

# Game Rules

## Introduction

Technician shuffles the matching category and distributes 5 cards to each player. All remaining cards are placed face down in a deck in the center of the table in the solid color corresponding to the category as seen in figure II. One card is placed face up in the white space outlined by the color corresponding to the category as seen in figure II. Players must

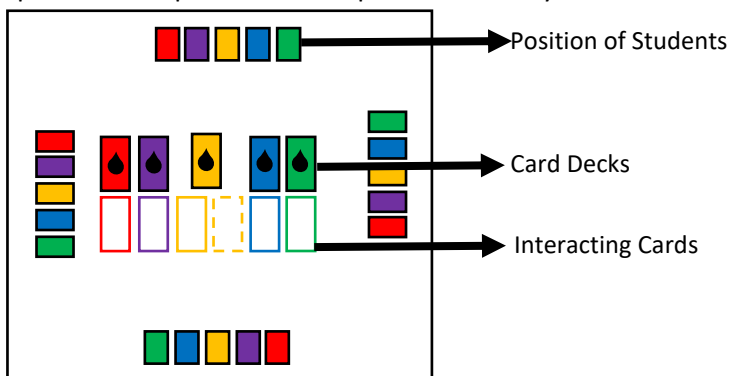


Fig I. Game set up between four participants

match the face up card with a card in their hand. Once a match is made the player puts both cards face up in front of them. The player then takes the sum of the top right number of the matching cards, this sum is the amount of points the player scores based on the match. The player then pulls the top card from the center deck for themselves and places the next top card from the center deck face up. Technician records all the scores that players have during and at the end of each round. If there is no match possible between the player and the face up card, then the player must draw a card from the center deck. Reflector will record all the incorrect matches throughout the round. If there is confusion about what cards do and do not match Reflector can reference the Answer Key Guide. Each round ends at after 5 min or after a player accumulates 80 points, which ever happens soonest.

## Player Options During Turns

Players have three options when it is their turn 1. Match, 2. Draw, 3. Trade. **Match:** If the player has a match with the face up card they will remove the matching card from the game field and place it in front of them. They will then pull the top card from that category and place it face up. Lastly the player will pull a new card from any category. **Draw:** If the player does not have any matches, they can draw a card from any active category. **Trade:** If

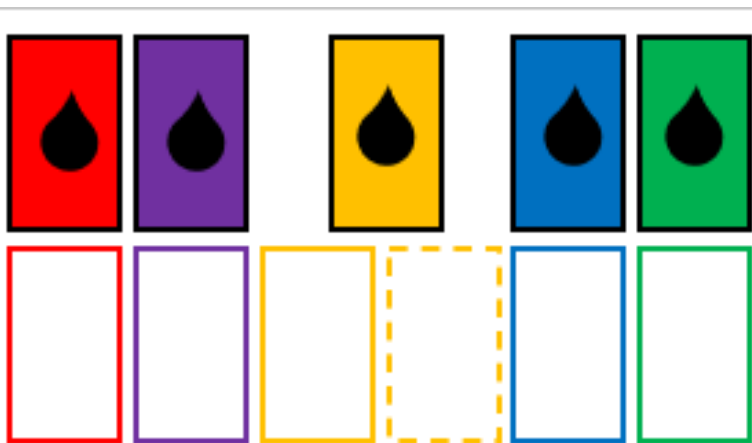


Fig II. Gameboard Layout

a player does not have any matches but does not want to draw a card from the main deck, they can trade a card with another player. The player can trade a card based on a category (i.e. they request a Reactions card from another player) or they can trade for a specific card (i.e. similar to Go-Fish in which the player ask for a specific type of card). In order for a trade to happen, both players have to agree. Once the trade happens, the player ends their turn.

## Scoring

Players scores start back at zero for each new round. **Turn by Turn Scoring:** The player then takes the sum of the top right number of the matching cards, this sum is the amount of points the player scores based on the match. **End of the Round Scoring:** At the end of each round players take the cards that are left in their hand and make any possible matches by placing matching cards in the matching pile in front of the player. Cards that don't match that are left in the players hands are subtracted from the players score at the end of each round. The score that is subtracted is the number of points in the top righthand corner of the card. **End of Game Scoring:** Once all the rounds are completed the Reflectors will sum up all the scores from each round. The player with the highest score wins.

## Confusion in Matching

If there is confusion about what cards do and do not match the Reflector can reference the Answer Key Guide. This is not an exhaustive list of every possible card pair, but only those that are definitively correct. For those that may require more debate, it is up to the students to discuss their positions amongst their groups and make their arguments or to ask questions to the facilitator for clarification. An example is listed below:

The card that is being matched is a card asking for Polar Bonded Compounds. The hydrochloric acid is a definite match because it is a polar compound that contains polar bonds. The carbon tetrachloride is not a definite match because although there are polar bonds the compound itself is a nonpolar compound. The card is asking for polar bonded compounds which are essentially polar compounds. The debate could be made that the card is only asking for a compound containing polar bonds. The ethane is not a match because it contains no polar bonds.

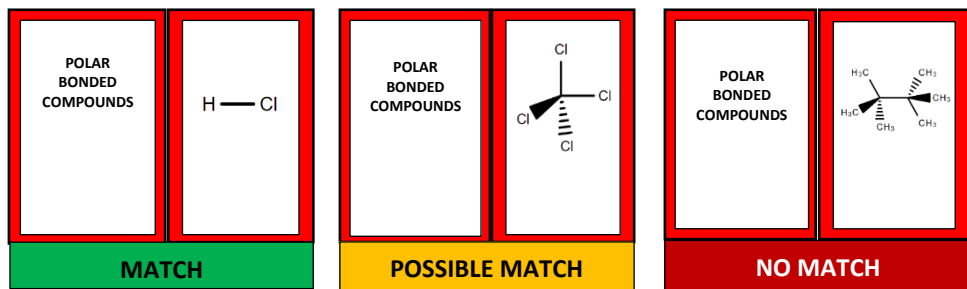


Fig III. Example of correct and incorrect card matching

### Frequently Asked Questions?

*What if a category runs out of cards?*

If a category runs out of cards, either because all the cards are pulled or because all the cards are matched, students must play from the next available active category. If there are no active categories available, then the round ends and players score their matches.

*Do I have to pull a card from the same category I matched with?*

No. You if you just matched a pair of cards, you do not have to pull your new card from that same category. The face up card placed on the gameboard must be from the same category but the card you draw does not.

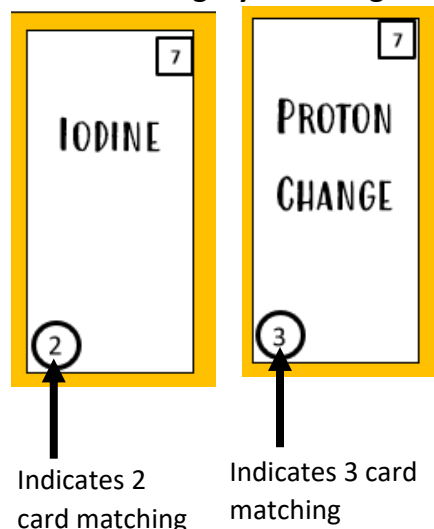
*When and how many times can I use the Answer Key Guide?*

The answer key guide can only be used once a student claims theirs a match and there is a dispute with the group. Students can not use the Answer Key Guide at any point before then. If there is an incorrect match, and no student disputes the match before the next player starts their turn, the answer guide cannot be used retroactively.

*What happens if I have matching cards in my hand?*

If there are matching cards in your hand place them down in your matching pile and pull a new card from any active category. You do not have to wait for your turn to do this.

### Reaction Category Matching Rules



The Reaction category is the only category where the matching rules are different from the other categories. The reaction category starts with one card face up same as all the other categories as described. However, unlike the other categories, the Reaction category requires three cards to match rather than two. Players can place both of the additional matching cards down during their turn if they have them. If the player only has one of the matching card then they may place that in the dotted yellow section. This does not guarantee that the player will receive points for the match. If the player places only one card down, then they do not receive the points from the match. It is only the player who places down the third matching card who receives the points. This means the player who places down both matching cards with the face up card OR the player who places down the third matching card with the face up card and the card they or another player placed in the dotted yellow section will receive the points.

# Group Roles

**Player 1 Technician** [*POGIL-Performs all technical operations of the group, making calculations and using a computer if need be*]- The Technician in gameplay will help distribute cards to players, shuffle the card decks if needed, and record the player's scores in the game.

**Player 2 Reflector** [*POGIL-Observes and comments on group dynamics and behavior with respect to the learning process. The reflector may be called upon to report to the group (or the entire class) about how well the group is operating (or what needs improvement), and why.*]- The Reflector will be responsible for recording matching patterns, incorrect matches amongst their group, and clarify answers or disputes amongst players.

**Player 3 Presenter** [*POGIL-Presents oral reports to the class. These reports should be as concise as possible; the instructor will normally set a time limit*]- The Presenter is responsible for recording questions and communicating with the instructor.

**Player 4 Manager** [*POGIL-Manages the group, ensures everyone is fulfilling their roles. Makes sure everyone participates. Instructor only answers questions from the manager*]- The Manager will help everyone to participate and lead discussion during the POGIL lesson.

# Gamification Answer Guide

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College of Natural Sciences

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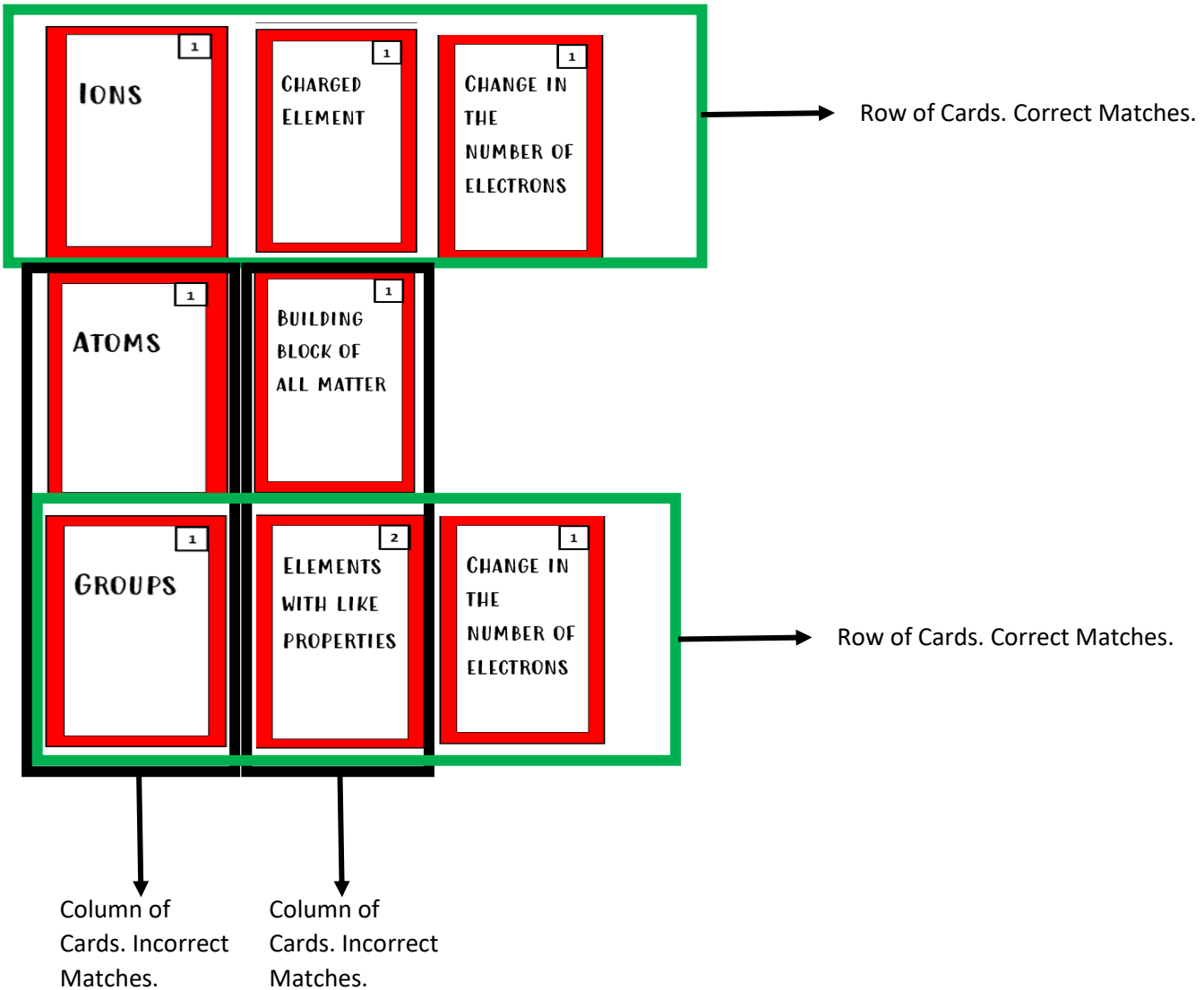
Author: Nathan Turner

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## How to use the answer reference guide

There may be some confusion between which cards match with which. This guide is to provide clarity to this confusion. Each row of cards listed indicates which cards are a correct match. Columns do not indicate a correct match and can be ignored.



