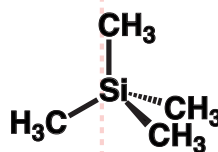


# **<sup>1</sup>H NMR SPECTRUM**



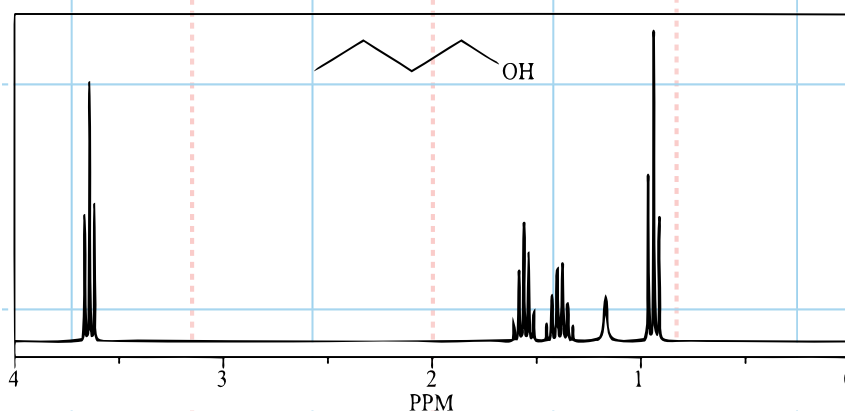
**Free-For-All  
Mode**

**Rulebook**

**By.  
Zachary  
Thammavongsy**

# BACKGROUND

$^1\text{H}$  NMR (Nuclear Magnetic Resonance) spectroscopy is an advanced chemistry technique used by scientists to identify complex molecules. Students are first introduced to  $^1\text{H}$  NMR spectroscopy in sophomore organic chemistry.  $^1\text{H}$  NMR Spectrum is a board game aimed to help students practice and develop their own method towards solving the identity of molecular structures via  $^1\text{H}$  NMR spectroscopy. Students will be able to compete with one another to interpret  $^1\text{H}$  NMR spectra of organic molecules. In addition, the goal of this board game is to build student's confidence, enjoyment, and interaction on the topic of  $^1\text{H}$  NMR.

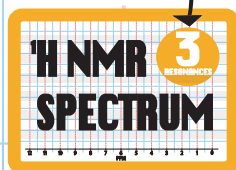


# OBJECTIVE

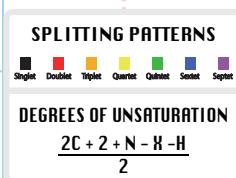
Objective of the game is for students to build their skills solving molecular structures via  $^1\text{H}$  NMR spectroscopy. Students compete with one another to gain as many structure points as possible in 4-5 rounds of play.

# CONTENTS

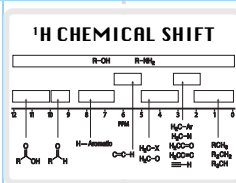
Resonance  
Point Value



(back of card)  
100 Structure Cards



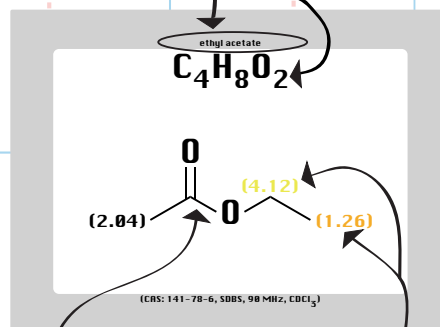
(back of card)  
5 Information Cards



(front of card)  
5 Information Cards

Name of  
Molecule

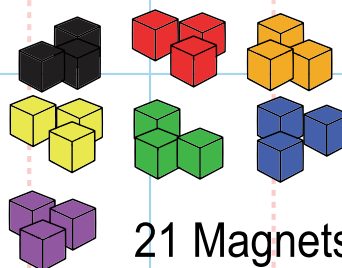
Molecular  
Formula



(front of card)  
Structure Card

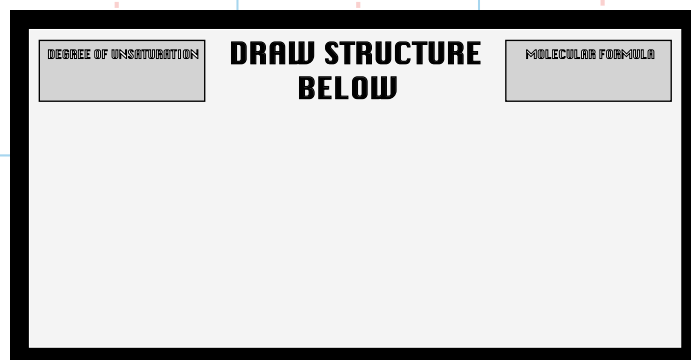
Structure of  
Molecule

Shift (ppm)  
Color = Splitting



21 Magnets

(3 of each color)



