SI Chemistry - Full Discipline Demo

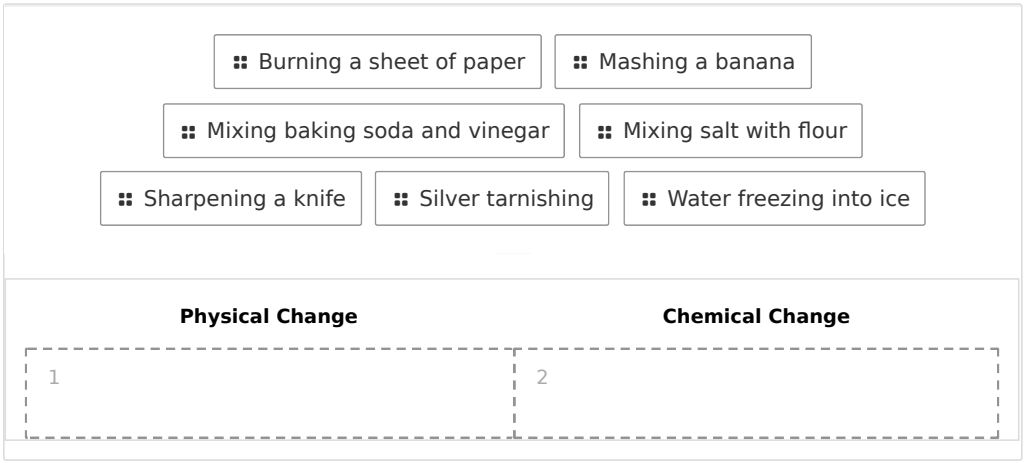
Digital Observation of Chemical Changes - Beyond Labz

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Chemistry - Full Discipline Demo
Course	SI Chemistry - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Categorize each change as physical or chemical.

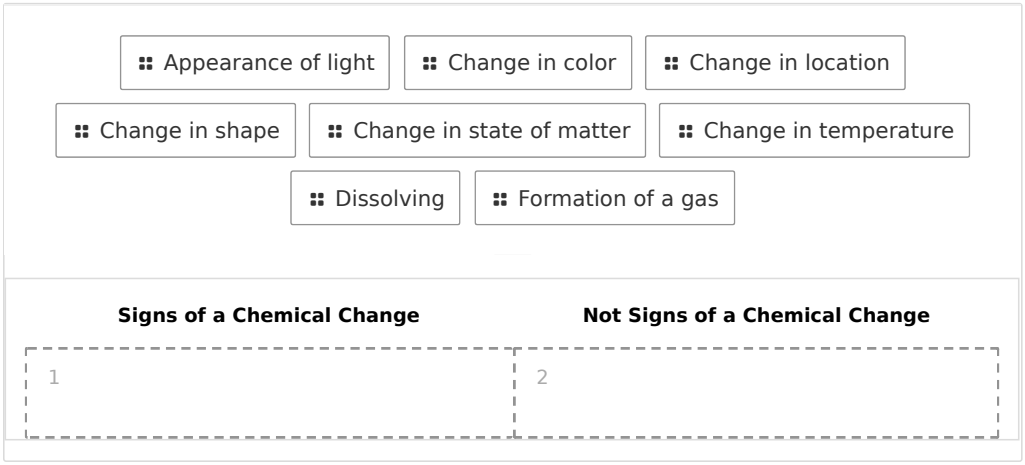


Correct answers:

1 Sharpening a knife Water freezing into ice Mixing salt with flour Mashing a banana

2 Silver tarnishing Burning a sheet of paper Mixing baking soda and vinegar

Classify the following as signs of a chemical change or not signs of a chemical change.

