SNC2D/2P Chemical Reactions/Chemical Reactions and their Practical Applications

Student Activity: Formulas Poker

Topics	Timing
naming and writing formulas for ionic compounds	preparation: 20 min activity: 15–25 min

Specific Expectations

SNC2D

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

A1.12 use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurement (e.g., SI and imperial units)

C3.1 describe the relationships between chemical formulae, composition, and names of binary compounds (e.g., carbon dioxide, CO_2, has two oxygen atoms and one carbon atom)

C3.8 identify simple ionic compounds (e.g., NaCl), simple compounds involving polyatomic ions (e.g., KNO_3, NaOH), molecular compounds (e.g., CO_2, H_2O, NH_3), and acids (e.g., HCl(aq), H_2SO_4(aq)), using the periodic table and a list of the most common polyatomic ions (e.g., OH^-, SO_4^{2-}), and write the formulae

SNC2P

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

A1.12 use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurement (e.g., SI and imperial units)

C3.2 name and write the formulae for simple ionic and molecular compounds (e.g., NaCl, NaOH, H_2O, CO_2)

Introduction

This activity can be an engaging way for students to visualize how ionic compounds are formed and where their formulas come from. Although it will take time to create the decks of cards the first time around, they can be reused year after year. This game can be used as a review activity to reinforce students' understanding of formulas and names of ionic compounds.

The purpose of the activity is for students to use cards representing ions and subscripts to create chemical formulas, and to assess each other's formulas to determine whether they are correct.

Materials

1 score card per student (see below)
1 deck of nomenclature cards per group (see below)
magnetic tape (optional)

Safety Considerations

None

Procedure

Prepare the following before performing the activity.

1. Create one deck of cards per group. Templates, which can be photocopied onto cardstock, are provided at the end of this demo. Alternatively you could hand-write on index cards. Each deck should contain the following:
    a. Two blank cards ("free" cards)
    b. Fourteen cards (seven each with subscripts "2" and "3")
    c. One (or more) card each with the following ions (these can be modified as required):

H^+	Ba^{2+}	Al^{3+}	F^-	O^{2-}	N^{3-}
Na^+	Ca^{2+}	Sc^{3+}	Br^-	S^{2-}	P^{3-}
Li^+	Mg^{2+}	Fe^{3+}	Cl^-	SO_4^{2-}	PO_4^{3-}
K^+	Zn^{2+}	Ni^{3+}	I^-	CO_3^{2-}	
Rb^+	Be^{2+}		OH^-		
Cu^+	Cu^{2+}		NO_3^-		
Ag^+	Sn^{2+}		$C_2H_3O_2^-$		
NH_4^+	Pb^{2+}		ClO_3^-		
	Fe^{2+}		HCO_3^-		
	Sr^{2+}		HSO_4^-		

2. Create a scorecard for each student from the template at the end of this demo.

During class:

Organize your class into groups of 3–5 students per group.

3. Hand out a deck of cards to each group and explain the rules:
    a. This game is played using rules similar to 5-card draw. The dealer will shuffle the deck (including both ions and subscripts) and deal out 5 cards to each player, including her/himself. All remaining cards stay in the central deck.
    b. Play begins with the player immediately to the left of the dealer. The player may discard up to three cards, and take the same number of cards from the central deck.
    c. The player then tries to make one or two chemical formulas using as many of their cards as possible. The formula(s) must be shown to/checked by the other players for correctness and then should be recorded and tallied in their score sheet. One point per card used to make a correct chemical formula is awarded per turn (up to a maximum of 5 points).
    d. OPTIONAL: One bonus point per name can be awarded if players write down on their score sheets the correct name of the chemical formula(s) created.
    e. Once a players has completed a turn, his or her used card are discard and replaced with the same number of cards from the central deck in order to replenish the hand to 5 cards.
    f. The turn then passes to the next player. If players cannot play, then they should pass.

g. Play then passes to the player on the left and continues. Play continues until no more formulas can be made by any player.

