g, h
13. An electron resides in an atomic orbital with **n=4, l=3, and  $m_l=2$** . Which of the following is the **CORRECT designation for this orbital**?
- A. 3g
  - B. 4f
  - C. 4p
  - D. 2s
  - E. 7d

14. An electron in an atom **CAN** have which one of the following sets of quantum numbers?
- A.  $n=1, l=1, m_l=0$
  - B.  $n=2, l=2, m_l=1$
  - C.  $n=3, l=1, m_l=2$
  - D.  $n=2, l=0, m_l=0$
  - E.  $n=5, l=3, m_l=+1$
15. Which of the following pairs **ARE isoelectronic**?
- A.  $\text{Se}^{-2}$  and  $\text{Ca}^{+2}$
  - B.  $\text{I}^-$  and  $\text{Br}^-$
  - C.  $\text{Y}^+$  and  $\text{Kr}$
  - D.  $\text{Ar}$  and  $\text{Na}^+$
  - E.  $\text{P}^{-3}$  and  $\text{Cl}^-$
16. The **electronic configuration of  $\text{V}^{+2}$**  is:
- A.  $[\text{Ar}]4s^23d^1$
  - B.  $[\text{Ar}]3d^3$
  - C.  $[\text{Ar}]4s^13d^2$
  - D.  $[\text{Ar}]4s^23d^5$
  - E.  $[\text{Ar}]4s^23d^3$
17. The **electronegativity** of nitrogen is 3.0 while that for oxygen is 3.5. Therefore, the compound NO would be expected .....
- A. to have pure covalent bonds with an electron pair shared equally between N and O.
  - B. to have polar covalent bonds with an electron pair shared equally between N and O.
  - C. to have polar covalent bonds with a partial negative charge on the N.
  - D. to have pure ionic bonds with oxygen as the anion.
  - E. to have polar covalent bonds with a partial negative charge on the O.
18. Which of the following has a **CORRECT ordering of radii**?
- A.  $\text{S} > \text{Te}$
  - B.  $\text{S} > \text{S}^{-2}$
  - C.  $\text{Te} > \text{Sr}$
  - D.  $\text{Sr}^{+2} > \text{Sr}$
  - E.  $\text{Mg} > \text{S}$

19. Which of the elements shown below has the **HIGHEST first ionization energy ( $IE_1$ )**?

- A. Se
- B. Rb
- C. Cl
- D. Na
- E. Both B and D.

20. Which of the following species **IS paramagnetic**?

- A. Ba
- B. Fe
- C. Se
- D. None of the above.
- E. Both B and C.

**Exam III Version A (White)**  
**Answer Key**

Summer I' 2001

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