Culver City H.S. • Chemistry Honors

Name KEY

Period _____ Date _____

Spring Final Exam Review

ch.13- STATES OF MATTER

Identify the type of bonding that takes place in each of the following compounds.

I = Ionic M = Metallic NC = Non-Polar Covalent PC = Polar Covalent

I 1. KBr
M 2. Cu
NC 3. CO_2
M 4. Pb
NC 5. CH_4
I 6. $CaCl_2$
NC 7. Br_2
I 8. Na_2O
NC 9. SiO_2
M 10. brass (Cu + Zn)
I 11. ZnI_2
M 12. Ag
I 13. NaCl
NC 14. $C_{(graphite)}$
NC 15. C_3H_8

Determine which type of bond is described by each of the statements.

C = Covalent Bond I = Ionic Bond M = Metallic Bond

C 1. held together by e^- shared between atoms.
M 2. conducts electricity as a solid
I 3. alternating positive and negative particles
C 4. sharing electrons between two atoms
M 5. positive ions in a "sea of electrons"
M 6. malleable and ductile
I 7. conducts electricity when dissolved in water
I 8. involves a transfer of electrons
C 9. involved in molecules and in network solids
C 10. does not usually conduct electricity

Exception?: graphite

Which type of intermolecular force would exist between atoms or molecules of the following substances?

(nonpolar molecules/atoms) (polar molecules) (polar w/ H-F, H-O, or H-N)

D=dispersion forces DD=dipole-dipole forces HB=hydrogen bonding

D 1. He
DD 2. HCl
D 3. CO_2
D 4. Ne
D 5. CH_4
HB 6. NH_3
D 7. Br_2
HB 8. H_2O
D 9. SiO_2
HB 10. HF
HB 11. H_2O_2
DD 12. CO
DD 13. NO
DD 14. HBr
D 15. C_3H_8

Which of these changes are associated with an increase in viscosity? = resistance to flow

___1. Increasing heat

___2. Weaker intermolecular forces

✓ 3. Increased surface tension

___4. Less cohesive forces

___5. Temporary dipoles

✓ 6. Hydrogen bonding

✓ 7. Less movement among molecules

✓ 8. Lots of capillary action

___9. A "flatter" droplet

✓ 10. Other increasing density, cooling, stronger IMFs, "rounder" droplet

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ch.14- GAS LAWS

Standard Temperature is: 0 °C or 273 K

Convert:

26.0 °C = 299 K

100 K = -173 °C

-127 °C = 146 K

400 K = 127 °C

135 °C = 408 K

4 K = -269 °C

What is the temperature of a sample of gas that has **double** the kinetic energy (motion energy) of a sample of gas at 80°C?

80°C + 273 = 353K

× 2

706 K ← (double the Kelvin temperature)

In Kinetic Molecular Theory, the temperature is the: measure of the motion of the particles (a.k.a. energy of the particles)

Standard Pressure is: 1 atm = 760 mmHg = 760 torr = 14.7 psi = 101.3 kPa

Convert the following: (Show your work)

550 mmHg = ? kPa

$550\ mmHg \times \frac{101.3\ kPa}{760\ mmHg} = 73\ kPa$

55 psi = ? mmHg

$55\ psi \times \frac{760\ mmHg}{14.7\ psi} = 2800\ mmHg$

325 kPa = ? atm

$325\ kPa \times \frac{1\ atm}{101.3\ kPa} = 3.21\ atm$

2284 torr = ? kPa

$2284\ torr \times \frac{101.3\ kPa}{760\ torr} = 304.4\ kPa$

48.0 mmHg = ? torr

$48.0\ mmHg \times \frac{760\ torr}{760\ mmHg} = 48.0\ torr$

1.85 atm = ? mmHg

$1.85\ atm \times \frac{760\ mmHg}{1\ atm} = 1406 = 1410\ mmHg$

In Kinetic Molecular Theory, the pressure describes: the amount of collisions between a gas and its container.

Explain the following observations in terms of the "kinetic molecular theory" (that is, what do the gas particles look like?)

A balloon of gas is placed in a car on a hot day. The balloon gets larger. Explain.

The particles are moving faster *and collide with the walls of the balloon* more often *and* with more force.
The gas particles inside the balloon push more *than the air particles outside of the balloon.*

A syringe is squeezed so the gas sample changes from 10 cc to 5 cc. The pressure doubles.

When the gas is squeezed, the distance particles must travel between collisions with the container wall is less *so the number of collisions* increase.

