Reference Table Review

Regents Chemistry

Name: _____

Table A
Standard Temperature and Pressure

Name	Value	Unit
Standard Pressure	101.3 kPa 1 atm	kilopascal atmosphere
Standard Temperature	273 K 0°C	kelvin degree Celsius

Table A Questions:

1. Convert 2 atm in kPa. **202.6 kPa**
2. Convert 303.9 kPa in atm. **3 atm**
3. What is the difference between 1 K and 1°C? **273 degrees, Celsius is higher**
4. What is the 0 K temperature called? **Absolute zero, no kinetic energy**
5. Describe the volume and the movement of the particles in a sample of H_2 gas at -273°C. **no volume, no movement (-273°C = 0 K)**
6. What does STP stand for? **Standard temperature and pressure**
7. What are the two units of pressure represented in the table? **kPa & atm**
8. What are the two units of temperature represented in the table? **Kelvin [K] and Celsius**
9. How many pascals are in 10 kPa? **10,000 Pa**

Table B
Physical Constants for Water

Heat of Fusion	334 J/g
Heat of Vaporization	2260 J/g
Specific Heat Capacity of H_2O (ℓ)	4.18 J/g•K

Table B Questions:

1. What is the definition of the Heat of Fusion? **Amount of energy needed to melt 1 g of ice**
2. Based on the definition of the Heat of Fusion make up a problem. **How much energy is needed to melt 30g of ice if its temperature is 0 C?**
3. Convert the units of the Heat of Fusion into cal/g and kcal/g (1 cal = 4.18 J) **80 cal/g, 0.080 kcal/g**
4. Give a synonym for the word fusion. **melting**
5. What is the definition of the Heat of Vaporization? **Amount of energy needed to vaporize 1g of water**
6. Based on the definition of the Heat of Vaporization make up a problem. **How much energy is needed to melt 30 g of ice if its temperature is 100 C?**
7. Convert the units of the Heat of Vaporization into cal/g and kcal/g (1 cal = 4.18 J) **541 cal/g, 0.540 kcal/g**
8. What is the definition for the Specific Heat Capacity of H_2O (l). **The amount of energy needed to raise 1g of water 1 K.**
9. Based on the definition of the Specific Heat Capacity of H_2O (l) make up a problem. **How much energy is needed to raise 30 g of water from 293 K to 358 K?**

10. Convert the units of the Specific Heat Capacity of H_2O (l) into cal/g and kcal/g (1 cal = 4.18 J). **1 cal/g, .001 kcal/g**
11. Relate the heat of fusion with energy and bonding. **The heat of fusion is the amount of energy needed to overcome the intermolecular forces between molecules of the solid**
12. Relate the heat of vaporization with energy and bonding. **The heat of vaporization is the amount of energy needed to overcome the intermolecular forces between molecules of the liquid.**

Table C
Selected Prefixes

Factor	Prefix	Symbol
10^{3}	kilo-	k
10^{-1}	deci-	d
10^{-2}	centi-	c
10^{-3}	milli-	m
10^{-6}	micro-	μ
10^{-9}	nano-	n
10^{-12}	pico-	p

Table C Questions

1. What is a prefix? **Comes before a unit to give it a multiple of 10 higher or lower**
2. How many grams are in 10 kg? **10,000**
3. How many meters are in 100 micrometers? **.0001 m**
4. Convert 45 pm to cm. **(0. 000 000 004 5 cm)**
5. Convert 1 kg to pg. **(1,000,000,000,000,000)**
6. How many decimeters **(10)**, centimeters **(100)**, millimeters **(1000)**, micrometers **(1,000,000)**, nanometers **(1,000,000,000)**, and picometers **(1,000,000,000,000)** are in 1 meter?
7. What is the name of this unit system and what is it based on? **(System International ([also called metric]) powers of 10.**

Table D
Selected Units

Symbol	Name	Quantity
m	meter	length
g	gram	mass
Pa	pascal	pressure
K	kelvin	temperature
mol	mole	amount of substance
J	joule	energy, work, quantity of heat
s	second	time
L	liter	volume
ppm	part per million	concentration
M	molarity	solution concentration

Table D Questions:

1. What are units? **What we use to measure quantities such as length, mass, and volume**
2. What units could be used to calculate the density of a solid? **mass and volume**
3. What are the units for molarity? **Moles per (divided by) liters**
4. What units could be used to measure the velocity of a molecule of gas? **Meters per second**
5. What is the numerical value of a mole? **6.02X 10^23 atoms or molecules**
6. A calorimeter is used to measure the amount of heat released in chemical reactions, what units are used? **Joules (J)**
7. The concentration of pollutants can

be measured in ppm. Write the fraction that ppm represents? **(parts per million, 1 mg / 1 L of solution)**

8. What are the units quantities used in STP? **101.3 kPa, 273 K (1 atm, 0 C)**

Table E
Selected Polyatomic Ions

H_3O^+	hydronium	CrO_4^{2-}	chromate
Hg_2^{2+}	dimercury (I)	$Cr_2O_7^{2-}$	dichromate
NH_4^+	ammonium	MnO_4^-	permanganate
$C_2H_3O_2^-$ / CH_3COO^-	acetate	NO_2^-	nitrite
CN^-	cyanide	NO_3^-	nitrate
CO_3^{2-}	carbonate	O_2^{2-}	peroxide
HCO_3^-	hydrogen carbonate	OH^-	hydroxide
$C_2O_4^{2-}$	oxalate	PO_4^{3-}	phosphate
ClO^-	hypochlorite	SCN^-	thiocyanate
ClO_2^-	chlorite	SO_3^{2-}	sulfite
ClO_3^-	chlorate	SO_4^{2-}	sulfate
ClO_4^-	perchlorate	HSO_4^-	hydrogen sulfate
		$S_2O_3^{2-}$	thiosulfate

Table E Questions:

1. What is a polyatomic ions? **An ion made of more than one atom covalently bonded together**
2. What is the charge of carbonate? **2-**
3. What is the charge of permanganate? **1-**
4. Why does acetate has two different ways of writing it? **It is organic so it has a condensed and a molecular formula**
5. What does the Roman numeral "I" on dimercury (I) stand for? **The roman numeral stands for the +1 charge on each atom of mercury. The two mercury atoms together give a total charge of +2**

Table F
Solubility Guidelines for Aqueous Solutions

Ions That Form *Soluble* Compounds	Exceptions
Group 1 ions (Li^+, Na^+, etc.)	
ammonium (NH_4^+)	
nitrate (NO_3^-)	
acetate ($C_2H_3O_2^-$ or CH_3COO^-)	
hydrogen carbonate (HCO_3^-)	
chlorate (ClO_3^-)	
perchlorate (ClO_4^-)	
halides (Cl^-, Br^-, I^-)	when combined with Ag^+, Pb^{2+}, and Hg_2^{2+}
sulfates (SO_4^{2-})	when combined with Ag^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, and Pb^{2+}

Ions That Form *Insoluble* Compounds	Exceptions
carbonate (CO_3^{2-})	when combined with Group 1 ions or ammonium (NH_4^+)
chromate (CrO_4^{2-})	when combined with Group 1 ions, Ca^{2+}, Mg^{2+}, or ammonium (NH_4^+)
phosphate (PO_4^{3-})	when combined with Group 1 ions or ammonium (NH_4^+)
sulfide (S^{2-})	when combined with Group 1 ions or ammonium (NH_4^+)
hydroxide (OH^-)	when combined with Group 1 ions, Ca^{2+}, Ba^{2+}, Sr^{2+}, or ammonium (NH_4^+)

Table F Questions

Write the products and balance the reaction for the following double replacement reactions including the phase to describe the solubility of the products.

