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 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.

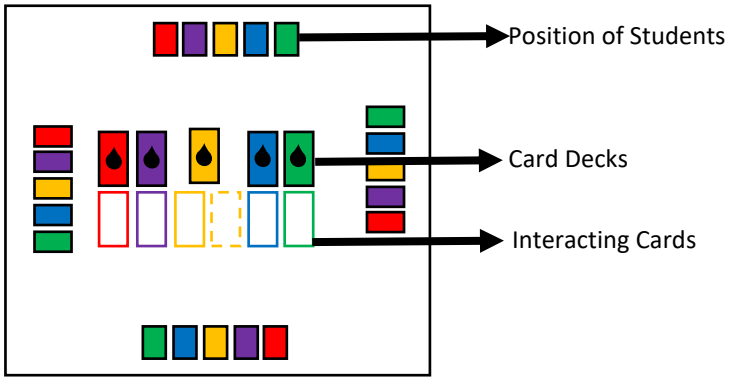


Fig I. Game set up between four participants

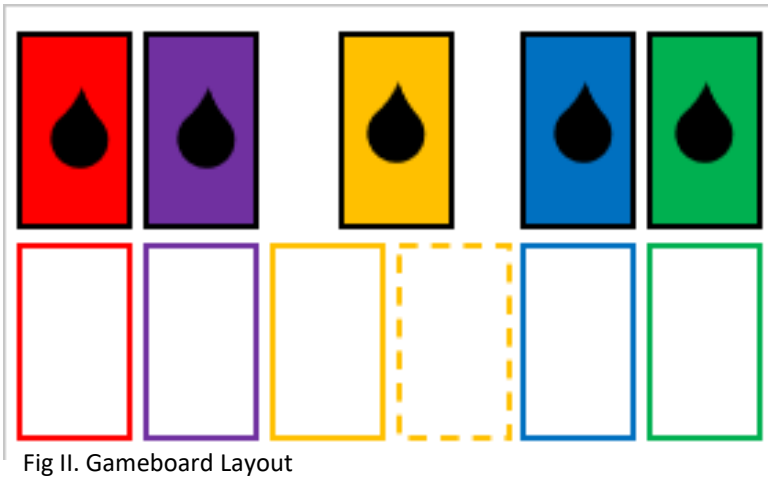


Fig II. Gameboard Layout

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 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.

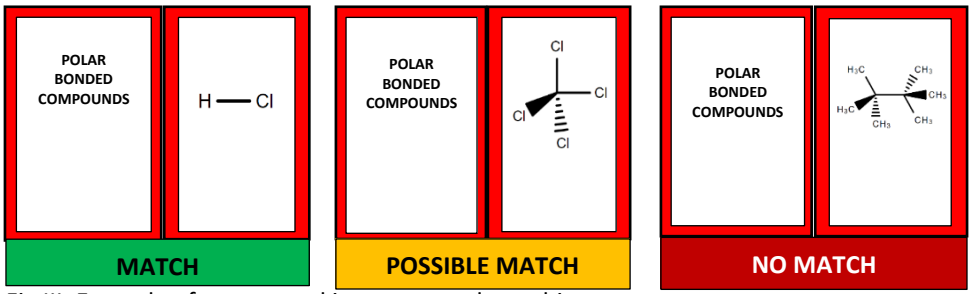


Fig III. Example of correct and incorrect card matching

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.

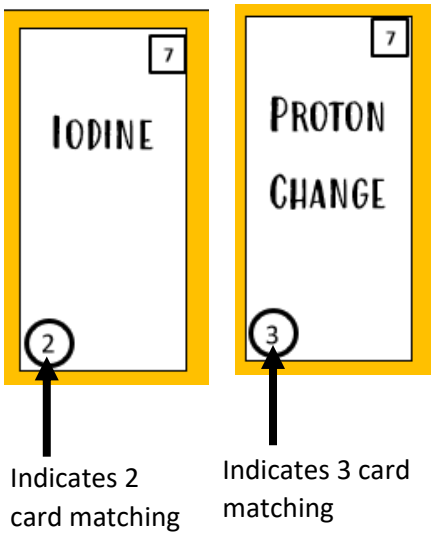
When and how many times can I use the Answer Key Guide?