***Label** the **variables** in each problem and decide **which law** applies (Boyle, Charles, Combined, Ideal, etc.). Solve the problem.*

1. A balloon has a volume of 5.00 L at 2.50 atm. What is the balloon's volume at 1.50 atm? (V_1 P_1 V_2 P_2)

$P_1V_1 = P_2V_2$ Boyle's Law

$V_2 = \frac{P_1V_1}{P_2} = \frac{(2.50\ atm)(5.00\ L)}{1.50\ atm} = 8.33\ L$

2. A balloon has a volume of 3.50 L at 21.0°C when the air pressure is 1.05 atm. How many moles of gas are contained in the balloon? (V T +273 P)

$PV = nRT$ Ideal Gas Law

$n = \frac{PV}{RT} = \frac{(1.05\ atm)(3.50\ L)}{(0.0821\ \frac{L \cdot atm}{K \cdot mol})(294\ K)} = 0.152\ mol$

3. A balloon at 35°C has a volume of 2.5 L. What is its volume at 45°C? (T_1 +273 V_1 T_2 +273)

Charles's Law $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$V_2 = \frac{V_1T_2}{T_1} = \frac{(2.5\ L)(318\ K)}{(308\ K)} = 2.58\ L$

4. A balloon has a volume of 1.0 L at 21.0°C and 750 mmHg. What is the balloon's volume at STP? (V_1 T_1 +273 P_1 V_2 T_2 P_2)

Combined Gas Law $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$V_2 = \frac{P_1V_1T_2}{P_2T_1} = \frac{(750\ mmHg)(1.0\ L)(273\ K)}{(760\ mmHg)(294\ K)} = 0.916\ L$

5. A 10.0 gram chunk of dry ice (solid CO_2) changes to gas. What is the volume of that gas measured at 27°C and 740 mmHg? What is the density of the gas?

+273 $740\ mmHg \times \frac{1\ atm}{760\ mmHg} = 0.974\ atm$

$10.0\ g\ CO_2 \times \frac{1\ mol\ CO_2}{44.01\ g} = 0.227\ mol\ CO_2$

Ideal Gas Law $PV = nRT$ $V = \frac{nRT}{P} = \frac{(0.227\ mol)(.0821\ \frac{L \cdot atm}{K \cdot mol})(300\ K)}{0.974\ atm} = 5.74\ L$

$D = \frac{M}{V} = \frac{10.0\ g}{5.74\ L} = 1.74\ \frac{g}{L}$

6. Calculate the moles of a gas sample if 3.0 grams of the gas in a 2.0 L container at 25°C has a pressure of 2.294 atm. What is the molar mass of the gas? (+273)

Ideal Gas Law $PV = nRT$

$n = \frac{PV}{RT} = \frac{(2.294\ atm)(2.0\ L)}{(0.0821\ \frac{L \cdot atm}{K \cdot mol})(298\ K)} = 0.19\ mol$

$\text{Molar mass} = \frac{\text{mass}}{\text{mole}} = \frac{3.0\ g}{.19\ mol} = 16\ \frac{g}{mol}$

7. What is the partial pressure of water vapor in an air sample when the total pressure is 1.00 atm, the partial pressure of nitrogen is 0.79 atm, the partial pressure of oxygen is 0.20 atm, and the partial pressure of all other gases in air is 0.0044 atm?

$1.00\ atm = P_{H_2O} + .79\ atm + .20\ atm + .0044\ atm$

$P_{H_2O} = 0.0056\ atm$

8. What is the total gas pressure in a sealed flask that contains oxygen at a partial pressure of 0.41 atm and water vapor at a partial pressure of 0.58 atm?

$P_{total} = 0.41\ atm + 0.58\ atm$

$= \boxed{0.99\ atm}$

9. Find the partial pressure of oxygen in a sealed vessel that has a total pressure of 2.6 atm and also contains carbon dioxide at 1.3 atm and helium at 0.22 atm.

$2.6\ atm = P_{O_2} + 1.3\ atm + 0.22\ atm$

$P_{O_2} = \boxed{1.08\ atm}$

10. What is the molar mass of gas that takes three times longer to effuse than helium?

$\frac{rate\ He}{rate\ unk} = \frac{3}{1} = \sqrt{\frac{x}{4\ g/mol}}$ → square both sides → $\frac{9}{1} = \frac{x}{4}$ → $x = \boxed{36\ g/mol}$

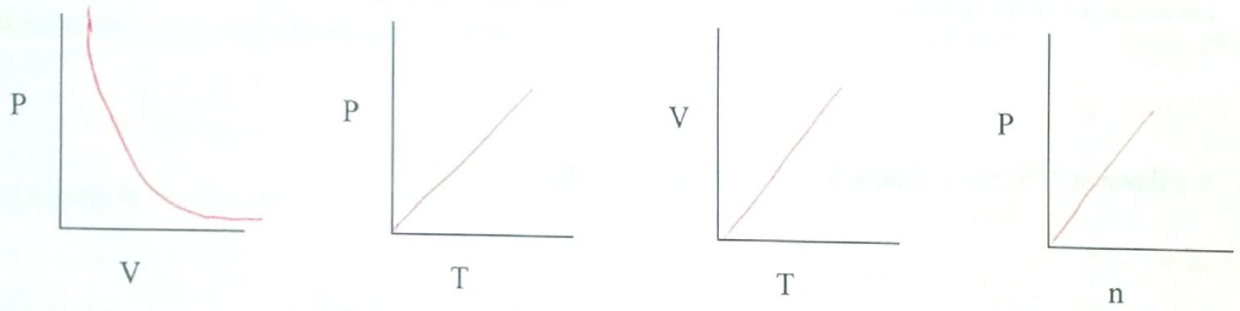
11. What is the ratio of effusion rates of krypton and neon at the same temperature and pressure?