1. $MgSO_4$ (aq) + $BaCl_2$ (aq) --> **$MgCl_{2\ (aq)}$ + $BaSO_{4(s)}$**
2. $Ca(OH)_2$ (aq) + H_2SO_4 (aq) -->**$2H_20\ (l)$+ $CaSO_{4(s)}$**
3. $Al_2(SO_4)_3$ (aq) + $ZnCl_2$ (aq) --> **$AlCl_{3\ (s)}$ + $Zn(SO_4)$ (aq)**
4. $2Ag(NO_{3)}$ (aq) + $MgCl_2$ (aq) --> **$2AgCl_{\ (s)}$ + $Mg(NO_{3)2\ (aq)}$**
5. $AlBr_3$ (aq) + K_2SO_4 (aq) --> **no rxn**
6. $FeCl_3$ (aq) + NaOH (aq) --> **NaCl (aq)+ $Fe(OH)_{3\ (s)}$**
7. $AgNO_3$ (aq) + NaCl (aq) --> **AgCl (s) + $NaNO_{3\ (aq)}$**

Table G Solubility Curves

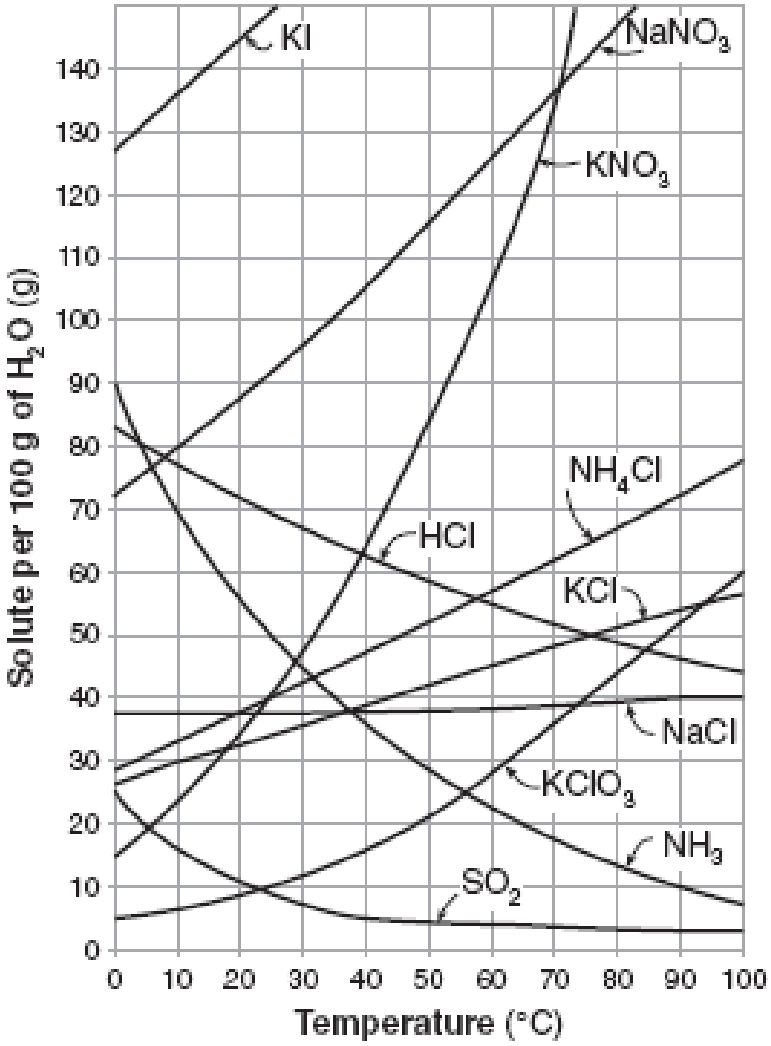


Table G Questions:

1. What compounds show a decrease in solubility from 0 to 50°C? **SO2, NH3, HCl (all the gases)**
2. Which salt is most soluble at 60°C? **probably KI**
3. Which compound is least soluble at 100°C? **SO2**
4. Which salt is least soluble at 70°C? **KClO3**
5. How many grams of KCl can be dissolved in 500 g of H_2O at 30°C? **5 x (35) = 175 g**
6. At 50°C, how much KNO_3 can be dissolved in 200 g of H_2O? **2 x (85g) = 170g**
7. Which salt shows the least change in solubility from 50 to 100°C? **NaCl**
8. At 30°C, 90 g of $NaNO_3$ is dissolved in 200 g of H_2O. Is the solution saturated or unsaturated? **unsaturated**
9. A saturated solution of $KClO_3$ is formed from 50g of water. If the solution is cooled from 90°C to 70°C, how many grams of precipitate are formed? **2g**

