JASPERSE CHEM 210 PRACTICE TEST 1 VERSION 2
Forces and Intermolecular Forces between Ions and Molecules
Solutions and Their Colligative Properties
Chemical Kinetics: Rates of Reactions

Constants and/or Formulas	Formulas
Formulas for First Order Reactions: $kt = \ln([A_o]/[A_t])$	$kt_{1/2} = 0.693$

Note: This practice test is a little longer than the real one will be.

1. Increasing the pressure above a liquid will cause the boiling point of the liquid to:

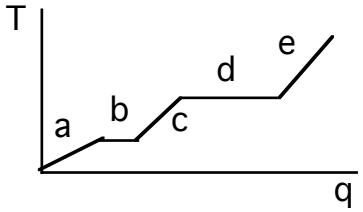
   a. increase b. decrease c. remain the same d. depends on the liquid

2. Which of the following is a gas at room temperature?

   a. KCl b. C_2H_6 c. $Fe(NO_3)_2$ d. Al e. $C_{38}H_{62}O_4$

3. The intermolecular force(s) responsible for NH_3 having the highest boiling point in the set NH_3, PH_3, AsH_3, SbH_3,is/are:
   a. hydrogen bonding
   b. dipole-dipole interactions
   c. London-dispersion forces
   d. Mainly London-dispersion forces but also dipole-dipole intereactions

4. Region "b" on the heating curve shown (Temperature versus heat, "q") corresponds to:
   a. a pure gas increasing in temperature
   b. a liquid increasing in temperature
   c. a solid increasing in temperature
   d. a solid melting
   e. a liquid boiling



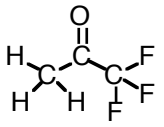
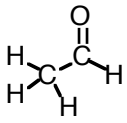
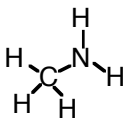
5. Which of the following indicates the existence of strong noncovalent forces of attraction in a liquid?

   a. a very low boiling point
   b. a very low vapor pressure
   c. a very low viscosity
   d. a very low molar heat of vaporization

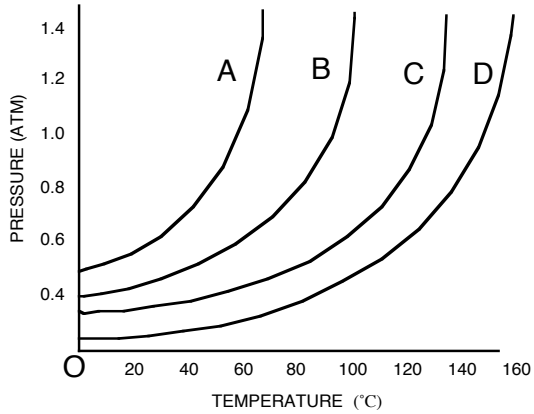
6. Which of the following would have the highest melting point?

   a. H_2O b. CO_2 c. Br_2 d. NaCl e. C_3H_8

7. Which one of the following substances would have hydrogen bonding as one of its intermolecular forces?

   a. 
   b. 
   c. 
   d. 

8. Which of the following statements is false for the vapor pressure/temperature diagram shown:?



   a. the vapor pressure for C at 60˚ is about 0.4 atm
   b. substance D has the weakest binding forces
   c. the normal boiling point for A is about 58˚
   d. to achieve a vapor pressure of 0.4 atm, substance D must be heated to about 96˚C

9. The vapor pressure of a liquid:

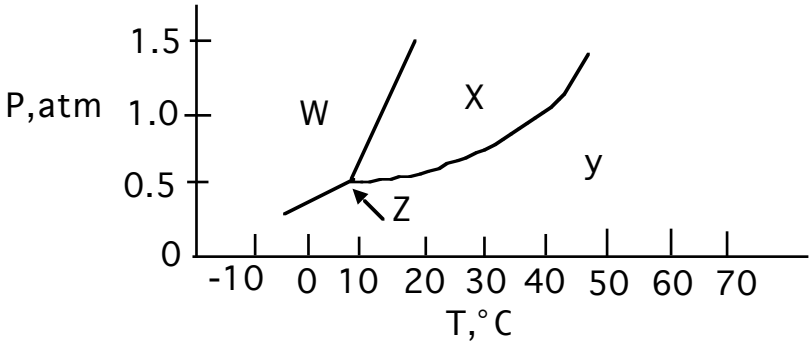
   a. Increases with increasing intermolecular force
   b. Increases with increasing temperature
   c. Decreases with increasing temperature
   d. Is completely unrelated to molecular structure

