Game Theory

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Session Code CS403

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Teachers' Conference 2016
Engage. Collaborate. Inspire.

Game Theory: Educational Games as a Means of Teaching, Learning and Assessment

Dr. Chris Slatter – Nanyang Girls' High School – Singapore

Introduction

- This presentation can be found online at www.scientist.sg

Introduction

Lesson Launhcer Cube

- What questions do you have about this topic?
- What do you predict this presentation is about?
- What interests you about this topic?
- What do you already know about this topic?
- What would you like to learn about this topic?
- Tell a partner why this topic is important.

Introduction

- What are the elements of a good lesson?

Why Use Games in Teaching?

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The Straits Times

Tuesday, October 23, 2007

Time to Study, Students, so Let's Play!

"It's a novel way to improve my grades.
I was quite bad at organic chemistry,
but after playing the game, my marks
went from a fail to a pass."

Temasek Junior College Student Lee Jin Hui, 18,
on a card game for organic chemistry.

Why Use Games in Teaching?

Surprisingly, Tech Pushes Resurgence of Board Games

By NICK WINGFIELD

MERCER ISLAND, Washington — Dan Shapiro sold a company to Google and worked at Microsoft. His name is on nearly a dozen technology-related patents.

But for his latest venture, Mr. Shapiro turned to technology to produce something decidedly low-tech: a board game for children.

Technology should have killed old-fashioned games, which can never equal the eye-popping graphics, visceral action and immense online communities of video games. Yet largely because of new technologies, there has been a creative outpouring of games by independent designers like Mr. Shapiro.

"It has unlocked a whole generation of innovative gameplay experimentation that just wasn't feasible before," he said.

New tools now power the creation of tabletop games from idea to delivery. Crowdfunding sites provide the seed money and gauge demand. Machines like 3-D printers can rapidly create prototype game pieces. And Amazon can handle distribution, cutting out the need for middlemen.

While the video game business long ago eclipsed its low-tech cousin, sales of tabletop games have continued to grow. Sales at stores that stock leisure activity products in the United States rose 15 percent to 20 percent in each of the last three years, according to a trade publication that tracks the business. Amazon says board game sales increased by a double-digit percentage from 2012 to 2013.

DAVID RYDER FOR THE NEW YORK TIMES

Dan Shapiro and his children played a game he made that teaches programming skills.

On Kickstarter, the crowdfunding service in which users can pledge money to finance projects, the amount raised last year for tabletop games exceeded the amount for video games, $52.1 million to $45.3 million.

Mr. Shapiro's experience with his creation Robot Turtles, a game meant to teach children basic computer programming concepts, illustrates the new model.

Mr. Shapiro raised $631,000 on Kickstarter in under a month, far exceeding his $25,000 goal. He found a manufacturer in Michigan by doing a Google search, and paid it to make 25,000 copies of the game, shipping most of them to a warehouse for Amazon, which delivered them to customers.

He sold all 25,000 copies.

Some new games from independent makers have even started to outsell games by major companies.

Cards Against Humanity and four expansion card packs for the game created by eight young men from Illinois are the top five best-selling items in Amazon's toys and games category.

Max Temkin, one of Cards creators, said that without crowdfunding, he doubted the game would have been made.

"Nobody in their right mind would think it would be a commercially viable project," he said. "It was too nerdy and weird and taboo."

Surprisingly, perhaps, video game players are often among the biggest devotees of tabletop games. Some in the business say the abundance of opportunities to connect electronically with people has also created a hunger for face-to-face contact.

At his home in Mercer Island, a Seattle suburb, Mr. Shapiro recently played a round of Robot Turtles with his twins, a boy and a girl, who are 5.

Mr. Shapiro said he created the game for a simple reason: "This came from, 'I want to do something fun with my kids.' "

The New York Times International Weekly, Saturday May 24 2014, Page 8.

Why Use Games in Teaching?

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★ Optimal learning is achieved when a high level of challenge is coupled with a low level of stress (Csikszentmihalyi, 1990).

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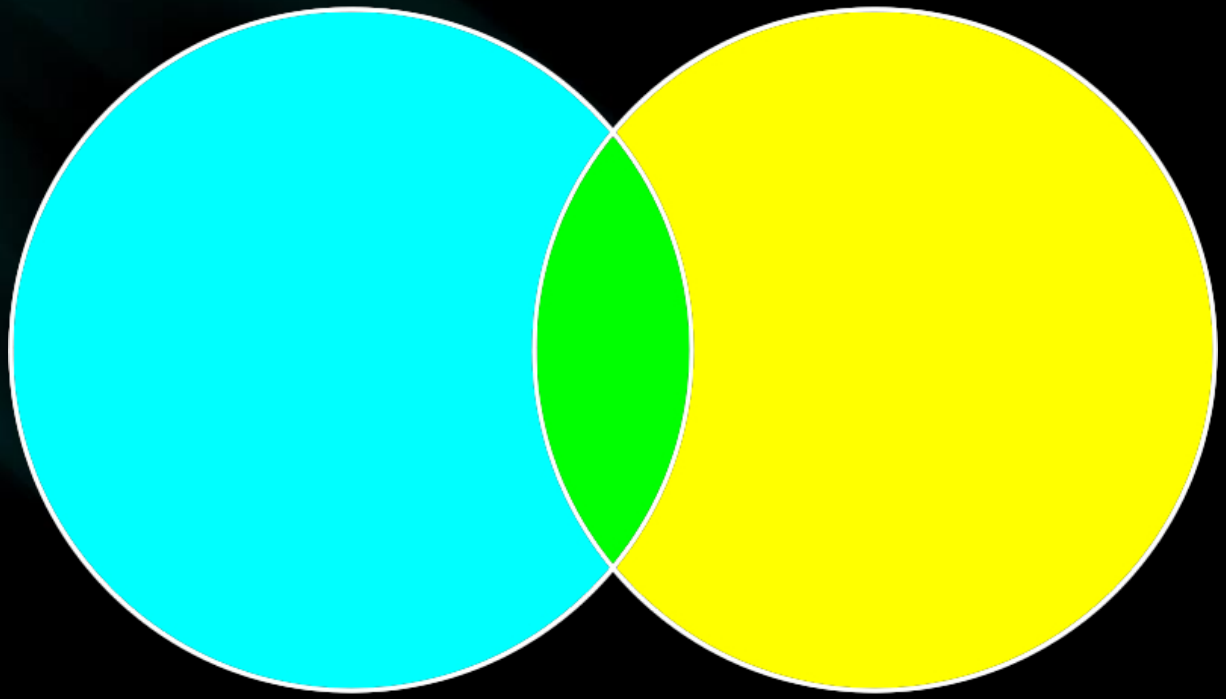
★ By engaging students in their learning, the use of games in the classroom can attempt to address underachievement (Neihart, 1988).

★ Students can write down the answers to the questions that they are posed while playing the games. These answers can then be collected by the teacher, reviewed and graded as required.

Why Use Games in Teaching?



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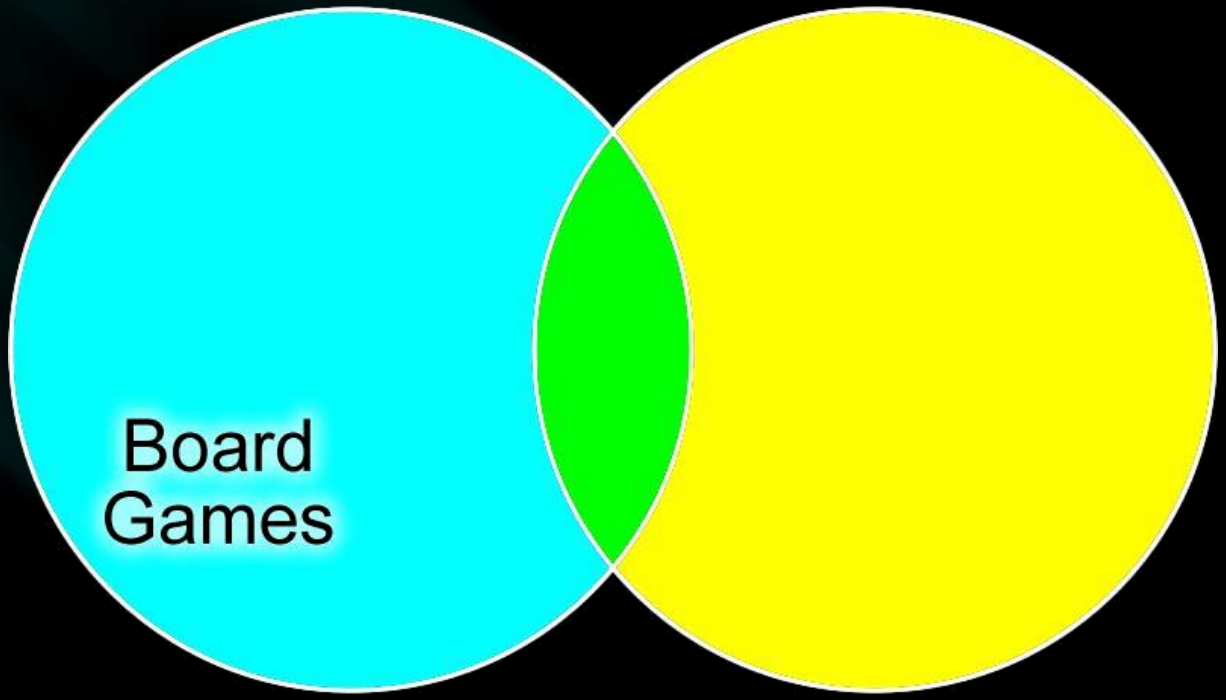

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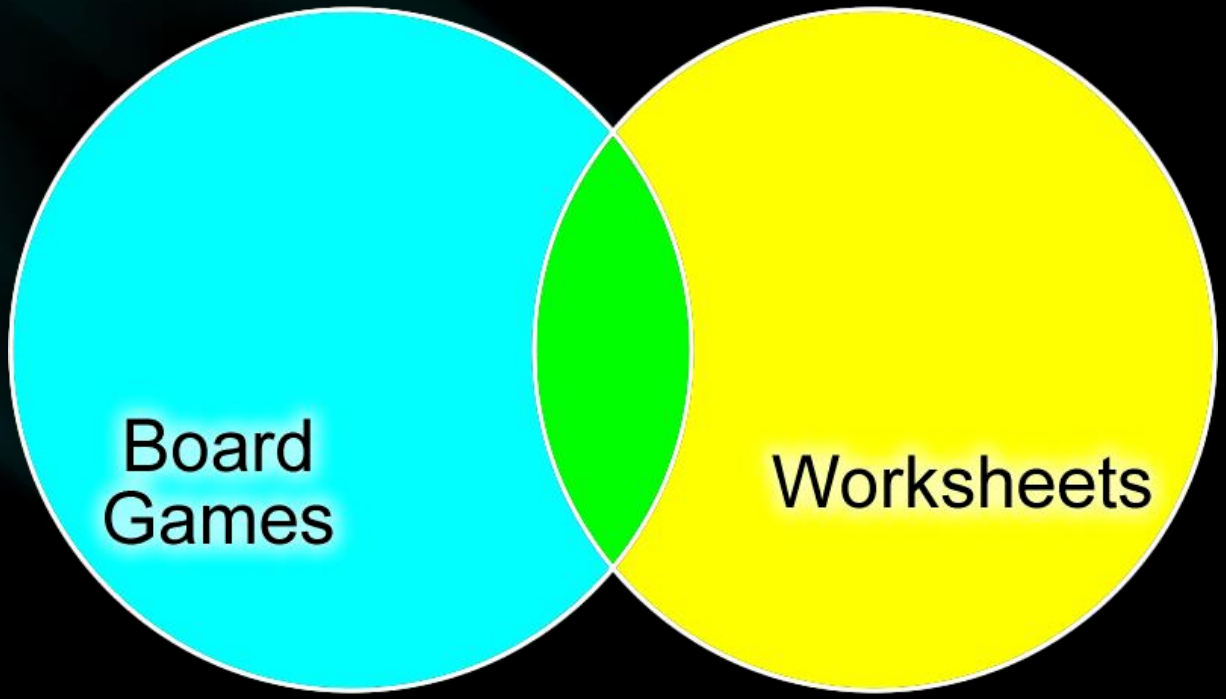

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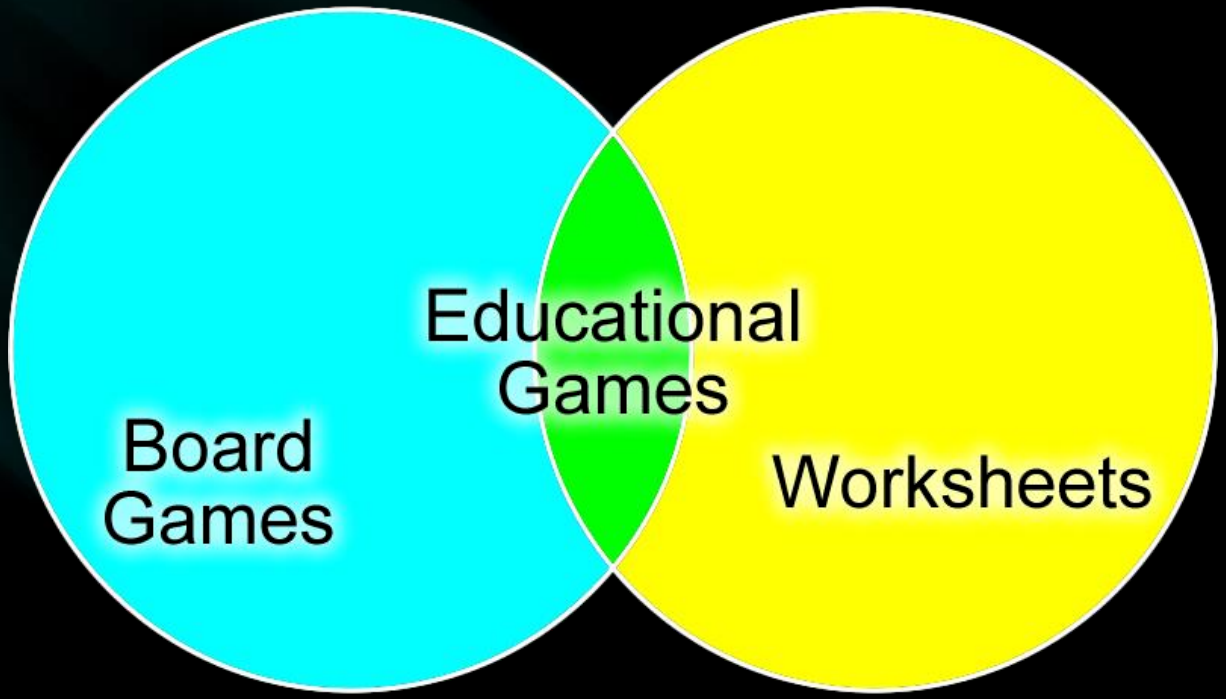

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★ In addition to logical mathematical and verbal linguistic, games encourage use of the visual spatial, bodily-kinaesthetic and interpersonal multiple intelligences (Gardner).

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★ A game may simply be played during the course of a unit to act as an energiser.

Some Guidelines…

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★ The game must have educational value! The students must learn or revise something as a result of playing the game. Consider the game as an interactive worksheet.

★ Use games that have simple, easy to follow rules. Alternatively, use games that the students are familiar with. Time should be spent playing the game, not working out the rules of the game!

Some Things to Consider…

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- Print game boards, dice and playing cards on thin cards and laminate them to make them more durable and increase their protection.

Some Things to Consider…

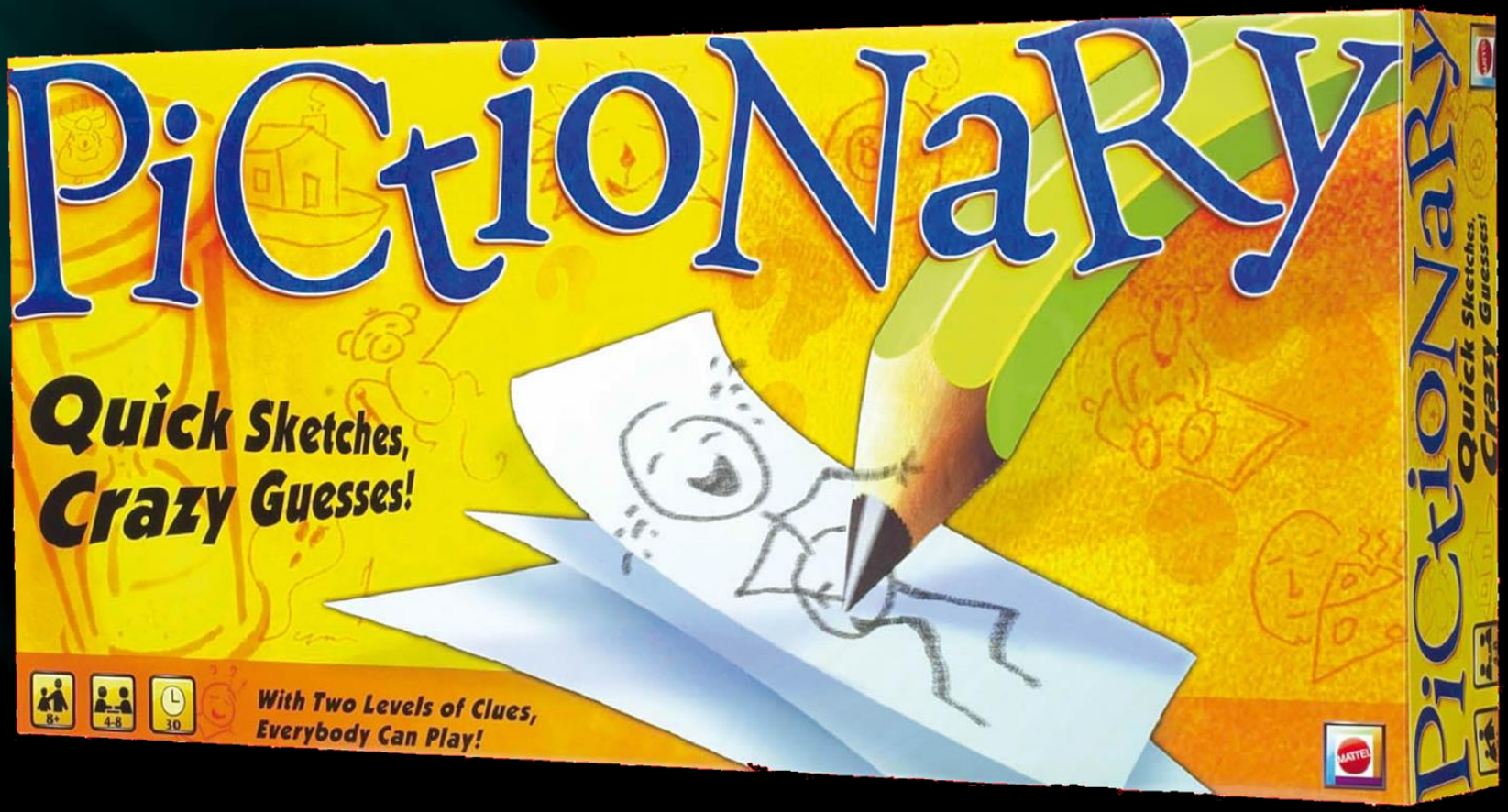
★ The use of colour adds to the visual impact of the game, but also adds to the cost!

★ Print game boards, dice and playing cards on thin card and laminate them to make them more durable and increase their protection.

★ Number playing cards. This helps to identify which questions the students have a problem answering. It also helps to identify which cards have gone missing at the end of the lesson!

On to the Games…

Quick and Easy



Quick and Easy

★ Pictionary:

In small groups, the students take turns to write words associated with a certain topic on pieces of paper. These pieces of paper are then exchanged with another group.

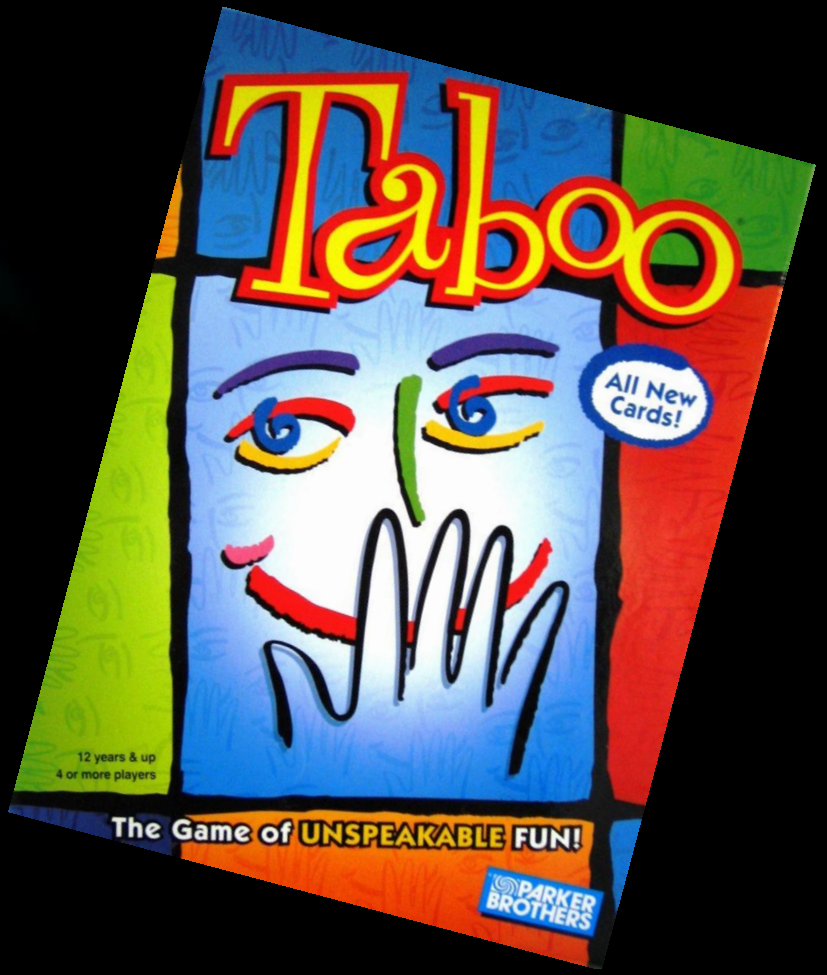
Quick and Easy

★ Pictionary:

Members of the second group then take turns to represent each word in the form of a diagram while their friends try to guess the word from the drawing.

Simple to Prepare

★ Taboo. Taboo is a word game. The objective of the game is for a player to have his / her partner(s) guess the word on his / her card by describing it. However, the player is not allowed to use the actual word, or any of the other words printed on the card.



Simple to Prepare

1) Television

Watch

Cartoon

Film

Channel

TV

Simple to Prepare

2) Violin

Strings
Orchestra
Conductor
Music
Instrument

Simple to Prepare

3) iPod

Music Player

MP3

Apple

iPad / iPhone

Songs

Simple to Prepare

4) Diamond

Rock

Engagement

Ring

Jewel

Stone

Brilliant

Simple to Prepare

5) Bee

Honey

Insect

Hive

Sting

Bumble

Simple to Prepare

6) Spaghetti

Pasta
Noodles
Meatball
Italian
Tomato

Simple to Prepare

7) Mickey Mouse

Cartoon
Donald
Daisy
Pluto
Disney

Simple to Prepare

8) Coffee

Brown

Hot

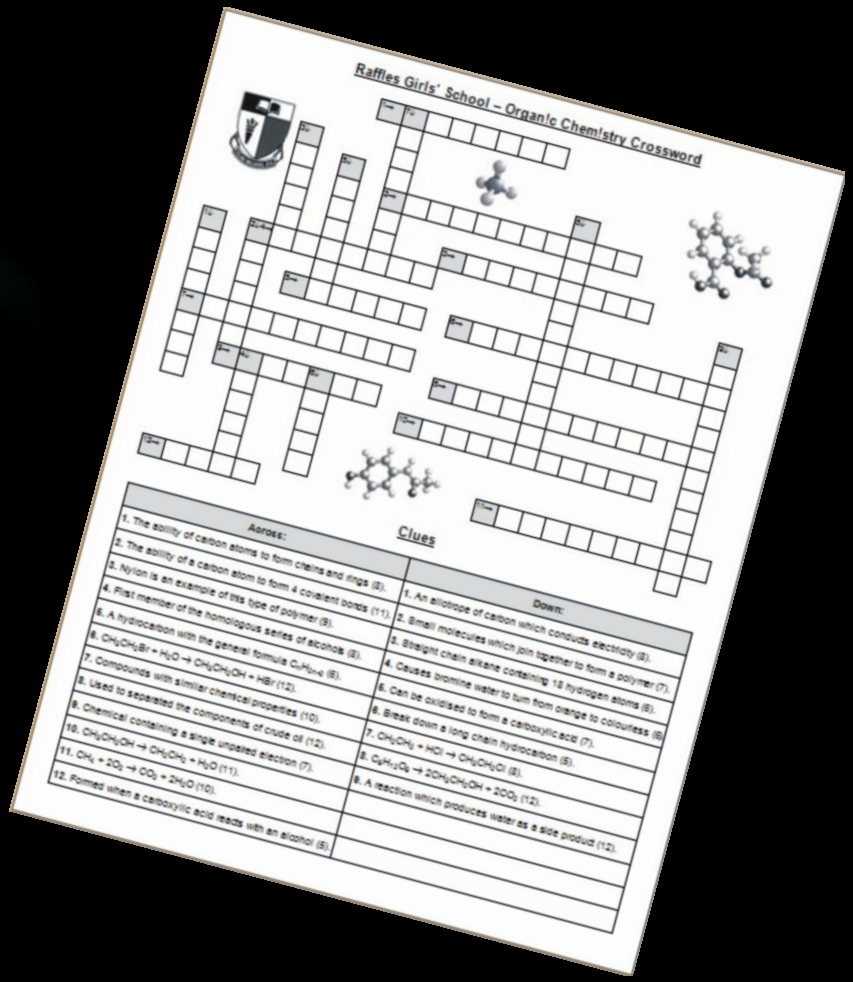
Brewed

Caffeine

Decaffeinated

Simple to Prepare

★ Crosswords, word searches and Sudoku can easily be prepared using software that is available for downloading from the internet.



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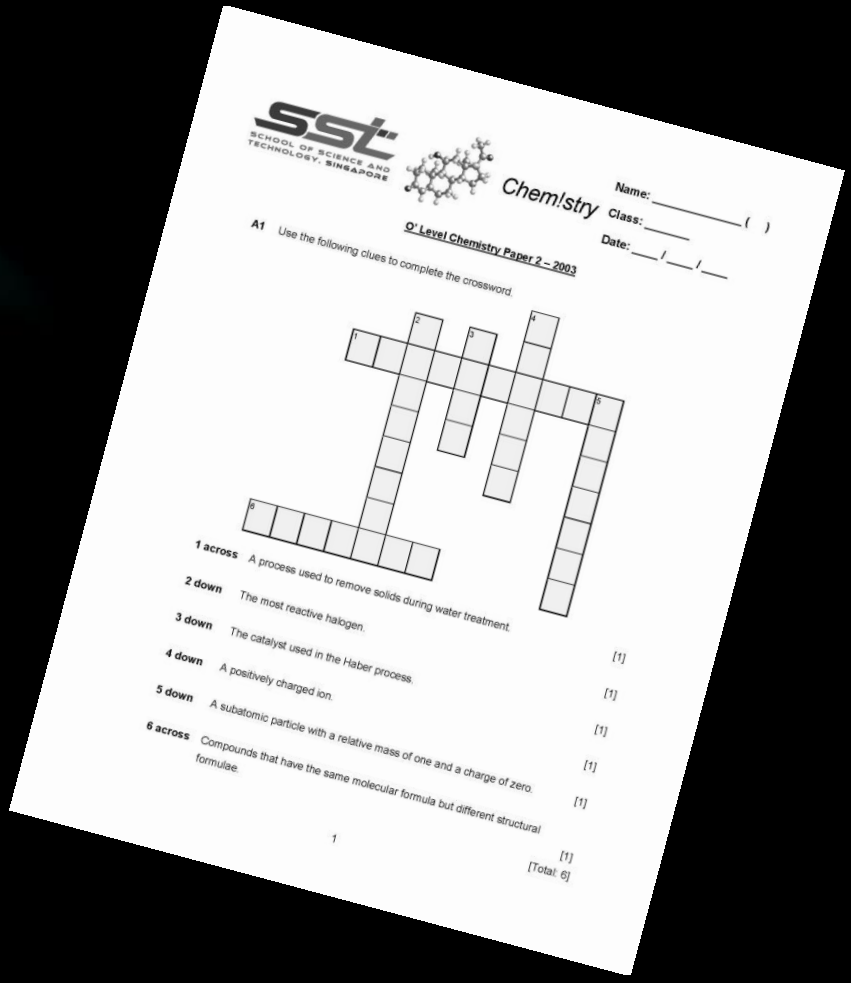
SST
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE

Chem!stry

Name: _____ ( )

Class: _____

Date: ___/___/___

O' Level Chemistry Paper 2 – 2003

A1 Use the following clues to complete the crossword.

1 across A process used to remove solids during water treatment. [1]

2 down The most reactive halogen. [1]

3 down The catalyst used in the Haber process. [1]

4 down A positively charged ion. [1]

5 down A subatomic particle with a relative mass of one and a charge of zero. [1]

6 across Compounds that have the same molecular formula but different structural formulae. [1]

[Total: 6]

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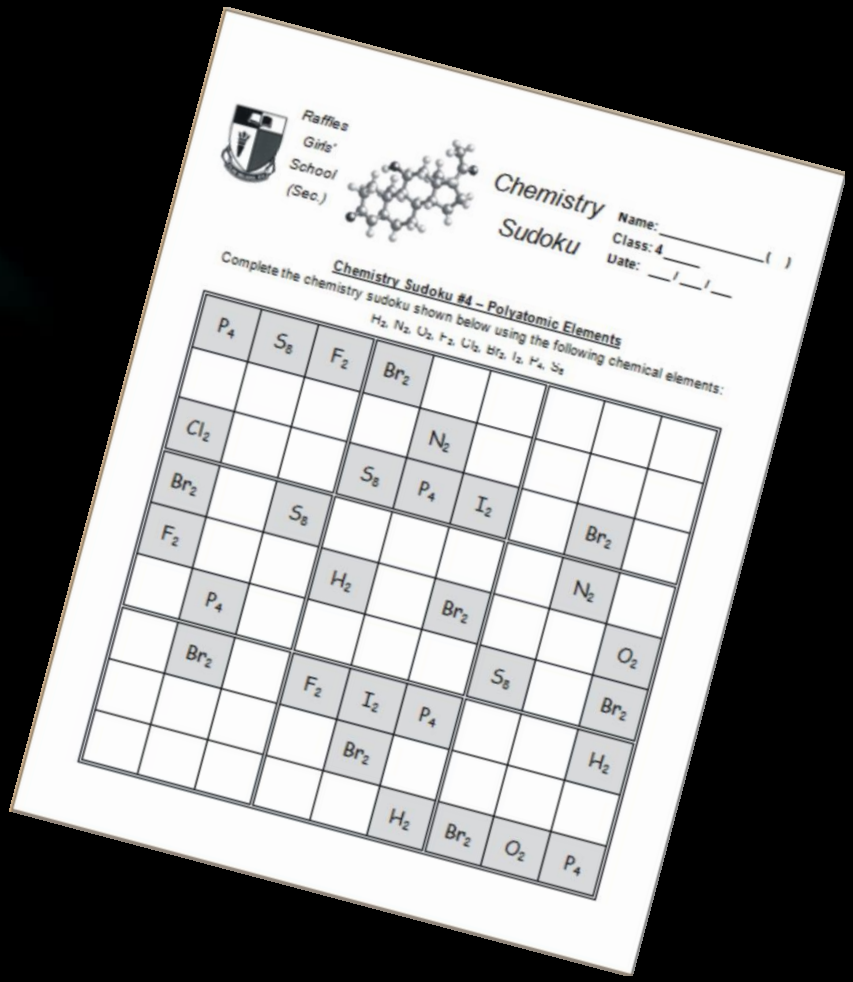
Simple to Prepare

★ Crosswords, word searches and Sudoku can be attached to worksheets and assignments for the students to attempt once everything else has been completed.