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



Indicates 2 card matching

Indicates 3 card matching

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

South Dakota State University

College of Natural Sciences

Department of Chemistry and Biochemistry

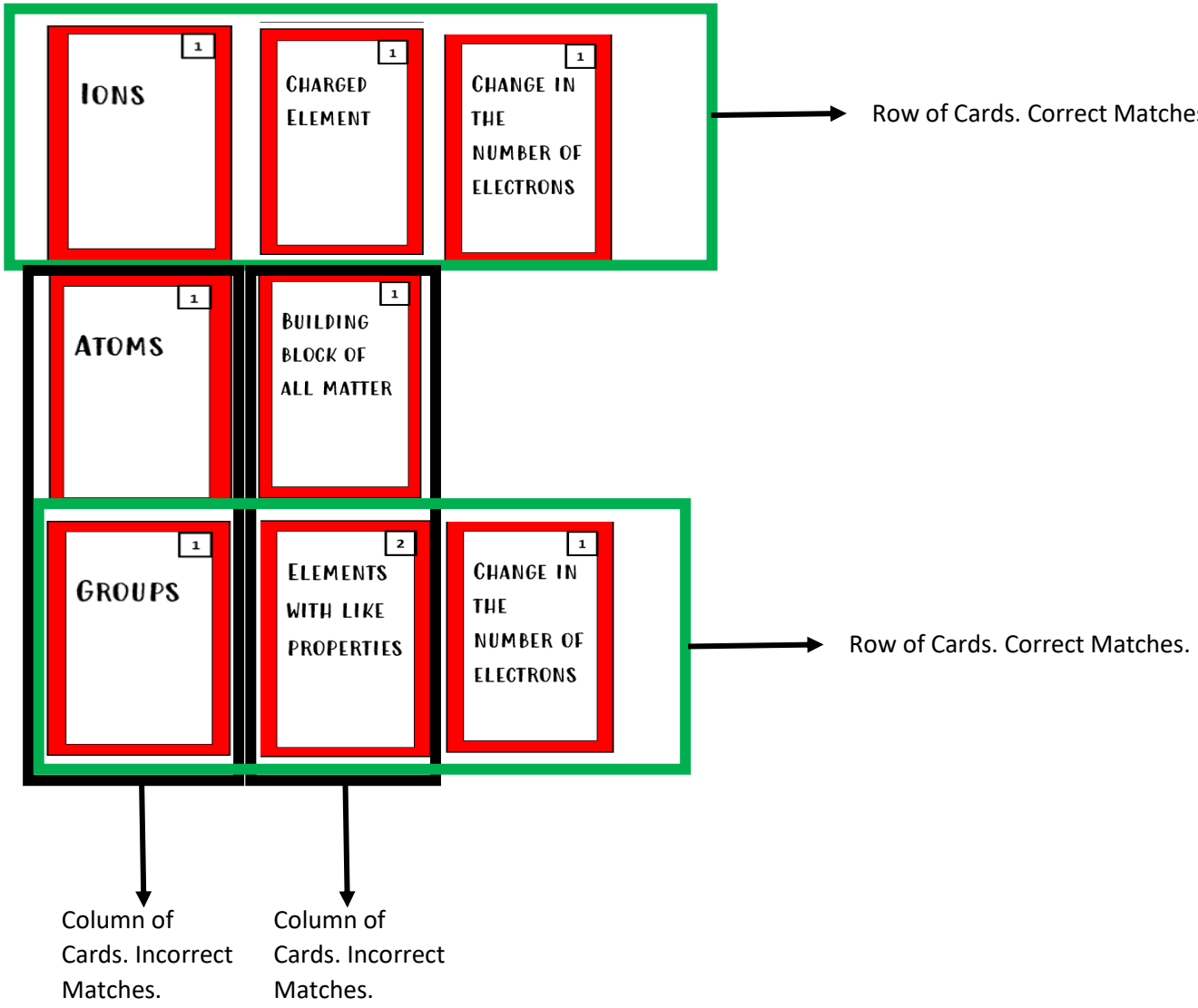
PI: Dr. Tanya Gupta

Author: Nathan Turner

Table of Contents

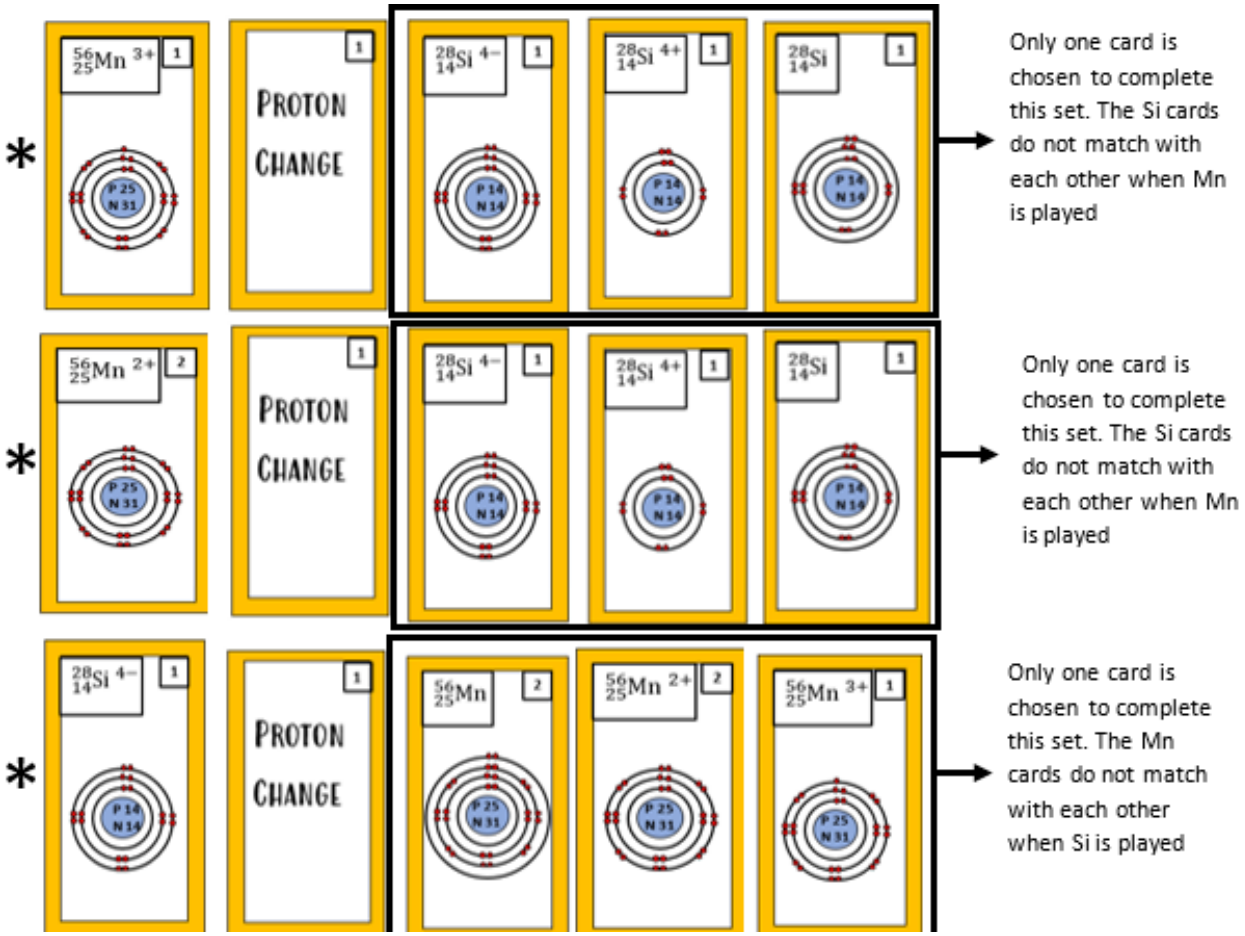
How to use the answer reference guide

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.

