Mr. Dyson
Chemistry 1-2

Atomic structure Test Review

1. How do we determine the number of valence electrons?

2. Name what family the following elements are in:

Na Li Mg Cl F Ne

3. For the elements above, give their electron configurations, along with how many valence electrons they would have.

4. Explain one periodic trend.

5. Give the isotope notation for Carbon. Its mass number is 14.

6. What makes an isotope different from a normal element?

7. Which of these elements has the largest atomic radius (atomic size)? Na, Li, Cs, K

8. True or False? An atom is mostly made up of empty space.

9. Complete a nuclear reaction that shows alpha decay and one that shows beta decay.

10. Between each pair of atoms, tell me which one has the largest electronegativity.

S and O Li and F Al and Cl N and As

11. What occurs during beta decay? What about alpha?

12. What can block gamma radiation?

13. Give the atomic number, # of protons, # of neutrons, and # of electrons for the following elements:

U (with a mass number of 238) Cr (with a mass number of 52)
Iodine (with a mass number of 127)

Review for Bonding Test

1. Draw the Lewis Dot symbols for the following elements:

N H C O P S

2. Draw the Lewis structures for the following compounds.

COI_2 FCN C_2H_5OH CCl_4 HF

H_2O CO_2H_2 PF_3 CH_2NH COFH

3. If a molecule is an amino acid, then it is a subunit of what biological molecule?
4. What is the difference between covalent bonding and ionic bonding?

5. What is the HONC rule?

6. How many bonds does carbon like to form?

7. How many electrons are shared in a double bond? What about a triple bond?

8. When do you add a double bond to a Lewis structure?

9. How do you name covalent compounds?

10. What is the charge on the following elements when they form ions?

Na F O S Mg Al

11. What type of electron configuration do ions try and get?

12. Form ionic compounds with the following elements:

Mg and S Na and O Al and Cl

Ca and SO_4 Al and NO_3 Au (+1 charge) and Cl

Zn (+2 charge) and PO_4 Sr and P

13. Name the ionic compounds formed in question 12.

14. What type of bonding is present in the following compounds?

NaCl CN CH_4 C (diamond) Cu

15. What do the electrons do in ionic bonding? What about covalent bonding?

Moles Review

Do the following conversions: 1-10

1. Convert 2 moles of Zn to atoms of Zn
2. Convert 6.02x10^13 molecules of carbon dioxide to moles of carbon dioxide.
3. Convert 12 grams of NaCl to moles of NaCl
4. 2 moles of $Zn(NO_3)_2$ to grams.
5. 12 L of oxygen gas, at STP, to moles
6. 2.1 moles of fluorine gas to liters at STP
7. 50 grams of $Al_2(SO_4)_3$ to molecules.
8. 5 x 10^12 atoms of Au to grams.
9. 15 grams of KNO_3 to moles.
10. 2 moles of MgO to grams.
11. Find the molar mass of the following species:

MgS NaI Cu $AlPO_4$ $Mg_3(PO_4)_2$

12. Find the empirical formula of a compound that is 22.1% aluminum, 25.4% phosphorous, and 52.4% oxygen.
13. Find the molecular formula of a compound that has a molar mass of 86 grams and is 16.3% hydrogen and 83.7% oxygen. The empirical formula for this compound is CH_4

Reactions Review:

Balance the following equations:

1. $NaOH + HCl = H_2O + NaCl$
2. $NaOH + H_2SO_4 = H_2O + Na_2SO_4$
3. $Ca(OH)_2 + H_3PO_4 = H_2O + Ca_3(PO_4)_2$
4. $C_3H_8 + O_2 = CO_2 + H_2O$
5. $BaCl_2 + AgNO_3 = Ba(NO_3)_2 + AgCl$
6. $I^- + Cl_2 = I_2 + Cl^-$

7. $Na_2CO_3 + HCl = NaCl + H_2O + CO_2$

8. $S_8 + O_2 = SO_2$

9. $SO_2 + O_2 = SO_3$

10. $SO_3 + H_2O = H_2SO_4$

11. $Na + Cl_2 = NaCl$

12. $H_2 + O_2 = H_2O$

13. $Na + H_2O = NaOH + H_2$

14. $C_6H_6 + H_2 = C_6H_{12}$

15. $CaC_2 + H_2O = C_2H_2 + CaO$

Write out the following reactions (identify the type also):

1. $Al + NaCl \rightarrow$
2. $MgSO_4 + AlPO_4 \rightarrow$
3. $C_4H_{10} + O_2 \rightarrow$
4. $ZnNO_3 + Al \rightarrow$
5. $Al(NO_3)_3 + MgSO_3 \rightarrow$
6. $HCl + Mg(OH)_2 \rightarrow$
7. $NaOH + Ca(SO_4) \rightarrow$

Reactions

Balance the following reactions:

1. $Al + NaCl \rightarrow Na + AlCl_3$

2. $MgSO_4 + AlPO_4 \rightarrow Mg_3(PO_4)_2 + Al_2(SO_4)_3$

3. $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$

4. $ZnNO_3 + Al \rightarrow Zn + Al(NO_3)_3$

5. $Al(NO_3)_3 + MgSO_4 \rightarrow Al_2(SO_4)_3 + Mg(NO_3)_2$

6. $HCl + Mg(OH)_2 \rightarrow MgCl_2 + H_2O$

7. $NaOH + Ca(SO_4) \rightarrow Na_2SO_4 + Ca(OH)_2$

Review for Test 1-Semester two

Solutions:

1. What can I do to get more solute to dissolve in a solvent?

2. If I increase the pressure above a solution, then I can get more ___ to dissolve.
3. What is a solute? What is a solvent? Identify the solute and solvent in this solution: 30 grams of NaCl dissolved in 2 liters of water.
4. How do substances dissolve?
5. I have 30 grams of NaCl dissolved in 2 liters of water. Express this concentration in molarity and grams per liter.
6. I have 44 grams of $AlPO_4$ dissolved in 5 liters of water. Express this concentration in molarity and grams per liter.
7. How many grams of $AlPO_4$ must I dissolve in 8 L of water in order to make a 2 M solution? Which substance is the solute? Which substance is the solvent?
8. If I have 20 mg of KOH dissolved in 3 kg of water, what is the concentration in parts per million? Which substance is the solute? Which substance is the solvent?
9. I have 60 mg of $Zn(NO_3)_2$ in 300 grams (.3 kg) of water. What is the concentration of this substance in parts per million? Which substance is the solute? Which substance is the solvent?

Acids and Bases

1. What is an acid? What is a base?

2. What is the difference between a strong acid and a weak acid? How would you classify a substance that has a pH=7? What about a substance that has a pH=1?

3. If an acid has a pH of 2.4, what is its H^+ ion concentration in molarity? If an acid has $[H^+]$= .0002 M, what is its pH? What is its pOH?

4. A base has $[OH^-]$ concentration= $6x10^{-8}$ M. What is its pOH? What about pH?

Gas Laws

1. Convert the following temperatures to Kelvin:

59 °C 100 °C -55 °C 23 °C 75 °C

2. What is absolute zero? Can there be any temperature lower than that? What occurs at this temperature?

3. On the ground, a balloon has a pressure of 1 atm, a temperature of 25 °C, and a volume of 15 L. It rises 1000 ft where it has a pressure of .25 atm and a temperature of 10 °C. What is the new volume?

4. A piston, at constant temperature, has air inside of it with a pressure of 6 atm and a volume of 5 L. If the volume is decreased to .5 L, what is the new pressure?

5. What is pressure? What is temperature? What temperature scale do we use for the gas laws?

6. On the ground, a tire has a pressure of 3 atm, a temperature of 30 °C, and a volume of 28.4 L. It goes on the water where it now has a pressure of 6 atm and a temperature of 40 °C. What is the new volume?