Gamification Answer Guide

Any of the cards that are in the row paired together can be counted as a correct match. Answers that have a star (\*) next to them indicate a special rule pertaining to matches. For each special rule there is a black rectangle that indicates the special rule that is required for matching

*	$\frac{56}{25}\text{Mn}^{3+}$ 1 	1 <b>PROTON CHANGE</b>	$\frac{28}{14}\text{Si}^{4-}$ 1 	$\frac{28}{14}\text{Si}^{4+}$ 1 	$\frac{28}{14}\text{Si}$ 1 	Only one card is chosen to complete this set. The Si cards do not match with each other when Mn is played
*	$\frac{56}{25}\text{Mn}^{2+}$ 2 	1 <b>PROTON CHANGE</b>	$\frac{28}{14}\text{Si}^{4-}$ 1 	$\frac{28}{14}\text{Si}^{4+}$ 1 	$\frac{28}{14}\text{Si}$ 1 	Only one card is chosen to complete this set. The Si cards do not match with each other when Mn is played
*	$\frac{28}{14}\text{Si}^{4-}$ 1 	1 <b>PROTON CHANGE</b>	$\frac{56}{25}\text{Mn}$ 2 	$\frac{56}{25}\text{Mn}^{2+}$ 2 	$\frac{56}{25}\text{Mn}^{3+}$ 1 	Only one card is chosen to complete this set. The Mn cards do not match with each other when Si is played

## Category 1: Atomic Structure

**IONS** 1

**CHARGED  
ELEMENT** 1

**CHANGE IN  
THE  
NUMBER OF  
ELECTRONS** 1

**ATOMS** 1

**BUILDING  
BLOCK OF  
ALL MATTER** 1

**GROUPS** 1

**ELEMENTS  
WITH LIKE  
PROPERTIES** 2

**CHANGE IN  
THE  
NUMBER OF  
ELECTRONS** 1

**PERIOD** 2

**CHANGE IN  
THE NUMBER  
OF PROTONS** 1

**CHANGE IN  
THE  
NUMBER OF  
ELECTRONS** 1



## Gamification Answer Guide

2

28  
**Ni**  
Nickel  
58.69

1

74  
**W**  
Tungsten  
183.8

1

**METAL**

1

4  
**Be**  
Beryllium  
9.012

1

**METAL**

2

34  
**Se**  
Selenium  
78.96

1

8  
**O**  
Oxygen  
15.99

1

**NON-METAL**

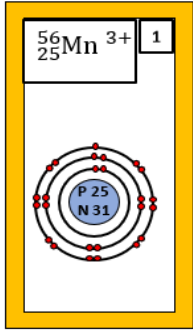
1

33  
**As**  
Arsenic  
74.92

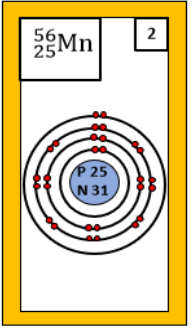
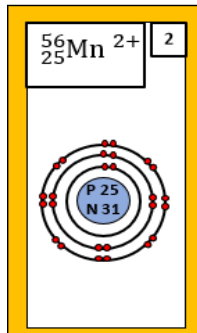
1

**NON-METAL**

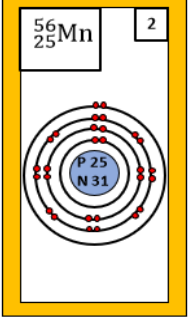
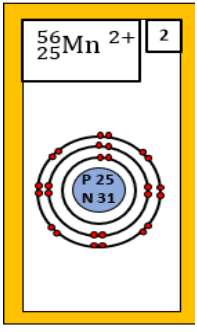
Gamification Answer Guide



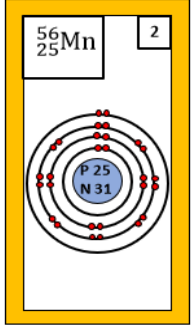
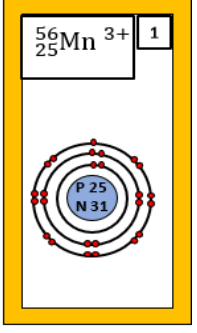
ELECTRON  
TRANSFER 2



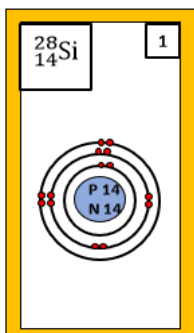
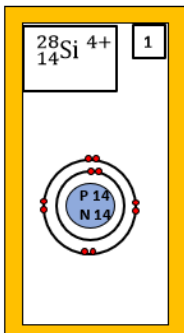
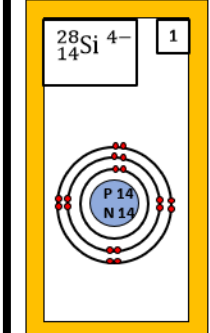
ELECTRON  
TRANSFER 2



ELECTRON  
TRANSFER 2



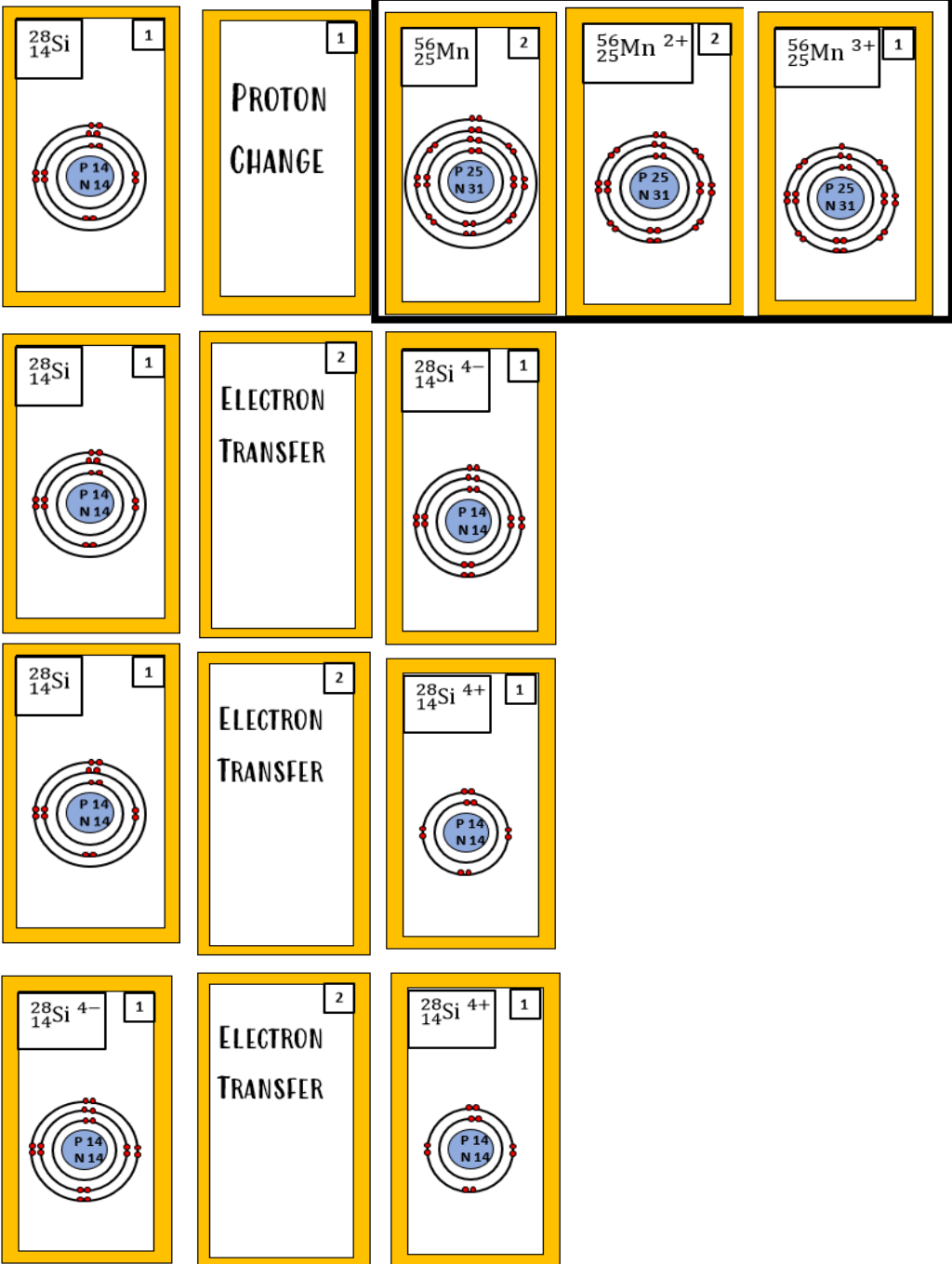
PROTON  
CHANGE 1



Only one card is chosen to complete this set. The Si cards do not match with each other when Mn is played

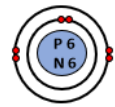
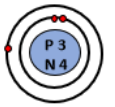
*	${}_{25}^{56}\text{Mn}^{3+}$ 1 	1 <b>PROTON CHANGE</b>	${}_{14}^{28}\text{Si}^{4-}$ 1 	${}_{14}^{28}\text{Si}^{4+}$ 1 	${}_{14}^{28}\text{Si}$ 1 	<p>Only one card is chosen to complete this set. The Si cards do not match with each other when Mn is played</p>
*	${}_{25}^{56}\text{Mn}^{2+}$ 2 	1 <b>PROTON CHANGE</b>	${}_{14}^{28}\text{Si}^{4-}$ 1 	${}_{14}^{28}\text{Si}^{4+}$ 1 	${}_{14}^{28}\text{Si}$ 1 	<p>Only one card is chosen to complete this set. The Si cards do not match with each other when Mn is played</p>
*	${}_{14}^{28}\text{Si}^{4-}$ 1 	1 <b>PROTON CHANGE</b>	${}_{25}^{56}\text{Mn}$ 2 	${}_{25}^{56}\text{Mn}^{2+}$ 2 	${}_{25}^{56}\text{Mn}^{3+}$ 1 	<p>Only one card is chosen to complete this set. The Mn cards do not match with each other when Si is played</p>
*	${}_{14}^{28}\text{Si}^{4+}$ 1 	1 <b>PROTON CHANGE</b>	${}_{25}^{56}\text{Mn}$ 2 	${}_{25}^{56}\text{Mn}^{2+}$ 2 	${}_{25}^{56}\text{Mn}^{3+}$ 1 	<p>Only one card is chosen to complete this set. The Mn cards do not match with each other when Si is played</p>

Gamification Answer Guide

\* 

Only one card is chosen to complete this set. The Mn cards do not match with each other when Si is played

## Category 2: Isotopes

<p>1</p> <p>CARBON-12</p>	<p>2</p> <p><math>^{12}_6\text{C}</math></p> 	<p>1</p> <p>ISOTOPES</p>	<p>1</p> <p>STANDARD USED FOR AMU</p>
<p>1</p> <p>LITHIUM-7</p>	<p>1</p> <p><math>^7_3\text{Li}</math></p> 	<p>1</p> <p>ISOTOPES</p>	
<p>1</p> <p>SUBATOMIC PARTICLE WITH A NEUTRAL CHARGE</p>	<p>2</p> <p>NEUTRONS</p>	<p>1</p> <p><math>^{41}_{19}\text{K}</math></p> <p>41-22=19</p>	<p>1</p> <p>SUBATOMIC PARTICLE THAT CHANGES WITH EACH ISOTOPE</p>
<p>1</p> <p>3</p> <p>Li</p> <p>Lithium</p> <p>6.94</p>	<p>2</p> <p>ATOMIC MASS</p>		