Simple to Prepare

★ Questions can be presented to the students on a noughts and crosses board. The students must answer the question correctly before placing either their ○ or ✕ on the board.

Sodium Bromide	Calcium Chloride	Aluminium Nitrate Aluminium Nitrate(V)
Copper(II) Hydroxide	Lead(II) Nitrate Lead(II) Nitrate(V)	Tin(IV) Oxide
Uranium(VI) Fluoride	Zinc Carbonate	Ammonium Sulphate Ammonium Sulfate(VI)

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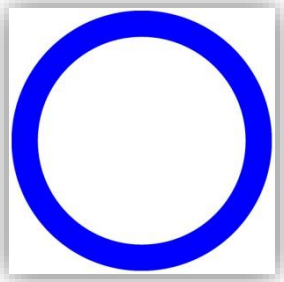	Calcium Chloride	Aluminium Nitrate Aluminium Nitrate(V)
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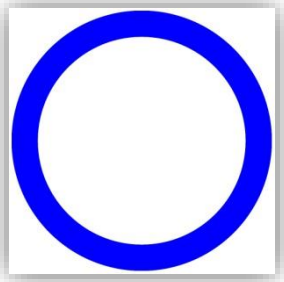
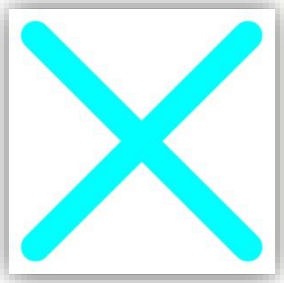
	Calcium Chloride	Aluminium Nitrate Aluminium Nitrate(V)
Copper(II) Hydroxide		Tin(IV) Oxide
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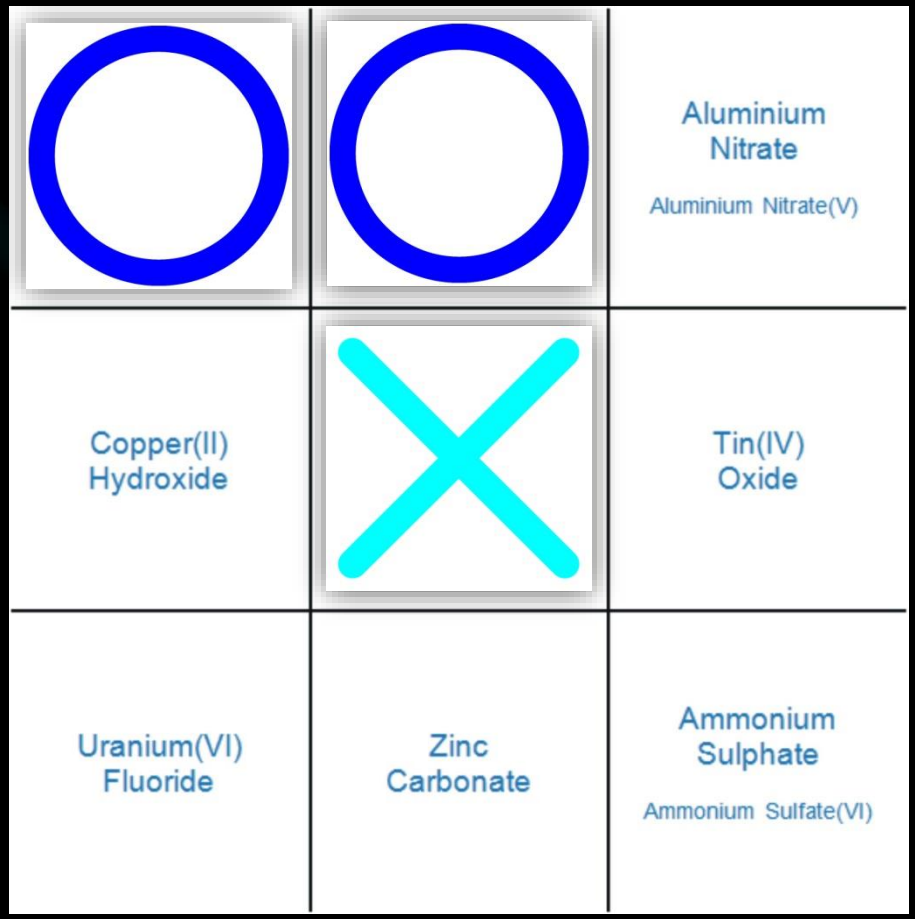

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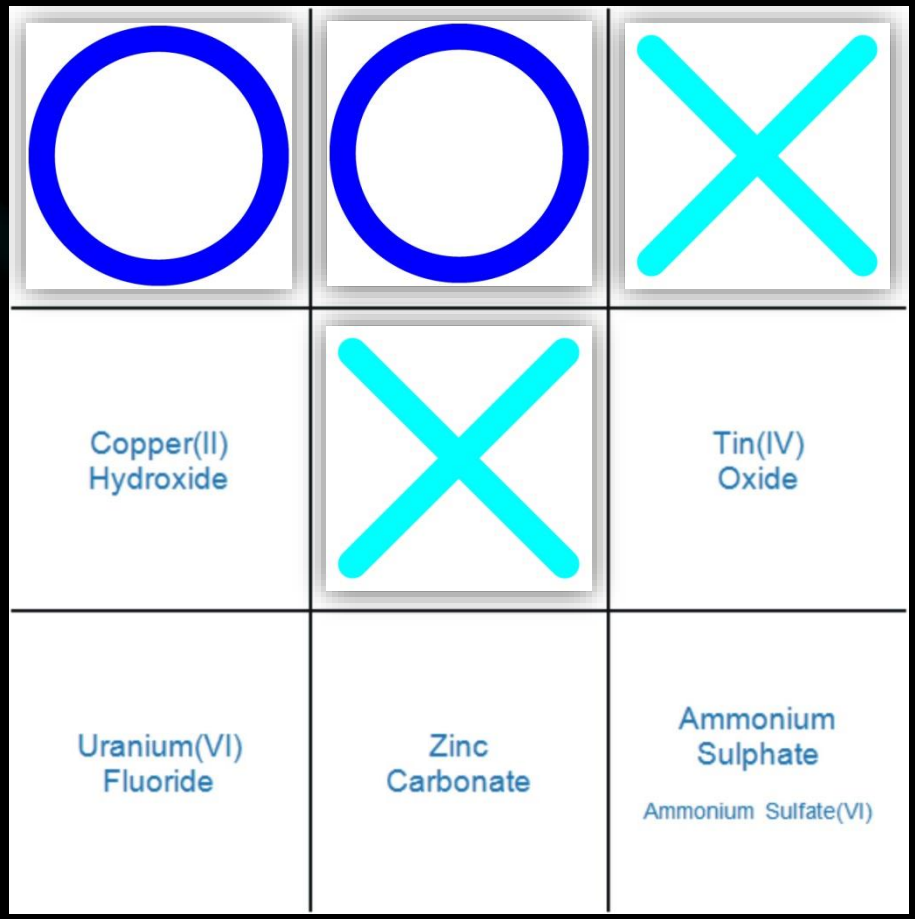

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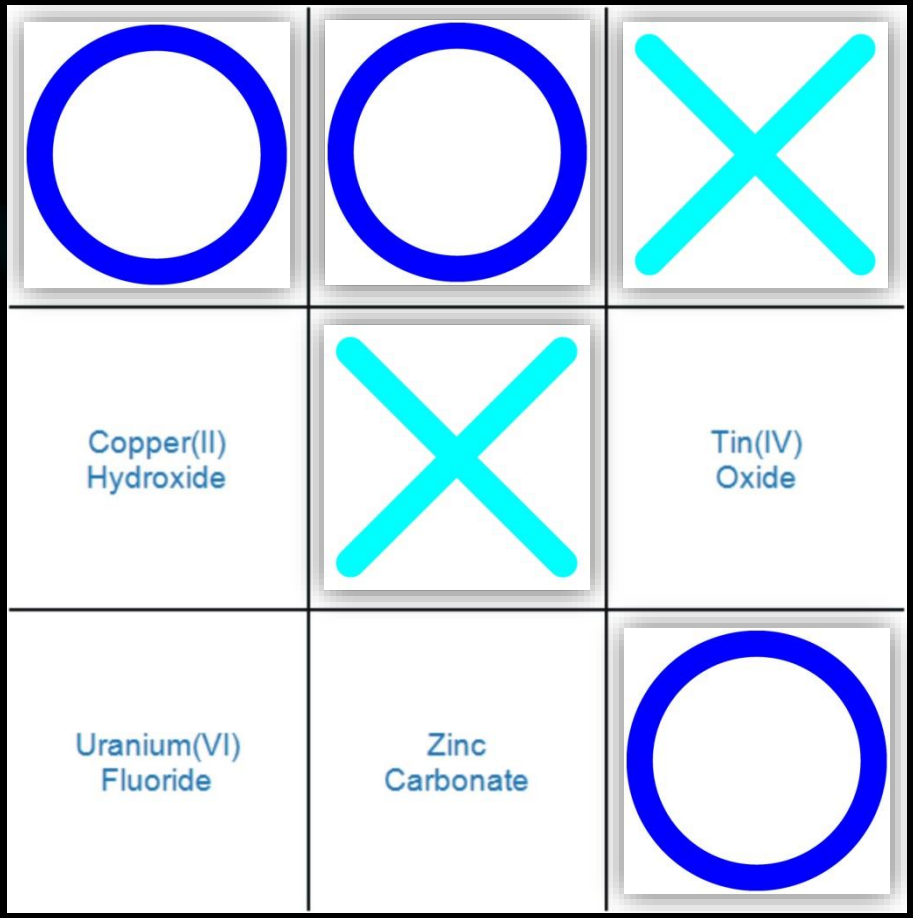

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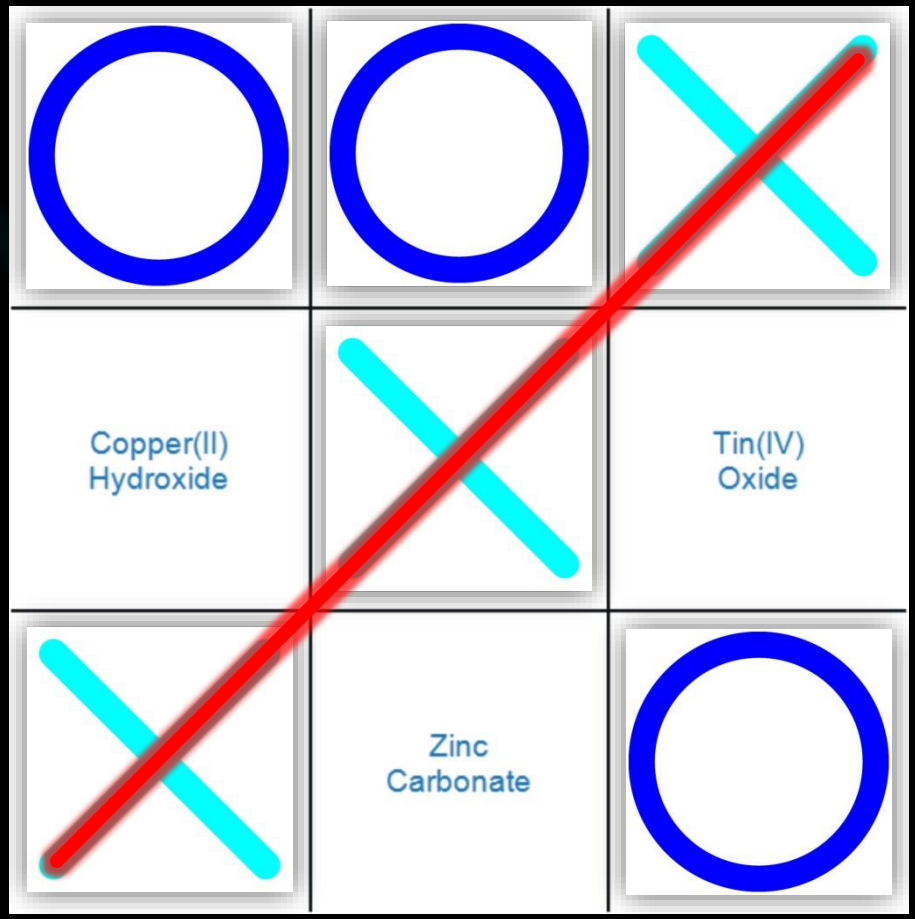
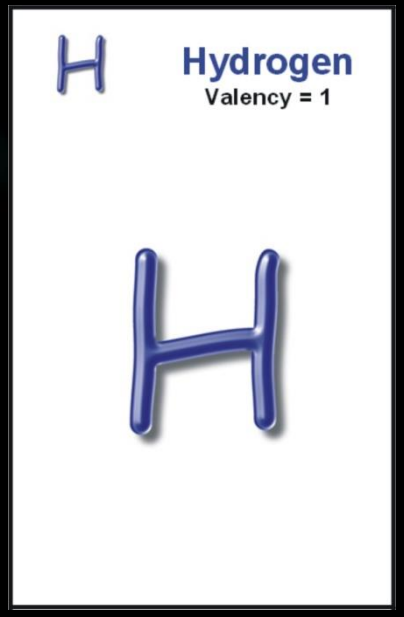


Card Games

★ In Chemical Formulae Rummy, each student is dealt ten cards. Each card has either the symbol of a chemical element or a number printed on it. The objective of the game is for the students to discard their playing cards by creating legitimate chemical formulae.



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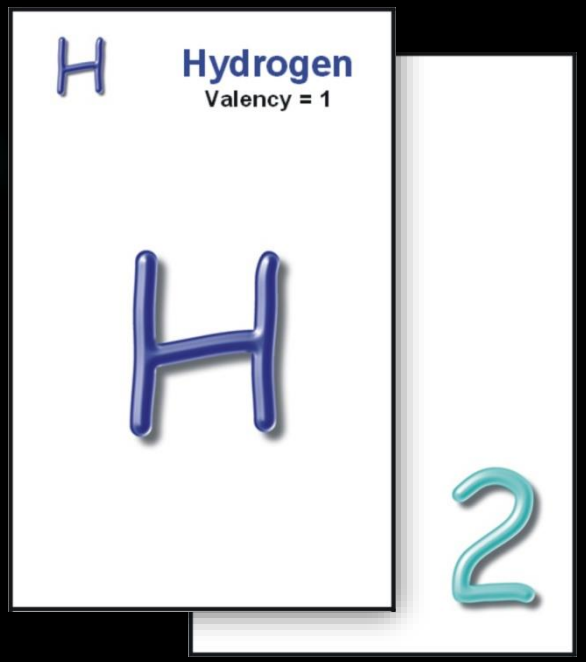

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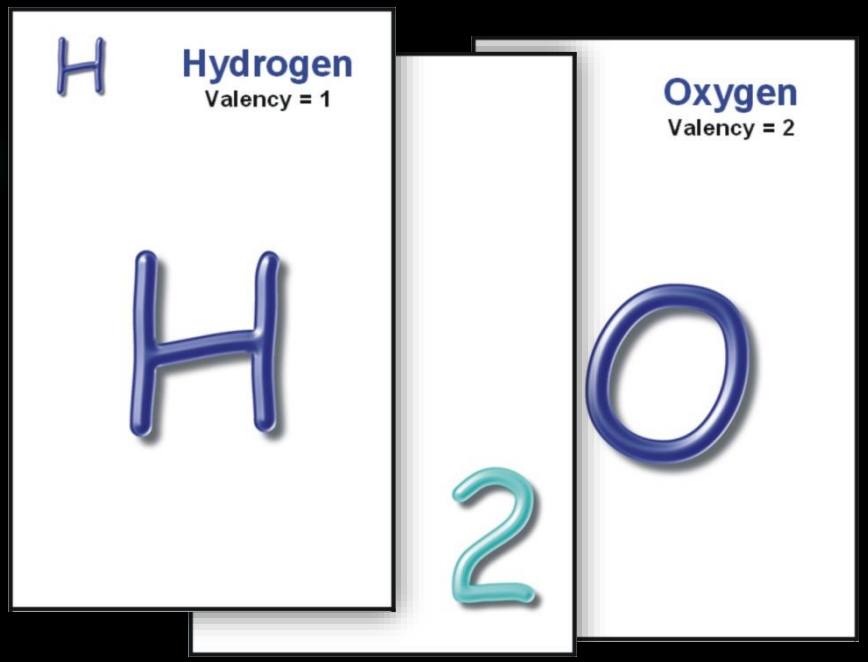
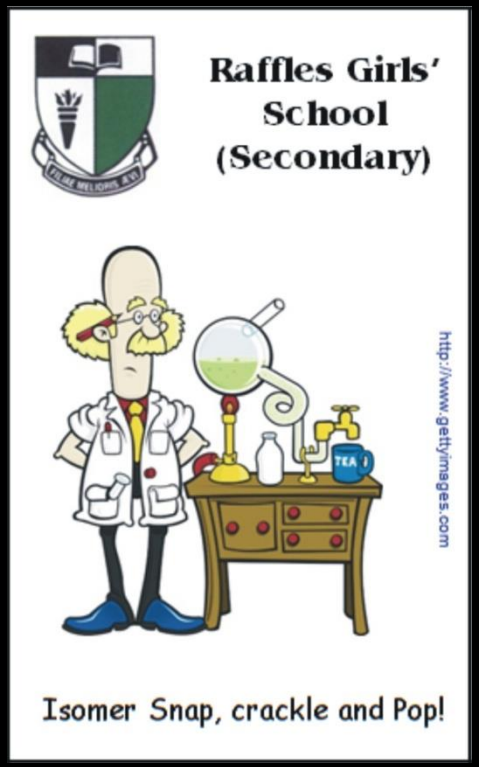


Card Games

★ Organic Chemistry Snap introduces students to the concept of isomerism and teaches them to recognise compounds that share the same molecular formula, but have different graphical formulae.



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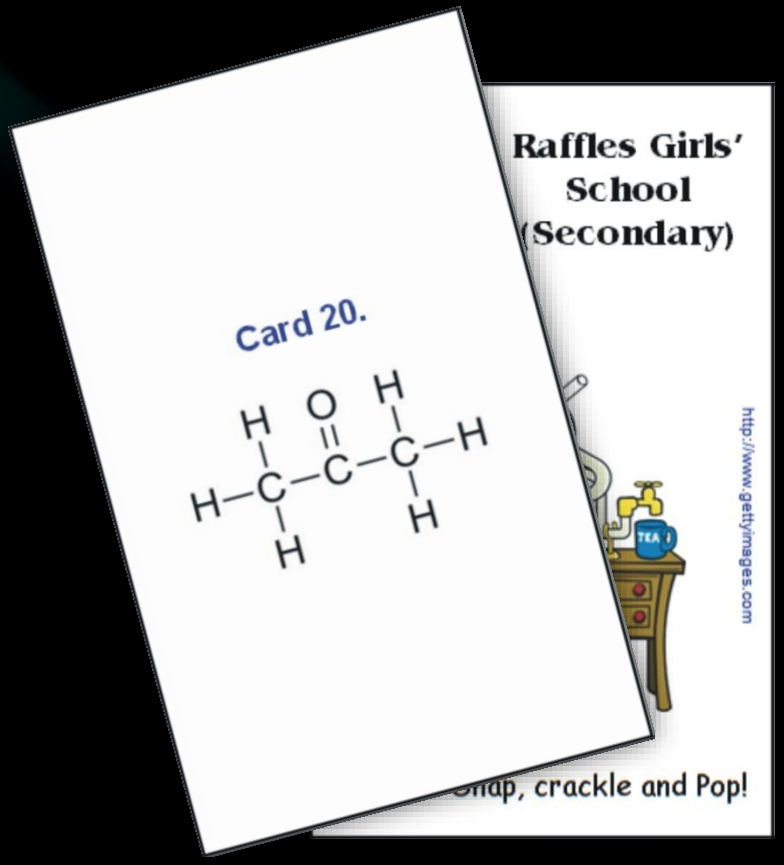

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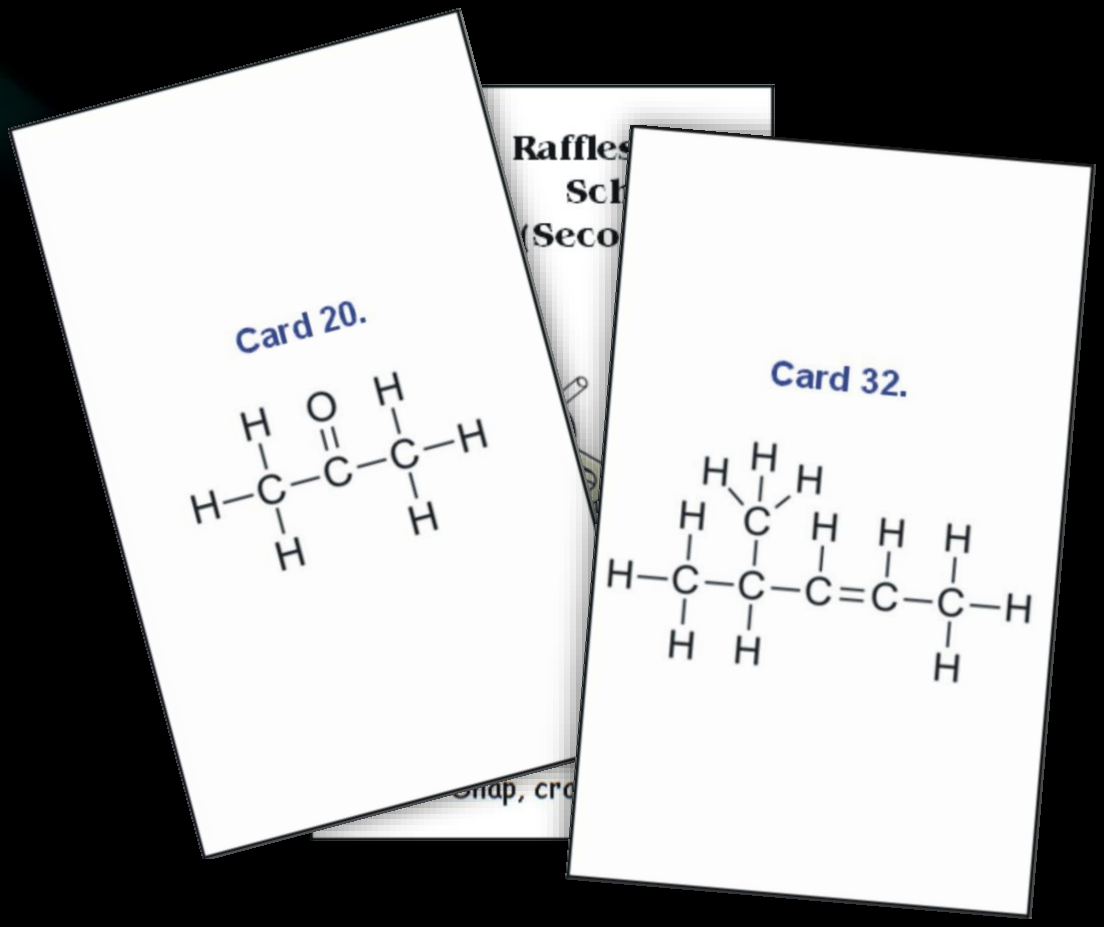

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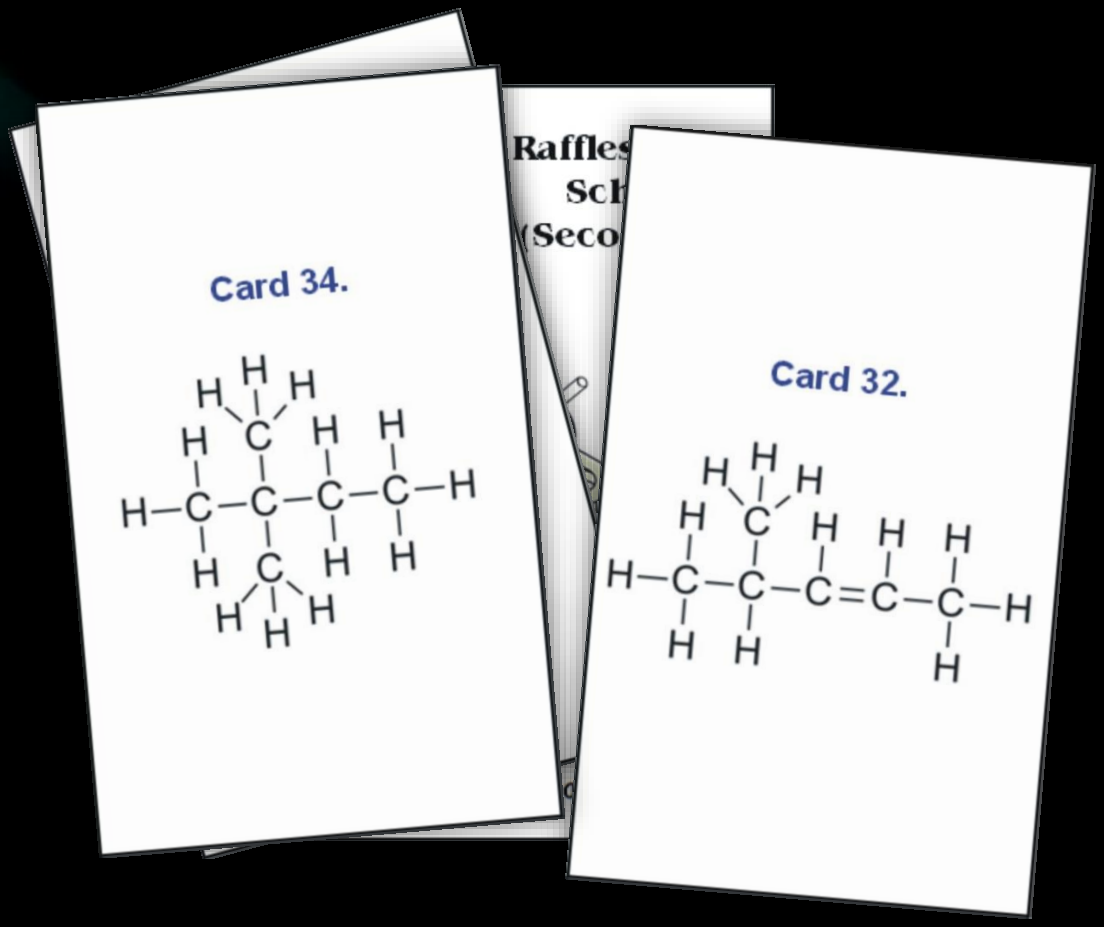

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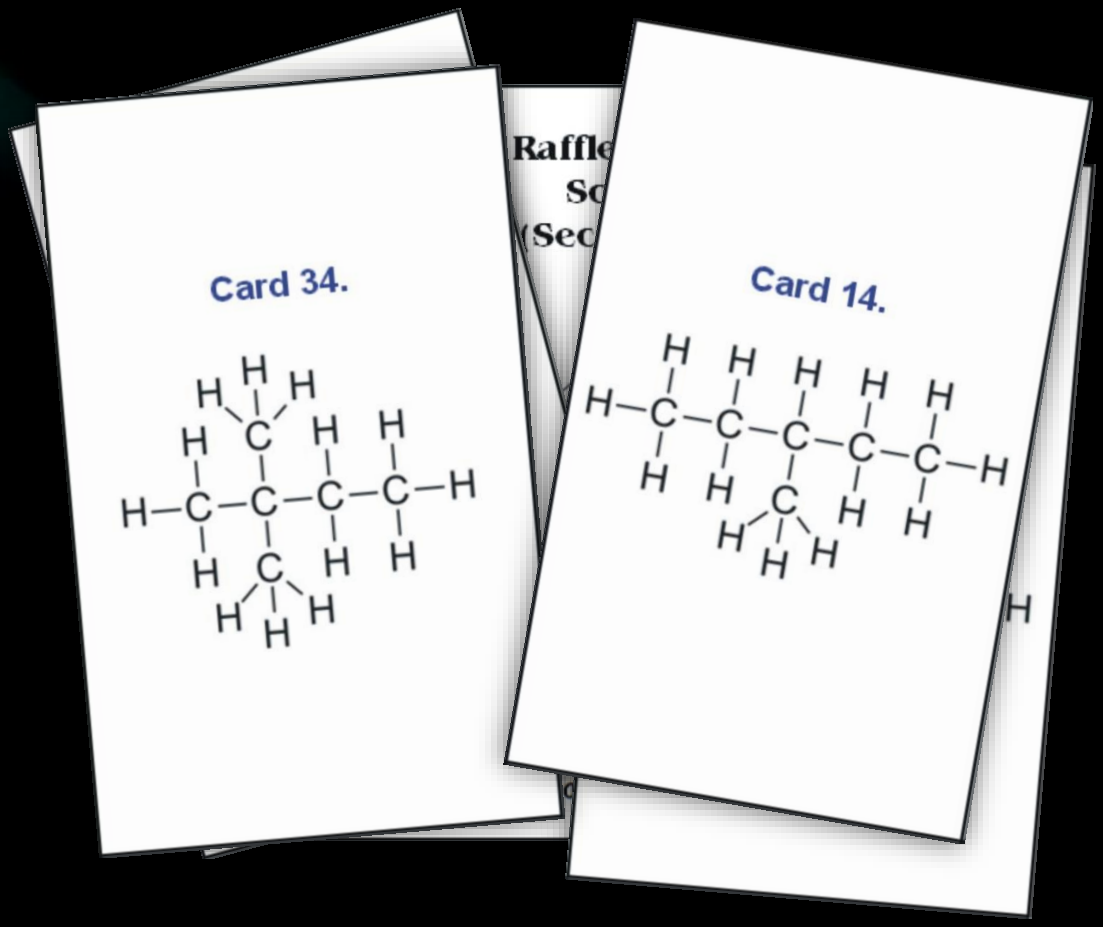

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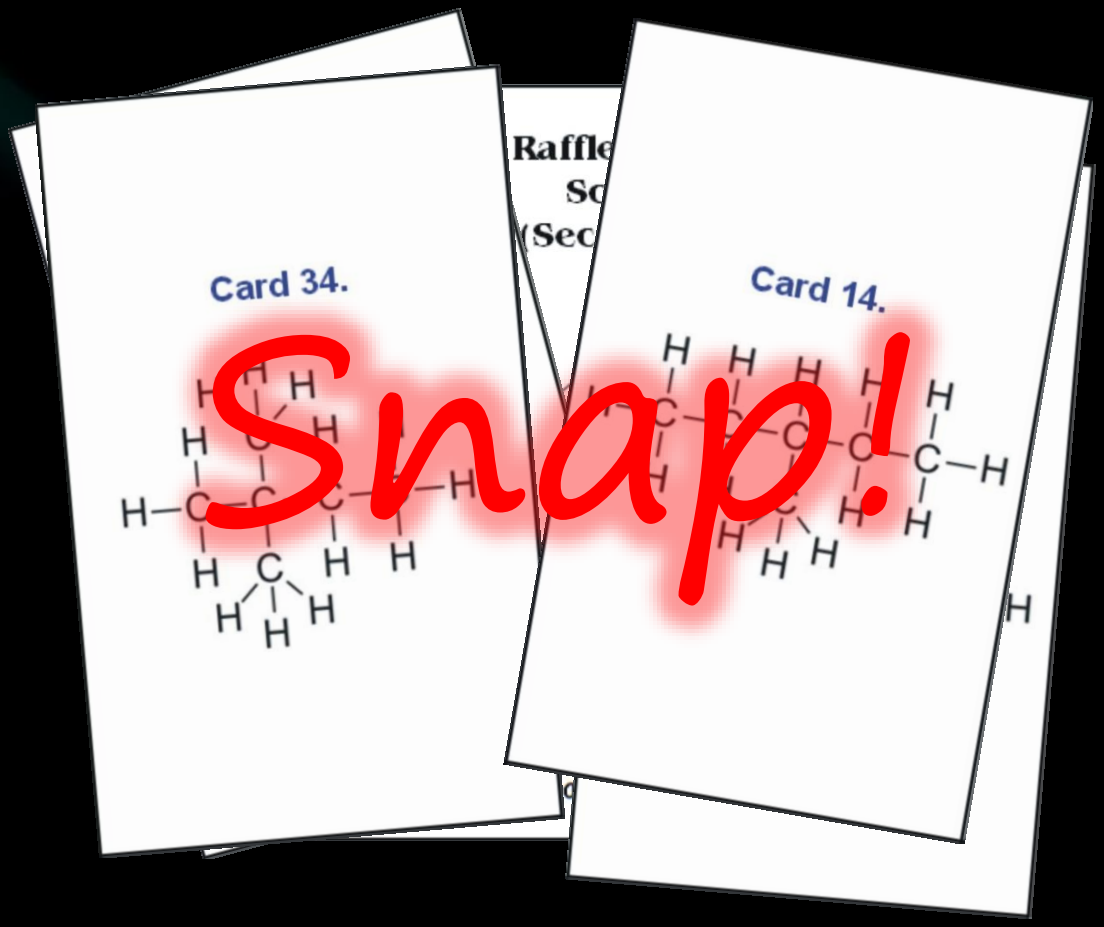

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Card Games – Guess Who?