Review for Test 2

Acids and Bases, reaction rates, equilibrium

1. When has a reaction reached equilibrium? What principle tells us what happens to an equilibrium system when a stress is placed on it?
2. What is the difference between a strong acid and a weak acid? How would you classify a substance that has a pH=7? What about a substance that has a pH=1?
3. According to Le Chatlier's Principle, which way does the equilibrium shift if I increase the pressure? What about increasing the temperature?
4. What are three things that I can do to increase a reaction rate? Why do they increase the reaction rate? How do catalysts affect reaction rates?
5. What does a catalyst do? What does an inhibitor do?
6. Consider the following reaction,

$2NO_{2(g)} \leftrightarrow 2NO_{(g)} + O_{2(g)} + \text{heat}$

Which way does the equilibrium shift if I increase the pressure? Increase the temperature? Decrease the temperature? Add more reactant? Add more oxygen? Remove NO? Remove the nitrogen dioxide (NO_2)? Decrease the pressure?

Thermo. Review

1. What does it mean if a reaction is exothermic? What about endothermic?
2. How much heat does it take to melt 50 grams of ice? Is heat absorbed or released in this process? Heat of fusion=334 J/g
3. When 440 J is added to 30 g of an unknown substance, its temperature goes from 40 degrees Celsius to 90 degrees Celsius. What is the specific heat of this unknown substance?
4. How much heat does it take to melt 15 grams of ice, that are initially at –10 degrees Celsius, into water at 0 degrees Celsius? Specific heat of ice=2.1 J/g C and heat of fusion=334 J/g
5. When I add 10 grams of iron, initially at 70 degrees Celsius, to 20 grams of water at 25 degrees Celsius. What is the final temperature of the iron and water? Specific Heat of water=4.184 J/g C and for iron=.46 J/g C
6. How much heat does it take to vaporize 10 grams of water at 100 C? Heat of vaporization= 2261 J/g
7. 25 grams of an unknown substance at 70 degrees Celsius is placed in 40 grams of water at 25 degrees Celsius. If the final temperature of the water is 35 degrees Celsius and the final temperature of the unknown substance is 35 degrees Celsius, what is the specific heat of the unknown substance? Specific heat of water=4.184 J/g C.

8. What type of phase change occurs when a substance goes from a liquid to a solid? What about when a substance goes from a gas to a liquid?

Review for Honors Bonding Test

1. Draw the Lewis Dot symbols for the following elements:

N H C O P S

2. Draw the Lewis structures for the following compounds:

COI_2 FCN C_2H_5OH CCl_4 HF

H_2O CO_2H_2 PF_3 CH_2NH COFH

3. For the molecules in number two, tell me whether or not they are polar. What hybridization and geometry would you find around the central atom?
4. If a molecule is an amino acid, then it is a subunit of what biological molecule?
5. What is the difference between covalent bonding and ionic bonding?

6. What is the HONC rule?

7. How many bonds does carbon like to form?

8. When counting bonds for shape, do double bonds count as 1 or 2 bonds?

9. When do you add a double bond to a Lewis structure?

10. Between HF, HCl, and HI, which one of these molecules has the higher boiling point? Why?

11. What is the charge on the following elements when they form ions?

Na F O S Mg Al

12. What type of electron configuration do ions try and get?

13. Form ionic compounds with the following elements:

Mg and S Na and O Al and Cl

Ca and SO_4 Al and NO_3 Au (+1 charge) and Cl

Zn (+2 charge) and PO_4 Sr and P

14. Name the ionic compounds formed in question 13.

15. What type of bonding is present in the following compounds?

NaCl CN CH_4 C (diamond) Cu

Mr. Dyson
Honors Chemistry 1-2

Review

1. How do we determine the number of valence electrons?

2. Name what family the following elements are in:

Na Li Mg Cl F Ne

3. For the elements above, give their electron configurations, along with how many valence electrons they would have.

4. Explain one periodic trend.

5. Give the isotope notation for Carbon. Its mass number is 14.

6. What makes an isotope different from a normal element?

7. Which of these elements has the largest atomic radius (atomic size)? Na, Li, Cs, K

8. True or False? An atom is mostly made up of empty space.

9. Write an alpha and beta decay reaction. Also, give the types of radiation, along with which one is the strongest and what materials block each one.

10. Between each pair of atoms, tell me which one has the largest electronegativity.

S and O Li and F Al and Cl N and As

11. Element X has three isotopes. X 11 is 75% abundant, X 12 is 14 % abundant, and X 13 is 11 % abundant. What is the atomic mass of element X?

12. What is the wavelength (in nm) of light that has a frequency of $6*10^{14}$ hz? What is the energy of this photon of light? How much energy is released when hydrogen's electron falls from the n=4 to the n=2 level?

13. Give the atomic number, # of protons, # of neutrons, and # of electrons for the following elements:

U (with a mass number of 238) Cr (with a mass number of 52)
Iodine (with a mass number of 127)

Reviews

Gas Laws

1. Convert the following temperatures to Kelvin:

59 °C 100 °C -55 °C 23 °C 75 °C

2. What is absolute zero? Can there be any temperature lower than that? What occurs at this temperature?

3. On the ground, a balloon has a pressure of 1.5 atm, a temperature of 20 °C, and a volume of 10 L. It rises 1000 ft where it has a pressure of .5 atm and a temperature of 15 °C. What is the new volume?
4. A piston, at constant temperature, has air inside of it with a pressure of 2 atm and a volume of 1 L. If the volume is decreased to ..5 L, what is the new pressure?
5. On the ground, a tire has a pressure of 1.5 atm, a temperature of 25 °C, and a volume of 22.4 L. It goes on the water where it now has a pressure of 5 atm and a temperature of 30 °C. What is the new volume?
6. A capped syringe, at constant temperature, has air inside of it with a pressure of 6 atm and a volume of 1 L. If the volume is decreased to 2 L, what is the new pressure?
7. A balloon, at constant pressure, has a volume of 3 L at 25 °C. What is the new volume if the volume is increased to 6 L?
8. Air inside a pressure cooker, at constant volume, has a pressure of 3 atm at 25 °C. What is the new temperature if the pressure increases to 4.5 atm?
9. I have a 20 grams of CO_2 at 2 atm, and 3L. What is the temperature of this gas?
10. I have two moles of hydrogen gas at 5L and 30 C. What is the pressure of the hydrogen?
11. I have a container with a total pressure of 7 atm. This container contains three gases, carbon dioxide (p=2 atm), hydrogen gas (p=1.25 atm) and oxygen gas. Based on Dalton's Law of partial pressure, what is the pressure of the hydrogen gas?
12. What happens to the speed of molecules as the temperature increases?

Honors Review for Test 1

Stoichiometry

1. Use the following balanced equation to answer the following questions:

$3Ca(NO_3)_2 + 2AlCl_3 \rightarrow 3CaCl_2 + 2Al(NO_3)_3$

   a. How much $CaCl_2$ can be produced from 10 g of $Ca(NO_3)_2$? Assume excess $AlCl_3$.
   b. What is the mole ratio between $Ca(NO_3)_2$ and $Al(NO_3)_3$? What about $AlCl_3$and $CaCl_2$?
   c. If I have 10 grams of $Ca(NO_3)_2$ and 30 grams of $AlCl_3$, which is my limiting reagent? How much product will form?
   d. What is my excess reagent, how much of it is left over at the end of the reaction?
   e. Answer c and d for these amounts: 50 grams $Ca(NO_3)_2$ and 15 grams of $AlCl_3$?
   f. For problem c, what is my percent yield if I get 4 grams of $CaCl_2$ from this reaction?

2. According to the balanced equation, $C_3H_{10} + 5\ O_2 \rightarrow 3CO_2 + 6\ H_2O$

   a. How many grams of water will be produced if Suzy starts with 134 g Oxygen.
   b. How many moles of carbon dioxide will you make if 376 grams of water are produced?
   c. If 89.4 moles of C_3H_{10} react, how many moles of CO_2 will be produced?
   d. If you want to make .87 moles carbon dioxide, how many moles of water will be made?
   e. If you start with .43 grams C_3H_{10} , how many grams of CO_2 will you make?
   f. Joe starts with 12 moles oxygen, how many grams of carbon dioxide will be produced?
   g. How many grams of propane (C_3H_{10}) will you need to react with 578 g O_2?

