

## How to Play

### CONTENTS OF BOX

\*Set of rules

\*Cards in Deck

4 each 'Oxidize', 'Reduce', H, O

3 each N, F

3 each of the noble gases, alkali metals and alkaline earth metals

2 each C, P, S, Cl, Br, I, pnictogens and chalcogens

9 from groups IIIA, IVA, transition metals, lanthanides and actinides

\*One decoder card.

### GENERAL RULES FOR MAKING COMPOUNDS

\*The two ways to make compounds with these cards are by using the valence electrons OR by using the oxidation states.

**\*Valence electrons:**

The number of valence electrons in a compound must be 8 or a multiple thereof (16, 24, 32, 40 etc.)

The simplest route to 8 electrons must be chosen. Players cannot double-up two compounds into one.

For example,  $6+6+4=16$  is an acceptable compound;  $7+7+1+1=16$  is unacceptable because it is really two compounds of  $7+1$ .

**\*Oxidation States:**

The sum of all oxidation states in a compound must equal zero.

Some elements have more than one oxidation state.

The 'Oxidize' and 'Reduce' cards may be used to change an element from one oxidation state to another.

The 'Oxidize' card makes the oxidation state of the element more positive. For example, in CO, the O has the -2 oxidation state and the C has the +2 oxidation state. An 'Oxidize' card and another O (oxidation state -2) are used to make  $\text{CO}_2$ , which has C in the +4 oxidation state. When an element has several oxidation states, an 'Oxidize' card is needed for each change.

The 'Reduce' card makes an oxidation state more negative. For example, in SbP the oxidation states are +3 for the Sb and -3 for the P. A 'Reduce' card will change the oxidation state of the Sb to -3.

Therefore, a total of +6 oxidation states are needed to complete the new compound. The +6 may come from metals, such as Ca, Ba, K and Na.

Be creative!

### ORGANIZER GAME

This game is played using the groups and periods.

**Goal:** The first person who collects 4 cards of the same group or period wins.

For 2 to 4 players, ages 7 to 12.

- Deal 5 cards to each player.
- Start with the player who has the highest atomic number card; continue clockwise.
- The player picks a card from the deck and then discards a card from his hand face up.
- The next player takes the top card from the deck.
- The discarded pile may be shuffled and used as a deck, if necessary.
- The winner is the first person to have four cards of a group, period, 'Oxidize' or 'Reduce'.

## LUCKY 100

This game is played by using the atomic numbers and oxidation states.

**Goal:** The person who has the highest total atomic numbers wins.

For 2 to 4 players, Ages 10 to adult.

Discard the noble gases, 'Oxidize' and 'Reduce' cards.

- Deal two cards to each player.
- Start with the player who has the lowest atomic number; continue clockwise.
- Make compounds by having the oxidation states add to zero AND having the atomic numbers add to more than 100.
- Any oxidation state number on any card may be used.
- The player picks two cards from the deck and attempts to form a compound. If no compound can be made, the next person has a turn.
- A player with a 'Toxic' card must discard all cards and pick two new cards on the next turn.
- When a player forms an acceptable compound, the player shows it to the other players for approval. Then, the player puts the compound in the personal 'win' pile and picks another card. The next person has a turn.
- When the deck is gone and no-one can play, the players add the atomic numbers in their 'win' piles and subtract the atomic numbers in their hands.
- The person who has the highest total atomic numbers wins.

## CHEMICAL SMASH

This game is played using the atomic numbers.

**Goal:** The person who collects all the cards wins. For 2 to 4 players, ages 6 to 12.

- Deal the cards in the deck equally to all players. Discard any extras.
- The players hold the cards face down.
- Each player puts the top card from their hand face-up on the table. The player with the card that has the highest atomic number wins all of the cards. (Exception: 'Toxic' beats 'Oxidize' which beats 'Reduce' which beats atomic number.)
- The winning cards are placed at the bottom of the player's hand.
- Players who run out of cards are eliminated, until only one person has all of the cards.
- Similar games may be played using the boiling point (bp) or melting point (mp). The sublimation point may be used for both the boiling and melting points.

## **SUPER 8**

This game is played using the valence electrons.