Card Games

★ Chemical Elements "Guess Who" teaches students the chemical and physical properties of the chemical elements.

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Card Games


Sodium - Na
Phosphorus - P
Magnesium - Mg
Iron - Fe
Iron
The Periodic Table (Elements With Style)
Sulphur - S
Sulphur
The Periodic Table (Elements With Style)
Potassium - K
Potassium
The Periodic Table (Elements With Style)

Card Games

Is the chemical element a non-metal?

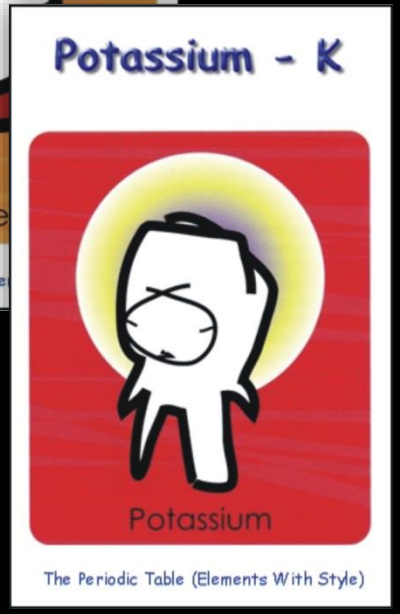
Card Games

No, it is a metal.

Card Games

No, it is a metal.

Card Games



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Card Games

Does the metal form coloured compounds?

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Card Games

No, the metal's compounds are colourless.

Card Games

No, the metal's compounds are colourless.

Card Games

Dr. Chris Slatter – Nanyang Girls' High School – Singapore

Card Games

Is the metal less dense than water?

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Card Games

Yes, the metal is less dense than water.

Card Games

Yes, the metal is less dense than water.

Card Games


Sodium - Na
Sodium
The Periodic Table (Elements With Style)


Potassium - K
Potassium
The Periodic Table (Elements With Style)

Card Games

Does the metal have a yellow flame colour?

Card Games

Yes, the metal has
a yellow flame colour.

Card Games

Yes, the metal has
a yellow flame colour.

Card Games

Card Games

Is the chemical element sodium?

Card Games

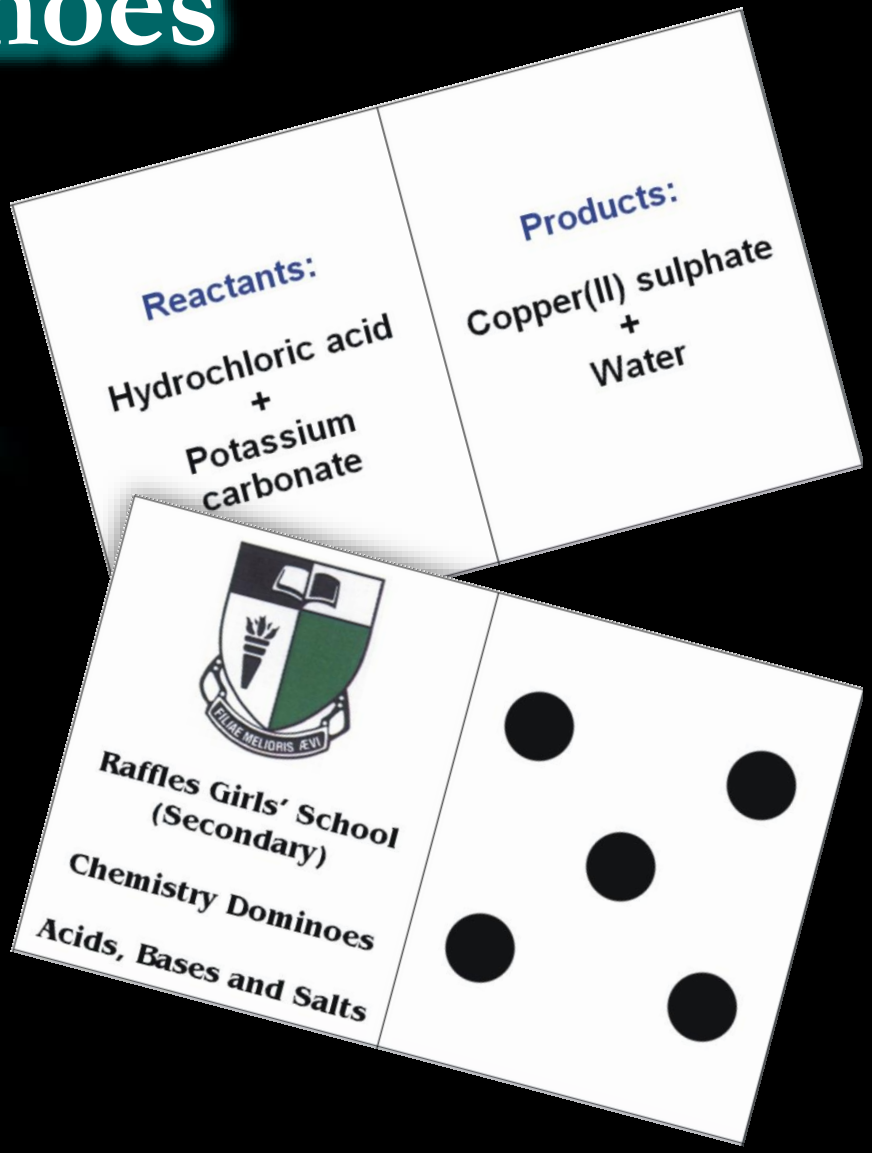
Yes, the chemical element is sodium!

Dominoes

★ The dominoes are designed in Microsoft Word. Each domino has two essential items printed on it:

1) A question, the answer to which is printed on another domino.

2) An answer, the original question being printed on another domino.



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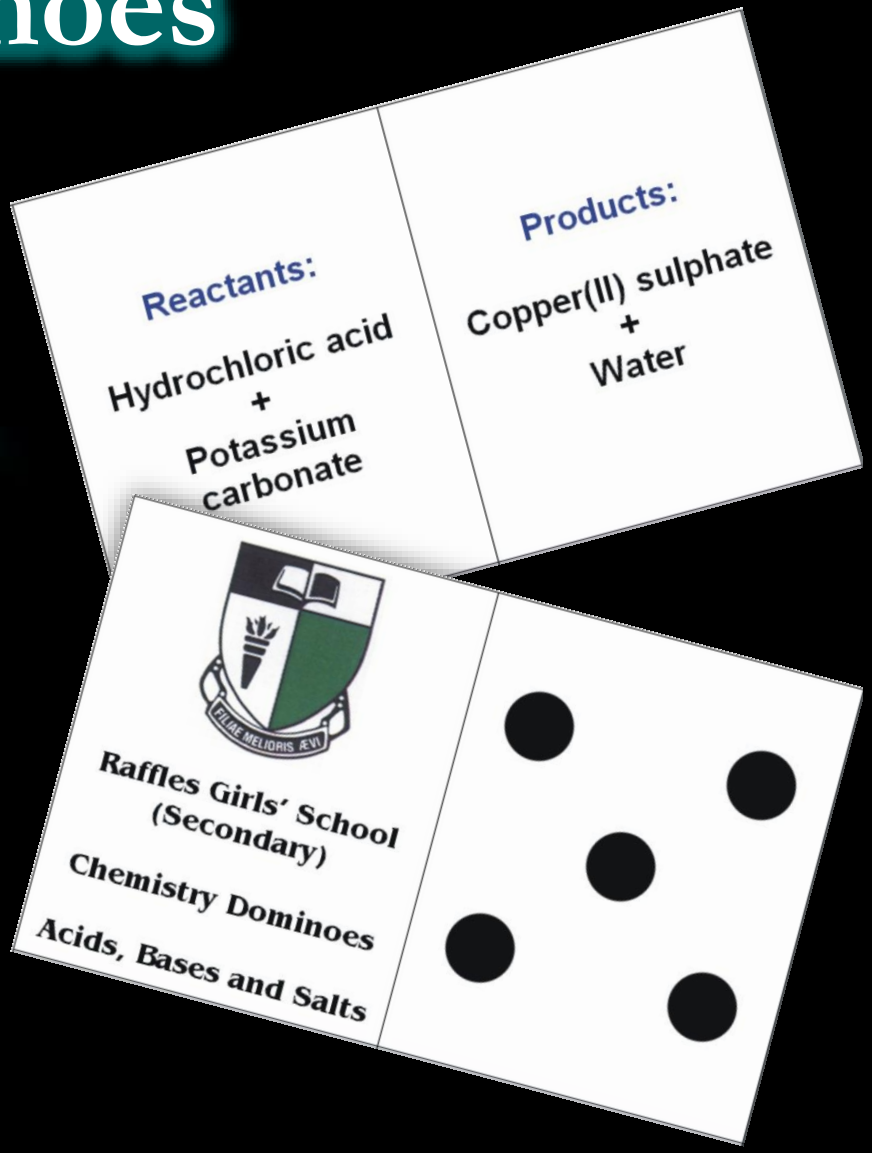
Dominoes

★ One student starts by reading out the question printed on his/her domino. The student with the correct answer printed on his/her domino responds, and then proceeds to read out his/her question. This continues around the class in a domino effect.

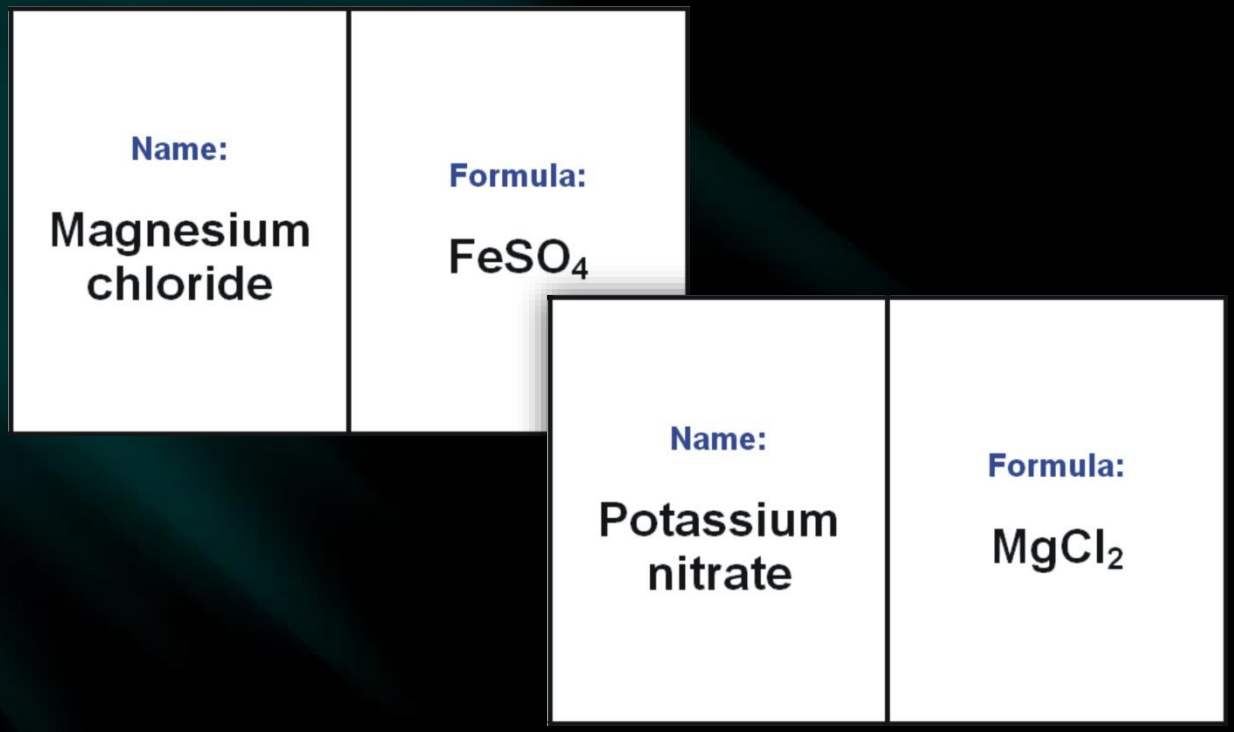


Dominoes

Dominoes

Name:	Formula:
Magnesium chloride	$FeSO_4$

Dominoes



Dominoes

Name:	Formula:
Magnesium chloride	$FeSO_4$

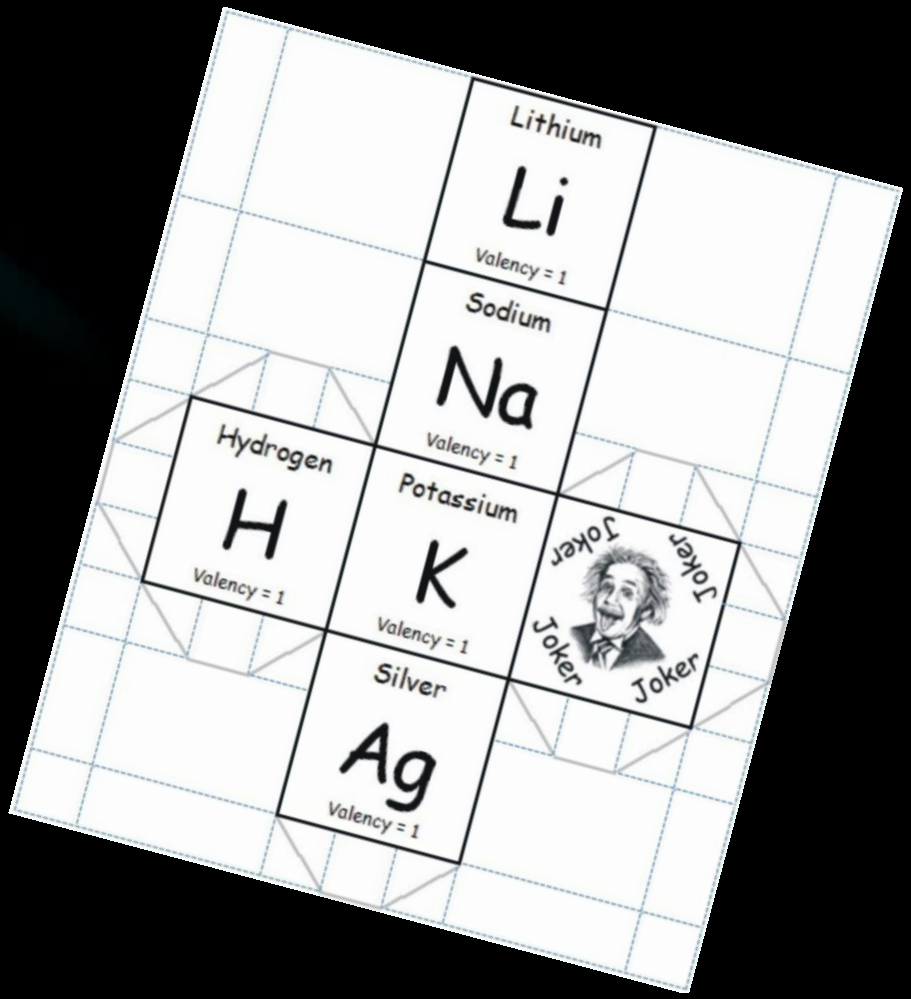
Name:	Formula:
Potassium nitrate	$MgCl_2$

Name:	Formula:
Carbon dioxide	KNO_3

Dice Games

★ The dice are designed in Microsoft Word. Several dice with different words or symbols on are thrown together to generate a question or statement for the students to either answer or discuss.

★ Chemical Formulae Boggle is a variation on the "Boggle" word game.

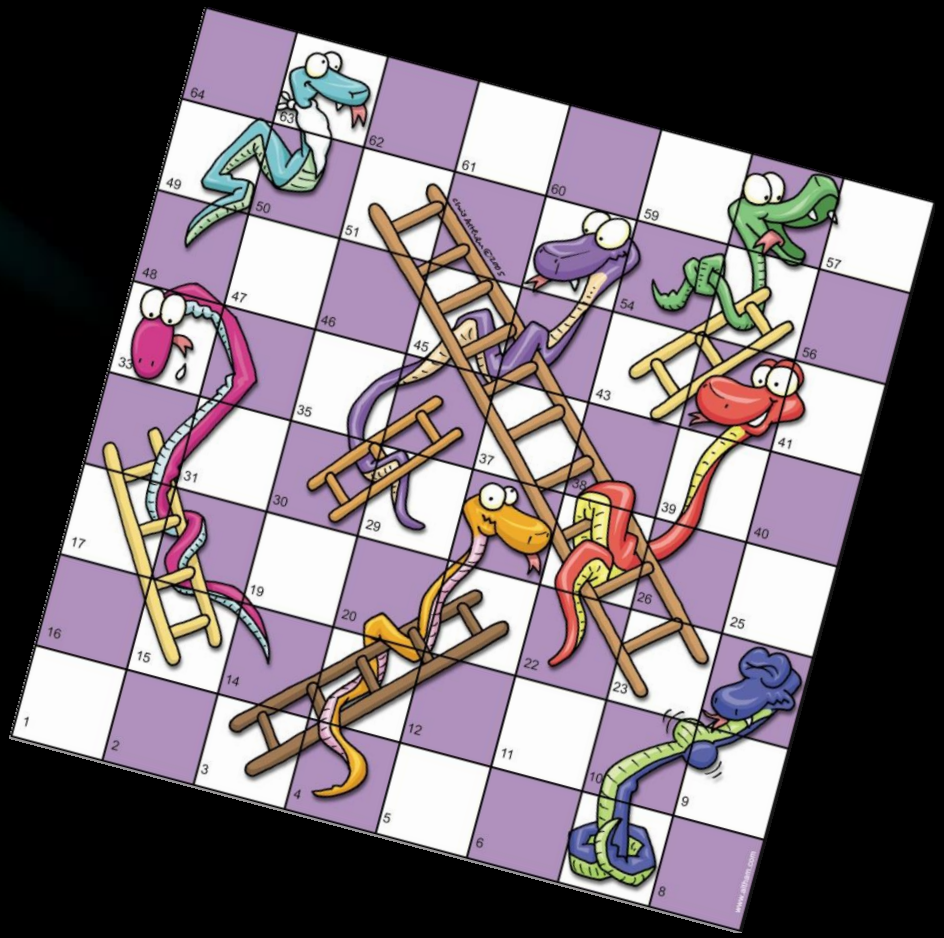


Simple Board Games

★ Simple board games are quite straightforward to make and the rules are easy to follow. The students move their counter from start to finish but must correctly answer a question before they can roll the dice.

Snakes and Ladders

★ Another simple board game. In this game, however, the student does not roll any dice to move. The student has to answer a question with a numerical answer. The student then moves the number of squares that corresponds to the correct answer.



Snakes and Ladders

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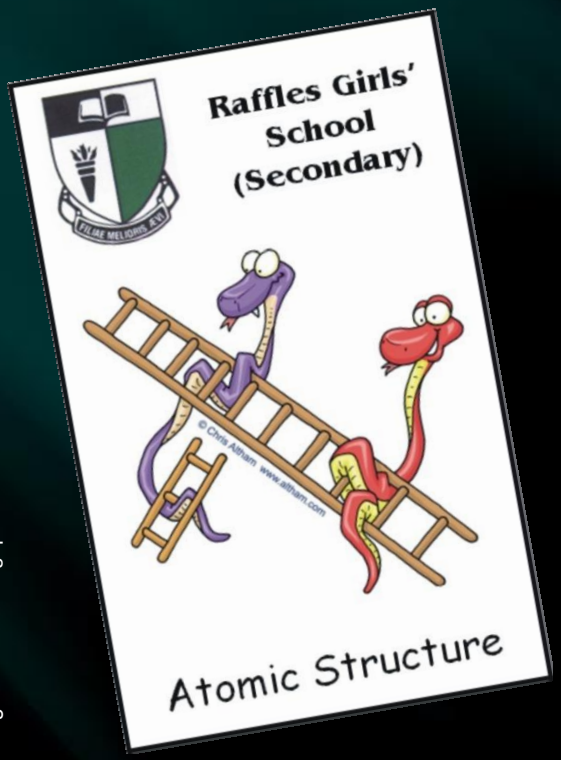
Snakes and Ladders



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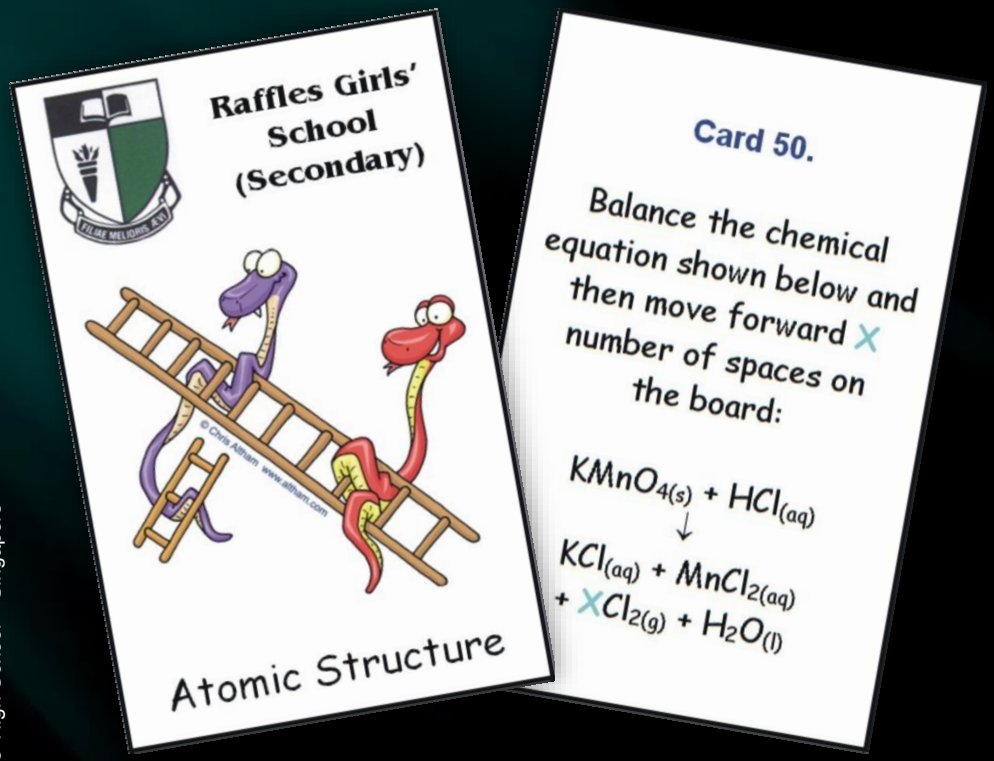

★ Chemical Equations

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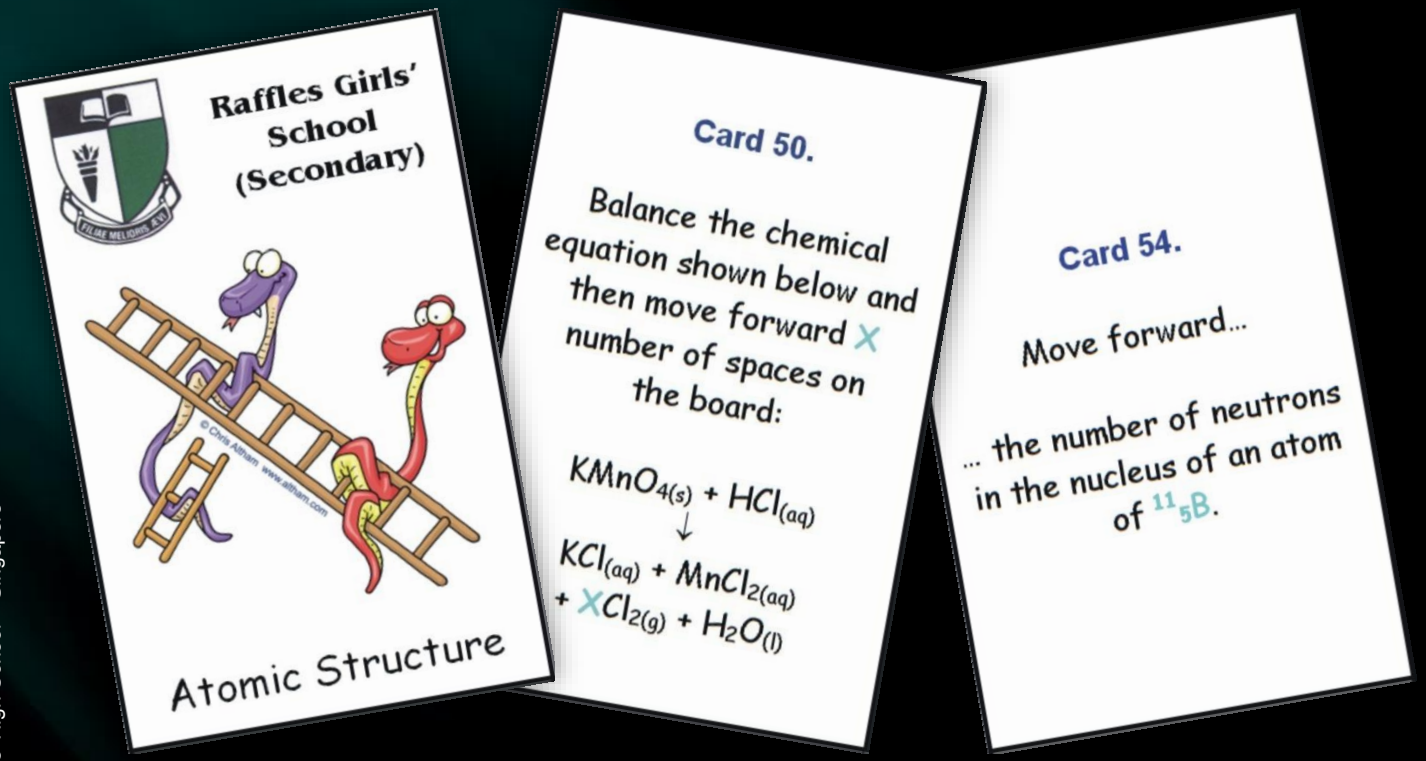
Snakes and Ladders



★ Chemical Equations

★ Atomic Structure

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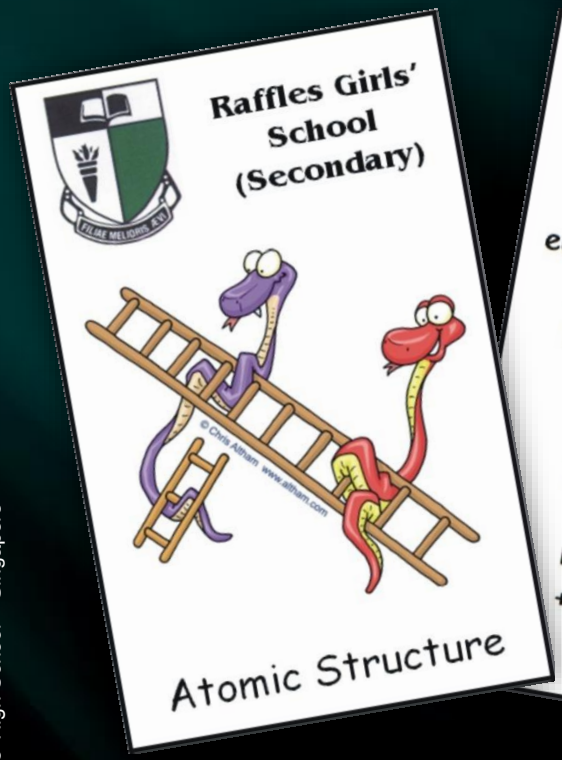
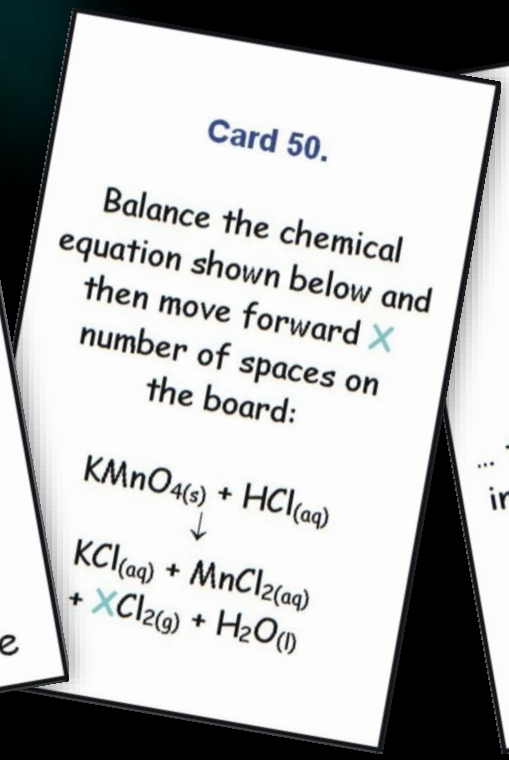
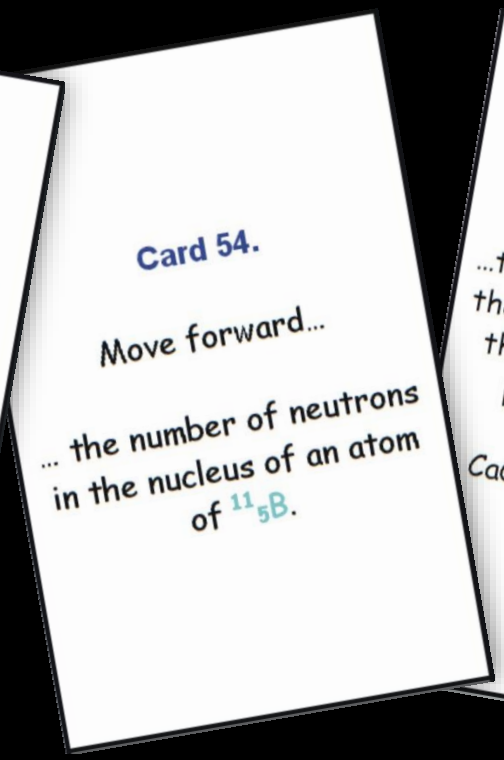
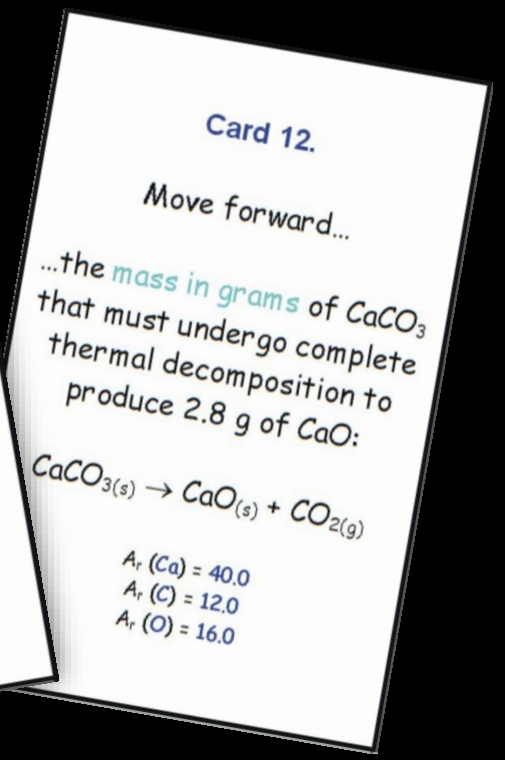
Snakes and Ladders









★ Chemical Equations

★ Atomic Structure

★ Mole Concept

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Snakes and Ladders

★ Differentiation is achieved by playing the same game, but using more challenging questions.