Table H
Vapor Pressure of Four Liquids

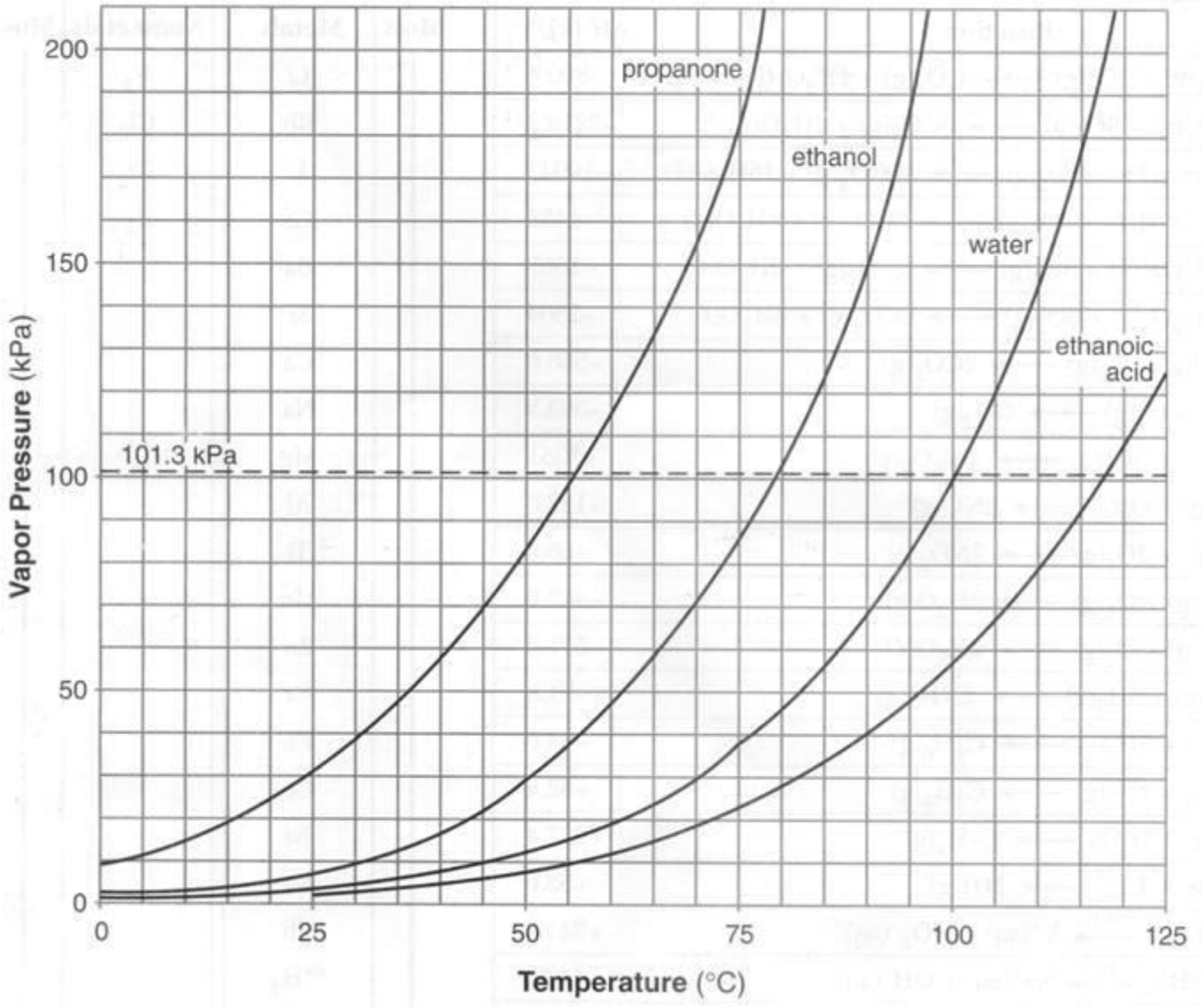


Table H Questions:

1. Define the term vapor pressure. **The pressure exerted by molecules that have evaporated from a liquid in a sealed container. Depends only on temperature of the liquid (not surface area of liquid, or volume of liquid).**
2. What is the vapor pressure in kPa and atm of water at 100°C? **1 atm, 101.3 kPa**
3. What is the vapor pressure in kPa and atm of ethanoic acid at 120°C? **108 kPa, [108/101] x 1 atm = 1.07 atm**
4. What is the vapor pressure in kPa and atm of propan**one** at 75°C? **181 kPa, 181/101 x 1atm = 1.79 atm**
5. Compare the vapor pressure of the four liquids at 70°C**. Greatest=propanone; least=eth. acid**
6. Liquids boil when the vapor pressure is equal to the pressure on the system. For instance, water boils at 100°C at 1atm but when the pressure is 2 atm water boils at 118°C. Consider the four liquids boiling at 70°C, what is the pressure on the system for each liquid?
   If the liquids are boiling at 70 degrees then atm press must be, for each:
   Propanone - atm press = 155 kPa; ethanol – atm press=70 kPa; watet – atm press=30kPa; ethanoic acid – atm press=19 kPa

Table I
Heats of Reaction at 101.3 kPa and 298 K

Reaction	ΔH (kJ)*
$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(\ell)$	–890.4
$C_3H_8(g) + 5O_2(g) \longrightarrow 3CO_2(g) + 4H_2O(\ell)$	–2219.2
$2C_8H_{18}(\ell) + 25O_2(g) \longrightarrow 16CO_2(g) + 18H_2O(\ell)$	–10943
$2CH_3OH(\ell) + 3O_2(g) \longrightarrow 2CO_2(g) + 4H_2O(\ell)$	–1452
$C_2H_5OH(\ell) + 3O_2(g) \longrightarrow 2CO_2(g) + 3H_2O(\ell)$	–1367
$C_6H_{12}O_6(s) + 6O_2(g) \longrightarrow 6CO_2(g) + 6H_2O(\ell)$	–2804
$2CO(g) + O_2(g) \longrightarrow 2CO_2(g)$	–566.0
$C(s) + O_2(g) \longrightarrow CO_2(g)$	–393.5
$4Al(s) + 3O_2(g) \longrightarrow 2Al_2O_3(s)$	–3351
$N_2(g) + O_2(g) \longrightarrow 2NO(g)$	+182.6
$N_2(g) + 2O_2(g) \longrightarrow 2NO_2(g)$	+66.4
$2H_2(g) + O_2(g) \longrightarrow 2H_2O(g)$	–483.6
$2H_2(g) + O_2(g) \longrightarrow 2H_2O(\ell)$	–571.6
$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$	–91.8
$2C(s) + 3H_2(g) \longrightarrow C_2H_6(g)$	–84.0
$2C(s) + 2H_2(g) \longrightarrow C_2H_4(g)$	+52.4
$2C(s) + H_2(g) \longrightarrow C_2H_2(g)$	+227.4
$H_2(g) + I_2(g) \longrightarrow 2HI(g)$	+53.0
$KNO_3(s) \xrightarrow{H_2O} K^+(aq) + NO_3^-(aq)$	+34.89
$NaOH(s) \xrightarrow{H_2O} Na^+(aq) + OH^-(aq)$	–44.51
$NH_4Cl(s) \xrightarrow{H_2O} NH_4^+(aq) + Cl^-(aq)$	+14.78
$NH_4NO_3(s) \xrightarrow{H_2O} NH_4^+(aq) + NO_3^-(aq)$	+25.69
$NaCl(s) \xrightarrow{H_2O} Na^+(aq) + Cl^-(aq)$	+3.88
$LiBr(s) \xrightarrow{H_2O} Li^+(aq) + Br^-(aq)$	–48.83
$H^+(aq) + OH^-(aq) \longrightarrow H_2O(\ell)$	–55.8

*Minus sign indicates an exothermic reaction.

Table I Questions:

1. Draw a potential energy diagram for each reaction. **Yeah right… exo products are lower**
2. What is the formula for Heat of reaction (ΔH)? **ΔH = products energy – reactant energy**
3. What is the sign of ΔH when the Heat of reactants is more than the Heat of the products? **negative**
4. What is a exothermic reaction? **One that has less energy in the products, heat EXITS to the surroundings.**
5. What is the sign of ΔH when the Heat of reactants is less than the Heat of the products? **Could it be … positive**
6. What is an endothermic reaction? **More energy in products than reactants, heat must ENTER from surroundings to happen**
7. What is the pressure and temperature at which ΔH was calculated for the reactions in the table? **See top of the Table I!**