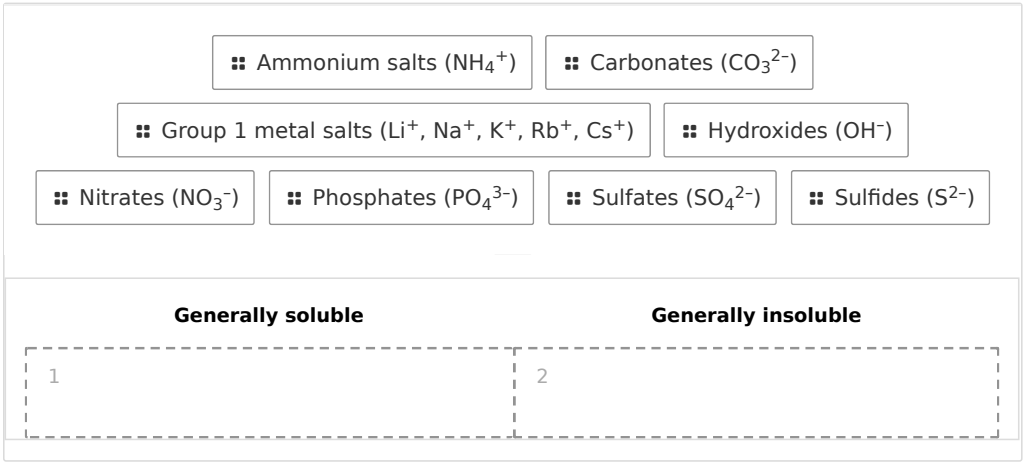


Correct answers:

1 Change in color Formation of a gas Appearance of light Change in temperature

2 Change in shape Change in state of matter Change in location Dissolving

Categorize the ions as either generally soluble or generally insoluble.



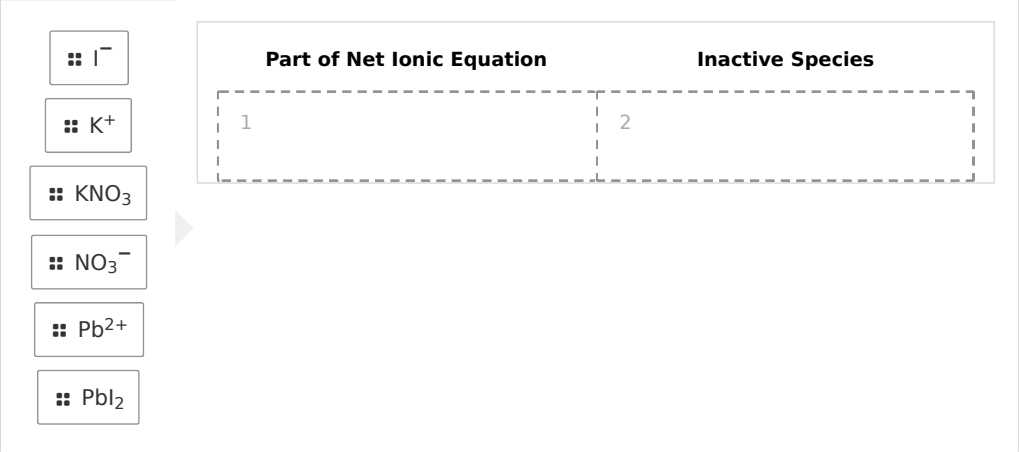
Correct answers:

1 Ammonium salts (NH_4^+) Group 1 metal salts (Li^+, Na^+, K^+, Rb^+, Cs^+) Nitrates (NO_3^-) Sulfates (SO_4^{2-})

2 Carbonates (CO_3^{2-}) Phosphates (PO_4^{3-}) Hydroxides (OH^-) Sulfides (S^{2-})

Identify whether each species is part of the net ionic equation of this reaction:

$2\ KI + Pb(NO_3)_2(aq) \rightarrow PbI_2(s) + 2\ KNO_3(aq)$



Correct answers:

1 Pb^{2+} PbI_2 I^- 2 K^+ NO_3^- KNO_3

Exploration

A chemical change may also be referred to as a _____.

- physical change
- chemical reaction ✔
- chemical compound
- state of matter

A change in _____ is a sign that a physical change is occurring (as opposed to a chemical change).

- state ✔
- temperature
- color
- odor

Silver tarnishing is chemical change.

- [x] True ✔
- [ ] False

Sulfides (S^{2-}) are generally insoluble.

- [x] True ✔
- [ ] False

The chemical equation type that shows only active species is called the _____equation.

- [ ] active ions
- [ ] complete ionic
- [ ] aqueous salt
- [x] net ionic ✔

Exercise 1

What is the balanced net ionic equation for a reaction that occurred with the silver cation?

Several possible answers exist, but a correct answer must be for silver in conjunction with an anion besides sulfate, which does not form a precipitate.

Ex: $Ag^+ + Cl^- \rightarrow AgCl$

What cation/anion combinations from Data Table 1 exemplify the solubility rules? List one cation/anion combination for each of the 8 rules.

1 (group 1 & NH_4 are soluble) --all combinations with K^+ cation

2 (nitrates mostly soluble) --all cations by themselves are nitrates

3 (Br^- Cl^- I^- mostly soluble except Ag Pb Hg) --reactions of NaCl were soluble except Ag and Pb.

