Salt From Poison

Name _____

Date _____

Period _____

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Sodium (Na) is a metal that catches fire in water. Chlorine (Cl_2) is a poison gas. Together they make table salt (NaCl). In this lab you will run the reaction, watch one electron move, build other salts, and test all three substances.

☐ I can use the masses in a reaction to show that mass is conserved and to name the limiting reactant.

☐ I can explain how moving electrons from a metal to a nonmetal makes ions, and use that to write a salt's formula and explain its properties.

Part 1. The demo (Tab 1)

SEP 5 Using Math · CCC Energy and Matter

Set the sodium, then press **Add a drop of water** or **Skip to the end**. Press **New flask** to go again. **Your runs** keeps the numbers.

1. Run **1.0 g** of sodium. Use the Before and After columns. Sodium used _____ g + chlorine used _____ g = _____ g. Salt made: _____ g. Balance: _____ g before and _____ g after. What do you notice?

2. Fill in the table. "Left over" means what is still in the flask after the flame goes out.

Sodium added (g)	0.5	1.0	1.5	2.0	2.5	3.0
Salt made (g)						
Left over (what?)						
Heat given off (kJ)						

3. From 0.5 g to 1.0 g of sodium, the salt _____. From 2.0 g to 3.0 g, the salt _____. Use the slider in 0.1 g steps. The leftover switches from chlorine to sodium between _____ g and _____ g.

READ FIRST. In the lab, find the **Learn It** box and read it. Then answer 4 and 5.

4. Use **limiting reactant** to explain why the salt stopped growing. Which reactant was limiting at 3.0 g? At 0.5 g?

5. The balance did not change (Q1). Use the word **atoms** to explain why.

Part 2. One electron (Tab 2)

SEP 2 Models · CCC Structure and Function

Click sodium's gold electron. Then use the buttons on the right. The **Atoms and ions** box fills in as you go.

6. Fill in the table.

Particle	Electrons by shell	Protons	Electrons	Charge	Radius (pm)
Sodium atom, Na					
Chlorine atom, Cl					
Sodium ion, Na^+					
Chloride ion, Cl^-					

7. Na^+ has the same electrons as the noble gas _____. Cl^- matches _____. Press **Try to pull a second electron off Na^+** . First electron: _____ kJ. Second: _____ kJ. That is _____ times as much.

READ FIRST. In the lab, find the **Learn It** box and read it. Then answer 8 and 9.

8. Use the word **shell** to explain why Na^+ is so much smaller than the Na atom. Then use your Q7 energies to explain why sodium gives away only one electron.

9. Look at **Where the heat comes from** . The step that costs the most: _____. The step that gives back the most: _____. Net: _____ kJ for every 58.44 g of salt. In Tab 1, 2.54 g of salt gave off 17.9 kJ. Do the numbers agree? Show your math.

Part 3. Other salts (Tab 3)

SEP 2 Models · CCC Patterns

Move electrons from metal atoms to nonmetal atoms. Add atoms with + until every metal is empty and every nonmetal has 8.

10. Fill in the table.

Metal + nonmetal	Outer electrons (metal, nonmetal)	Atoms needed (metal, nonmetal)	Formula	Ion charges
Na + Cl				
Mg + Cl				
K + O				
Al + F				
Ca + S				
Al + O				

11. Look for the pattern. How can you tell a metal's charge from its outer electrons? A nonmetal's? Use it to predict calcium + chlorine without the lab: _____

Part 4. Test all three (Tab 4)

SEP 3, 4 Investigating · CCC Structure and Function

12. Run every test on all three. Fill in the table.

	Looks like	Melts at (°C)	Conducts as a solid?	Conducts when melted?	In water
Sodium					
Chlorine					
Table salt					

READ FIRST. In the lab, find the **Learn It** box and read it. Then answer 13 and 14.

13. Solid salt does not light the bulb, but melted salt does. Use the crystal from Tab 2 and the word **ions** to explain why.

Wrap it up

SEP 6, 7 · CCC Energy and Matter

14. Claim: Salt is a new substance. It is not just sodium and chlorine mixed together. Give **evidence** from two different tabs. Then give your **reasoning** : what happened to the atoms and their electrons?

NYSSLS: building toward HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4 and HS-PS1-7 (DCI PS1.A Structure and Properties of Matter, PS1.B Chemical Reactions). Tags: SEP = Science and Engineering Practice, CCC = Crosscutting Concept.