10. The substance with the largest heat of vaporization is:

    a. I_2 b. Br_2 c. Cl_2 d. F_2

11. In which phase does the substance whose phase diagram is shown below exist at 30˚C and 0.2 atm pressure?

a. gas b. liquid c. solid d. supercritical fluid



12. Which of the following liquids would have the lowest vapor pressure, factoring in both the impact of the substance and the temperature?

a. CH_4 at 60˚
b. CH_3OH at 20˚
c. CH_3OH at 60˚
d. CH_3CH_2OH at 20˚
e. CH_3CH_2OH at 60˚

13. Rank the following in terms of increasing melting point:

$NaNO_3$ CH_4 CH_3OCH_3 $CH_3CH_2CH_2CH_2OH$

a. $NaNO_3 < CH_4 < CH_3OCH_3 < CH_3CH_2CH_2CH_2OH$
b. $CH_4 < CH_3OCH_3 < CH_3CH_2CH_2CH_2OH < NaNO_3$
c. $NaNO_3 < CH_3CH_2CH_2CH_2OH < CH_3OCH_3 < CH_4$
d. $CH_3CH_2CH_2CH_2OH < CH_3OCH_3 < CH_4 < NaNO_3$
e. $CH_4 < CH_3CH_2CH_2CH_2OH < CH_3OCH_3 < NaNO_3$

14. Which is a brittle, high-melting solid but dissolves in water?

a. $C_{16}H_{32}O_2$ b. $MgCl_2$ c. $C_{12}H_{26}$ d. Fe

15. Which is the following is polar?

a. CH_4 b. H_2S c. . CH_3CH_3 d. F_2

16. Which of the following is most likely to be soluble in water?
a. Pentane, C_5H_{12}
b. Tetrachloromethane, CCl_4
c. Methanol, CH_3OH
d. Bromoethane, C_2H_5Br

17. Which of the following statements is false?

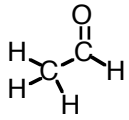
    a. While temperature reflects the average kinetic energy for molecules in the liquid stage, some molecules have well-above-average kinetic energy
    b. Evaporation occurs below room temperature because some above-average molecules have enough energy to escape
    c. Evaporation increases at higher temperature because then a higher percentage of molecules have enough energy to escape
    d. Evaporation is endothermic and results in cooling of the liquid because as the high-energy molecules leave, the average kinetic energy of the remaining molecules is reduced
    e. For two liquids at the same temperature, the reason that one evaporates faster than the other is because the more volatile liquid has stronger noncovalent binding forces

18. What is the nature of the intermolecular attractive forces that exist between the solvent and solute molecules shown, if/when the solute was dissolved in the solvent?

    Solvent: CH_3OH Solute: CH_4

    a. Dipole-dipole attractions
    b. Hydrogen bonding
    c. London dispersion force
    d. Ion-dipole attractions

19. The following molecule "ethanal" is highly soluble in water. The reason this is possible is because of:



    a. Strong hydrogen-bonding between ethanal and water
    b. Strong London forces between ethanal and water
    c. Strong hydrogen-bonding between ethanal and other ethanal molecules
    d. Weak intermolecular forces between ethanal and water

20. Which relationship is true for solubility in water?
    a. $C_5H_{11}Br > C_5H_{11}OH$
    b. $C_6H_{14} > C_3H_7OH$
    c. $C_6H_{14} > NaNO_3$
    d. $C_3H_7OH > C_7H_{15}OH$

21. As the concentration of a solute in a solution increases, the freezing point of the solution _____, the vapor pressure of the solution _____, and the boiling point of the solution_____?

