

Please read all the questions VERY carefully before answering. If you do not understand any question, please ask. Use the reverse side of the question paper as scratch. Use the periodic table and constant chart in the last page. No outside paper is allowed. Total points =  $52 + (26 \times 3) = 78 + 52 = 130$

SHORT ANSWER. Please write the set-up equation first, then insert the raw data with units in the equation before doing your calculations. Points will be deducted if your answer is not clear.

1) A fictional element has three isotopes with their natural abundances shown as:

1) \_\_\_\_\_

MASS (amu)	ABUNDANCE
22.1760	45.00%
23.1847	45.00%
24.1934	10.00%

Show your calculation to determine the atomic mass of the element. (8 pts.)

2) Calculate the number of atoms in 39.7 g iodine (Note the formula of Iodine). (6 pts.)

2) \_\_\_\_\_

3) Write the formula for (2 pts. each; Total 6 pts.):

3) \_\_\_\_\_

(a) Aluminum chromate:

(b) Tin (II) hydrogen sulfate:

(c) Diiodine tetrasulfide:

4) Calculate the amount (in grams) of phosphorous in a 15.5 gram sample of diphosphorous pentoxide. (10 pts.) 4) \_\_\_\_\_

5) An acid has 40% C, 6.7% H, 53.3% O and its molar mass is 60.05 g/mol. Show your calculation to find the molecular formula of the acid? (10 pts.) 5) \_\_\_\_\_

6) Write the name next to the formula for (2 pts. each; Total 6 pts.): 6) \_\_\_\_\_

(a)  $\text{Cu}(\text{HSO}_3)_2$ :

(b)  $\text{Cr}_2(\text{CrO}_4)_3$ :

(c)  $\text{Sr}(\text{BrO}_4)_2$ :

7) If a mixture of salt and sand contained 45.9% salt then calculate the amount of sand present in 25.68 g of the mixture (6 pts.) 7) \_\_\_\_\_

MULTIPLE CHOICE. On scantron, answer the questions starting from number 8. Choose the one alternative that best completes the statement or answers the question. (3 points each)

8) What is the mass percent of chlorine in hydrochloric acid? 8) \_\_\_\_\_  
A) 35.5  
B) 70.1  
C) 97.2  
D) 2.8  
E) none of the above

9) How many of each type of atom are there in the formula  $(\text{NH}_4)_2\text{HPO}_4$ ? 9) \_\_\_\_\_  
A) N = 2, H = 8, P = 1, O = 4  
B) N = 2, H = 9, P = 1, O = 4  
C) N = 1, H = 5, P = 1, O = 4  
D) N = 2, H = 5, P = 1, O = 4  
E) none of the above

10) Which among the following elements does NOT exist as a diatomic molecule in nature? 10) \_\_\_\_\_  
A) nitrogen  
B) fluorine  
C) hydrogen  
D) neon  
E) none of the above

11) Carbon monoxide is considered which of the following? 11) \_\_\_\_\_  
A) atomic element  
B) molecular compound  
C) molecular element  
D) ionic compound  
E) none of the above

12) What is the formula for an ionic compound made of barium and nitrogen? 12) \_\_\_\_\_  
A)  $\text{Ba}_2\text{N}_3$   
B)  $\text{BaN}$   
C)  $\text{Ba}_2\text{N}_4$   
D)  $\text{Ba}_3\text{N}_2$   
E) none of the above

13) What is the formula for an ionic compound made of carbon and oxygen? 13) \_\_\_\_\_  
A)  $\text{CO}_2$   
B)  $\text{C}_2\text{O}$   
C)  $\text{CO}_3$   
D)  $\text{CO}$   
E) Carbon and oxygen do not form an ionic compound.

- 14) Which formula shown is incorrect for the name given? 14) \_\_\_\_\_  
A) aluminum sulfate:  $\text{Al}_2(\text{SO}_4)_3$   
B) sodium hydrogen carbonate:  $\text{NaHCO}_3$   
C) potassium hydroxide:  $\text{KOH}$   
D) calcium carbonate:  $\text{CaCO}_3$   
E) magnesium nitrite:  $\text{Mg}(\text{NO}_2)_3$
- 15) What is the formula mass for diboron tetrachloride? 15) \_\_\_\_\_  
A) 198.89 amu  
B) 163.43 amu  
C) 127.98 amu  
D) 234.34 amu  
E) none of the above
- 16) You have 10.0 g each of Na, C, Pb, Cu and Ne. Which contains the smallest number of moles? 16) \_\_\_\_\_  
A) Ne                      B) Na                      C) Pb                      D) C                      E) Cu
- 17) How many moles of carbon are in 3.5 moles of calcium carbonate? 17) \_\_\_\_\_  
A) 7  
B) 3.5  
C) 100.09  
D) 10.5  
E) none of the above
- 18) Determine the empirical formula of a compound containing 83% potassium and 17.0% oxygen. 18) \_\_\_\_\_  
A)  $\text{K}_2\text{O}$   
B)  $\text{KO}$   
C)  $\text{K}_2\text{O}_3$   
D)  $\text{KO}_2$   
E) none of the above
- 19) What are the coefficients for the following reaction when it is properly balanced? 19) \_\_\_\_\_  
 $\text{___Na}_3\text{PO}_4 + \text{___Ba}(\text{NO}_3)_2 \rightarrow \text{___NaNO}_3 + \text{___Ba}_3(\text{PO}_4)_2$   
A) 6, 1, 3, 2  
B) 2, 3, 6, 1  
C) 2, 3, 1, 6  
D) 2, 1, 1, 3  
E) none of the above
- 20) When the equation  $\text{___Ca}_3\text{N}_2 + \text{___H}_2\text{O} \rightarrow \text{___Ca}(\text{OH})_2 + \text{___NH}_3$  is balanced, the coefficient of  $\text{H}_2\text{O}$  is: 20) \_\_\_\_\_  
A) 12  
B) 2  
C) 3  
D) 6  
E) none of the above

