

Write Answers on a Separate Sheet of Paper!

Directions for Questions #1 to #2: For each word equation, (1) write an unbalanced chemical equation including correct chemical formulas and state symbols. (2) Then write the balanced chemical equation that satisfies the law of conservation of mass.

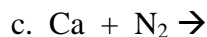
1. Solid sodium carbonate is reacted with aqueous hydrochloric acid, producing gaseous carbon dioxide, liquid water, and aqueous sodium chloride.
2. An electric current is passed through liquid water and it decomposes into oxygen gas and hydrogen gas.

Directions: Predict the products for each reaction and then balance each equation.

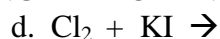
DECOMPOSITION:



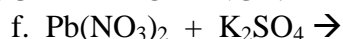
COMBINATION:



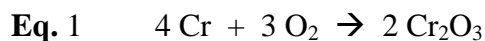
SINGLE EXCHANGE:



DOUBLE EXCHANGE:



Directions: Use Eq. 1 to answer Questions #5-10. Show work.



5. What is the mole ratio of oxygen gas to chromium (III) oxide?
6. How many moles of oxygen is needed to produce 2 moles of chromium (III) oxide?
7. What is the molar mass of chromium in grams/mole?
8. Using the molar mass from #7, how many moles of product can be made from 104 grams of chromium?
9. What is the molar mass of the product, chromium (III) oxide? Show work.

10. Using the molar mass from #9, how many grams of product can be made from 52 grams of chromium (Cr) and excess oxygen gas?

11. What is the molarity of a solution made by dissolving 0.5 moles of NaCl in water to make 5 liters of solution?

12. What is the molar mass of Na₂CO₃? Show work.

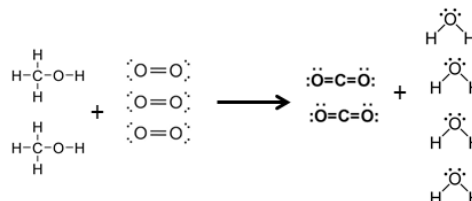
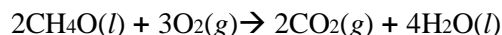
13. Using the molar mass calculated in #12, find the molarity of a solution prepared by dissolving 31.9 grams of Na₂CO₃ in water to make 750 mL of solution.

14. A student dissolved sodium hydroxide (NaOH) in water at 23 °C. The final temperature is 49.0 °C. Is the reaction endothermic or exothermic? How do you know?

Use the following information to answer Question #15.

Bond	C-H	C-C	O-H	C-O	C=O	O=O
Average bond energy (kJ/mol)	413	347	467	358	799	495

15. What is the energy change during the combustion of 2 moles of methanol?



a. Calculate the energy to break the bonds of the reactants:

b. Calculate the energy released when the bonds of the products form:

c. Which of the following is delta-H (ΔH) for the combustion of 2 moles of methanol?

A. 2214 kJ/mol

C. -2214 kJ/mol

B. 1319 kJ/mol

D. -1319 kJ/mol

16. Which of the two energy diagrams correctly portrays the energy change for the combustion of methanol? Explain by referring to the lettered portions of the diagram:

