KEY

Name: _____ Per: _____

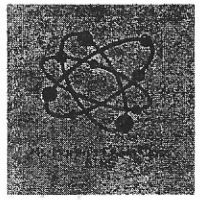
Reference Tables Review- Use your Reference Tables to answer the following review questions.

Table A

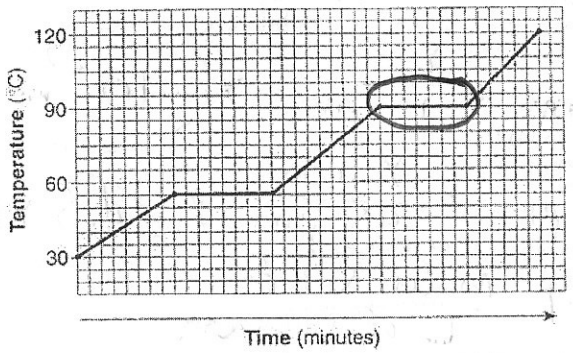
1. What does STP stand for? Standard Temp + Pressure
2. What are the two units of pressure represented in the table?
   KPa and atm
3. What are the two units of temperature represented in the table?
   °C and K
4. Describe the movement of particles in a sample of H_2 ~~gas~~ at -273°C.
   not very fast. Lower Temp = less movement
5. Convert 2 atm to kPa. $\frac{1\ atm}{101.3\ KPa} = \frac{2\ atm}{202.6\ KPa}$
6. Convert 373K to °C.
   373 - 273 = 100°C

Table B

1. Define Heat of Fusion. The amt of energy required to melt (per gram) of a substance
2. Based on the definition of the heat of fusion, make up a theoretical problem.
   How many J of energy are required to melt 50g of ice?



3. Define Heat of Vaporization.
   The amt of energy required to vaporize (per gram) of a substance
4. Label the Heat of Vaporization on the heating curve below.



5. In what type of problem would you use the specific heat capacity of $H_2O_{(l)}$?
   How much energy does it take to heat 50g of water from 30°C to its boiling point?
6. Relate the heat of fusion/vaporization with the strength of interparticle/molecular forces of a sample.
   Stronger interparticle forces = greater heat of fusion/vaporization.

Tables C & D

1. Why are prefixes used? order of magnitude / simplification of measurement(s)
2. How many grams are in 10kg?

$\frac{1\ Kg}{1{,}000\ g} = \frac{10\ Kg}{19{,}000\ g}$

3. How many meters are ~~in 100 nanometers~~?

$\frac{1\ m}{10^9\ nm} = \frac{X\ m}{100\ nm}$ $X = 10^{-7}\ m$

4. Convert 45pm to cm.

$\frac{1\ cm}{10^{10}\ pm} = \frac{X\ cm}{45\ pm}$ $X = 4.5 \times 10^{-9}\ cm$

5. What are the units for molarity?

M $\frac{\text{moles solute}}{\text{L of solution}}$

6. How many particles are in a mole?

6.02×10^{23} = avogadros #

7. A calorimeter is used to measure the amount of heat absorbed/ released in chemical reactions. What units are used?

Joules

Table E

1. What is a polyatomic ion? A group of covalently bonded atoms w/ an overall charge.
2. What type of bonds are present in the compound, Na_2SO_4?

Ionic and Covalent

3. What is the formula and charge of the permanganate ion?

MnO_4^-

4. What is the formula of copper (II) nitrate?

$Cu(NO_3)_2$

Table F

1. Is the compound NH_4Cl soluble in water? Explain.

Yes - all compounds containing NH_4^+ are soluble.