Gamification Answer Guide

**PROTONS**

1

SUBATOMIC  
PARTICLE WITH  
A POSITIVE  
CHARGE

1

${}_{19}^{41}\text{K}$

$41 - 22 = 19$

1

SUBATOMIC  
PARTICLE THAT  
CHANGES WITH  
EACH  
ELEMENT

1

**ELECTRONS**

1

SUBATOMIC  
PARTICLE WITH  
A NEGATIVE  
CHARGE

1

${}_{19}^{41}\text{K}$

$41 - 22 = 19$

1

Gamification Answer Guide

5

MAGNESIUM  
ATOMIC MASS =  
24.305

$^{25}_{12}\text{Mg}$

6

ISOTOPE IN  
LOW  
ABUNDANCE

5

MAGNESIUM  
ATOMIC MASS =  
24.305

$^{24}_{12}\text{Mg}$

6

ISOTOPE IN  
HIGH  
ABUNDANCE

5

URANIUM  
ATOMIC MASS =  
238.029

$^{235}_{92}\text{U}$

6

ISOTOPE IN  
LOW  
ABUNDANCE

5

OXYGEN ATOMIC  
MASS = 15.999

$^{17}_{8}\text{O}$

6

ISOTOPE IN  
LOW  
ABUNDANCE

Gamification Answer Guide

5

OXYGEN ATOMIC  
MASS= 15.999

$^{16}_8\text{O}$

6

ISOTOPE IN  
HIGH  
ABUNDANCE

5

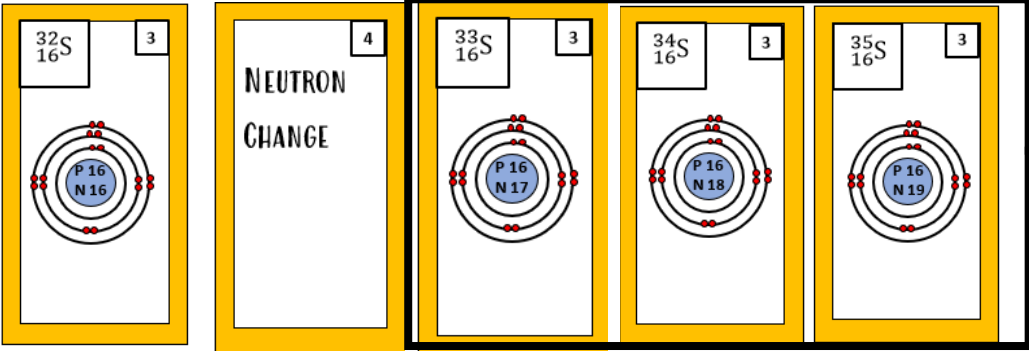
URANIUM  
ATOMIC MASS=  
238.029

$^{238}_{92}\text{U}$

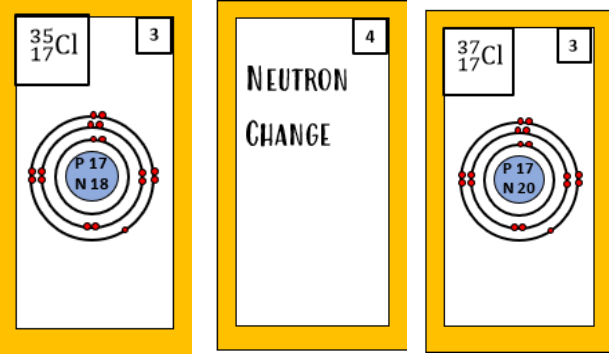
6

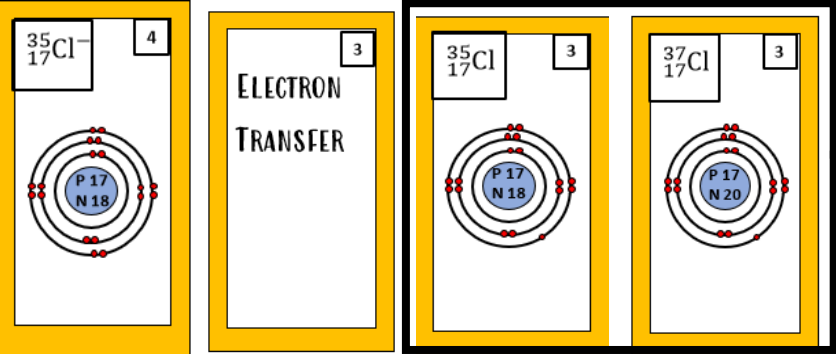
ISOTOPE IN  
HIGH  
ABUNDANCE



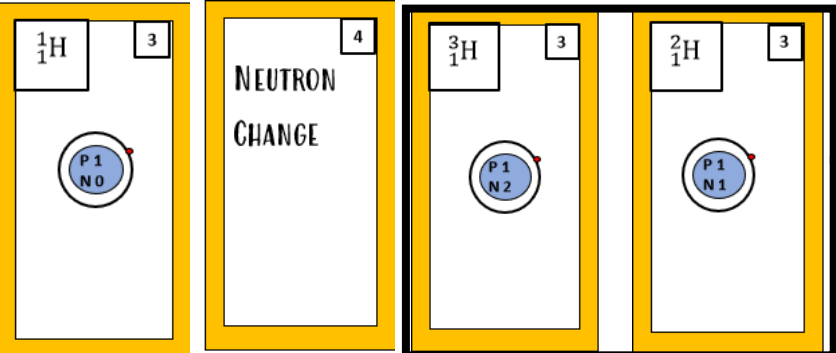
\* 

Only one card is chosen to complete this set. Any two cards can be chosen as long as Neutron Change is selected in the set



\* 

Only one card is chosen to complete this set. Cl<sup>-</sup> ion and electron transfer card must be selected along with any other card.

\* 

Only one card is chosen to complete this set. Any two cards can be chosen as long as Neutron Change is selected in the set

Gamification Answer Guide

4

DEUTERATED  
CHLOROFORM

5


INCLUDES  
HYDROGEN  
ISOTOPE

5

SOLVENT USED  
BY CHEMIST TO  
ANALYZE  
COMPOUNDS

${}^2_1\text{H}$

4



A diagram of a deuterium nucleus, showing a central blue circle labeled 'P 1' (proton) and 'N 1' (neutron), surrounded by a single electron shell with two red dots representing electrons.

5

INCLUDES  
HYDROGEN  
ISOTOPE

4

AMERICIUM-241

4

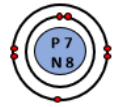
ISOTOPE USED  
IN SMOKE  
DETECTORS

4

NITROGEN-15

${}^{15}_7\text{N}$

4



A diagram of a nitrogen-15 nucleus, showing a central blue circle labeled 'P 7' (protons) and 'N 8' (neutrons), surrounded by two electron shells with a total of seven red dots representing electrons.

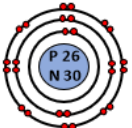
5

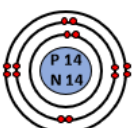
INCLUDES  
NITROGEN  
ISOTOPE

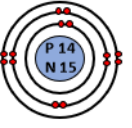
4

USED IN  
AGRICULTURAL  
RESEARCH IN  
SOIL SCIENCE

Gamification Answer Guide

 <p>2</p>	<p>IRON-56</p>	${}^{56}_{26}\text{Fe}$
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 <p>2</p>	${}^{28}_{14}\text{Si}$	<p>SILICON-28</p>
--	-------------------------	-------------------

${}^{29}_{14}\text{Si}$	 <p>2</p>	<p>SILICON-29</p>
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### Category 3: Ions (monoatomic)

NON-METAL IONS GENERALLY ARE/HAVE

ANION

MORE ELECTRONS THAN PROTONS

NEGATIVE CHARGE

METAL IONS GENERALLY ARE/HAVE

CATION

MORE PROTONS THAN ELECTRONS

POSITIVE CHARGE

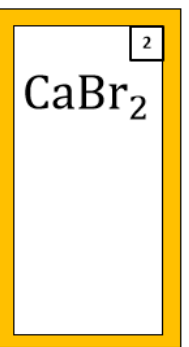
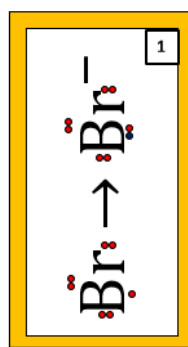
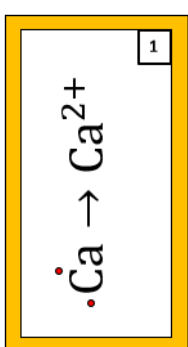
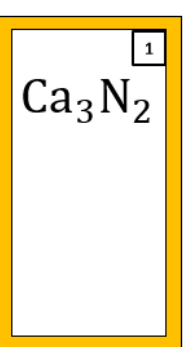
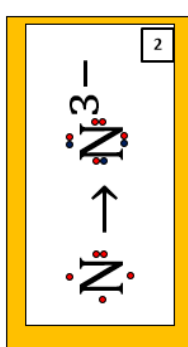
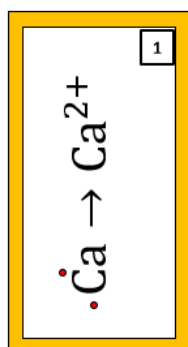
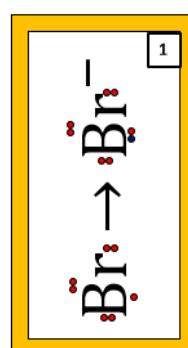
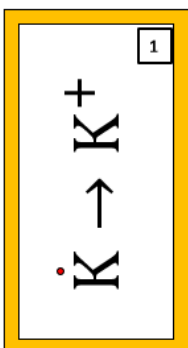
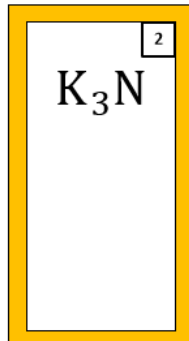
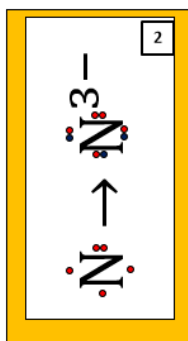
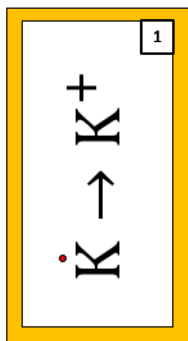
IONIZATION ENERGY

ENERGY REQUIRED TO REMOVE ONE ELECTRON FROM A SINGLE ATOM IN THE GASEOUS STATE.