Snakes and Ladders

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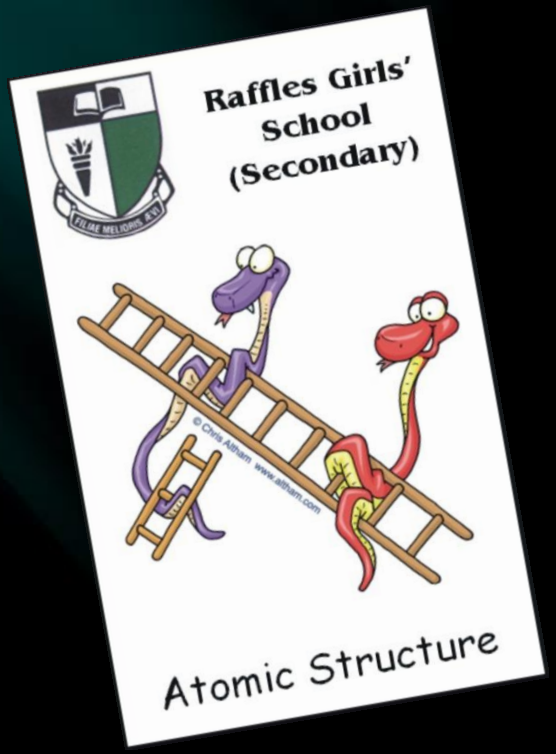

Snakes and Ladders

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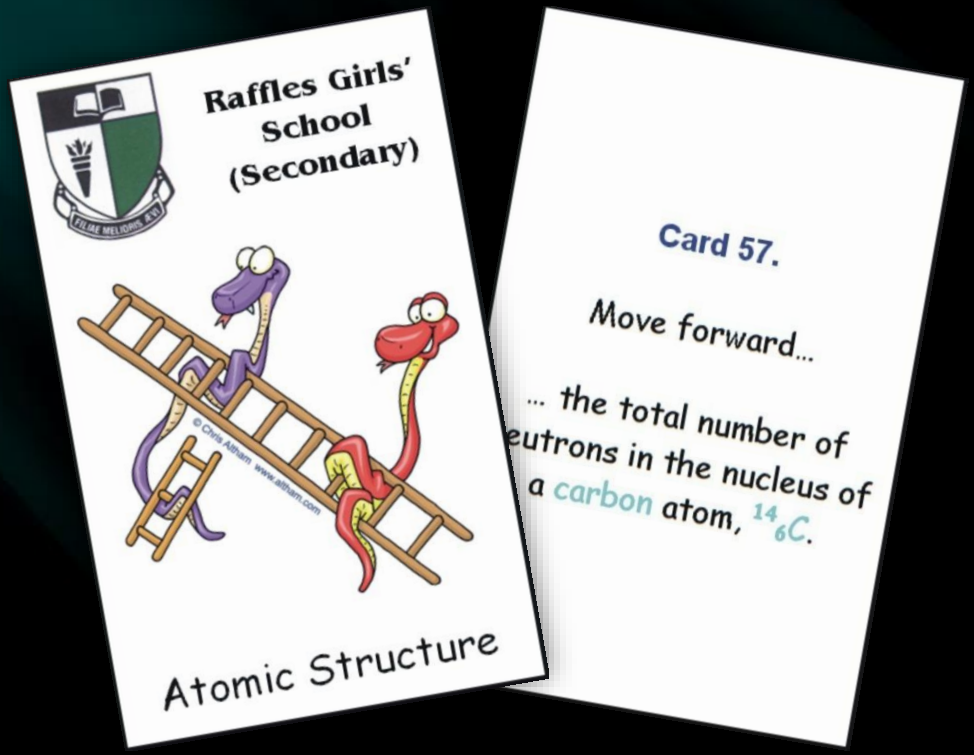

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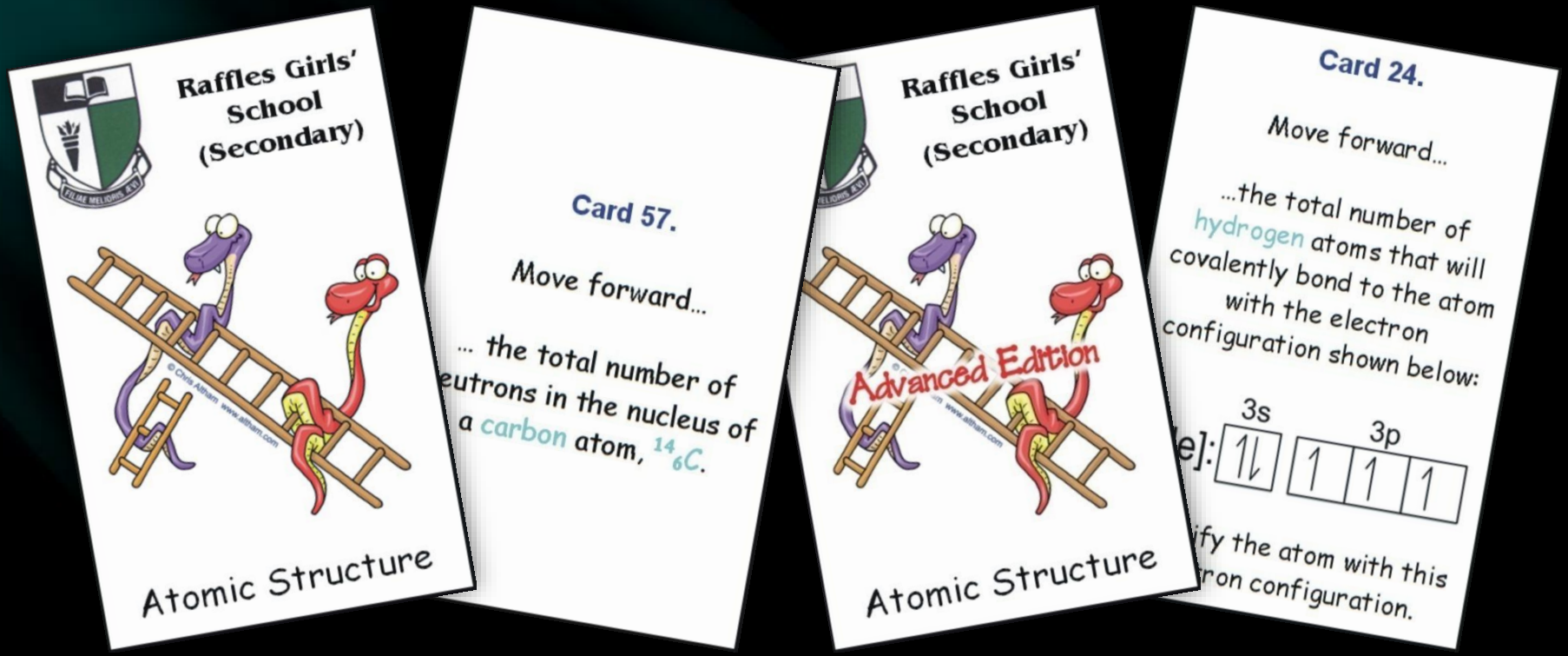
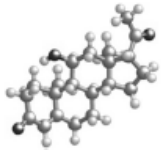


Bingo

SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE



Chem!stry

Name: _____ ( )

Class: _____

Date: ____ / ____ / ____

1. Find someone who can name the first six straight chain alkanes.	**2.** Find someone who can explain the different ways of measuring the speed of a chemical reaction.	**3.** Find someone who can explain the terms "oxidation" and "reduction".	**4.** Find someone who can describe how to measure the percentage oxygen in the Earth's atmosphere.	**5.** Find someone who can explain the properties of a catalyst and how it increases the speed of a chemical reaction.
6. Find someone who can explain how to electroplate an object with a layer of silver.	**7.** Find someone who can name the main atmospheric pollutants and explain why they are harmful.	**8.** Find someone who can, in terms of chemical bonds, explain why exothermic reactions release energy.	**9.** Find someone who can explain the concept of "collision theory".	**10.** Find someone who can explain what happens during the electrolysis of concentrated aqueous potassium iodide.
11. Find someone who can summarise the reactions of the alkanes, with examples.	**12.** Find someone who can recall the test for **i)** an oxidising agent **ii)** a reducing agent.	People Bingo!	**13.** Find someone who can name all the fractions in the fractional distillation of crude oil.	**14.** Find someone who can sketch the labelled energy profile diagram for an endothermic reaction.
15. Find someone who can explain the "carbon cycle".	**16.** Find someone who can explain why an increase in temperature increases the speed of a chemical reaction.	**17.** Find someone who can explain how a strip of copper and a strip of zinc can be used to generate electricity.	**18.** Find someone who can name the main atmospheric pollutants and explain how to reduce / minimise them.	**19.** Find someone who can, in terms of chemical bonds, explain why endothermic reactions absorb energy.
20. Find someone who can recall the reactivity series of metals, including carbon and hydrogen.	**21.** Find someone who can draw all of the isomers of $C_4H_{10}O$	**22.** Find someone who can recall the rules for calculating oxidation states.	**23.** Find someone who can explain what happens during the electrolysis of aqueous copper(II) nitrate using copper electrodes.	**24.** Find someone who can summarise the reactions of the alkenes, with examples.

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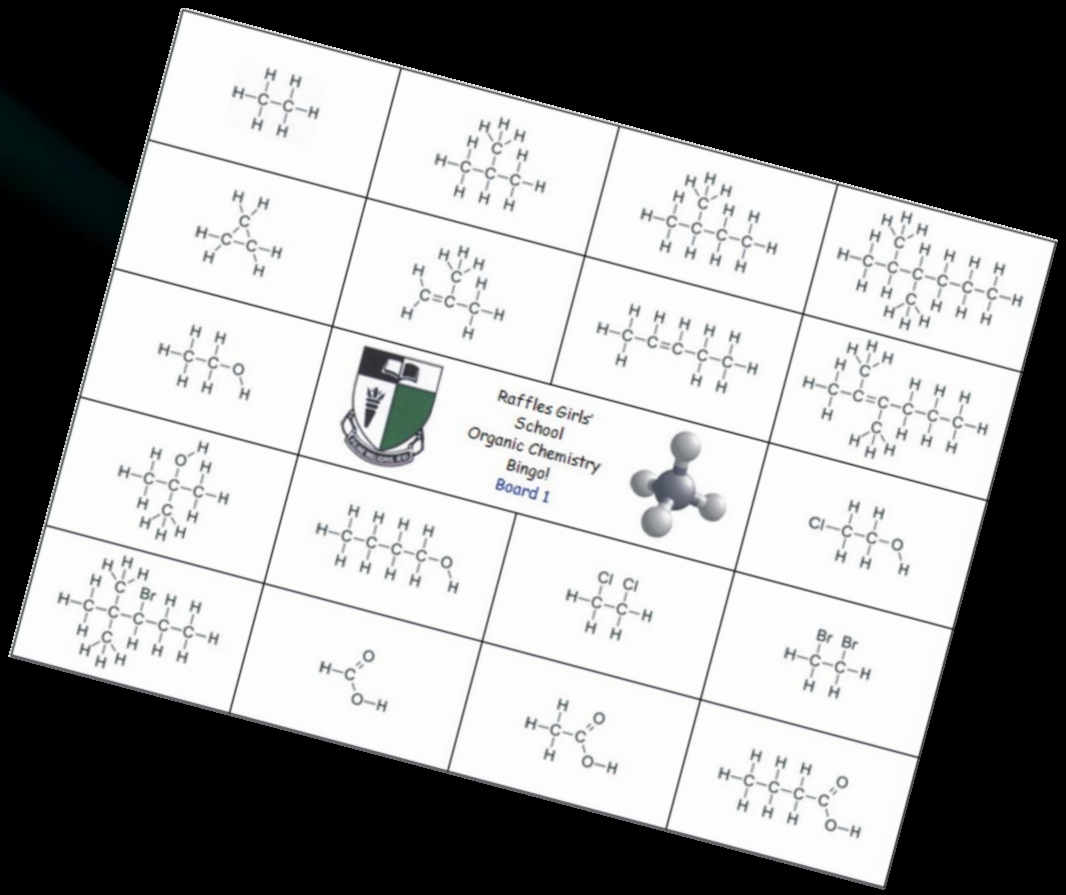
Bingo

★ In this example for organic chemistry, the students must firstly name all of the compounds on their bingo board. The teacher then randomly reads out the names of the compounds which the students check accordingly.



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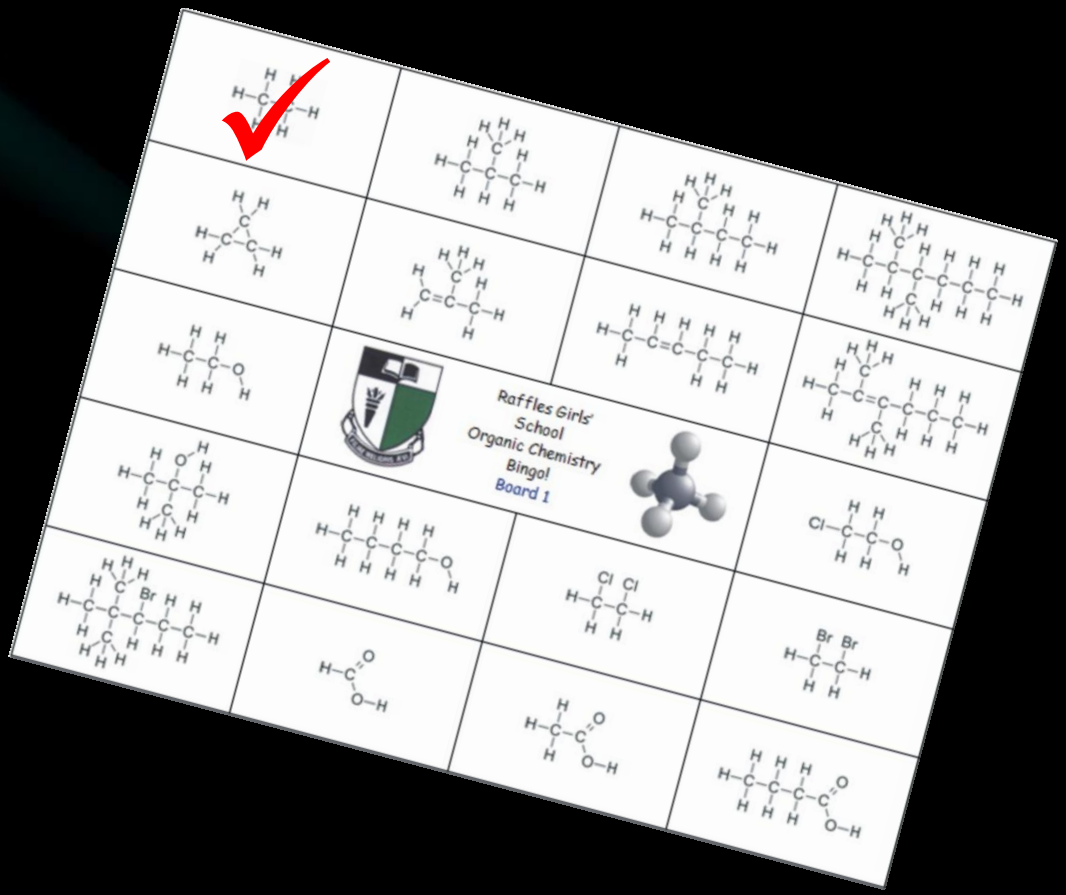

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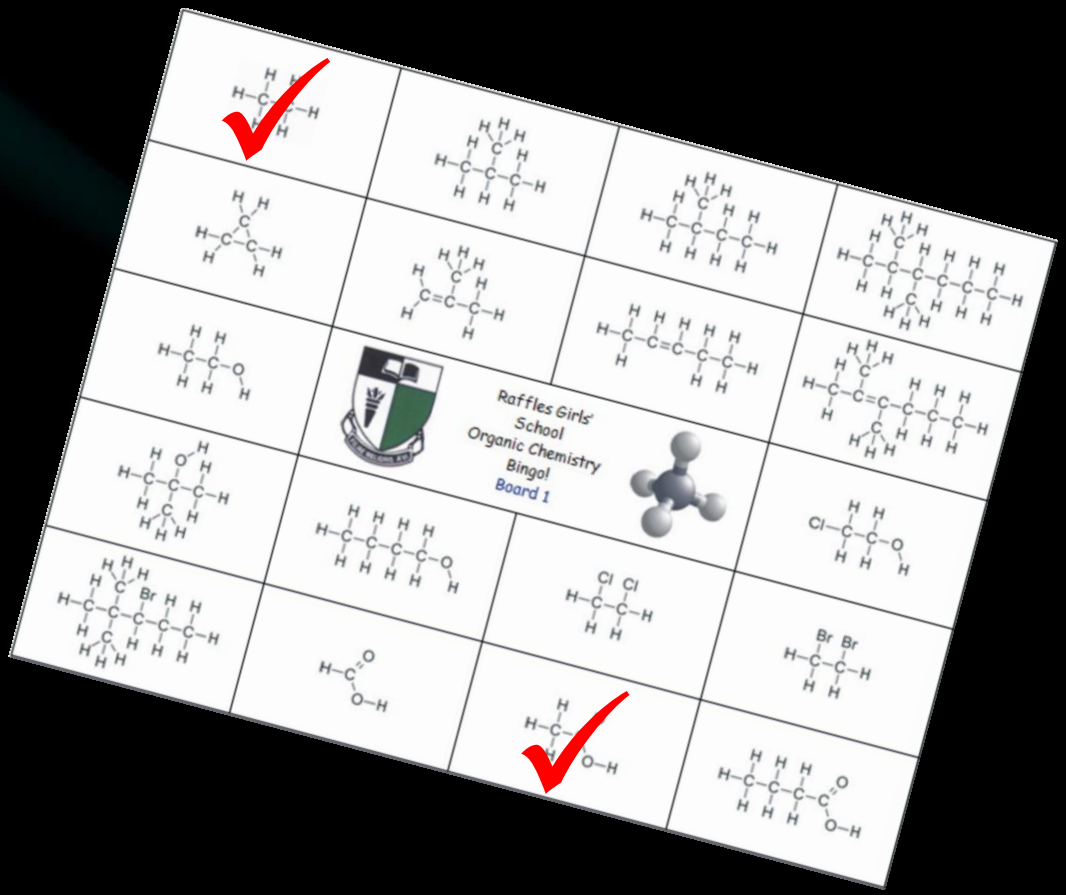

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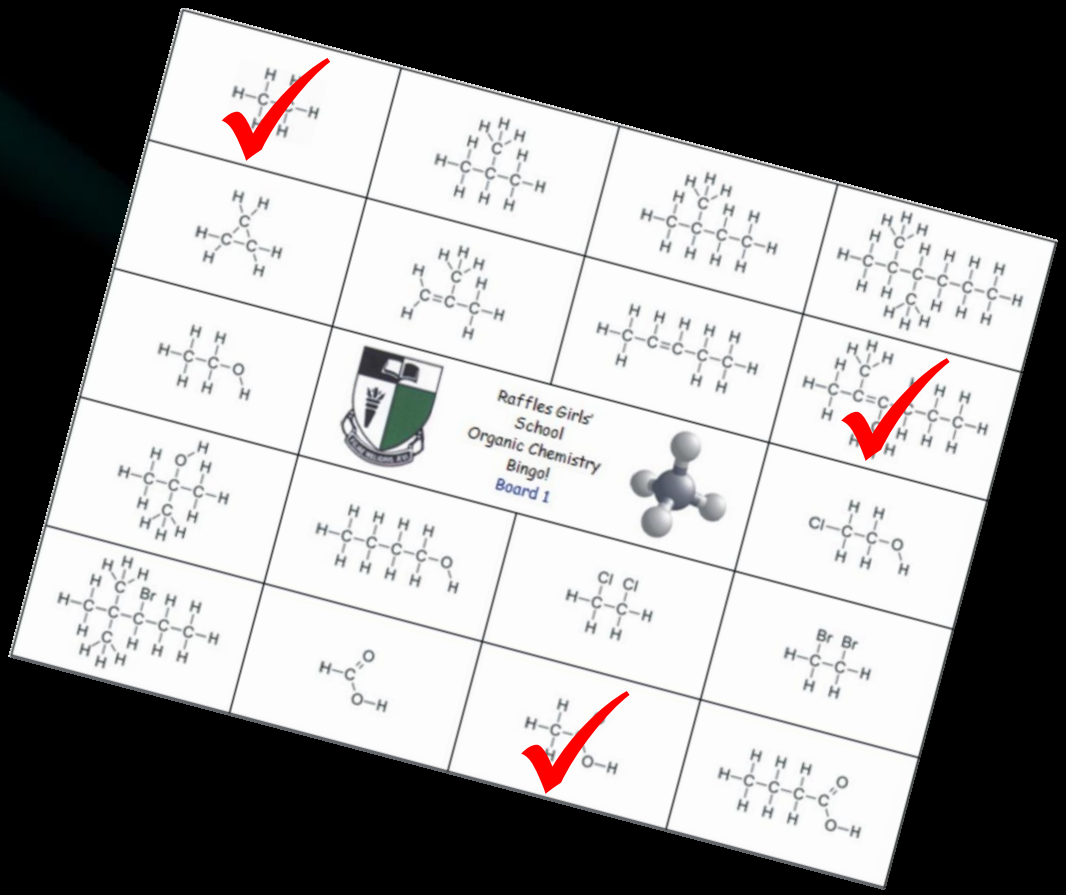
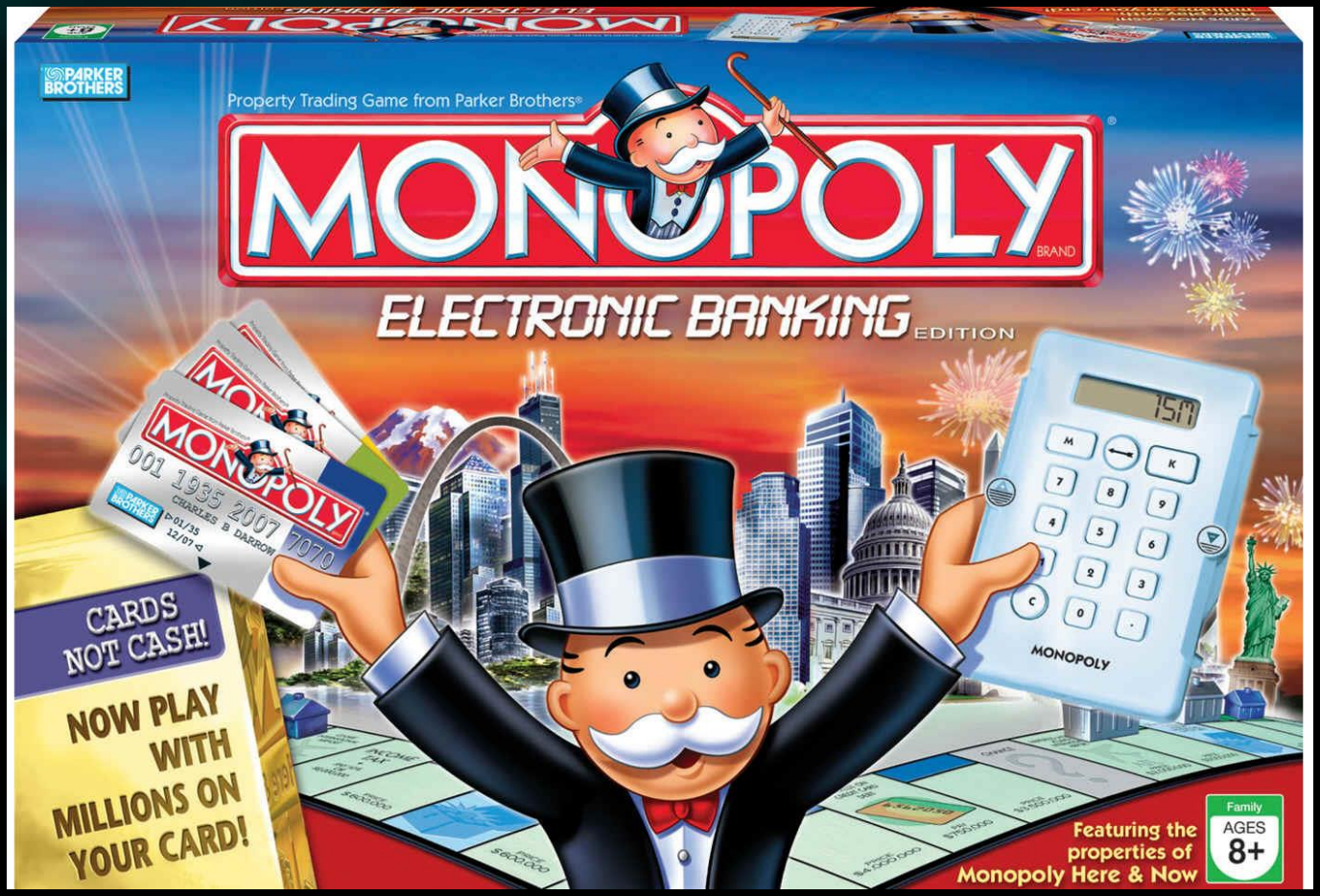
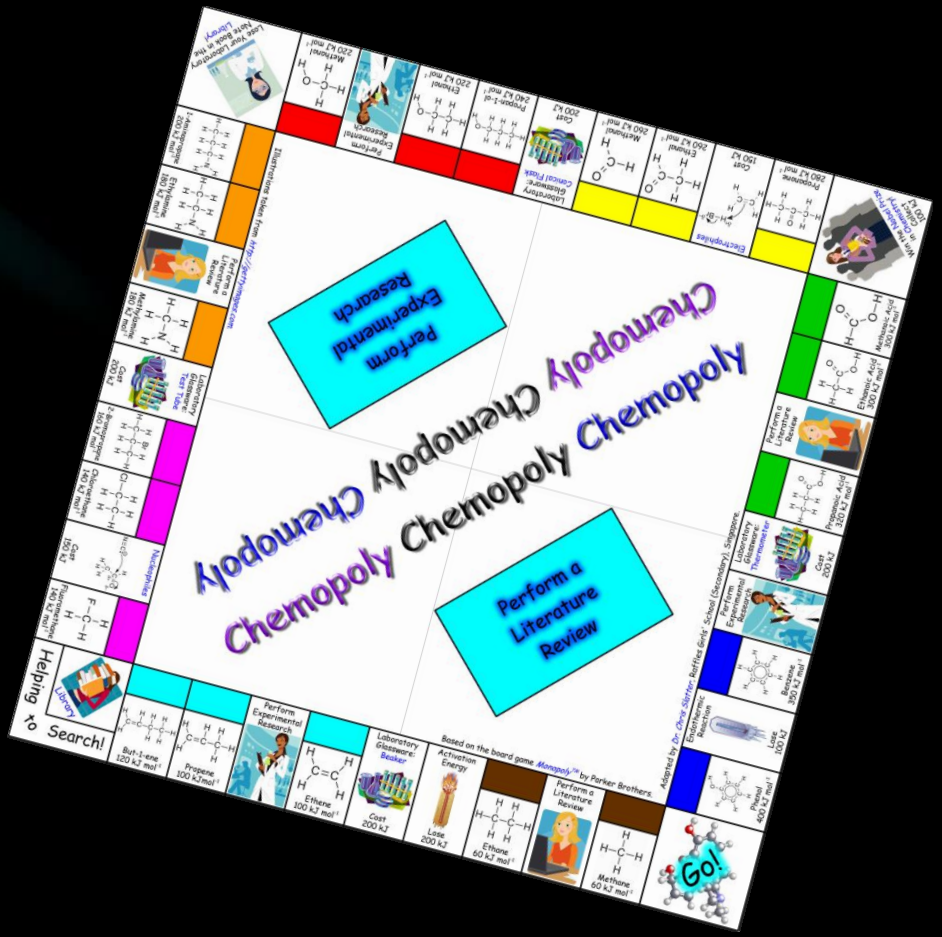


Monopoly


PARKER BROTHERS
Property Trading Game from Parker Brothers®
MONOPOLY
BRAND
ELECTRONIC BANKING EDITION
CARDS NOT CASH!
NOW PLAY WITH MILLIONS ON YOUR CARD!
MONOPOLY
Featuring the properties of Monopoly Here & Now
Family
AGES
8+

Monopoly

★ The most complex game made so far! There are two versions: Organic Chemistry and Chemical Elements. Students move about the board, answering questions and buying elements or compounds using either electrons or energy as the currency.



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Monopoly


Chemopoly Chemopoly Chemopoly
Perform Experimental Research
Perform a Literature Review
Helping to Search!
Library
Calcium 120 Electrons
Magnesium 100 Electrons
Perform Experimental Research
Beryllium 100 Electrons
Silver
Cost 200 Electrons
Oxidised!
Lose 200 Electrons
Sodium 60 Electrons
Perform a Literature Review
Lithium 60 Electrons
Go!
Go!
Go!
Go!