$\frac{rate\ Kr}{rate\ Ne} = \sqrt{\frac{20.18\ g/mol}{83.80\ g/mol}} = \boxed{0.4907}$

12. Calculate the molar mass of a gas that diffuses three times faster than oxygen under similar conditions.

$\frac{rate\ unk}{rate\ O_2} = \frac{3}{1} = \sqrt{\frac{32.00\ g/mol}{x}}$ → square both sides → $\frac{9}{1} = \frac{32}{x}$ → $9x = 32$, $x = \boxed{3.556\ g/mol}$

Sketch the graph of the following pairs of variables:



Circle the "Law" that would relate each pair of variables:

$P \cdot V = \text{constant}$ $\frac{P}{V} = \text{constant}$	$P \cdot T = \text{constant}$ $\frac{P}{T} = \text{constant}$	$V \cdot T = \text{constant}$ $\frac{V}{T} = \text{constant}$	$P \cdot n = \text{constant}$ $\frac{P}{n} = \text{constant}$
Inverse	Direct	Direct	Direct

ch.15- SOLUTIONS

If a solution of KNO_3 with 90 grams of KNO_3 in 100 grams of water is cooled from 60°C to 40°C what happens? (See solubility curve.) The solubility goes from unsaturated to supersaturated ∴ the solution will form some precipitate.

What is the solubility of the following: (See solubility curve.)

a. NaCl at 85°C — $\frac{40g\ NaCl}{100g\ H_2O}$

b. $KClO_3$ at 30°C — $\frac{10\ g\ KClO_3}{100g\ H_2O}$

c. NH_3 at 40°C — $\frac{34\ g\ NH_3}{100g\ H_2O}$

d. KCl at 50°C — $\frac{40g\ KCl}{100g\ H_2O}$

What is a saturated solution? an unsaturated solution? a supersaturated solution?

maximum amt. of solute is dissolved in solution. = more solute can dissolve in the solution = more than the maximum amt. of solute is dissolved in the solution.

How many grams of KCl are needed to prepare 250 mL of a 0.158 *M* solution?

$M = \frac{n}{V}$ $n = MV$ $= (.158\ \frac{mol}{L})(.25L) = .0395 mol$

$.0395 mol\ KCl \times \frac{74.55 g\ KCl}{1 mol\ KCl} = 2.94 g\ KCl$

What is the molarity of a solution that contains 5.68 grams of NaOH in 400 mL of water?

$5.68 g\ NaOH \times \frac{1 mol\ NaOH}{40 g\ NaOH} = .142 mol$ $M = \frac{n}{V} = \frac{.142 mol}{.4L} = .355\ M$

Calculate the molarity of a solution that contains 200.0 grams of hydrochloric acid in 810 mL of water.

$200.0 g\ HCl \times \frac{1 mol\ HCl}{36.46 g\ HCl} = 5.485 mol$ $M = \frac{n}{V} = \frac{5.485 mol}{.81 L} = 6.77\ M$

If 20.0 grams of sodium chloride are dissolved in 100.0 grams of water, what is the mole fraction of the water?

$20.0 g\ NaCl \times \frac{1 mol\ NaCl}{58.44 g\ NaCl} = 0.342 mol\ NaCl$

$100.0 g\ H_2O \times \frac{1 mol\ H_2O}{18.02 g\ H_2O} = 5.549 mol\ H_2O$

$X_{H_2O} = \frac{5.549}{5.549 + .342} = .942$

ch.10- CHEMICAL REACTIONS

For each of the following equations, classify the reaction, then balance the equation.
C—combustion DR—double replacement SR—single replacement S—synthesis D—decomposition

DR … ZnS (aq) + 2 HCl (aq) → …$ZnCl_2$ (aq) + …H_2S (g)

SR 2 HCl (aq) + … Zn (s) → … $ZnCl_2$ (aq) + … H_2 (g)

S, C 2 H_2 (g) + … O_2 (g) → 2 H_2O (ℓ)

DR 3 $Ca(OH)_2$ (aq) + 2 H_3PO_4 (aq) → …$Ca_3(PO_4)_2$ (s) + 6 H_2O (ℓ)

SR 8 Al (s) + 3 Fe_3O_4 (s) → 4 Al_2O_3 (s) + 9 Fe (s)

C … C_5H_{12} (ℓ) + 8 O_2 (g) → 5 CO_2 (g) + 6 H_2O (ℓ)

D 2 H_2O_2 (aq) → 2 H_2O (ℓ) + … O_2 (g)

S … CaO (s) + … CO_2 (g) → … $CaCO_3$ (s)

Write the balanced equation for the reaction between phosphoric acid and magnesium hydroxide.

