Name:		Date:			HURBAN EASSEMBLY	
<b>Chemistry</b> ~ Ms. Hart	<u>Class:</u>	Anions	or	Cations	FOR CRIMINAL	
<b>200 Things to Know to P</b> Directions: Review each of the co (if applicable).	<mark>ass the Chem</mark> incepts below a	<b>istry Rege</b> nd answer t	<b>nts –</b> the qu	Part I estions associ	iated with each number	
1. <b>Protons</b> are positively charged <i>Example: Which has the g</i>	l (+) with a mas preatest nuclear	ss of 1 amu. <i>r charge?</i> C	Cl-35	Ar-40 K-39	Ca-40	
2. <i>Neutrons</i> have no charge and	l a mass of 1 am	u.				
3. <i>Electrons</i> are small and are n	egatively charge	ed (-) with a	mass	of almost o a	mu	
4. Protons & neutrons are in an at Which has the greatest number o	tom's nucleus ( <b>1</b> f nucleons? S	n <b>ucleons</b> ). 'n-119		Sb-122	Te-128 I-127	
5. Electrons are found in "clouds" Where is most of the mass Where is most of the size (	( <b>orbitals</b> ) aro s of an atom fou (volume) of an o	ound an ator und? atom found?	n's nu P	ıcleus.		
6. The <b>mass number</b> is equal to What is the mass number	an atom's num of an atom wit	ber of proto h 18 proton	ons an s <i>and</i>	d neutrons ad 22 neutrons?	lded together.	
7. The <b>atomic number</b> is equal Which has the greatest at S Cl	to the number o omic number? Ar	of protons in <i>K</i>	n the i	nucleus of an a	atom.	
8. The <b>number of neutrons</b> = $1$ Which correctly represent $^{11}Ne$ $^{21}Ne$	mass number – ts an atom of ne e <sup>20</sup> N	atomic nun eon contain e <sup>2</sup>	nber. ing 11 ²Ne	neutrons?		
9. In a neutral atom the number of	of protons = the	number of	electr	ons.		
10. <i>Isotopes</i> are atoms with equ <i>Two isotopes of the same</i> <i>neutrons and elect</i> <i>protons and nucle</i>	al numbers of p element will ha rons, ons,	protons, but ve the same neutrons protons	differ num and and e	r in their neut ber of nucleons, electrons	ron numbers.	
<b>11. Cations</b> are positive (+) ions They <b>are</b> smaller than the Which of the following wi Cl N	and form when eir parent atom <i>ll form an ion u</i> Br	a neutral a vith a small E	tom lo er rac Ba	oses electrons. lius that that	of its atom?	
12. <b>Anions</b> are negative ions and They are larger than their Which electron configuration 2-7 $2-8$	form when a non- parent atom. tion is correct for $2-8$	eutral atom or a fluoride –1 2	gains e ion? 2–6	electrons.		
13. Ernest <i>Rutherford's</i> gold for dense, positively charged nucleus	oil experiment s	showed that	an at	om is mostly o	empty space with a small,	
14. J.J. Thompson discovered t	he electron and	developed	he "p	lum-pudding'	" model of the atom.	

+ - + -	Positive & negative
+ - + - +	particles spread throughout
- + - +	entire atom.

15. *Dalton's* model of the atom was a solid sphere of matter that was uniform throughout.

16. The *Bohr Model* of the atom placed electrons in "planet-like" orbits around the nucleus of an atom.

17. The current, *wave-mechanical model* of the atom has electrons in "clouds" (orbitals) around the nucleus.

18. Electrons can be excited to jump to higher energy levels. They emit energy as light when they fall from higher energy levels back down to lower (*ground state*) energy levels. *Bright line spectra* are produced.

19. *Elements* are pure substances composed of atoms with the same atomic number. They cannot be decomposed. *A compound differs from an element in that a compound* 

Has a homogeneous compositionhas one set of propertiesHas a heterogeneous compositioncan be decomposed

20. *Binary compounds* are substances made up of only *two* kinds of atoms. "Ternary" compounds contain three (or more) kinds of atoms. *Which substance is a binary compound? Ammonia magnesium potassium nitrate methanol* 

21. *Diatomic molecules* are elements that form two atom molecules in their natural form at STP. *Which element is a diatomic liquid at STP? Chlorine fluorine bromine iodine* 

22. Use this diagram to help determine the *number of significant figures* in a measured value...



Atlantic

If the decimal point is **present**, start counting digits from the **Pacific** (left) side, starting with the first non-zero digit.

0.003100 (..... sig. figs.)

If the decimal point is absent, start counting digits from the Atlantic (right) side, starting with the first non-zero digit.

31,400 (.....sig. figs.)

23. When multiplying or dividing measurements, final answer must have as many digits as the measurement with the fewest number of digits.