Monopoly


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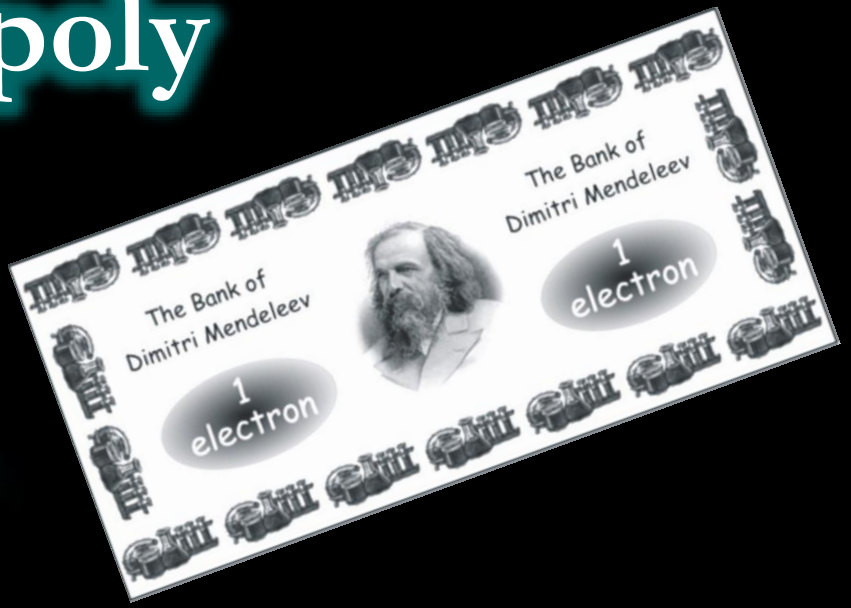
Go!
Based on the board game Monopoly™ by Parker Brothers


The Bank of Dimitri Mendeleev
1 electron
The Bank of Dimitri Mendeleev
1 electron

Monopoly


Chemopoly Chemopoly Chemopoly
Perform Experimental Research
Perform a Literature Review
Helping to Search!
Library
Calcium 120 Electrons
Magnesium 100 Electrons
Perform Experimental Research
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Cost 200 Electrons
Oxidised!
Lose 200 Electrons
Sodium 60 Electrons
Perform a Literature Review
Lithium 60 Electrons
Go!
Based on the board game Monopoly™ by Parker Brothers


The Bank of Dimitri Mendeleev
1
The Bank of
The Bank of Albert Einstein
5 kJ
The Bank of Albert Einstein
5 kJ

Monopoly


Chemopoly Chemopoly Chemopoly
Perform Experimental Research
Perform a Literature Review
Helping to Search!
Library
Go!


The Bank of Dimitri Mendeleev
1
The Bank of Albert Einstein
5 kJ
The Bank of Dimitri Mendeleev
10 electrons
The Bank of Dimitri Mendeleev
10 electrons

Monopoly

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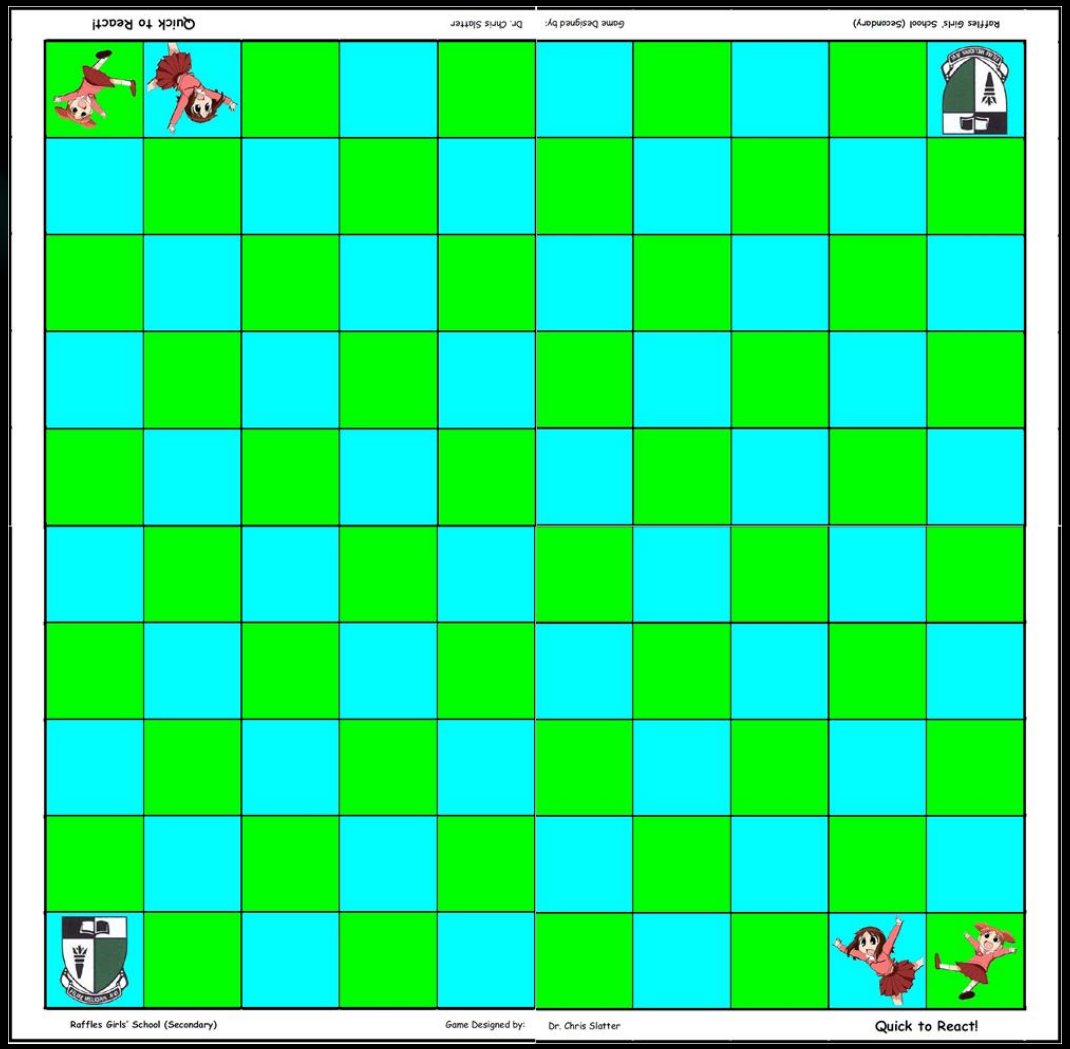
Rate of Reaction Game

★ Students play a board game that models how different variables affect the rate of a chemical reaction. There are two versions:

$$N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$$

and

$$CH_{4(g)} + 2O_{2(g)} \downarrow CO_{2(g)} + 2H_2O_{(l)}$$



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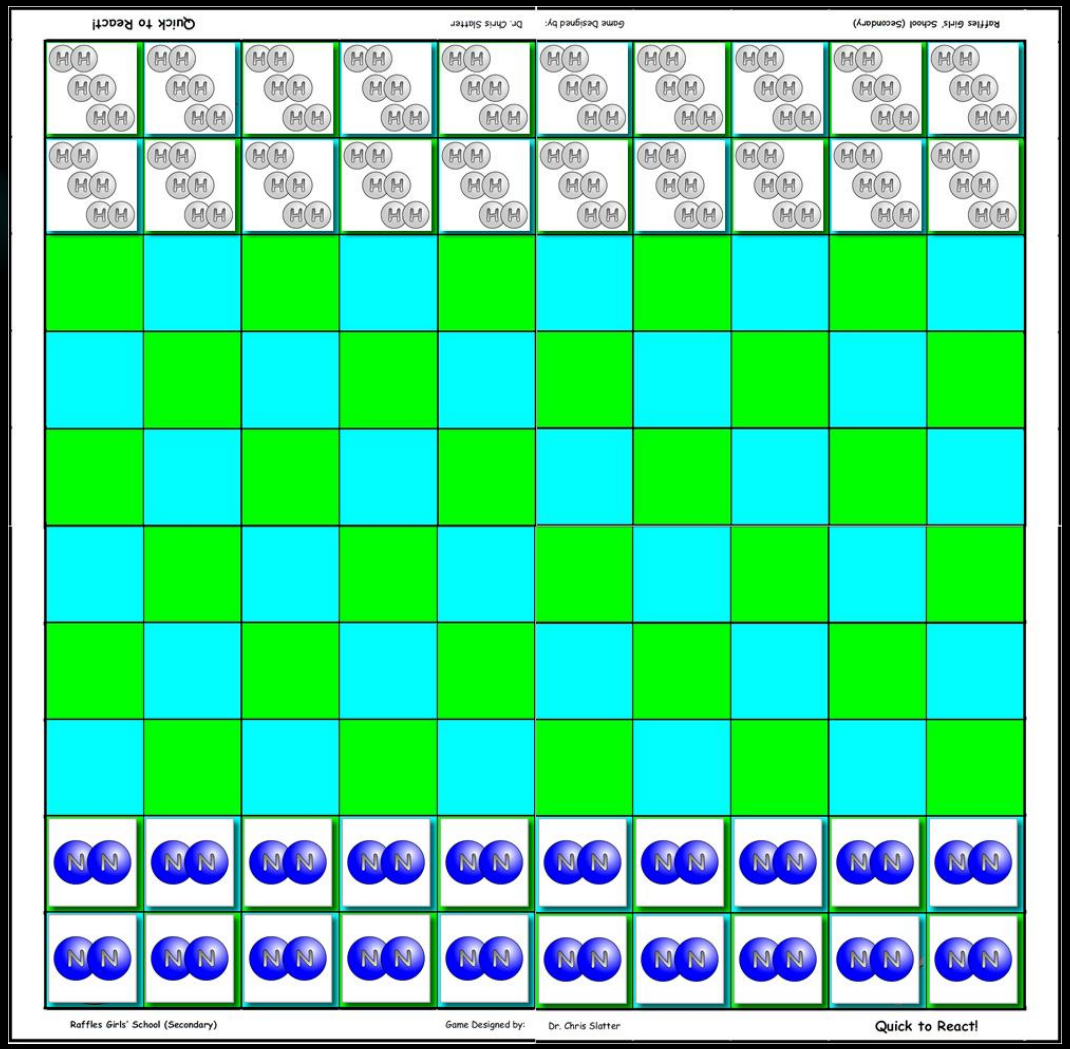
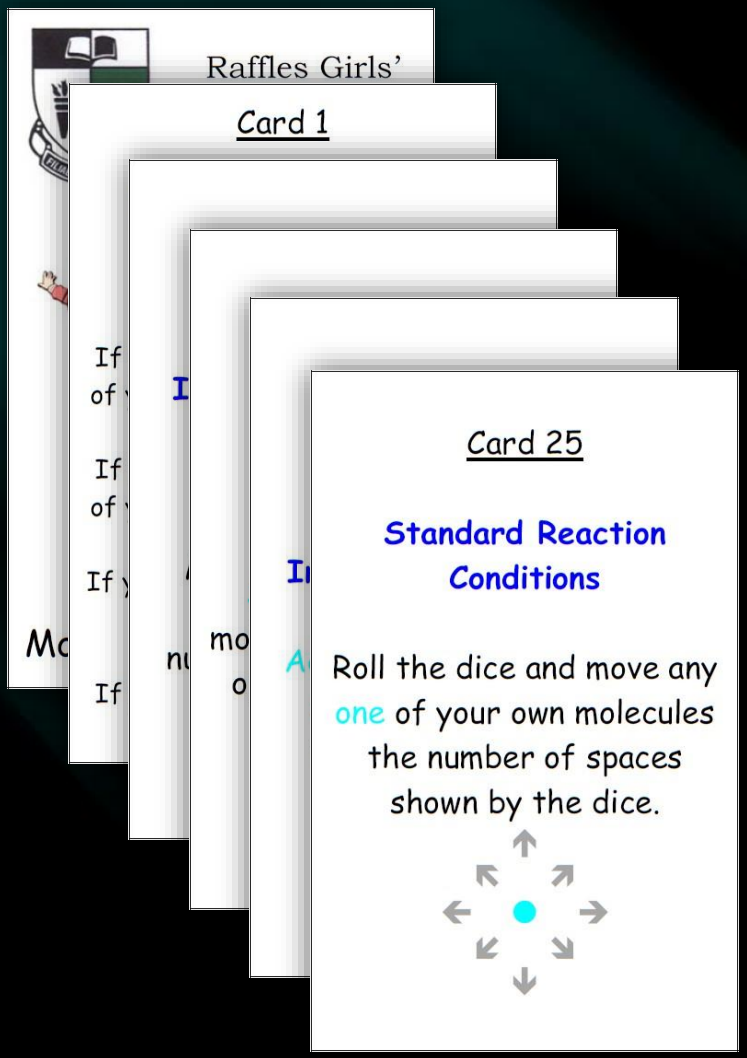
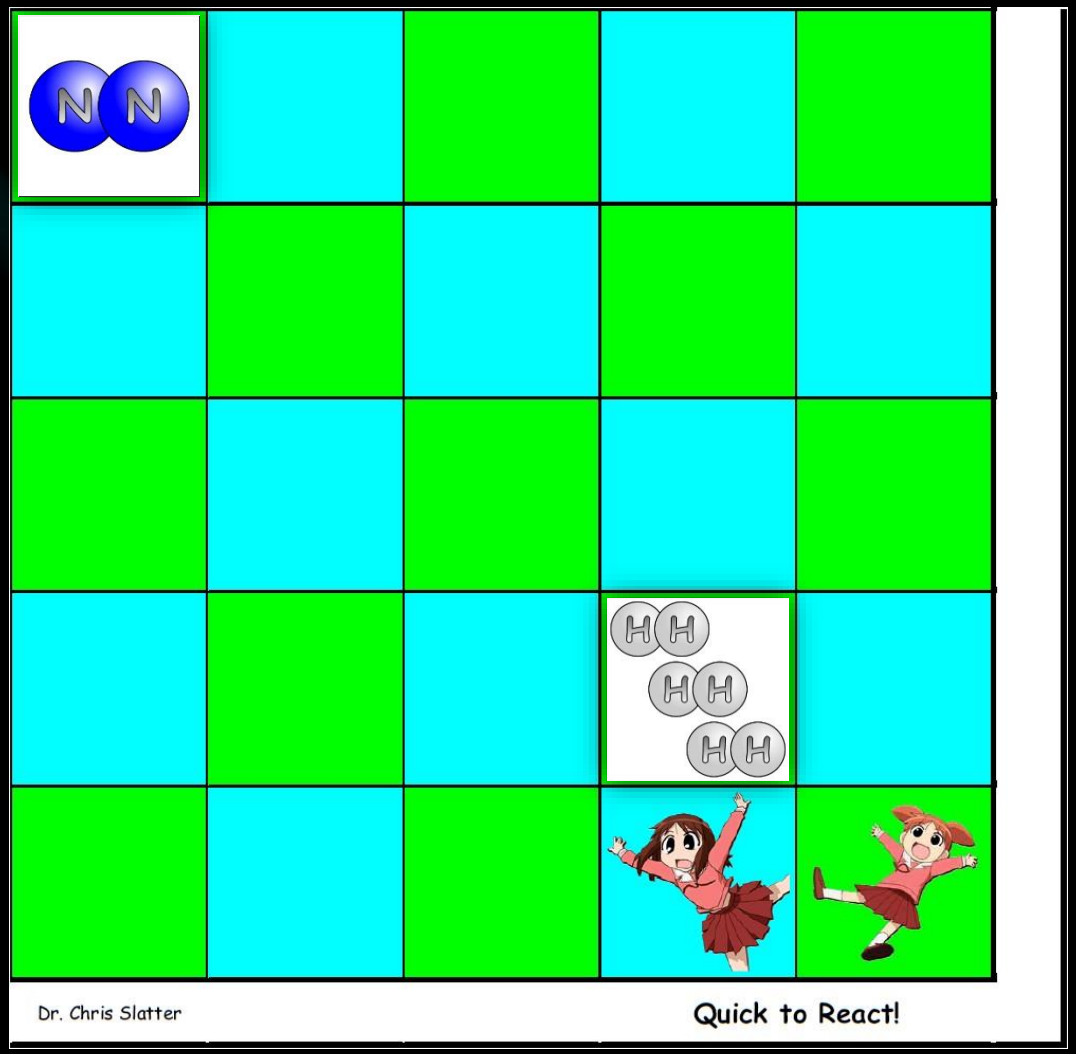
Rate of Reaction Game

★ Students place their reactants on the board. One student takes charge of one reactant. Students roll dice and refer to the information on cards in order to move their reactants around the board.

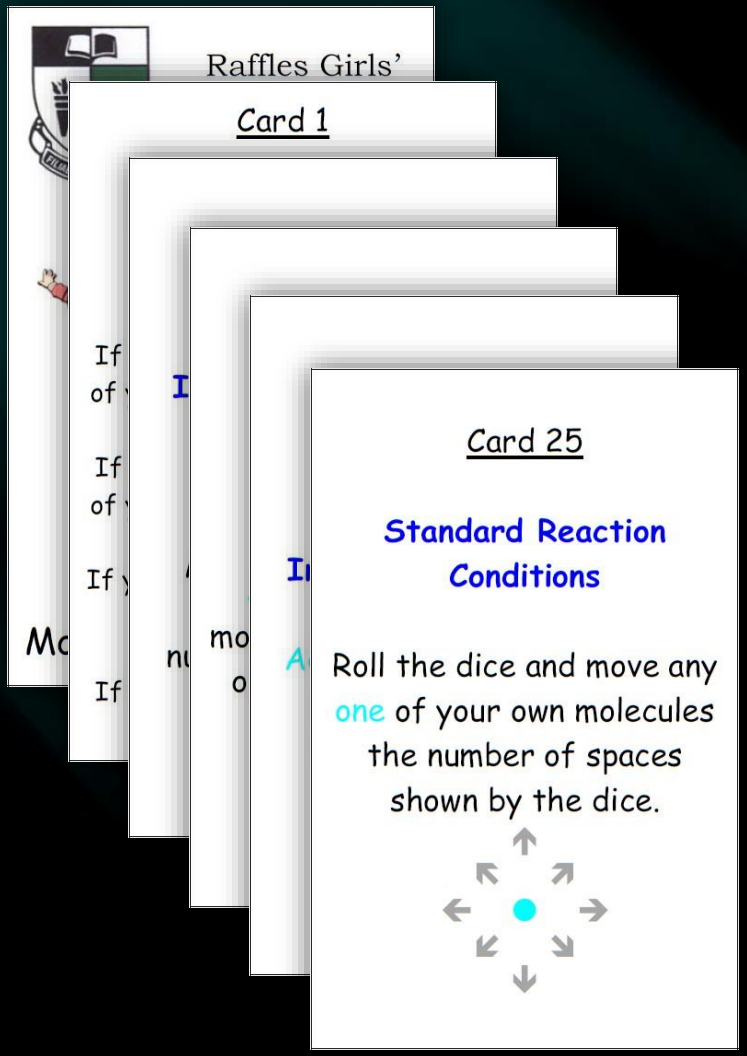


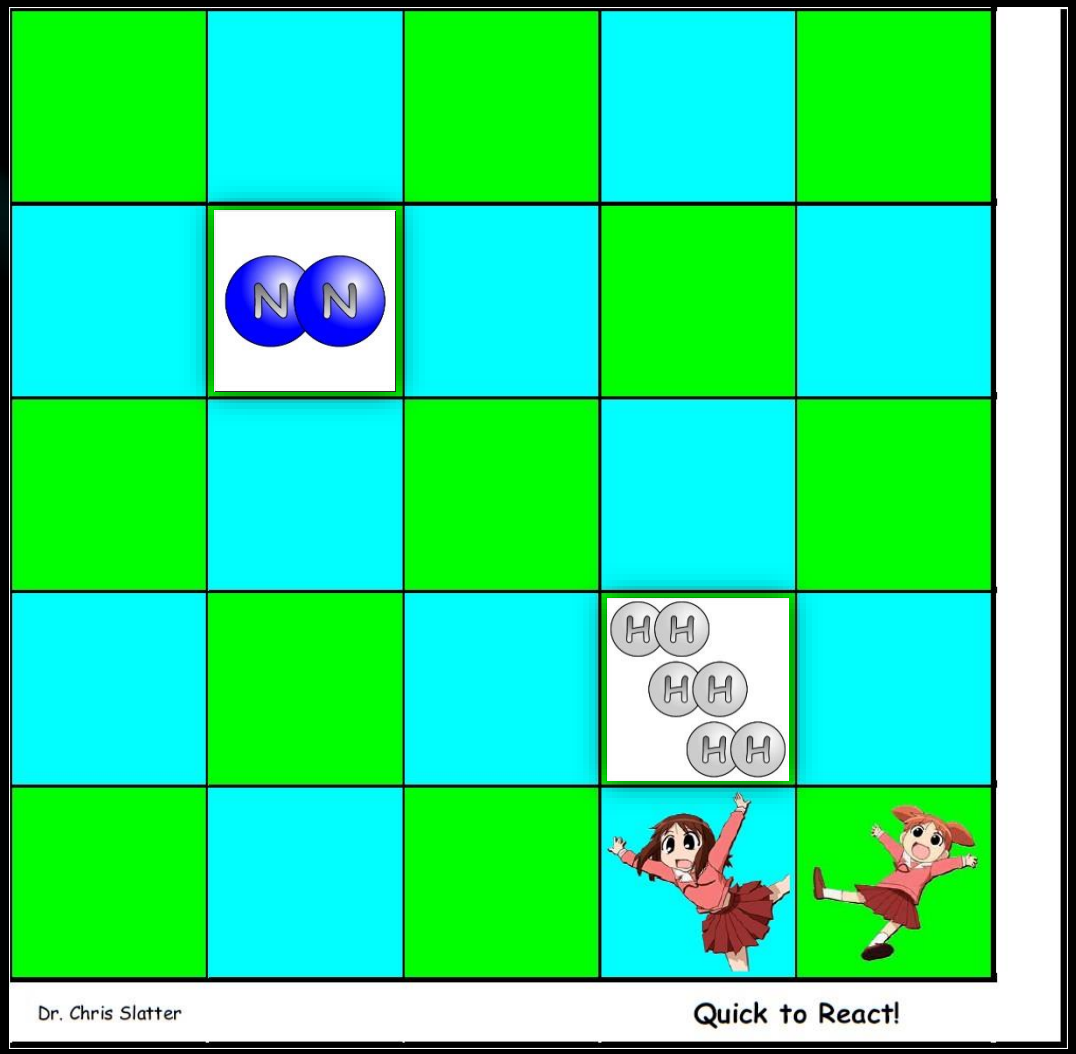
Rate of Reaction Game





Rate of Reaction Game





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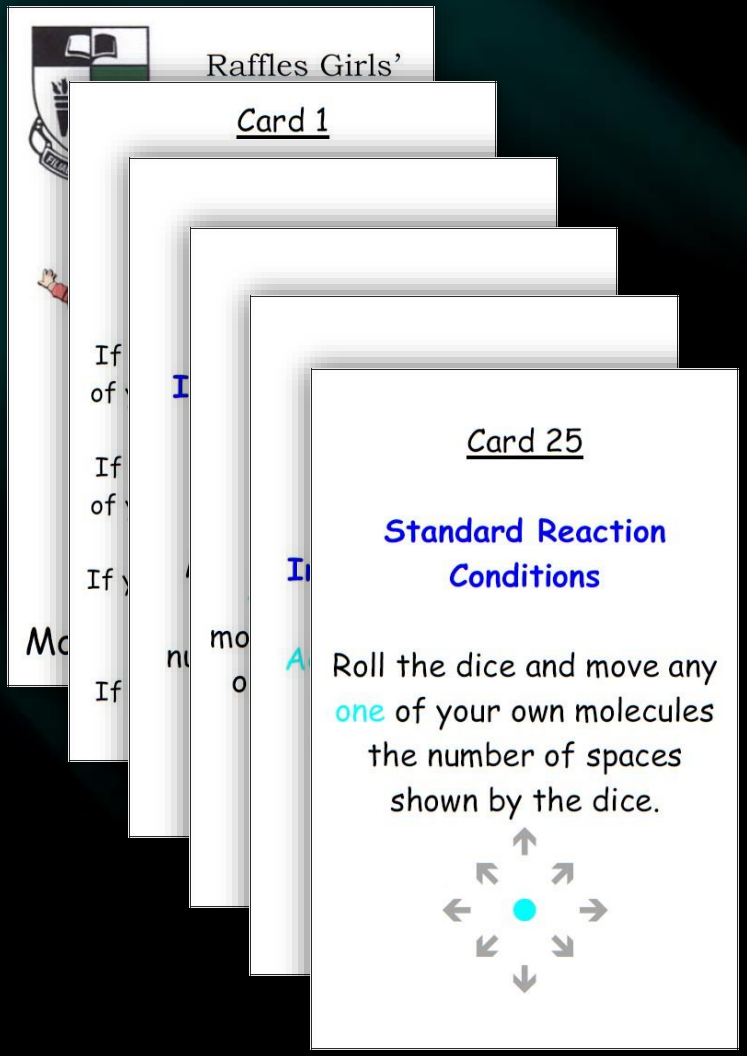

