Please Print your Name: KEY

- **The EXAM is closed book & notes. CSUS operates on the honor system. All works must be clearly shown for credit. If we can't read it, we won't grad it. Good luck!**

1) Calculate the <u>empirical formula</u> and <u>molecular formulas</u> of a compound that contains 80.0% C, 20.0& H, and has a molar mass of 30.00? (**6 pts**) **{CH7 }**
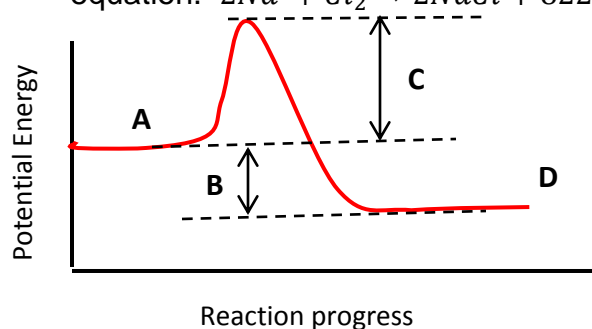
$$\frac{80\ g}{12\ g/mol} = 6.67\ mol\ C \qquad\qquad \frac{20\ g}{1.01\ g/mol} = 19.8\ mol\ H \qquad \frac{6.67}{6.67} =$$

$$1\ C\ ; \qquad \frac{19.8}{6.67} = 2.96\ H$$

$$CH_3 \quad ; \quad molar\ mass = 15$$

$$n= \frac{30.00}{15} = 2 \qquad C_2H_6$$

2) For the following reaction, labels the part of the graph with information from the chemical equation. $2Na + Cl_2 \rightarrow 2NaCl + 822\ kJ$ (**5 pts**) **{CH8}**

Potential Energy

C

A

B

D

Reaction progress

A) Na + Cl

B) 822 kJ heat

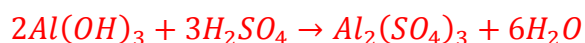C) Activation Energy

D) NaCl

Is this reaction Exothermic or Endothermic?   Exothermic

3) When aluminum hydroxide is mixed with sulfuric acid, the products are aluminum sulfate and water. Write a balance equation for this reaction.(**4 pts**) **{CH8}**

$$2Al(OH)_3 + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 6H_2O$$

4) How many grams of silver nitrate are required to produce 0.25 mol of silver sulfide? The balanced equation is: **(5 pts)** {CH8}

$$2AgNO_3 + H_2S \rightarrow Ag_2S + 2HNO_3$$

$2\ mol\ AgNO_3 \propto 1\ mol\ Ag_2S$
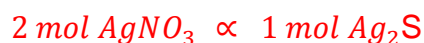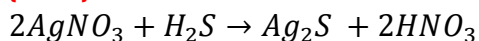
$$0.25\ mol \times \frac{2\ mol\ AgNO_3}{1\ mol\ Ag_2O} = 0.50\ mol\ AgNO_3$$

$mass\ of\ AgNO_3 = 0.5\ mol \times 169.87 \frac{g}{mol} = 85.\ g$

5) Write the electron configuration for Tin (Sn). **(3pts)** **{CH10}**

$$[Kr]4s^{10}5s^25p^2$$

6) Put in the order the following element based on their relative atomic radii.(**2 pts) {CH11}**

Na, Cs, O, C   Cs > Na > C > O

7) Which of these compounds would you predict to be ionic and which would be covalent? (**4 pts) {CH11}**

$SrCl_2$	PCl_5	NH_3	LiCl
Ionic	Covalent	Covalent	ionic

8) Predict the molecular shape: (**12 pts){CH11}**

Molecule	Lewis Structure	Number of electron pairs	Electron Pair geometry	Molecular geometry
CF_4			Tetrahedral	Tetrahedral
NF_3			Tetrahedral	Trigonal Pyramidal
BeI_2			Linear	Linear

9) A gas with a mass of 86 g occupies 5.00 L at 25.0 °C and 3.00 atm pressure. What is the molar mass of the gas? (**5 pts) {CH12}**

$$P \cdot V = \left(\frac{mass}{molar\ mass}\right) \cdot R \cdot T$$

$$molar\ mass = \left(\frac{mass}{P \cdot V}\right) R \cdot T$$

$$molar\ mass = \left(\frac{86}{3 \times 5.00}\right) \times 0.0821 \times 298.2 = 1.4 \times 10^2\ {}^g/_{mol}$$

10) What is the density of oxygen, O_2, in g/L at 25.0 °C and 0.85 atm? Assume O2 is an ideal gas.   (**5 pts) {practice}**

$$P \cdot V = \frac{mass}{molar\ mass} \cdot R \cdot T$$

$$P \cdot (molar\ mass) = \frac{mass}{V} \cdot R \cdot T$$

$$P \cdot (molar\ mass) = d \cdot R \cdot T$$

d= 1.11 g/L

11) A 128 g of solid carbon dioxide (dry ice) sublimates into CO_2 gas. How many liters of gas are formed at STO? (**5 pts) {practice}**