4 (Ag generally insoluble) --all reactions of Ag produced a ppt (except SO_4^{2-})

5 (most sulfates soluble) --all reactions with sulfates were soluble except Pb

6 (most hydroxides not soluble) --most hydroxides produced a ppt except Zn Pb and K

7 (sulfides of trans metals insoluble) --all transition metals produced ppt

8 (most carbonates insoluble) --all carbonates except K produced ppt

If a substance is suspected of containing cobalt, what tests could you perform on it and what results would be expected if it did contain cobalt? Use your results from Data Table 1 as a guide.

Test for cobalt by adding anions that would give unusual results:

-Combine a sample with hydroxide--a pink ppt is a strong positive indicator

-Combine a sample with carbonate--a purple ppt is a strong positive indicator

-Combine a sample with sulfide--a black ppt is a weak positive indicator, but could indicate something else

At least two of these tests together present a very strong argument that the product contains cobalt.

What simple system of tests could confirm that lead is present or absent in a solution? Use your observations in Data Table 1 to describe what a positive result would be.

A combination of at least two tests is required, as any one test could be a different species. For example:

(1) Add sodium chloride. A white ppt is a positive test, but it could also be silver instead of lead.

(2) Add sodium hydroxide. No reaction is a positive test for zinc, lead, or potassium, but could not be silver.

Therefore, these two test together confirm the presence of lead.

Data Table 1: Reaction Notes
(SAMPLE ANSWER BELOW)

Cation	**Na_2S**	**NaCl**	**Na_2SO_4**	**NaOH**	**Na_2CO_3**
Manganese	light orange PPT	NR	NR	orange PPT	white PPT
Zinc	white PPT	NR	NR	NR	white PPT
Lead	black PPT	white PPT	white PPT	NR	white PPT
Potassium	NR	NR	NR	NR	NR
Iron	black PPT	NR	NR	red-brown PPT	red-brown PPT
Cobalt	black PPT	NR	NR	light pink PPT	purple PPT
Calcium	NR	NR	NR	white PPT	white PPT
Silver	black PPT	white PPT	NR	brown PPT	pink PPT

Competency Review

A chemical change is a change in the form of a substance.

- True
- False ✔

_____ is an example of a chemical change.

- Boiling water
- Tarnishing silver ✔
- Condensing vapor
- Cutting a steak

In a chemical reaction, the reactants are on the _____ in the written chemical equation.

- same side as the products
- right side
- left side ✔
- reaction arrow

Physical observations can be used to determine if a chemical change has occurred.

- [x] True
- [ ] False

A white precipitate formed from the mixing of two liquids is an indication of a chemical change.

- [x] True
- [ ] False

A series of compounds contain potassium (K^+) as their cation. These compounds are _____.

- [x] soluble
- [ ] insoluble
- [ ] slightly soluble
- [ ] a mix of soluble and insoluble

The species that are part of the net ionic equation of the following equation are _____.

$$\mathrm{BaCl_2}\,(aq)\ +\ \mathrm{Na_2SO_4}\,(aq)\ \rightarrow\ 2\,\mathrm{NaCl}\,(aq)\ +\ \mathrm{BaSO_4}\,(s)$$

- [ ] $BaCl_2$, Na_2SO_4, and $BaSO_4$
- [ ] Cl^-, Na^+, and NaCl
- [ ] Ba^{2+}, Cl^-, and $BaCl_2$
- [x] Ba^{2+}, SO_4^{2-}, and $BaSO_4$

Precipitation reactions are performed by adding two solutions containing soluble ions together and observing whether a precipitate solidifies and comes out of solution.

- [x] True
- [ ] False

Two solutions added together produce a blue solid. The correct observation to record is _____.

- [x] blue PPT
- [ ] NR
- [ ] CC blue
- [ ] precipitate

The precipitate AgCl comes out of solution following the mixing of $Ag(NO_3)$ and NaCl. This is associated with Solubility Rule _____.

- [ ] 1: Salts of Group 1 metals are ammonium are soluble
- [ ] 2: Nitrates, acetates, chlorates, and perchlorates are soluble.
- [ ] 3: Chlorides, bromides, and iodides are soluble
- [x] 4: Silver salts are insoluble

Extension Questions

You notice your tap water tastes like metal—possibly iron. To verify that it is iron, you add a few drops of sodium sulfide. The sample takes on some black coloration. From this result, can you assume this water does indeed contain iron? Explain your answer.
(SAMPLE ANSWER BELOW)

You cannot exclude the possibility that the water contains iron, as this is a positive test for iron. However, because several other metals produce a black ppt when combined with sodium sulfide, you cannot conclude that the metal you tasted in the water is definitely iron.