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). Run the reaction, watch one electron move, build other salts, and test all three.

☐ 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.

Example: used = before – after. If 2.95 g of chlorine went in and 1.00 g was left, 2.95 – 1.00 = 1.95 g was used.

1. Run **1.0 g** of sodium. Sodium used _____ g + chlorine used _____ g = _____ g. Salt made: _____ g. Balance before: _____ g. After: _____ g.

The salt weighs ☐ more than ☐ the same as ☐ less than the sodium and chlorine that were used.

2. Write the numbers. For "Left over" write **Na** or **Cl** .

Sodium added (g)	0.5	1.0	1.5	2.0	2.5	3.0
Salt made (g)						
Left over (Na or Cl)						
Heat given off (kJ)						

3. Salt, 0.5 g to 1.0 g: ☐ doubled ☐ stayed the same. Salt, 2.0 g to 3.0 g: ☐ doubled ☐ stayed the same.

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. The salt stopped growing because the _____ ran out. It is the _____.

WORD BANK chlorine · sodium · limiting reactant · flame · water

5. The balance did not change because:

☐ atoms were not made or destroyed, only rearranged ☐ salt weighs nothing

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.

Example: charge = protons – electrons. 12 protons and 10 electrons: 12 – 10 = +2.

6. Write the numbers.

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

7. Na^+ matches ☐ neon ☐ argon. Cl^- matches ☐ neon ☐ argon.

First electron: _____ kJ. Second: _____ kJ. That is about ☐ 2 ☐ 9 ☐ 100 times as much.

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

8. Na^+ is smaller than the Na atom because it lost its whole outer _____.

WORD BANK shell · nucleus · proton

Sodium gives away only one electron because the next one sits in a

☐ full shell close to the nucleus ☐ empty shell far away.

9. Look at **Where the heat comes from** . Costs the most: ☐ pull e^- off Na ☐ split Cl_2

Gives back the most: ☐ Cl takes the e^- ☐ + and – pull together

Example: 58.44 ÷ 2.54 = 23.0. So 58.44 g of salt is 23 times the 2.54 g from Tab 1.

Net: _____ kJ for every 58.44 g of salt. Check: 17.9 kJ × 23.0 = _____ kJ. Do they agree? ☐ yes ☐ no

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.

Example: Na + Cl needs 1 Na and 1 Cl, so the formula is NaCl. If it needed 1 Mg and 2 Cl, you would write $MgCl_2$.

10. Write the numbers and the formula.

Metal + nonmetal	Outer electrons (metal, nonmetal)	Atoms needed (metal, nonmetal)	Formula	Ion charges
Na + Cl	**1 , 7**	**1 , 1**	**NaCl**	**+1 , –1**
Mg + Cl				
K + O				
Al + F				
Ca + S				
Al + O				

11. A metal's charge is ☐ + the electrons it gives ☐ always +1. A nonmetal's charge is ☐ – the electrons it needs to reach 8 ☐ always –1.

Predict calcium + chlorine: ☐ CaCl ☐ $CaCl_2$ ☐ Ca_2Cl

Part 4. Test all three (Tab 4)

SEP 3, 4 Investigating · CCC Structure and Function

12. Run every test on all three. Write a few words, a number, or **yes** / **no** .

	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. In solid salt the ions are _____. When salt melts, the ions are _____, so they can carry electricity. **WORD BANK** locked in place · free to move · gone · electrons

Wrap it up

SEP 7 Argument from Evidence · CCC Energy and Matter

14. Claim: Salt is a new substance. It is not just sodium and chlorine mixed together.

Evidence 1 (Tab 4): Sodium melts at 98 °C, but salt melts at _____ °C. Salt is _____ to eat, but chlorine is a poison.

Evidence 2 (Tab 1 or 2): The reaction gave off _____ kJ of heat (1.0 g run). A new substance formed.

Reasoning: Each sodium atom _____ one electron to a chlorine atom. They became _____ that stick together. **WORD BANK** gave · took · ions · safe · molecules

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