$2\ H_3PO_{4\,(aq)} + 3\ Mg(OH)_{2\,(aq)} \rightarrow 6\ H_2O_{(\ell)} + \_\ Mg_3(PO_4)_{2\,(aq)}$

Write the balanced chemical equation for the reaction of butane and oxygen gas.

$2\ C_4H_{10\,(\ell)} + 13\ O_{2\,(g)} \rightarrow 8\ CO_{2\,(g)} + 10\ H_2O_{(g)}$

Write the balanced equation for the reaction between nickel metal and a solution of cupric chloride.

$\_\ Ni_{(s)} + \_\ CuCl_{2\,(aq)} \rightarrow \_\ Cu_{(s)} + \_\ NiCl_{2\,(aq)}$

Write the balanced equation for the reaction between calcium metal and a solution of hydrochloric acid.

$\_\ Ca_{(s)} + 2\ HCl_{(aq)} \rightarrow \_\ CaCl_{2\,(aq)} + \_\ H_{2\,(g)}$

ch.12- STOICHIOMETRY

Consider the following balanced equation: $C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(g)$

Molar Masses:	44.09	32.00	44.01	18.02 g/mol

a. What mass of CO_2 is formed when 100. grams of C_3H_8 react?

$$100.\ g\ C_3H_8 \times \frac{1\ mol\ C_3H_8}{44.09\ g\ C_3H_8} \times \frac{3\ mol\ CO_2}{1\ mol\ C_3H_8} \times \frac{44.01\ g\ CO_2}{1\ mol\ CO_2} = \boxed{299\ g\ CO_2}$$

b. What volume (at STP) of $O_2(g)$ is needed to completely react with 7.55 grams of C_3H_8?

$$7.55\ g\ C_3H_8 \times \frac{1\ mol\ C_3H_8}{44.09\ g\ C_3H_8} \times \frac{5\ mol\ O_2}{1\ mol\ C_3H_8} \times \frac{22.4\ l\ O_2}{1\ mol\ O_2} = \boxed{19.2\ l\ O_2}$$

c. How many molecules of H_20 are formed when 19.0 g O_2 are used?

$$19.0\ g\ O_2 \times \frac{1\ mol\ O_2}{32.00\ g\ O_2} \times \frac{4\ mol\ H_2O}{5\ mol\ O_2} \times \frac{6.02 \times 10^{23}\ molecule\ H_2O}{1\ mol\ H_2O} = \boxed{2.86 \times 10^{23}\ molec.\ H_2O}$$

43.0 grams of aluminum reacts with 21.0 grams of copper (II) chloride to produce copper metal and aluminum chloride.

a. Write the balanced equation for the reaction.

$$\underline{2}\ Al_{(s)} + \underline{3}\ CuCl_{2\,(aq)} \rightarrow \underline{3}\ Cu_{(s)} + \underline{2}\ AlCl_{3\,(aq)}$$

b. What is the theoretical yield of aluminum chloride?

$$43.0\ g\ Al \times \frac{1\ mol\ Al}{26.98\ g\ Al} \times \frac{2\ mol\ AlCl_3}{2\ mol\ Al} \times \frac{133.33\ g\ AlCl_3}{1\ mol\ AlCl_3} = 212\ g\ AlCl_3$$

$$21.0\ g\ CuCl_2 \times \frac{1\ mol\ CuCl_2}{134.45\ g\ CuCl_2} \times \frac{2\ mol\ AlCl_3}{3\ mol\ CuCl_2} \times \frac{133.33\ g\ AlCl_3}{1\ mol\ AlCl_3} = \boxed{13.9\ g\ AlCl_3}$$

c. Which reactant is limiting? $\boxed{CuCl_2}$

d. How much excess react remains after the reaction is complete?

$$21.0\ g\ CuCl_2 \times \frac{1\ mol\ CuCl_2}{134.45\ g\ CuCl_2} \times \frac{2\ mol\ Al}{3\ mol\ CuCl_2} \times \frac{26.98\ g\ Al}{1\ mol\ Al} = 2.81\ g\ Al\ needed\ to\ react$$

$$43.0\ g - 2.81\ g = \boxed{40.19\ g\ Al\ in\ excess}$$

Write the balanced equation given the following reactants. Indicate the state of each substance. Circle any precipitates that form.

a. Solutions of aluminum nitrate and lithium oxide are combined.

$$\underline{2}\ Al(NO_3)_{3(aq)} + \underline{3}\ Li_2O_{(aq)} \rightarrow \underline{\quad}\ Al_2O_{3\,(s)} + \underline{6}\ LiNO_{3\,(aq)}$$

b. Solutions of calcium hydroxide and sulfuric acid are mixed.

$$\underline{\quad}\ Ca(OH)_{2\,(aq)} + \underline{\quad}\ H_2SO_{4\,(aq)} \rightarrow \underline{2}\ H_2O_{(l)} + \underline{\quad}\ CaSO_{4\,(s)}$$

c. Solutions of lead nitrate and hydrochloric acid are combined.