Solutions:

1. What can I do to get more solute to dissolve in a solvent?
2. If I increase the pressure above a solution, then I can get more ___ to dissolve.
3. What is a solute? What is a solvent? Identify the solute and solvent in this solution: 30 grams of NaCl dissolved in 2 liters of water.
4. How do substances dissolve?
5. I have 30 grams of NaCl dissolved in 2 liters of water. Express this concentration in molarity and grams per liter.
6. I have 44 grams of $AlPO_4$ dissolved in 5 liters of water. Express this concentration in molarity and grams per liter.
7. How many grams of $AlPO_4$ must I dissolve in 8 L of water in order to make a 2 M solution? Which substance is the solute? Which substance is the solvent?
8. If I have 20 mg of KOH dissolved in 3 kg of water, what is the concentration in parts per million? Which substance is the solute? Which substance is the solvent?
9. I have 60 mg of $Zn(NO_3)_2$ in 300 grams (.3 kg) of water. What is the concentration of this substance in parts per million? Which substance is the solute? Which substance is the solvent?

10. If I have 30 grams of ZnO in 100 mL of water, what is the concentration in percent composition? Which substance is the solute? Which substance is the solvent?

Review for Test 1

Stoichiometry

1. Use the following balanced equation to answer the following questions:

$3Ca(NO_3)_2 + 2AlCl_3 \rightarrow 3CaCl_2 + 2Al(NO_3)_3$

   a. How much $CaCl_2$ can be produced from 10 g of $Ca(NO_3)_2$? Assume excess $AlCl_3$.
   b. What is the mole ratio between $Ca(NO_3)_2$ and $Al(NO_3)_3$? What about $AlCl_3$and $CaCl_2$?
   c. If I have 10 grams of $Ca(NO_3)_2$ and 30 grams of $AlCl_3$, which is my limiting reagent? How much product will form?
   d. What is my excess reagent, how much of it is left over at the end of the reaction?
   e. Answer c and d for these amounts: 50 grams $Ca(NO_3)_2$ and 15 grams of $AlCl_3$?

2. According to the balanced equation, $C_3H_{10} + 5\ O_2 \rightarrow 3CO_2 + 6\ H_2O$

   a. How many grams of water will be produced if Suzy starts with 134 g Oxygen.
   b. How many moles of carbon dioxide will you make if 376 grams of water are produced?
   c. If 89.4 moles of C_3H_{10} react, how many moles of CO_2 will be produced?
   d. If you want to make .87 moles carbon dioxide, how many moles of water will be made?
   e. If you start with .43 grams C_3H_{10} , how many grams of CO_2 will you make?
   f. Joe starts with 12 moles oxygen, how many grams of carbon dioxide will be produced?
   g. How many grams of propane (C_3H_{10}) will you need to react with 578 g O_2?

Solutions:

1. What can I do to get more solute to dissolve in a solvent?
2. If I increase the pressure above a solution, then I can get more ___ to dissolve.
3. What is a solute? What is a solvent? Identify the solute and solvent in this solution: 30 grams of NaCl dissolved in 2 liters of water.
4. How do substances dissolve?
5. I have 30 grams of NaCl dissolved in 2 liters of water. Express this concentration in molarity and grams per liter.
6. I have 44 grams of $AlPO_4$ dissolved in 5 liters of water. Express this concentration in molarity and grams per liter.
7. How many grams of $AlPO_4$ must I dissolve in 8 L of water in order to make a 2 M solution? Which substance is the solute? Which substance is the solvent?
8. If I have 20 mg of KOH dissolved in 3 kg of water, what is the concentration in parts per million? Which substance is the solute? Which substance is the solvent?

9. I have 60 mg of $Zn(NO_3)_2$ in 300 grams (.3 kg) of water. What is the concentration of this substance in parts per million? Which substance is the solute? Which substance is the solvent?

10. If I have 30 grams of ZnO in 100 mL of water, what is the concentration in percent composition? Which substance is the solute? Which substance is the solvent?

Atomic theory and radioactivity

1. Name what family the following elements are in:

   Na Li Mg Cl F Ne
2. For the elements above, give their electron configurations, along with how many valence electrons they would have.
3. Explain one periodic trend.
4. What is the wavelength of a photon of light that has a frequency of 640000 Hz? What is the energy associated with this photon of light?
5. What makes an isotope different from a normal element?
6. An electron emits photons of light at 700 nm. What part of the electromagnetic spectrum is this in? What is its frequency and energy?
7. Complete the nuclear reaction showing Uranium 238 undergoing alpha decay. Name the three types of nuclear decay.
8. Between each pair of atoms, tell me which one has the largest electronegativity.

   S and O Li and F Al and Cl N and As
9. Give the atomic number, # of protons, # of neutrons, and # of electrons for the following elements:

   U (with a mass number of 238) Cr (with a mass number of 52)

Iodine (with a mass number of 127)

Bonding

1. What type of bonding is present in the following compounds?

   NaCl CN CH_4 C (diamond) Cu

   $MgCl_2$ FeO
2. Make ionic compounds with the following atoms:

Sr and O Na and S Al and Cl Sr and N

Mg and OH Al and NO_3 Mg and PO_4

3. What charges do the following atoms have when they become ions?

   Mg Cl As N Na Al
4. Draw the Lewis structures for the following compounds:

   COI_2 FCN C_2H_5OH CCl_4 HF

   H_2O CO_2H_2 PF_3 CH_2NH COFH
5. Give the geometry and hybridization around the central atom for each molecule in #4. What is the hybridization around the central atom in SeF_6?
6. Between H_2O, CH_4, and PH_3, which substance has the higher boiling point and why based on intermolecular forces?

Moles

Do the following conversions: 1-10

1. Convert 2 moles of Zn to atoms of Zn
2. Convert 6.02x10^13 molecules of carbon dioxide to moles of carbon dioxide.
3. Convert 12 grams of NaCl to moles of NaCl
4. 2 moles of $Zn(NO_3)_2$ to grams.
5. 12 L of oxygen gas, at STP, to moles
6. 2.1 moles of fluorine gas to liters at STP
7. 50 grams of $Al_2(SO_4)_3$ to molecules.
8. 5 x 10^12 atoms of Au to grams.
9. 15 grams of KNO_3 to moles.
10. 2 moles of MgO to grams.
11. Find the molar mass or gfm of the following species:
    MgS NaI Cu $AlPO_4$ $Mg_3(PO_4)_2$
12. What is the empirical formula of a substance that is 80 % carbon and 20% hydrogen? If its molecular mass is 30 g, what is the molecular formula of this compound?

Reactions

Balance the following equations:

1. $NaOH + HCl = H_2O + NaCl$
2. $NaOH + H_2SO_4 = H_2O + Na_2SO_4$
3. $Ca(OH)_2 + H_3PO_4 = H_2O + Ca_3(PO_4)_2$
4. $C_3H_8 + O_2 = CO_2 + H_2O$
5. $BaCl_2 + AgNO_3 = Ba(NO_3)_2 + AgCl$
6. $Al + NaCl \rightarrow Na + AlCl_3$
7. $MgSO_4 + AlPO_4 \rightarrow Mg_3(PO_4)_2 + Al_2(SO_4)_3$
8. $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$

Write out and balance the following reactions:

1. $NaCl + Fe(NO_3)_3 \rightarrow$
2. $C_7H_{16} + O_2 \rightarrow$
3. $Mg + Al_2(SO_4)_3 \rightarrow$
4. $H_2SO_4 + KOH \rightarrow$

Stoichiometry

1. Use the following balanced equation to answer the following questions:

$3Ca(OH)_2 + 2AlCl_3 \rightarrow 3CaCl_2 + 2Al(OH)_3$

   a. How much $CaCl_2$ can be produced from 10 g of $Ca(OH)_2$? Assume excess $AlCl_3$.
   b. What is the mole ratio between $Ca(OH)_2$ and $Al(OH)_3$? What about $AlCl_3$and $CaCl_2$?
   c. If I have 10 grams of $Ca(OH)_2$ and 30 grams of $AlCl_3$, which is my limiting reagent? How much product will form?
   d. What is my excess reagent, how much of it is left over at the end of the reaction?
   e. Answer c and d for these amounts: 50 grams $Ca(OH)_2$ and 15 grams of $AlCl_3$?
   f. For problem c, what is my percent yield if I get 4 grams of $CaCl_2$ from this reaction?