Table J
Activity Series**

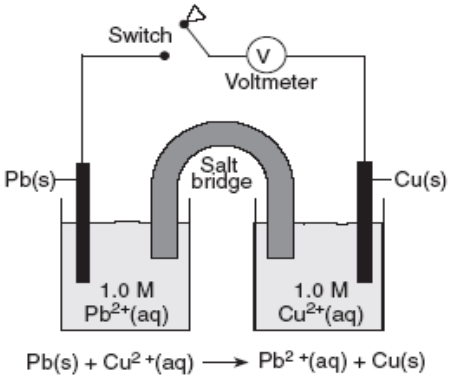
Most	Metals	Nonmetals	Most
	Li	F_2	
	Rb	Cl_2	
	K	Br_2	
	Cs	I_2	
	Ba		
	Sr		
	Ca		
	Na		
	Mg		
	Al		
	Ti		
	Mn		
	Zn		
	Cr		
	Fe		
	Co		
	Ni		
	Sn		
	Pb		
	**H_2		
	Cu		
	Ag		
	Au		
Least			Least

**Activity Series based on hydrogen standard

Note: H_2 is *not* a metal

Table J Questions:

1. Is a more active metal easier to oxidize or reduce?
   Ox … "metalliness" is due to losing e- (LEO)
2. Is a more active nonmetal easier to oxidize or reduce? **Red… nonmetals gain e- (GER)**
3. A solution of $CrCl_2$ will react with which of the following metals?
   Ag **Al** Cu Mg Ni **Zn**
   Metal higher than Cr+2
4. Write the oxidation and reduction half-reactions (if they occur) for
   a. A copper penny placed in a silver nitrate solution. **$Cu + 2 Ag^+ \rightarrow Cu^{+2} + 2 Ag$**
   b. A zinc bar is placed in a solution of $NiCl_2$ **$Zn + Ni^{+2} \rightarrow Ni + Zn^{+2}$**
   c. An aluminum nail is placed in a solution of $MgCl_2$ **no rxn**
5. Draw a voltaic cell with a copper electrode and a nickel electrode. Include ions in solution. Label the anode and the cathode. Don't forget the salt bridge! Show the direction of current flow. Write equations for the oxidation and reduction half-reactions.



just change Pb for Ni and its all good

6. Which one of the following pairs represents a spontaneous reaction?
   a. Ni, Zn^{2+} **No** b. Ag^+, Cu **Yes** c. Al, Mg^{2+} **No**

Table K
Common Acids

Formula	Name
$HCl(aq)$	hydrochloric acid
$HNO_3(aq)$	nitric acid
$H_2SO_4(aq)$	sulfuric acid
$H_3PO_4(aq)$	phosphoric acid
$H_2CO_3(aq)$ or $CO_2(aq)$	carbonic acid
$CH_3COOH(aq)$ or $HC_2H_3O_2(aq)$	ethanoic acid (acetic acid)

Table K Questions:

7. What are Arrhenius acids? **Substances that dissolve in water to form H^+ ions (hydronium)**
8. Write the dissociation reaction for each acid in the table. Example: HCl(aq) --> $H^+(aq)$ + Cl^- (aq)

Example: $HCl \rightarrow H^+ + Cl^-$

9. Are acids electrolytes? Why? **Yes, produce ions when dissolved**
10. What is the alternate theory for acids? **Acids donate Protons (H^+)** Given this reaction: $H_2SO_4(aq) + H_2O(l) <--> HSO_4^-(aq) + H_3O^+(aq)$ find the acids in the forward and reverse reaction. **$H_2SO_4(aq)$ – forward; $HSO_4^-(aq)$ - reverse**
11. What are the possible pH for acidic solutions? **1 - 6**

Table L
Common Bases

Formula	Name
$NaOH(aq)$	sodium hydroxide
$KOH(aq)$	potassium hydroxide
$Ca(OH)_2(aq)$	calcium hydroxide
$NH_3(aq)$	aqueous ammonia

Table L Questions:

1. What are Arrhenius bases? **Produce OH^- when dissolved in water**
2. Write the dissociation reaction for each base in the table. Example: NaOH(aq) --> $Na^+(aq) + OH^-$
3. Are bases electrolytes? Why? **produce ions when dissolved**
4. What is the alternate theory for bases? **bases bond to H^+ (protons)**
5. Given this reaction: $CH_3COO^-(aq) + H_2O(l) <--> CH_3COOH(aq) + OH^-(aq)$ find the bases in the forward and reverse reaction. **$H_2O(l)$ – forward; OH- reverse**
6. What are the possible pH for acidic solutions? **8 – 14**
7. In the process of neutralization, an Arrhenius acid and an Arrhenius base react to form a salt and water. Write 5 neutralization reactions. **$KOH + HNO_3 \rightarrow KNO_3 + H_2O$**

Table M
Common Acid–Base Indicators

Indicator	Approximate pH Range for Color Change	Color Change
methyl orange	3.2–4.4	red to yellow
bromthymol blue	6.0–7.6	yellow to blue
phenolphthalein	8.2–10	colorless to pink
litmus	5.5–8.2	red to blue
bromcresol green	3.8–5.4	yellow to blue
thymol blue	8.0–9.6	yellow to blue

Table M Questions:

Describe the color of the indicators in the solutions given below.

How about you ask how to use this Table M if you are not sure /don't remember, instead of filling in that stupid chart we put in here!!!

Table N Questions:

1. What is the half-life of neon-19? **17.2 sec**
2. What is the decay mode of plutonium-239? **alpha**
3. Which radioisotope decays the fastest? **Ca-37**
4. Which radioisotope decays the slowest? **Th-232**
5. How many decay modes are included in the table? **3**
6. Write the nuclear reaction of each radioisotope. **Yeah right, just make sure you know how to use this chart,Table O and the Periodic Table to write natural transmutation equations**
7. List all the radioisotopes that undergo beta decay and compare their atomic mass with the relative atomic mass of the respective element. What do you notice and can you find an explanation for the trend? **No thanx**
8. List all the radioisotopes that undergo positron decay and compare their atomic mass with the relative atomic mass of the respective element. What do you notice and can you find an explanation for the trend? **Not today**
9. Alpha decay occurs mainly in isotopes with atomic numbers larger than 60. List all the radioisotopes undergoing alpha decay and verify the statement. **Ok, this is a dumb question.**

Table O
Symbols Used in Nuclear Chemistry

Name	Notation	Symbol
alpha particle	${}^{4}_{2}\mathrm{He}$ or ${}^{4}_{2}\alpha$	α
beta particle (electron)	${}^{0}_{-1}\mathrm{e}$ or ${}^{0}_{-1}\beta$	β^-
gamma radiation	${}^{0}_{0}\gamma$	γ
neutron	${}^{1}_{0}\mathrm{n}$	n
proton	${}^{1}_{1}\mathrm{H}$ or ${}^{1}_{1}\mathrm{p}$	p
positron	${}^{0}_{+1}\mathrm{e}$ or ${}^{0}_{+1}\beta$	β^+

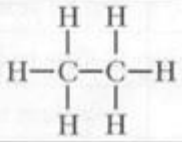
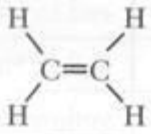
Table O Questions:

1. What is the charge and mass of an alpha particle? **Mass = 4 amu charge = +2**
2. What is the difference between a beta particle and a positron? **Beta charge is -1, other is +1**
3. What is the result of adding a positron and a beta particle together? **annihilation**
4. Why is a proton the same as hydrogen-1? **A hydrogen-1 nucleus contains just a proton**
5. What is the charge and mass of gamma radiation? **Zero for both**
6. What is another term for an electron? **Beta particle**
7. Which particle has the most matter? **alpha**
8. What is the symbol for beta particles? **Look in the table above**
9. Which particles will be deflected towards the positive electrode in an electrical field? **beta**
10. Which particles will be deflected towards the negative electrode in an electrical field? **Alpha, and positron**
11. Which particles will not be deflected in an electrical field? **gamma**

Table P
Organic Prefixes

Prefix	Number of Carbon Atoms
meth-	1
eth-	2
prop-	3
but-	4
pent-	5
hex-	6
hept-	7
oct-	8
non-	9
dec-	10

Table Q
Homologous Series of Hydrocarbons

Name	General Formula	Examples	
		Name	Structural Formula
alkanes	C_nH_{2n+2}	ethane	
alkenes	C_nH_{2n}	ethene	
alkynes	C_nH_{2n-2}	ethyne	

n = number of carbon atoms

Table P and Q Question:

Write the name, molecular formula, and draw the structural formula for five alkanes, alkenes, and alkynes using the table P.

