JASPERSE CHEM 210 PRACTICE TEST 1 VERSION 1
Ch. 11 Liquids, Solids, and Materials
Ch. 10 Gases
Ch. 15 The Chemistry of Solutes and Solutions
Ch. 13 Chemical Kinetics

Constants and/or Formulas Formulas

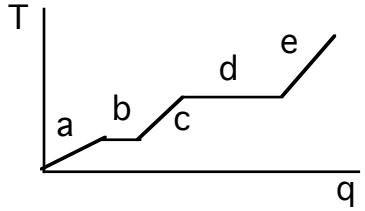
PV=nRT	R=0.0821 L•atm/mol•K	1 atm = 760 mm Hg	K=273 + ºC
1 mol = 22.4 L (at STP)			
Formulas for First Order Reactions: $kt = \ln([A_o]/[A_t])$		$kt_{1/2} = 0.693$	

1. Which of the following would have the highest vapor pressure at 25˚C?

   a. C_4H_{10} b. NaCl c. $C_6H_{12}O_6$ d. $C_4H_9NH_2$

2. Arrange CH_3OH, NaF, and CO_2 in order of increasing boiling point.
   a. $CH_3OH < CO_2 < NaF$
   b. $CO_2 < NaF < CH_3OH$
   c. $CO_2 < CH_3OH < NaF$
   d. $NaF < CO_2 < CH_3OH$
   e. none of the above

3. Region "c" 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



4. Which of the following would have the highest boiling point?

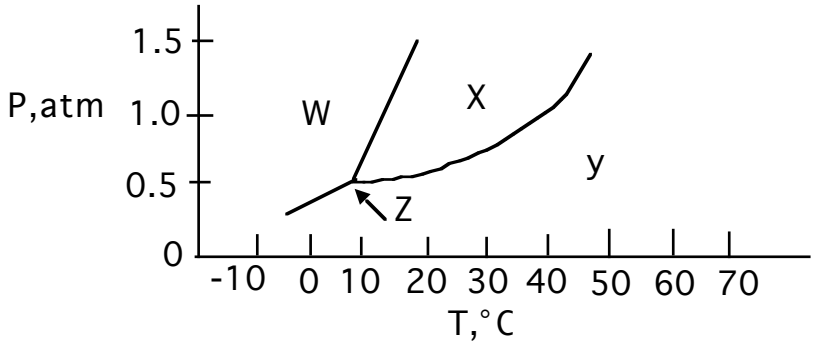
   a. $CH_3CH_2CH_2OH$ b. $CH_3CH_2OCH_3$ c. CH_3CH_2OH d. $CH_3CH_2CH_2CH_3$

5. The ΔH_{fusion} for water is 6.0 kJ/mol, and the specific heat for liquid water is 4.18 J/g-K. How many kJ of heat would it take to convert 36 g of solid ice (18 g/mol) from 0˚C to liquid water at 53˚C?

   a. 8.0 kJ b. 12.0 kJ c. 20.0 kJ d. 7987 kJ

6. In which phase does the substance whose phase diagram is shown below exist at 0˚C and atmospheric pressure?

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



7. Which of the following would have the greatest surface tension at 25˚C?

   a. CH_4 b. CH_3F c. CH_3OH d. CO

8. Which of the following shows a relatively high boiling temperature due to <u>hydrogen bonding</u>?

   a. CH_3OH b. CH_3SH c. CH_3OCH_3 d. SnH_4

9. Which is a gas at room temperature? (You may apply memory as well as principle to answer this question!)

   a. Na_2S b. NO_2 c. H_2O d. Fe

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

    a. I_2 b. K_2CO_3 c. $C_{12}H_{26}$ d. Al

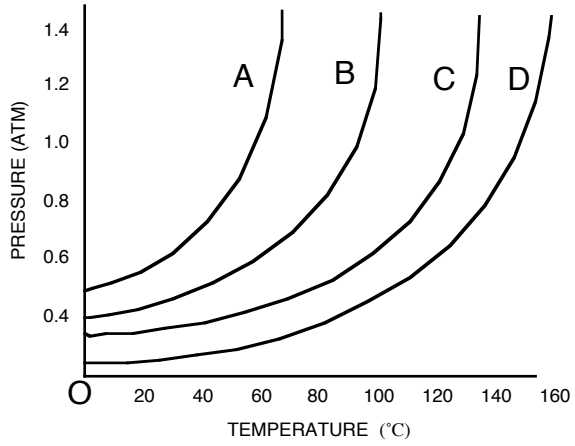
11. Which of the following statements is <u>true</u>?