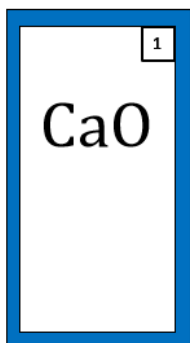
Gamification Answer Guide

$S^{2-}$ 2	ANION 1	HIGHER IONIZATION ENERGY GENERALLY 1
BaCl <sub>2</sub> 1 ↓ ION TYPE OR IONIZATION ENERGY	ANION 2	HIGHER IONIZATION ENERGY GENERALLY 1
Al <sub>2</sub> O <sub>3</sub> 1 ↓ ION TYPE OR IONIZATION ENERGY	CATION 1	LOWER IONIZATION ENERGY GENERALLY 2
Na <sup>+</sup> 1	CATION 1	LOWER IONIZATION ENERGY GENERALLY 2

Gamification Answer Guide

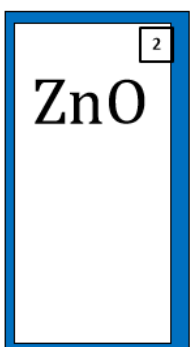


Gamification Answer Guide



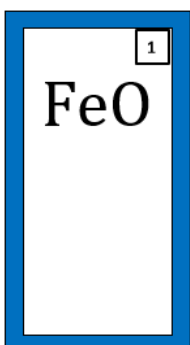
1  
CALCIUM  
OXIDE

1  
LIME, USED  
AS LAWN  
TREATMENT



2  
ZINC  
OXIDE

1  
SKIN  
PROTECTION



2  
IRON  
(II)  
OXIDE

1  
DISCOLORS  
AND  
DEGRADES  
METALLIC  
SURFACE

1  
ION WITH  
MULTIPLE  
CHARGES

Gamification Answer Guide

1  
ELECTROLYTE

2  
CAN INCREASE  
THE VOLTAGE OF  
A SOLUTION

1  
NaCl

2  
HCl

1  
ACIDIC  
COMPOUND

1  
COMPOUND THAT  
EASILY IONIZES  
BUT IS NOT AN  
IONIC  
COMPOUND

1  
CaCO<sub>3</sub>

1  
A DOCTOR  
RECOMMENDS  
WHAT ION TO  
HELP A  
PATIENT'S  
BONE GROWTH?

2  
NaOH

1  
BASIC  
COMPOUND



### Category 3: Ions (polyatomic)

<p>1</p> <p>POLYATOMIC ION</p>	<p>2</p> <p><math>\text{Ca}^{2+}</math> <math>\text{CO}_3^{2-}</math></p>	<p>1</p> <p>COMPOUNDS WITH MULTIPLE CHARGES</p>	<p>2</p> <p>CARBONATE</p>
<p>1</p> <p>ANION</p>	<p>2</p> <p><math>\text{Ca}^{2+}</math> <math>\text{CO}_3^{2-}</math></p>	<p>2</p> <p>CARBONATE</p>	<p>1</p> <p>GENERALLY LOW ELECTRON AFFINITY</p>
<p>2</p> <p>CATION</p>	<p>1</p> <p>GENERALLY HIGH ELECTRON AFFINITY</p>		
<p>1</p> <p>ELECTRON AFFINITY</p>	<p>1</p> <p>ENERGY RELEASED ON ADDING AN ELECTRON TO AN ATOM IN THE GASEOUS STATE</p>		

Gamification Answer Guide

2 AMMONIUM	1 $\text{NH}_4^+$	1 CATION
---------------	----------------------	-------------

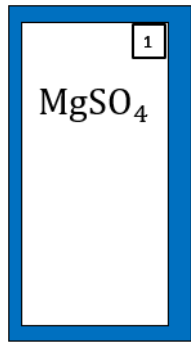
2 PHOSPHATE	1 $\text{PO}_4^{3-}$	1 ANION
----------------	-------------------------	------------

1 $\text{NO}_3^-$	1 NITRATE	1 ANION
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Gamification Answer Guide

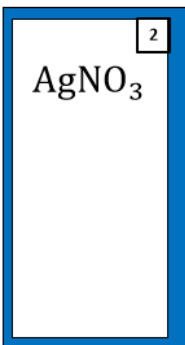
$\text{NH}_3 \rightarrow \text{NH}_4^+$ $(\text{N}^{5+}\text{H}_4^{4-})^+$ <p style="text-align: right;">2</p>	$\text{I} \rightarrow \text{I}^-$ <p style="text-align: right;">1</p>	$\text{NH}_4\text{I}$ <p style="text-align: right;">2</p>
$\text{NH}_3 \rightarrow \text{NH}_4^+$ $(\text{N}^{5+}\text{H}_4^{4-})^+$ <p style="text-align: right;">2</p>	$\text{H}_2\text{O} \rightarrow \text{OH}^-$ <p style="text-align: right;">1</p>	$\text{NH}_4\text{OH}$ <p style="text-align: right;">1</p>
$\text{Na} \rightarrow \text{Na}^+$ <p style="text-align: right;">1</p>	$\text{I} \rightarrow \text{I}^-$ <p style="text-align: right;">1</p>	$\text{NaI}$ <p style="text-align: right;">2</p>
$\text{Na} \rightarrow \text{Na}^+$ <p style="text-align: right;">1</p>	$\text{H}_2\text{CO}_3 \rightarrow \text{HCO}_3^-$ $(\text{H}^{+}\text{C}^{4+}\text{O}_3^{6-})^-$ <p style="text-align: right;">1</p>	$\text{NaHCO}_3$ <p style="text-align: right;">1</p>
$\text{NH}_3 \rightarrow \text{NH}_4^+$ $(\text{N}^{5+}\text{H}_4^{4-})^+$ <p style="text-align: right;">2</p>	$\text{H}_2\text{CO}_3 \rightarrow \text{HCO}_3^-$ $(\text{H}^{+}\text{C}^{4+}\text{O}_3^{6-})^-$ <p style="text-align: right;">1</p>	$\text{NH}_4\text{HCO}_3$ <p style="text-align: right;">1</p>

Gamification Answer Guide



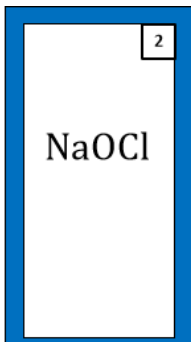
EPSOM SALT  
(MAGNESIUM  
SULFATE) 1

USED AS A  
LAXATIVE  
OR IN  
BATHS 2



SILVER  
NITRATE 1

USED AS  
AN  
ANTISEPTIC 1



BLEACH  
(SODIUM  
HYPOCHLORITE) 1

USED AS  
HOUSEHOLD  
DISINFECTANT 1

Gamification Answer Guide

1  
 $\text{Mg(OH)}_2$

1  
MILK OF  
MAGNESIA

1  
THE COMPOUND  
YOU RECOMMEND  
TO SOMEONE WHO  
HAS AN UPSET  
STOMACH OR  
HEARTBURN

1  
 $\text{Ca(OH)}_2$

2  
HYDRATED  
LIME

2  
USED TO INCREASE  
THE  
CONCENTRATION  
OF A BASE IN A  
SOLUTION

1  
 $\text{KNO}_3$

1  
SALTPETER

2  
USED TO INCREASE  
THE NITRATE  
CONCENTRATION OF  
A COMPOUND

1  
A BLACK POWDER  
LEFT ON A  
COUNTER TURNED  
OUT TO BE  
FLAMMABLE, ITS  
MOST LIKELY  
WHAT

## Category 4: Periodic Table

1 TRANSITION METALS	1 GROUP 3-12 METALS	2 METAL COMPOUNDS
---------------------------	------------------------------	-------------------------

1 METALLOID	2 STAIRSTEP PATTERN OF METAL AND NON-MEAL ELEMENTS
----------------	---

1 ALKALI & ALKALINE EARTH	2 GROUP 1 AND 2 METALS	1 METAL COMPOUNDS
---------------------------------------	---------------------------------	-------------------------

1 LANTHANIDE AND ACTINIDE	1 ELEMENTS WITH ATOMIC NUMBERS 57-71 AND 89-103
------------------------------------	---

Gamification Answer Guide

1  
NOBLE  
GASES

1  
GROUP 18  
ELEMENTS

2  
NON-METAL

2  
A PROPERTY HELD BY  
CARBON, NITROGEN,  
OXYGEN, FLUORINE,  
CHLORINE,  
BROMINE, IODINE

1  
DIATOMIC  
IONS

2  
NON-METAL

1  
ELEMENTS  
THAT BOND  
TO  
THEMSELVES

1  
PERIODIC  
TRENDS

1  
DESCRIBES  
CHEMICAL  
PROPERTIES

2  
NON-METAL

2  
GROUP 17  
ELEMENTS

1  
ELEMENTS  
BETWEEN  
GROUP 14-16

Gamification Answer Guide

1  
ATOMIC  
RADIUS

1  
PERIODIC  
TRENDS

1  
RADIUS OF TWO  
LIKE ATOMS  
BONDED  
TOGETHER

1  
ELECTRONEGATIVITY

1  
PERIODIC  
TRENDS

2  
RELATIVE  
ABILITY OF A  
BONDED ATOM  
TO ATTRACT  
SHARED  
ELECTRONS

1  
IONIZATION  
ENERGY

1  
PERIODIC  
TRENDS

1  
ENERGY  
REQUIRED TO  
REMOVE ONE  
ELECTRON FROM  
A SINGLE ATOM  
IN THE GASEOUS  
STATE.

2  
ELECTRON  
AFFINITY

1  
PERIODIC  
TRENDS

2  
ENERGY  
RELEASED ON  
ADDING AN  
ELECTRON TO AN  
ATOM IN THE  
GASEOUS STATE



Gamification Answer Guide

NOBLE  
GAS

NON-  
METAL

XENON

METALLOID

ARSENIC

BORON

ALKALINE  
EARTH  
METAL

METAL

STRONTIUM

TRANSITION  
METAL

METAL

URANIUM

MERCURY

ACTINIDE

IRON

Gamification Answer Guide

1  
ALKALI  
METAL

1  
METAL

1  
POTASSIUM

1  
HALOGEN

1  
NON-  
METAL

2  
BROMINE

Gamification Answer Guide

1+ IONS 1

RUBIDIUM 1

COPPER 1

2+ IONS 1

MANGANESE 1

COBALT 2

COPPER 1

3+ IONS 2

BORON 2

MANGANESE 1

3- IONS 1

PHOSPHORUS 1

Gamification Answer Guide

2- IONS	OXYGEN	SELENIUM
---------	--------	----------

1- IONS	FLUORINE	IODINE
---------	----------	--------

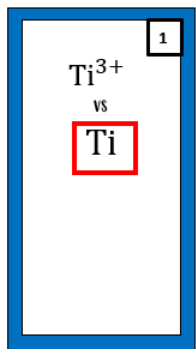
1 $\text{Ca}^{2+}$ vs Ca	2 LOWEST ATOMIC RADII
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1 $\text{Co}^{2+}$ vs Co	2 LOWEST ATOMIC RADII
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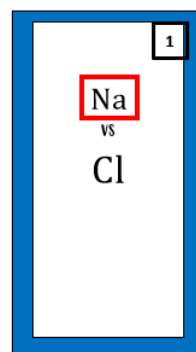
2 P vs K	2 LOWEST ATOMIC RADII
-------------------	--------------------------------

2 $\text{Na}^+$ vs $\text{Cl}^-$	2 LOWEST ATOMIC RADII
---	--------------------------------

Gamification Answer Guide



HIGHEST  
ATOMIC  
RADI



HIGHEST  
ATOMIC  
RADI

1  
NOBLE  
GAS

1  
IN THE LAB YOU  
DETECT AND  
ODORLESS GAS  
THAT IS  
UNREACTIVE. YOU  
SUSPECT IT IS  
MOST  
LIKELY\_ \_ \_ \_ \_

2  
METALLOID

1  
IN THE LAB YOU FIND A  
METAL SHARD ON THE LAB  
BENCH. YOU EXPECT IT TO  
BE STRONG BUT IT TURNS  
OUT TO BE BRITTLE AN  
INEFFECTIVE AS A  
CONDUCTOR OF  
ELECTRICITY. IT IS MOST  
LIKELY\_ \_ \_ \_ \_

1  
HALOGEN

2  
IN THE LAB YOU DETECT  
AND A GAS. IT DOESN'T  
SEEM VERY REACTIVE  
UNTIL YOU INTRODUCE  
METAL IONS TO IT. IT  
IS MOST  
LIKELY\_ \_ \_ \_ \_

Gamification Answer Guide

2

ALKALI  
METAL

1

IN THE LAB YOU FIND A  
METAL SHARD ON THE  
LAB BENCH. YOU SPILL  
WATER ON IT AND IT  
CATCHES ON FIRE  
NEARLY BURNING THE  
LAB BENCH. IT IS MOST  
LIKELY ----



