Name: ____________________________

1. Convert 3.070×10^{-5} L to mL.

2. Convert 88.42 °C to K.

3. What is the charge on a single proton?

4. Give the symbol and name for the element with 18 protons. How many neutrons and electrons?

5. A liquid has a volume of 2.4 mL and a mass of 3.602 g. Calculate its density. Is it more or less dense than pure water?

6. Carbon has 2 naturally occurring isotopes: carbon-12 weighing 12.000 amu (98.90%), and carbon-13 weighing 13.034 amu (1.10%). Calculate the average atomic mass of carbon.

7. List 2 examples of pure substances.

8. List 2 examples of physical changes.

9. List 2 examples of a heterogeneous mixture.

10. Carbon tetrachloride (CCl_4) has a melting point of -22.9 °C and a boiling point of 76.6 °C. What is the state of pure CCl_4 at 94.0 °C?

11. Write the name and molecular formula for an ionic compound of the elements bromine and barium.

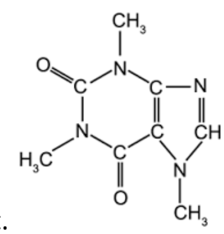
12. A piece of metal weighs 22.834 g. The metal is heated from 1.5 °C to 70.2 °C. How much energy is gained by the metal upon heating if it has a heat capacity c_p = 0.44 J/°C g?

$$\Delta H = m\, c_p\, \Delta T$$

Name: ______________________________

13. Give the chemical formula for:
    a. magnesium chloride
    b. iron (III) oxide
    c. silver chloride
    d. sodium hydroxide
    e. sulfuric acid

14. Name the following compounds:
    a. NaBr
    b. FeO
    c. $BaSO_4$
    d. $Mg(OH)_2$
    e. HCl (aq)



15. Write the molecular formula for caffeine, shown to the right.

16. Give 2 examples of diatomic molecules.

17. Are diatomic molecules polar or nonpolar?

18. Circle the **reducing agent** in the following redox reactions:

a. $2\ Fe\ (s) + O_2\ (g) \rightarrow 2\ FeO\ (s)$

b. $Cu\ (s) + 2\ Ag^{+}\ (aq) \rightarrow Cu^{2+}\ (aq) + 2\ Ag\ (s)$

c. $Mg\ (s) + Cl_2\ (g) \rightarrow 2\ MgCl_2\ (s)$

19. Indicate whether the following reactions are precipitation, neutralization, or redox.

____________ a. $Fe\ (s) + Cu^{2+}(aq) \rightarrow Fe^{2+}(aq) + Cu\ (s)$

____________ b. $2\ NaOH\ (aq) + MgCl_2\ (aq) \rightarrow Mg(OH)_2\ (s) + 2NaCl\ (aq)$

____________ c. $Mg(OH)_2\ (aq) + H_2SO_4\ (aq) \rightarrow MgSO_4\ (aq) + 2\ H_2O\ (l)$

Name: ___________________________

20. Give the oxidation number for carbon in the following:

a. C (s) ____

b. H_2CO (l) ____

c. H_2CO_3 (l) ____

d. CO_3^{2-} (aq) ____

e. CBr_4 (l) ____

21. Predict whether the following covalent bonds are polar or non-polar using electronegativity difference:

a. H-Cl ____

b. H-C ____

c. H-S ____

d. H-H ____

22. Determine the limiting reactant when 19.3 g propane (C_3H_8) is burned in the presence of 70.8 g oxygen gas using the balanced combustion equation below. What is the theoretical yield of CO_2 in grams? What is the percent yield if an experiment produced 99.6 g of CO_2? Show your work, and write your answers below.

$$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$$

Limiting reactant: __________

Theoretical yield: __________

Percent yield: __________

Name: ___________________________

23. Give the complete and net ionic equations.

Molecular equation: $AgNO_3\ (aq)\ +\ HCl\ (aq)\ \rightarrow\ AgCl\ (s)\ +\ HNO_3\ (aq)$

Complete Ionic equation:

Net ionic equation:

