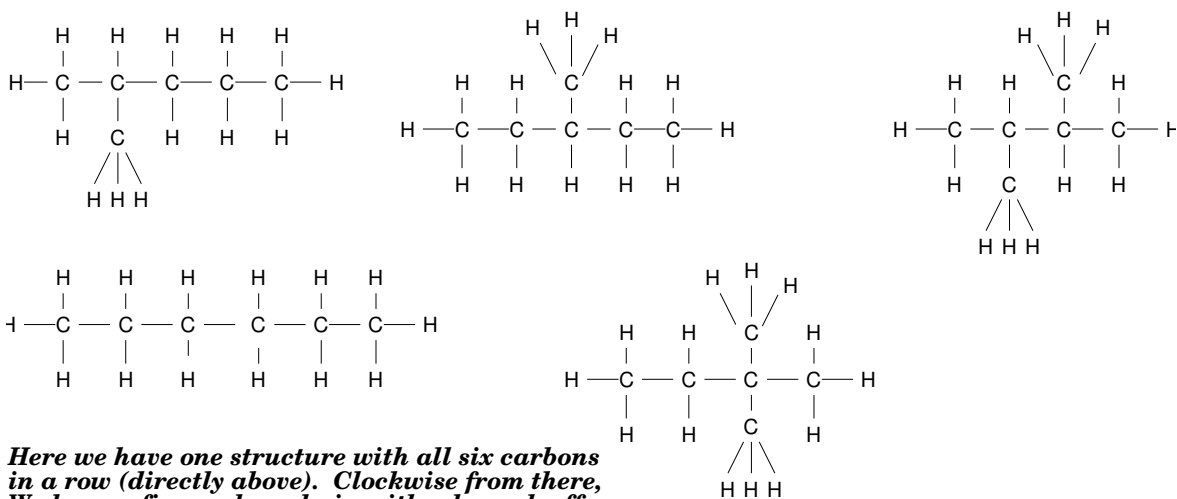


Chemistry 100 Solutions Study Guide for Exam 2

Answers to the study guide questions are provided below.

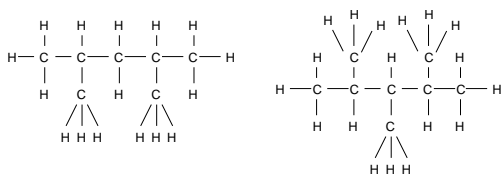
Sample questions, Chapter 3

1. What is the shape of the molecule CHCl_3 ? *Tetrahedral*
2. What is the shape of the molecule NH_2Cl ? *Pyramidal*
3. What is the shape of the molecule HCN ? *Linear*
4. There 5 different structural isomers of hexane, C_6H_{14} . Draw any two of them.



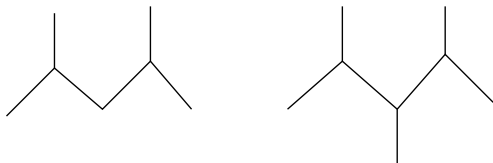
Here we have one structure with all six carbons in a row (directly above). Clockwise from there, We have a five carbon chain with a branch off the second carbon, a five carbon chain with a branch off the middle carbon, a four carbon chain with two branches, one on carbon 2 and one on carbon 4. Lastly, we have a four carbon chain with two branches off the same carbon.

5. Are the following compounds isomers, identical, or neither?



Neither

6. Draw line structures of the above hydrocarbons.



7. Identify two reasons carbon is unique and is able to form such a wide variety of compounds

- *Its small size enables it to form strong bonds with itself and other elements*
- *It also forms strong double and triple bonds with itself*

- C-C bonds are relatively inert to exposure to air and water
- Able to form rings and long chains with itself
- Isomers and functional groups give carbon based compounds even more variety

8. Give an example of an unsaturated hydrocarbon.

Various answers possible, must have at least one multiple bond.

Sample questions, Chapter 4

1. Write the chemical formulas for:

- | | |
|--------------------------------|----------------------------------|
| (a) barium sulfate $BaSO_4$ | (d) sodium bicarbonate $NaHCO_3$ |
| (b) potassium nitrate KNO_3 | (e) calcium carbonate $CaCO_3$ |
| (c) ammonium chloride NH_4Cl | (f) lithium hydroxide $LiOH$ |

2. Name the compound NH_4NO_3 . *ammonium nitrate*

3. Name the compound K_2CO_3 . *potassium carbonate*

4. What is the molarity of a solution made from 0.25 moles of glucose and enough water to make 500 mL of solution?

$$500\text{mL} \times \frac{1\text{ L}}{1000\text{ mL}} = 0.5\text{ L}$$

$$\text{Molarity} = \frac{\text{mol solute}}{\text{L solution}} = \frac{0.25\text{ mol}}{0.5\text{ L}} = 0.5\text{M}$$

