Chemistry 110

Practice Exam 3 (Ch 5,6,7[Energy])

Note:
1. Sit according to the seat number assigned (ask the TA or the instructor).
2. Use a softhead pencil, fill in you name, z-number, department name (CHEM), course name (110), and today's date () in the scantron sheet.
3. Use the following Periodic Table for the problems involving atomic mass and group names in this exam.
4. This is a **closed-book** exam. You **cannot** use your textbook or notes. However, you should use a calculator. **Cell phones are not allowed during the exam**. The following data will be helpful to you.

Gas constant R = 0.0821 L atm/(mol K)   Avogadro's number N = 6.022×10^{23}
Molar volume of an ideal gas at STP = 22.4 L/mol
Ideal gas equation: PV = nRT
Pressure units: 1 atm = 760 mm Hg = 760 torr
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$P_iV_i=P_fV_f$
$\Delta G° = \Delta H° - T\Delta S°$
q= (amt)(ΔT) (Specific heat)

$$\frac{V_i}{T_i} = \frac{V_f}{T_f}$$

Concentration units:
m/V % = (grams of solute/mL of solution)   × 100%
m/m % = (grams of solute/grams of solution) × 100%
ppm   = (grams of solute/grams of solution) × 10^6
ppb   = (grams of solute/grams of solution) × 10^9
Molarity = moles of solute / Volume of solution in L
Dilution equation: $M_1V_1 = M_2V_2$

$$\frac{P_iV_i}{T_i} = \frac{P_fV_f}{T_f} \qquad \frac{V_i}{n_i} = \frac{V_f}{n_f}$$

Choose the most appropriate answer.

1. What state(s) of matter is(are) is least compressible?
A. Liquid   C. Gas   C. Solid and gas   D. Liquid and gas   E. Solid

2. When we measure the pressure of a gas using a pressure gauge, we really are measuring
A. the stickiness of the gas molecules   B. the weight of the gas molecules
C. the bond energy of the gas molecules   D. the shape of the gas molecules
E. how strong and how often the gas molecules hit the pressure gauge

3. A 10.0-L tank contains helium gas at 2280 mm Hg. What is the pressure of the gas in atm?
A. 1.00 atm   B. 2.00 atm   C. 3.00 atm   D. 4.00 atm   E. 5.00 atm

4. Which of the following correctly describes the process of expiration (air leaving the lungs)?
A. The lungs expand, causing their internal pressure to increase.
B. The lungs contract, causing their internal pressure to decrease.
C. The lungs contract, causing their internal pressure to increase.
D. The lungs expand, causing their internal pressure to decrease.
E. There is no change in the internal pressure in the lungs.

5. In the calculations using the gas equations, we need to use the Kelvin temperature unit. To convert from Kelvins to Celsius degrees , we need to
A. do nothing   B. add 100 to Kelvins
C. add 273 to Kelvins   D. subtract 273 from Kelvins
E. subtract 32 from Kelvins

6. In comparing gases with liquids, gases have _____ compressibility and _____ density.
A. smaller; greater   B. greater; smaller   C. greater; greater   D. smaller; smaller   E. none of the above

7. Which description best fits a gas?
A. Volume and shape of container; no intermolecular attractions
B. Definite shape and volume; strong intermolecular attractions
C. Definite volume; shape of container; weak intermolecular attractions
D. Volume and shape of container; strong intermolecular attractions
E. Definite volume; shape of container; moderate intermolecular attractions

8. A gas sample contains 16.0 g of O_2 and 4.00 g of He. What is the volume of the sample at STP?
A. 22.4 L   B. 11.2 L   C. 44.8 L   D. 33.6 L   E. 4.00 L

9. At constant temperature, a sample of helium at 760. torr in a closed container was expanded from 1.00 L to 4.00 L. What was the new pressure exerted by the helium on its container?
A. 440. torr   B. 328 torr   C. 151 torr   D. 190. torr   E. 782 torr

10. A sample of nitrogen gas had a volume of 1.00 L, a pressure in its closed container of 760. torr, and a temperature of 25 ^{o}C. What was the new volume of the gas when the temperature was changed to 323 ^{o}C and the new pressure was 380. torr?
A. 2.00 L   B. 3.00 L   C. 4.00 L   D. 5.00 L   E. 1.00 L