Remember that molecular formulas are like "C_3H_8", whereas structural ones are drawings like shown in the right column of Table Q.

Table R
Organic Functional Groups

Class of Compound	Functional Group	General Formula	Example
halide (halocarbon)	−F (fluoro-) −Cl (chloro-) −Br (bromo-) −I (iodo-)	$R-X$ (X represents any halogen)	$CH_3CHClCH_3$ 2-chloropropane
alcohol	−OH	$R-OH$	$CH_3CH_2CH_2OH$ 1-propanol
ether	−O−	$R-O-R'$	$CH_3OCH_2CH_3$ methyl ethyl ether
aldehyde	$-\overset{\overset{O}{\|\|}}{C}-H$	$R-\overset{\overset{O}{\|\|}}{C}-H$	$CH_3CH_2\overset{\overset{O}{\|\|}}{C}-H$ propanal
ketone	$-\overset{\overset{O}{\|\|}}{C}-$	$R-\overset{\overset{O}{\|\|}}{C}-R'$	$CH_3\overset{\overset{O}{\|\|}}{C}CH_2CH_2CH_3$ 2-pentanone
organic acid	$-\overset{\overset{O}{\|\|}}{C}-OH$	$R-\overset{\overset{O}{\|\|}}{C}-OH$	$CH_3CH_2\overset{\overset{O}{\|\|}}{C}-OH$ propanoic acid
ester	$-\overset{\overset{O}{\|\|}}{C}-O-$	$R-\overset{\overset{O}{\|\|}}{C}-O-R'$	$CH_3CH_2\overset{\overset{O}{\|\|}}{C}OCH_3$ methyl propanoate
amine	$-\overset{\|}{N}-$	$R-\overset{\overset{R'}{\|}}{N}-R''$	$CH_3CH_2CH_2NH_2$ 1-propanamine
amide	$-\overset{\overset{O}{\|\|}}{C}-\overset{\|}{N}H$	$R-\overset{\overset{O}{\|\|}}{C}-\overset{\|}{N}H$	$CH_3CH_2\overset{\overset{O}{\|\|}}{C}-NH_2$ propanamide

R represents a bonded atom or group of atoms.

Table R Question:

Make up 2 more examples for each class of compounds. Write their names, and draw their structural formulas.

Show your teacher if you do not know how or are not sure if your are doing this right!

Table S
Properties of Selected Elements

Atomic Number	Symbol	Name	First Ionization Energy (kJ/mol)	Electro-negativity	Melting Point (K)	Boiling* Point (K)	Density** (g/cm^3)	Atomic Radius (pm)
1	H	hydrogen	1312	2.1	14	20	0.00009	37
2	He	helium	2372	—	1	4	0.000179	32
3	Li	lithium	520	1.0	454	1620	0.534	155
4	Be	beryllium	900	1.6	1551	3243	1.8477	112
5	B	boron	801	2.0	2573	3931	2.340	98
6	C	carbon	1086	2.6	3820	5100	3.513	91
7	N	nitrogen	1402	3.0	63	77	0.00125	92
8	O	oxygen	1314	3.5	55	90	0.001429	65
9	F	fluorine	1681	4.0	54	85	0.001696	57
10	Ne	neon	2081	—	24	27	0.0009	51
11	Na	sodium	496	0.9	371	1156	0.971	190
12	Mg	magnesium	736	1.3	922	1363	1.738	160
13	Al	aluminum	578	1.6	934	2740	2.698	143
14	Si	silicon	787	1.9	1683	2628	2.329	132
15	P	phosphorus	1012	2.2	317	553	1.820	128
16	S	sulfur	1000	2.6	386	718	2.070	127
17	Cl	chlorine	1251	3.2	172	239	0.003214	97
18	Ar	argon	1521	—	84	87	0.001783	88
19	K	potassium	419	0.8	337	1047	0.862	235
20	Ca	calcium	590	1.0	1112	1757	1.550	197
21	Sc	scandium	633	1.4	1814	3104	2.989	162
22	Ti	titanium	659	1.5	1933	3580	4.540	145
23	V	vanadium	651	1.6	2160	3650	6.100	134
24	Cr	chromium	653	1.7	2130	2945	7.190	130
25	Mn	manganese	717	1.6	1517	2235	7.440	135
26	Fe	iron	762	1.8	1808	3023	7.874	126
27	Co	cobalt	760	1.9	1768	3143	8.900	125
28	Ni	nickel	737	1.9	1726	3005	8.902	124
29	Cu	copper	745	1.9	1357	2840	8.960	128
30	Zn	zinc	906	1.7	693	1180	7.133	138
31	Ga	gallium	579	1.8	303	2676	5.907	141
32	Ge	germanium	762	2.0	1211	3103	5.323	137
33	As	arsenic	944	2.2	1090	889	5.780	139
34	Se	selenium	941	2.6	490	958	4.790	140
35	Br	bromine	1140	3.0	266	332	3.122	112
36	Kr	krypton	1351	—	117	121	0.00375	103
37	Rb	rubidium	403	0.8	312	961	1.532	248
38	Sr	strontium	549	1.0	1042	1657	2.540	215
39	Y	yttrium	600	1.2	1795	3611	4.469	178
40	Zr	zirconium	640	1.3	2125	4650	6.506	160

USE YOUR OWN TABLES: THESE ARE TOO SMALL TO READ!