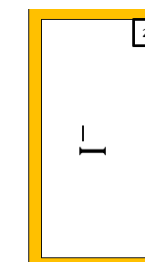
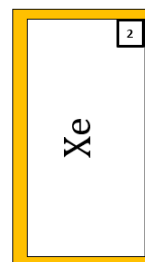
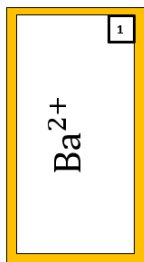
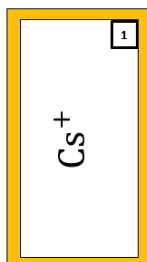
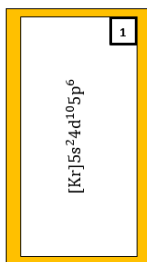
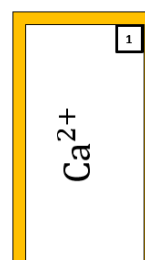
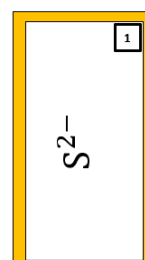
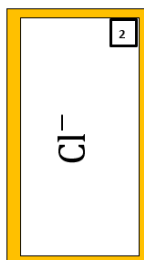
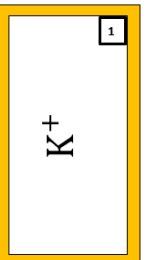
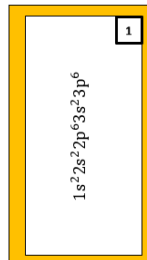
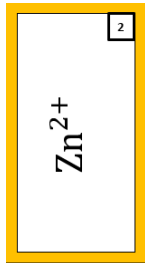
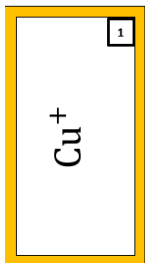
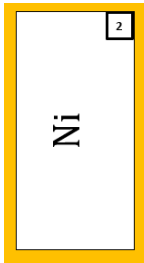
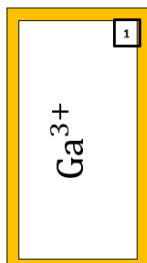
## Category 5: Electronic Structure of Atoms

<b>SUBSHELL</b> 1	SUBDIVISION OF ELECTRON SHELLS 1	WHAT SHELLS ARE COMPOSED OF, LABELED S, P, D, F 1
ELECTRON CONFIGURATION 2	WRITTEN REPRESENTATION OF HOW ELECTRONS IN SUBSHELLS IN ELEMENTS ARE ARRANGED 2	
ENERGY LEVEL ( SHELL ) 1	PRINCIPAL QUANTUM NUMBER OF AN ATOMS ELECTRONS 1	REGIONS OF SPACE WITHIN AN ATOM WHERE THE SPECIFIC ELECTRONS ARE MOST LIKELY TO BE FOUND 2

Gamification Answer Guide

Na <span>2</span>	ALKALI METAL <span>2</span>	S-ORBITAL IS THE ORBITAL OF THE VALENCE ELECTRON <span>1</span>	$1s^2 2s^2 2p^6 3s^1$ <span>1</span>
Cl <span>1</span>	HALOGEN <span>1</span>	P-ORBITAL IS THE ORBITAL OF THE VALENCE ELECTRON <span>1</span>	$1s^2 2s^2 2p^6 3s^2 3p^5$ <span>2</span>
Li <span>1</span>	S-ORBITAL IS THE ORBITAL OF THE VALENCE ELECTRON <span>1</span>	$1s^2 2s^1$ <span>1</span>	

## Gamification Answer Guide



## Category 6: Mole & Stoichiometry

1

**MOLE**

1

THE AMOUNT OF A  
SUBSTANCE WHOSE  
MASS IN GRAMS  
IS NUMERICALLY  
EQUAL TO ITS  
MOLECULAR  
WEIGHT

1

**MOLAR  
MASS**

1

THE MASS OF  
1 MOLE OF A  
SUBSTANCE

1

**MOLAR  
RATIO**

1

FRACTION OF  
MOLES PRODUCED  
IN A REACTION  
BASED ON THE  
MOLES IN THE  
REACTANTS

1

**AVOGADRO 'S  
NUMBER**

1

DEVELOPED BY  
PHYSICIST  
AMEDEO  
AVOGADRO.  
 $6.022 \times 10^{23}$

2

**CONVERSION  
FACTORS**

2

VALUE USED TO  
CONVERT BETWEEN  
COMPOUNDS OR  
CONVERT BETWEEN  
GRAMS, MOLES,  
OR ATOMS

Gamification Answer Guide

4 <b>MOLAR MASS</b>	4 CONVERTING MOLES OF CaCl <sub>2</sub> TO GRAMS OF CaCl <sub>2</sub>	4 CONVERTING GRAMS OF H <sub>2</sub> O TO MOLES OF H <sub>2</sub> O	4 CONVERTING GRAMS OF ZnCl <sub>2</sub> TO MOLES OF H <sub>2</sub>	4 CONVERTING GRAMS OF Mg TO MOLES OF AlPO <sub>4</sub>
4 <b>MOLAR RATIO</b>	4 CONVERTING MOLES OF AgNO <sub>3</sub> TO MOLES OF NaCl	4 CONVERTING MOLES OF BaSO <sub>4</sub> TO MOLES OF KBr	4 CONVERTING MOLES OF Pb(NO <sub>3</sub> ) <sub>2</sub> TO MOLES OF CaCl <sub>2</sub>	
5 <b>AVOGADRO 'S NUMBER</b>	4 CONVERTING MOLECULES OF CO <sub>2</sub> TO MOLES OF CO <sub>2</sub>	4 CONVERTING MOLES OF CuO TO MOLECULES OF CuO		

$\text{MgCl}_{2(\text{aq})} + 2\text{Na}_{(\text{s})} \rightarrow 2\text{NaCl}_{(\text{aq})} + \text{Mg}_{(\text{s})}$   
**1 MOL Na =? ATOMS Na**

$6.022 \times 10^{23}$   
**ATOMS / MOLECULES**

1 MOL Na	$6.022 \times 10^{23}$ Na <small>ATOMS / MOLECULES</small>
	1 MOL Na

$\text{Ca}(\text{NO}_3)_2(\text{aq}) + 2\text{Li}_{(\text{s})} \rightarrow 2\text{LiNO}_3(\text{aq}) + \text{Ca}_{(\text{s})}$   
**0.5 MOL Ca(NO<sub>3</sub>)<sub>2</sub> =? MOL Li**

**1 MOLE**

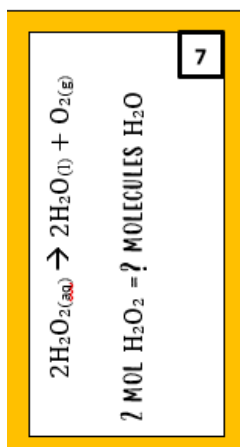
0.5 MOL Ca(NO <sub>3</sub> ) <sub>2</sub>	2 MOL Li
	1 MOL Ca(NO <sub>3</sub> ) <sub>2</sub>

$2\text{LiCl}_{(\text{aq})} + \text{F}_{2(\text{g})} \rightarrow 2\text{LiF}_{(\text{aq})} + \text{Cl}_{2(\text{g})}$   
**1 MOL LiCl =? MOLECULES LiCl**

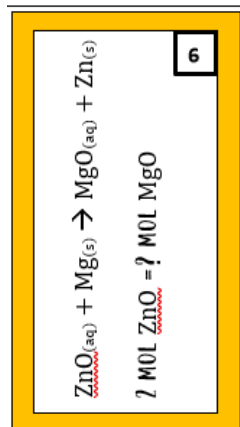
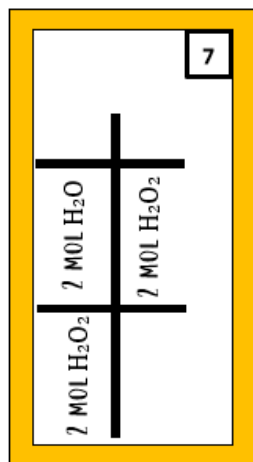
$6.022 \times 10^{23}$   
**ATOMS / MOLECULES**

1 MOL LiCl	$6.022 \times 10^{23}$ LiCl <small>ATOMS / MOLECULES</small>
	1 MOL LiCl

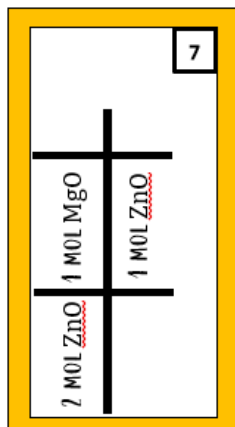
Gamification Answer Guide



2 MOLE



2 MOLE



TRUE

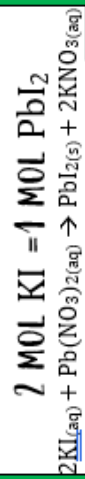
12

TRUE OR FALSE?



12

TRUE OR FALSE?



12

TRUE OR FALSE?



12

FALSE

12

TRUE OR FALSE?



12

TRUE OR FALSE?



12



## Category 7: Chemical Naming

1 MONO-	1 NO	1 CO	1 N <sub>2</sub> O
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1 DI-	1 N <sub>2</sub> S	1 CO <sub>2</sub>	1 S <sub>2</sub> Cl <sub>2</sub>
----------	-----------------------	----------------------	-------------------------------------

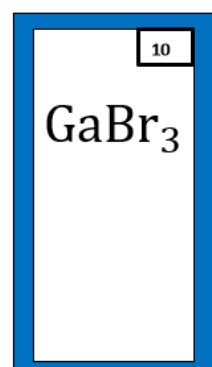
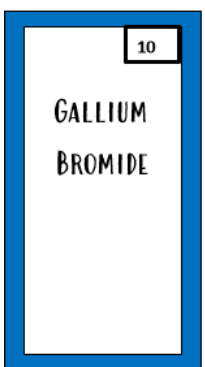
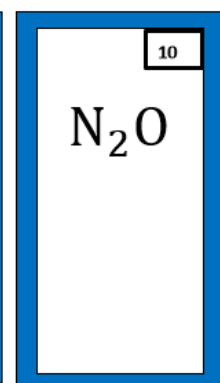
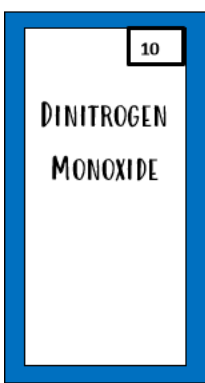
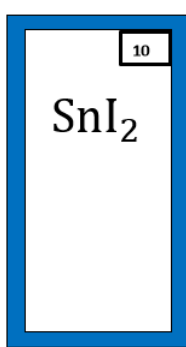
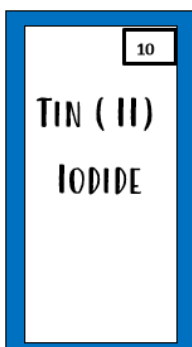
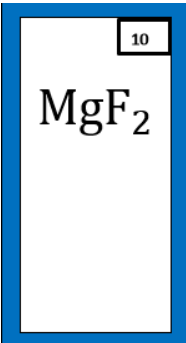
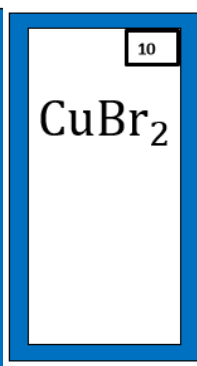
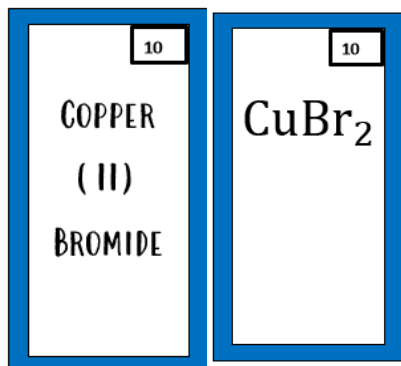
2 TRI-	1 NF <sub>3</sub>	1 PI <sub>3</sub>
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2 TETRA-	1 N <sub>2</sub> O <sub>4</sub>	1 XeF <sub>4</sub>
-------------	------------------------------------	-----------------------

4 ENDS WITH -ATE OR -ITE	4 $\text{Na}_3\text{PO}_4$	4 $\text{NaClO}$	4 $\text{NaCN}$	4 $\text{K}_2\text{CO}_3$	4 $\text{NaOH}$
-----------------------------------	-------------------------------	---------------------	--------------------	------------------------------	--------------------

4 ENDS WITH -IDE	4 $\text{NaCl}$	4 $\text{CaBr}_2$	4 $\text{CO}_2$	4 $\text{H}_2\text{O}$	4 $\text{LiN}_3$
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Gamification Answer Guide