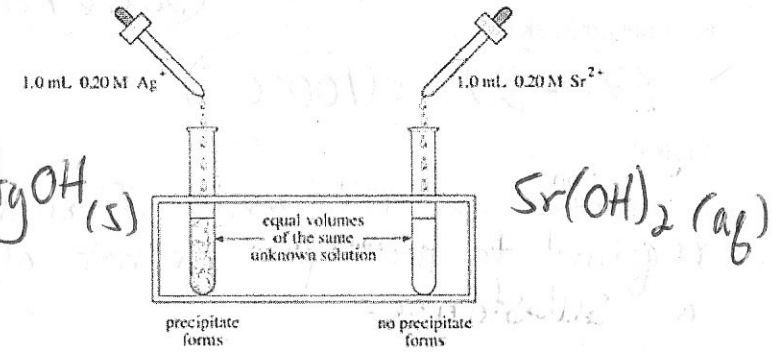
2. Is the compound $CaCO_3$ soluble in water? Explain.

No - CO_3^{2-} is insoluble when combined with a group II metal.

3. What is a precipitate in a chemical reaction?

A solid that is formed.

4. Consider the following experiment:



The unknown solution could contain:

A) .20 M OH^-
B) .20 M NO_3^-
C) .20 M CO_3^{2-}
D) .20 M PO_4^{3-}

5. Complete and balance the following precipitation reaction (include phases of products).

$3\ ZnCl_{2(aq)} + 2\ Na_3PO_{4(aq)} \rightarrow Zn_3(PO_4)_{2(s)} + 6NaCl_{(aq)}$

($Zn_3(PO_4)_2$ ↓ precipitate)

Table G

1. Define solute.

The substance being dissolved.

2. Is water a polar or nonpolar solvent? Draw the lewis structure of water and use it to explain your answer.

Polar. Bent shape - asymmetric charge dist.

H–O–H (δ+ on H, δ− on O) Oxygen is more negative than H.

3. Which compounds show a decrease in solubility as temperature increases? What is the reason for this?

HCl, SO_2, NH_3 - They are gases

4. Which salt is most soluble at 60°C? $NaNO_3$

5. Which compound is least soluble at 100°C? SO_2

6. How many grams of KCl can be dissolved in 500g of H_2O at ~~30°C~~?

$\frac{366}{100g\ H_2O} = \frac{x}{500g\ H_2O}$ $x = \sim 180g$

7. At 30°C, 90g of $NaNO_3$ is dissolved in 200g of H_2O. Is this solution unsaturated, saturated, or supersaturated?

unsaturated

8. What is the solubility of sulfur dioxide at 40°C?

$\frac{5g}{100g\ H_2O}$

9. Compare the rate of solute dissolving to the rate of crystallization in a solution containing 50g of ammonium chloride in 100g of water at 45°C.

They are equal. Saturated solutions are in solution equilibrium.

10. A saturated solution of $KClO_3$ is formed in 100g of water. If the solution is cooled from 90°C to 60°C, how many g of solute will precipitate out?

$52g\ (90°C) - 28g\ (60°C) = \sim 24g$

Table H

1. What is vapor pressure?

pressure caused by the vapor of a substance as it goes from $\ell \rightarrow g$.

2. What is the vapor pressure in kPa and atm of propanone at 75°C?

180 KPa ÷ 101.3 KPa = 1.78 atm

3. What is the normal boiling point of ethanoic acid?

Normal B.P. : Dotted line.
Vapor Pressure = atmospheric pressure

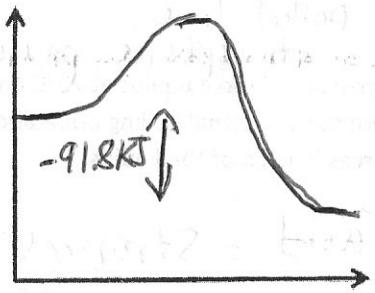
118°C

4. Compare the vapor pressure of the 4 liquids at 70°C and relate the trend in vapor pressure to the normal boiling point and strength of the intermolecular forces in each of the liquids.