    a. All of the molecules in the liquid state have the same energy
    b. When evaporation occurs the average kinetic energy of the molecules remaining in the liquid state is lower than that of the molecules that left, resulting in cooling of the liquid
    c. The vapor pressure of a liquid decreases as the temperature increases
    d. The rate of evaporation is faster for substances with lower vapor pressures than for substances with higher vapor pressures

12. In a liquid, the attractive intermolecular forces are:

    a. weaker than in a substance that is a gas at the same temperature
    b. always insignificant and unable to keep molecules close together
    c. so strong that molecules are locked close together and are unable to move
    d. strong enough to hold molecules relatively close but <u>not</u> strong enough to keep molecules from moving past each other

13. Which of the following statements is <u>false</u> 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 <u>weakest</u> 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 100˚C

14. Which of the following statements is false?
a. diamond is higher melting than CH_3CH_2OH (alcohol)
b. solid glucose is less dense than melted, liquid glucose
c. CH_2Br_2 is more volatile than CBr_4 at room temperature
d. evaporation of freon-12 absorbs heat from the surroundings

15. How many moles of gas occupy a 355 L container at 0ºC and 730 mm Hg?
a. 15.8 mol
b. 15.2 mol
c. 16.4 mol
d. 11,100 mol

16. What is the final volume if 16.0 L of helium is heated from 10ºC to 40ºC at standard pressure?
a. 17.7 L
b. 64.0 L
c. 4.00 L
d. 14.5 L

17. What is the volume of 8.0 g of O_2 (32g/mol) at STP?
a. 0.011 L
b. 0.36 L
c. 5.6 L
d. 11 L

18. Why does the kinetic-molecular theory say that pressure increases when the volume of a gas decreases (for a fixed amount of gas at fixed temperature)?
    a. Because the average kinetic energy of the gas molecules decreases
    b. Because the gas molecules collide more frequently with the wall
    c. Because the gas molecules collide more energetically with the wall
    d. Because the average velocity of the gas molecules increases.

19. What is the density of carbon monoxide (CO, 28g/mol) at STP?
    a. 1.17 g/L
    b. 0.0133 g/L
    c. 17.1 g/L
    d. 1.25 g/L

20. Rank the average velocities of the following molecules at 25ºC.

    CH_4 CO_2 He Ne

    a. $CO_2 > CH_4 >$ Ne > He
    b. He > $CO_2 >$ Ne > CH_4
    c. He > Ne > $CH_4 > CO_2$
    d. He > $CH_4 >$ Ne > CO_2

21. If the CO_2 (44 g/mol) gas produced in the following reaction occupies 26 L at STP, then how many grams of C_4H_8 (56 g/mol) were combusted in the process?

    $C_4H_8 + 6\ O_2 \rightarrow 4CO_2 + 4H_2O$

    a. 16 g
    b. 65 g
    c. 8.0×10^3 g
    d. 2.6 g

22. Potassium hydroxide dissolves readily in water due to

    a. strong solute-solute interactions
    b. strong solvent-solvent interactions
    c. strong solute-solvent interactions
    d. weak solute-solvent interactions

23. Which of the following substances would be the most soluble in water?

    a. Ar b. $CH_3CH_2CH_2CH_3$ c. NaCl d. CH_4

24. Which relationship is false for solubility in water?
    a. $C_5H_{11}OH > C_{11}H_{23}OH$
    b. $C_5H_{11}OH > C_5H_{12}$
    c. $CCl_4 > CaCl_2$
    d. $CH_3OCH_3 > CH_3CCl_3$

25. Which of the following statements is <u>true</u>?
    a. In a saturated solution at equilibrium, the rate at which solid material is dissolving differs from the rate at which solid material is reforming
    b. For solids that dissolve in water, the primary reason is because dissolving results in increasing disorder
    c. Any solid that dissolves in water does so in an exothermic way
    d. The solubility of a solid always decreases at higher temperature

26. Which of the following should be least miscible in carbon tetrachloride, CCl_4?

    a. C_6H_{14} b. CH_3OH c. Br_2 d. C_3H_8

27. Which one of the following 0.1 M aqueous solutions would have the lowest melting/freezing point?

    a. CH_3CH_2OH
    b. $AlPO_4$
    c. $NaNO_3$
    d. $CaBr_2$

28. Which of the following statements is <u>false</u>?
    a. C_6H_{14} has very low solubility in water because it can't hydrogen bond to itself or to water
    b. NaCl has poor solubility in CCl_4 because strong solute-solute interactions are replaced by feeble solute-solvent interactions, making things strongly endothermic
    c. C_6H_{14} has good solubility in CCl_4 . Neither original nor final intermolecular interactions are very strong.
    d. CH_3OCH_3 has very low solubility in water because it can't hydrogen bond to itself or to water