$$\underline{\quad}\ Pb(NO_3)_{2\,(aq)} + \underline{2}\ HCl_{(aq)} \rightarrow \underline{2}\ HNO_{3\,(aq)} + \underline{\quad}\ PbCl_{2\,(s)}$$

d. Solutions of magnesium acetate and water are combined.

$$\underline{\quad}\ Mg(C_2H_3O_2)_{2\,(aq)} + \underline{2}\ H_2O_{(l)} \rightarrow \underline{\quad}\ Mg(OH)_{2\,(s)} + \underline{2}\ HC_2H_3O_{2\,(aq)}$$

Determine whether each process is an Endothermic (ENDO) or Exothermic (EXO) process.

EXO The baggie gets hotter when $CaCl_2$ (s) is dissolved. (reaction produced HEAT)

EXO A hot *aluminum slab* cools down in a beaker of water.

EXO Ethanol undergoes combustion. (rxn produces HEAT)

EXO Ethanol vapor condenses to liquid.

ENDO The baggie gets colder when NH_4Cl (s) is dissolved. (rxn took in HEAT)

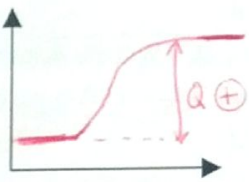
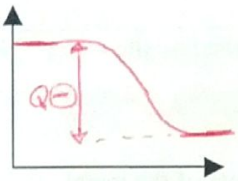
ENDO A *beaker of water* is warmed when a hot aluminum slab is placed in it.

EXO Water freezes into ice when placed in a freezer.

EXO The size of a *balloon* shrinks when placed over ice.

ENDO *Ethanol liquid* vaporizes when heated by a person's hands.

ENDO A block of ice melts in the sun.

Water is vaporized to steam.	**Vapor is condensed to liquid water.**
This process is [endothermic | exothermic] because energy is [absorbed by | released from] the system & molecular attractions are [strengthened | weakened]. The value of Q is [negative | positive].	This process is [endothermic | exothermic] because energy is [absorbed by | released from] the system & molecular attractions are [strengthened | weakened]. The value of Q is [negative | positive].
Chemical equation: $H_2O_{(l)} + heat \rightarrow H_2O_{(g)}$	Chemical equation: $H_2O_{(g)} \rightarrow H_2O_{(l)} + heat$
Potential Energy Graph:  Q = final − initial = ⊕ pos.	Potential Energy Graph:  Q = final − initial = ⊖ neg.

lower resistance higher resistance

Silver and sodium have specific heats 0.233 J/g·°C and 1.20 J/g·°C, respectively.

(a) 40 gram blocks of each metal at 20°C are placed in a hot stove for the same amount of time. Which metal will have a higher temperature when they are taken out? Justify your choice.

Silver ($C_p = 0.233$ J/g°C) — less resistance to change in temp.

(b) Samples of each block are heated by adding 3000 J of energy. The temperatures of both blocks increase by 120°C. Which metal has a larger mass? Justify your choice.

Silver — less resistance = more silver changes temp.

(c) 20 gram samples of each metal at 15°C are heated until they reach 50°C. Which metal required more energy? Justify your choice.

Sodium — larger C_p = greater resistance to change so more energy needed.

Warm samples of liquids X and Y each has a mass of 80 g and are at 25°C. When the samples are cooled so that 200 calories of heat are released, liquid X has a final temperature of 15°C, and liquid Y has a final temperature of 5°C. Which has a greater specific heat? Justify your choice.

Liquid X — only dropped in temp. to 15°C, so it had a greater resistance to change in temp ∴ greater Cp.

How much heat is required to increase the temperature of a 25.0 g sample of steam from 150°C to 180°C? (C_p = 0.497 cal/g·°C)

m, T_i, T_f

$Q = mC\Delta T = (25.0\,g)(.497\,\frac{cal}{g°C})(30°C) = 372.75\,cal$ $\Delta T = 180° - 150° = 30°C$

What is the initial temperature of an 8.5 gram piece of gold if, after applying 220 J of heat, the temperature rose to 350°C? (C_p = 0.129 J/g·°C)

m, Q, T_f

$Q = mC\Delta T$ $\Delta T = \frac{Q}{mC} = \frac{220\,J}{(8.5g)(.129\,J/g°C)} = 200.6°C$ $\Delta T = T_f - T_i$ $T_i = T_f - \Delta T$ $= 350°C - 200.6°C =$ 149.4°C

What is the specific heat of mercury if 612 cal of heat is required to heat a 262 g sample of mercury from 10°C to 80°C?

