Class: Grade 5 Science

Lesson Title: Properties of Matter – Chemical vs. Physical Change

Class Size: **20**
Time: **60 mins**

Curriculum Outcomes:
301-10: identify and describe changes to materials that are reversible and some which are not
301-11: describe changes that occur in the properties of materials when materials interact with each other

Learning Objectives:
1. Students will be familiar with differences between solids, liquids and gases on a molecular level.
2. Students will be able to identify a change as physical or chemical.

Materials:
- Pinnies (4 different colors)
- Tape
- Cards with different "smells" on them (pictures of fish, skunk, etc.)
- Music (slow-fast composition and then any general music that will get students moving)
  - Minion's "Banana Song" that goes from slow to fast
  - Carly Rae Jepsen's "I really like you"
  - Beyonce's "Irreplacable (to the left, to the left)"
  - Taylor Swift's "Shake It Off"

SUGGESTION: Complete this activity in a gym setting, or open area free of obstacles.

Preparation beforehand:
- Split the room up into 4 by taping two perpendicular lines
- Have the cards printed out for the smells (optional to have tape on them or string)

Introduction:
1. Introduce the topic. Possible prompt questions include:
   a. What do you know about the states of matter? (might talk about melting, freezing, evaporating, or that liquids fill the container, solids do not necessarily, and gases will escape open containers)
   b. What do the atoms or molecules of each behave like? (solid – fixed, vibrate, no motion; liquid – motion, vibrate, bump into each other, rotate, but not moving fast, also limited to the container in which they are in; gas – freely moving anywhere, fast, rotate, bump into one another, etc.) Students might talk about the relative speed (fast, medium, slow) of the molecules, which is okay as well.
   c. What are indicators of:
      i. Physical change: change of state (ice melting), split into smaller pieces of same thing (shredding paper), dissolving materials (sugar in water), moving them from one place to another (throwing a ball to other side of the room)
      ii. Chemical change: color change (not just mixing of two colors), smell given off (that wasn't there before), bubbles or gas formed, new substance formed (something that wasn't there before), heat or light given off
2. Explain what a kinulation is (broken up into kinesthetic and simulation). Ask the students if they'd like to try one out! Can be related to Phineas and Ferb (they perform simulations to test different science phenomena, sometimes things we can't actually do in real-life; students will know these characters for sure!).

Activity Instructions:

This activity will involve a series of repeating events where something new is done each time. It will follow the sequence: 1. Instruction, 2. Music + Class Participation, 3. Freeze Time + Discuss. The students will be paired up and be given the same color pinnies as their partner to start off, the four colours representing Hydrogen, Nitrogen, Oxygen or Chlorine (they may wish to be water, etc; not critical they know the compound/element). **Students will always start each new activity with this same partner**, so they must remember who they are paired with (it's only vital for activity 1/2)!

Activity # 1 – Physical Change (change of state):

1. Have students pair up. Hand out the 4 colors of pinnies so that each student is wearing the same color as their partner. The students will hold hands all throughout the activities to represent a bond. **If you think they are going to have trouble holding hands, or linking arms, you may want to provide something physical they both need to hang on to, it could be as simple as a piece of paper, or a piece of clothing).**
2. Have students separate into the 4 quadrants of the room (this will be our closed containers for each molecule N_2, O_2, Cl_2, H_2). They will first act as solids and follow the music speed to act out how fast the molecules are moving (representing solid – liquid – gas). Having just gone over how the molecules act in each case, they should be okay. **Make sure to tell students to stay within their containers! Play the Minions' "Banana song."**
3. After the music has gotten to the point where they are gases (fast music, they should be spread out in the container, and probably energetic and moving fast), you should "freeze time." Have students sit down on the floor.
4. Ask the students if anything has changed between them and their partner (did they get a new one, did they break, did they change color, etc.). Talk about as a whole in the container, if there was a change (from solid to gas they got faster). This should demonstrate that nothing has actually happened to them and their partner chemically, so it's a physical change.

Activity # 2 – Chemical Change (new compound formed, colour change):

1. Students should still be with their partner, this time they are gases but can use the whole class as the container (from this point on the individual containers are obsolete).
2. Rule: If you and your partner get close to another pair of people, swap partners. Keep doing this every time you and your partners find another pair of students. **Make sure to always be linked with one other person; do not be on your own as this is no longer a molecule! Play Carly Rae Jepson's "I really like you" song.**
3. When the song stops, "freeze time." Have the students sit down on the floor.
4. Have students look at who their partner is. Is it the same person? Is it someone new or a new color? What does this indicate then? (new chemical formed, change in color so a chemical change).

Activity # 3 – Physical Change (moved the compounds to a different part of the room):

1. Students should get back with their partners, but again use the whole classroom as the container (everyone is mixed).
2. Rule: No swapping partners this time; you hold onto your partner for dear life. They should follow the direction of the song (if it tells them to do something). **Play Beyonce's "Irreplacable (to the left, to the left)" song.** When the song is being played, pretend to be some driving force and push the kids to the left side of the room.
3. When the song stops, "freeze time." Have the students sit on the floor.
4. Have students look at who their partner is. Is it the same person? Is it someone new or a new color? Or have they just moved in the classroom (no chemical changes on the molecular level, just moved to different part of the "container," hence a physical change).

Activity # 4 – Chemical Change (change in odor; smell formed):

1. Students should still be with their partner, this time they are gases but can use the whole class as the container.
2. Rule: No swapping of partners, just move around as a gas. **Play Taylor Swift's "Shake It Off" song.** As students are moving around, hand out "smells" to the different pairs. They can either hold these cards, have them taped, or on strings around their neck (completely preferential; holding is easier for them).
3. When the song stops, "freeze time." Students should sit on the floor.
4. Have students look at who their partner is. Is it the same person? Is it someone new or a new color? Has anything else changed between them and their partner? What does this indicate then? (They and their partner now have a "smell;" production of odor indicates a chemical change).
   Note: The production of an odor would typically pair with a new substance formed, color change etc. but for demonstration purposes, swapping was not permitted so that students could focus on the production of odor as a chemical change.

Conclusion – Possible wrap-up questions:

1. If we don't have an indicator that we can see with our senses (melting, odor, colour change) does that mean that no change occurred? (No, it might be a new substance, but no indicators that we can find with our senses, and example being food breaking down in the stomach. We can't observe this first-hand, but we know something is happening).
2. Can you undo all physical changes (give example if we melt and ice cube, we can freeze it again)? See if they can come up with any (ripping paper, tape it back together, etc.); ask about shredding carrots if that is chemical or physical (physical because you've just made it into smaller pieces, but it's difficult, if not impossible to undo, so not all physical changes can be undone, just MOST).