ethanoic acid = Strongest IMFs
propanone = Weakest IMFs

Table I ΔH total/net

1. What is heat of reaction? The energy absorbed or released during a chemical reaction / process. PEP - PER
2. What does the sign of the ΔH value tell you about the reaction/process?
   − = exothermic
   + = endothermic
3. Is the dissolving of ammonium nitrate in water endo or exothermic? How can you tell?
   endothermic. ΔH = +25.69KJ
   + = endo
4. Is the formation of water from its elements endothermic or exothermic?
   Very Exothermic. ΔH = -571.6KJ
5. How much heat is released for every **one mole** of octane that is combusted? Show your work.
   2 mole octane : 10943 KJ
   1 mole octane : 5,471.5 KJ
6. Draw the potential energy diagram for the synthesis of ammonia below and label each part of the diagram.



exo 

endo 

Table J

1. Is a more active metal more easily oxidized or reduced?
   Oxidized - metals lose electrons
2. Is a more active nonmetal more easily oxidized or reduced?
   reduced - nonmetals gain electrons
3. Will Sn gain or lose electrons when it reacts with Cu? Explain.
   Lose. Sn is higher on Table J and therefore more likely to be oxidized.
4. $CrCl_2$ will spontaneously react with which of the following?
   a. Cu b. Al c. Ni d. Fe
   Higher on Table J
5. Will the following reaction be spontaneous? (If yes, write out the chemical reaction and state the type of chemical reaction that t) A copper penny is placed in a silver nitrate solution.
   $Cu_{(s)} + AgNO_{3(aq)} \rightarrow CuNO_{3(aq)} + Ag_{(s)}$
   Yes.
6. Will Cl_2 spontaneously react with HF to produce F_2 gas? Explain.
   No, because F_2 is more likely to be reduced, not oxidized.

Table K

1. List two properties of acids.

Sour electrolytes
react with metals to form $H_{2(g)}$

2. What is an Arrhenius acid?

A substance that produces H^+ or H_3O^+ in aqueous solution.

3. What is the formula of carbonic acid? H_2CO_3

4. Complete the dissociation equation of sulfuric acid. $H_2SO_4 \rightarrow 2H^+ + SO_4^{2-}$

$H_2SO_{4(aq)} \rightarrow$

5. Are acids electrolytes or nonelectrolytes? Why? electrolytes
they produce ions in solution that carry an electric current.

6. What is the pH range for acidic solutions?

0 < 7

Table L

1. List two properties of bases. Slippery -
react with acids, electrolytes

2. What is an Arrhenius base?

A substance that produces OH^- (hydroxide) in aqueous solution.

3. How does an Arrhenius base differ from an alternate theory base?

↓ produce OH^- in aq solution

↓ H^+ acceptor.

4. Give the formula of an Arrhenius base. NaOH

5. Give the formula of an alternate theory base. NH_3 ⇒ notice no OH^-

6. What is the pH range for basic solutions?

7 - 14

7. In the process of neutralization, an Arrhenius acid and base react to form a salt and water. Write out and balance a neutralization reaction below using an acid from table k and a base from table l.

$2HNO_3 + Ca(OH)_2 \Rightarrow Ca(NO_3)_2 + 2H_2O$

Acid Base Salt Water

Table M

1. What is an acid base indicator?

A substance that changes color depending on the pH of a solution.

2. Use the pH values given below and table M to answer the following questions.

Liquid	pH
Tap water	6.8
Lemon juice	2.3
Human blood	7.3
Liquid bleach	11

a. What color would tap water be in bromcresol green? Blue

b. What color would phenolphthalein be in bleach? Pink

c. Using one of the indicators from the reference table, state how you could distinguish tap water from lemon juice.

6.8 ↓ ↘ 2.3

You could use methyl orange. Tap H_2O would be yellow and Lemon Juice would be Red.