Solutions:

1. What can I do to get more solute to dissolve in a solvent?

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Acids and Bases, reaction rates, equilibrium

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4. If an acid has a pH of 2.4, what is its H^+ ion concentration in molarity? If an acid has $[H^+]$= .0002 M, what is its pH? What is its pOH?
5. A base has $[OH^-]$ concentration= $6x10^{-8}$ M. What is its pOH? What about pH?
6. According to Le Chatlier's Principle, which way does the equilibrium shift if I increase the pressure? What about increasing the temperature?

7. What are three things that I can do to increase a reaction rate? Why do they increase the reaction rate? How do catalysts affect reaction rates?
8. What does a catalyst do? What does an inhibitor do?
9. Consider the following reaction,

$2NO_{2(g)} \leftrightarrow 2NO_{(g)} + O_{2(g)} + heat$

Which way does the equilibrium shift if I increase the pressure? Increase the temperature? Decrease the temperature? Add more reactant? Add more oxygen? Remove NO? Remove the nitrogen dioxide (NO_2)? Decrease the pressure?

Thermo. Review

1. What does it mean if a reaction is exothermic? What about endothermic?
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3. When 440 J is added to 10 g of an unknown substance, its temperature goes from 40 degrees Celsius to 90 degrees Celsius. What is the specific heat of this unknown substance?
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7. 25 grams of an unknown substance at 70 degrees Celsius is placed in 40 grams of water at 25 degrees Celsius. If the final temperature of the water and unknown substance is 35 degrees Celsius, what is the specific heat of the unknown substance? Specific heat of water=4.184 J/g C.
8. What type of phase change occurs when a substance goes from a liquid to a solid? What about when a substance goes from a gas to a liquid?

Gas Laws

1. Convert the following temperatures to Kelvin:

59 °C 100 °C -55 °C 23 °C 75 °C

2. What is absolute zero? Can there be any temperature lower than that? What occurs at this temperature?
3. What is pressure? What is temperature? What temperature scale do we use for the gas laws?
4. On the ground, a balloon has a pressure of 1 atm, a temperature of 25 °C, and a volume of 15 L. It rises 1000 ft where it has a pressure of .25 atm and a temperature of 10 °C. What is the new volume?
5. A piston, at constant temperature, has air inside of it with a pressure of 6 atm and a volume of 5 L. If the volume is decreased to .5 L, what is the new pressure?

6. On the ground, a tire has a pressure of 3 atm, a temperature of 30 °C, and a volume of 28.4 L. It goes on the water where it now has a pressure of 6 atm and a temperature of 40 °C. What is the new volume?

Final Review
Chemistry 1-2
Atomic theory and radioactivity

1. Name what family the following elements are in:

Na Li Mg Cl F Ne

2. For the elements above, give their electron configurations, along with how many valence electrons they would have.
3. Explain one periodic trend.
4. Give the isotope notation for Carbon. Its mass number is 14.
5. What makes an isotope different from a normal element?
6. True or False? An atom is mostly made up of empty space.
7. Complete the nuclear reaction showing Uranium 238 undergoing alpha decay. Name the three types of nuclear decay.
8. Between each pair of atoms, tell me which one has the largest electronegativity.

S and O Li and F Al and Cl N and As

9. Give the atomic number, # of protons, # of neutrons, and # of electrons for the following elements:

U (with a mass number of 238) Cr (with a mass number of 52)
Iodine (with a mass number of 127)

Bonding

1. What type of bonding is present in the following compounds?

NaCl CN CH_4 C (diamond) Cu

$MgCl_2$ FeO

2. Make ionic compounds with the following atoms:

Sr and O Na and S Al and Cl Sr and N

Mg and OH Al and NO_3 Mg and PO_4

3. What charges do the following atoms have when they become ions?

Mg Cl As N Na Al

4. Draw the Lewis structures for the following compounds:

COI_2 FCN C_2H_5OH CCl_4 HF

H_2O CO_2H_2 PF_3 CH_2NH COFH

Moles

Do the following conversions: 1-10

1. Convert 2 moles of Zn to atoms of Zn
2. Convert 6.02x10^13 molecules of carbon dioxide to moles of carbon dioxide.
3. Convert 12 grams of NaCl to moles of NaCl
4. 2 moles of $Zn(NO_3)_2$ to grams.
5. 12 L of oxygen gas, at STP, to moles
6. 2.1 moles of fluorine gas to liters at STP
7. 50 grams of $Al_2(SO_4)_3$ to molecules.
8. 5 x 10^12 atoms of Au to grams.
9. 15 grams of KNO_3 to moles.
10. 2 moles of MgO to grams.
11. Find the molar mass of the following species:

MgS NaI Cu $AlPO_4$ $Mg_3(PO_4)_2$

Balance the following reactions:

1. $Al + NaCl \rightarrow Na + AlCl_3$

2. $MgSO_4 + AlPO_4 \rightarrow Mg_3(PO_4)_2 + Al_2(SO_4)_3$

3. $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$

4. $ZnNO_3 + Al \rightarrow Zn + Al(NO_3)_3$

5. $Al(NO_3)_3 + MgSO_4 \rightarrow Al_2(SO_4)_3 + Mg(NO_3)_2$

6. $HCl + Mg(OH)_2 \rightarrow MgCl_2 + H_2O$

7. $NaOH + Ca(SO_4) \rightarrow Na_2SO_4 + Ca(OH)_2$

Stoichiometry

1. Use the following balanced equation to answer the following questions:

$3Ca(OH)_2 + 2AlCl_3 \rightarrow 3CaCl_2 + 2Al(OH)_3$

   a. How much $CaCl_2$ can be produced from 10 g of $Ca(OH)_2$? Assume excess $AlCl_3$.
   b. What is the mole ratio between $Ca(OH)_2$ and $Al(OH)_3$? What about $AlCl_3$and $CaCl_2$?
   c. If I have 10 grams of $Ca(OH)_2$ and 30 grams of $AlCl_3$, which is my limiting reagent? How much product will form?
   d. What is my excess reagent?

e. Answer c and d for these amounts: 50 grams $Ca(OH)_2$ and 15 grams of $AlCl_3$?
f. For problem c, what is my percent yield if I get 4 grams of $CaCl_2$ from this reaction?

Solutions:

7. What can I do to get more solute to dissolve in a solvent?

8. If I increase the pressure above a solution, then I can get more ___ to dissolve.

9. What is a solute? What is a solvent? Identify the solute and solvent in this solution: 30 grams of NaCl dissolved in 2 liters of water.

10. How do substances dissolve?

11. I have 30 grams of NaCl dissolved in 2 liters of water. Express this concentration in molarity and grams per liter.

12. I have 44 grams of $AlPO_4$ dissolved in 5 liters of water. Express this concentration in molarity and grams per liter.

13. How many grams of $AlPO_4$ must I dissolve in 8 L of water in order to make a 2 M solution? Which substance is the solute? Which substance is the solvent?

14. If I have 20 mg of KOH dissolved in 3 kg of water, what is the concentration in parts per million? Which substance is the solute? Which substance is the solvent?

15. I have 60 mg of $Zn(NO_3)_2$ in 300 grams (.3 kg) of water. What is the concentration of this substance in parts per million? Which substance is the solute? Which substance is the solvent?