Q, m, T_i, T_f

$Q = mC\Delta T$

$C = \frac{Q}{m\Delta T} = \frac{612\,cal}{(262g)(80°C - 10°C)} = 0.0334\,cal/g°C$

What is the mass of a sample of oxygen gas, if 800 J of energy is released when it is cooled from 35°C to 15°C? (C_p = 0.918 J/g·°C)

Q, T_i, T_f

$Q = mC\Delta T$ $m = \frac{Q}{C\Delta T} = \frac{-800\,J}{(.918\,J/g°C)(15°C - 35°C)} = 43.57\,g$

An experiment was carried out to determine the specific heat of a slab of an unknown metal. Record the data.

- A 175-mL sample of water was placed in a Styrofoam cup, and the temperature of 25.5°C was recorded.
- The metal slap was carefully taken out of a beaker of boiling water at 100.0°C and submerged into the water in the Styrofoam cup. The temperature of the water with the metal slab rose to 28.7°C.
- The mass of the dry metal slab was found to be 86.8 g.

Volume of Water	175mL = 175g	Mass of Metal	86.8 g
Initial Temp of Water	25.5°C	Initial Temp of Metal	100.0°C
Final Temp of Water	28.7°C	Final Temp of Metal	28.7°C

Calculate the heat absorbed by the water. The specific heat of water is 4.18 J/g·°C. Water's density is 1.00 g/mL.

$Q_{H_2O} = m_{H_2O} C_{H_2O} \Delta T_{H_2O} = (175g)(4.18\,\frac{J}{g°C})(28.7°C - 25.5°C) = 2340.8\,J$

Calculate the specific heat of the metal.

$Q_{metal} = -(Q_{H_2O})$ $= -2340.8\,J$ $Q_{metal} = m_{metal} C_{metal} \Delta T_{metal}$ $-2340.8\,J = (86.8g)(C_p)(28.7°C - 100.0°C)$ $C_p = 0.378\,J/g°C$

Determine the identity of the unknown metal and calculate % error of the experiment.

Zinc metal

$\%\,error = \frac{|0.387 - 0.378|}{0.387} \times 100 = 2.326\%$

Metal	C_p (J/g·°C)
Al	0.897
Fe	0.450
Mg	1.02
(Zn)	(0.387)

Given the reaction: $2SO_{2\,(g)} + O_{2\,(g)} \rightarrow 2SO_{3\,(g)} + 197.8kJ$.

a. Is the reaction endothermic or (exothermic)? energy is released as a product.
b. Calculate how much heat is produced if 6.29 grams of SO_2 reacts.

$6.29\,g\,SO_2 \times \frac{1\,mol\,SO_2}{64.07\,g\,SO_2} \times \frac{197.8\,kJ}{2\,mol\,SO_2} = 9.71\,kJ$

For water, ΔH_{fus} = 333 J/g and ΔH_{vap} = 2260 J/g. Does it require more energy to melt 50.0g of ice or vaporize 50.0 g of water? Explain why using the concept of intermolecular forces.

It requires much more energy to vaporize 50.0 g water.

$\Delta H_{vap} >> \Delta H_{fus}$ because more IMF's must be overcome when L → G than when S → L.

80.0 gram pieces of solid gold and silver were placed in separate hot ovens at their respective melting points. When they were taken out, all of the gold had melted, while only half of the silver half melted. Which metal has a higher value for ΔH_{fus}? Justify your choice.

Silver — ΔH_{fus} is larger = greater resistance to change in state

5500 cal of heat was applied to samples of water and ethanol at their respective boiling points. At exactly five minutes, both samples were completely vaporized. Which sample had the greater mass? Justify your choice. (ΔH_{vap} for water = 540 cal/g, ethanol = 200 cal/g)

more changes = less resistance to change ∴ smaller ΔH_{vap}

Ethanol had greater mass.

What is the value of Q when 31.6 grams of water freezes at 0°C? (ΔH_{fus} = 333 J/g)

$Q = m \Delta H_{fus}$

$= (31.6\,g)(333\,J/g) = 10522.8\,J$ released (or $-10522.8\,J$)

How many grams of CO_2 can be vaporized when 500 cal is applied at its boiling point, -57°C? (ΔH_{vap} = 83.2 cal/g)

$Q = m \Delta H_{vap}$

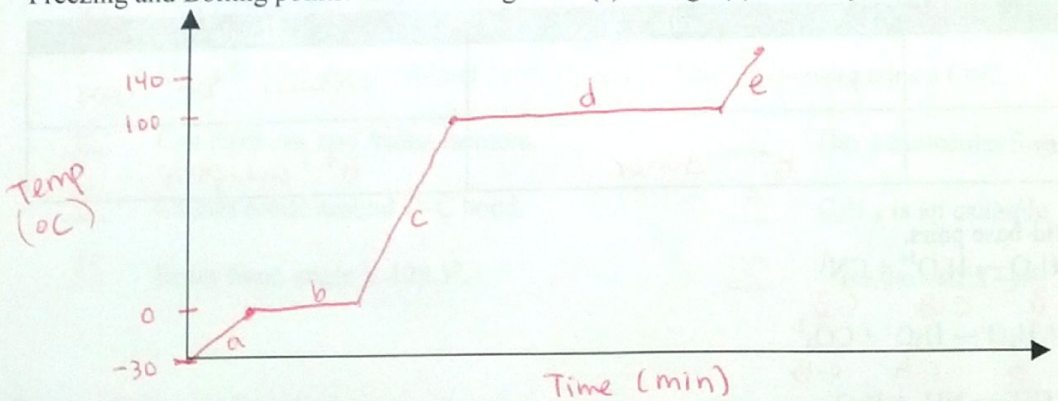
$m = \frac{Q}{\Delta H_{vap}} = \frac{500\,cal}{83.2\,cal/g} = 6.01\,g$

What is the value of ΔH_{vap} of ammonia in J/mol if 18,500 J of heat is required to vaporize a 13.5 g sample?