When adding or subtracting, use place value.

Pacific

What is the density of the object measured in lab by the displacement of water according to The data below:

Mass of object:	23.6 g
Volume of water:	15.0 mL
<i>Volume of water + object:</i>	18.2 mL

24. *Solutions* are the best examples of *homogeneous mixtures*. They have two sets of properties.

25. *Heterogeneous mixtures* have discernable components and *are not* uniform throughout.

Air is classified chemically as a(n)

Substance compound element mixture

26. A *solute* is the substance being dissolved; the *solvent* is the substance that dissolves the solute. *NaCl* (*s*) *is added to water. The solute is ..... the solvent is ..... the solution is ......* 

27. Isotopes are written in a number of ways: C-14 is also Carbon-14, and is also

14C 6

atomic number = .....

*mass number* = ......

- 28. The average atomic mass is the weighted average mass of all the known isotopes of an element. *Find the average atomic mass of lithium if 7.4 % are <sup>6</sup>Li and 92.6% are <sup>7</sup>Li.*
- 29. The distribution of electrons in an atom is its *electron configuration*.

**30.** Electron configurations are written in the bottom center of an element's box on the periodic table in your reference tables. The outermost electrons are the valence electrons.



33. *Electron dot model* is a way of representing the valence electron of an atom.

 $\mathbf{x}$  represents the electron-dot symbol of this element ~C~~O~~B~~N

34. The *kernel* of an atom includes everything in an atom *except* the atom's valence electrons. *The kernel of this element contains 11 protons and 10 electrons* O F Ne Na

35. Polyatomic ions (Table E) are groups of atoms, **covalently** bonded together, with an overall charge.

Nitrate: $NH_4^+$ :sulfite:Which of the following contains both ionic and covalent bonds?NaOH $CH_3OH$ NaCl $Cl_2$ 

36. **Coefficients** are written in front of the formulas of reactants and products to balance chemical equations. They give the ratios of reactants and products in a balanced chemical equation. ......Na + ......NaCl

37. Chemical formulas are written so that the charges of cations and anions neutralize (cancel) one another.

calcium phosphate:  $Ca^{2+} PO_4^{3-} = \dots$ 

38. When naming binary ionic compounds, write the name of the positive ion (cation) first, followed by the name of the negative ion (anion) with the name ending in "-ide."

 $CaCl_2$  ..... MgS .....

39. When naming compounds containing polyatomic ions, keep the name of the polyatomic ion the same as it is written in Table E.

NH<sub>4</sub>Cl ..... Dimercury (I) nitrate

40. **Roman numerals** are used to show the positive oxidation number of the cation if it has more than one positive oxidation number

FeO: ..... Nickel (III) sulfate: .....

41. *Physical changes* do not form new substances. They merely change the appearance of the original material. (The melting of ice)  $H_2O(s) \rightarrow H_2O(l)$ 

42. *Chemical changes* result in the formation of new substances. *Which process is an example of a chemical change?* 

the melting of ice the electrolysis of water

the boiling of water

## 43. *Reactants* are on the left side of the reaction arrow and *products* are on the right.

44. *Temperature* is a measure of average kinetic.

Which sample has the hig	hest average kinetic e	nergy?	
$H_2O(l)$ at $O^oC$	$H_2O(s)$ at $O^oC$	$CO_2(g)$ at $STP$	Mg (s) at 298K

58. *Solids* have a definite shape and volume.

In what region of the graph below would you only find molecules with definite shape and volume?

59. *Liquids* have closely-spaced particles that easily slide past one another; they have no definite shape, but have a definite volume.

60. *Gases* have widely-spaced particles that are in random motion (collide with container to create pressure).

61. *Gases* are easily compressed and have no definite shape or volume.

In what region of the graph below would you only find a sample with no definite shape or volume?

62. Be able to read and interpret heating/cooling curves as pictured below.

During which interval on the graph are solid and liquid in equilibrium?



- 63. Substances that *sublime* turn from a solid directly into a gas. They have very weak attractive forces. (examples include CO<sub>2</sub> & I<sub>2</sub>)
- 64. As they evaporate, liquids become gases, which create vapor pressure. (Reference Table H). As temperature increases, vapor pressure increases.

This liquid on Refere	ence Table H	I has the <b>weakest</b>	attractive forces:
Propanone	ethanol	water	acetic acid

- 65. "**STP**" means "**S**tandard **T**emperature and **P**ressure." Reference Table B These conditions define STP  $P = \dots$  atm  $T = \dots K$
- 66. Degrees Kelvin = C + 273 Room temperature =  $25^{\circ}C$  = ......K Boiling point of helium = 4 K = ......°C
- 67. Heat is a transfer of energy from a material at higher temperature to one at lower temperature. *When an ice pack is applied to a bruised arm, ...... transfers from ....... to ......*
- 68. Use this formula to calculate heat absorbed/released by substances. q = mcDtq = heat absorbed or released (Joules)

m = mass of substance in grams

c = specific heat capacity of substance (J/gC) ... for water it's 4.18 J/g C.