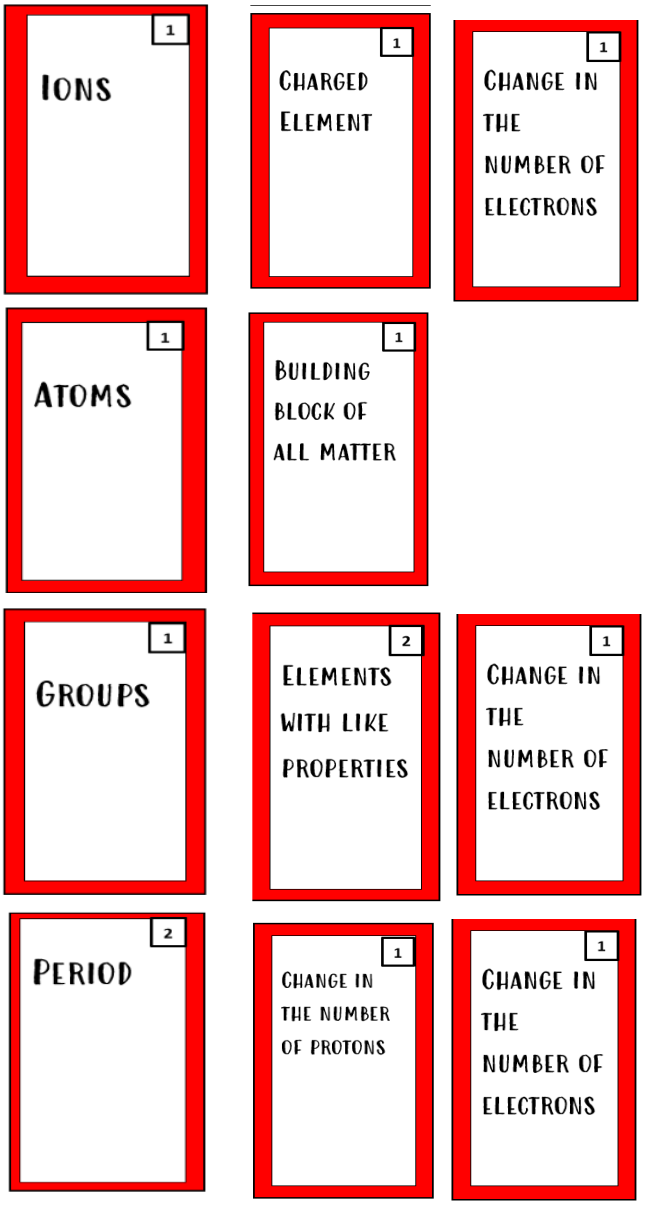


Gamification Answer Guide

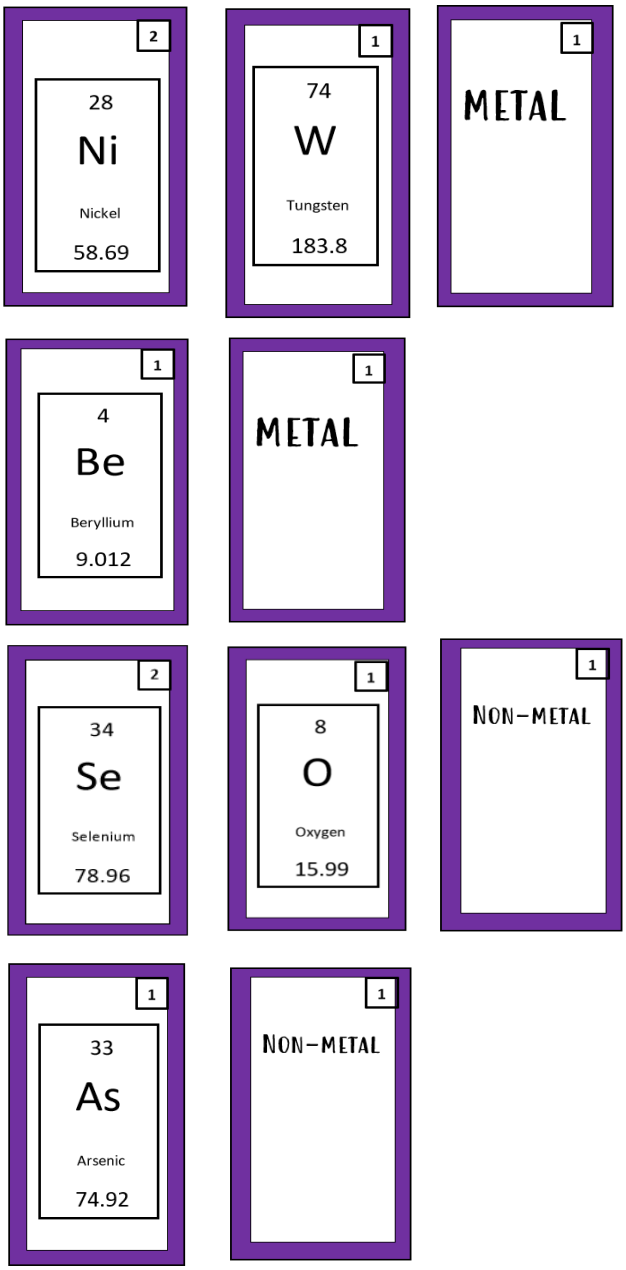
Any of the cards that are in the row paired together can be counted as a correct match. Answers that have a star (✻) next to them indicate a special rule pertaining to matches. For each special rule there is a black rectangle that indicates the special rule that is required for matching