Acids and Bases, reaction rates, equilibrium

16. What is an acid? What is a base?

17. What is the difference between a strong acid and a weak acid? How would you classify a substance that has a pH=7? What about a substance that has a pH=1?

Thermo. Review

1. What does it mean if a reaction is exothermic? What about endothermic?
2. How much heat does it take to melt 50 grams of ice? Is heat absorbed or released in this process? Heat of fusion=334 J/g
3. When 440 J is added to 30 g of an unknown substance, its temperature goes from 40 degrees Celsius to 90 degrees Celsius. What is the specific heat of this unknown substance?
4. How much heat does it take to melt 15 grams of ice, that are initially at –10 degrees Celsius, into water at 0 degrees Celsius? Specific heat of ice=2.1 J/g C and heat of fusion=334 J/g
5. When I add 10 grams of iron, initially at 70 degrees Celsius, to 20 grams of water at 25 degrees Celsius. What is the final temperature of the iron and water? Specific Heat of water=4.184 J/g C and for iron=.46 J/g C
6. How much heat does it take to vaporize 10 grams of water at 100 C? Heat of vaporization= 2261 J/g
7. 25 grams of an unknown substance at 70 degrees Celsius is placed in 40 grams of water at 25 degrees Celsius. If the final temperature of the water is 35 degrees Celsius and the final temperature of the unknown substance is 35 degrees Celsius, what is the specific heat of the unknown substance? Specific heat of water=4.184 J/g C.
8. What type of phase change occurs when a substance goes from a liquid to a solid? What about when a substance goes from a gas to a liquid?

Gas Laws

Convert the following temperatures to Kelvin:

59 °C 100 °C -55 °C 23 °C 75 °C

2. What is absolute zero? Can there be any temperature lower than that? What occurs at this temperature?

3. On the ground, a balloon has a pressure of 1 atm, a temperature of 25 °C, and a volume of 15 L. It rises 1000 ft where it has a pressure of .25 atm and a temperature of 10 °C. What is the new volume?

4. A piston, at constant temperature, has air inside of it with a pressure of 6 atm and a volume of 5 L. If the volume is decreased to .5 L, what is the new pressure?

5. What is pressure? What is temperature? What temperature scale do we use for the gas laws?

6. On the ground, a tire has a pressure of 3 atm, a temperature of 30 °C, and a volume of 28.4 L. It goes on the water where it now has a pressure of 6 atm and a temperature of 40 °C. What is the new volume?

Key Equations: Cell Potential $E^{o}_{cell} = E^{o}_{cathode} - E^{o}_{anode}$

Practice Problems

1. Define *oxidation* and *reduction* in terms of electron transfer and change in oxidation number.

2. Consider the following balanced redox reaction:

$$2\ CrO_2^-(aq) + 2\ H_2O(l) + 6\ ClO^-(aq) \rightarrow 2\ CrO_4^{2-}(aq) + 3\ Cl_2(g) + 4\ OH^-(aq)$$

   a) Which species is oxidized?
   b) Which species is reduced?
   c) Which species is the oxidizing agent?
   d) Which species is the reducing agent?
   e) From which species to which does electron transfer occur?

3. Assign oxidation numbers to each of the following compounds: a) NH_2OH, N_2H_4, NH_4, HNO_2.

4. Which of the following equations are oxidation – reduction reactions?
   a) $N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$

   b) $2\ NaClO_3(s) \xrightarrow{\Delta} 2\ NaCl(s) + 3\ O_2(g)$

   c) $Ba(s) + 2\ H_2O(l) \rightarrow Ba(OH)_2(aq) + H_2(g)$

5. Assign oxidation numbers to each element in the following equation and identify the oxidizing agent and the reducing agent.

$$4NH_3(g)\ +\ 5O_2(g)\ \rightarrow\ 4NO(g)\ +\ 6H_2O(l)$$

6. A voltaic cell is constructed with an Sn/Sn^{2+} half-cell and a Zn/Zn^{2+} half-cell. The zinc electrode is negative.
   a) Write balanced half-reactions and the overall reaction.
   b) Draw a diagram of the cell, labeling electrodes with their charges and showing the directions of electron flow in the circuit and of cation and anion flow in the salt bridge.

7. Are the following reactions balanced for atoms and charge?

a) $Fe^{2+}(aq) + MnO_4^-(aq) \rightarrow Mn^{2+}(aq) + Fe^{3+}(aq) + 2\ O_2(g)$

b) $4\ O_2(g) + 4\ NO(g) \rightarrow 4\ NO_3^-(aq)$

8. Write the cell notation for the voltaic cell that incorporates the following redox reaction:

$$Al(s)| + Cr^{3+}(aq) \text{ } Al^{3+}(aq) + Cr(s)$$

For organic Chemistry: Review your notes and redo homework problems that are on those topics.

Practice Problems – Answers

1. *Oxidation* is the loss of electrons (resulting in a higher oxidation number), while *reduction* is the gain of electrons (resulting in a lower oxidation number). In an oxidation-reduction reaction, electrons transfer from the oxidized substance to the reduced substance. The oxidation number of the reactant being oxidized increases while the oxidation number of the reactant being reduced decreases.

2. a) The **CrO_2^-** is the oxidized species because Cr increases in oxidation state from +3 to +6.
b) The **ClO^-** is the reduced species because Cl decreases in oxidation state from +1 to 0.
c) The oxidizing agent is **ClO^-**; the oxidizing agent is the substance reduced.
d) The reducing agent is **CrO_2^-**; the reducing agent is the substance oxidized.
e) Electrons transfer from **CrO_2^- to ClO^-**.

3. a) NH_2OH: (O.N. for N) + 3(+1 for H) + 1(–2 for O) = 0 O.N. for N = **–1**
b) N_2H_4: 2(O.N. for N) + 4(+1 for H) = 0 O.N. for N = **–2**
c) NH_4^+: (O.N. for N) + 4(+1 for H) = +1 O.N. for N = **–3**
d) HNO_2: (O.N. for N) + 1(+1 for H) + 2(–2 for O) = 0 O.N. for N = **+3**

4. All the reactions are oxidation – reductions.

5. $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(l)$

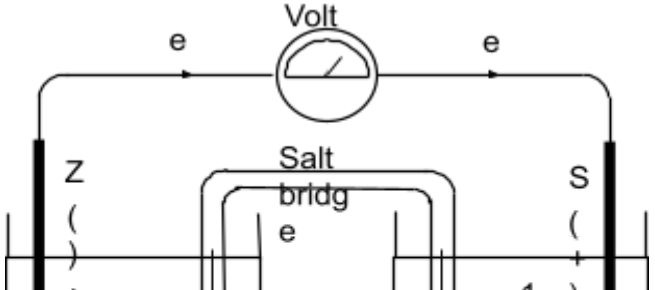
O.N.:	N = –3	O = 0	N = +2	H = +1
	H = +1		O = –2	O = –2

N oxidized from –3 to +2 by O_2, and O is reduced from 0 to –2.

Oxidizing agent = O_2 Reducing agent = NH_3

6. a) If the zinc electrode is negative, oxidation takes place at the zinc electrode:
$Zn(s) \rightarrow Zn^{2+}(aq) + 2\ e^-$
Reduction half-reaction: $Sn^{2+}(aq) + 2\ e^- \rightarrow Sn(s)$
Overall reaction: $Zn(s) + Sn^{2+}(aq) \rightarrow Zn^{2+}(aq) + Sn(s)$

b)



7. a) Balanced for atoms but not charge.

   b) Balanced for atoms but not charge.

8. In cell notation, the oxidation components of the anode compartment are written on the left of the salt bridge and the reduction components of the cathode compartment are written to the right of the salt bridge. A double vertical line separates the anode from the cathode and represents the salt bridge. A single vertical line separates species of different phases.

   Anode || Cathode

   a) Al is oxidized, so it is the anode and appears first in the cell notation:

   Al(*s*)|Al^{3+}(*aq*)||Cr^{3+}(*aq*)|Cr(*s*)

Chemistry 2
Mr. Dyson

Review for Test #2

1. What is specific heat?

2. When has a reaction reached equilibrium? What principle tells us what happens to an equilibrium system when a stress is placed on it?

