CST:
Chem: 1h, 1i, 1j
IE: 1d

Technicolor Atoms

ChemCatalyst:

Q: What would you end up w/ in each case?	A:

Notes:

• How does light help us find out about atomic structure?	• In the 1900s scientists began to observe that some elements give off light • light is electromagnetic radiation (shortest) - x-rays → uv rays → visible light → Infrare → Microwaves → radio waves (longest) - acts as a wave, with different frequenc & wavelengths - also acts as little particles because it can knock electrons around • some elements give off an atomic emission spectrum when excited - gives off certain colors of light, specific to each element • the color of light emitted depends on the movement of electrons in the atom

Technicolor Atoms

Name: _____

Period: _____Date:_____

Purpose: In this activity you will observe evidence that atomic structure is changed when atoms are heated.

Instructions:
You will use a piece of nichrome wire with a loop at the end to place some drops of a solution you want to test in a Bunsen burner flame. You will also test a piece of solid copper, and a copper penny, by placing them directly in the flame. Work in pairs or teams of four.

Note: Do not exchange wires. For each solution only use the wire that is already in that solution. After you use the wire, be sure to put it back in the solution from which it came.

1. Remove the wire from the solution.
2. Place the tip of the wire with the solution on it in the flame. For testing the copper wire and the penny, place them directly into the flame using the tongs. The two copper samples may need to be cleaned with hydrochloric acid first.
3. Observe and record the color of the flame.
4. Place the wire back in the solution for the next group to use.
5. Record your results in the data table below.
6. Go to the next solution.

Substance Name	Color of Flame
sodium carbonate	Yellow
potassium nitrate	Pink
copper nitrate	Green
strontium nitrate	Red
potassium chloride	Pink
sodium chloride	Yellow
copper sulfate	Green
strontium chloride	Red
sodium nitrate	Yell
potassium sulfate	Pink
copper wire	Green
copper penny	Green

Student Worksheet

1. Group the substances based on the color of the flame produced.

2. What patterns do you notice in the groupings?

3. Predict the color of the flame for a substance called strontium sulfate. Explain your reasoning.

4. What evidence do you have that atoms of certain elements produce a flame with a specific color?

Making Sense

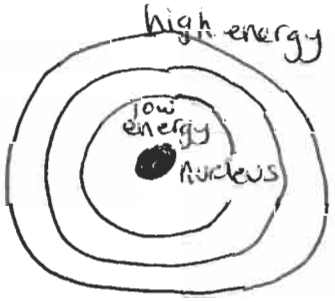
The yellow color of the flame for sodium indicates that the sodium atoms changed in some way when they were heated. Consider the following possibility that the electron configuration of sodium changed from $[Ne]3s^1$ to $[Ne]4p^1$. What is the difference between $[Ne]3s^1$ and $[Ne]4p^1$? (Are the total number of electrons the same? Are the electrons in the same locations?)

Do you think gold can be made by changing the arrangement of electrons in atoms? Explain.

Making Sense Notes:

- Which atoms produce color?
  - Red – $Sr(NO_3)_2$, $SrCl_2$
    Blue/Green – $Cu(NO_3)_2$, $CuSO_4$
    Yellow/orange – Na_2CO_3, $NaCl$, $NaNO_3$
    Pink/Purple – KNO_3, KCl, K_2SO_4
  - * only the metal atoms produce color

- Why do atoms produce color?
  - According to Bohr's theory, e⁻ move around the nucleus in energy levels/shells
    - each shell has a certain amount of energy
    - shells closest to the nucleus have low energy. shells further away have higher energy



  - Unexcited atoms have their e⁻ in the ground state = lowest energy shells possible
  - When atoms are heated they absorb the energy ∴ their e⁻ jump to outer shells
  - When atoms release the energy the e⁻ return to ground state ∴ the energy is released as specific colors of light