4. As the game proceeds, have students look at all the formulas that are made and try to determine whether or not they are correct, and why.
5. Ask the groups to describe how to determine that a chemical formula is correct.

Disposal

The cards can be saved and reused many times.

What happens?

The students will create a variety of different compounds from their cards, record them, and attempt to name them.

Example of Scoring:

Score Sheet Template

Name that Game Player Name: __EXAMPLE____

Round	Cards used to create formula(s)					Formula of compound (and name for bonus point)	TOTAL
1	Na^+	Cl^-	Mg^{2+}	O^{2-}	------	sodium chloride magnesium oxide	6 (4 + 2 bonus points)
2	NH_4^+	2	SO_4^{2-}	------	-----	ammonium sulfate	4 (3 + 1 bonus point)
3	Fe^{3+}	Cl^-	3	------	------	-------	3
OVERALL TOTAL:							13

How does it work?

Ionic compounds are formed due to the electrostatic attraction between oppositely charged ions. A stable ionic compound will form when the magnitude of the positive charge on the cation(s) is equal to the magnitude of the negative charge on the anion(s). Subscripts are used to indicate the number of ions present in the ionic compound and are written after the ion symbol that it corresponds to in the formula. When only one ion is present, a subscript of 1 is not required. When writing formulas or names, the symbol (or name) for the positively charged ion is written first. When an atom can have more than one possible charge (i.e., Cu^+ or Cu^{2+}), a roman number indicating the charge of the ion in that particular compound is written in brackets after the relevant ion name. Metal ion names are the same as the metal atom name. Non-metal ion names

have the "-*ide*" suffix replace the atom name suffix. Charges of ions are not included in either the formula or name of the compound (except in case previously mentioned). Polyatomic ions contain two or more atoms covalently bonded together with an overall positive or negative charge, and have specific names associated to them.

Teaching Suggestions/Hints

1. To demonstrate the game before playing, stick magnetic tape to the back of some cards and use them as manipulatives on the board to demonstrate how to play the game.
2. It may be useful to have a list of possible compounds (formulas and names) that can be formed from the cards to use as quick reference if students have any questions.
3. Cards could be created without charges included and students could use a periodic table (and possibly a list of polyatomic ions) to assist them when creating compounds using the cards.

Next Steps

Other card games could be modified using these cards. These cards could also be used as part of a balancing equations activity if "+", "→" and coefficient cards were added.

Additional Resources:

1. Explanation of different variations of poker game rules: http://www.pagat.com/poker/rules/
2. Using and naming polyatomic compounds: http://antoine.frostburg.edu/chem/senese/101/compounds/polyatomic.shtml
3. Naming and writing formulae for ionic compounds: http://www.elmhurst.edu/~chm/vchembook/143Aioniccpds.html

Score Sheet Template

Formula Poker Player Name: _____

Round	Cards used to create formula(s)					Formula of compound (and name for bonus point)	TOTAL
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
OVERALL TOTAL:							

Card Template

H^+	Ba^{2+}	Al^{3+}
Na^+	Ca^{2+}	Fe^{3+}
Li^+	Mg^{2+}	Sc^{3+}
K^+	Zn^{2+}	Ni^{3+}
Rb^+	Be^{2+}	N^{3-}
Cu^+	Cu^{2+}	P^{3-}

Ag^{+}	Sn^{2+}	PO_4^{3-}
NH_4^{+}	Pb^{2+}	O^{2-}
F^{-}	Fe^{2+}	S^{2-}
Br^{-}	Sr^{2+}	SO_4^{2-}
Cl^{-}	$C_2H_3O_2^{-}$	CO_3^{2-}
I^{-}	ClO_3^{-}	HSO_4^{-}
OH^{-}	HCO_3^{-}	NO_3^{-}

2	2	2
2	2	2
2	3	3
3	3	3
3	3	