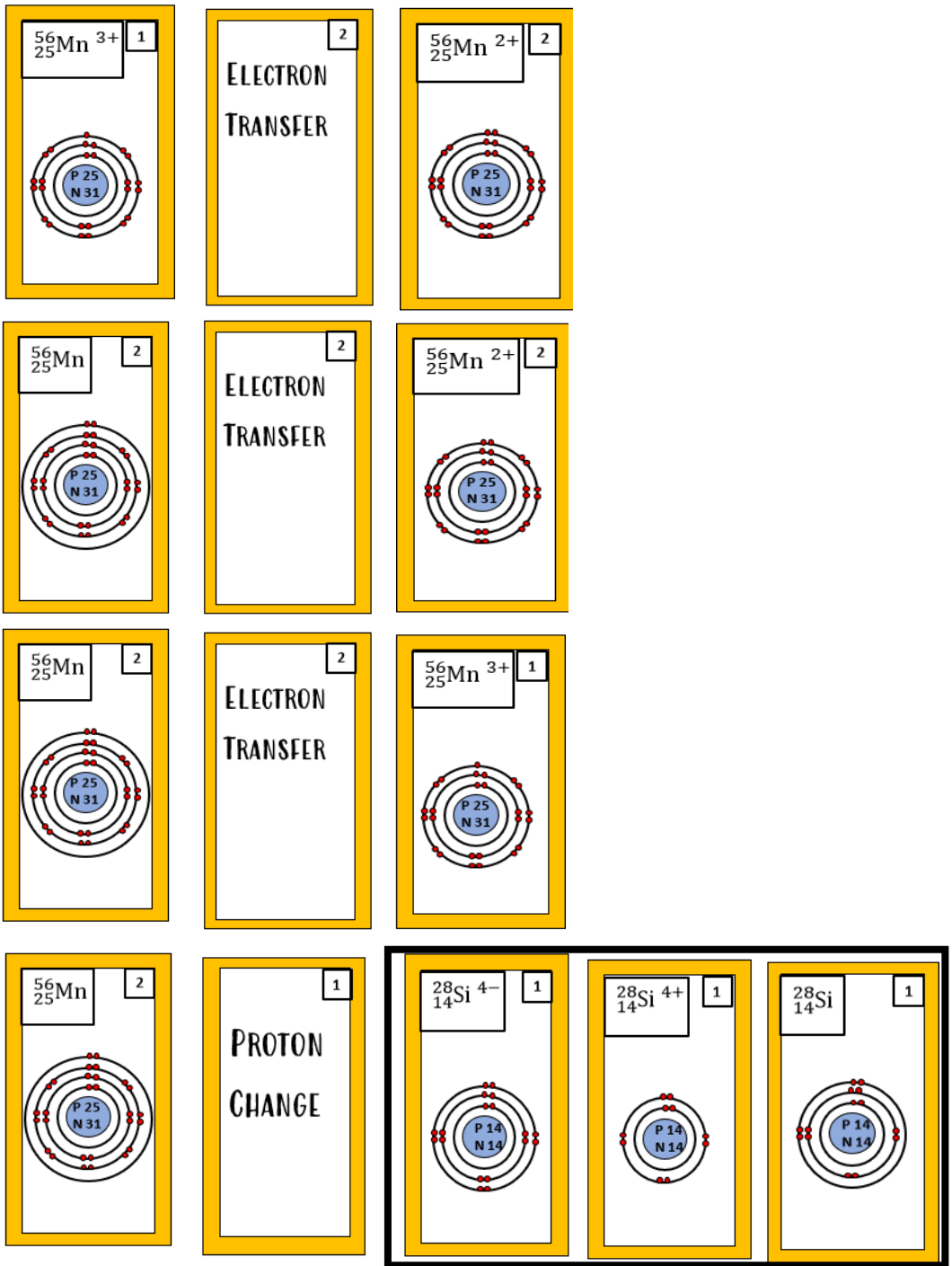


Category 1: Atomic Structure



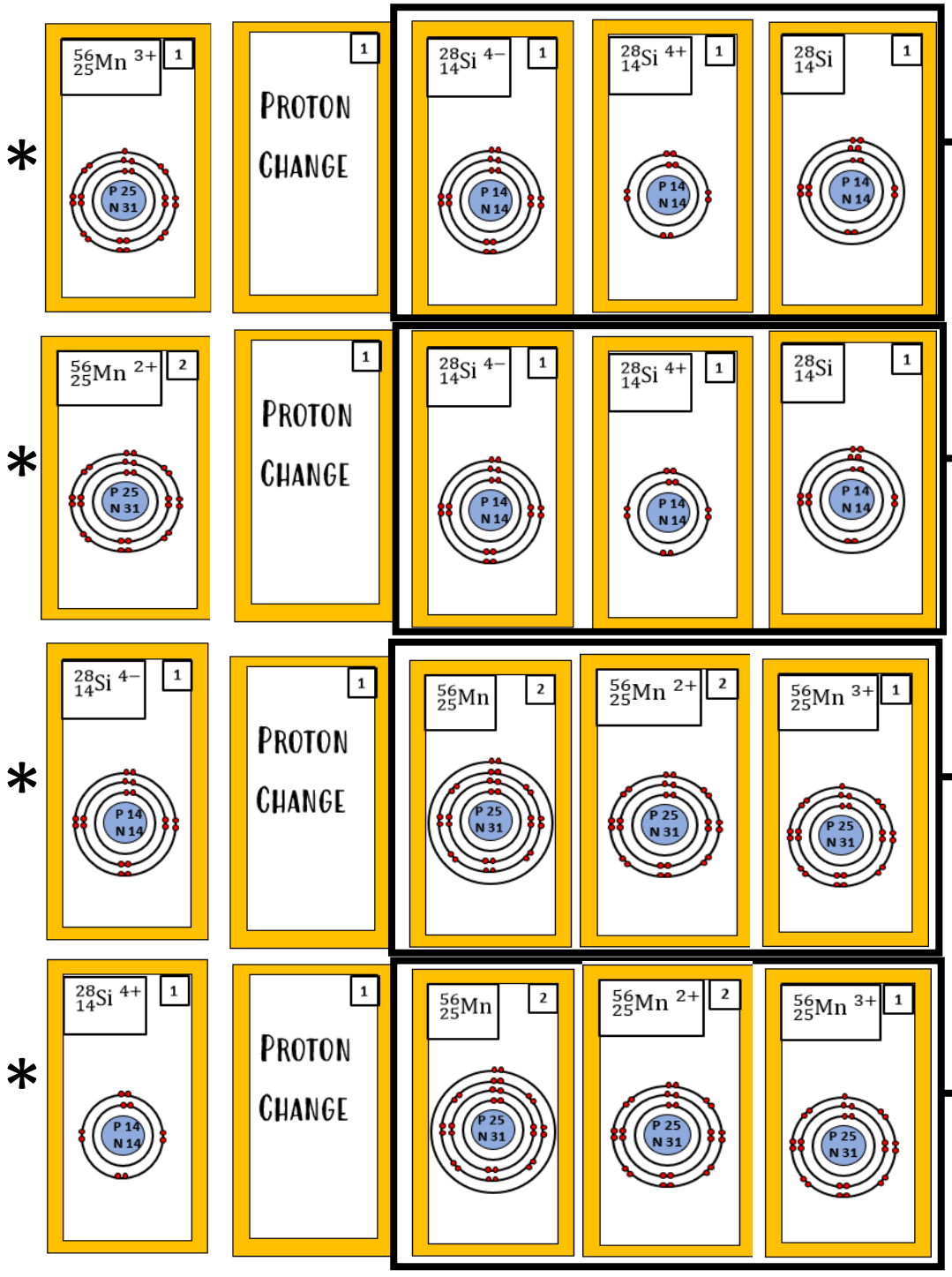
Gamification Answer Guide





*

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