- 21) If you had an aqueous mixture that contained  $\text{Ag}^+$ ,  $\text{K}^+$ , and  $\text{Pb}^{+2}$  cations, how many different solids could precipitate if a chloride solution was added? 21) \_\_\_\_\_
- A) 4
  - B) 2
  - C) no solids will precipitate
  - D) 3
  - E) 1
- 22) A precipitate is expected to be formed when an aqueous solution of sodium sulfate is added to an aqueous solution of 22) \_\_\_\_\_
- A) iron(III) chloride.
  - B) potassium chloride.
  - C) barium chloride.
  - D) magnesium chloride.
  - E) none of the above
- 23) What type of reaction is the generic equation  $\text{AB} + \text{CD} \rightarrow \text{AD} + \text{CB}$ ? 23) \_\_\_\_\_
- A) double-displacement
  - B) decomposition
  - C) synthesis/combination
  - D) single displacement
  - E) none of the above
- 24) What type of a reaction occurs when a silver nitrate solution is mixed with sodium chloride solution? 24) \_\_\_\_\_
- A) acid-base neutralization
  - B) oxidation-reduction
  - C) gas evolution
  - D) precipitation
  - E) no reaction
- 25) What is the molecular equation for the reaction of hydrochloric acid with potassium hydroxide? 25) \_\_\_\_\_
- A)  $\text{HCl} + \text{KOH} \rightarrow \text{H}_2\text{O} + \text{KCl}$
  - B)  $2\text{HCl} + \text{K}(\text{OH})_2 \rightarrow 2\text{H}_2\text{O} + \text{KCl}_2$
  - C)  $\text{H}_2\text{Cl} + 2\text{KOH} \rightarrow \text{H}_2\text{O} + 2\text{KCl}$
  - D)  $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
  - E) none of the above
- 26) What type of a reaction occurs when a hydrochloric acid solution is mixed with a sodium bicarbonate solution? 26) \_\_\_\_\_
- A) precipitation
  - B) gas evolution
  - C) acid-base neutralization
  - D) oxidation-reduction
  - E) no reaction

- 27) Identify the double displacement reactions among the following: 27) \_\_\_\_\_
1.  $\text{KCl(aq)} + \text{AgNO}_3\text{(aq)} \rightarrow \text{AgCl(s)} + \text{KNO}_3\text{(aq)}$
  2.  $\text{Na}_2\text{SO}_4\text{(aq)} + \text{BaCl}_2\text{(aq)} \rightarrow \text{BaSO}_4\text{(s)} + 2\text{NaCl(aq)}$
  3.  $\text{H}_2\text{SO}_4\text{(aq)} + 2\text{NaOH(aq)} \rightarrow \text{Na}_2\text{SO}_4\text{(aq)} + 2\text{H}_2\text{O(l)}$
- A) 1 and 3 only  
B) 2 and 3 only  
C) 1 and 2 only  
D) All of 1, 2, and 3  
E) None of 1, 2, and 3

TRUE/FALSE. On scantron, choose "A" for a true answer and "B" for wrong answer. (3 points each)

- 28) The mass of 2.0 moles of  $\text{H}_2\text{O}$  is greater than the mass of 1.0 mole of  $\text{CO}_2$ . 28) \_\_\_\_\_
- 29) One mole of chlorine gas has a mass of 35.45 grams. 29) \_\_\_\_\_
- 30) The reaction of carbonate ion with magnesium ion to form solid magnesium carbonate is an example of an oxidation reduction reaction. 30) \_\_\_\_\_
- 31) The subscripts in a chemical formula represent the relative mass of each atom in a chemical compound. 31) \_\_\_\_\_
- 32) The molar mass of a compound serves as a conversion factor between grams and moles. 32) \_\_\_\_\_
- 33) An empirical formula gives the specific number of each type of atom in a molecule. 33) \_\_\_\_\_