Atomic Number	Symbol	Name	First Ionization Energy (kJ/mol)	Electro-negativity	Melting Point (K)	Boiling* Point (K)	Density** (g/cm^3)	Atomic Radius (pm)
41	Nb	niobium	652	1.6	2741	5015	8.570	146
42	Mo	molybdenum	684	2.2	2890	4885	10.220	139
43	Tc	technetium	702	1.9	2445	5150	11.500	136
44	Ru	ruthenium	710	2.2	2583	4173	12.370	134
45	Rh	rhodium	720	2.3	2239	4000	12.410	134
46	Pd	palladium	804	2.2	1825	3413	12.020	137
47	Ag	silver	731	1.9	1235	2485	10.500	144
48	Cd	cadmium	868	1.7	594	1038	8.650	171
49	In	indium	558	1.8	429	2353	7.310	166
50	Sn	tin	709	2.0	505	2543	7.310	162
51	Sb	antimony	831	2.1	904	1908	6.691	159
52	Te	tellurium	869	2.1	723	1263	6.240	142
53	I	iodine	1008	2.7	387	458	4.930	132
54	Xe	xenon	1170	2.6	161	166	0.0059	124
55	Cs	cesium	376	0.8	302	952	1.873	267
56	Ba	barium	503	0.9	1002	1910	3.594	222
57	La	lanthanum	538	1.1	1194	3730	6.145	138
Elements 58–71 have been omitted.								
72	Hf	hafnium	659	1.3	2503	5470	13.310	167
73	Ta	tantalum	728	1.5	3269	5698	16.654	149
74	W	tungsten	759	2.4	3680	5930	19.300	141
75	Re	rhenium	756	1.9	3453	5900	21.020	137
76	Os	osmium	814	2.2	3327	5300	22.590	135
77	Ir	iridium	865	2.2	2683	4403	22.560	136
78	Pt	platinum	864	2.3	2045	4100	21.450	139
79	Au	gold	890	2.5	1338	3080	19.320	146
80	Hg	mercury	1007	2.0	234	630	13.546	160
81	Tl	thallium	589	2.0	577	1730	11.850	171
82	Pb	lead	716	2.3	601	2013	11.350	175
83	Bi	bismuth	703	2.0	545	1833	9.747	170
84	Po	polonium	812	2.0	527	1235	9.320	167
85	At	astatine	—	2.2	575	610	—	145
86	Rn	radon	1037	—	202	211	0.00973	134
87	Fr	francium	393	0.7	300	950	—	270
88	Ra	radium	—	0.9	973	1413	5.000	233
89	Ac	actinium	499	1.1	1320	3470	10.060	—
Elements 90 and above have been omitted.								

*Boiling point at standard pressure
**Density at STP

Table S Questions:

1. Draw an empty periodic table (omit groups 3-12) and include Symbols, Atomic Number, and Electronegativity value for each element.
   a. Draw a bar graph representing the trend of electronegativity in group 1 and 2. Organize symbols of elements on the X axis and the numerical values on the Y axis.
   b. Draw a line graph representing the trend of electronegativity in period 3 and 4. Organize symbols of elements on the X axis and the numerical values on the Y axis.
   c. In complete sentences, describe the Electronegativity's general trend in groups and periods.
   d. State the reasons for your observations?
2. Draw an empty periodic table (omit groups 3-12) and include Symbols, Atomic Number, and Ionization Energy value for each element.
   a. Draw a bar graph representing the trend of Ionization Energy in groups 1 and 2. Organize symbols of elements on the X axis and the numerical values on the Y axis.
   b. Draw a line graph representing the trend of Ionization Energy in period 3 and 4. Organize symbols of elements on the X axis and the numerical values on the Y axis.
   c. In complete sentences, describe the Ionization Energy 's general trend in groups and periods.
   d. State the reasons for your observations?
3. Draw an empty periodic table (omit groups 3-12) and include Symbols, Atomic Number, and Atomic Radius value for each element.
   a. Draw a bar graph representing the trend of Atomic Radius in group 1 and 2. Organize symbols of elements on the X axis and the Atomic Radius on the Y axis.
   b. Draw a line graph representing the trend of Atomic Radius in period 3 and 4. Organize symbols of elements on the X axis and the Atomic Radius on the Y axis.
   c. In complete sentences, describe the Atomic Radius 's general trend in groups and periods.
   d. State the reasons for your observations?
4. Using answers from problems #1 & 2 find any correlation between Electronegativity and Ionization Energy.
5. Using answers from problem #3 find any correlation between Atomic Radius and Atomic Number.
6. Make a bar graph for the boiling points values of the Noble Gases.
   a. Find the correlation between the trend for Atomic Radius and the Atomic Number for the Noble Gases.
   b. Explain your findings.

IF YOU DID #1-6, You are a SICK-O!!! An actual CHEM NERD!!

7. At what pressure the Boiling Points have been calculated? **Atmospheric , 1 atm , 101.3 kPa**
8. At what temperature and pressure the Densities have been calculated? **STP**
9. What is the density of 2 moles of water? **1.0 g/mL**
10. Using the density of helium, **0.0000179 g/mL** what is the mass of 2 moles of helium? **8 g**
11. Would the density of neon be higher or lower if its density were calculated at 2 atm.**Higher**
12. What is the general correlation between Melting Points and Boiling Points? **Direct correlation… if an element has a low m. pt. it also has a low b. pt.**

Table T
Important Formulas and Equations

Density	$d = \frac{m}{V}$	d = density m = mass V = volume
Mole Calculations	number of moles = $\frac{\text{given mass (g)}}{\text{gram-formula mass}}$	
Percent Error	% error = $\frac{\text{measured value} - \text{accepted value}}{\text{accepted value}} \times 100$	
Percent Composition	% composition by mass = $\frac{\text{mass of part}}{\text{mass of whole}} \times 100$	
Concentration	parts per million = $\frac{\text{grams of solute}}{\text{grams of solution}} \times 1\,000\,000$	
	molarity = $\frac{\text{moles of solute}}{\text{liters of solution}}$	
Combined Gas Law	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$	P = pressure V = volume T = temperature (K)
Titration	$M_AV_A = M_BV_B$	M_A = molarity of H^+ M_B = molarity of OH^- V_A = volume of acid V_B = volume of base
Heat	$q = mC\Delta T$ $q = mH_f$ $q = mH_v$	q = heat H_f = heat of fusion m = mass H_v = heat of vaporization C = specific heat capacity ΔT = change in temperature
Temperature	K = °C + 273	K = kelvin °C = degrees Celsius
Radioactive Decay	fraction remaining = $\left(\frac{1}{2}\right)^{\frac{t}{T}}$	t = total time elapsed T = half-life
	number of half-life periods = $\frac{t}{T}$	

Table T Questions:

Density

1. Calculate m in **terms** of d and v. **m = d x v**
2. Calculate v in terms of m and d. **v = m/d**
3. What is the d of an object with a mass of 102.0 g and a volume of 10 cm^3?**102/10 = 10.2 g/mL**
4. What happened to the d of an object whose v decreases? **Nothing d is still the same**
5. A nail (m = 2 g and V = 0.5 cm^3) is cut in 2 pieces. Explain why the d of each half remains the same as the original nail. **D is a property unrelated to size**
6. An object has a mass of 23 g and a density of 10 g/cm^3 what is its volume? **2.3 mL (2.3 cm^3)**
7. What is the density of aluminum? **2.608 g/ml at STP (Table S)**

Mole Calculations

1. What is the number of mole in a sample of 45g of H_2O? **molar mass = 18, so 45/18 = 2.5 moles**
2. What is the number of mole in a sample of 6g of NH_3? **Molar mass = 17, so 6/17 = 0.35 moles**
3. What is the mass of 2 moles of H_2O_2? **Molar mass = 34, so 34 x 2 = 68 grams**
4. What is the mass of 4 moles of C_2H_2? **Molar mass = 26, so 26 x 4 = 104 grams**