According to Le Chatlier's Principle, which way does the equilibrium shift if I increase the pressure? What about increasing the temperature?

What are three things that I can do to increase a reaction rate? Why do they increase the reaction rate? How do catalysts affect reaction rates?

What does a catalyst do? What does an inhibitor do?

Consider the following reaction,

$2NO_{2(g)} \leftrightarrow 2NO_{(g)} + O_{2(g)} + heat$

Which way does the equilibrium shift if I increase the pressure? Increase the temperature? Decrease the temperature? Add more reactant? Add more oxygen? Remove NO? Remove the nitrogen dioxide? Decrease the pressure?

What does it mean if a reaction is exothermic? What about endothermic?

How much heat does it take to melt 50 grams of ice? Is heat absorbed or released in this process? Heat of fusion=334 J/g

When 440 J is added to 20 g of an unknown substance, its temperature goes from 40 degrees Celsius to 90 degrees Celsius. What is the specific heat of this unknown substance?

How much heat does it take to melt 15 grams of ice, that are initially at –10 degrees Celsius, into water at 0 degrees Celsius? Specific heat of ice=2.1 J/g C and heat of fusion=334 J/g

When I add 10 grams of iron, initially at 70 degrees Celsius, to 20 grams of water at 25 degrees Celsius. What is the final temperature of the iron and water mixture (Assume they both have the same final temperature)? Specific Heat of water=4.184 J/g C and for iron=.46 J/g C

How much heat does it take to vaporize 10 grams of water at 100 C? Heat of vaporization= 2261 J/g

25 grams of an unknown substance at 70 degrees Celsius is placed in 40 grams of water at 25 degrees Celsius. If the final temperature of the water and unknown is 35 degrees Celsius, what is the specific heat of the unknown substance? Specific heat of water=4.184 J/g C.

Gas Laws and Thermo. Review

Chemistry 2
Mr. Dyson

Review for Test #2

1. What is specific heat?
2. What does it mean if a reaction is exothermic? What about endothermic?
3. How much heat does it take to melt 50 grams of ice? Is heat absorbed or released in this process?
4. When 440 J is added to 20 g of an unknown substance, its temperature goes from 40 degrees Celsius to 90 degrees Celsius. What is the specific heat of this unknown substance?
5. How much heat does it take to melt 15 grams of ice, that are initially at –10 degrees Celsius, into water at 0 degrees Celsius?
6. When I add 10 grams of silver, initially at 70 degrees Celsius, to 20 grams of water at 25 degrees Celsius. What is the final temperature of the system (Assume water and silver come to the same final temperature)?
7. How much heat does it take to vaporize 10 grams of water at 100 C?
8. 25 grams of an unknown substance at 70 degrees Celsius is placed in 40 grams of water at 25 degrees Celsius. If the final temperature of the water and unknown is 35 degrees, what is the specific heat of the unknown substance?
9. Convert the following temperatures to Kelvin:

59 °C 100 °C -55 °C 23 °C 75 °C

10. What is absolute zero? Can there be any temperature lower than that? What occurs at this temperature?
11. What type of phase change occurs when a substance goes from a liquid to a solid? What about when a substance goes from a gas to a liquid?
12. On the ground, a balloon has a pressure of 1.5 atm, a temperature of 20 °C, and a volume of 10 L. It rises 1000 ft where it has a pressure of .5 atm and a temperature of 15 °C. What is the new volume?
13. A piston, at constant temperature, has air inside of it with a pressure of 2 atm and a volume of 1 L. If the volume is decreased to .5 L, what is the new pressure?
14. At rest, a car tire has a pressure of 3 atm and 25 C. While driving, the tire's temperature raises to 100 C. What is the new pressure inside the tire if the volume stays constant?
15. A gas, at constant pressure, has a volume of 4 L at 50 C. If the volume is decreased to 2 L, what is the new temperature?

Review for Intermolecular Forces, Functional Groups, and Biochemistry.

1. Identify the functional groups on the following molecules:

2. Name the following molecules according to IUPAC rules:

3. Complete the following organic chemistry reactions:

4. What is oxidation and reduction? What is the oxidation number on the following elements in these compounds: CaO, $Mg(NO_3)_3$, Cl_2
5. I have CO_2 gas at a pressure of 3 atm, a volume of 5 L and a temperature of 30C, what is the mass of this gas?
6. What type of intermolecular force is found between DNA helices?
7. For the following reaction, determine which element is oxidized, which is reduced, which is the oxidizing agent, and which is the reducing agent:

$Mg + H_2NO_3 \rightarrow Mg(NO_3)_2 + H_2$

8. How many different amino acids are there? Draw the basic structure of an amino acid.
9. What important cell structure contains lipids?
10. How do we know if a lipid is saturated? What makes it unsaturated?
11. What type of carbohydrate makes up starch?
12. What is the difference between a monosaccharide and a polysaccharide?
13. Given this DNA strand's sequence, AATCCGACCGTG, give the sequence of the corresponding strand of DNA.
14. What are enzymes? What type of biological molecule are they?
15. How do we find standard cell voltages? How do we balance redox reactions?
16. What is a polypeptide?
17. What makes up a molecule of DNA?

Final Review
Adv. Chem
Atomic theory and radioactivity

1. Name what family the following elements are in:

   Na Li Mg Cl F Ne
2. For the elements above, give their electron configurations, along with how many valence electrons they would have.
3. Explain one periodic trend.

4. What is the wavelength of a photon of light that has a frequency of $6*10^{13}$ Hz? What is the energy of this photon?
5. What makes an isotope different from a normal element?
6. Which is higher in energy, red or blue light?
7. Complete the nuclear reaction showing Uranium 238 undergoing alpha decay. Name the three types of nuclear decay.
8. Between each pair of atoms, tell me which one has the largest electronegativity.

S and O Li and F Al and Cl N and As

9. Give the atomic number, # of protons, # of neutrons, and # of electrons for the following elements:

U (with a mass number of 238) Cr (with a mass number of 52)
Iodine (with a mass number of 127) Phosphorous (with a mass number of 31)

10. Complete the following nuclear reactions:

Alpha Decay:

U-235 Th-232 Rn-222 Pu-244

Beta Decay

Si-28 P-31 C-14 O-16

Bonding

1. What type of bonding is present in the following compounds?

NaCl CN CH_4 C (diamond) Cu

$MgCl_2$ FeO

2. Make ionic compounds with the following atoms:

Ca and O Na and Se Al and I Ca and N

Mg and OH Al and SO_4 Mg and PO_4

3. What charges do the following atoms have when they become ions?

Mg Cl As N Na Al

4. Draw the Lewis structures for the following compounds :

COF_2 HCN C_2H_5OH CI_4 HCl

H_2O CO_2H_2 AsF_3 CH_2NH COFH

5. For the compounds in #4, tell me whether or not they are polar and what geometry and hybridization they have.

Moles

Do the following conversions: 1-10

1. Convert 2 moles of Zn to atoms of Zn
2. Convert 6.02x10^13 molecules of carbon dioxide to moles of carbon dioxide.
3. Convert 12 grams of NaCl to moles of NaCl
4. 2 moles of $Zn(NO_3)_2$ to grams.
5. 12 L of oxygen gas, at STP, to moles
6. 2.1 moles of fluorine gas to liters at STP
7. 50 grams of $Al_2(SO_4)_3$ to molecules.
8. 5 x 10^12 atoms of Au to grams.
9. 15 grams of KNO_3 to moles.
10. 2 moles of MgO to grams.
11. Find the molar mass of the following species:

MgS NaI Cu $AlPO_4$ $Mg_3(PO_4)_2$

12. Find the empirical formula of a compound that is 20.22 % aluminum and 79.78% chlorine.
13. What is the percent of each element in NaOH?

