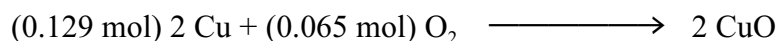


Moles and Solution Calculations: Review

- Find the mass of:
 - 1 average antimony atom
 - 0.2 moles of carbon dioxide [CO₂]
 - 1.5 moles of aluminum hydroxide [Al(OH)₃]
 - 6.47 x 10⁻² mol of nitrogen dioxide [NO₂]
- Find the number of atoms in:
 - 4.0 g of aluminum
 10. g of sodium
- Calculate the number of molecules in 1.00 g of N₂.
- Calculate the number of moles of:
 - 284 g of Na₂SO₄.
 - 0.100 mg of NaF
- A compound consisting of carbon, hydrogen and oxygen has a mass of 40.85 g. Analysis shows that the compound contains 10.90 g of carbon and 0.90 g of hydrogen. What is the percentage composition of the compound?
(Answers: 26.7% C, 2.2% H, 71.1% O)
 - Analysis of an ore of calcium shows that it contains 13.61 g of calcium and 21.77 g of oxygen in a sample of mass of 46.28 g. What is the percentage composition of this compound? (29.4% Ca, 47.0% O, 23.6% unknown)
- Analysis of a salt results in the following composition: 3.47 g of sodium, 2.12 g of nitrogen, and 7.27 g of oxygen. What is the empirical formula for this salt? (NaNO₃)
 - A barium salt is found to contain 21.93 g of barium, 5.12 g of sulfur, and 10.24 g of oxygen. What is the empirical formula of this compound? (BaSO₄)
- The analysis of a compound shows that it is made up of 21.9% Na, 45.7% C, 1.9% H, and 30.5% O. What is the molecular formula of the compound if its molecular mass is 210.0 u? (Na₂C₈H₄O₄)
 - An unknown compound is found to have a molecular mass of 75.0 u and to contain 32.0% carbon, 6.7% hydrogen and 18.7% nitrogen, with the rest of the molecule consisting of oxygen. What is the molecular formula of the compound? (C₂H₅NO₂)
- $$2\text{C}_2\text{H}_2 + 5\text{O}_2 \rightarrow 4\text{CO}_2 + 2\text{H}_2\text{O}.$$
Refer to the above equation to determine the number of moles:
 - of water produced by 1.75 moles of acetylene, C₂H₂;
 - of carbon dioxide produced in .3 moles of oxygen was used;
 - of water produced if 4 moles of oxygen was used.
- What mass of water and diphosphorus pentoxide will be needed in order to produce 95.5 g of phosphoric acid? P₂O₅ + 3H₂O → 2H₃PO₄ (69.2g P₂O₅; 26.3 g H₂O)
 - How much aluminum is needed to replace all of the iron from 27.8 g of iron(III) oxide in a single displacement reaction? (9.39 g)
 - What mass of iron metal will be required to produce 20.8 g of iron(III) oxide in an addition reaction with pure oxygen? (14.5 g)
 - 2KClO₃(s) → 2KCl(s) + 3O₂(g)
 - What mass of KClO₃ must be decomposed to give 0.96 g of oxygen?
 - How many moles of KCl will be produced during this same reaction? (2.5 g of KClO₃; 0.020 mol KCl)

10. When copper is heated in the presence of oxygen, a black oxide of copper is formed. If 8.24 g of Cu(s) reacts with 2.08 g of O₂(g) what is the formula for the oxide formed?



11. How many moles of oxygen are required to react with 9.7 g of magnesium to produce magnesium oxide? What mass of oxygen is required? (Write a balanced equation first)
(O₂: 6.4 g) (MgO: 16 g)
12. In the following equation: $2\text{KClO}_3 \longrightarrow 2\text{KCl} + 3\text{O}_2$
(a) How many grams of KClO₃ must be decomposed to yield 0.96 g of oxygen? (2.5 g)
(b) How many moles of KCl will be produced during this same reaction? (0.020 mol)
13. Sulfuric acid can be prepared by reacting sulfur dioxide, oxygen, and water.
The unbalanced chemical reaction is:
 $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) \longrightarrow 2\text{H}_2\text{SO}_4(\text{aq})$
If 15.0 g of oxygen and 50.0 g of sulfur dioxide are reacted with an unlimited quantity of water:
(i) What is the limiting reagent? (O₂)
(ii) How much sulfuric acid will be formed? (76.5 g)
14. How many grams of CO₂ gas will be produced when 8.50 g of methane react with 15.9 g of oxygen? (Note: You must first write the balanced chemical reaction and determine the limiting reactant).
15. A chemist makes nitroglycerin, C₃H₅(NO₃)₃ from glycerol C₃H₅(OH)₃ and HNO₃. The balanced chemical reaction is listed below:
 $\text{C}_3\text{H}_5(\text{OH})_3(\text{l}) + 3\text{HNO}_3(\text{aq}) \longrightarrow \text{C}_3\text{H}_5(\text{NO}_3)_3(\text{l}) + 3\text{H}_2\text{O}(\text{l})$
If 4.1 g of glycerol and 13.5 g of HNO₃ are used to produce 8.8 g of nitroglycerin:
(a) What is the limiting reagent?
(b) What is the theoretical yield of nitroglycerin?
(c) What is the actual yield of nitroglycerin?
(d) What is the percentage yield of nitroglycerin?

Solution Chemistry: Review

1. (a) What is the number of moles of Mg(NO₃)₂ needed to prepare 500 cm³ of a 0.450 mol dm⁻³ solution? (0.2 mol)
(b) What mass of magnesium nitrate does this amount represent? (30 g)
(c) Describe how you would prepare the solution. (Add 30 g of Mg(NO₃)₂ to 200 cm water in a graduated cylinder. Add water until there is 500 cm³ of solution in the cylinder)
2. What volume of 3.0 moldm⁻³ NaOH would be required to make 250 cm³ of 0.15 moldm⁻³ of NaOH solution? (13 cm³)
5. What volume of 16.0 moldm⁻³ stock nitric solution is needed to prepare 300 cm³ of 3.0 moldm⁻³ nitric acid solution ?
6. If 265.4 cm³ of LiOH are required to neutralize 21.7 cm³ of 0.500 moldm⁻³ HBr what is the concentration of the base? (0.0409 mol dm⁻³)
7. How many grams of table sugar C₁₂H₂₂O₁₁ are contained in 50.0 cm³ of a 0.400 moldm⁻³ solution of sugar in water? (6.85 g)
8. What is the concentration in moldm⁻³ of a solution that contains 49.0 g of hydrochloric acid in a 3.00 dm³ solution?