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

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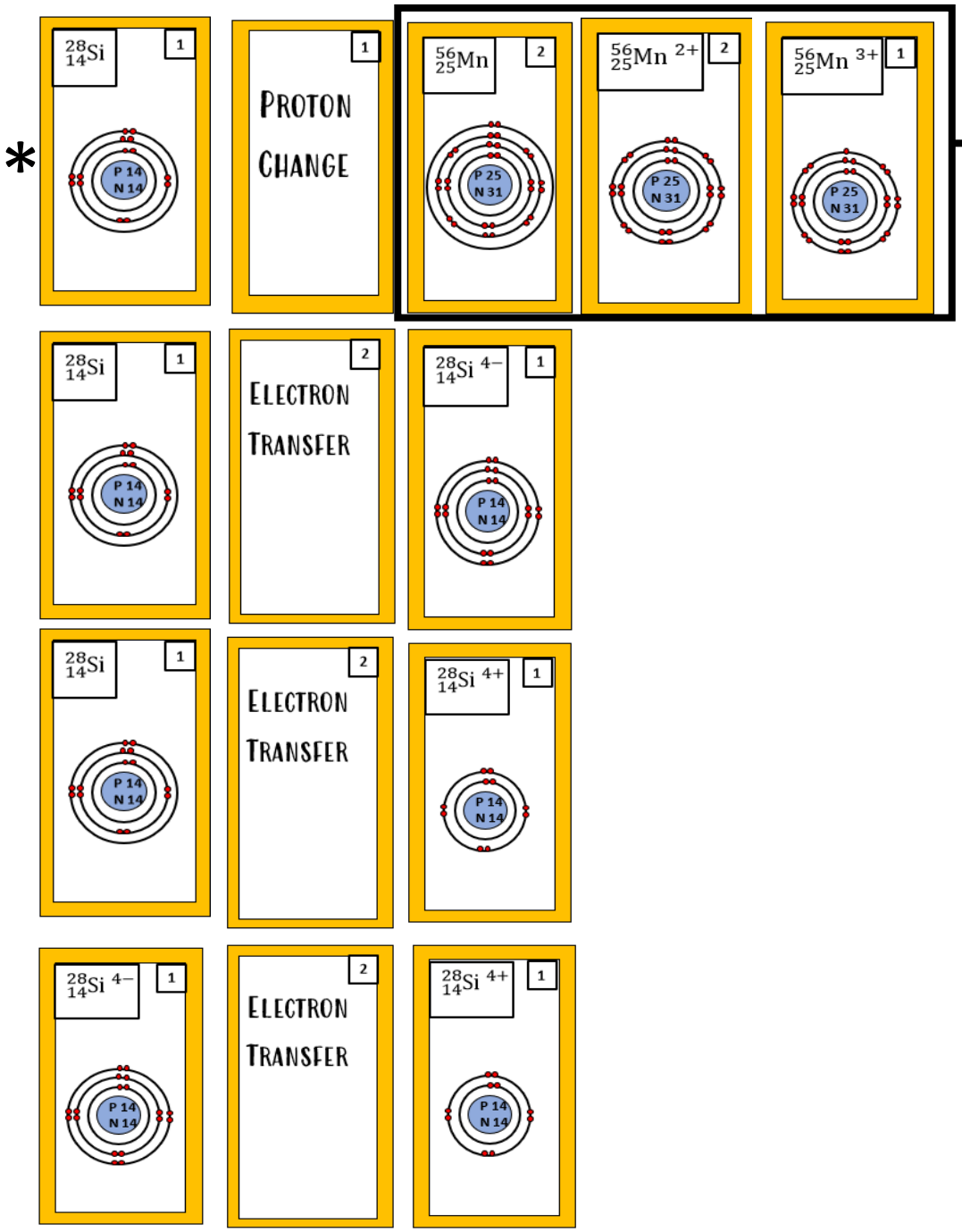
Only one card is chosen to complete this set. The Mn cards do not match with each other when Si is played