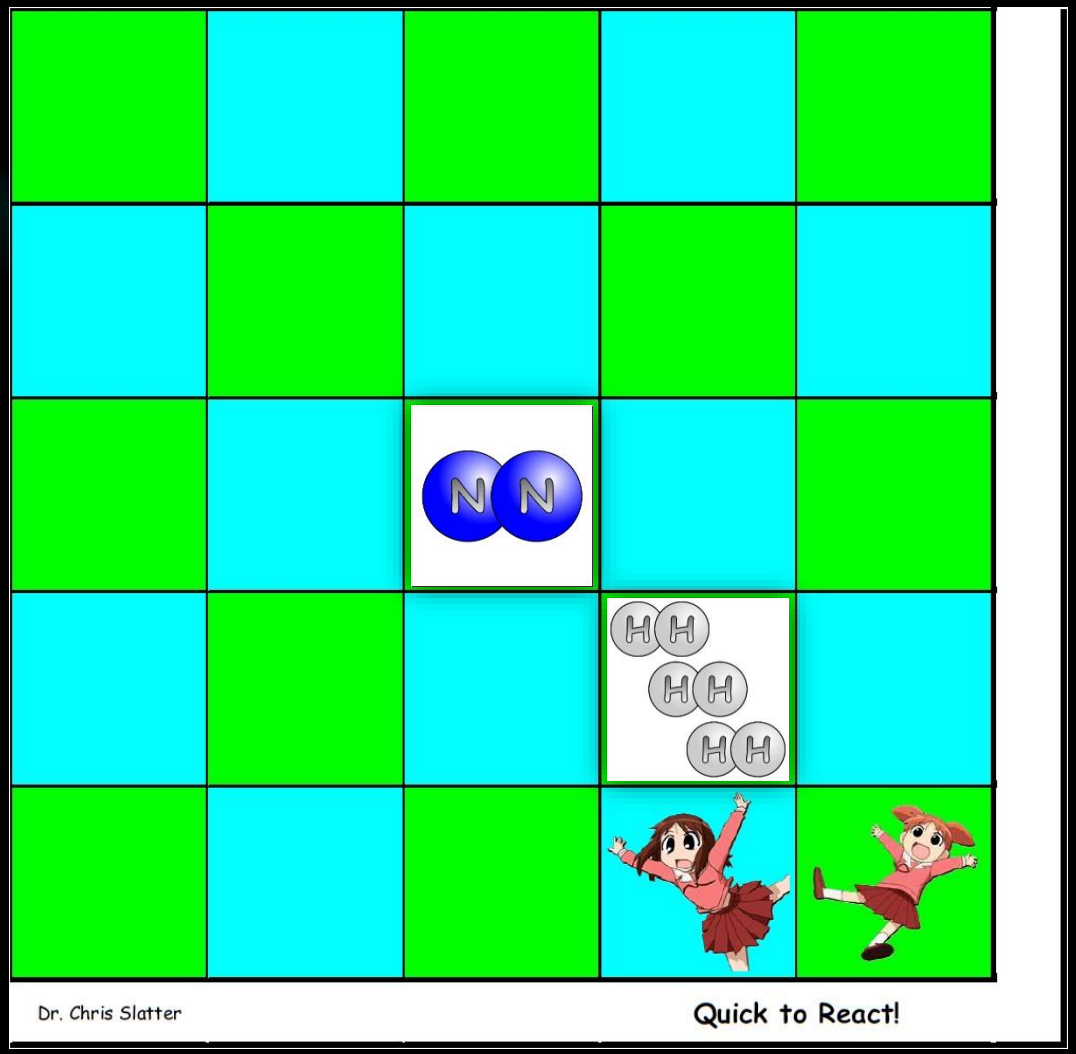

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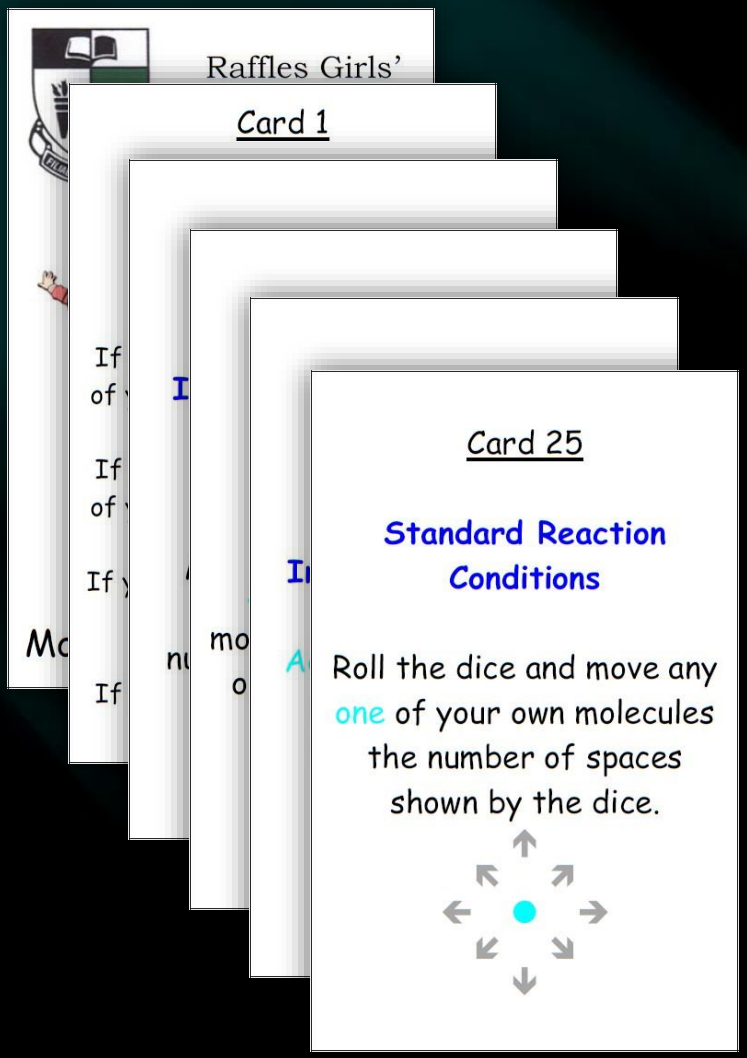
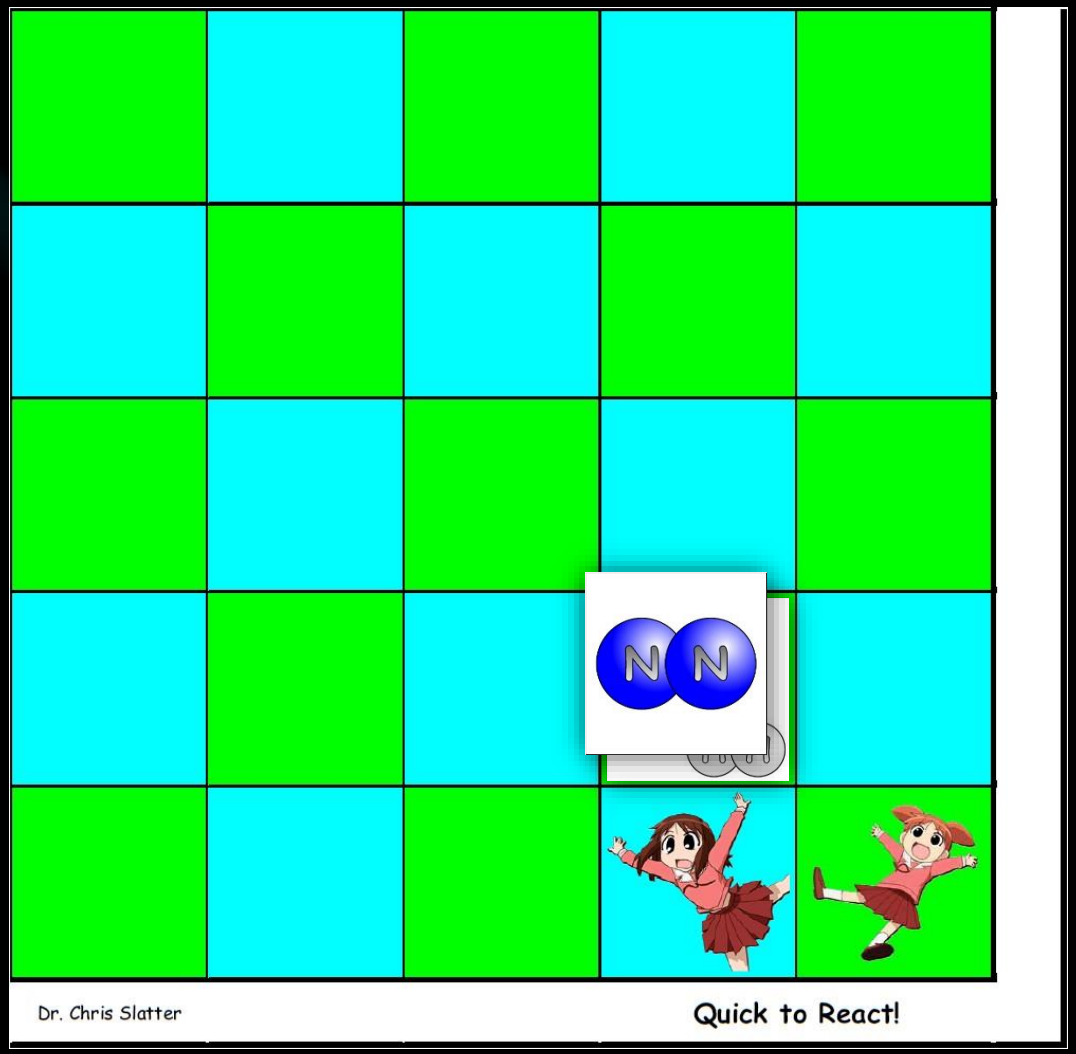
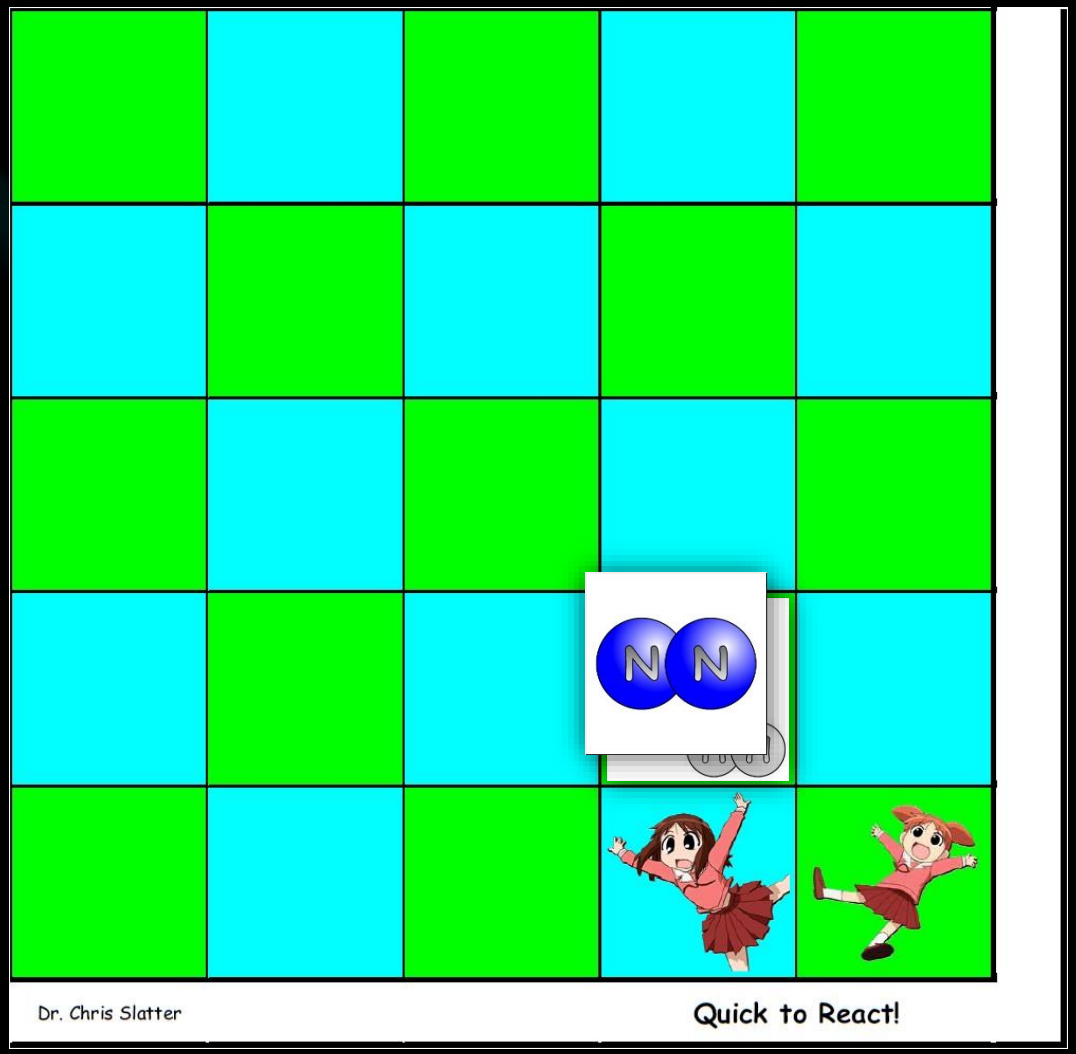




Rate of Reaction Game

★ When two reactants "collide" the students roll dice and refer to the information on cards to determine whether or not a reaction takes place.



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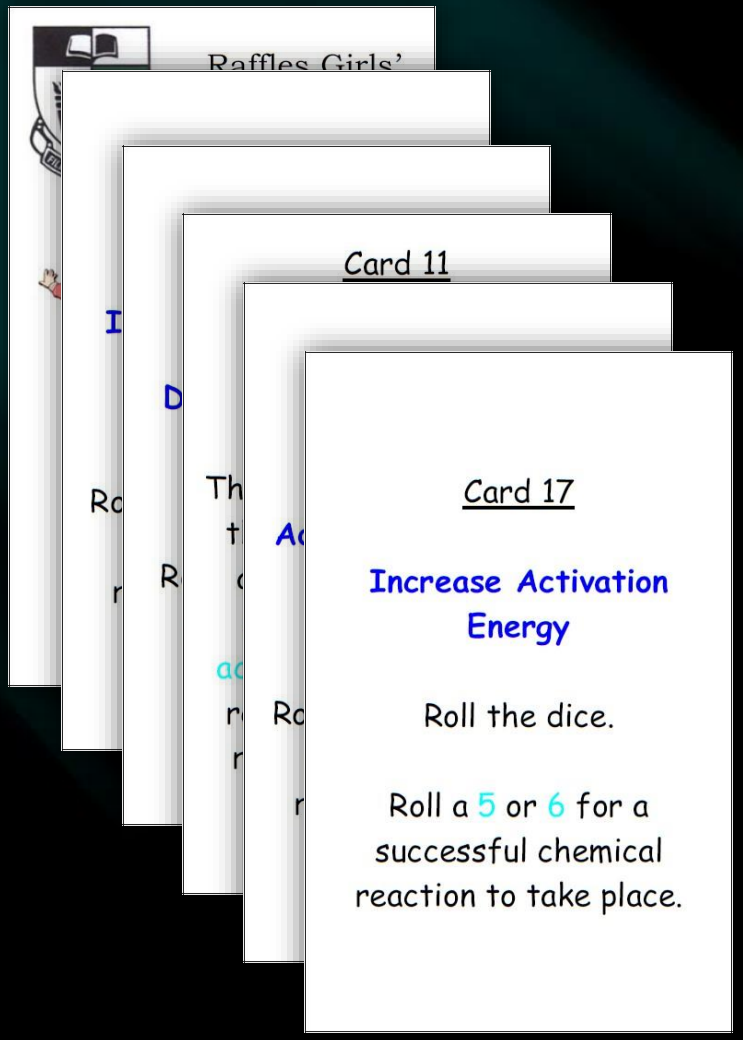

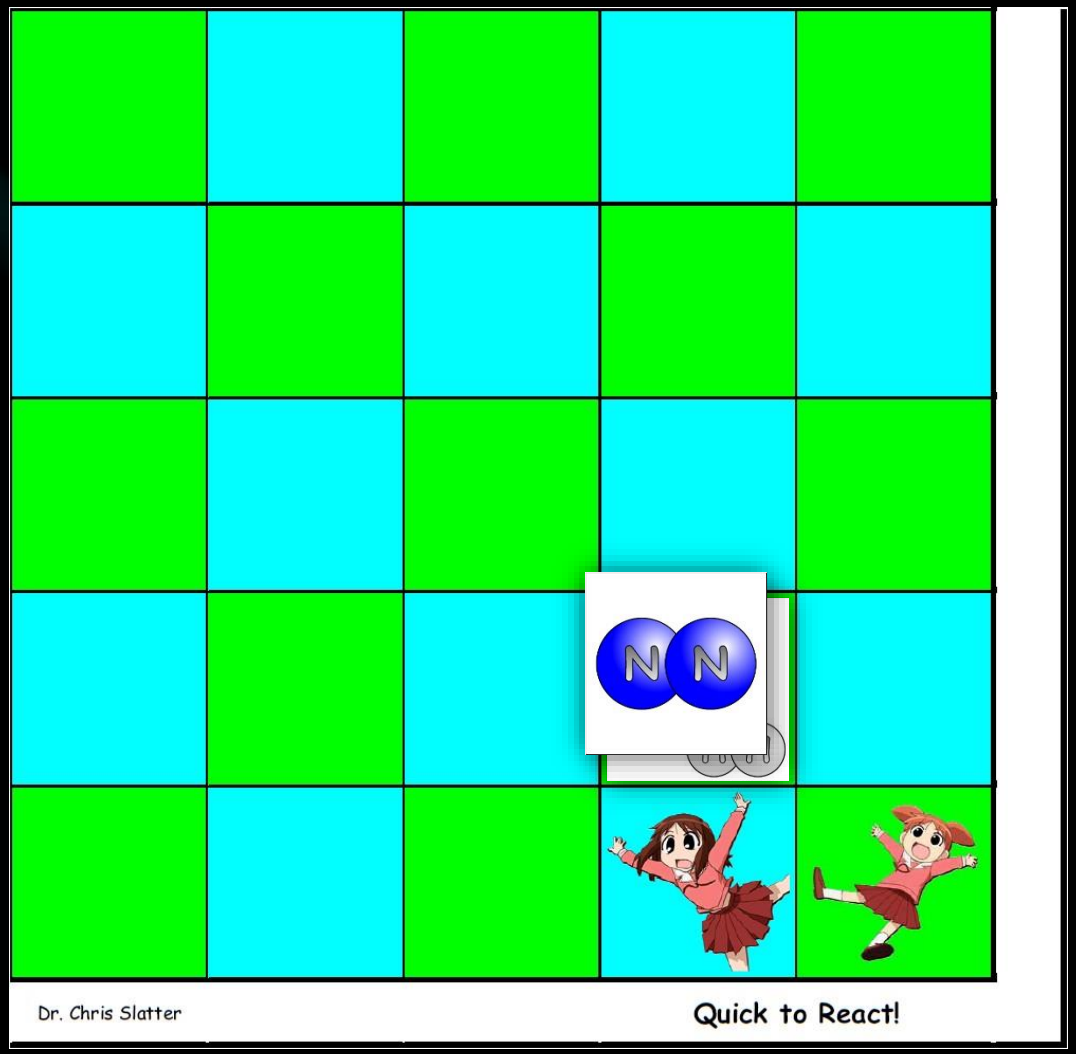

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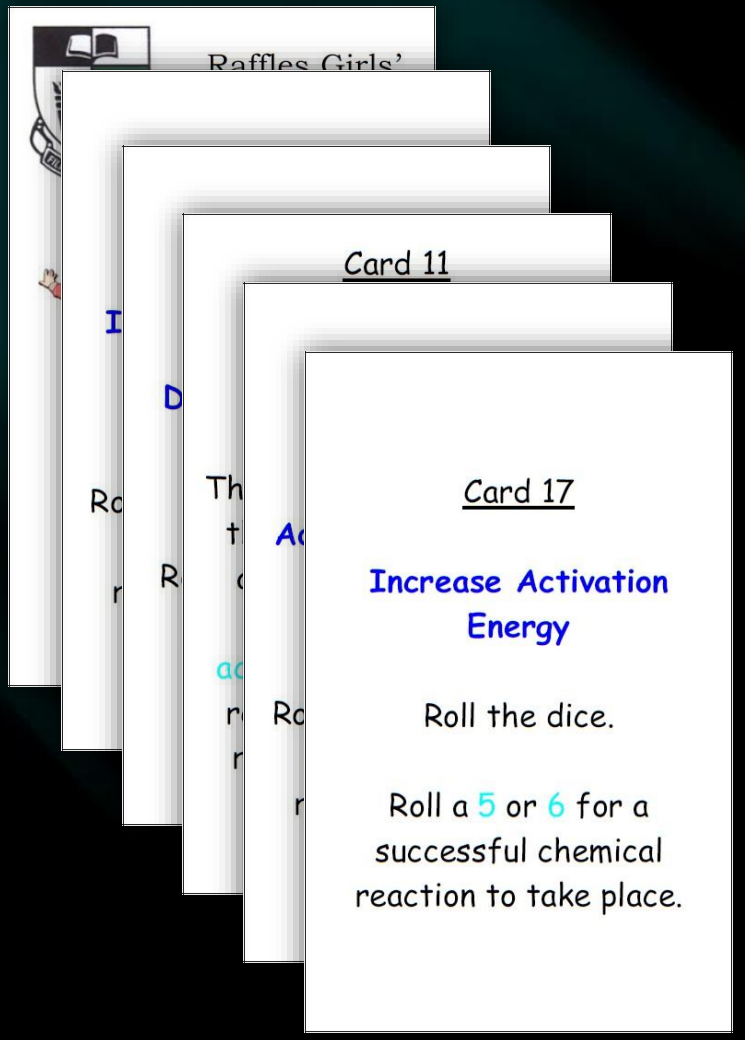
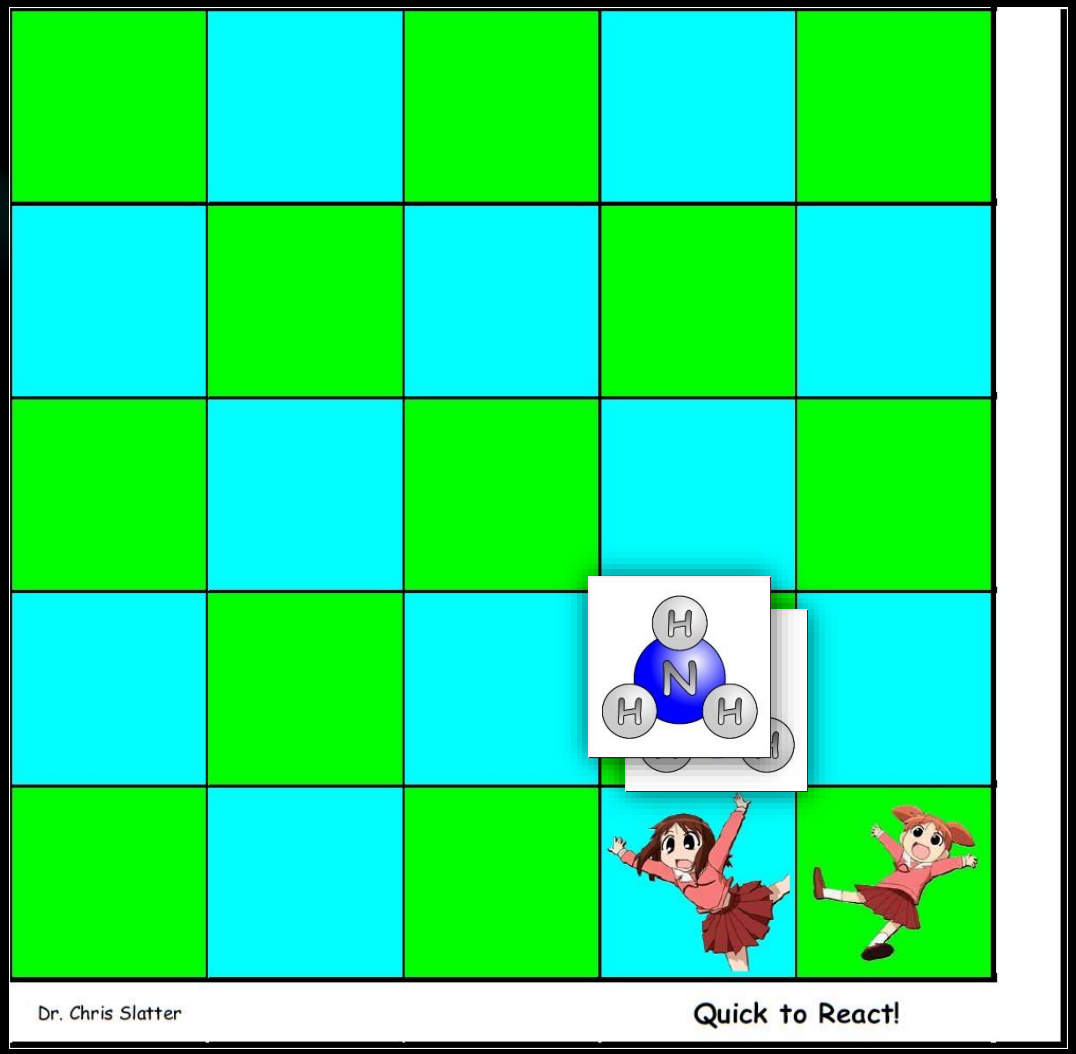
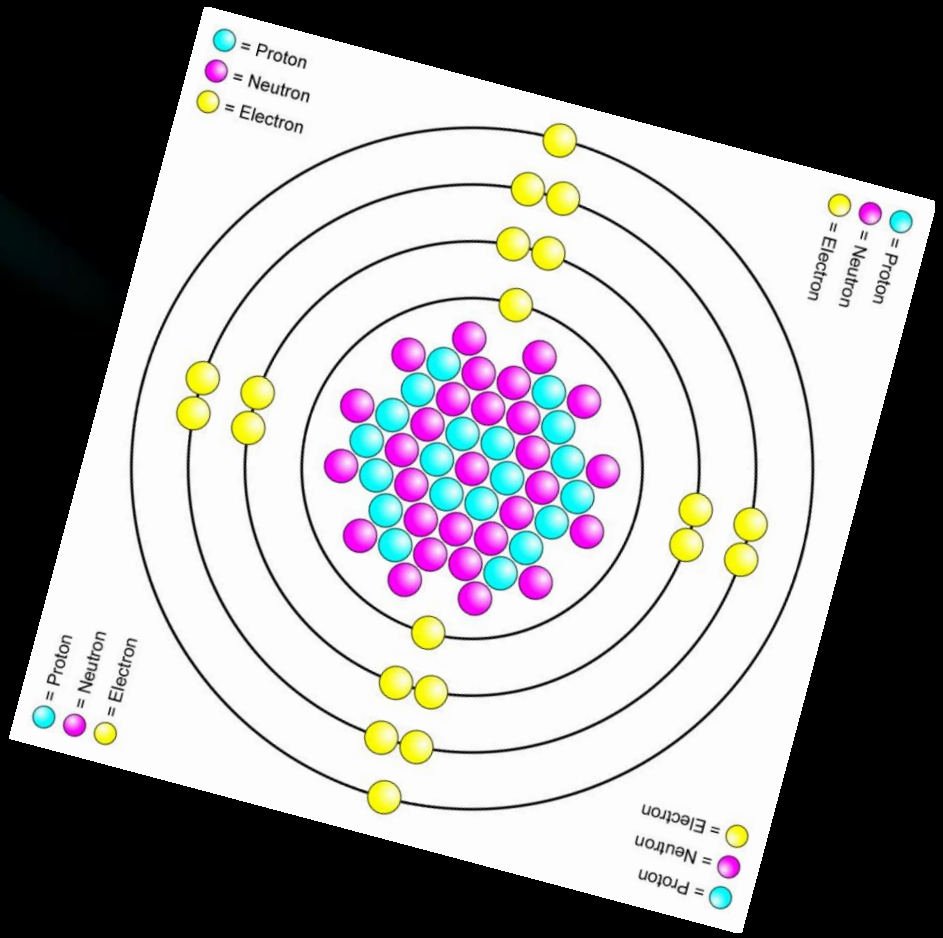




Atom Building Game

★ Unique to Chemistry: The Atom Building Game. Students investigate atomic structure by placing protons, neutrons and electrons on the board. They score points by forming stable, neutral atoms.



Atom Building Game

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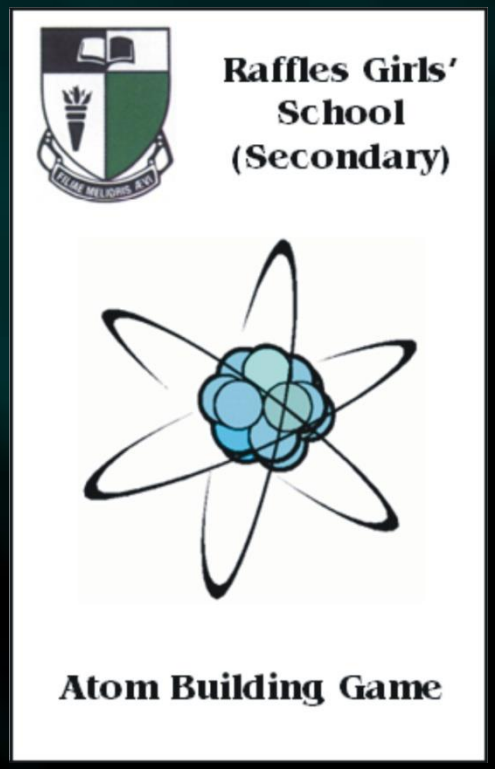
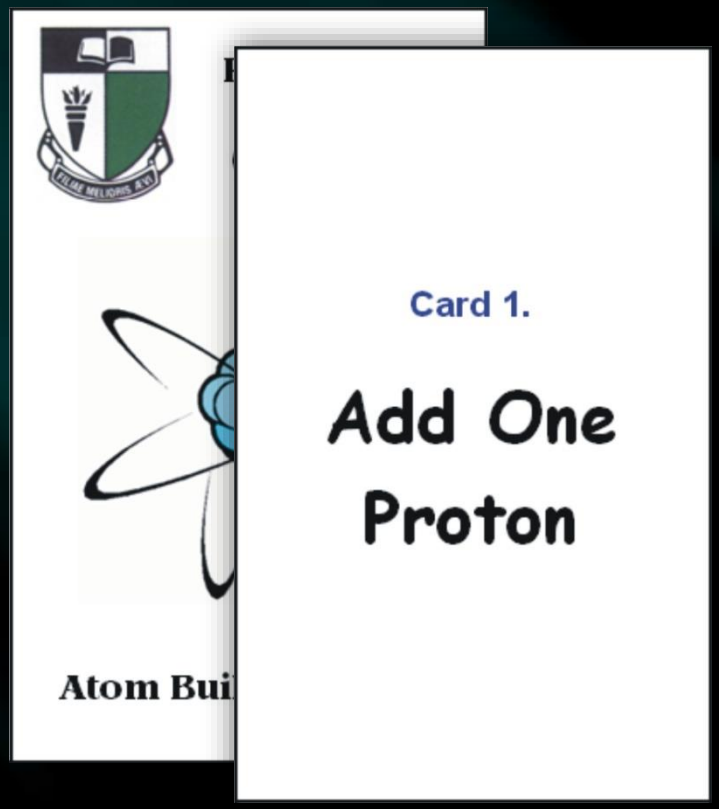
Atom Building Game



Atom Building Game



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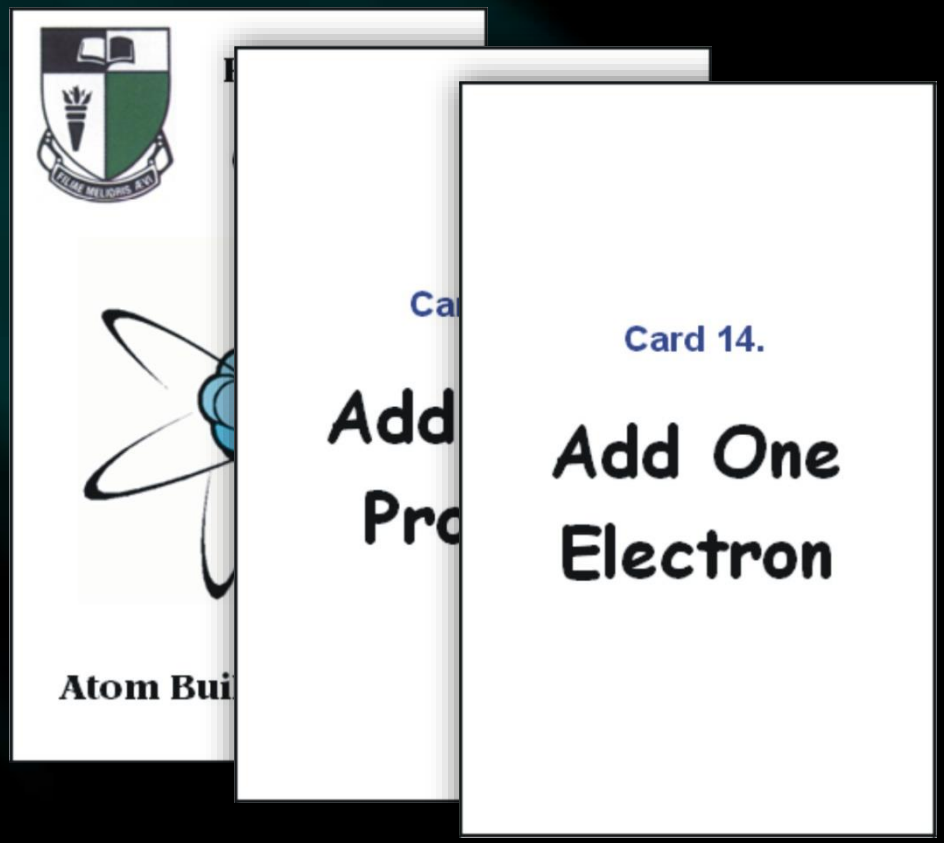
Atom Building Game



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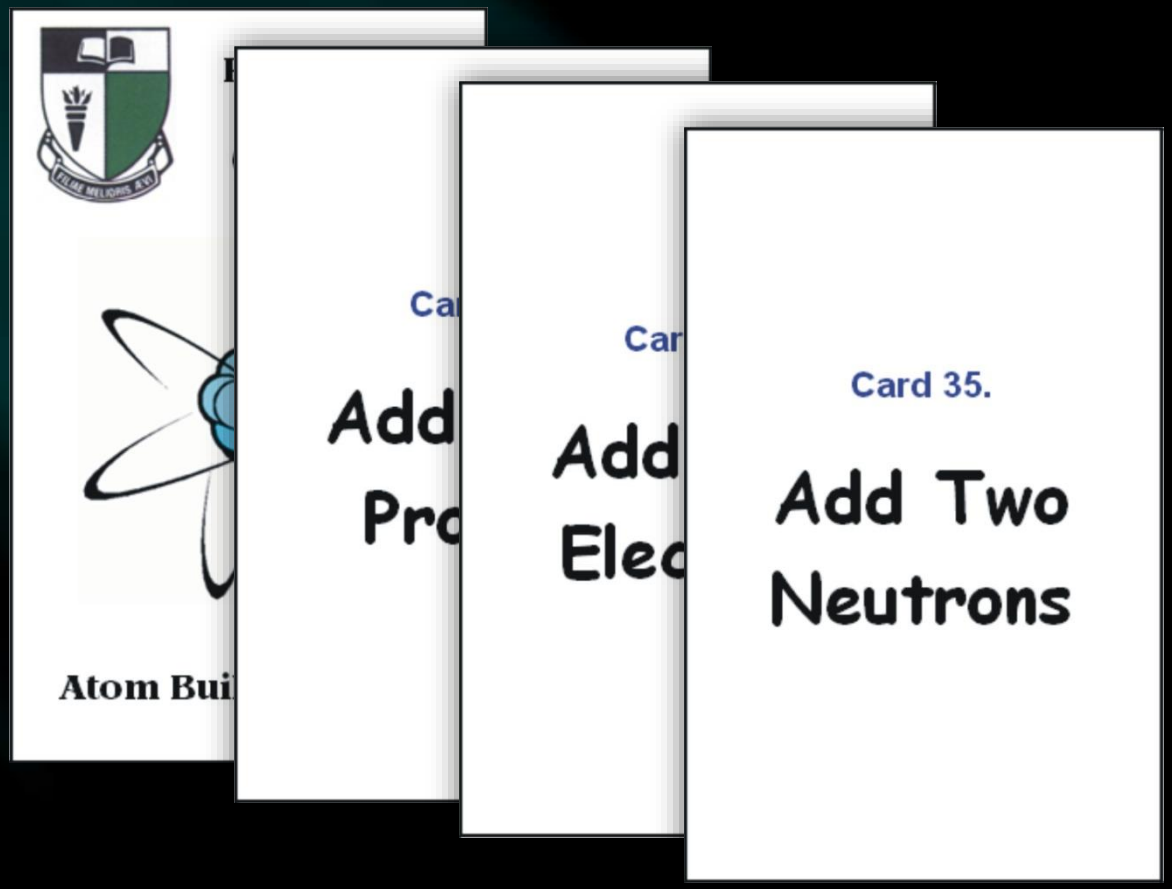