5 Sketchboard

1 Whiteboard (shown in Set Up )



# SET UP


\*5 Players Maximum


Use 16" x 12" White Board

# = Integration








Molecular Formula

WHITE BOARD



  
**TIMER**  
 (CELL PHONE)



13 12 11 10 9 8 7 6 5 4 3 2 1 0 PPM


  
  
  
  
  
  


**PLACE STRUCTURE CARDS NEXT TO GAME BOARD**

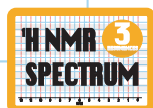
**PLACE MAGNETS ON WHITE BOARD**

**4 Sketchboards**  
**4 Information Cards**  
**5 Dry Erase Markers**



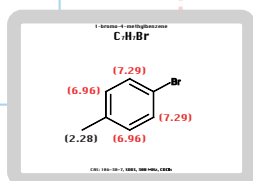
# GAME PLAY

1. For each round, select one of the players to be the "Structure Giver." Assign the Structure Giver in order of increasing age, starting with the youngest player.
2. The Structure Giver chooses a Structure Card.



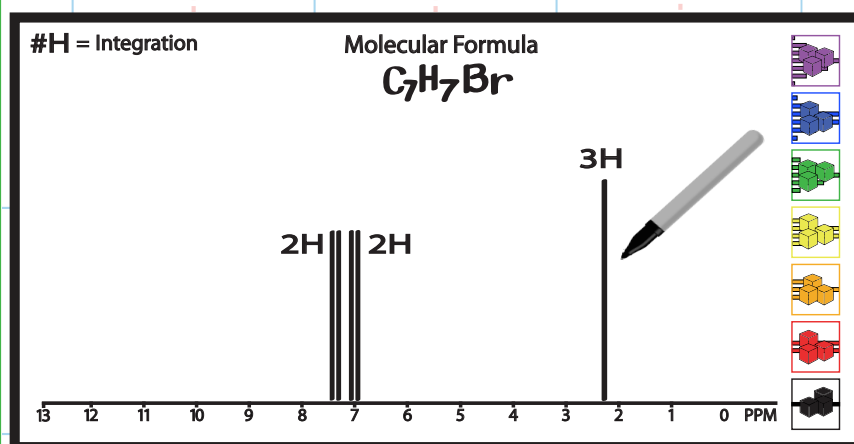
(The Structure Giver does not show anyone else the card.)

3. Once the Structure Card is selected, the Structure Giver writes out the molecular formula and draws the spectrum from the Structure Card on the whiteboard.



- **Molecular Formula** displayed on top
- **Chemical Shift** of proton displayed next to carbon
- **Chemical Splitting** represented by a color
- Structure Giver must figure out **integration**
- **Reference** for molecule displayed on bottom

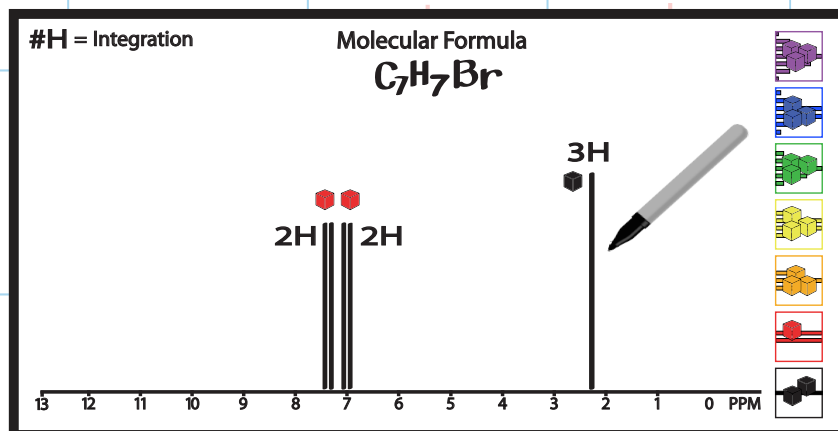
4. Timer starts when the Structure Giver starts drawing. Default time is 5 minutes.



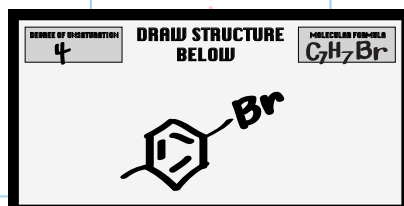
# GAME PLAY

**CONTINUED**

5. Structure Giver can also place the color magnets on the drawn splitting patterns to help players determine the splitting patterns.



6. All players (excluding Structure Giver) should compete to determine the molecular structure.



7. Players have unlimited chances to show their drawn structure on the Sketchboard to the Structure Giver before time runs out.

