Part 1: Knowledge/Understanding (/21)

**Multiple Choice (/8):** For each question, select the best choice from the four options.

1. Which of the following is evidence of a chemical change occurring?
   (a) Energy is released or absorbed.
   (b) A precipitate forms.
   (c) A gas is produced.
   (d) All of the above.

2. Which of the following compounds has a name that ends in –ate?
   (a) NaNO₃
   (b) KOH
   (c) CaO
   (d) N₂O

3. Which of the following is an ionic compound?
   (a) NH₃
   (b) PbSO₄
   (c) C₆H₁₂O₆
   (d) OCl₂

4. Which of the following compounds has a prefix in its name?
   (a) PbO₂
   (b) Ba(OH)₂
   (c) P₂O₃
   (d) Al₂O₃

5. What is the ending of the name of the compound with the formula Na₂SO₄?
   (a) -ane
   (b) -ate
   (c) -ide
   (d) –ite
6. Based on their locations in the periodic table, which combination of elements most often forms ionic compounds?
(a) an element from period 1 combined with an element from period 2
(b) an element from period 1 combined with an element from period 7
(c) an element from group 1 combined with an element from group 17
(d) an element from group 17 combined with an element from group 18

7. Which of these chemical equations is balanced?
(a) \(H_3PO_4(aq) + NaOH(aq) \rightarrow Na_3PO_4(aq) + H_2O(l)\)
(b) \(H_3PO_4(aq) + 3 NaOH(aq) \rightarrow Na_3PO_4(aq) + H_2O(l)\)
(c) \(H_3PO_4(aq) + 3 NaOH(aq) \rightarrow Na_3PO_4(aq) + 3 H_2O(l)\)
(d) \(H_3PO_4(aq) + 2 NaOH(aq) \rightarrow Na_3PO_4(aq) + 2 H_2O(l)\)

8. The equation for the reaction of silver nitrate and copper is
\(2 AgNO_3 + Cu \rightarrow 2 Ag + Cu(NO_3)_2\)

(a) Synthesis
(b) Decomposition
(c) Single displacement
(d) Double displacement

**Fill in the blanks (1/4)**

9. A __________________ change is a change that involves the formation of a new substance.

10. A change of state, such as melting, is a __________________ change.

11. The substances found on the right-hand side of a chemical equation are called the ____________________.

12. Atoms tend to form bonds to achieve electron arrangements like those of Group ____________________ elements.
True or False (/4)

13. An ionic bond will form between two elements that are non-metals.

14. The law of conservation of mass states that the total number of reactant molecules and total number of product molecules in a chemical reaction are equal.

15. Metals form positively-charged ions by losing electrons.

16. Covalent bonds result from two elements sharing electrons.

Matching (/5)

17. _____ (a) FeCl₃ (i) carbon tetrachloride
   _____ (b) SnCl₄ (ii) tin (IV) chloride
   _____ (c) (NH₄)₃PO₄ (iii) iron (III) chloride
   _____ (d) CCl₄ (iv) carbon monoxide
   _____ (e) CO (v) ammonium phosphate
Part 2: Thinking/Inquiry, Application and Communication (/19)
Short Answer

18. Identify the following reactions as synthesis, decomposition, single displacement or double displacement. Then balance the equations. (/9)

a) \[ \text{Ca(s) + H}_2\text{O(l)} \rightarrow \text{H}_2\text{(g) + Ca(OH)}_2\text{(aq)} \] _________________

b) \[ \text{K(s) + Br}_2 \rightarrow \text{KBr(aq) } \] _________________

c) \[ \text{Pb(NO}_3\text{)}_2\text{(aq) + KI(aq) } \rightarrow \text{PbI}_2\text{(s) + KNO}_3\text{(aq) } \] _________________

19. An unknown element, \( X \), combines with aluminum to form a compound with the empirical formula \( \text{Al}_2\text{X}_3 \). What would be the most likely formula for the compound that element \( X \) forms with calcium, \( \text{Ca} \)? Explain your answer. (/5)

20. How is a balanced chemical equation related to the law of conservation of mass? (/5)
**Bonus:** The compounds BaSO₄ and KCl are the products of a chemical reaction. Write a balanced chemical equation for this reaction. (/2)