Find the PhET Simulator site on your computer or click on the link below.

a) Open the “Salts and Solubility” simulation. (“Chemistry”) or click on:

<http://phet.colorado.edu/new/simulations/sims.php?sim=Salts_and_Solubility>

1. Click on the “**Table Salt**” tab in the upper left corner of the simulation.

2. Click the Salt shaker and give it ONE shake. RECORD your observations as the salt hits the water (*What happens to the “solid” in the water in terms of the particles?*):

3. Click the Salt shaker and give it NINE more shakes (*10 total shakes*).

a. RECORD your observations as the salt hits the water:

b. What are the little red particles? The bigger green particles?

c. The process in which the salt breaks apart in the solution (*water*) is called \_\_\_\_\_\_\_\_\_\_\_\_.

d. The salt is being dissolved and is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_. The water does the dissolving and is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

4. Click the Salt shaker and give it TEN more shakes (*20 total shakes*). Do you notice any difference in the particles other than that there are more of them?

5. Click the Salt shaker and give it TEN more shakes (*30 total shakes*).

a. Do you notice any difference in the particles other than that there are more of them (*observe the particles at the bottom of the container*)?

b. Would you describe this solution as “unsaturated” or “saturated”?

6. Click the Salt shaker and give it ONE more shake (31 total shakes). Observe the particles as they hit the water. Do they respond differently than before?

7. PREDICT what will happen if you add more salt to the water.

8. Click the Salt shaker and give it ONE more shake (*42 total shakes*). Wait. Then another shake … up to 45-50 total shakes. Would you describe this solution as “unsaturated” or “saturated”?

9. Notice the table in the upper right hand corner of the screen, called “salt.” How do the numbers of dissolved and bound ions of Sodium and Chlorine compare? What is the chemical formula of table salt?

Determining Solubility of slightly soluble salts. [*say that fast 5 times!*]

11. Click on the “**Slightly Soluble Salts**” tab in the upper left corner of the simulation.

12. You will add salt by shaking the container ONE shake at a time, allowing the salt to dissolve or sink before shaking it again.

a. COUNT how many shakes it takes for the salt to sink.

b. Use the number of dissolved and bound ions (chart at upper right) to determine the ratio of ions in each salt compound. Then, write the formula in the table below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Salt | Mercury II Bromide | Silver Bromide | Copper I Iodide | Strontium Phosphate | Thallium II Sulfide | Silver Arsenate |
| # of Shakes |  |  |  |  |  |  |
| Formula of Salt |  |  |  | **Sn3(PO4)2** | **ThS** | **AgAsO4** |

13. Place the salts in order from MOST soluble to LEAST soluble.

Designing a Salt

14. Click on the “**Designing a Salt**” tab in the upper center of the simulation.

15. Add NINE shakes of salt to the water and wait.

a. Is this a saturated or unsaturated solution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. How do you know?

16. Notice the “Ksp” in the upper right hand corner of the screen. Change the “-12” box to “-13” by clicking DOWN, and wait 30 seconds. RECORD what happens to the salt.

17. Change the “Ksp” from “-13” box to “-10” by clicking UP, and wait 30 seconds. RECORD what happens to the salt.

18. Change the “Ksp” from “-10” box to “-20” by clicking DOWN, and wait one minute. RECORD what happens to the salt.

a. Is this a saturated or unsaturated solution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. How do you know?

## ANSWER KEY

1. Click on the “**Table Salt**” tab in the upper left corner of the simulation.

2. Click the Salt shaker and give it ONE shake. RECORD your observations as the salt hits the water (*What happens to the “solid” in the water in terms of the particles?*):

***The salt breaks apart in the water and move around randomly.***

3. Click the Salt shaker and give it NINE more shakes (*10 total shakes*).

a. RECORD your observations as the salt hits the water:

***The salt breaks apart in the water and move around randomly.***

b. What are the little red particles? The bigger green particles?

***The red particles are sodium ions. The green particles are chlorine ions.***

c. The process in which the salt breaks apart in the solution (*water*) is called **dissolving.**

d. The salt is being dissolved and is called the **solute**. The water does the dissolving and is called the **solvent**.

4. Click the Salt shaker and give it TEN more shakes (*20 total shakes*). Do you notice any difference in the particles other than that there are more of them?

***The salt breaks apart in the water and move around randomly.***

5. Click the Salt shaker and give it TEN more shakes (*30 total shakes*).

a. Do you notice any difference in the particles other than that there are more of them (*observe the particles at the bottom of the container*)?

***The salt particles are moving faster due to more collisions.***

b. Would you describe this solution as “**unsaturated**” or “saturated”?

6. Click the Salt shaker and give it ONE more shake (31 total shakes). Observe the particles as they hit the water. Do they respond differently than before?

***The salt begins to stay together and sink to the bottom.***

7. PREDICT what will happen if you add more salt to the water.

8. Click the Salt shaker and give it ONE more shake (*32 total shakes*). Wait. Then another shake … up to 35-40 total shakes. Would you describe this solution as “unsaturated” or “**saturated**”?

9. How do the numbers of dissolved and bound ions of Sodium and Chlorine compare? What is the chemical formula of table salt? **The number of ions is the same. NaCl. 1:1 ratio.**

Determining Solubility of slightly soluble salts.

12. You will add salt by shaking the container ONE shake at a time, allowing the salt to dissolve or sink before shaking it again.

a. COUNT how many shakes it takes for the salt to sink.

b. Use the number of dissolved and bound ions (chart at upper right) to determine the ratio of ions in each salt compound. Then, write the formula in the table below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Salt | Mercury II Bromide | Silver Bromide | Copper I Iodide | Strontium Phosphate | Thallium II Sulfide | Silver Arsenate |
| # of Shakes | **3** | **8** | **13** | **4** | **2** | **19** |
| Formula of Salt | **HgBr2** | **AgBr** | **CuI** | **Sn3(PO4)2** | **ThS** | **AgAsO4** |

13. Place the salts in order from MOST soluble to LEAST soluble.

Copper I Iodide … Silver Arsenate … Silver Bromide … Strontium Phosphate … Mercury II Bromide … Thallium II Sulfide

Designing a Salt

14. Click on the “**Designing a Salt**” tab in the upper center of the simulation.

15. Add NINE shakes of salt to the water and wait.

a. Is this a saturated or unsaturated solution? **unsaturated**

b. How do you know? **None of the salt particles sank to the bottom and stuck together**

16. Notice the “Ksp” in the upper right hand corner of the screen. Change the “-12” box to “-13” by clicking DOWN, and wait 30 seconds. RECORD what happens to the salt.

**A bunch of the salt particles sank to the bottom and stuck together**

17. Change the “Ksp” from “-13” box to “-10” by clicking UP, and wait 30 seconds. RECORD what happens to the salt.

**The salt particles re-dissolved and move randomly again.**

18. Change the “Ksp” from “-10” box to “-20” by clicking DOWN, and wait one minute. RECORD what happens to the salt.

**Amost all of the salt particles sank to the bottom and stuck together**

a. Is this a **saturated** or unsaturated solution? **saturated**

b. How do you know? **The water could not dissolve the salt particles.**