Percent Error

1. Can the Percent Error be less than 0? **Technically yes, means measured value is less than accepted one**
2. What is the difference between the measured value and the accepted value if the Percent Error is 100? **1:2 ratio between the two (one is twice in value of the other)**
3. A Student calculates the density of iron at STP to be 8.956 g/cm^3. What is the Percent Error? **7.874 is accepted value (Table S) so 13.7%**
4. Why do we have to calculate the Percent Error in scientific experiments? **TO check the quality of the data**
5. In an experiment a student calculates the atomic radius for iridium. The % error of the calculation is 23 %. What is the experimental value? **Don't worry about this one**

Percent Composition

1. What is the percent composition by mass of H in H_2O_2? **2/34 x 100 = 5.9%**
2. What is the percent composition by mass of all the elements in $(NH_4)_3PO_4$? **Solve molar mass and then divide mass from each element by the molar mass. N = 28.1%, H = 8.1%, P = 20.8%, O = 43.0%**
3. What is the percent, by mass, of water in $MgSO_4.2H_2O$? **Find molar mass of $MgSO_4$ and add to it the mass of 2x molar mass of water = 120.3 + 2(18) = 156.3 is total mass of the hydrate. 36/156.3 = .23 or 23% of the mass is from water**
4. How many grams of O can be produced from the decomposition of 50g of H_2O? **Not to worry**
5. How much phosphorus can be recovered from 25g of $(NH_4)_3PO_4$?
6. How much potassium can be produced from 125g of $KMnO_4$?

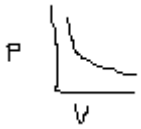
Concentration

1. Describe the laboratory procedure to make a 2 M NaCl(aq) solution.
2. What is the molarity of a solution of KOH if 1000 ml of the solution contains 11.2 grams of KOH? **11.2 g KOH is 0.2 moles of KOH (11.2/molar mass = 11.2/ 56) Molarity = 0.2/1.0 L = 0.2**

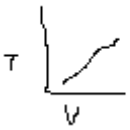
3. How many moles of KOH are contained in 250 mL of 2.0 M solution of KOH? **2 M x .250 L = 0.5 moles**
4. A 40.0 milliliter sample of 0.50 M HCl is diluted with water to a volume of 100. milliliters. What is the new concentration of the solution? **Don't worry about this one.**
5. What is the concentration in parts per millions if a 500 g solution of copper (II) sulfate contains 5 mg of copper (II) sulfate?

Combined Gas Law

1. Given the formula for the combine gas law, express every single term in term of the other terms.
2. What will be the new formula if temperature is constant? $\mathbf{P_1V_1 = P_2V_2}$
   a. What is the name of this formula? **Boyles Law**



   b. Draw a line graph representing the relationship.
   c. Explain in a sentence the result of the line graph. **As P increases on a gas, its volume decreases… INVERSE relationship.**
   d. Find an example to illustrate your findings. **Gas contained in a syringe.**
3. What will be the formula if pressure is constant? $\mathbf{V_1/T_1 = V_2/T_2}$
   a. What is the name of this formula? **Charles Law**



   b. Draw a line graph representing the relationship.
   c. Explain in a sentence the result of the line graph. **As T increases, so does V, DIRECT Relation.**
   d. Find an example to illustrate your findings. **Hot air balloon**
4. What temperature scale has to be used for temperature? **KELVIN!!!!**
5. Do any specific scales have to be used for pressure and volume? **no**
6. At STP, a sample of hydrogen gas has a volume of 10 L. If the temperature is double and the pressure is double, what is the new volume of the gas sample? **10 L (double the T causes doubling of V, but doubling pressure causes volume to reduce to ½, so no volume change)**
7. At STP, a sample of helium gas has a volume of 5 L. If the temperature is quadruple and the pressure is triple, what is the new volume of the gas sample? **4x T causes 4x volume, but 3x P causes 1/3 x volum,e, so volume changes by 4 x 1/3 or 4/3. So 4/3 x 5 = 20/3 = 6.67 L**

Titration

1. What is a titration? **Controlled neutralization of an acid of known concentration against a base of unknown concentration (or visa-versa), for the purpose of figuring out the concentration of the acid or the base … Use MaVa = MbVb**
2. How many milliliters of 0.50 M NaOH are required to exactly neutralize 20.0 milliliters of 0.20 M HCl? **(0.20 M)(20 mL) = (0.50 M) Vb Vb = 8 mL**
3. If 100. milliliters of a 3.0 M solution of HCl is exactly neutralized by 80. milliliters of NaOH, what is the molarity of the NaOH solution? **3.75 M NaOH**
4. What is the molarity of an HNO_3 solution if 10.0 milliliters of 0.40 M LiOH is required to exactly neutralize 200 milliliters of the HNO_3 solution? **0.020 M**

5. How many milliliters of 1.0 M HCl are needed to exactly neutralize 50. milliliters of 0.5 M KOH? **25 mL**
6. Describe the laboratory procedure of titration. **Measure a known amount of the solution of unknown concentration (say it s the acid). Add an indicator (usually phenolphthalein or bromothymol blue). Slowly add the other solution (say the base) until the indicator changes to its "neutral" color. Measure the amount of base added. Calculate the concentration of the acid using MaVa = MbVb equation.**

Heat

1. What is the definition of specific heat capacity? **Heat energy in Joules needed to change the temperature of one gram of the substance by one degree C or K.**
2. How is the heat of fusion defined? **Heat energy needed to MELT one gram of the substance**
3. What is the definition of heat of vaporization? **Heat energy needed to BOIL one gram of the substance**
4. Write the formula for change in temperature. **ΔT**
5. What is the specific heat capacity of water? **Look on Table B**
6. The temperature of 10 g of water has increased by 10 K, how much heat was absorbed? **Use $q = mc\Delta T$ = (10 g) (4.18 J/g ^oC) (10^oC) …. (change of 10 degrees K = change of 10 degrees C as well)**
7. After an experiment using 2 g of water, 20 J was released in the surrounding and the final temperature is 257 K, what was the original temperature of the water? **Don't do**
8. What is the value for the heat of fusion for water in J/g?**Table B…**
9. What is the value for the heat of vaporization in J/g? **Table B…**
10. How many Joules are required to melt 1000 g of water? **q = mHf = 1000 g x 334 J/g = 334,000 J or 334 kJ**
11. How many Joules are needed to vaporize 10 g of water? **q = mHv = 10g x 2260 J/g = 22,600 J = 22.6 kJ**