24. Give Lewis structures, molecular geometry (shape), and indicate if resonance structures exist for the following:

	Lewis structure	shape	resonance?
a. Cl_2			
b. CO_2			
c. NH_3			
d. NO_3^-			
e. H_3O^+			
f. H_2O			
g. OH^-			

Name: ___________________________

25. Use the below expression for Gibbs Free Energy ΔG to determine if carbon dioxide (CO_2) will spontaneously boil at 273 K. For CO_2, ΔH_{vap} = 15.326 kJ/mol and ΔS_{vap} = 70.8 J/mol·K. Show a calculation for ΔG.

$$\Delta G = \Delta H - T\Delta S$$

ΔG = ____________

spontaneous at 373K? ______

26. 3. Draw a reaction diagram (energy vs. time) for an exothermic reaction that releases 10 kJ of energy and has an activation energy of 5 kJ. Label the reactants, products, activation energy, enthalpy change, and both axes.

27. Use the Le Chatlier principle to predict the effects on the below equilibrium.

$CO_2\ (g)\ +\ H_2O\ (l)\ \rightleftarrows\ H_2CO_3\ (aq)\ +\ \text{heat}$

shift: left/right/none? **CO_2 increases/decreases/stays the same?**

a. increase H_2O

b. decrease H_2o

c. increase H_2CO_3

d. increase temperature

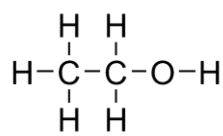
e. increase pressure

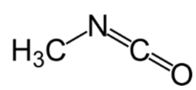
Name: ___________________________

28. Indicate the strongest intermolecular force (IMF) for the following as pure liquids. Choices are dipole-dipole interactions, London dispersion forces, and hydrogen bonding.

a. hexadecane ($C_{16}H_{34}$) ________________

b. water (H_2O) ________________

c. ethanol (CH_3CH_2OH)  _______________

d. methyl isocyante (CH_3NCO)  ________________

e. diatomic chlorine (Cl_2) Cl-Cl ________________

f. ammonia (NH_3) ________________

g. formaldehyde (CH_2O) ________________

29. Use the concept of IMFs to explain the low boiling point of helium, a noble gas, in 1-3 sentences.

30. Convert the pressure of 550 mm Hg into the unit atm.

Pressure = ____________

Name: ________________________

31. A sample of air has a pressure of 843 mm Hg. The oxygen mole percent is 21%. Calculate the partial pressure of oxygen in mm Hg.

P_{O2} = ____________

32. How much energy is gained/released when 15.2 g of ice melts to form water given ΔH_{fus} = 333 J/mol? Show the correct sign and number of significant figures.

ΔH =___________

33. Use PV = nRT to calculate the number of moles of gas occupying a volume of 25.4 L at a pressure of 721 mm Hg and a temperature of 50 °C. Use R = 0.0821 L·atm/ mol·K.

n = _____________

34. What is the concentration in units of molarity (M) for 2.84 L of aqueous solution containing 10.3 g of dissolved HCl?

Name: ___________________________

35. Provide the equilibrium reaction between formic acid (HCOOH) and formate ion ($HCOO^-$) in water. Label the Lewis acid/base and conjugate base/acid.

36. What is the pH of a solution with $[H^+] = 3 \times 10^{-4}$ M?

37. What is the $[H^+]$ of a solution with pH = 3.6?

38. A titration experiment uses 40.60 mL of 0.205 M of magnesium hydroxide $Mg(OH)_2$ to neutralize 50.00 mL of hydrochloric acid (HCl). What is the concentration of the acid?

$$N_{acid}V_{acid} = N_{base}V_{base}$$

39. Complete the following nuclear reactions for alpha emission:

$$^{238}_{92}U \rightarrow \, ^{4}_{2}He + \ ?$$

Name: ___________________________

Table of solubility guidelines for ionic compounds.