**Goal:** The person who gets the highest number of valence electrons wins. For 2 to 4 players, ages 9 to adult.

- Discard the 'Oxidize' and 'Reduce' cards.
- Deal 5 cards to each player.
- Start with the player who has the highest atomic number; continue clockwise.
- The players make compounds by adding the valence electrons to make 8 or a multiple thereof (16, 24, 32 etc.).
- The player makes compounds from the cards in hand. The compound is approved by the other players and then put in a personal 'win' pile. If a player cannot play, the player picks a card from the deck. If the player still cannot play, the next person has a turn.
- Only one compound may be made in a single turn.
- The player then picks from the deck to restore their hand to 5 cards.
- When a 'Toxic' card is used the player gets an extra turn.
- When a player uses all cards in one compound, the player chooses 5 more cards and gets an extra turn.
- The noble gases count as a compound.
- After the deck has been used and no more plays are possible, the players add the number of valence electrons in their 'win' piles and subtract those in hand.
- The person with the highest total wins.

## **ELECTRON POWER**

This game is played using the valence electrons and the electronegativity.

**Goal:** The first person who has no cards left wins. For 2 to 4 players, ages 11 to adult.

- Discard the 'Oxidize' and 'Reduce' cards.
- Deal 8 cards to each player.
- Start with the player who has the highest atomic number card; continue clockwise.
- The players make compounds by adding the valence electrons to make 8 or a multiple thereof.
- The player makes compounds from the cards in hand. The compound is approved by the other players and then put face-up on the table in front of the player.
- If the player cannot play, the player picks a card from the deck. If the player still cannot play, then the next person has a turn.
- Only one compound may be made in a single turn.
- The next player may form a compound OR make a knock-out play.
- In a 'knock-out' play the player replaces one card in an opponent's compound with a card in their own hand, and sends the replaced card back to the opponent. This play may be made only if both elements belong to the same group AND the replacement card has a higher electronegativity than the replaced card. For example, player A makes LiBr. Player B replaces the Br with a Cl, and gives the Br back to player A.
- The noble gases count as a compound.
- The first player to have no cards left wins.

## PERFECT ZERO

This game is played using the oxidation states and atomic numbers.

**Goal:** The person who gets the highest total atomic numbers wins. For 2 to 4 players, ages 10 to adult.

- Remove the 'Reduce' and 'Oxidize' cards.
- Use only the **largest, bold** oxidation state on the card. For H, C and Si either oxidation state may be used.
- Deal 5 cards to each player.
- Place six cards face-up on the table. Place the deck face down.
- Start with the player who has the highest atomic number card; continue clockwise.
- The player uses at least one card from the table and at least one card from her hand to make compounds such that the oxidation states total zero.
- The player has the compound approved by the other players, then puts it in his personal 'win' pile.
- A noble gas is considered a compound.
- After the play, refill the player's hand, and the table, from the deck.
- A player who cannot play misses a turn. If no-one can play, the 6 cards on the table are removed, shuffled within the deck, and a new table is made.
- The game continues until all possible cards have been used.
- At the end of the game, the players total the atomic numbers for the cards in their personal 'win' piles and subtract those in their hands.
- The highest total wins!

## ADVANCED PERFECT ZERO

This game is 'PERFECT ZERO' with the ability to use the 'Reduce' and 'Oxidize' cards on one's own or another player's 'reactive' compounds.

**Goal:** to get the highest number of atomic numbers by making compounds that have zero charge based on adding the valences. For 2 to 4 players, ages 10 to adult.

- The differences from 'PERFECT ZERO' are:
- If there are several valences on a card, the **largest, bold** valence is used **first**. For H, C and Si either oxidation state may be used.
- When a player makes a compound that has at least one element with multiple oxidation states that compound is placed face-up on the table in front of the player in the personal 'reactive' pile. These compounds are 'reactive', and may be attacked by oneself or another player in another turn.
- When a player makes a compound by using elements have only one oxidation state the cards are put face down in the personal 'win' pile.
- Compounds that use a 'Toxic' element are put face-down in the personal 'win' pile regardless of the oxidation states on them.
- A compound that uses one or more 'Oxidize' or 'Reduce' is put face-down in the 'win' pile.
- During a turn a player may make a compound or attack another player's compound.
- To attack, a player needs an 'Oxidize' or 'Reduce' card plus additional cards to compensate for the change in oxidation state. The attacker places the cards in the personal 'win' pile after the compound has been approved by all players.
- At the end of the game, the players total the atomic numbers for the cards in their 'win' and 'reactive' piles and subtract those in their hands.
- The highest total wins!