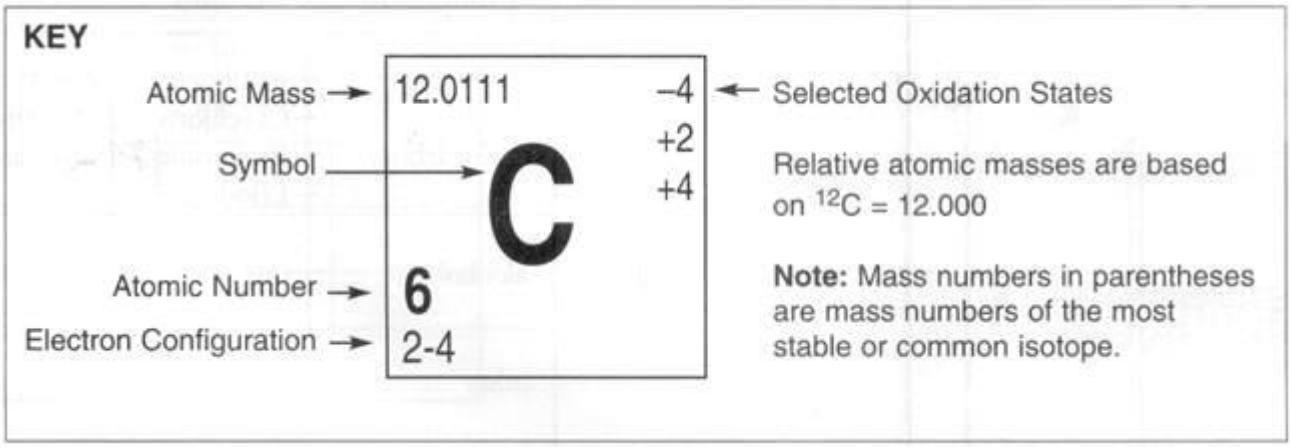
Temperature

1. Convert the followings: 0^{o}C to K, **273 K** 373 K to ^{o}C, **100^{o}C** 35oC to K **308 K**
2. What is the difference in degree Celsius and in Kelvin between the freezing and the boiling point of water? **100 degrees on both scales**
3. How is temperature defined? **Measure of average kinetic energy of the particles in the sample**
4. Is 1 K equal to 1^{o}C? Why? **well… a CHANGE of 1 degree on the Celsius scale is equal to a CHANGE of 1 degree on the Kelvin scale. However, the temperature 1 K is -272 ^{o}C**

Radioactive Decay

1. What is the concept of half-life? **Amount of time it takes for ½ of the atoms in a sample of a radioactive element to transmutate (radioactively decay by emitting radiation).**
2. What is the concept of Radioactive Decay? **Elements that have naturally unstable nuclei will emit a form of radiation (they will "decay") as the ratio of protons: neutrons is adjusted to achieve more stability.**
3. What is the value of $(1/2)^0$? **1**

4. What is the value of $(1/2)^1$?
5. When is t/T = 0?
6. When is t/T = 1?
7. After how many half-life periods an original sample of a radioisotope will decreased by ¼? **2**
8. What is the fraction remaining after 5 half-lives have elapsed? **1/32**
9. What is the half-life of nitrogen-16? **7.2 sec**
10. A sample of uranium-238 is stored in a safe place, what is the amount remaining after 1.35 x 10^{10} years and what kind of decay particle are given throughout the years? **This is 3 half lives (divide 1.35 E^10 by i/2 life of U-238) so 1/8 remains. Table N says this to happen by alpha decay.**
11. A sample of an unknown radioisotope has taken 2 weeks and 2/5 of a day to have 1/64 of the original sample remaining. What is this radioisotope? **Don't do**
12. If the initial mass of a sample of cesium-137 is 1.00 g, how much will remain after 151 years? **151 years divided by half-life of 30 years is 5 half lives, so 1/32 of 1.00 g remains, or 0.03125 g**
13. Consider a sample of fossilized wood that originally contained 24 g of carbon-14. It now contains 1.5 g of carbon-14. **24 → 12g → 6 g → 3g → 1.5 g**, **so 4 half lives of time have elapsed** How old is the sample? **C-14 half life is 5730 yrs, so 5 x 5730 y = 28,650 years**
14. A 64 g sample of germanium-66 is left undisturbed for 12.5 hours. At the end of that period, only 2.0 g remain. What is the half-life of this material? **64g → 32g → 16g → 8g → 4g → 2g so 5 half lives have occurred, so 12.5 divided by 5 = 2.5 hours is the value of one half-life.**
15. If a pellet of cobalt-60 that has been in storage for 26.5 years contains 14.5 g of cobalt-60, how much of this radioisotope was present when the pellet was put into storage? **26.5 y divided by the half life of 5.26 y = about 5 half lives. So if 14.5 g remains now, work by doubling back 5 times… 14.5g → 29g → 58g → 116g → 232g → 464 g**
16. How long will it take for 1.00 gram of strontium-90 to decay to 125 mg? **125 mg = 0.125 g… 1 → 0.5g → 0.25g → 0.125 g so 3 half-lives have elapses. Half life is 28.1 y so 3 x 28.1 y = 84.3 y**
17. A patient receives iodine-131 as a medical treatment on Sunday October 18 at 8:00:00 am.
    On what day, date, hour, minute, and second will only 1/8 of the original sample still be radioactive? **fogedabowdit**



Periodic Table Questions:

1. Which elements are in the liquid phase at room temperature?**bromine (Br) and mercury (Hg)**
2. Which elements are in the gas phase at room temperature? **All 6 noble gases as well as O, N, F, Cl H**
3. What are the 2 main divisions of the periodic table? **Metals and nonmetals**
4. What are the 7 metalloids?**B, Si, Ge, As, Sb Te, Po**
5. What is the number of e-, p, and n in a neutral atom of nitrogen? **Can't say #n without knowing the isotope number. But has 7 p and e**
6. What is the Atomic Mass of xenon? **131.29**
7. What is the Atomic Number of barium? **56**
8. What is the electron configuration of iodine? **2-8-18-18-7**
9. What are the relative atomic masses based on? **Mass and % abundance of the naturally occurring isotopes of that element (know how to set up that calculation)**
10. What are the Selected Oxidation States of chlorine?**-1, +1, +3, +5, +7**
11. What is the Symbol of krypton?**Kr**
12. Name the 6 Noble Gases?**in order helium neon argon krypton xenon radon**
13. What are the characteristics of metals?**shiny (luster) conductors malleable**
14. What are the characteristics of nonmetals?**dull non-conductors brittle**
15. What are the characteristics of metalloids?**some of both metals and nonmetals**
16. Is hydrogen considered a metal?**NO!!!!!!!!!!!!!!!!!!!!!!!!**
17. What is the difference between helium and the other Noble Gases?**He has only 2 valence e, others have 8**
18. How many groups are in the Periodic Table of Elements?**18**
19. How many periods are in the Periodic Table of Elements?**7**
20. What does the period number indicate in the electron configuration of an atom? **Number of energy levels of electrons that element uses**
21. What does the group number indicate in the electron configuration of an atom?**Number of valence e that element has**
22. What is the name of groups 3-12? **Not to worry about it**
23. What is the name of group 1?**alkali metals**
24. What is the name of group 2?**alkaline earth metals**
25. What is the name of group 17?**halogens**
26. What is the name of group 18?**noble gases**
27. What does the Selected Oxidation States numbers represent?**possible charges that element is known to take on in its various compounds it forms with other elements**
28. How many valence electrons are in an atom of cesium? **Cs… one**

29. What is the outermost principal quantum number for an atom of arsenic? **As – the 4th energy level**
30. What element has an electron configuration of 2-8-10-2? **Find it in order on the chart or count up 2+8+10+2 = 22 e so element #22 so Ti**