

CHE 107-002
First Exam
September 25, 1997

- Which one of the following crystallizes in a metallic lattice?
 - C
 - NaMnO_4
 - K
 - LiClO_4
- What mass of H_2O (in grams) would have to evaporate from your skin in order to dissipate 193.4 kJ of heat from your body? The enthalpy of vaporization of water is 40.7 kJ/mol.
 - 4.75
 - 10.3
 - 85.6
 - 7.87×10^2
- The phase diagram for carbon dioxide is shown below. What is the stable phase of carbon dioxide at 0.5 atm and -20°C .
 - solid
 - vapor
 - liquid
 - solid, liquid, and vapor all coexisting
- What amount of heat (in kJ) is required to convert 688 g of ice at -11°C to liquid water at 0°C . [The specific heat of ice is $2.03 \text{ J/g}^\circ\text{C}$ and of water is $4.184 \text{ J/g}^\circ\text{C}$. The molar heat of fusion of water is 6.01 kJ and the molar heat of vaporization of water is 40.79 kJ.]
 - 245.
 - 263.
 - 1.79×10^3
 - 4.15×10^3

5. Suppose that a face-centered cubic cell contains 8 aluminum atoms at the corners of the cell and 6 chlorine atoms at the faces. What is the empirical formula of the solid compound.
- AlCl_3
 - Al_2Cl_3
 - Al_4Cl_3
 - Al_8Cl_6
6. Which one of the following compounds has the highest surface tension?
- $\text{CH}_3\text{CH}_2\text{-OH}$
 - $\text{CH}_3\text{-O-CH}_3$
 - $\text{HO-CH}_2\text{CH}_2\text{-OH}$
 - $\text{CH}_3\text{-O-CH}_2\text{CH}_2\text{-OH}$
7. What is the freezing point (in $^\circ\text{C}$) of a solution made by dissolving 18.9 g of K_2SO_4 (molar mass = 174.3 g/mol) in 179. g of water? The freezing point depression constant for water is 1.86°C/m .
- 1.13
 - 3.38
 - 7.91
 - 9.26
8. Assume that the solubility of N_2 in blood at 36.9°C and at a partial pressure of 0.80 atm is 5.70×10^{-4} mol/L. What is the solubility (in mol/L) of N_2 in blood at 36.9°C when the partial pressure is 5.6 atm.
- 3.99×10^{-3}
 - 0.713×10^{-4}
 - 0.800×10^{-4}
 - 0.140×10^{-4}
9. What is the vapor pressure (in mm Hg) of a solution prepared by adding 123. g of urea (molar mass is 60.06) to 575. g of water at 35°C ? The vapor of pure water at 35°C is 42.2 mm Hg.
- 41.6
 - 39.7
 - 3.11
 - 0.64

10. Suppose that a semipermeable membrane completely encloses a solution of 0.05 M NaCl. Now suppose that the the membrane and the 0.05 M solution inside are immersed in a beaker containing 0.1 M NaCl solution. Which statement below correctly describes the result when the 0.05 M NaCl solution in the membrane is placed into the solution of 0.1 M NaCl?

- NaCl moves out through the membrane into the beaker.
- NaCl moves in through the membrane from the beaker.
- Water moves out through the membrane into the beaker.
- Water moves in through the membrane from the beaker.

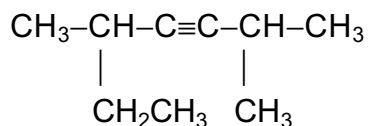
11. Arrange the following solutions in order of decreasing freezing point: Solution A is 0.10 m Na_3PO_4 ; Solution B is 0.35 m NaCl; Solution C is 0.20 m MgCl_2 ; Solution D is 0.15 m $\text{C}_6\text{H}_{12}\text{O}_6$ (glucose). [C>D means that solution D is freezes at a lower temperature than does solution C.]

- B>C>D>A
- B>C>A>D
- A>C>B>D
- D>A>C>B

12. Three of the following structures are identical. Which one is **different** from the others.

- a.
$$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3-\text{C}-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- b. $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)_2$
- c.
$$\begin{array}{c} \text{CH}_3-\text{CH}-\text{CH}_2\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- d.
$$\begin{array}{c} \text{H} \\ | \\ \text{CH}_3-\text{C}-\text{CH}_3 \\ | \\ \text{CH}_2\text{CH}_3 \end{array}$$

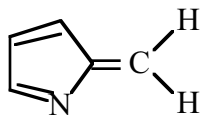
13. What is the correct IUPAC name of the following compound?



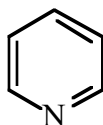
- 2,5-dimethyl-3-heptyne
- 2-ethyl-5-methyl-3-hexyne
- 3,6-dimethyl-4-heptyne
- 5-ethyl-2-methyl-3-hexyne

14. Which one of the following compounds is **not** an isomer of C_5H_5N ?

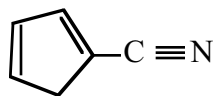
a.

b. $HC\equiv C-C\equiv C-CH_2-NH_2$

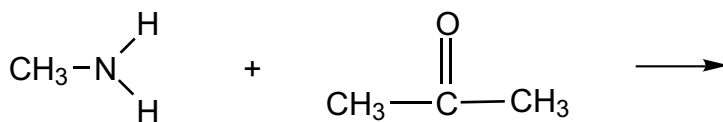
c.