Gamification Answer Guide

<p>12</p> <p>ROMAN NUMERAL</p> <p><b>I</b></p> <p>IN IONIC NAME</p>	<p>12</p> <p><math>\text{CuCl}_2</math> v.s. <math>\text{CuCl}</math></p>	<p>12</p> <p><math>\text{AuCl}_3</math> v.s. <math>\text{AuCl}</math></p>	
<p>12</p> <p>ROMAN NUMERAL</p> <p><b>II</b></p> <p>IN IONIC NAME</p>	<p>12</p> <p><math>\text{FeCl}_2</math> v.s. <math>\text{FeCl}_3</math></p>	<p>12</p> <p><math>\text{Cu}_3\text{N}</math> v.s. <math>\text{Cu}_3\text{N}_2</math></p>	<p>12</p> <p><math>\text{Hg}_2\text{O}</math> v.s. <math>\text{HgO}</math></p>
<p>12</p> <p>ROMAN NUMERAL</p> <p><b>III</b></p> <p>IN IONIC NAME</p>	<p>12</p> <p><math>\text{NiCl}_2</math> v.s. <math>\text{NiCl}_3</math></p>	<p>12</p> <p><math>\text{NiCO}_3</math> v.s. <math>\text{Ni}_2(\text{CO}_3)_3</math></p>	
<p>12</p> <p>ROMAN NUMERAL</p> <p><b>IV</b></p> <p>IN IONIC NAME</p>	<p>12</p> <p><math>\text{MnCl}_2</math> v.s. <math>\text{MnCl}_4</math></p>	<p>12</p> <p><math>\text{TiO}_2</math> v.s. <math>\text{Ti}_2\text{O}_3</math></p>	<p>12</p> <p><math>\text{MnS}</math> v.s. <math>\text{MnS}_2</math></p>

## Category 8: Electronegativity Trend & Polarity

1  
ELECTRONEGATIVITY

1  
RELATIVE  
ABILITY OF A  
BONDED ATOM  
TO ATTRACT  
SHARED  
ELECTRONS

1  
DIPOLE

1  
DIRECTION OF  
PARTIAL POSITIVE  
AND PARTIAL  
NEGATIVE CHARGE

1  
NEGATIVE  
POSITIVE  
CHARGE

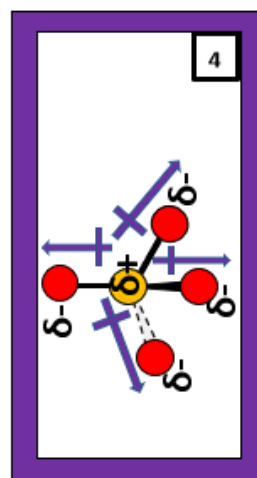
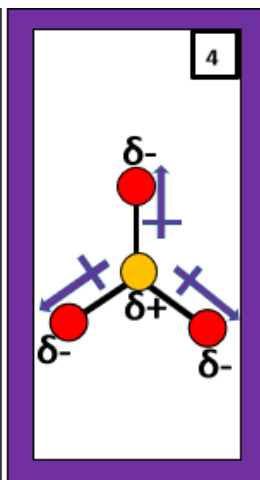
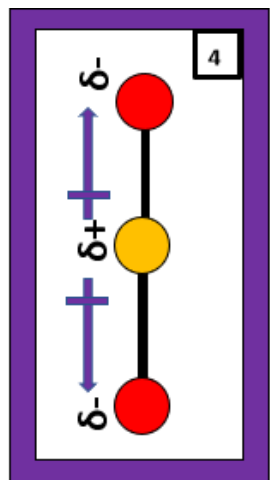
1  
HIGH  
ELECTRONEGATIVITY

1  
PARTIAL  
POSITIVE  
CHARGE

1  
LOW  
ELECTRONEGATIVITY

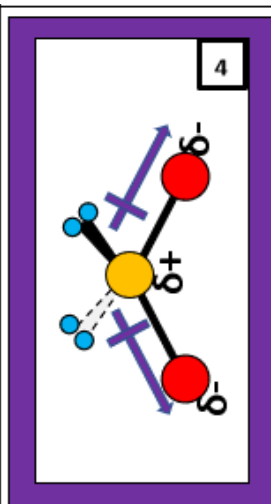
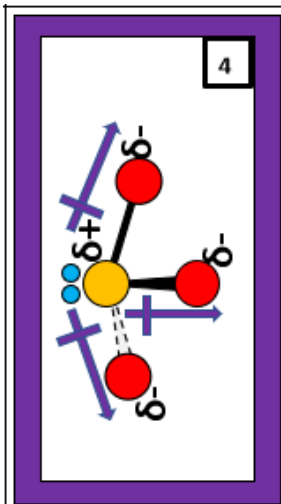
NONPOLAR

4



POLAR

5



Gamification Answer Guide

11  
GREATER  
ELECTRONEGATIVITY  
OR  
PARTIAL NEGATIVE  
CHARGE

10  
C  
VS  
O

10  
P  
VS  
Al

10  
SMALLER  
ELECTRONEGATIVITY  
OR  
PARTIAL POSITIVE  
CHARGE

10  
Cl  
VS  
C

10  
F  
VS  
H

10  
Li  
VS  
N

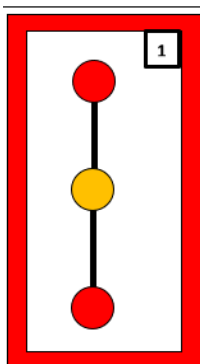
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------------------------	------------------------------------	------------------------------------	------------------------------------

<p>12</p> <p>NONPOLAR</p>	<p>12</p> <p><math>CO_2</math></p>	<p>12</p> <p><math>CCl_4</math></p>
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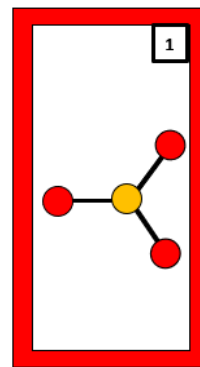


## Category 9: Molecular Geometry

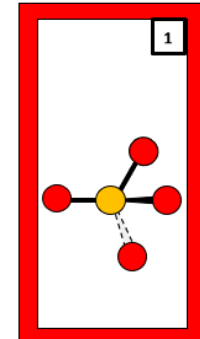
1  
LINEAR



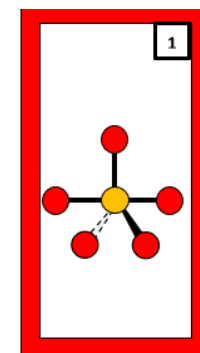
1  
TRIGONAL  
PLANAR



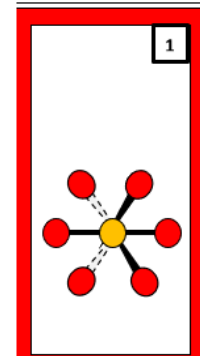
1  
TETRAHEDRAL



1  
TRIGONAL  
BIPYRAMIDAL

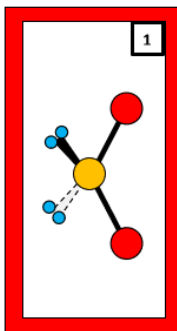


1  
OCTAHEDRAL

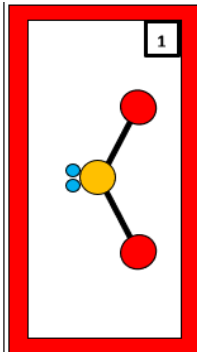


Gamification Answer Guide

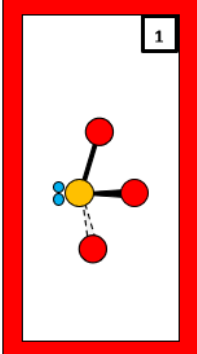
2  
BENT / ANGULAR  
( 4 DOMAINS )



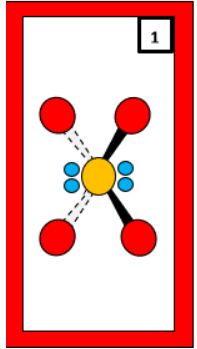
2  
BENT / ANGULAR  
( 3 DOMAINS )



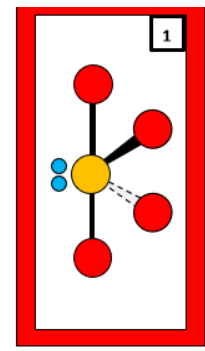
1  
TRIGONAL  
PYRAMID



1  
SQUARE PLANAR



1  
SEESAW



## Gamification Answer Guide

4  
LINEAR

4  
2 DOMAINS (2  
BONDED  
ATOMS)

4  
TRIGONAL  
PLANAR

4  
3 DOMAINS  
(3 BONDED  
ATOMS)

4  
BENT

5  
3 DOMAINS  
(1 LONE  
PAIR, 2  
BONDED  
ATOMS)

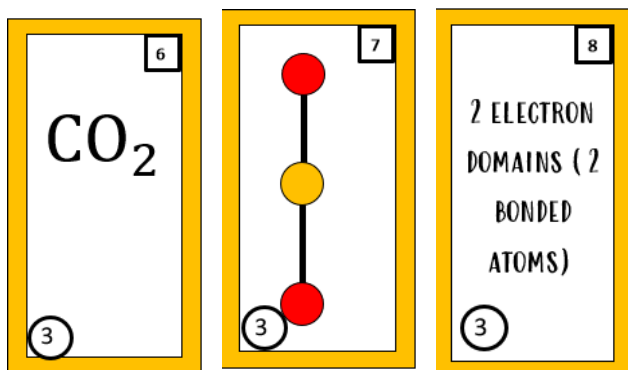
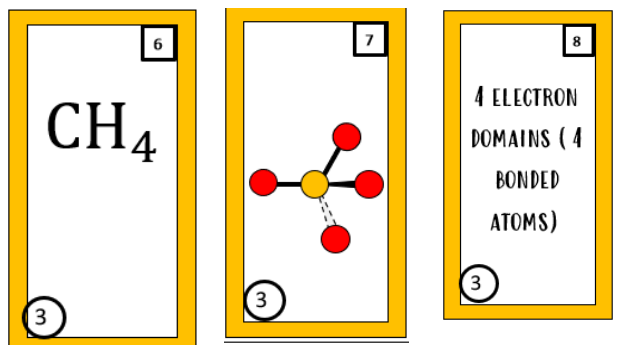
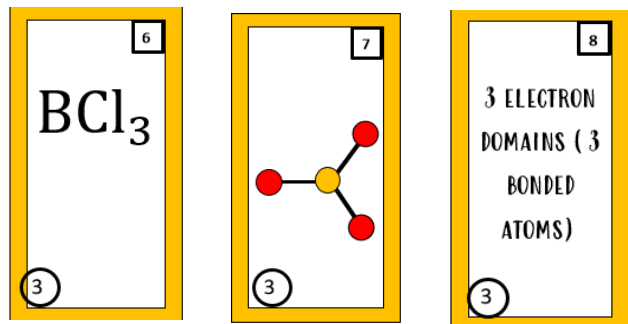
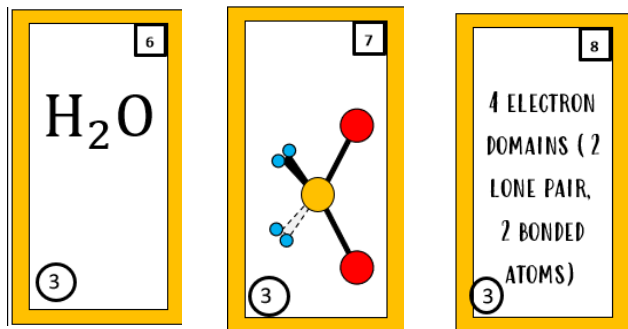
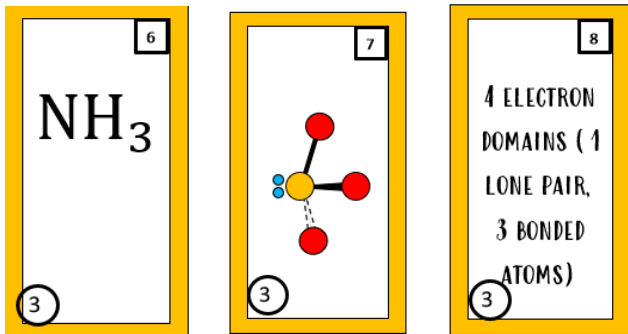
4  
TETRAHEDRAL

