

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) H₂
 D (B) Ne
 (C) CO₂
 (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) H₂O (B) O₂ (C) Ne (D) F₂
 18 32 20 36
5. Which has lowest freezing point?
 (A) 0.2 m CaCl₂ 3
 A (B) 0.2 m BaSO₄ 2
 (C) 0.2 m sugar 1
 (D) H₂O 0
6. Which substance has the highest boiling point?
 C (A) CH₄ (B) He (C) HF (D) Cl₂
7. Arrange Ne, NH₃, and CH₄ in order of increasing boiling point.
 A (A) CH₄<Ne<NH₃ (C) NH₃<Ne<CH₄
 (B) CH₄<NH₃<Ne (D) NH₃<CH₄<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.

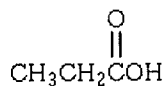
12. What main functional group is present in the following molecule?

(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.

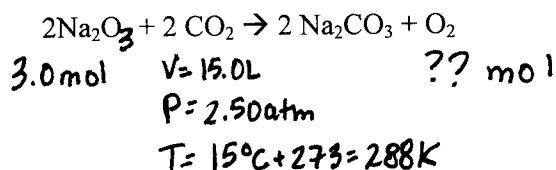
(D) hydrogen bonds.

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 (Na_2O_2) with CO_2 is used in space vehicles to remove CO_2 from the air and generate O_2 for breathing. How many moles of O_2 can be made from 3.0 mols Na_2O_2 and 15.0L of CO_2 gas at 2.50 atm and at 15°C ?



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

$$PV = nRT$$

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

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

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.