Mole of carbon dioxide $= \frac{mass}{molar\ mass} = 2.91\ mol$

$$2.91\ mol\ \times \frac{22.4\ L}{mol} = 65.1\ L/mol$$

12) The property of water whereby molecules tend to stick to objects is called: **(4 pts)**
  a. cohesion.
  b. surface tension.
  c. dissolving ability.
  d. adhesion.
  e. viscosity

3

13) Write the formula for: (**4 pts**)

Compound	Formula
Chromium(III) nitrate nona hydrate	$Cr(NO_3)_3 \cdot 9H_2O$
Platinum(IV) oxide trihydrate	$PtO_2 \cdot 3H_2O$

14) How much energy would it take to melt 30.0 g of ice at 0 °C and warm the resulting liquid to 35.0 °C? (**6 pts**)　　　　　$q_f = m \cdot K_f = \mathbf{30.0\,g \times 333.55 = 10006.5\,J}$

a) 4.39 KJ　　　　　　　　　　　$q = m \cdot c . \Delta T = \mathbf{30.0\,g \times 4.18\,(35.0 - 0.0) = 4389\,J}$

b) 10.0 KJ　　　　　　　　　　　　　　$q_{total} = 10006.5 + 4389 = 14395.5\,J$

c) 14.4 KJ　　　　　　　　　　　　　　$q_{total} = 14.4\,KJ$
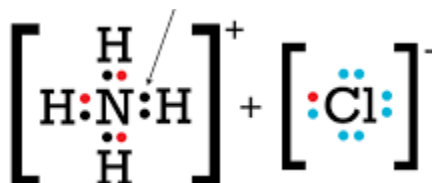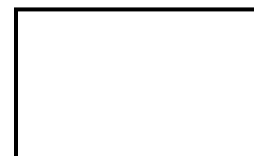
d) 4400 KJ

e) None of these are correct.

333.55 J/g (heat of fusion of ice)
The specific heat of water is 4.18 J/ (g·°C)

15) Determine whether each of the following atoms will form a nonpolar covalent compound or a polar covalent compound, and give the formula of the compound. (**4 pts**)

a) 2 oxygen　　　　　　　　O_2 : non-polar

b) Hydrogen and bromine　　　HBr : polar

c) Oxygen and 2 hydrogen　　H_2O : polar
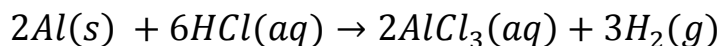
d) 2 iodine　　　　　　　　　I_2: non-polar

16) Draw Lewis structures for the following: (**4 pts**)

a) CS₂

$$\ddot{\underset{..}{S}} = C = \ddot{\underset{..}{S}}$$

$$\left[\begin{array}{c} \overset{\text{H}}{\underset{\text{H}}{\text{H:N:H}}} \end{array} \right]^{+} + \left[:\ddot{\underset{..}{Cl}}: \right]^{-}$$

b) NH₄Cl　　(Ionic compound)

4

17) A 1.00 L sample of dry air at 25.0 °C and 786 mmHg contains 0.925 g of N2, plus other gases. What is the partial pressure of N_2 in the air sample? (**4 pts**)

$$P_{N_2} = \frac{(0.330\ mol)(0.0821)(298)}{1.00\ L} = 0.807\ atm$$

18) In the following reaction:

$$2Al(s) + 6HCl(aq) \rightarrow 2AlCl_3(aq) + 3H_2(g)$$

If 35.5 mL of H2 gas is collected over water at 26.0 °C and a barometric pressure of 755 mmHg, how many moles of HCl must have been consumed? (The vapor pressure of water at 26.0 °C is 25.2 mmHg). (**6 pts**)

$$P_{bar} = P_{H_2} + P_{H_2O}$$

$$P_{H_2} = 730\ mm\ Hg$$

$$P_{H_2} = 730\ mm\ Hg \times \frac{1\ atm}{760\ mm\ Hg} = 0.961\ atm$$

$$n = \frac{(0.961\ atm)(0.0355\ L)}{(0.0821)(299)} = 0.00139\ mol\ \ hydrogen\ gas$$

$$0.00139\ mole\ of\ H_2 \times \frac{6\ mol\ HCl}{3\ mol\ H_2} = 2.78 \times 10^{-3}\ mol\ of\ HCl$$

19) IF we assume that there are 6.1 billion people on the earth, how many moles of people is this? (**4 pts**)

$$6.1 \times 10^9 \times \frac{mol}{6.022 \times 10^{23}} = 1.0 \times 10^{-14}\ \ mol$$

20) How many atoms are contained in 1.25 g K? (**4 pts**)

$$1.25\ g \times \frac{1\ mol}{39.098\ g} \times \frac{6.022 \times 10^{23}\ atoms}{1\ mol} = 1.93 \times 10^{22}\ \ atoms$$

21) Calculate the partial pressure of H_2 at 20ºC when the vapor pressure of water is 17.5torr. The total pressure of the gases is 750 torr. (**4 pts**)

$P_{total} = P_{H2O} + P_{H2}$
750torr = 17.5torr + P_{H2}
P_{H2} = 732torr