

Practice Calculations for LAD D5

Law of Constant Composition

1. When your shiny bumper dulls, chrome oxide is formed. We can accomplish the same process by exposing chrome metal to oxygen and allowing it to corrode completely in the same manner that we reacted magnesium with oxygen.

The chemical formula for the chromium oxide that forms is shown to the right: CrO_3

This formula is important for determining the theoretical ratio of chromium to oxygen.

- a. Fill in the data & results table. Show HOW you made ALL calculations to the right of the chart. Do NOT show actual multiplication and division. Show the method of your calcs. **NO CALCs shown = NO CREDIT awarded.**

mass of evaporating dish and watch glass (g)	33.75
mass of chrome (g)	2.79
mass of dish, watch glass and chrome oxide product (g)	38.92
mass of chrome oxide (g)	
mass of oxygen (g)	
EXP mass ratio of chrome / oxygen	
THEOR mass ratio of chrome / oxygen	
% error	

- b. Which is the most likely source of error for this trial:
- some of the smoke flew out of the dish as we were heating it
 - some black smokey soot formed on the bottom of the dish during the heating
- Refer to the data while explaining why you made the choice that you did.

- c. Which is the most likely source of error for this trial:

2. When nickel reacts with oxygen, nickel(III) oxide is formed. We could run this reaction in same manner that we reacted magnesium with oxygen in LAD 3.4C

The chemical formula for the nickel oxide that forms is shown to the right: Ni_2O_3

- a. Fill in the data & results table. Show HOW you made ALL calculations to the right of the chart. Do NOT show actual multiplication and division. Show the method of your calcs. **NO CALCs shown = NO CREDIT awarded.**

1	mass of evaporating dish and watch glass (g)	22.71
2	mass of nickel (g)	1.34
3	mass of dish, watch glass and nickel(III) oxide product (g)	24.64
4	mass of nickel(III) oxide (g)	
5	mass of oxygen (g)	
6	EXP mass ratio of nickel / oxygen	
7	THEOR mass ratio of nickel / oxygen	
8	% error	

- b. Which is the most likely source of error for this trial:
- some of the smoke flew out of the dish as we were heating it
 - some black smokey soot formed on the bottom of the dish during the heating
- Refer to the data while explaining why you made the choice that you did.

- c. State the Law of Constant Composition in less than 25 words.

Problem 1

mass of evaporating dish and watch glass (g)	33.75	
mass of chrome (g)	2.79	
mass of dish, watch glass and chrome oxide product (g)	38.92	
mass of chrome oxide (g)	5.17	$38.92 - 33.75$
mass of oxygen (g)	2.38	$5.17 - 2.79$
EXP mass ratio of chrome / oxygen	1.17	$\frac{2.79}{2.38}$
THEOR mass ratio of chrome / oxygen	1.08	$\frac{52}{3 \times 16}$
% error	8.2	$\frac{ 1.17 - 1.08 }{1.08} \times 100$

- b. Since the experimental mass ratio is larger than the theoretical value, it must be caused by the product chromium(IV) oxide appearing smaller than it should be, causing the oxygen to be smaller than it should be, and since the oxygen is in the denominator of the mass ratio, this would make the ratio larger than it should be – Of the two errors suggested, the smoke flying out of the dish before weighing is the one that could cause the error just described.

Problem 2

mass of evaporating dish and watch glass (g)	22.71	
mass of nickel (g)	1.34	
mass of dish, watch glass and nickel(III) oxide product (g)	24.64	
mass of nickel(III) oxide (g)	1.93	$24.64 - 22.71$
mass of oxygen (g)	0.59	$1.93 - 1.34$
EXP mass ratio of nickel / oxygen	2.27	$\frac{1.34}{0.59}$
THEOR mass ratio of nickel / oxygen	2.45	$\frac{2 \times 58.69}{3 \times 16}$
% error	7.3	$\frac{ 2.27 - 2.45 }{2.45} \times 100$

- b. Since the experimental mass ratio is smaller than the theoretical value, it must be caused by the product nickel(II) oxide appearing larger than it should be, causing the oxygen to be larger than it should be, and since the oxygen is in the denominator of the mass ratio, this would make the ratio smaller than it should be – Of the two errors suggested, the excess mass on the dish before weighing is the one that could cause the error just described.
- c. Law of Constant Composition - the mass ratio of the elements in a compound will always be the same.