$Q = m \Delta H_{vap}$

$\Delta H_{vap} = \frac{Q}{m} = \frac{18500\,J}{13.5\,g} = 1370\,J/g$

Sketch the graph when 40.0 g of ice at -30°C is heated to steam at 140°C. Label the axes (with units), and the Freezing and Boiling points. Label the segments (a) through (e). Identify the state(s) of matter of each segment.



In which segments: (circle)

- are molecular attractions weakening? a (b) c (d) e
- are the kinetic energy increasing? (a) b (c) d (e)
- are the processes endothermic? (a b c d e)
- are the processes exothermic? a b c d e NONE
- do you use $Q = m (\Delta T) C_p$ to calculate the heat? (a) b (c) d (e)
- do you use $Q = m \Delta H$ to calculate the heat? a (b) c (d) e

ch.17,18- RATES & EQUILIBRIUM

Write equilibrium expressions for:

a. $MgO_{(s)} \rightleftharpoons 2Mg_{(s)} + O_{2(g)}$ $K_{eq} = [O_2]$

b. $2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$ $K_{eq} = \frac{[N_2][O_2]}{[NO]^2}$

What would occur in each reaction if the concentration of O_2 increased?

a. $MgO_{(s)} \rightleftharpoons 2Mg_{(s)} + O_{2(g)}$ shift left

b. $2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$ shift left

The K_{eq} for the reaction $2NO_{2(g)} \rightleftharpoons N_2O_{4(g)}$ is 4.73. If a container holds 2.10 M of N_2O_4 and $8.87X10^{-2}$M NO_2, determine if the reaction is at equilibrium. If not, in what direction will the reaction proceed in order to reach equilibrium?

$K_{eq} = \frac{[N_2O_4]}{[NO_2]^2} = \frac{2.10}{(8.87\times10^{-2})^2} = 267 \neq 4.73$ The rxn is NOT at equilibrium. It must shift toward reactant side to reach equilibrium

How does an increase in temperature effect a reaction at equilibrium if the forward reaction is endothermic?

$A + B + heat \leftrightharpoons C$

Increasing the temperature would cause the reaction to favor the forward rxn (shift right)

ch.19 ACIDS AND BASES

Identify each description an acidic solutions (A), a basic solution (B) or a neutral solution (N).

B 1. tastes bitter
A 2. turns cabbage juice pink
A 3. neutralizes NaOH
B 4. has a pH > 7.0
A 5. tastes sour
A 6. $[H^+] = 1.0 \times 10^{-4}$ M
B 7. neutralizes HCl
B 8. Ammonia water
B 9. feels slippery
N 10. Has a pOH = 7.0
B 11. turns cabbage juice blue/green
B 12. $[OH^-] = 1.0 \times 10^{-1}$ M
A, B 13. Corrosive
A 14. Has $[H^+] > [OH^-]$

Give theoretical definitions of Acids and Bases.

	Acids	Bases
Arrhenius	produces H^+ ions	produces OH^- ions
Bronsted-Lowry	H^+ donor	H^+ acceptor

Identify the conjugate acid-base pairs.

a. $HCN + H_2O \rightarrow H_3O^{1+} + CN^{1-}$
A B C.A C.B

b. $HCO_3^{1-} + H_2O \rightarrow H_3O^+ + CO_3^{2-}$
A B C.A C.B

c. $NH_4^{1+} + OH^- \rightarrow NH_3 + H_2O$
A B C.B C.A

d. $H_3PO_4 + H_2O \rightarrow H_2PO_4^{1-} + H_3O^{1+}$
A B C.B C.A

Calculate the $[OH^-]$ for a 0.10M $Ca(OH)_2$ solution.

$[OH^-] = 2(0.10\,M) = \boxed{0.20M}$

Write the steps for the complete dissociation of H_3PO_4.

$H_3PO_4 + H_2O \rightleftharpoons H_3O^+ + H_2PO_4^-$

$H_2PO_4^- + H_2O \rightleftharpoons H_3O^+ + HPO_4^{2-}$

$HPO_4^{2-} + H_2O \rightleftharpoons H_3O^+ + PO_4^{3-}$

Write the net equation for the complete dissociation of H_3PO_4.

$H_3PO_4 + 3H_2O \rightleftharpoons 3H_3O^+ + PO_4^{3-}$

Complete the table.