Reactions

Balance the following equations:

1. $NaOH + HCl = H_2O + NaCl$
2. $NaOH + H_2SO_4 = H_2O + Na_2SO_4$
3. $Ca(OH)_2 + H_3PO_4 = H_2O + Ca_3(PO_4)_2$
4. $C_3H_8 + O_2 = CO_2 + H_2O$
5. $BaCl_2 + AgNO_3 = Ba(NO_3)_2 + AgCl$

Write out the following reactions:

1. $Al + NaCl \rightarrow$
2. $MgSO_4 + AlPO_4 \rightarrow$
3. $C_4H_{10} + O_2 \rightarrow$
4. $Mg + Al(OH)_3 \rightarrow$

Final Review
Chemistry 1-2
Atomic theory and radioactivity

1. Name what family the following elements are in:

Na Li Mg Cl F Ne

2. For the elements above, give their electron configurations, along with how many valence electrons they would have.
3. Explain one periodic trend.
4. Give the isotope notation for Uranium. Its mass number is 235.
5. What makes an isotope different from a normal element?
6. True or False? An atom is mostly made up of empty space.
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8. Between each pair of atoms, tell me which one has the largest electronegativity.

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9. Give the atomic number, # of protons, # of neutrons, and # of electrons for the following elements:

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2. Make ionic compounds with the following atoms:

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3. What charges do the following atoms have when they become ions?

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4. Draw the Lewis structures for the following compounds:

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H_2O CO_2H_2 AsF_3 CH_2NH COFH

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Do the following conversions: 1-10

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3. Convert 12 grams of NaCl to moles of NaCl
4. 2 moles of $Zn(NO_3)_2$ to grams.
5. 12 L of oxygen gas, at STP, to moles
6. 2.1 moles of fluorine gas to liters at STP
7. 50 grams of $Al_2(SO_4)_3$ to molecules.
8. 5 x 10^12 atoms of Au to grams.
9. 15 grams of KNO_3 to moles.
10. 2 moles of MgO to grams.
11. Find the molar mass of the following species:

MgS NaI Cu $AlPO_4$ $Mg_3(PO_4)_2$

Reactions

Balance the following equations:

1. $NaOH + HCl = H_2O + NaCl$

2. $NaOH + H_2SO_4 = H_2O + Na_2SO_4$

3. $Ca(OH)_2 + H_3PO_4 = H_2O + Ca_3(PO_4)_2$

4. $C_3H_8 + O_2 = CO_2 + H_2O$

5. $BaCl_2 + AgNO_3 = Ba(NO_3)_2 + AgCl$

6. $Al + NaCl \rightarrow Na + AlCl_3$

7. $MgSO_4 + AlPO_4 \rightarrow Mg_3(PO_4)_2 + Al_2(SO_4)_3$

8. $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$

9. What is conservation of mass? What are the 5 types of reactions?
10. Write out the following reactions:

$Al + NaCl \rightarrow$

$MgSO_4 + AlPO_4 \rightarrow$

Review for Test 1 Semester 2

Gas Laws

1. Convert the following temperatures to Kelvin:

59 °C 100 °C -55 °C 23 °C 75 °C

2. What is absolute zero? Can there be any temperature lower than that? What occurs at this temperature?

3. On the ground, a balloon has a pressure of 1 atm, a temperature of 25 °C, and a volume of 15 L. It rises 1000 ft where it has a pressure of .25 atm and a temperature of 10 °C. What is the new volume?

4. A piston, at constant temperature, has air inside of it with a pressure of 6 atm and a volume of 5 L. If the volume is decreased to .5 L, what is the new pressure?

5. What is pressure? What is temperature? What temperature scale do we use for the gas laws?

6. On the ground, a tire has a pressure of 3 atm, a temperature of 30 °C, and a volume of 28.4 L. It goes on the water where it now has a pressure of 6 atm and a temperature of 40 °C. What is the new volume?

Solutions:

1. What can I do to get more solute to dissolve in a solvent?

2. If I increase the pressure above a solution, then I can get more ___ to dissolve.

3. What is a solute? What is a solvent? Identify the solute and solvent in this solution: 30 grams of NaCl dissolved in 2 liters of water.

4. How do substances dissolve?

5. I have 30 grams of NaCl dissolved in 2 liters of water. Express this concentration in molarity and grams per liter.

6. I have 44 grams of $AlPO_4$ dissolved in 5 liters of water. Express this concentration in molarity and grams per liter.

7. How many grams of $AlPO_4$ must I dissolve in 8 L of water in order to make a 2 M solution? Which substance is the solute? Which substance is the solvent?

8. If I have 20 mg of KOH dissolved in 3 kg of water, what is the concentration in parts per million? Which substance is the solute? Which substance is the solvent?

9. I have 60 mg of $Zn(NO_3)_2$ in 300 grams (.3 kg) of water. What is the concentration of this substance in parts per million? Which substance is the solute? Which substance is the solvent?

Acids and Bases, reaction rates, equilibrium

1. What is an acid? What is a base?
2. What is the difference between a strong acid and a weak acid? How would you classify a substance that has a pH=7? What about a substance that has a pH=1?
3.

Semester 2 Final Review:

Reaction Rates and Equilibrium

1. When has a reaction reached equilibrium? What principle tells us what happens to an equilibrium system when a stress is placed on it?

According to Le Chatlier's Principle, which way does the equilibrium shift if I increase the pressure? What about increasing the temperature?

2. What are three things that I can do to increase a reaction rate? Why do they increase the reaction rate? How do catalysts affect reaction rates?

What does a catalyst do? What does an inhibitor do?

3. Consider the following reaction,

$2NO_{2(g)} \leftrightarrow 2NO_{(g)} + O_{2(g)} + heat$

Which way does the equilibrium shift if I increase the pressure? Increase the temperature? Decrease the temperature? Add more reactant? Add more oxygen? Remove NO? Remove the nitrogen dioxide? Decrease the pressure?

Solutions:

7. What can I do to get more solute to dissolve in a solvent?

8. If I increase the pressure above a solution, then I can get more ___ to dissolve.

9. What is a solute? What is a solvent? Identify the solute and solvent in this solution: 30 grams of NaCl dissolved in 2 liters of water.

10. How do substances dissolve?

11. I have 30 grams of NaCl dissolved in 2 liters of water. Express this concentration in molarity and grams per liter.

12. I have 44 grams of $AlPO_4$ dissolved in 5 liters of water. Express this concentration in molarity and grams per liter.

13. How many grams of $AlPO_4$ must I dissolve in 8 L of water in order to make a 2 M solution? Which substance is the solute? Which substance is the solvent?

14. If I have 20 mg of KOH dissolved in 3 kg of water, what is the concentration in parts per million? Which substance is the solute? Which substance is the solvent?

15. I have 60 mg of $Zn(NO_3)_2$ in 300 grams (.3 kg) of water. What is the concentration of this substance in parts per million? Which substance is the solute? Which substance is the solvent?

Acids and Bases

16. What is an acid? What is a base?
17. What is the difference between a strong acid and a weak acid? How would you classify a substance that has a pH=7? What about a substance that has a pH=1?

Thermo. Review

11. What does it mean if a reaction is exothermic? What about endothermic?
12. How much heat does it take to melt 50 grams of ice? Is heat absorbed or released in this process? Heat of fusion=334 J/g
13. When 440 J is added to 30 g of an unknown substance, its temperature goes from 40 degrees Celsius to 90 degrees Celsius. What is the specific heat of this unknown substance?
14. How much heat does it take to melt 15 grams of ice, that are initially at –10 degrees Celsius, into water at 0 degrees Celsius? Specific heat of ice=2.1 J/g C and heat of fusion=334 J/g
15. When I add 10 grams of iron, initially at 70 degrees Celsius, to 20 grams of water at 25 degrees Celsius. What is the final temperature of the iron and water? Specific Heat of water=4.184 J/g C and for iron=.46 J/g C
16. How much heat does it take to vaporize 10 grams of water at 100 C? Heat of vaporization= 2261 J/g
17. 25 grams of an unknown substance at 70 degrees Celsius is placed in 40 grams of water at 25 degrees Celsius. If the final temperature of the water is 35 degrees Celsius and the final temperature of the unknown substance is 35 degrees Celsius, what is the specific heat of the unknown substance? Specific heat of water=4.184 J/g C.
18. What type of phase change occurs when a substance goes from a liquid to a solid? What about when a substance goes from a gas to a liquid?