5. How many grams of KBr do I need to make 100 mL of a 2M solution?

$$100\text{mL} \times \frac{1\text{ L}}{1000\text{ mL}} = 0.1\text{ L}$$

$$0.1\text{ L} \times \frac{2\text{ moles}}{1\text{ Liter}} = 0.2\text{ mol}$$

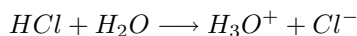
$$MM = 39.10\text{ g} + 79.90\text{ g} = 119.00\text{ g}$$

$$0.2\text{ mol} \times \frac{119.00\text{ g}}{1\text{ mol}} = 23.8\text{ g}$$

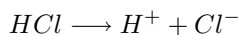
6. If I mix 40 ml of isopropanol with enough water to make 250 mL of solution, what is my concentration in v/v%?

$$v/v\% = \frac{40\text{ mL}}{250\text{ mL}} \times 100 = 16\%$$

7. Write a chemical equation for what happens when the acid HCl dissolves in water. (an acid dissociation equation).



also ok:



8. A solution has a pH of 9.0. Which one of the following is true:

- (a) The solution has more H_3O^+ ions than it has OH^- ions.
 (b) The solution has the same amount of H_3O^+ ions as it has OH^- ions.
 (c) The solution has fewer H_3O^+ ions than it has OH^- ions. **CORRECT**
 (d) We cannot say anything about the relative amounts of H_3O^+ ions and OH^- ions.
9. Describe the difference between a strong and a weak acid.
Strong acids dissociate completely in water. Weak acids only partially dissociate.
10. A substance tastes sour. Is this substance likely an acid or a base?
Acid
11. Write the balanced chemical equation for the neutralization reaction between sodium hydroxide, NaOH (a base) with hydrobromic acid, HBr.



12. Consider a solution of pH = 3.2. Is this solution acidic or basic?
Acidic
13. What is the pH of a solution with an H_3O^+ concentration of 1.0×10^{-8} M? Is this solution acidic or basic?

$$pH = -\log[H_3O^+] = -\log(1.0 \times 10^{-8}) = -(-8) = 8$$

14. What is the OH^- concentration of a solution with an H_3O^+ concentration of 7.4×10^{-6} M?

$$[OH^-] = \frac{1 \times 10^{-14}}{[H_3O^+]} = \frac{1 \times 10^{-14}}{7.4 \times 10^{-6}} = 1.35 \times 10^{-9} \text{ M}$$

15. What is the pH of a solution with an OH^- concentration of 5.2×10^{-4} M? Is this solution acidic or basic?

$$[H_3O^+] = \frac{1 \times 10^{-14}}{[OH^-]} = \frac{1 \times 10^{-14}}{5.2 \times 10^{-4}} = 1.92 \times 10^{-11} \text{ M}$$

$$pH = -\log[H_3O^+] = -\log(1.92 \times 10^{-11}) = -(-10.7) = 10.7$$

Sample questions, Air Pollution/Acid Rain

- What are the two primary components of our atmosphere?
nitrogen and oxygen
- Describe the two primary causes of acid rain discussed in class. Include the sources and chemical formulas of original (primary) pollutants.
Burning sulfur containing coal for the production of power releases SO_2 . Transportation is the primary source of NO , another acid rain culprit. NO arises from the combination of nitrogen and oxygen in the high temperatures present in internal combustion engines.
- What is incomplete combustion and how is it relevant to pollution from automobile exhaust?
In what is known as complete combustion, hydrocarbons are converted into CO_2 and water. When incomplete combustion occurs, not all of the carbon is converted to CO_2 and/or not all of the hydrogen is converted into water. Instead, one gets CO and some hydrocarbon fragments. Transportation is a major source of CO emission.

4. What are the three things needed for photochemical smog formation?

Hydrocarbons, sunlight, nitrogen oxide.

5. Describe the effect of acid rain and on aquatic environments, such as lakes and streams.

Various answers

6. Describe (in one or more complete sentences) 1 potential negative effect of acid rain, other than its effect on aquatic environments.

Various answers

7. What are the primary advantages and disadvantages of switching to lower-sulfur coal to reduce emissions that lead to acid rain?

See powerpoint handout on Acid Rain.

8. Besides switching to lower sulfur coal, describe one of the remaining primary methods for reducing acid-rain producing emissions by coal power plants and mention the method's primary disadvantage.

See powerpoint handout on Acid Rain.

Sample questions, Chapter 5

1. How many electrons are in the outer most shell of neon (Ne)? 8

2. What is the maximum number of electrons allowed in a p subshell? 6

3. Write out the full electron configuration of zirconium (Zr), with **and** without using the noble gas notation.

Zr: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 5s^2 4d^2$

Or if you are familiar with the rule for 1/2 filled subshells:

Zr: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 5s^1 4d^3$

4. Write out the full electron configuration of boron (B), with **and** without using the noble gas notation.

B: $1s^2 2s^2 2p^1$

[He] $2s^2 2p^1$