8. The Structure Giver have the option to pass on a Structure Card if they deemed to challenging to solve.

9. The round ends once a player correctly drawn the structure on their Sketchboard.

10. The player who solved the structure first receives the structure points on the Structure Card.



# GAME PLAY

## CONTINUED

11. The Structure Giver also receives 1 structure point if the structure was solved correctly within the time limit.

12. If the structure is not correctly guessed within the time limit then no one receives the points associated with the Structure Card.

13. Remove the Structure Card from the game to ensure it does not get played in the following rounds.

14. Repeats steps 1 - 13 with a new Structure Giver.

15. Play until every player had a chance to be the Structure Giver.

## ***Determined Winner***

Structure Points will be tallied up after every player had a chance to be the Structure Giver.



Example:  
Player A won two Structure Cards  
and helped others guessed a structure  
correctly as a Structure Giver  
 $3 + 3 + 1 =$   
7 Structure Points

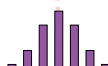
The player with the most Structure Points is crowned the winner.

Instructor's Note: Although this rulebook provides key steps on how to play the game, instructors are encouraged to add/change steps as needed to suit their classroom. Certain recommended changes include the time of gameplay, allocation of structure points, and total round of play.

## CREDITS

Game Designer: Zachary Thamavongsy (Ph.D.)

[www.dorbitalgames.org](http://www.dorbitalgames.org)



### What Materials to Buy – Free-For-All Mode (per one game set)

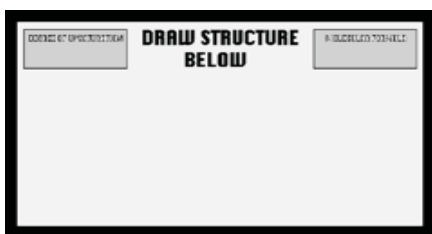
- Magnet (0.5 inch x 25 feet) - Must cut into 21 total magnetic pieces with each piece measuring 0.5" x 0.5" in dimension.



- Colored Tapes – Make sure to buy tape that have 7 different colors. Recommended colors are red, orange, yellow, green, blue, purple, and black.



- Laminator – Laminate the Sketch Board

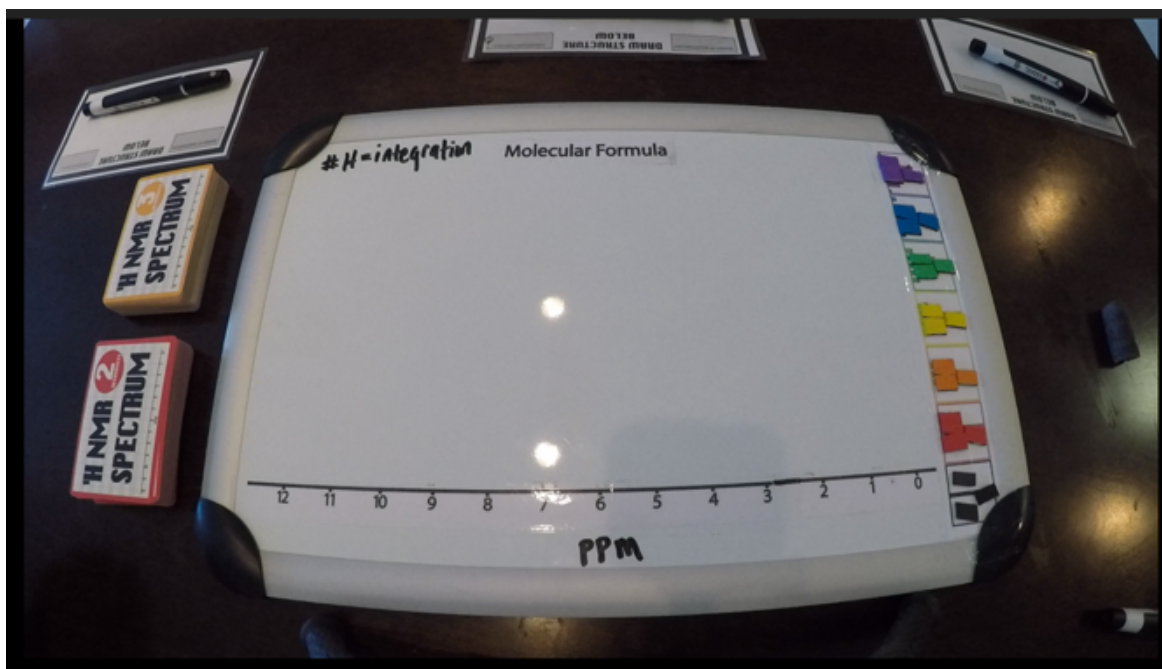


- Magnetic White Board (16" x 12")



- Dry Erase Markers – 5 total

### Example of what the set up should look like...



Full View of Set Up