Dt = temperature change in degrees Celsius

What is the total number of joules of heat energy absorbed by 12 grams of water when it is heated from 30°C to 40°C?

69. The heat absorbed or released when 1 gram of a substance changes between the solid and liquid phases is the substance's *heat of fusion*. (*Reference Table B*: 334 J/g for water) How many joules are required to melt 15 g  $H_2O(s)$ ?

70. The heat absorbed or released when 1 gram of a substance changes between the liquid and gaseous phases

is the substance's **heat of vaporization**. (*Reference Table B:* 2260 J/g for water) *How many joules are required to boil 120 g H*<sub>2</sub>O (*l*)?

71. Always use Kelvins for temperature when using the **combined gas law**.

$$\frac{\underline{P}_{\underline{1}}\underline{V}_{\underline{1}}}{\underline{T}_{\underline{1}}} = \frac{\underline{P}_{\underline{2}}}{\underline{T}_{\underline{2}}}$$

Set up the equation to calculate the volume of 50. mL of methane gas collected at STP when the pressure rises to 2.4 atm and the temperature drops to 240 K.

72. As the **pressure** exerted on a gas increases, the **volume** decreases proportionally. 25 L of a gas is held at 1.2 atm pressure. Find the new volume if pressure drops to 0.80 atm at constant temperature.

73. As the **pressure** on a gas increases, **temperature** increases. A sample of gas exerts a pressure of 220. kPa at 373 K. Find the pressure at 373 K at constant volume.

74. As the **temperature** of a gas increases, **volume** increases. 15 mL of oxygen gas is collected at 0°C. Find the volume at 50°C at constant pressure.

75. *Real gas* particles have volume and are attracted to one another. They don't always behave like *ideal gases*.

Lighter gases (with weaker attractive forces) are often most ideal. Which of the following is the most ideal gas? He Ne Ar Kr

76. Real gases behave more like ideal gases at *low pressures and high temperatures*.

77. Mixtures may be separated by several physical means:

*Distillation* separates mixtures with different boiling points.

Fractional distillation is a common method to separate and collectHydrocarbonsIonic solidsMetalsPrecipitates

*Filtration* separates mixtures of solids and liquids. *What would collect in filter paper* if a mixture of NaCl (aq) and CaCO<sub>3</sub>(s) were poured through?

*Chromatography* can also be used to separate mixtures of liquids and mixtures of gases.

78. *The Periodic Law* states that the properties of elements are periodic functions of their *atomic numbers*.

Elements are arranged on the modern periodic table in order of increasing .....

- 79. *Periods* are horizontal rows on the Periodic Table. In which energy level are the valence electrons of the elements in Period 3 found?
- 80. *Groups* are vertical columns on the Periodic Table. *Which group on the periodic table contains a solid, liquid, and gas(es)?*

81. *Metals* are found left of the "staircase" on the Periodic Table and at the bottom, *nonmetals* are above it and at the top, and *metalloids* border it.

Which of the following Group 14 elements has the greatest metallic character? Carbon silicon germanium tin

Metals	Malleable and ductile	All solids except 	Lustrous	Good conductors of heat & electricity	ionization energy and electroneg.	Tend to form ions
Nonmetals	Brittle when solid	Mostly gases at STP	Dull	Good insulators	ionization energy and electroneg.	Tend to form ions

82. Complete and memorize this chart.

- 83. *Noble gases* (Group 18) are unreactive and stable due to the fact that their valence level of electrons is completely filled.
- 84. *Ionization energy* increases as you go up and to the right on the Periodic Table. *Which element among the diagrams below has the lowest ionization energy?*
- 85. *Atomic radii* decrease left to right across a period due to increasing nuclear charge. *Which period 3 element among the diagrams below has the largest radius?*
- 86. *Atomic radii* increase as you go down a group due to increased electron energy levels. *Which alkali metal among the diagrams below has the largest radius?*
- 87. *Electronegativity* is a measure of an element's attraction for electrons. Which of the following atoms has the greatest tendency to attract electrons? calcium carbon copper chlorine
- 88. Electronegativity *increases* as you go up and to the right on the Periodic Table. *Which element among the diagrams below has the greatest electronegativity?*
- 89. The elements in Group 1 are the **alkali metals**; those in Group 2 are the **alkaline earth metals**. Which atom below represents the alkali metal of period 2?
- 90. The elements in Group 17 are the **halogens**. Which element among the diagrams below is a halogen?
- 91. The elements in Group 18 are the **noble gases**. Which element among the diagrams below is a noble gas?