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



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

1

CARBON-12

2

$^{12}_{6}C$

1

ISOTOPES

1

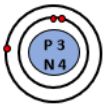
STANDARD USED FOR AMU

1

LITHIUM-7

1

$^{7}_{3}Li$



1

ISOTOPES

1

SUBATOMIC PARTICLE WITH A NEUTRAL CHARGE

2

NEUTRONS

1

$^{41}_{19}K$

41-22=19

1

SUBATOMIC PARTICLE THAT CHANGES WITH EACH ISOTOPE

1

3

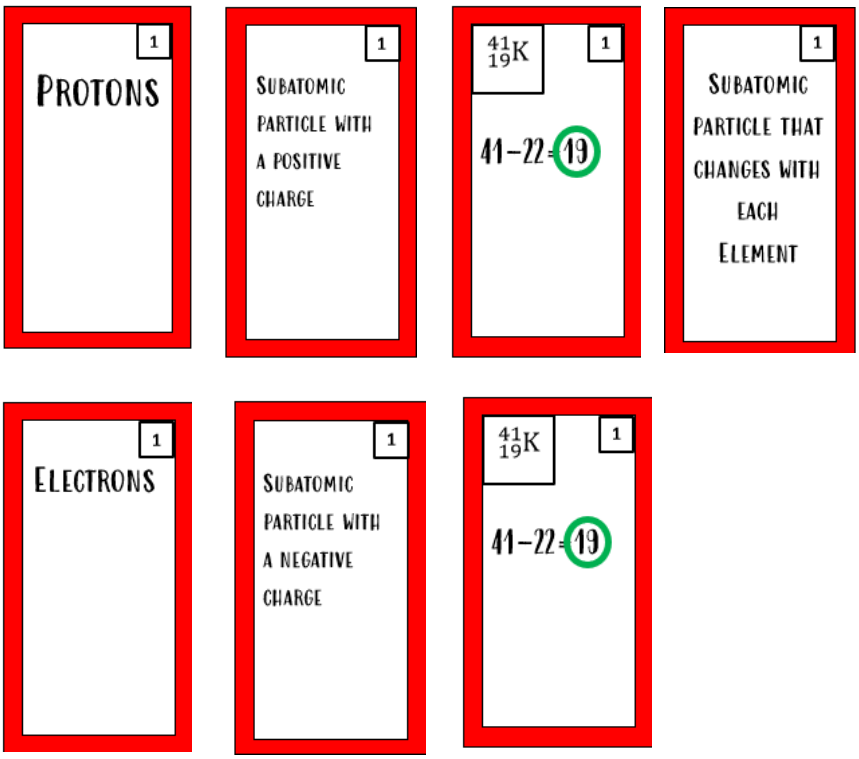
Li

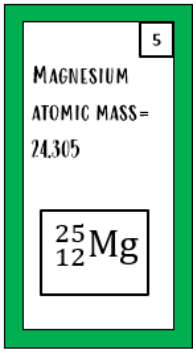
Lithium

6.94

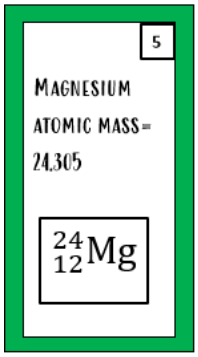
2

ATOMIC MASS

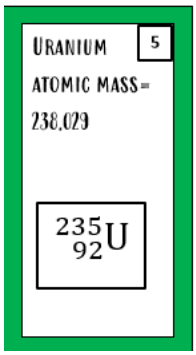

1
PROTONS
1
SUBATOMIC PARTICLE WITH A POSITIVE CHARGE
$^{41}_{19}K$
1
41-22=19
1
SUBATOMIC PARTICLE THAT CHANGES WITH EACH ELEMENT
1
ELECTRONS
1
SUBATOMIC PARTICLE WITH A NEGATIVE CHARGE
$^{41}_{19}K$
1
41-22=19