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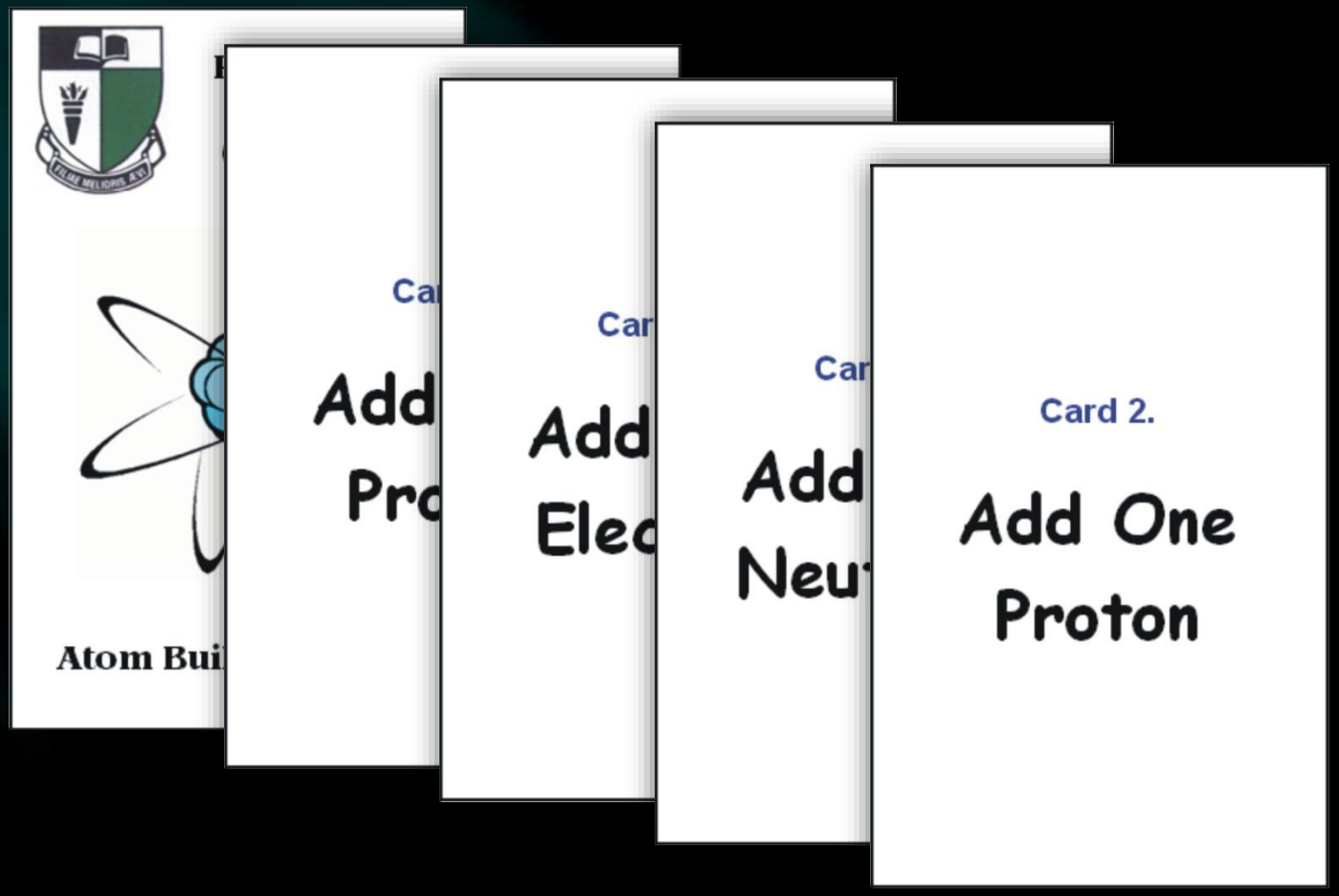
Atom Building Game



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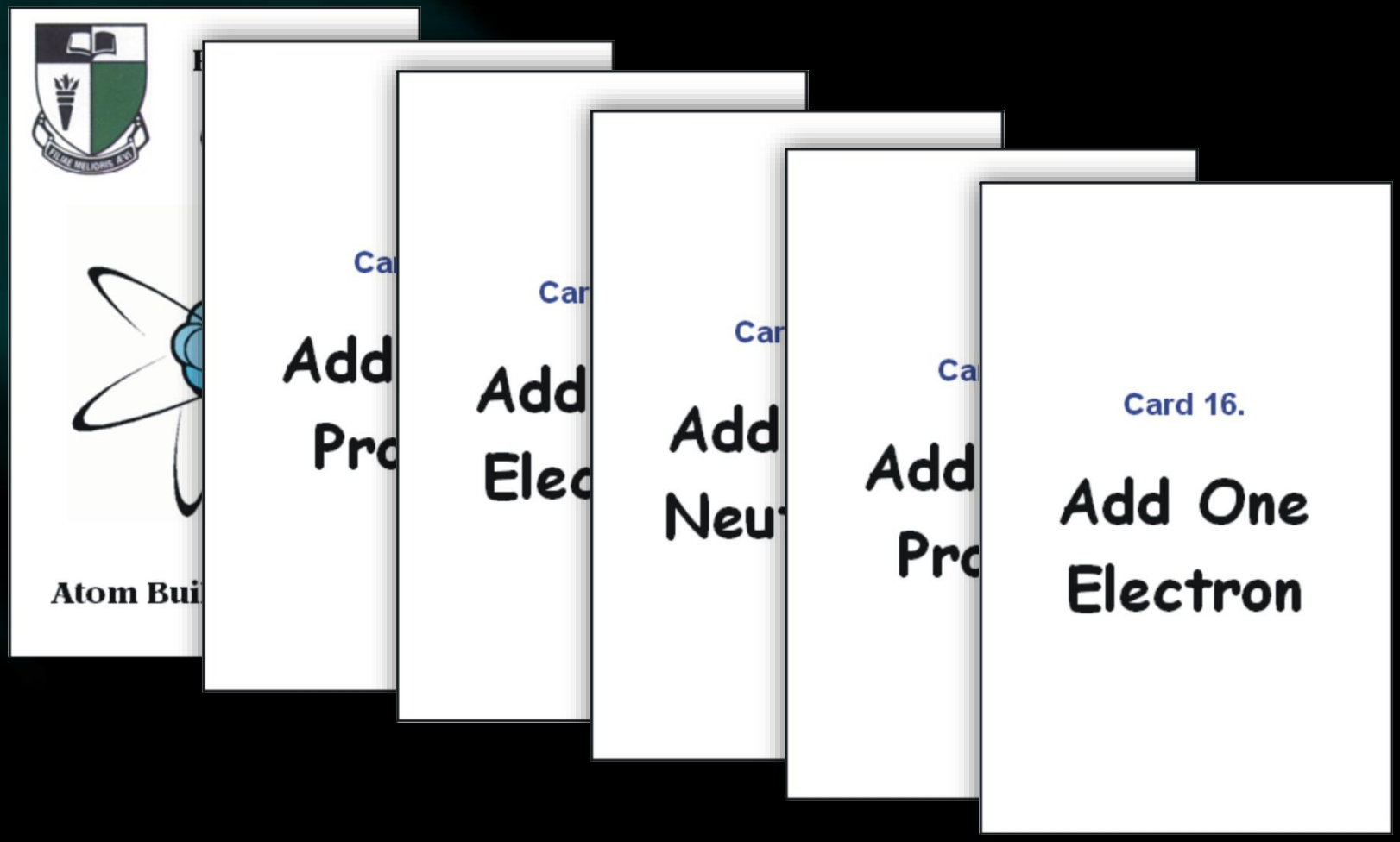

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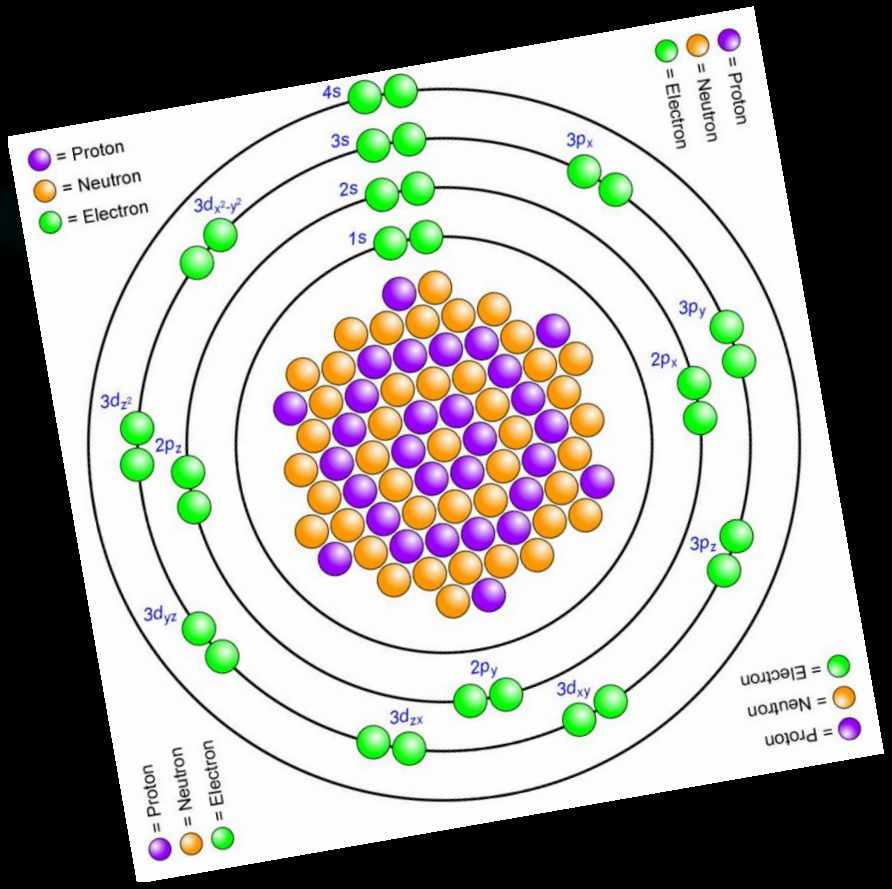
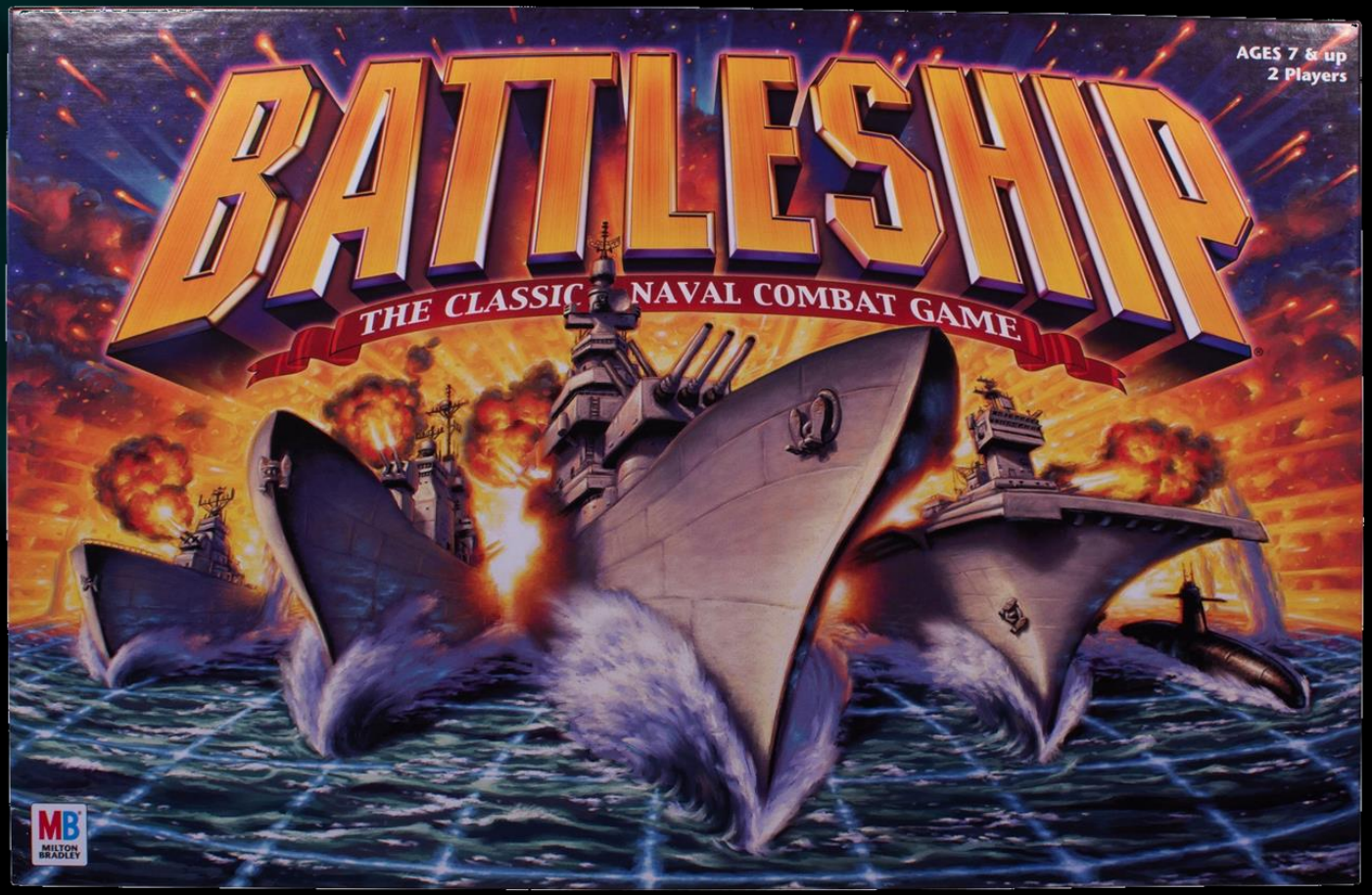
Atom Building Game

★ Differentiation is achieved by using two different game boards. The first requires a knowledge of simple electron configurations taught at O' level. The second requires a deeper understanding of s, p and d-orbitals.



Battleship – Periodic Table

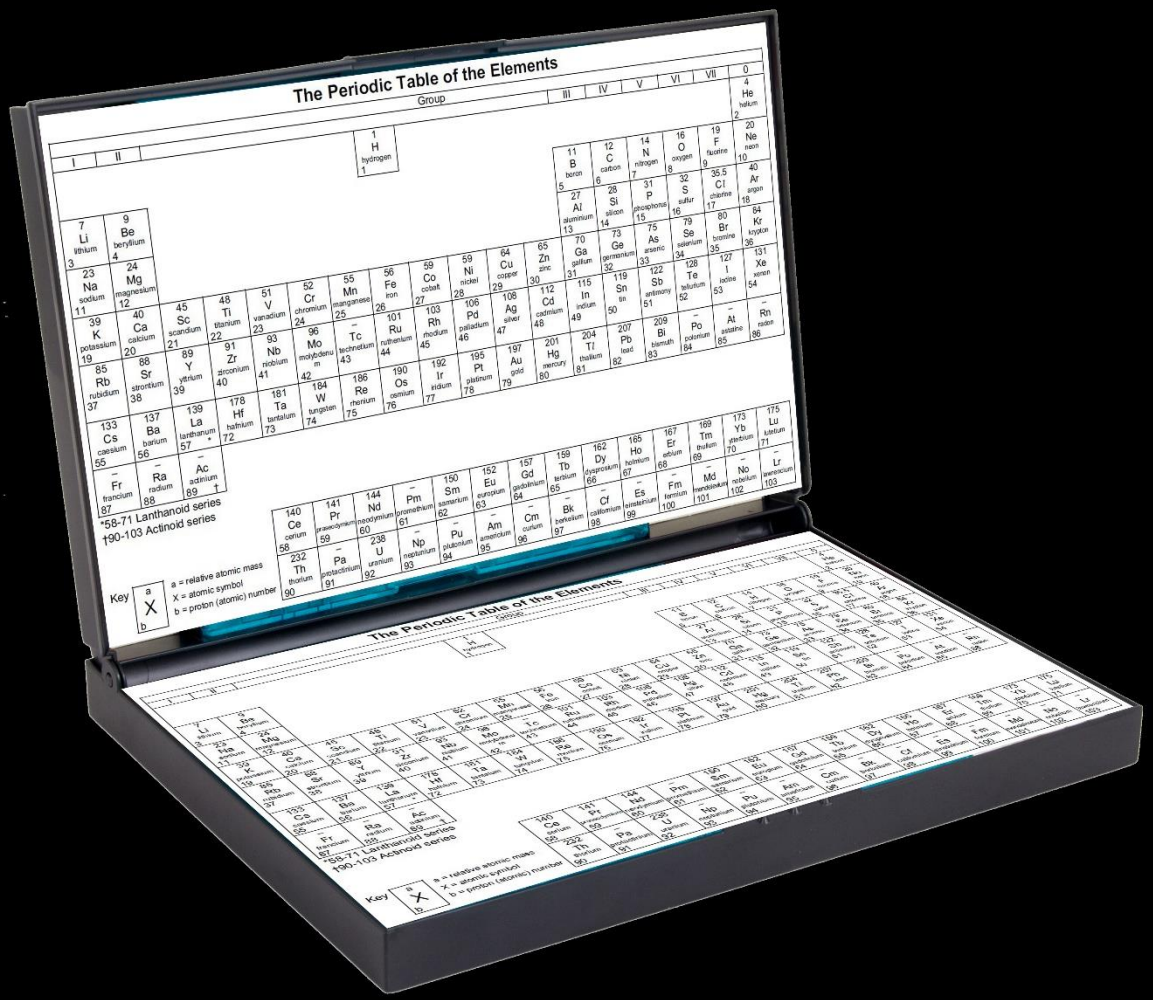


Battleship – Periodic Table

★ Instead of reading out coordinates, *e.g.* "C-6" in an attempt to locate and sink their opponent's battleship…

Battleship – Periodic Table

…students read out the names or symbols of the chemical elements from the Periodic Table. This helps students learn the locations of the elements in the Periodic Table.



Battleship – Periodic Table

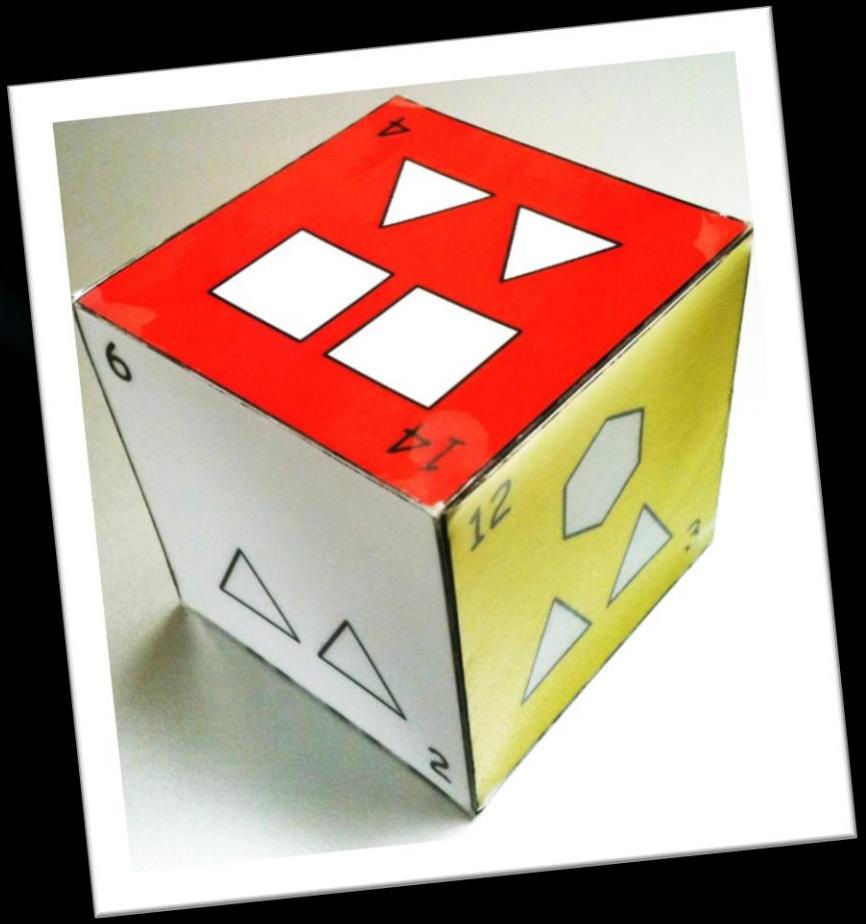
★ Students may still use the coordinate system to play the game by using Group and Period numbers to identify the locations of the chemical elements.

Miscellaneous

Mystery Tubes

- Each cardboard tube has four holes, through which there is a piece of string.
- Students gently pull the pieces of string and observe what happens.
- Students suggest possible relationships between the variables.
- Students draw conclusions about what cannot be observed directly.
- The activity challenges the students to think critically.
- The activity can be used as an introduction to atomic structure.

Curiosity Cubes



- From the information given, deduce what the pattern on the bottom of the cube is.

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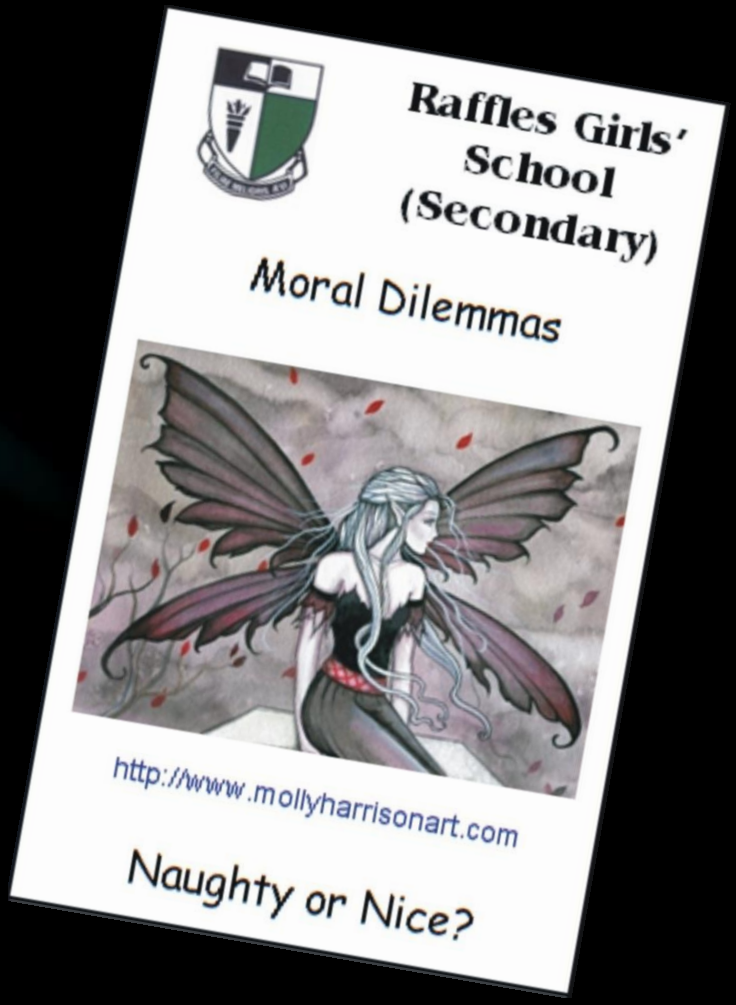
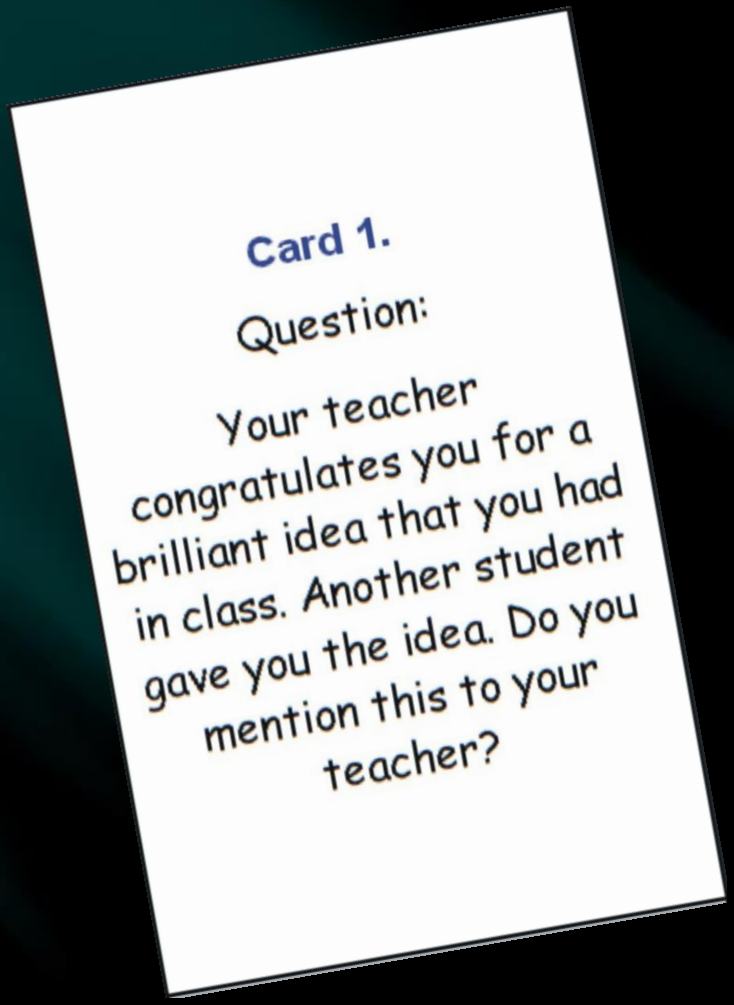
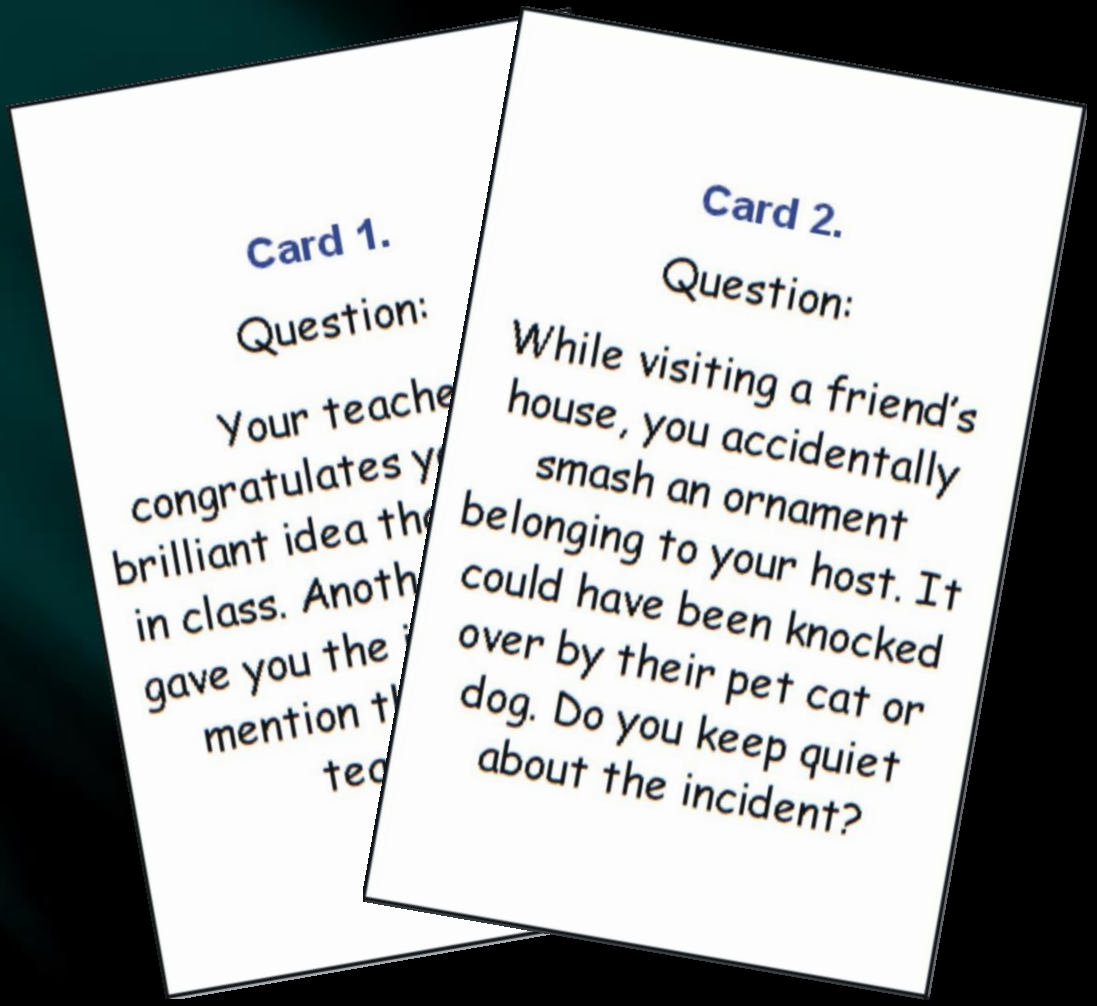
Moral Dilemmas