- 92. Use **Table S** to compare and look up the properties of specific elements. *The freezing point of phosphorus is ......*<sup>o</sup>C
- 93. Energy is *absorbed* when a chemical bond *breaks*. Energy is *released* when a chemical bond *forms*. The greater the energy, the more stable the bond that forms. *Which of the following, according to Reference Table I, is the most stable compound?*

	Ethane	ethane	ethyne	hydroge	n iodide
94. The last Whi	digit of an elen ch contains the	nent's group nu greatest numb	umber is e ber of vale	qual to its <b>num</b> ence electrons?	per of valence electrons.
	Са	Ge	Se	Kr	
95. Draw or <b>diagram</b> . Whi	ne dot for each w ich dot model w	valence electro ould contain ti	n when dr he fewest (	awing an elemer dots as valence e	t's or ion's <b>Lewis electron dot</b> lectrons?
	Са	Ge	Se	Kr	
96. <b>Metalli</b> a "sea" o <i>Met</i>	<b>ic bonds</b> can be of mobile valenc allic bonding of sulfur	e thought of as e electrons. ccurs between sodium flue	a crystall atoms of oride	ine lattice of kern sodium	nels surrounded by carbon
97. Atoms a such a confi Whi	re most stable v iguration of elec ich of the follow Li	vhen they have etrons. <i>ing atoms forr</i> <i>F</i>	e 8 valence ns a stabl Na	e electrons (an <b>o</b> e ion that does <b>n</b> Cl	<b>ctet</b> ) and tend to form ions to obtain <b>ot</b> have an octet structure?
98. <b>Covale</b> Hou	e <b>nt bonds</b> form v many covalen	when two ato t bonds are for	ms <b>share</b> und in a n	a pair of electro itrogen (N₂) mo	ns. lecule?

99. *Ionic bonds* form when one atom *transfers* an electron to another atom when forming a bond with it.

Which substance exhibits ionic bonding rather than covalent bonding?  $CO_2$   $N_2O_4$   $SiO_2$   $CaBr_2$   $C_6H_{12}O_6$ 

100. Dot models may be used to represent the formation of ions or covalent molecules.

. Given the equation:  $F + 1e^{-} \longrightarrow [F]$ 

This equation represents the formation of a fluoride ion, which is smaller in radius than a fluorine atom fluoride ion, which is larger in radius than a fluorine atom fluorine atom, which is smaller in radius than a fluoride ion fluorine atom, which is larger is radius than a fluoride ion

101. *Nonpolar covalent bonds* form when two atoms of the *same element* bond together.

102. *Polar covalent bonds* form when the electronegativity difference between two bonding atoms is between 0.6 and 1.7.

Which of the following combinations would form a polar covalent bond?H and HNa and NH and NH and N

103. *Ionic bonds* form when the electronegativity difference between two bonding atoms is *greater than* 1.7.

104. Substances containing mostly covalent bonds are called *molecular substances*.

They are attracted to each other by weak van der Waals or stronger hydrogen attractions *Which of the following is a molecular substance?* 

*Lithium chloride* carbon monoxide sodium nitrate aluminum oxide

- 105. **Van der Waals** attractive forces are the attractive force between nonpolar molecules. Nonpolar molecules are molecules that have structural symmetry.
- 106. **Van der Waals** attractions become stronger with increasing molar mass. *Which of the following samples has the greatest forces of attraction?*

$F_2$	$Cl_2$	$Br_2$	$I_2$
=	=	-	-

107. Polar molecules have stronger forces of attraction. The lack structural symmetry.

Which of the following is a polar molecule?

 $CO_2$   $H_2O$   $C_4H_{10}$   $N_2$ 

108. *Hydrogen bonds* are attractive forces that form when hydrogen bonds to the elements N, O, or F and gives the compound unexpectedly high melting and boiling points.

The strongest forces of attraction occur between molecules of HCl HBr HF HI

109. Substances containing mostly ionic bonds are called *ionic compounds*. They are made of metal and nonmetallic ions. They are held together by electrostatic (ionic) forces.

110. Complete and memorize this table.

Substance Type	Properties	
	Hard	
Ionic	(Low/high) melting and boiling points	
	Conduct electricity when molten or aqueous	
	Soft	
Covalent (Molecular)	(Low/high) melting and boiling points	
	Do not conduct electricity (insulators)	

111. Remember: substances tend to be soluble in solvents with similar molecular properties. "Like dissolves like"

Pentane does not dissolve in water because pentane is ...... and water is ......

112. As temperature increases, solubility increases for most solids.

For which solid does increasing temperature have the least effect on solubility? Potassium nitrate ammonium chloride potassium chlorate sodium chloride