5
Magnesium
atomic mass=
24.305
$^{25}_{12}Mg$

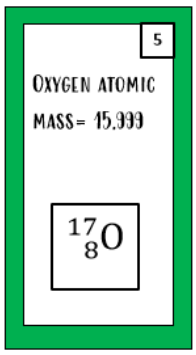

6
Isotope in
low
abundance


5
Magnesium
atomic mass=
24.305
$^{24}_{12}Mg$


6
Isotope in
High
abundance

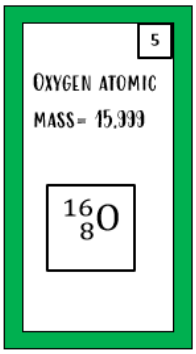

5
Uranium
atomic mass=
238.029
$^{235}_{92}U$

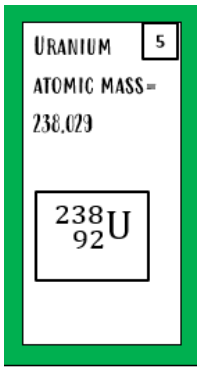

6
Isotope in
low
abundance

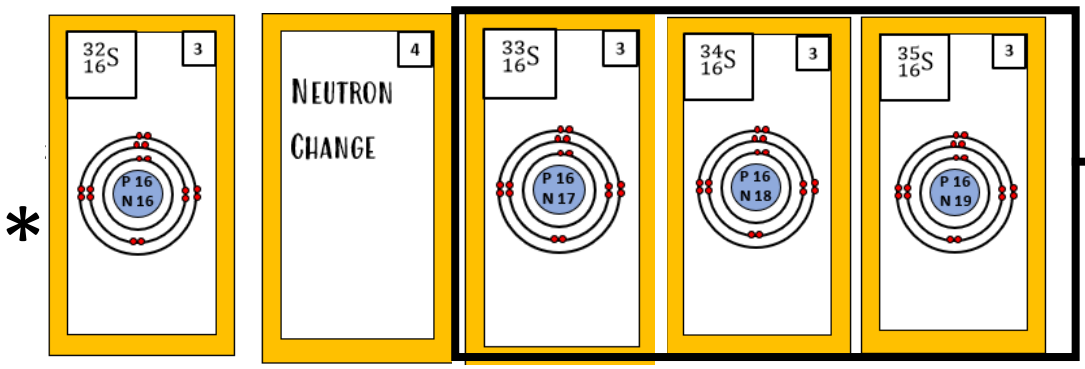

5
Oxygen atomic
mass= 15.999
$^{17}_{8}O$


6
Isotope in
low
abundance

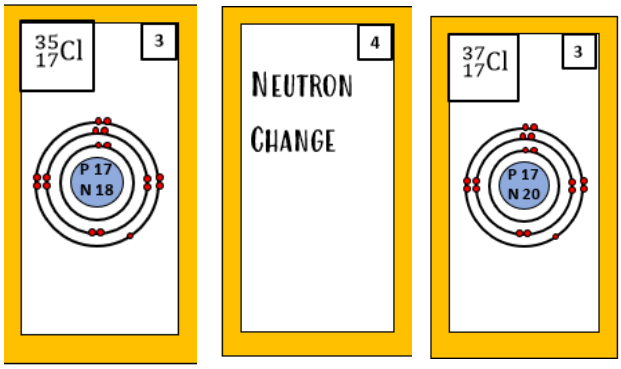
Gamification Answer Guide

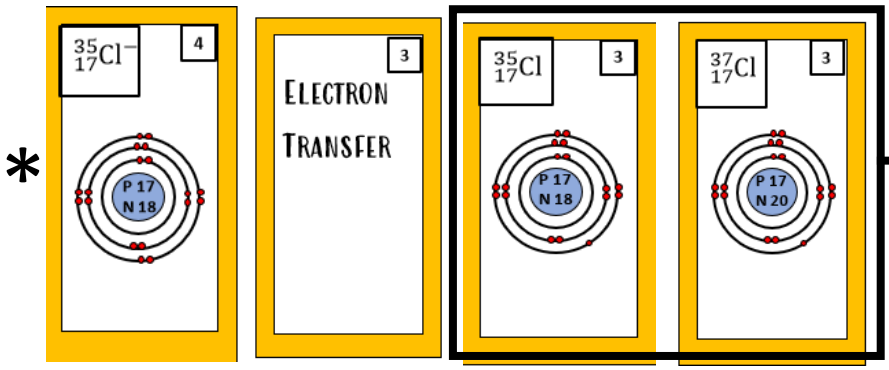




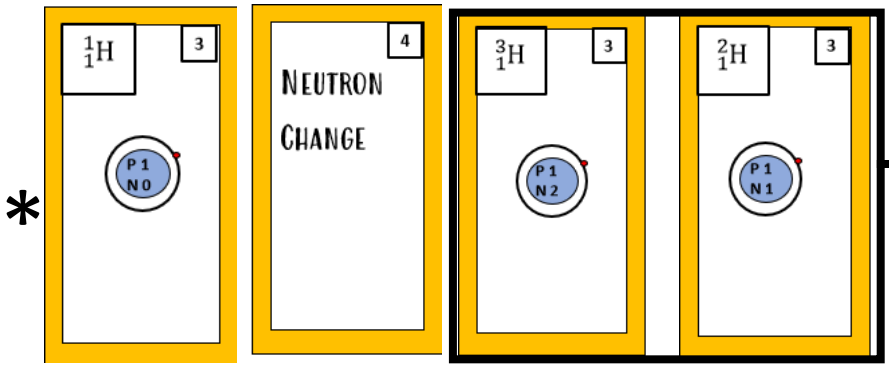


Only one card is chosen to complete this set. Any two cards can be chosen as long as Neutron Change is selected in the set





Only one card is chosen to complete this set. Cl^- 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

4

DEUTERATED CHLOROFORM

5

INCLUDES HYDROGEN ISOTOPE

5

SOLVENT USED BY CHEMIST TO ANALYZE COMPOUNDS

4

$^{2}_{1}H$

5

INCLUDES HYDROGEN ISOTOPE

4

AMERICIUM-241

4

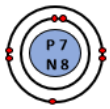
ISOTOPE USED IN SMOKE DETECTORS

4

NITROGEN-15

4

$^{15}_{7}N$

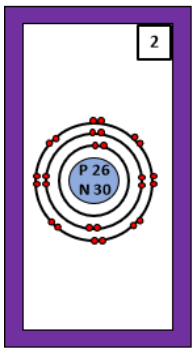


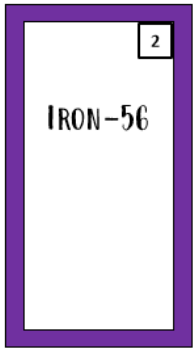
5

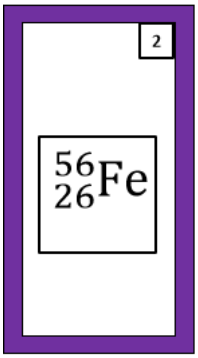
INCLUDES NITROGEN ISOTOPE

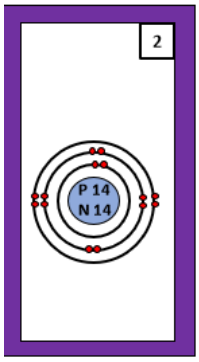
4

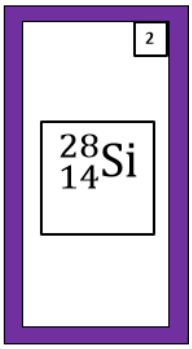
USED IN AGRICULTURAL RESEARCH IN SOIL SCIENCE