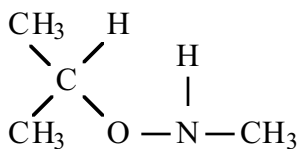
d.



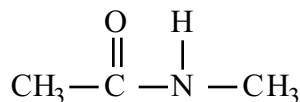
15. Choose a product that can be reasonably expected to form in the following reaction.



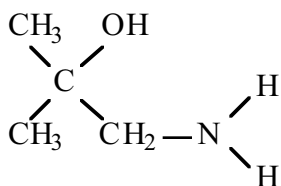
a.



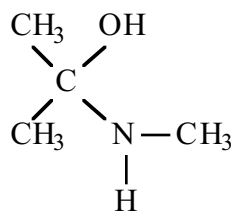
b.



c.



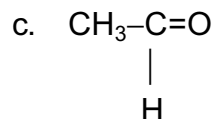
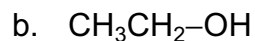
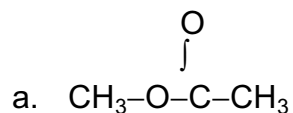
d.



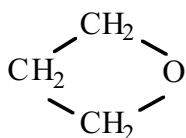
16. In which one of the following reagents does the underlined atom (in bold face) carry a partial **negative** charge?

a. $CH_3-\underline{N}H_2$ b. $H-\underline{C}-Na$
Hc. $\underline{H}-Br$ d. $H-\underline{C}-H$
O

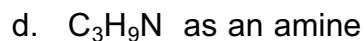
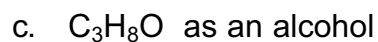
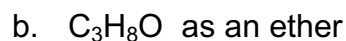
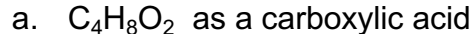
17. Which of the following compounds is an ether?



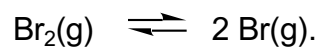
d.



18. Which one of the following formulas represents a compound that **cannot** have structural isomers?



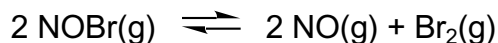
19. At 200°C , $K_c = 4 \times 10^{-18}$ for the reaction



If one starts with 0.10 mol Br_2 in a 2.0 L flask at 200°C , what will the equilibrium system contain? Choose one correct answer.

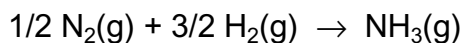
- About equal amounts of $\text{Br}_2(\text{g})$ and $\text{Br}(\text{g})$.
- Twice as much $\text{Br}(\text{g})$ as $\text{Br}_2(\text{g})$.
- Half as much $\text{Br}(\text{g})$ as $\text{Br}_2(\text{g})$.
- Mostly $\text{Br}_2(\text{g})$.

20. At 298 K, $K_c = 3.8 \times 10^{-4}$ for the gas-phase equilibrium

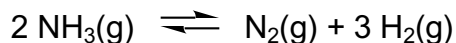


What is the K_p for this reaction at 298 K?

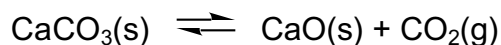
- a. 7.8×10^{-2}
 - b. 9.3×10^{-3}
 - c. 3.8×10^{-4}
 - d. 2.3×10^{-1}
21. K_p for the reaction



is 2.07×10^{-2} at 670 K. Determine K_p at the same temperature for the following reaction:



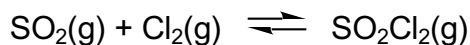
- a. 4.28×10^{-4}
 - b. 1.76×10^{-2}
 - c. 48.3
 - d. 2.33×10^3
22. $K_p = 1.1$ for the reaction



at 1000 K. What is the final (equilibrium) pressure (in atm) in a sealed 6.4 L flask containing 0.80 mol CaCO_3 and 0.95 mol CaO at 1000 K?

- a. 0.96
- b. 1.3
- c. 1.1
- d. 0.17

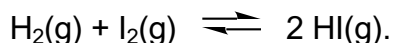
23. A gaseous mixture contains 0.80 mol SO_2Cl_2 , 0.40 mol SO_2 and 0.20 mol Cl_2 in a 1.0 L container. At 400 I, $K_c = 0.011$ for the reaction:



Is the system at equilibrium? If not, which direction will the system shift to achieve equilibrium? (Choose the one correct answer.)

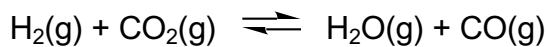
- The system is at equilibrium.
- More Cl_2 , but no more SO_2 , will form as the system achieves equilibrium.
- More SO_2 and Cl_2 will form as the system achieves equilibrium.
- More SO_2Cl_2 will form as the system achieves equilibrium.

24. In a 7.5 L flask, 0.106 mol hydrogen and 0.106 mol iodine are combined and heated to a high temperature. It is found that when equilibrium is attained, 0.137 mol of hydrogen iodide has been produced. What is the equilibrium constant K_c for the following reaction at this temperature?



- 12.2
- 1.67
- 732.
- 13.4

25. The equilibrium constant, K_c , for the following reaction is 1.70.



Initially, 0.40 moles each of H_2 and CO_2 are injected into a 1.00 L flask. Calculate the concentration of the H_2O at equilibrium.

- 0.17 M
- 0.23 M
- 0.40 M
- 1.74 M