Gas Laws

Convert the following temperatures to Kelvin:

59 °C 100 °C -55 °C 23 °C 75 °C

2. What is absolute zero? Can there be any temperature lower than that? What occurs at this temperature?

3. On the ground, a balloon has a pressure of 1 atm, a temperature of 25 °C, and a volume of 15 L. It rises 1000 ft where it has a pressure of .25 atm and a temperature of 10 °C. What is the new volume?
4. A piston, at constant temperature, has air inside of it with a pressure of 6 atm and a volume of 5 L. If the volume is decreased to .5 L, what is the new pressure?
5. What is pressure? What is temperature? What temperature scale do we use for the gas laws?

6. On the ground, a tire has a pressure of 3 atm, a temperature of 30 °C, and a volume of 28.4 L. It goes on the water where it now has a pressure of 6 atm and a temperature of 40 °C. What is the new volume?

Organic Chemistry and Biochemistry:

1. Study your notes on naming alkanes and alkenes, functional groups, and writing out substitution and addition reactions.
2. How many different amino acids are there? Draw the basic structure of an amino acid.
3. What important cell structure contains lipids?
4. How do we know if a lipid is saturated? What makes it unsaturated?
5. What type of carbohydrate makes up starch?
6. What is the difference between a monosaccharide and a polysaccharide?
7. Given this DNA strand's sequence, AATCCGACCGTG, give the sequence of the corresponding strand of DNA.
8. What are enzymes? What type of biological molecule are they?
9. What is a polypeptide?
10. What makes up a molecule of DNA?

Redox Review

Key Equations: Cell Potential $E^{o}_{cell} = E^{o}_{cathode} - E^{o}_{anode}$

Practice Problems

9. Define *oxidation* and *reduction* in terms of electron transfer and change in oxidation number.

10. Consider the following balanced redox reaction:

$$2\ CrO_2^-(aq) + 2\ H_2O(l) + 6\ ClO^-(aq) \rightarrow 2\ CrO_4^{2-}(aq) + 3\ Cl_2(g) + 4\ OH^-(aq)$$

a) Which species is oxidized?
b) Which species is reduced?
c) Which species is the oxidizing agent?

d) Which species is the reducing agent?
e) From which species to which does electron transfer occur?

11. Assign oxidation numbers to each of the following compounds: a) NH_2OH, N_2H_4, NH_4, HNO_2.

12. Which of the following equations are oxidation – reduction reactions?
a) $N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$

b) $2\ NaClO_3(s) \xrightarrow{\Delta} 2\ NaCl(s) + 3\ O_2(g)$

c) $Ba(s) + 2\ H_2O(l) \rightarrow Ba(OH)_2(aq) + H_2(g)$

13. Assign oxidation numbers to each element in the following equation and identify the oxidizing agent and the reducing agent.

$$4NH_3(g)\ +\ 5O_2(g)\ \rightarrow\ 4NO(g)\ +\ 6H_2O(l)$$

14. A voltaic cell is constructed with an Sn/Sn^{2+} half-cell and a Zn/Zn^{2+} half-cell. The zinc electrode is negative.
a) Write balanced half-reactions and the overall reaction.
b) Draw a diagram of the cell, labeling electrodes with their charges and showing the directions of electron flow in the circuit and of cation and anion flow in the salt bridge.

15. Are the following reactions balanced for atoms and charge?

a) $Fe^{2+}(aq) + MnO_4^-(aq) \rightarrow Mn^{2+}(aq) + Fe^{3+}(aq) + 2\ O_2(g)$

b) $4\ O_2(g) + 4\ NO(g) \rightarrow 4\ NO_3^-(aq)$

16. Write the cell notation for the voltaic cell that incorporates the following redox reaction:

$$Al(s) + Cr^{3+}(aq) \rightarrow Al^{3+}(aq) + Cr(s)$$

Redox Practice Problems – Answers

9. *Oxidation* is the loss of electrons (resulting in a higher oxidation number), while *reduction* is the gain of electrons (resulting in a lower oxidation number). In an oxidation-reduction reaction, electrons transfer from the oxidized substance to the reduced substance. The oxidation number of the reactant being oxidized increases while the oxidation number of the reactant being reduced decreases.

10. a) The **CrO_2^-** is the oxidized species because Cr increases in oxidation state from +3 to +6.

b) The **ClO^-** is the reduced species because Cl decreases in oxidation state from +1 to 0.

c) The oxidizing agent is **ClO^-**; the oxidizing agent is the substance reduced.

d) The reducing agent is **CrO_2^-**; the reducing agent is the substance oxidized.

e) Electrons transfer from **CrO_2^- to ClO^-**.

11. a) NH_2OH: (O.N. for N) + 3(+1 for H) + 1(–2 for O) = 0 O.N. for N = **–1**

b) N_2H_4: 2(O.N. for N) + 4(+1 for H) = 0 O.N. for N = **–2**

c) NH_4^+: (O.N. for N) + 4(+1 for H) = +1 O.N. for N = **–3**

d) HNO_2: (O.N. for N) + 1(+1 for H) + 2(–2 for O) = 0 O.N. for N = **+3**

12. All the reactions are oxidation – reductions.

13. $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(l)$

O.N.: N = –3 O = 0 N = +2 H = +1

H = +1 O = –2 O = –2

N oxidized from –3 to +2 by O_2, and O is reduced from 0 to –2.

Oxidizing agent = O_2 Reducing agent = NH_3

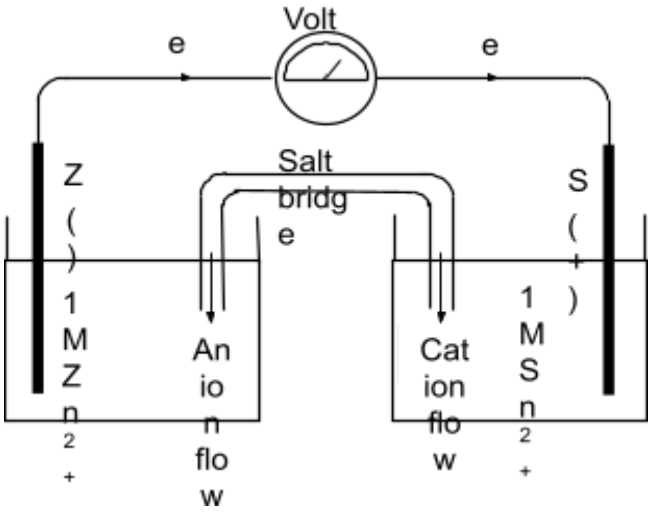
14. a) If the zinc electrode is negative, oxidation takes place at the zinc electrode:

$Zn(s) \rightarrow Zn^{2+}(aq) + 2\ e^-$

Reduction half-reaction: $Sn^{2+}(aq) + 2\ e^- \rightarrow Sn(s)$

Overall reaction: $Zn(s) + Sn^{2+}(aq) \rightarrow Zn^{2+}(aq) + Sn(s)$

b)



15. a) Balanced for atoms but not charge.

    b) Balanced for atoms but not charge.

16. In cell notation, the oxidation components of the anode compartment are written on the left of the salt bridge and the reduction components of the cathode compartment are written to the right of the salt bridge. A double vertical line separates the anode from the cathode and represents the salt bridge. A single vertical line separates species of different phases.

    Anode || Cathode

    a) Al is oxidized, so it is the anode and appears first in the cell notation:

    Al(*s*)|Al^{3+}(*aq*)||Cr^{3+}(*aq*)|Cr(*s*)