11. A sample of argon at 25.0 ^{o}C and 4.00 atm pressure is cooled in the same container to a temperature of -124 ^{o}C. What is the new pressure?
A. 5.00 atm   B. 10.0 atm   C. 25.0 atm   D. 2.00 atm   E. 1.00 atm

12. How many moles of gas are there in a gas-filled balloon, which has a volume of 22.4 L at a pressure of 2.00 atm and a temperature of 273 ^{o}C?
A. 0.250 mol   B. 1.00 mol   C. 22.4 mol   D. 2.00 mol   E. 0.500 mol

13. A gas sample having a total pressure of 2280. mmHg contains helium and oxygen. The partial pressure of helium is 1520. mmHg. What is the partial pressure of oxygen?
A. 1520. mmHg   B. 780. mmHg   C. 380. mmHg   D. 190. mmHg   E. 760. mmHg

14. What would be the new pressure if a 400 mL gas sample at 380 mm Hg is expanded to 800 mL with no change in temperature?

A. 760 mm Hg   B. 190 mm Hg   C. 950 mm Hg   D. 570 mm Hg   E. 380 mm Hg

15. Consider a sample of helium and a sample of neon, both at 25°C and 1.0 atm. Both samples have a volume of 22.4 liters. Which statement concerning these samples is not true?

A. Each sample contains the same number of moles of gas.   B. The density of the neon is greater than the density of the helium.
C. Each sample weighs the same amount.   D. Each sample contains the same number of atoms of gas.
E. none of the above

16. Which description best fits a solid?
A. Definite volume; shape of container; moderate intermolecular attractions
B. Definite volume; shape of container; no intermolecular attractions
C. Volume and shape of container; no intermolecular attractions
D. Volume and shape of container; strong intermolecular attractions
E. Definite shape and volume; strong intermolecular attractions

17) Which transformation is sublimation?

A) solid → gas   B) gas → liquid   C) liquid → gas
D) liquid → solid   E) solid → liquid

18). Calculate the % (m/m) of platinum in a gold ring that contains 5.0 g platinum and 11 g gold

A. 16%   B. 31%   C. 69%   D. 5%   E. 11%

19. Which of the following properly describes a colligative property of a solution?
A) a solution property that depends on the identity of the solute particles present
B) a solution property that depends on the electrical charges of the solute particles present
C) a solution property that depends on the amount of solute particles present
D) a solution property that depends on the pressure of the solute particles present
E) a solution property that depends on the amount, identity, and pressure of the solute particles present

20. In considering general behavior, water can be used to dissolve which type of compounds?
A. nonpolar compounds (like oil)   B. polar compounds (like ethanol)
C. ionic compounds (like NaCl)   D. both A and B   E. both B and C

21. The solubility of gases in liquids
A. increases as temperature increases and decreases as pressure increases
B. increases as temperature increases and increases as pressure increases
C. is independent of temperature and increases as pressure increases
D. decreases as temperature increases and increases as pressure increases
E. decreases as temperature increases and decreases as pressure increases

22. Which statement best explains the meaning of the phrase "like dissolves like"?
A. The only true solutions are formed when water dissolves a polar solute.
B. The only true solutions are formed when water dissolves a non-polar solute.
C. A solvent and solute with similar intermolecular forces will readily form a solution.
D. A solvent will easily dissolve a solute of similar mass.
E. None of these statements is correct.

23. Which of the following is NOT a colligative property of a solution?
A. Vapor pressure lowering   B. Conductivity   C. Boiling point elevation
D. Freezing point depression   E. Osmotic pressure

24. The drawing shows two water molecules. Which statement is correct?
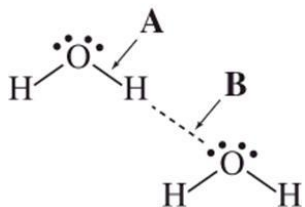
A. A: covalent bond; B: covalent bond   B. A: covalent bond; B: hydrogen bond
C. A: hydrogen bond; B: covalent bond   D. A: ionic bond; B: covalent bond
E. A: hydrogen bond; B: hydrogen bond