Table N

1. What is the decay mode of plutonium-239? alpha α
2. What is the half-life of neon-19? 17.22 s
3. Which radioisotope will decay the fastest? Calcium-37
4. Write out the decay equation for Co-60. → β^-

$$^{60}_{27}Co \rightarrow {}^{0}_{-1}e + {}^{60}_{28}Ni$$

5. Write out the decay equation for plutonium-239.

$$^{239}_{94}Pu \rightarrow {}^{4}_{2}He + {}^{235}_{92}U$$

6. According to the big bang theory, the universe started 1.5×10^{10} years ago. How many half-lives has uranium-238 undergone since the big bang?

time passed - 1.5×10^{10} yrs

^{238}U ½ life - 4.47×10^{9} yrs = 3.36 ½ Lives

7. How many half-lives will it take for 50g of Tc-99 to decay to 6.25g?

$50g \xrightarrow{1} 25g \xrightarrow{2} 12.5 \xrightarrow{(3)} 6.25$

8. Iodine-131 is used to destroy thyroid tissue in the treatment of an overactive thyroid. The half-life of iodine-131 is ~8 days. If a hospital receives a shipment of 200g of iodine-131, how much would remain after 32 days?

$200g \xrightarrow{1} 100g \xrightarrow{2} 50g \xrightarrow{3} 25g \xrightarrow{(4)} 12.5g$

$\frac{32 \text{ days}}{8 \text{ days}} = 4$ ½ Lives

9. Why could U-238 pose a serious health risk if a nuclear power plant melts down?

B/C it would take very, very long for the radioactive material to decay.

Table O

1. What is the difference between a beta article and a positron?

$^{0}_{-1}e$ ↓ $^{0}_{+1}e$ ↓ Same mass- opp charge

2. During what type of nuclear reaction will an alpha particle be emitted from an unstable nucleus?

natural transmutation

3. Compare the penetrating power of alpha, beta, and gamma radiation.

↓ least ↓ in-between ↓ most

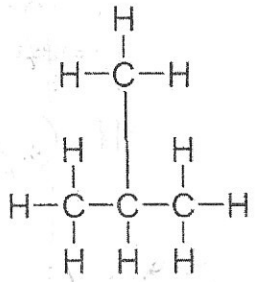
4. Which particles will be deflected towards the negative plate in an electrical field?

alpha, proton, positron

Table P

1. How many carbon atoms does heptane have? 7

2. Base your answers to the following questions on the organic compound represented in the diagram to the right.



   a. What is the prefix of the parent chain?

   prop

   b. What is the prefix of the branch?

   meth

   c. Name the compound.

   2- methyl propane

Table Q

1. What is a hydrocarbon? Molecule containing only carbon and hydrogen

2. Which hydrocarbon series would a compound containing the molecular formula $C_{32}H_{64}$ belong to? How can you tell?

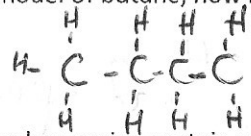
   alkenes C_nH_{2n} general formula

3. Each member of the alkyne series differs from the preceding member by one additional carbon atom and how many hydrogen atoms?

   C_2H_2, C_3H_4, C_4H_6

   2 hydrogens

4. If you built a model of butane, how many sticks (bonds) would you need to use?



   13

5. Which hydrocarbon series contain compounds that are unsaturated?

   alkenes and alkynes

6. Draw the structural formula and name any member of the series with the general formula C_nH_{2n-2} below.

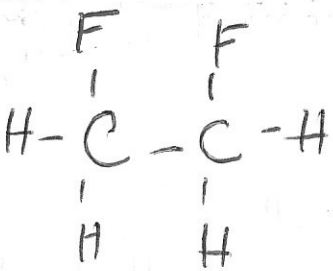
   ethyne

Table R

1. What is a functional group? A group of atoms that gives an organic compound unique chemical + physical properties

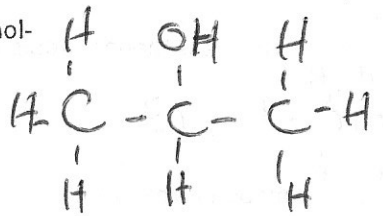
2. Make up one more example for each class of compounds (do not just use the one given on the table). Draw the structure and write the name of the compound.

