Please read all the questions VERY carefully before answering. Ask your instructor if you do not understand. No outside paper is allowed. The last page is a periodeic table with constants. Total points = 53 + (25 * 3 =) 75 = 128

SHORT ANSWER. Please write the set-up equation first, then put the raw data with units before calculating. Write the word or phrase that best completes each statement or answers the question.

1) In the reaction between Fe_2O_3 (s) and Al (s) to produce Fe (s) and Al_2O_3 (s), 23.5 g of Fe_2O_3 was reacted with 13.2 g of Al. (a) Show all your calculations to find out the limiting reagent (8 pts.) 1) _____

(b) [EXTRA POINT QUESTION}
Calculate the amount (in grams) of the reagent that remained unreacted (6 pts.)

2) Iron, Fe(s) reacts with oxygen gas, $O_2(g)$ to produce Fe_2O_3 (s). Calculate how many grams of (a) Fe and (b) O are necessary to make 23.7 g of Fe_2O_3 (4 pts. each, total 8 pts) 2) _____

3) Write the net-ionic equation for the following reactions: Include phase labels for both reactants and products. Also classify each reaction, giving its type. (4 pts/each; 8 pts. tot) 3) _____

a. $2Na(s) + 2H_2O(l) \text{ -----> } 2NaOH(aq) + H_2(g)$
Net Ionic Equation: Reaction Type:

b. $2HC_2H_3O_2(aq) + Ba(OH)_2(aq) \text{ -----> } Ba(C_2H_3O_2)_2(aq) + 2H_2O(l)$
Net Ionic Equation: Reaction Type:

4) Draw the complete ground state electron configuration for (4 pts./each; Total = 8pts.) 4) _____
(a) Potassium (K; Z=19):

(b) Cobalt (Co; Z=27)

5) Using only periodic table, 5) _____
(a) List atomic numbers 15, 16, 33 in order of increasing atomic size (6 pts.)

(b) List elements Be, N, F in order of increasing first ionic ionization energy (6 pts.)

6) A monoatomic ion with a charge of 1- has an electronic configuration of $1s^2 2s^2 2p^6 3s^2 3p^6$. 6) _____

(a) Circle the correct answer: It is a CATION/ It is an ANION (3pts.)

(b) Write the name and the symbol of the noble gas it is isoelectronic with(3 pts.)

(c) What is the symbol of the ion ? (3 pts.)

7) Using an arrow, indicate the direction of electron polarity of the following bonds (2 pts each) 7) _____

(a) Te--Se

(b) O--Te

(c) Draw the structure of the bond that is expected to be most polar:

8) (a) Calculate how many grams of anhydrous magnesium sulfate is in 63.6 grams of its hydrate salt . The hydrate salt contains 51.1% water by weight. (3 pts.) 8) _____

(b) Calculate how many grams of water is in the 63.6 grams of the magnesium sulfate hydrate salt (3 pts.)

MULTIPLE CHOICE. On the scantron, fill up the circle with the same number as the question number. Choose the one alternative that best completes the statement or answers the question (3 pts each).

9) A precipitate is expected to be formed when an aqueous solution of sodium sulfate is added to an aqueous solution of 9) _____
   A) potassium chloride.
   B) magnesium chloride.
   C) barium chloride.
   D) iron(III) chloride.
   E) none of the above

10) What type of a reaction occurs when a sodium hydroxide solution is mixed with an acetic acid solution? 10) _____
   A) gas evolution
   B) acid-base neutralization
   C) precipitation
   D) oxidation-reduction
   E) no reaction

11) How many eggs are needed to make 1 dozen waffles, assuming you have enough of all other ingredients? 11) _____
   Given: 2 cups flour + 3 eggs + 1 tbs oil $\rightarrow$4 waffles
   A) 48
   B) 12
   C) 9
   D) 16
   E) not enough information

12) What is the theoretical yield of a reaction if 25.0 grams of product were actually produced from a reaction that has a 88% yield? 12) _____
   A) 28.4
   B) 352
   C) 22.0
   D) 3.52
   E) none of the above

13) What is the limiting reactant for the following reaction given we have 2.6 moles of HCl and 1.4 moles of $Ca(OH)_2$? 13) _____
   Reaction: $2HCl + Ca(OH)_2 \rightarrow 2H_2O + CaCl_2$
   A) $CaCl_2$
   B) $Ca(OH)_2$
   C) HCl
   D) H_2O
   E) not enough information

14) Which of the following types of compounds will NOT undergo a gas evolution reaction when acid is added? 14) _____

A) carbonates
B) bisulfites
C) sulfides
D) hydroxides
E) none of the above

15) How many moles of H_2 can be made from complete reaction of 3.0 moles of Al? 15) _____

Given: $2\ Al + 6\ HCl \rightarrow 2\ AlCl_3 + 3\ H_2$

A) 9.0 moles
B) 3.0 moles
C) 3 moles
D) 4.5 moles
E) none of the above

16) The principal quantum number (n): 16) _____

A) specifies the subshell of the orbital.
B) specifies the 3-D shape of the orbital.
C) specifies the principal shell of the orbital.
D) specifies the maximum number of electrons.
E) none of the above

17) How many subshells are there in the n = 4 principal shell? 17) _____

A) 1
B) 4
C) 2
D) 3
E) not enough information

18) The "d" subshell can hold a maximum of _____ electrons. 18) _____

A) 5
B) 6
C) 10
D) 2
E) none of the above

19) How many electrons are unpaired in the orbitals of carbon? 19) _____

A) 6
B) 12
C) 2
D) 4
E) none of the above

20) What is the electron configuration for Ga? 20) _____

A) $1s^2 2s^2 2p^6 3s^2 3p^5 3d^{10} 4s^2 4p^1$
B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^1$
C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^1$
D) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$
E) none of the above

21) What is the correct Lewis structure for N_2? 21) _____

A) :N ≡ N:

B) :N - N:

C) :N ≡ N:

D) N - N

E) none of the above

22) Which sequence below represents the proper order of increasing bond strength? 22) _____

A) triple < double < single

B) double < single < triple

C) single < triple < double

D) single < double < triple

E) none of the above

23) When a nonmetal bonds with a nonmetal 23) _____

A) a covalent bond is involved.

B) electrons are shared.

C) a molecular compound forms.

D) all of the above are true

E) none of the above

TRUE/FALSE. On the scantron, fill up circle "A" for a true answer and "B" for wrong answer (3 pts each).

24) The reaction of baking soda and vinegar to produce carbon dioxide gas is an example of a precipitation reaction. 24) _____

25) The formation of a gas is evidence of a chemical reaction while the emission of light is not. 25) _____

26) Mixing two aqueous solutions will always result in formation of a precipitate. 26) _____

27) A photon of red light contains the same amount of energy as a photon of blue light. 27) _____

28) Wavelength of visible light determines color. 28) _____

29) The possible values for the principal quantum numbers are: n = 0, 1, 2, 3, 4. 29) _____

30) Li : is the proper Lewis structure (dot structure) for lithium. 30) _____

31) The Lewis structure of oxygen should have 8 valence electrons. 31) _____

32) The correct Lewis structure for potassium in KCl is: K^+. 32) _____

33) The Lewis structure of water has two sets of lone pair electrons. 33) _____