$[H^+]$	$[OH^-]$	pH	pOH	Acidic/Basic/Neutral
1.0×10^{-5} M	1.0×10^{-9} M	5	9	A
1.0×10^{-7} M	1.0×10^{-7} M	7	7	N
1.0×10^{-10} M	1.0×10^{-4} M	10	4	B
1.0×10^{-12} M	1.0×10^{-2} M	12	2	B
1.0×10^{-3} M	1.0×10^{-11} M	3	11	A
1.0×10^{-6} M	1.0×10^{-8} M	6	8	A
1.0×10^{-13} M	1.0×10^{-1} M	13	1	B

ch.22- HYDROCARBONS

Identify the following as characteristics of alkanes (A), alkenes (E), or alkynes (Y).

E Has a molecular formula of C_nH_{2n}.

E Has a H–C–C bond angle of 120°.

E Can have *cis*- and *trans*- isomers.

E Cannot rotate around C–C bond.

A Every bond angle is 109.5°.

E C_4H_8 is an example.

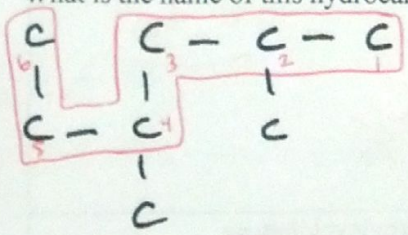
Y Contains a C≡C.

Y Has a molecular formula of C_nH_{2n-2}

A C_7H_{16} is an example.

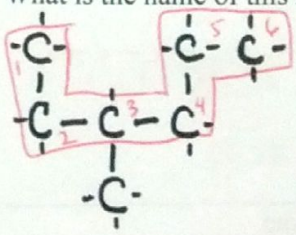
Y Uses the suffix *–yne*.

What is the name of this hydrocarbon?



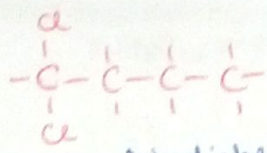
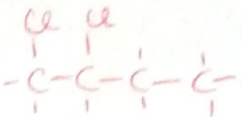
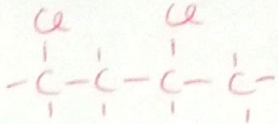
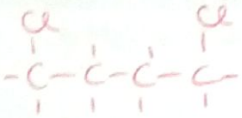
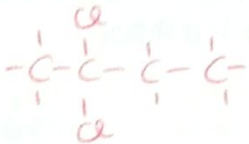
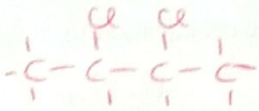
2,4-dimethylhexane

What is the name of this hydrocarbon?

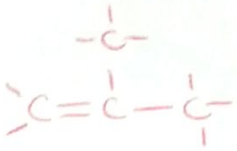
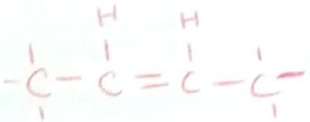
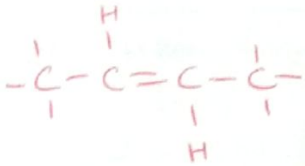


3-methylhexane

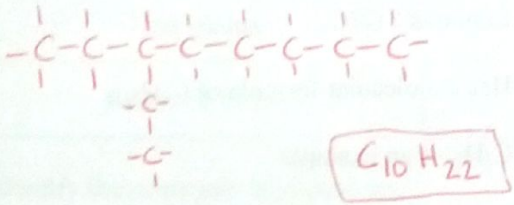
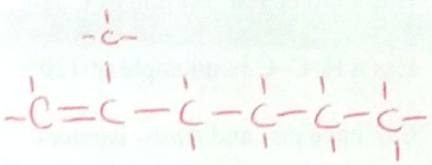
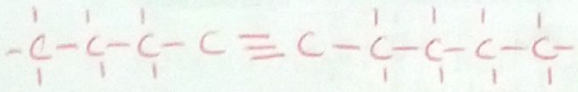
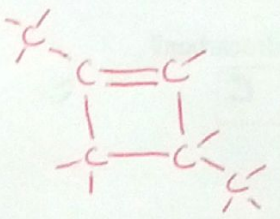
Draw and name the six isomers of **dichlorobutane**, $C_4H_8Cl_2$:

 1,1-dichlorobutane	 1,2-dichlorobutane	 1,3-dichlorobutane
 1,4-dichlorobutane	 2,2-dichlorobutane	 2,3-dichlorobutane

There are four isomers of butene, C_4H_8. Draw the structural formulas given the names:

 1-butene	 2-methylpropene
 cis-2-butene	 trans-2-butene

Draw structural formulas and write the molecular formulas for the following:

 $C_{10}H_{22}$ 3-ethyloctane	 C_7H_{14} 2-methyl-1-hexene
 C_9H_{16} 4-nonyne	 C_6H_{10} 1,3-dimethylcyclobutene