Halocarbon-



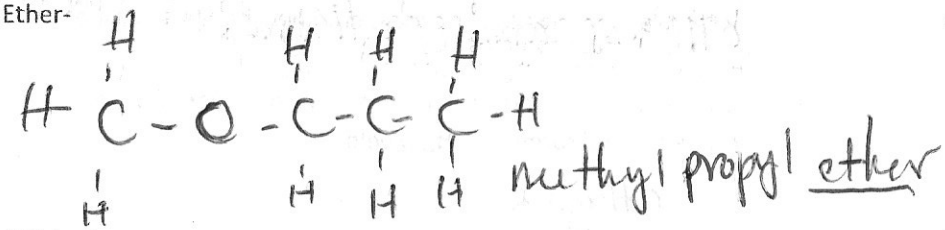
1,2-difluoro ethane

Alcohol-



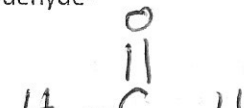
2-propanol

Ether-



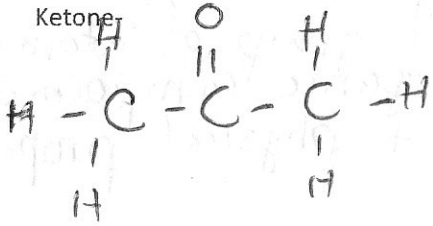
methyl propyl ether

Aldehyde-



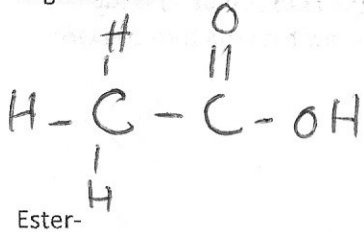
methanal
aka formaldehyde

Ketone-



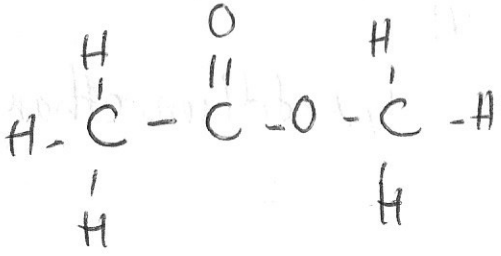
propanone

Organic acid-



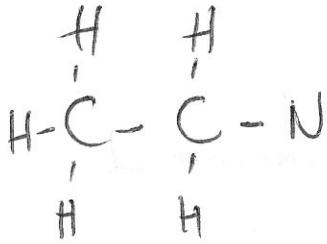
ethanoic acid

Ester-



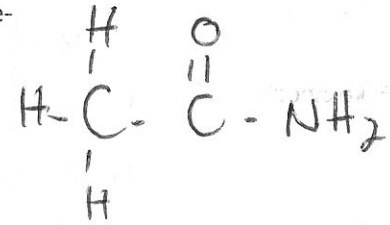
methyl ethanoate

Amine-



ethanamine

Amide-

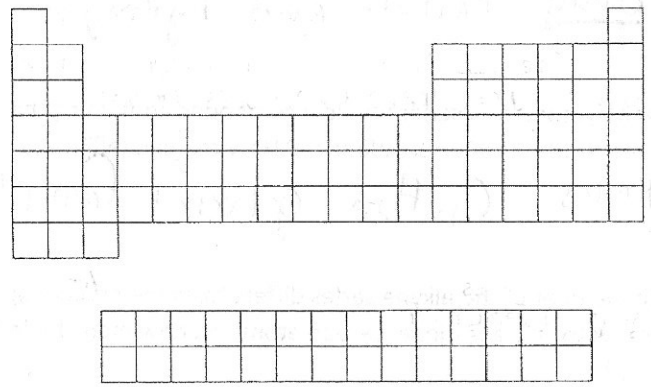


ethanamide

Table S

1. What is the name of the element with the symbol Sn? Tin
2. What is the symbol of gold. Au
3. On the blank periodic table below, draw and label arrows showing the trends in atomic radius, electronegativity, first ionization energy, and metallic character.

Atomic Radius Dec,
EN inc, IE inc, Metallic Character Dec.