29. If the reaction $2A + 3D \rightarrow$ products is first-order in A and second-order in D, then the rate law will have the form, rate =

    a. $k[A][D]$ b. $k[A]^2[D]^3$ c. $k[A][D]^2$ d. $k[A]^2[D]$
    e. $k[A]^2[D]^2$

30. Consider the reaction $A + B \rightarrow 4C$, if the rate of disappearance of A is 0.16 mol/min, what is the rate of formation of C?

    a. 0.04 mol/min b. 0.16 mol/min c. 0.32 mol/min d. 0.64 mol/min
    e. none of the above

31. What is the rate law for the reaction $A + 3B \rightarrow$ products

Initial [A]	Initial [B]	rate
0.273	0.763	3.0
0.273	1.526	3.0
0.819	0.763	27.0

    a. rate = $k[A][B]$ b. rate = $k[A]$ c. rate = $k[A]^2$ d. rate = $k[A]^3$
    e. none of the above

32. What is the rate constant k (ignore units) for the reaction shown, if the reaction is first order in both A and B. $2A + 3B \rightarrow 2C$

Initial [A]	Initial [B]	rate
0.23	0.17	0.33

a. 8.4
b. 5.6
c. 0.67
d. 0.18

33. What is the rate law for the reaction $2A + 5B \rightarrow$ products

Initial [A]	Initial [B]	rate
0.421	0.234	6.4×10^4
0.842	0.234	1.3×10^5
0.421	0.468	2.6×10^5

a. rate = k[A][B] b. rate = k[B] c. rate = $k[A][B]^2$ d. rate = $k[A][B]^3$
e. none of the above

34. If the rate law for a reaction is rate = $k[A]^2[B]$, what is the effect on the overall rate of doubling the concentration of both A and B?

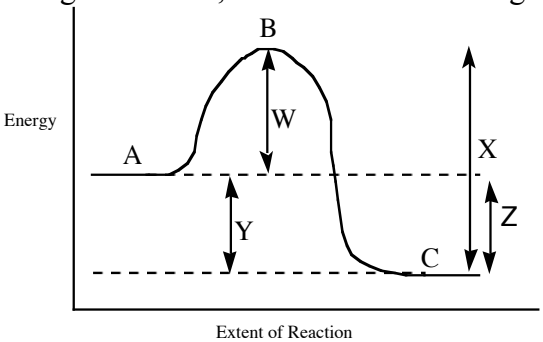
a. rate increases by 2 b. rate increases by 4 c. rate increases by 8
d. rate increases by 16 e. none of the above

35. A→B is a first order reaction. What is the rate constant for the reaction (in s^{-1}).

time (sec)	[A] (M)
0.0	1.60
5.0	0.80
10.0	0.40
15.0	0.20
20.0	0.10

a) 0.013 b) 0.030 c) 0.14 d) 3.0

36. For the reaction diagram shown, which of the following statements is <u>true</u>?



a. Line W represents the ΔH for the forward reaction; point B represents the transition state
b. Line W represents the activation energy for the forward reaction; point B represents the transition state
c. Line Y represents the activation energy for the forward reaction; point C represents the transition state
d. Line X represents the ΔH for the forward reaction; point B represents the transition state

37. Given the mechanism shown, what would be the rate law?
$2\ NO \rightarrow N_2O_2$ fast, equilibrium
$N_2O_2 + Br_2 \rightarrow 2NOBr$ slow

a. rate = $k[NO]^2[Br_2]$
b. rate = $k[N_2O_2]^2[Br_2]$
c. rate = $k[NO]^2[N_2O_2][Br_2]$
d. rate = $k[NO][Br_2]$
e. rate = $k[NO]$

38. In any multistep reaction mechanism, the rate of the overall reaction is determined by the rate of the _____ step in the mechanism.

a) first b) last c) slowest d) fastest

39. Which of the following statements is true?

a. the activation energy always increases as temperature rises
b. the activation energy always decreases as temperature rises
c. the rate constant always decreases as temperature rises
d. the rate constant always increases as temperature rises
e. the rate constant always increases as the activation energy increases

40. Which of the following statements is <u>false</u> regarding collision theory?

a. As temperature rises, a higher number of bimolecular collisions result in successful reaction
b. As the concentration of either chemical increases, the bimolecular collision frequency increases
c. Not all bimolecular collisions result in successful reactions
d. Elementary steps are routine that are either termolecular (three molecules colliding at once) or tetramolecular (four molecules colliding at once)

Jasperse
Chem 210
Test1
Version 1
Answers

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