25. Which one of the following samples is NOT an example of solution?
A. gasoline   B. wine   C. chicken noodle soup   D. air   E. vinegar

26. How can pure water be made to boil at a temperature above 100 $^{\circ}$C ?
A. Decrease pressure below 1 atm   B. Increase volume of water
C. Decrease volume of water   D. Both B and C
E. Increase pressure above 1 atm

27. Which of the following will exhibit the Tyndall effect?
A. wine   B. fog   C. a mixture of oxygen and nitrogen D. salty water   E. glass

28. How many grams of sugar are present in 250.0 mL of a 2.00% (W/V) solution ?
A. 5.00 g   B. 7.5 g   C. 75 g   D. 10.0 g   E. 25.0 g

29. What is the molarity of a solution prepared by dissolving 48.0 g of NaOH in enough water to make 1.50 L of solution?
A. 0.0313 M   B. 0.556 M   C. 0.800 M   D. 1.28 M   E. 32.0 M

30. How many moles of KCl are present in 250.0 mL of a 1.00 M solution?
A. 0.0500 mol   B. 0.0250 mol   C. 2.50 mol   D. 0.250 mol   E. 0.347 mol

31. How many grams of NaCl are present in 250.0 mL of a 2.00 M solution?
A. 5.32 g   B. 58.5 g   C. 29.3 g   D. 9.18 g   E. 2.93 g

32. How many mL of a 0.100 M solution can be made from 5.00 mL of a 1.00 M solution of sodium chloride in water?
A. 10.0 mL   B. 100. mL   C. 500. mL   D. 50.0 mL   E. 1,000 mL

33. A 20.0 g sample of groundwater was found to contain 5.0 µg of Pb^{2+}. What is the concentration of Pb^{2+} in parts per million?
A. 5.0 ppm   B. 0.50 ppm   C. 0.050 ppm   D. 0.25 ppm   E. 2.5×10^{-7} ppm

34. Which of the following aqueous solutions would possess the greatest boiling point.
A) 1.0 M Sucrose   B) 1.0M NaCl   C) 1.0M $MgCl_2$ D) pure water
E) Not enough information is given to answer the question.

35. Under normal conditions, which of the following would have the lowest entropy?
A. gaseous oxygen   B. solid iron   C. liquid nitrogen
D. mixture of liquid nitrogen and liquid oxygen   E. liquid helium

36. The chemical reaction equation $CH_4 \rightarrow C + 2 H_2$, has a $\Delta H = 18$ kcal. This tells us that this reaction is a
A. kilo calorie reaction   B. kilo watt reaction   C. heat seeking reaction
D. endothermic reaction   E. exothermic reaction

37. When gasoline burns, which of the following is a correct description of the process?
A. The reaction is exothermic; $\Delta H° < 0$ B. The reaction is endothermic; $\Delta H° > 0$
C. The reaction is endothermic; $\Delta H° < 0$ D. The reaction is exothermic; $\Delta H° > 0$
E. None of these statements is correct

38. Which statement is true about reaction rate for the reaction: $A + B \rightleftharpoons C + D$?
A. When the forward reaction rate is equal to the reverse reaction rate, the volume of the mixture will decrease
B. When the forward reaction rate is greater than the reverse reaction rate, the temperature of the mixture will go down
C. When the forward reaction rate is smaller than the reverse reaction rate, the temperature of the mixture will go up
D. When the forward reaction rate is equal to the reverse reaction rate, both forward and reverse reactions will stop
E. When the forward reaction rate is equal to the reverse reaction rate, there will be no change in the concentrations of reactants and products

39. After initiating a reaction in a coffee cup calorimeter, the temperature of the water was observed to decrease by several degrees.
Based on this information, the reaction is
A. accelerated by a catalyst   B. Exothermic   C. Endothermic
D. $\Delta S > 0$ E. $\Delta S < 0$

40. 10g of octane is burned in a bomb calorimeter containing 100g of H_2O. How much energy was released (in calories) if the temperature increased by 10°C. (note: specific heat of water is 1 cal/g/°C).
A.1000 cal   B. 100 cal   C. 1 cal
D. 10 kcal   E. 100 kcal

Calculation space