4. Which elements are liquids at STP?

non-metal ⇒ Br and Hg ⇒ metal

5. Name two noble gases.

Neon and Argon

6. Why don't the noble gases have electronegativity values?

Because they have full outer shells and do NOT want electrons

7. Name two metalloids. B and As

8. What is the density of $O_{2(g)}$ at 298K and 101.3 kPa? .001308 g/cm³

9. What is the melting point of Zinc in K? 693 K

Table T

1. An object has a mass of 23 kg and a density of 10.0 g/cm³. What is the objects volume to the correct number of sig figs?

23,000 g

$D = \frac{M}{V}$ $V = \frac{M}{D}$ $\frac{23,000 g}{10.0 g/cm^3} = 2,300\ cm^3$

2 Sig Figs

2. A student calculates the density of iron to be 8.956 g/cm³. What is the student's percent error?

$\frac{\text{Measured value} - \text{accepted}}{\text{accepted}} \times 100$

$\frac{8.956\ g/cm^3 - 7.87}{7.87} \times 100 = 13.8\%$ ← Table S

3. How many moles are in 65g of sodium chloride?

moles = $\frac{\text{given mass}}{\text{gfm}}$ $\frac{65 g}{58 g/mole} = 1.12$ moles

4. What is the concentration in parts per million if a 500g solution of copper (II) sulfate contains 5g of copper (II) sulfate?

$\frac{5g}{5g + 500g} \times 10^6 = \frac{5g}{505g} \times 100 = 9,900$ ppm

5. At STP, a sample of hydrogen gas has a volume of 10L. If the temperature is raised to 50°C and the pressure is decreased to .5 atm, what is the new volume of the hydrogen gas?

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\frac{(1 atm)(10L)}{273K} = \frac{(5 atm)(XL)}{323K}$

Must use Kelvin!

X = 2.4L

6. If the temperature of 10g of water increased from 15°C to 45°C, how much heat was absorbed by the water?

$q = mc\Delta T$ $q = (10g)(4.18 \frac{J}{gK})(30)$

q = 1,254 Joules

7. How much heat is released when 50g of $H_2O_{(g)}$ condenses to $H_2O_{(l)}$ at 100°C?

$q = mH_v$

$q = (50g)(2,260 J/g)$

q = -113,000 J

8. How many moles of sodium hydroxide are in .5L of a 3M aqueous solution?

$M = \frac{\text{moles solute}}{\text{L solution}} = \text{moles} = M \times V$

$\text{moles} = (3M)(.5L) = 1.5 \text{ moles}$

9. What is the percent composition by mass of water in the hydrate $MgSO_4 \bullet 2H_2O$?

$\frac{\text{mass of } H_2O}{\text{mass of whole}} \times 100 = \frac{36\,g}{156\,g} \times 100 = 23\%$

10. What is the molarity of a solution containing HNO_3 if 10.0 milliliters of 0.40 M LiOH are required to neutralize 200 milliliters of the HNO_3 solution?

$M_A V_A = M_B V_B$

$(x)(200mL) = (.4M)(10mL)$

$x = .02M$

11. What laboratory technique is used to carry out the neutralization reaction described in question 9?

Titration

12. How many L of .5 M NaOH are required to neutralize 2 L of a 1.5 M solution of H_2SO_4?

$2 M_A V_A = M_B V_B$

$2(1.5M)(2L) = (.5M)(x)$

$x = 12L$

13. 50g of $CuCl_2$ are dissolved in water to make 500mL of an aqueous solution. What is the molarity of the solution?

$\frac{50g\ CuCl_2}{134\ g/mole} = .37 \text{ moles}$ $\frac{.37 \text{ moles}}{.5L} = .74M$

14. To what volume should you dilute 75 mL of a 10.0 M HCl solution to obtain a 1.20 M HCl solution?

$M_1 V_1 = M_2 V_2$

$(10.0M)(75mL) = (1.20M)(X\ mL)$

$X = 625\ mL$