4  
4 DOMAINS  
(4 BONDED  
ATOMS)

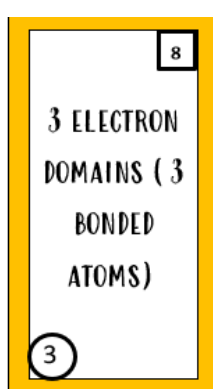
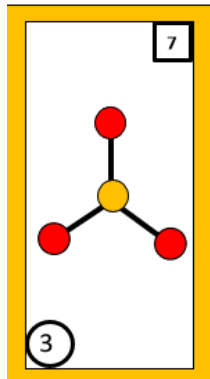
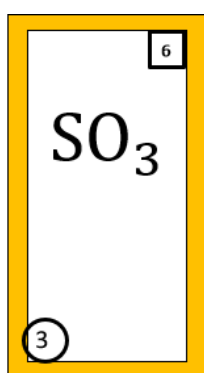
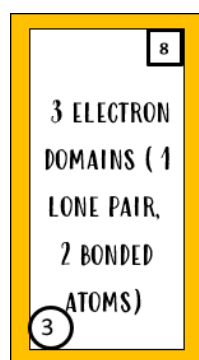
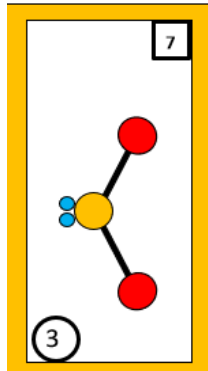
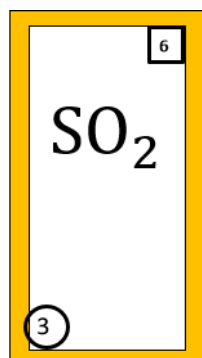
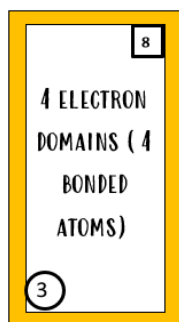
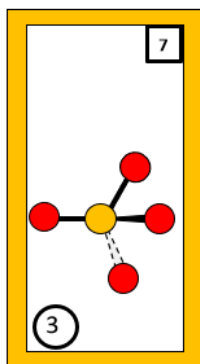
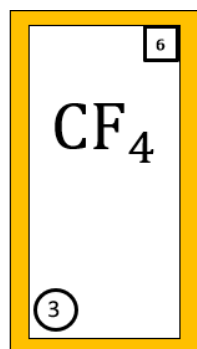
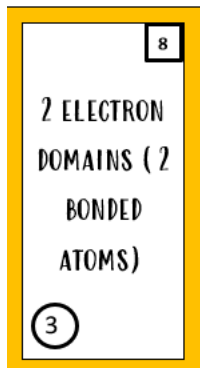
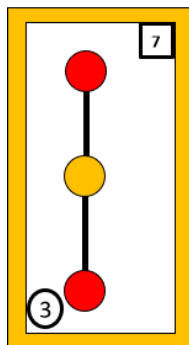
4  
TRIGONAL  
PYRAMID

4  
4 DOMAINS  
(1 LONE  
PAIR, 3  
BONDED  
ATOMS)

Gamification Answer Guide



Gamification Answer Guide



## Category 10: Ionic Bonding

<p>4</p> <p>GROUP 1A ALKALI METAL</p>	<p>5</p> <p>1+ CHARGE</p>	<p>4</p> <p>Na<sup>+</sup></p>	<p>4</p> <p>K<sup>+</sup></p>
<p>4</p> <p>GROUP 2A ALKALINE EARTH METAL</p>	<p>5</p> <p>2+ CHARGE</p>	<p>4</p> <p>Mg<sup>2+</sup></p>	<p>4</p> <p>Ca<sup>2+</sup></p>
<p>4</p> <p>GROUP 3A METALS</p>	<p>5</p> <p>3+ CHARGE</p>	<p>4</p> <p>Ga<sup>3+</sup></p>	<p>4</p> <p>Al<sup>3+</sup></p>

Gamification Answer Guide

4  
GROUP 5A  
NON-  
METALS

4  
3-  
CHARGE

4  
 $P^{3-}$

4  
 $N^{3-}$

4  
GROUP 6A  
NON-  
METALS

5  
2-  
CHARGE

4  
 $O^{2-}$

4  
GROUP 7A  
HALOGEN

5  
1-  
CHARGE

4  
 $Cl^{-}$

## Category 11: Covalent Bonding

1

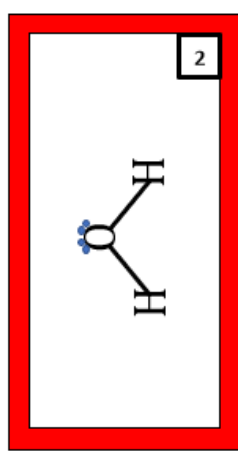
**POLAR  
BOND**

2

ELECTRONEGATIVITY  
DIFFERENCE < 0.4

1

**DIHYDROGEN  
MONOXIDE**



1

**NON-POLAR  
BOND**

2

ELECTRONEGATIVITY  
DIFFERENCE 0.4-1.8

1

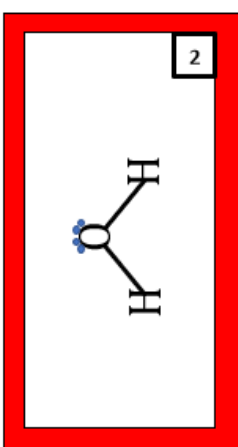
**COVALENT  
BOND**

1

**ELECTRONS  
ARE SHARED  
BETWEEN  
ELEMENTS/  
COMPOUNDS**

1

**DIHYDROGEN  
MONOXIDE**



1

**IONIC  
BOND**

1

**MORE  
ELECTRONEGATIVE  
ELEMENT TAKES  
ELECTRON PAIR**



<p>4</p> <p>CAN FORM 1 BOND</p>	<p>4</p> <p>H</p>	<p>4</p> <p>Cl</p>
<p>4</p> <p>CAN FORM 2 BONDS</p>	<p>4</p> <p>O</p>	<p>4</p> <p>S</p>
<p>4</p> <p>CAN FORM 4 BONDS</p>	<p>4</p> <p>C</p>	

Gamification Answer Guide

8  
H  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

6  
1 BOND  
3

8  
CAN MATCH WITH ANY CARD

Any card played with the previous two will result in a correct match

8  
Cl  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

6  
1 BOND  
3

8  
~~Br~~  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

Any card played with the previous two will result in a correct match EXCEPT Br.

8  
Br  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

6  
1 BOND  
3

8  
~~Cl~~  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

Any card played with the previous two will result in a correct match EXCEPT Cl.

8  
Se  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

6  
2 BONDS  
3

8  
P  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

8  
N  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

8  
C  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

8  
As  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

8  
Si  
3 ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE

Any of these listed cards played with the previous two will result in a correct match.

Gamification Answer Guide

<p>8</p> <p>C</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>6</p> <p>3 BONDS</p> <p>3</p>	<p>8</p> <p>P</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>8</p> <p>N</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>8</p> <p>Si</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>8</p> <p>As</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>Any of these listed cards played with the previous two will result in a correct match.</p>
<p>8</p> <p>Si</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>6</p> <p>3 BONDS</p> <p>3</p>	<p>8</p> <p>P</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>8</p> <p>N</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>8</p> <p>Si</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>8</p> <p>As</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>Any of these listed cards played with the previous two will result in a correct match.</p>
<p>8</p> <p>P</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>6</p> <p>3 BONDS</p> <p>3</p>	<p>8</p> <p>C</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>8</p> <p>Si</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>Any of these listed cards played with the previous two will result in a correct match.</p>		
<p>8</p> <p>N</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>6</p> <p>3 BONDS</p> <p>3</p>	<p>8</p> <p>C</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>8</p> <p>Si</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>Any of these listed cards played with the previous two will result in a correct match.</p>		
<p>8</p> <p>As</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>6</p> <p>3 BONDS</p> <p>3</p>	<p>8</p> <p>C</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>8</p> <p>Si</p> <p>3</p> <p>ONLY NEED CORRECT BOND NOT COMPLETE LEWIS STRUCTURE</p>	<p>Any of these listed cards played with the previous two will result in a correct match.</p>		

10

LOW  
MELTING  
POINT

10

$P_4O_{10}$  vs.  $K_3PO_4$

10

NaCl vs.  $Cl_2$

10

$CaCO_3$  vs.  $CO_3^{2-}$

11

HIGH  
MELTING  
POINT

10

$NaNO_3$  vs.  $NH_3$

10

$CaCO_3$  vs.  $CO_3^{2-}$

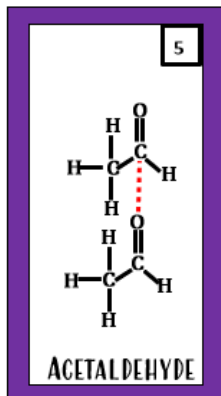
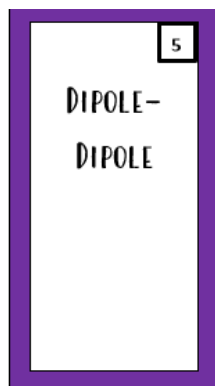
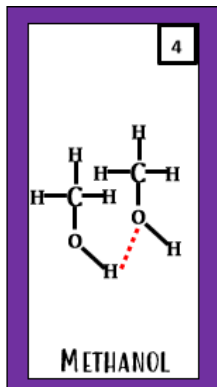
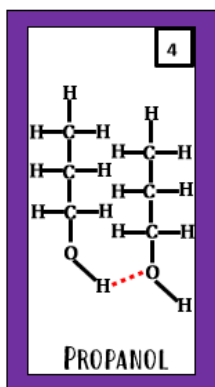
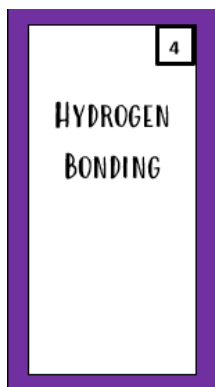
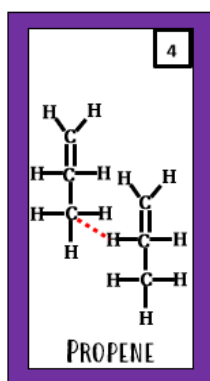
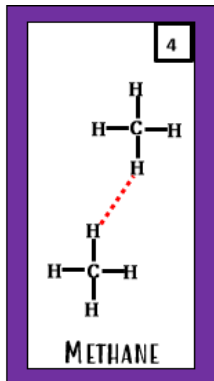
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--	---	---	--

<p style="text-align: right;">12</p> <p>GENERALLY, ELECTRICALLY CONDUCTIVE IN AQUEOUS SOLUTION</p>	<p style="text-align: right;">12</p> <p><math>NaCl</math> vs. <math>Cl_2</math></p>	<p style="text-align: right;">12</p> <p><math>CaCO_3</math> vs. <math>CO_3^{2-}</math></p>
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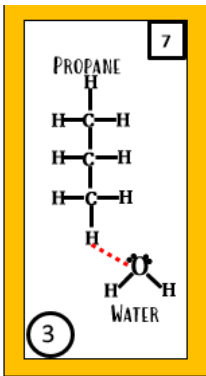
## Category 12: Intermolecular Forces

INTERMOLECULAR FORCES 2	FORCE THAT EXISTS BETWEEN ATOMS AND MOLECULES. EFFECTS PHYSICAL PROPERTIES 1	LONDON-DISPERSION FORCES 1	DIPOLE-DIPOLE FORCE 1	HYDROGEN BONDING 1
LONDON-DISPERSION FORCES 1	WEAKEST INTERMOLECULAR FORCE. SHORT LIVED PARTIAL CHARGES 1			
DIPOLE-DIPOLE FORCE 1	INTERMOLECULAR FORCE WHERE COMPOUNDS ARE ATTRACTED TO THE PARTIAL OPPOSITE CHARGE OF ITS NEIGHBOR 1			
HYDROGEN BONDING 1	H BONDED TO N, O, F (DONOR) ATTRACTS THE N, O, OR F (ACCEPTOR) OF ANOTHER COMPOUND 1			
INTRAMOLECULAR FORCE 3	IONIC BONDS AND COVALENT BONDS 2			