    a. Increases, increases, increases
    b. Decreases, decreases, decreases
    c. decreases, decreases, increases
    d. decreases, increases, decreases

22. Which of the following statements is false?

    a. In a saturated solution, both dissolved solute and undissolved solid are present, and the rate of crystallization equals the rate of dissolving
    b. When solids dissolve in water, the process may be exothermic or endothermic
    c. When solids dissolve in water, the primary reason is because of increasing disorder/entropy
    d. The solubility of a solid usually increases at higher temperature
    e. A solid will fail to dissolve only if the process is prohibitively endothermic
    f. A dissolving will fail only if the resulting solvent-solute intermolecular forces are much stronger than the original solute-solute and solvent-solvent binding forces

23. The aqueous solution with which of the following concentrations of solute will have the lowest melting/freezing point?

    a. 0.20 M $CH_3CH_2NO_2$
    b. 0.15 M NaOH
    c. 0.13 M $MgBr_2$
    d. 0.05 M $MgBr_2$

24. In the reaction $2NO_2 \rightarrow 2NO + O_2$ [NO_2 drops from 0.0100 to 0.00650 M in 100s. What is the average rate of disappearance of NO_2 for this period in M/s?

    a. 0.35 b. 0.0035 c. 0.000035 d. 0.0070
    e. 0.0018

25. Consider the reaction $A \rightarrow 2B$, if the rate of disappearance of A is 0.40 mol/min, what is the rate of formation of B?

    a. 0.40 mol/min b. 0.20 mol/min c. 0.80 mol/min d. 1.60 mol/min

26. The following reaction was found to be first order in both [A] and [B]. Calculate the value for the rate constant.

    $A + 2B \rightarrow C$

Initial [A]	Initial [B]	rate (M/s)
0.23	0.17	0.33

    a. 0.12 b. 19 c. 27 d. 8.4

27. What is the rate law for the reaction $2A + B \rightarrow$ products

Initial [A]	Initial [B]	rate (M/s)
0.130	0.230	0.400
0.260	0.230	0.800
0.130	0.460	1.600

    a. rate = $k[A]^2[B]$ b. rate = $k[A][B]$ c. rate = $k[A][B]^2$
    d. rate = $k[A]^2[B]^2$ e. none of the above

28. For the reaction shown in the previous problem, what would be the value for k?

a. 58.2 $M^{-2}s^{-1}$ b. 13.4 $M^{-1}s^{-1}$ c. 0.0172 $M^{-2}s^{-1}$ d. 13.4 $M^{-1}s^{-1}$

29. For the reaction used in the previous 2 problems, what would be the rate when [A] = 0.36M and [B]=0.45M?

a. 9.43 M/s b. 4.24 M/s c. 15.7 M/s d. 0.139 M/s

30. What is the rate law for the reaction A + 2B → C

Initial [A]	Initial [B]	rate (M/s)
0.20	0.17	0.33
0.40	0.17	2.64
0.20	0.51	0.33

a. rate = k[A][B] b. rate = $k[A][B]^2$ c. rate = $k[A]^2$
d. rate = $k[A]^3$ e. rate = $k[A]^4$

31. If the rate law for a reaction is rate = $k[A]^2[B]$, what is the effect on the overall rate of cutting in half the concentrations of both A and B?

a. rate decreases by 1/2 b. rate decreases by 1/4
c. rate decreases by 1/8 d. rate decreases by 1/16 e. none of the above