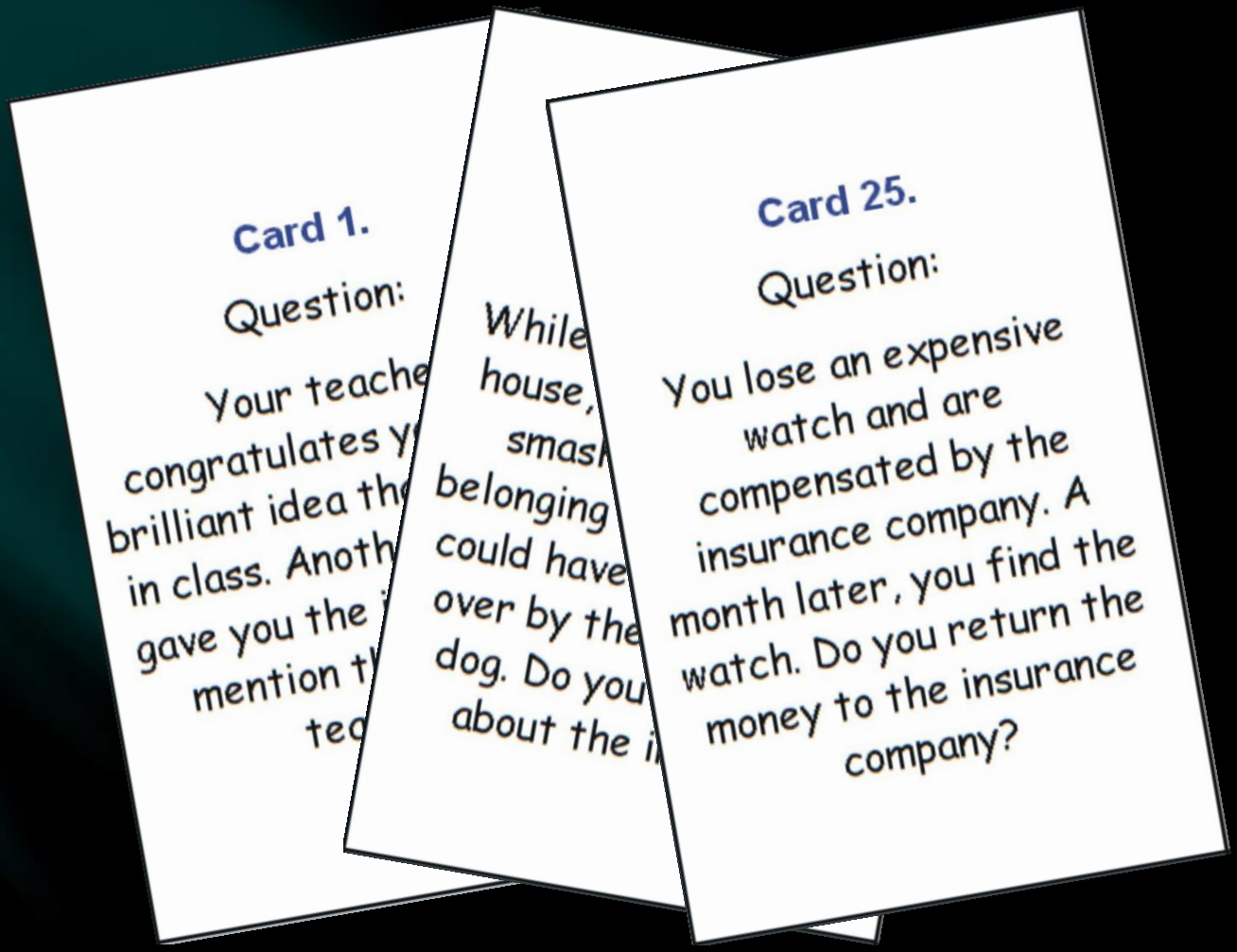
Moral Dilemmas



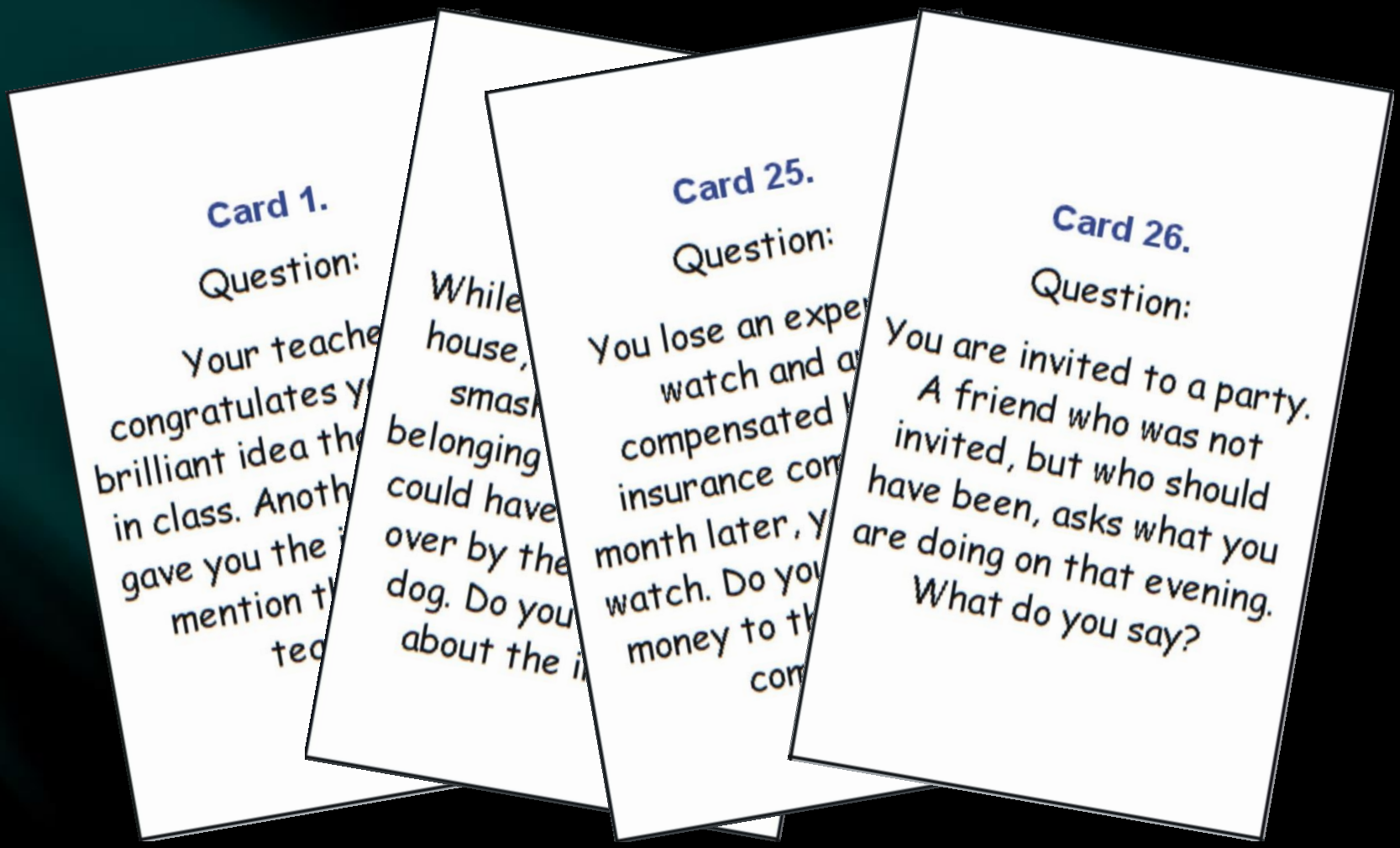
Moral Dilemmas



Moral Dilemmas



Moral Dilemmas

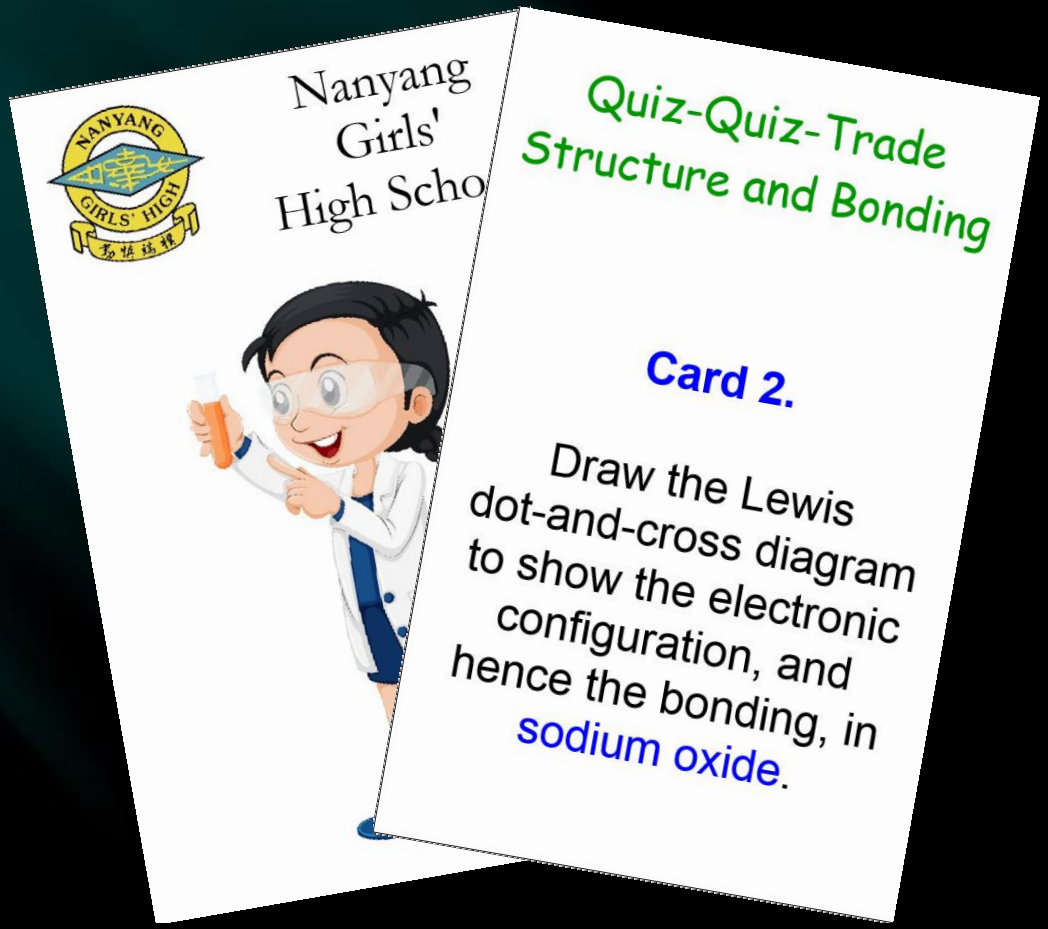


Quiz-Quiz-Trade

1) Teacher tells students to "stand up, put a hand up and pair up".
2) Student A quizzes Student B.
3) Student B answers.
4) Student A praises or coaches.
5) Students switch roles.
6) Students swap cards and thank each other.
7) Repeat 2 to 6 a number of times.

Quiz-Quiz-Trade

Quiz-Quiz-Trade



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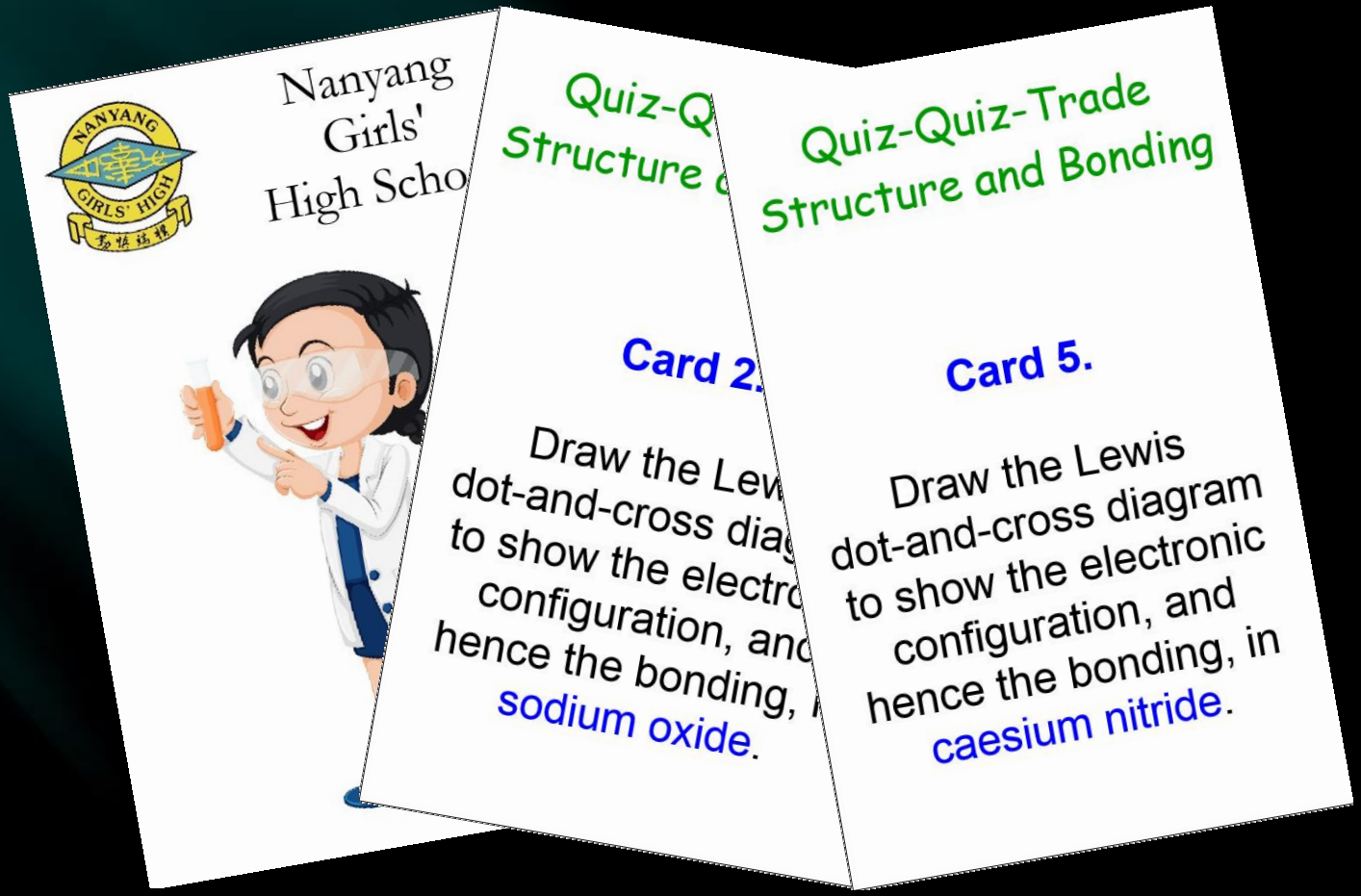
Quiz-Quiz-Trade



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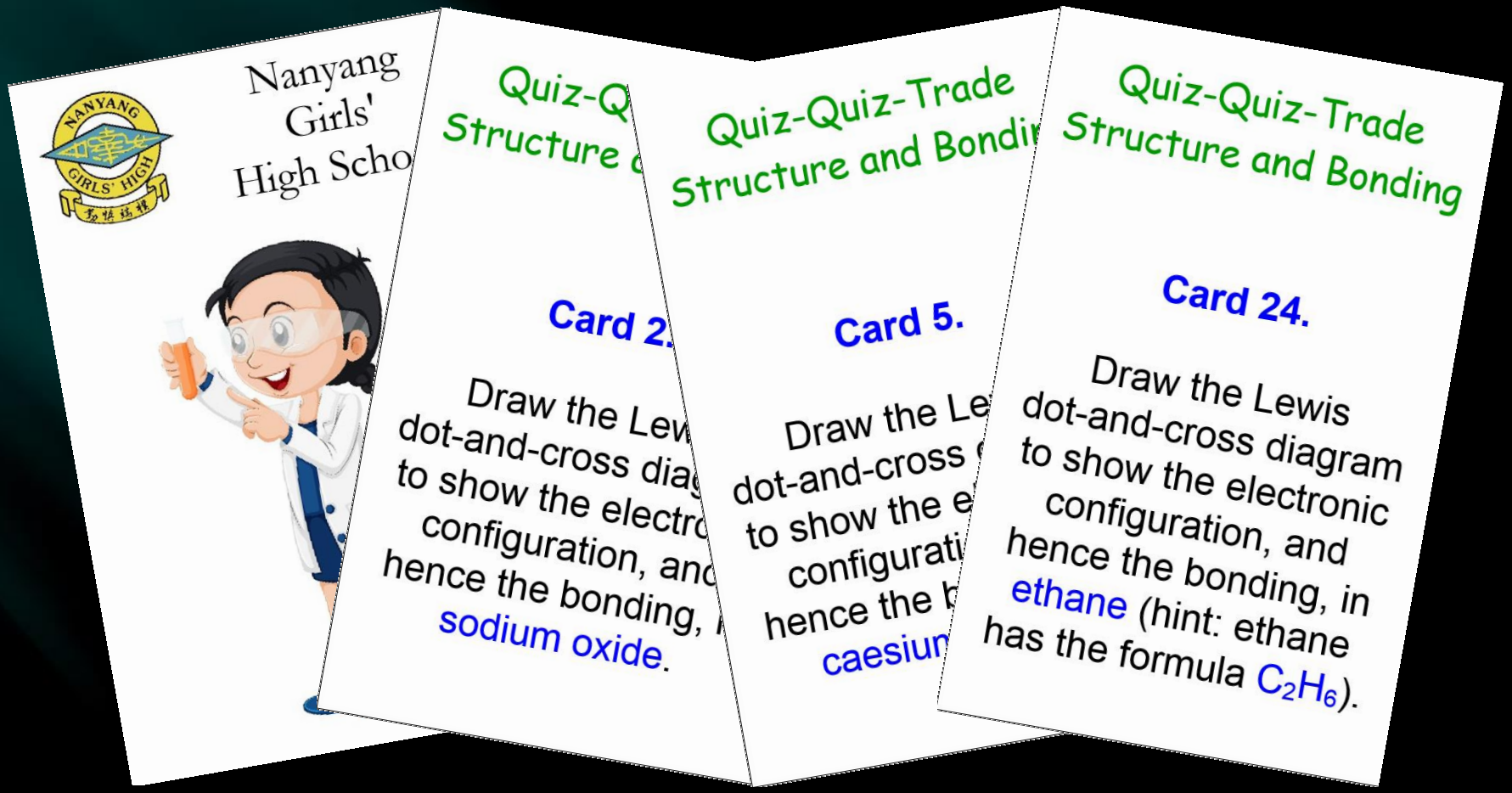
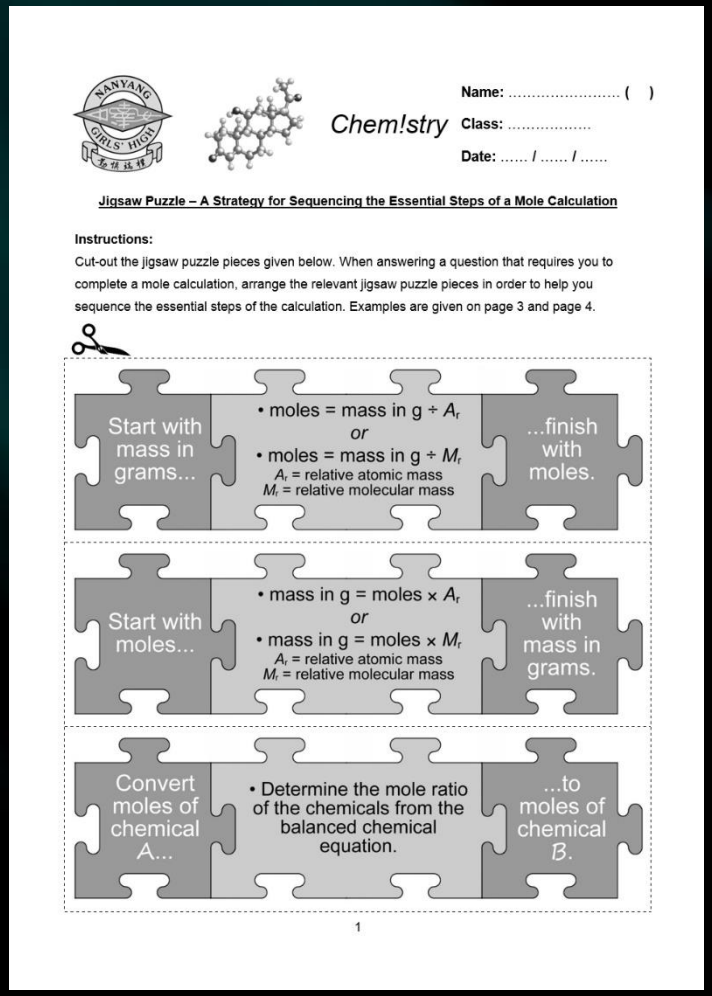
Quiz-Quiz-Trade



Jigsaw Puzzle



Chem!stry

Name: ..... ( )

Class: .....

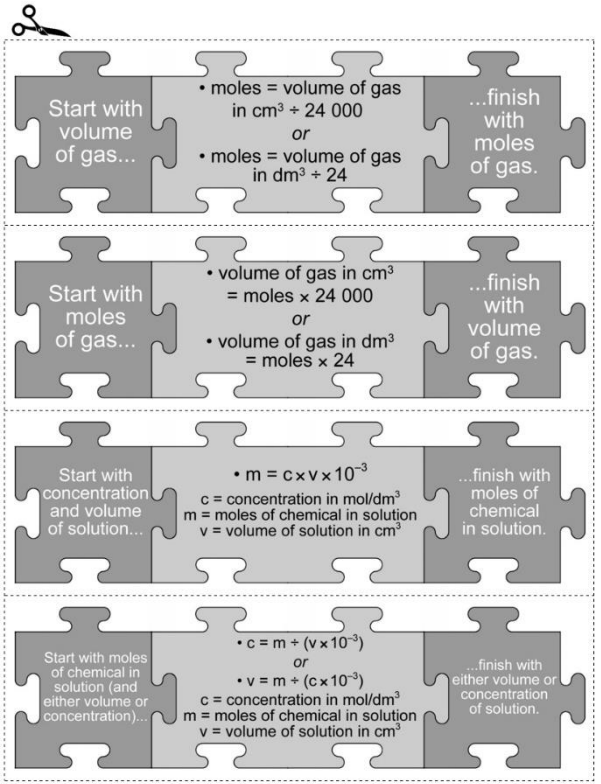
Date: ..... / ..... / .....

Jigsaw Puzzle – A Strategy for Sequencing the Essential Steps of a Mole Calculation

Instructions:

Cut-out the jigsaw puzzle pieces given below. When answering a question that requires you to complete a mole calculation, arrange the relevant jigsaw puzzle pieces in order to help you sequence the essential steps of the calculation. Examples are given on page 3 and page 4.

1



2

Constructing the Games

Card 6.

Move forward...

...the amount by which V changes its oxidation number during the following chemical reaction:

$$5VO^{2+}_{(aq)} + MnO_4^-{}_{(aq)} + H_2O_{(l)} \downarrow Mn^{2+}_{(aq)} + 5VO_2^+{}_{(aq)} + 2H^+_{(aq)}$$

What is the oxidizing agent in this chemical reaction?

Oxidation Numbers

Raffles Girls' School (Secondary)

Card 7.

Move forward...

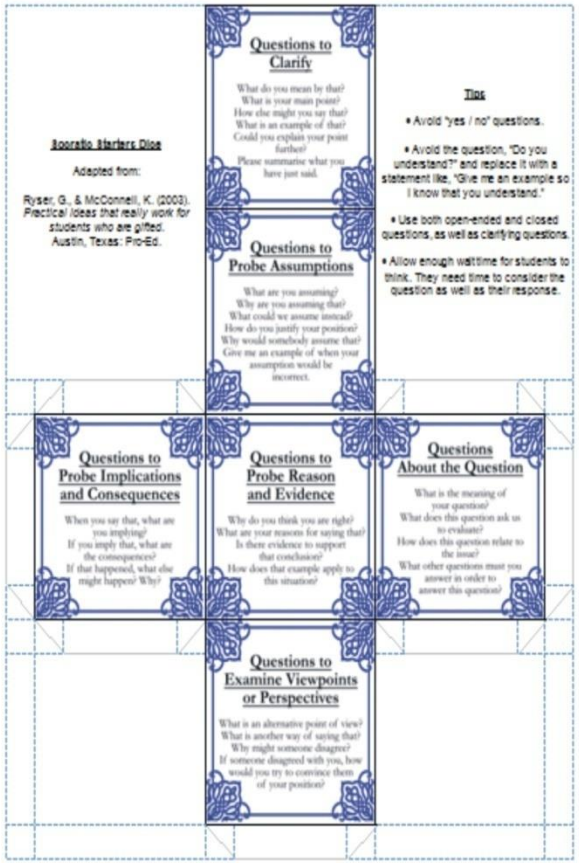
...the amount by which Ag changes its oxidation number during the following chemical reaction:

$$CH_3CHO_{(l)} + H_2O_{(l)} + 2Ag^+_{(aq)} \downarrow CH_3COOH_{(aq)} + 2H^+_{(aq)} + 2Ag_{(s)}$$

What is the reducing agent in this chemical reaction?

Oxidation Numbers

Raffles Girls' School (Secondary)



Socratic Starters Dice

Adapted from:

Ryser, G., & McConnell, K. (2003). *Practical ideas that really work for students who are gifted.* Austin, Texas: Pro-Ed.

Questions to Clarify

What do you mean by that?
What is your main point?
How else might you say that?
What is an example of that?
Could you explain your point further?
Please summarise what you have just said.

Questions to Probe Assumptions

What are you assuming?
Why are you assuming that?
What could we assume instead?
How do you justify your position?
Why would somebody assume that?
Give me an example of when your assumption would be incorrect.

Tips

- Avoid 'yes / no' questions.
- Avoid the question, "Do you understand?" and replace it with a statement like, "Give me an example so I know that you understand."
- Use both open-ended and closed questions, as well as clarifying questions.
- Allow enough waittime for students to think. They need time to consider the question as well as their response.

Questions to Probe Implications and Consequences

When you say that, what are you implying?
If you imply that, what are the consequences?
If that happened, what else might happen? Why?

Questions to Probe Reason and Evidence

Why do you think you are right?
What are your reasons for saying that?
Is there evidence to support that conclusion?
How does that example apply to this situation?

Questions About the Question

What is the meaning of your question?
What does this question ask us to evaluate?
How does this question relate to the issue?
What other questions must you answer in order to answer this question?

Questions to Examine Viewpoints or Perspectives

What is an alternative point of view?
What is another way of saying that?
Why might someone disagree?
If someone disagreed with you, how would you try to convince them of your position?

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Macromedia Fireworks MX - Chemical Elements Monolopy Board Trim.png

File Edit View Select Modify Text Commands Filters Window Help

Tools

Select

Bitmap

Vector

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Colors

View

Chemical Elements Monolopy Board Trim.png @ 25%

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Properties

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Research

Question 1)

The rules of the educational game were easy to understand:

- Strongly Agree: 16.7%
- Agree: 58.3% ←
- Disagree: 25.0%
- Strongly Disagree: 0.0%

n = 24

Question 2)

Sufficient time was given to play the educational game properly:

- Strongly Agree: 12.5%
- Agree: 33.3%
- Disagree: 45.8% ←
- Strongly Disagree: 8.3%

n = 24

Question 3)

Playing the educational game was more enjoyable than completing a worksheet on the same topic:

- Strongly Agree: 54.2% ←
- Agree: 41.7%
- Disagree: 4.2%
- Strongly Disagree: 0.0%

n = 24

Question 4)

Playing an educational game makes the topic more interesting to learn:

- Strongly Agree: 50.0% ←
- Agree: 37.5%
- Disagree: 12.5%
- Strongly Disagree: 0.0%

n = 24

Question 5)

I was more motivated to learn while playing the educational game than I would have been while completing a worksheet on the same topic:

- Strongly Agree: 41.7% ←
- Agree: 37.5%
- Disagree: 16.7%
- Strongly Disagree: 4.2%

n = 24

Question 6)

I was more focussed while playing the educational game than I would have been while completing a worksheet on the same topic:

- Strongly Agree: 25.0%
- Agree: 45.8% ←
- Disagree: 25.0%
- Strongly Disagree: 4.2%

n = 24

Question 7)

Playing educational games will improve my achievement more than completing worksheets:

- Strongly Agree: 4.2%
- Agree: 50.0% ←
- Disagree: 41.7%
- Strongly Disagree: 4.2%

n = 24

Question 8)

Playing educational games encourages communication between other students and myself:

- Strongly Agree: 37.5%
- Agree: 62.5% ←
- Disagree: 0.0%
- Strongly Disagree: 0.0%

n = 24

Question 9)

Playing educational games encourages co-operation between other students and myself:

- Strongly Agree: 33.3%
- Agree: 66.7% ←
- Disagree: 0.0%
- Strongly Disagree: 0.0%

n = 24

Question 10)

I found that the challenge offered by the educational game was appropriate for my level of ability:

- Strongly Agree: 12.5%
- Agree: 87.5% ←
- Disagree: 0.0%
- Strongly Disagree: 0.0%

n = 24

Question 11)

I was more concerned about answering the question correctly while playing the educational game than I would have been while completing a worksheet:

- Strongly Agree: 8.3%
- Agree: 45.8% ←
- Disagree: 37.5%
- Strongly Disagree: 8.3%

n = 24

Question 12)

I was more disappointed getting a question wrong while playing the educational game than I would have been while completing a worksheet:

- Strongly Agree: 0.0%
- Agree: 41.7%
- Disagree: 50.0% ←
- Strongly Disagree: 8.3%

n = 24

Question 13)

I learnt more about the topic while playing the educational game that I would have done while completing a worksheet:

- Strongly Agree: 4.2%
- Agree: 50.0% ←
- Disagree: 37.5%
- Strongly Disagree: 8.3%

n = 24

Question 14)

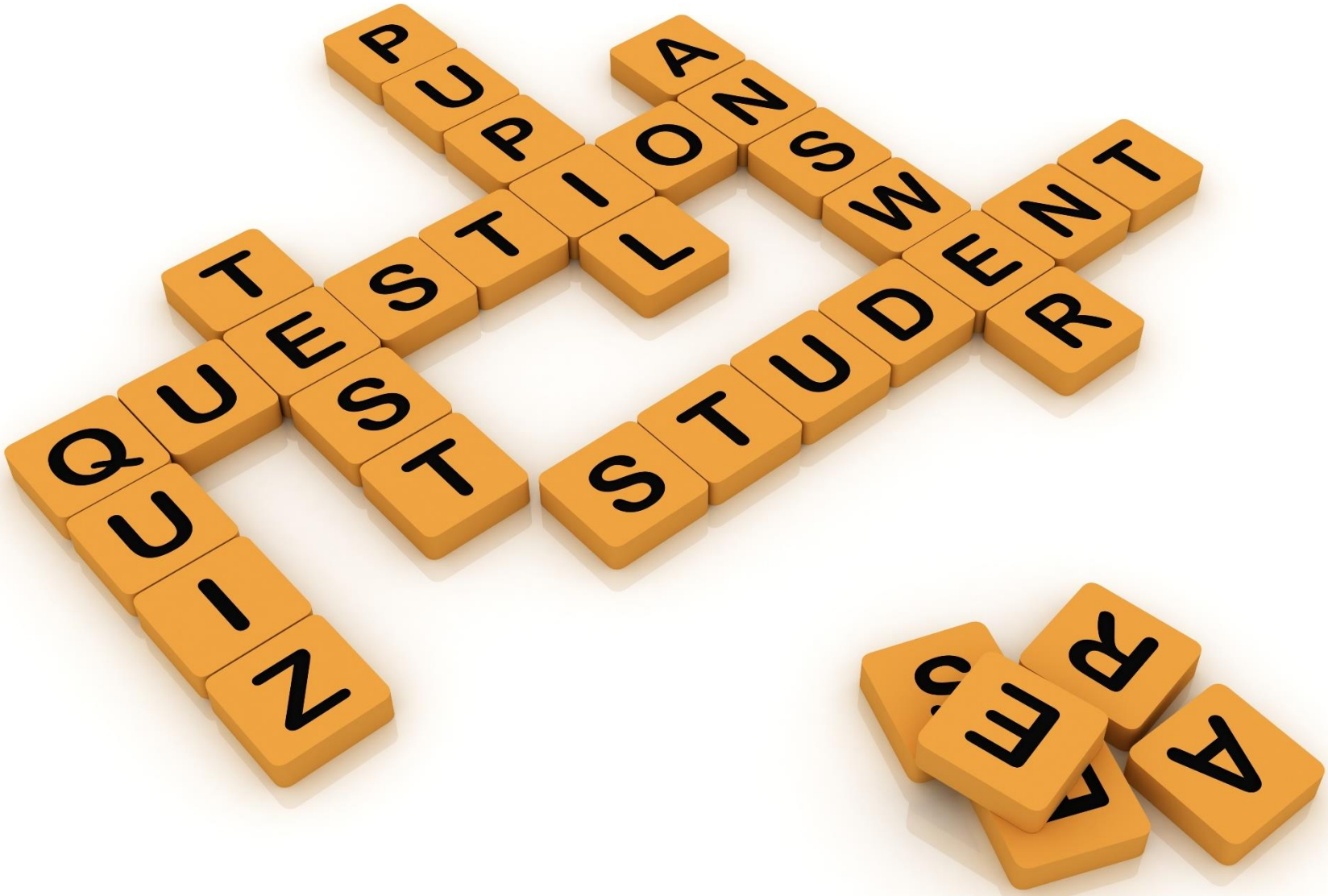
I would like to play more educational games in the future:

- Strongly Agree: 33.3%
- Agree: 66.7% ←
- Disagree: 0.0%
- Strongly Disagree: 0.0%

n = 24

Brainstorming

- What board games and / or card games do you know?
- How could these games be adapted so that they can be used in the classroom to teach and / or revise your subject?


PUPIL
ANSWER
STUDENT
TEST
QUIZ
AREA

Conclusion
Lesson Wrap-up Cube

- What was the most important thing that you learnt today?
- Tell a partner why today's session was important.
- How can you apply what you learnt today?
- How will you remember what you learnt today?
- What questions do you still have unanswered?
- How does what you learnt today integrate with what you already know?

Thank you for your attention!

What questions do you have?

Game Over