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Gamification Answer Guide



6

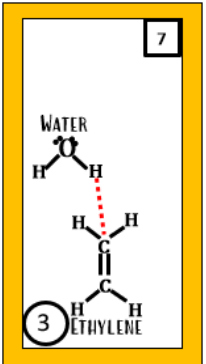
POLAR AND  
POLAR  
COMPOUNDS

3

9

SOLUBLE  
TOGETHER

3



6

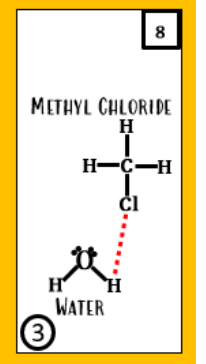
POLAR AND  
POLAR  
COMPOUNDS

3

9

SOLUBLE  
TOGETHER

3



6

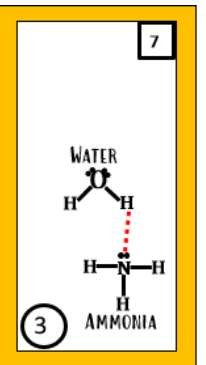
POLAR AND  
POLAR  
COMPOUNDS

3

9

SOLUBLE  
TOGETHER

3



6

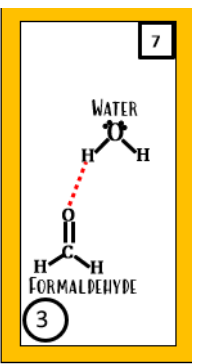
POLAR AND  
POLAR  
COMPOUNDS

3

9

SOLUBLE  
TOGETHER

3



6

POLAR AND  
POLAR  
COMPOUNDS

3

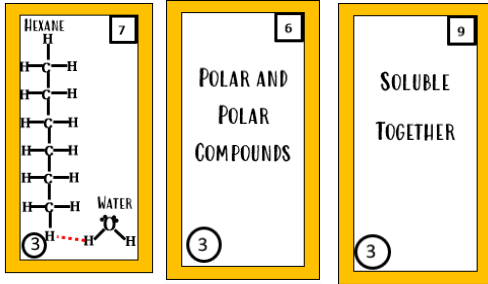
9

SOLUBLE  
TOGETHER

3



Gamification Answer Guide



6

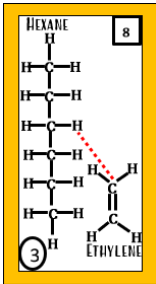
POLAR AND  
POLAR  
COMPOUNDS

3

9

SOLUBLE  
TOGETHER

3



9

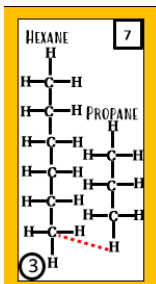
INSOLUBLE  
TOGETHER

3

6

POLAR AND  
NON POLAR  
COMPOUNDS

3



9

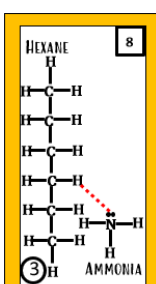
INSOLUBLE  
TOGETHER

3

6

POLAR AND  
NON POLAR  
COMPOUNDS

3



9

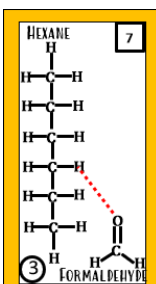
INSOLUBLE  
TOGETHER

3

6

POLAR AND  
NON POLAR  
COMPOUNDS

3



9

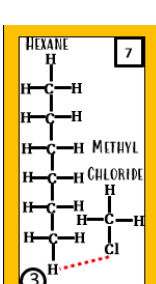
INSOLUBLE  
TOGETHER

3

6

POLAR AND  
NON POLAR  
COMPOUNDS

3



9

INSOLUBLE  
TOGETHER

3

6

POLAR AND  
NON POLAR  
COMPOUNDS

3

10

**HIGHER  
BOILING  
POINT**

10

$\text{CH}_3\text{CH}_2\text{CH}_3$   
**PROPANE**  
 vs.  
 $\text{H}_3\text{C}-\text{O}-\text{CH}_3$   
**DIMETHYL ETHER**

10

$\text{H}_3\text{C}-\text{O}-\text{CH}_2\text{CH}_3$   
**ETHYL METHYL ETHER**  
 vs.  
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$   
**PROPANOL**

10

**NO**  
**NITROGEN MONOXIDE**  
 vs.  
 $\text{N}_2$   
**NITROGEN**

10

**LOWER  
BOILING  
POINT**

10

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$   
**PENTANE**  
 vs.  
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$   
**BUTANOL**

10

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$   
**HEPTANE**  
 vs.  
 $\text{CH}_4$   
**METHANE**

Gamification Answer Guide

12

WEAKER  
HYDROGEN  
BONDING  
INTERMOLECULAR  
FORCE

12

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$   
OCTANOL  
V.S.  
 $\text{CH}_3\text{CH}_2\text{OH}$   
ETHANOL

12

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$   
BUTANOL  
V.S.  
 $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$   
DIETHYL ETHER

12

$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$   
PROPANOL  
V.S.  
 $\text{CH}_3\text{OCH}_3$   
DIMETHYL ETHER

12

STRONGER  
HYDROGEN  
BONDING  
INTERMOLECULAR  
FORCE

12

STRONGER  
HYDROGEN  
BONDING  
INTERMOLECULAR  
FORCE

12

STRONGER  
HYDROGEN  
BONDING  
INTERMOLECULAR  
FORCE

## Category 13: Redox Reaction

1  
REDOX  
REACTION

1  
A REACTION  
WITH ELECTRON  
TRANSFER, ONE  
OR MORE  
ELECTRONS  
TRANSFERRED

1  
OXIDATION  
NUMBER

1  
VALUE THAT  
INDICATES AN  
ELEMENTS  
DEGREE OF  
OXIDATION

2  
OXIDIZING  
AGENT

1  
THE  
ELEMENT/  
COMPOUND  
THAT IS  
REDUCING

2  
REDUCING  
AGENT

1  
THE  
ELEMENT/  
COMPOUND  
THAT IS  
OXIDIZING

1  
OIL RIG

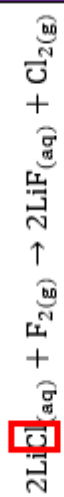
1  
SHORTHAND THAT  
INDICATES  
OXIDATION IS  
LOSING  
ELECTRONS AND  
REDUCTION IS  
GAINING  
ELECTRONS

OXIDIZING  
ELEMENT

4



4



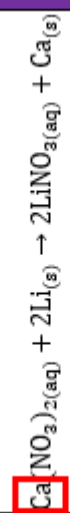
4



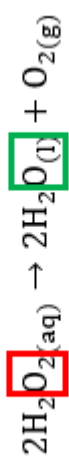
4

REDUCING  
ELEMENT

5



4



4

Gamification Answer Guide

$2\text{HCl}_{(\text{aq})} + \text{Zn}_{(\text{s})}$ REACTANTS 6	$\text{ZnCl}_{2(\text{aq})}$ PRODUCT 8	$\text{H}_{2(\text{g})}$ PRODUCT 8
$2\text{NaCl}_{(\text{aq})} + \text{F}_{2(\text{g})}$ REACTANTS 6	$\text{Cl}_{2(\text{g})}$ PRODUCT 8	$2\text{NaF}_{(\text{aq})}$ PRODUCT 8
$\text{AlPO}_{4(\text{aq})} + \text{Mg}_{(\text{s})}$ REACTANTS 6	$\text{Mg}_3(\text{PO}_4)_2(\text{aq})$ PRODUCT 8	$\text{Al}_{(\text{s})}$ PRODUCT 8
$\text{Cu}(\text{NO}_3)_2(\text{aq}) + \text{Mg}_{(\text{s})}$ REACTANTS 6	$\text{Mg}(\text{NO}_3)_2(\text{aq})$ PRODUCT 8	$\text{Cu}_{(\text{s})}$ PRODUCT 8
$2\text{H}_2\text{O}_{(\text{l})} + 2\text{Na}_{(\text{s})}$ REACTANTS 6	$2\text{NaOH}_{(\text{aq})}$ PRODUCT 8	$\text{H}_{2(\text{g})}$ PRODUCT 8

10

0

10

K

OXIDATION  
NUMBER

10

Rb

OXIDATION  
NUMBER

11

1+

10

KOH

OXIDATION  
NUMBER

10

3+

10

Fe<sub>2</sub>O<sub>3</sub>

OXIDATION  
NUMBER

10

Sc<sup>3+</sup>

OXIDATION  
NUMBER

## Category 14: Double Displacement

1  
NEUTRALIZATION  
REACTION

1  
REACTION THAT  
CONTAINS AN  
ACID AND BASE.  
A SALT AND  
WATER ARE THE  
RESULTING  
PRODUCTS

1  
PRECIPITATION  
REACTION

1  
REACTION  
THAT FORMS A  
PRECIPITATE  
IN THE  
PRODUCT

1  
DOUBLE  
DISPLACEMENT  
REACTION

1  
REACTION THAT  
HAS TWO  
CATIONS SWITCH  
PLACES  
FORMING TWO  
NEW  
COMPOUNDS

2  
NET IONIC  
REACTION

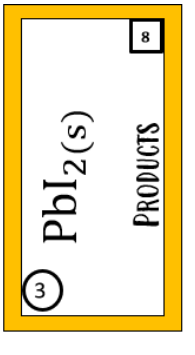
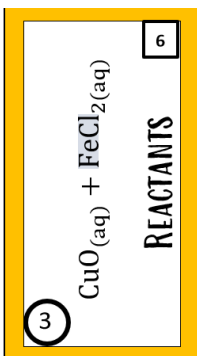
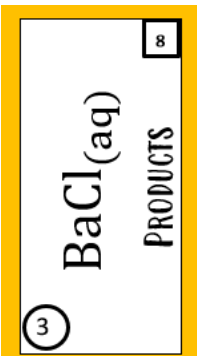
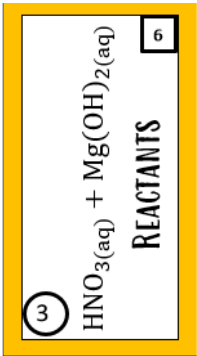
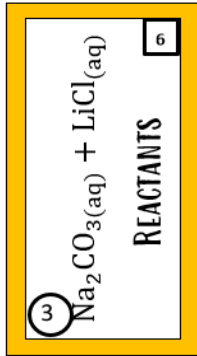
1  
BREAKDOWN OF  
IONIC REACTION  
THAT CONTAINS  
SPECTATOR IONS

2  
SPECTATOR  
IONS

1  
IONS THAT HAVE  
THE SAME IONIC  
CHARGE IN THE  
PRODUCTS AND  
REACTANTS



Gamification Answer Guide



$\text{Hg}(\text{NO}_3)_2(\text{aq})$ REACTANT	$3\text{MgI}_2(\text{aq})$ REACTANT	$\text{Pb}(\text{NO}_3)_2(\text{aq})$ REACTANT	$2\text{AlCl}_3(\text{aq})$ REACTANT	$\text{AgNO}_3(\text{aq})$ REACTANT
$2\text{LiI}(\text{aq})$ REACTANT	$2\text{Rb}_3\text{PO}_4(\text{aq})$ REACTANT	$\text{CaCl}_2(\text{aq})$ REACTANT	$3\text{MgS}(\text{aq})$ REACTANT	$\text{NaCl}(\text{aq})$ REACTANT
$\text{HgI}_2(\text{s}) + 2\text{LiNO}_3(\text{aq})$ PRODUCTS	$6\text{RbI}(\text{aq}) + \text{Mg}_3(\text{PO}_4)_2(\text{s})$ PRODUCTS	$\text{PbCl}_2(\text{s}) + \text{Ca}(\text{NO}_3)_2(\text{aq})$ PRODUCTS	$3\text{MgCl}_2(\text{aq}) + \text{Al}_2\text{S}_3(\text{s})$ PRODUCTS	$\text{NaNO}_3 + \text{AgCl}(\text{s})$ PRODUCTS