

# KEY

## Exam 4 Form A Chemistry 121 Fall 2003

### DIRECTIONS

You have 75 minutes to complete this 100-point exam. Indicate your exam form on the line marked "SUBJECT" on the scantron. You may only use a nonprogrammable calculator. NO GRAPHING CALCULATORS ALLOWED!

1. Which process is most likely to lead to acid rain?  
 (A) the indiscriminate spraying of herbicides  
 D (B) incomplete combustion of gasoline  
 (C) emission of freon from aerosol cans  
 (D) the burning of high-sulfur coal
2. The kinetic-molecular theory of ideal gases assumes that  
 (A) the collisions of gas molecules result in a loss of energy.  
 (B) all gas molecules travel at the same speed.  
 C (C) the volume of a gas molecule is negligible.  
 (D) gas molecules exert no pressure on the walls.
3. Which gas has the greatest average kinetic energy at a given temperature?  
 (A) H<sub>2</sub>  
 D (B) Ne  
 (C) CO<sub>2</sub>  
 (D) None; the kinetic energy is the same for each gas.
4. Under the same conditions of temperature and pressure, the gas whose molecules possess the highest average speed is  
 A (A) H<sub>2</sub>O      (B) O<sub>2</sub>      (C) Ne      (D) F<sub>2</sub>  
    18            32            20            36
5. Which has lowest freezing point?  
 (A) 0.2 m CaCl<sub>2</sub>    3  
 A (B) 0.2 m BaSO<sub>4</sub>    2  
 (C) 0.2 m sugar     1  
 (D) H<sub>2</sub>O             0
6. Which substance has the highest boiling point?  
 C (A) CH<sub>4</sub>      (B) He      (C) HF      (D) Cl<sub>2</sub>
7. Arrange Ne, NH<sub>3</sub>, and CH<sub>4</sub> in order of increasing boiling point.  
 A (A) CH<sub>4</sub><Ne<NH<sub>3</sub>      (C) NH<sub>3</sub><Ne<CH<sub>4</sub>  
 (B) CH<sub>4</sub><NH<sub>3</sub><Ne      (D) NH<sub>3</sub><CH<sub>4</sub><Ne
8. At constant volume, the pressure of gas Y increases with increasing temperature because as the temperature increases,  
 (A) molecules of Y move faster.  
 A (B) the molecular volume of Y increases.  
 (C) the mass of Y molecules increases.  
 (D) molecular collisions are more elastic.
9. The stronger the intermolecular forces in a substance,  
 (A) the lower the boiling point.  
 B (B) the higher the boiling point.  
 (C) the higher the vapor pressure.  
 (D) the smaller the deviation from ideal gas behavior.
10. Non-ideal behavior for a gas is most likely to be observed under conditions of:  
 (A) standard temperature and pressure.  
 B (B) low temperature and high pressure.  
 (C) low temperature and low pressure  
 (D) high temperature and high pressure.
11. A macromolecule consisting of several repeating units of much smaller molecules is called a (n):  
 (A) monor.  
 D (B) monomer.  
 (C) functional group.  
 (D) polymer.

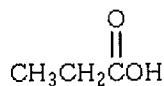
12. What main functional group is present in the following molecule?

(A) thiol

B  (B) carboxylic acid

(C) amine

(D) ketone



13. Which is the formula of an alcohol?

(A)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{-O-CH}_3$

B  (B)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{-OH}$

(C)  $\text{CH}_3\text{CH}_2\text{-}\overset{\text{O}}{\parallel}\text{C-CH}_3$

(D)  $\text{CH}_3\text{CH}_2\text{CH}_2\overset{\text{O}}{\parallel}\text{C-H}$

14. If the solution outside a cell has a higher concentration than inside the cell, it is called

(A) isotonic

C (B) hypotonic.

(C) hypertonic.

(D) heterogeneous.

15. A \_\_\_\_\_ is used to measure the pressure of the atmosphere.

(A) manometer

C (B) spectrometer

(C) barometer

(D) tensiometer

16. Which of the following forces is NOT prevalent in molecular solids?

(A) dispersion forces

D (B) hydrogen bonding

(C) dipolar forces

(D) covalent bonding

17. Normal boiling point occurs at what pressure?

(A) 760 atm

B  (B) 1 atm

(C) 755 mmHg

(D) 755 atm

18. Which of the following is NOT found in DNA?

(A) adenine

(B) guanine

D (C) cytosine

(D) uracil

19. Amino acids are monomer molecules of:

(A) proteins.

(B) ketones.

(C) lipids.

(D) carbohydrates.

20. The helices of DNA are connected by:

(A) covalent bonds.

D (B) ionic bonds.

(C) metallic bonds.

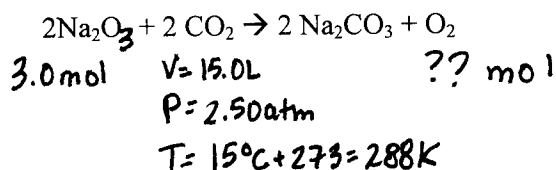
(D) hydrogen bonds.

II. Short Answer, Calculations and Essay (30 pts): Clearly indicate your answer in the space provided. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

1. (5 pts) What is the complementary structure for the following DNA base sequence:

ATAAGCTTAC  
TATTCTGAATG

2. (10 pts) The reaction of sodium peroxide ( $\text{Na}_2\text{O}_2$ ) with  $\text{CO}_2$  is used in space vehicles to remove  $\text{CO}_2$  from the air and generate  $\text{O}_2$  for breathing. How many moles of  $\text{O}_2$  can be made from 3.0 mols  $\text{Na}_2\text{O}_2$  and 15.0L of  $\text{CO}_2$  gas at 2.50 atm and at  $15^\circ\text{C}$ ?



$$3.0 \text{ mol Na}_2\text{O}_2 \times \frac{1 \text{ mol O}_2}{2 \text{ mol Na}_2\text{O}_2} = 1.50 \text{ mol O}_2$$

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{(2.50 \text{ atm})(15.0 \text{ L})}{(0.0821 \frac{\text{Latm}}{\text{molK}})(288 \text{ K})} = 1.59 \text{ mol CO}_2$$

$$1.59 \text{ mol CO}_2 \times \frac{1 \text{ mol O}_2}{2 \text{ mol CO}_2} = \boxed{0.793 \text{ mol O}_2}$$

$\text{CO}_2$  is limiting reactant

3. (5 pts) A gas mixture with a total pressure of 745 mmHg is composed of 0.250 mol of  $N_2$  and 0.500 mol of  $CO_2$ . What is the partial pressure of ~~X~~  $N_2$  in the mixture in mmHg?

$$X_{N_2} = \frac{0.250 \text{ mol}}{0.750 \text{ mol}} = 0.333$$

$$P_{N_2} = 0.333 (745 \text{ mmHg}) = \boxed{248 \text{ mmHg}}$$

4. In 3-4 **grammatically correct** sentences, discuss how oxides of nitrogen are formed in our troposphere and how they affect our environment.

Under extreme conditions,  $N_2$  reacts with  $O_2$  to form  $NO$  ( $N_2 + O_2 \rightarrow 2NO$ ).  $NO$  can further react with  $O_2$  to form  $NO_2$  ( $2NO + O_2 \rightarrow 2NO_2$ ).  $NO_2$  is a red-brown gas seen over many large cities.  $NO_2$  can decompose to form  $NO$  and  $O$  atoms.  $O$  atoms will react with  $O_2$  to form ozone,  $O_3$ . Both  $O_2$  &  $O_3$  react with hydrocarbons to produce photochemical smog.