Soluble	Exceptions
Ammonium compounds (NH^+_4)	None
Lithium compounds (Li^+)	None
Sodium compounds (Na^+)	None
Potassium compounds (K^+)	None
Nitrates (NO^-_3)	None
Perchlorates (ClO_4^-)	None
Acetates ($CH_3CO_2^-$)	None
Chlorides (Cl^-)	Ag^+, Hg_2^{2+}, and Pb^{2+} compounds
Bromides (Br^-)	
Iodides (I^-)	
Sulfates (SO_4^{2-})	Ba^{2+}, Hg_2^{2+}, and Pb^{2+} compounds

Name: ___________________________

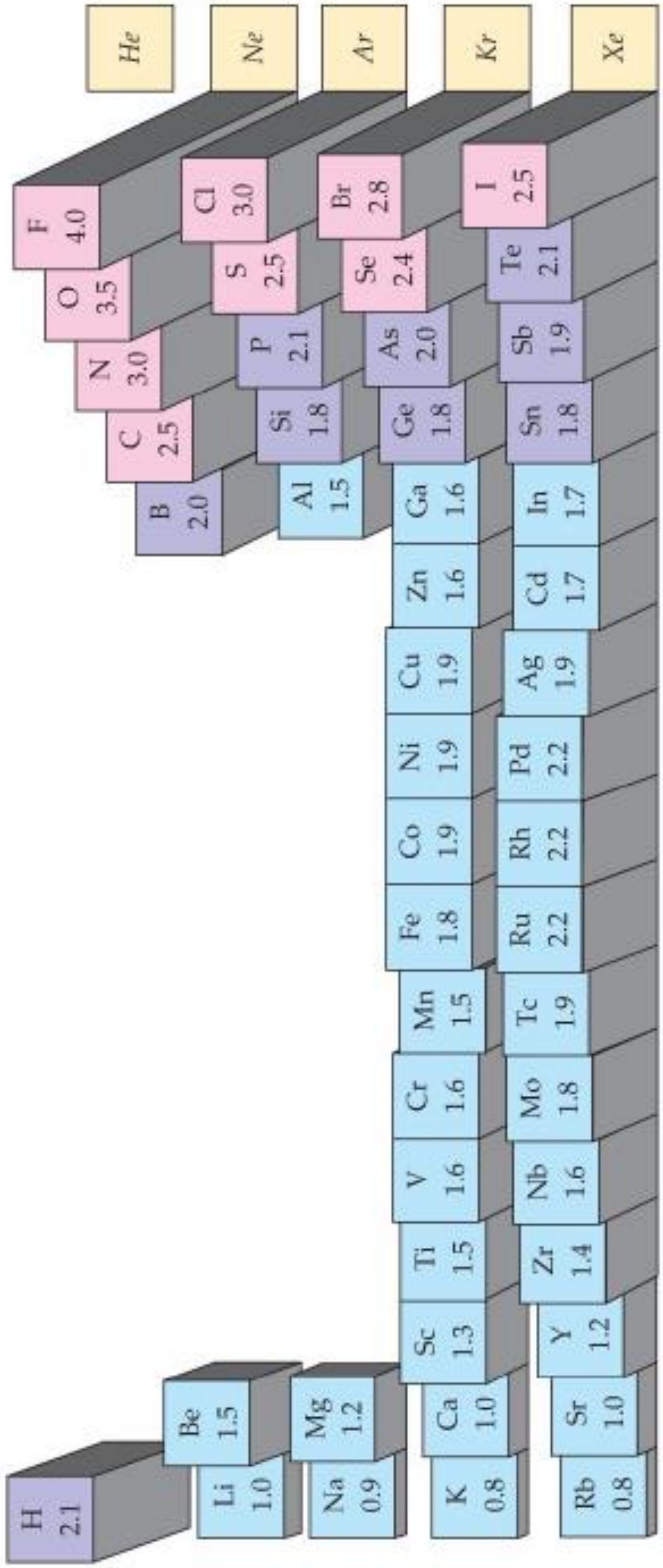


Table of Pauling electronegativity values.

Name: ___________________________

Periodic Table of the Elements

1 — atomic number
H — symbol
1.008 — atomic weight

1 H 1.008																	2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57–71*	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89–103‡	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 Ds (271)								

Numbers in parentheses are atomic mass numbers of radioactive isotopes.

*lanthanide series	57 La 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
‡actinide series	89 Ac (227)	90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)