32. A→B is a first order reaction. What is the half-life (in seconds) for the reaction?

time (sec)	[A] (M)
0.0	1.22
3.0	0.86
6.0	0.61
9.0	0.43
12.0	0.31

a) 3 b) 6 c) 0.7 d) 0.1

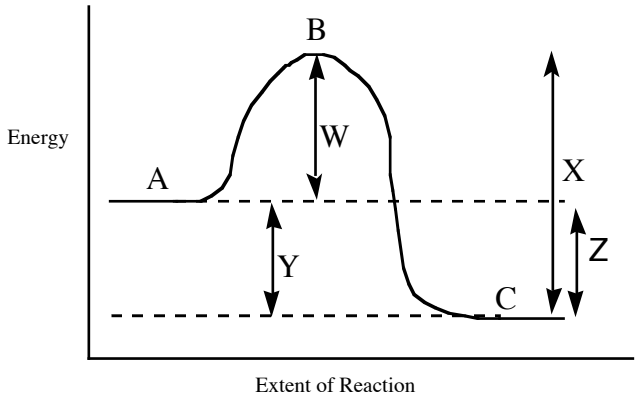
33. A→B is a first order reaction. If k = 0.33 min^{-1}, and the initial [A] = 0.13 M, how many minutes will it take for [A] to decrease to 0.088M?

    a. 1.2
    b. 1.4
    c. 0.51
    d. 0.13

34. A→B is a first order reaction. If k = 0.0286 min^{-1}, and the initial [A] = 0.80 M, what will be the concentration of [A] after 35.0 min?

    a. 0.080M
    b. 0.43M
    c. 0.29M
    d. 1.25M

35. For the reaction diagram shown, which of the following statements is false?



    a. For the forward reaction, line W represents the activation energy, and the forward reaction would be exothermic by the quantity Y
    b. For the reverse reaction, line X represents the activation energy, and the reverse reaction would be endothermic by the quantity Z
    c. The reverse reaction should be faster than the forward reaction
    d. In both the forward and the reverse direction, point B represents the Transition State

36. The reaction 2A + B → C + D has the rate law rate = $k[A]^2$. Which of the following will not increase the rate of the reaction?

    a. Increasing the concentration of reactant A
    b. Increasing the concentration of reactant B
    c. Increasing the temperature of the reaction
    d. Adding a catalyst

37. Which of the following statements about changes in temperature is false?

    a. Increasing the temperature increases the rate of a reaction
    b. Increasing the temperature increases the rate constant of a reaction
    c. Increasing the temperature lowers the activation energy of a reaction
    d. Increasing the temperature increases the percentage of reactants that are capable of crossing over the reaction's transition state

38. Given the mechanism shown, what would be the useful overall rate law?

    $A + B \rightarrow C$ fast, equilibrium
    $C + D \rightarrow E + F$ slow

    a. rate = k[A][B]
    b. rate = k[C][D]
    c. rate = k[A][B][C][D]
    d. rate = k[A][B][D]
    e. rate = $k[A][B][D]^2$

39. Given the mechanism shown, which of the following statements would be false?

    $A + B \rightarrow C$ slow
    $C + D \rightarrow E + F$ fast

    a. The rate law would be rate = k[A][B]
    b. Increasing the concentration of [D] would not accelerate the reaction
    c. C is an intermediate
    d. C is a catalyst
    e. The overall balanced reaction would be $A + B + D \rightarrow E + F$

40. For the reaction shown, which of the following statements is false?

    $A + B \rightarrow C$ slow
    $C + D \rightarrow E + F$ fast

    a. The first step is bimolecular
    b. Increasing the concentration of A will increase the rate, because the collision frequency will increase
    c. Every time A + B collide, reaction will take place
    d. Doubling the concentration of both A and B will increase the collision frequency by a factor of four.

41. Which of the following statements about catalysts is false:

    a. Catalysts do not appear in the balanced reaction
    b. Although a catalyst is used early in a reaction mechanism, it is regenerated later
    c. Catalysts do appear in the catalyzed reaction mechanism
    d. Catalysts do not alter the activation energy for a reaction, relative to the uncatalyzed version
    e. Catalysts do not alter the ΔH for a reaction, relative to the uncatalyzed version
    f. Catalysts can be used in small amounts

Jasperse
Chem 210
Practice Test1
Version 2
Answers

1. A
2. B
3. A
4. D
5. B
6. D
7. D
8. B
9. B
10. A
11. A
12. D
13. B
14. B
15. B
16. C
17. E
18. C
19. A
20. D
21. C
22. F
23. C
24. C
25. C
26. D
27. C
28. A
29. B
30. D
31. C
32. B
33. A
34. C
35. C
36. B
37. C
38. D
39. D
40. C
41. D