2
P 26
N 30

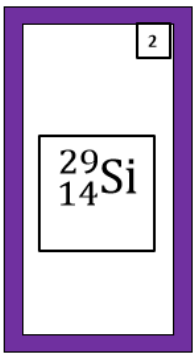

2
IRON-56

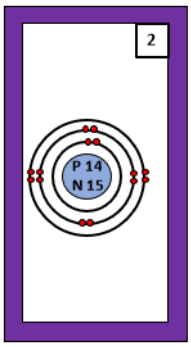

2
56
26Fe


2
P 14
N 14


2
28
14Si

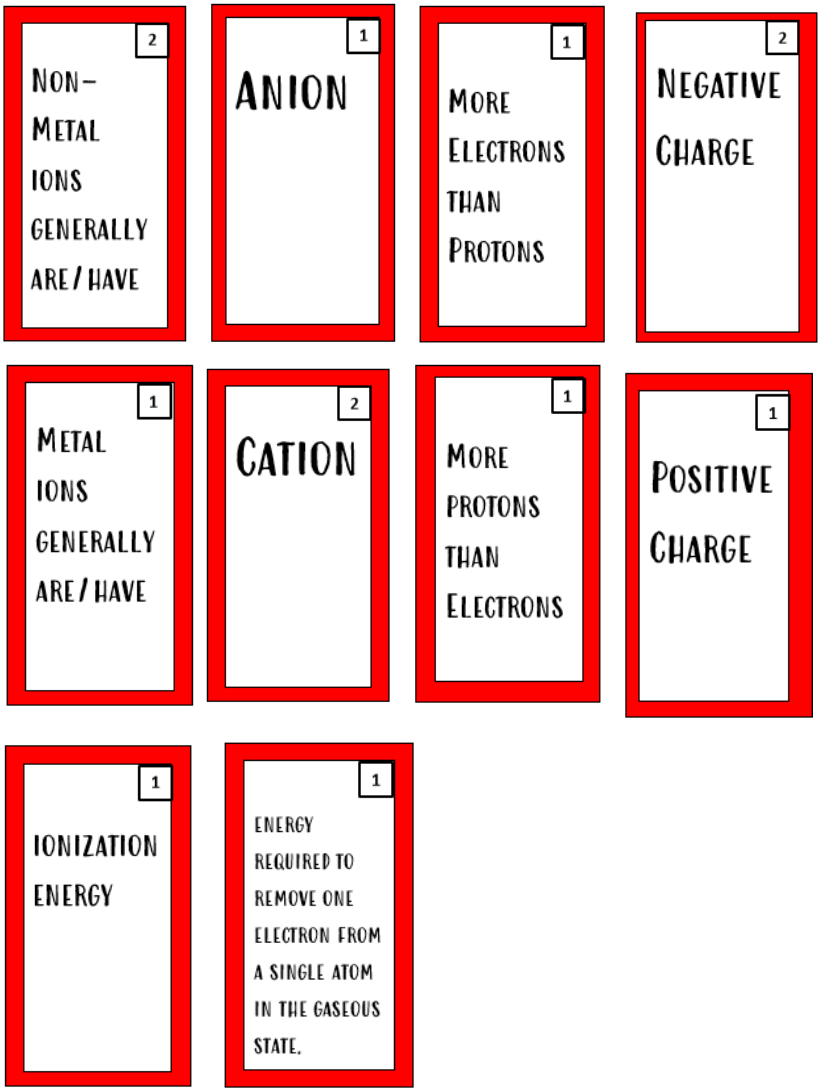

2
SILICON-28


2
29
14Si

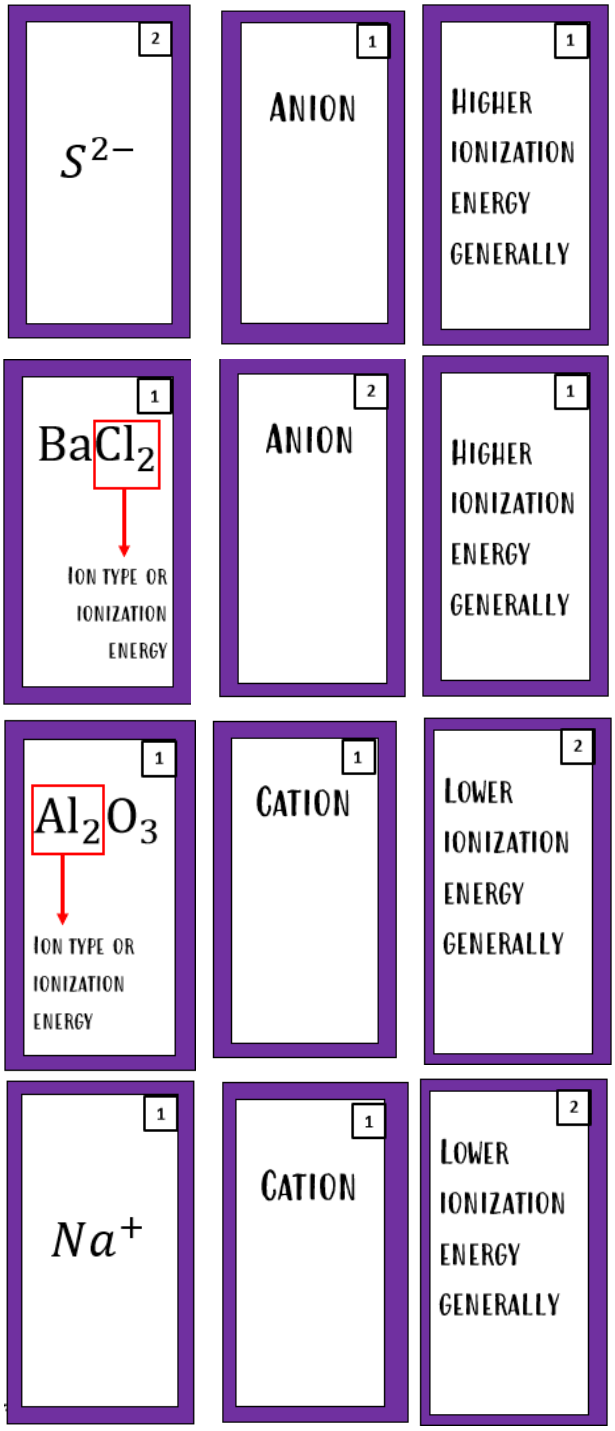

2
P 14
N 15

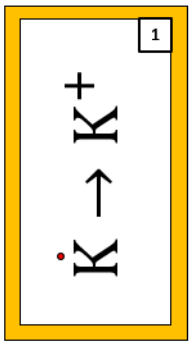

2
SILICON-29

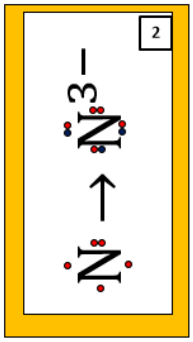
Category 3: Ions (monoatomic)

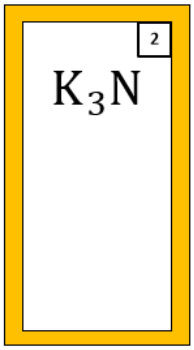


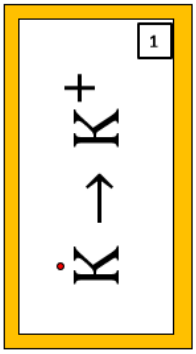
Gamification Answer Guide

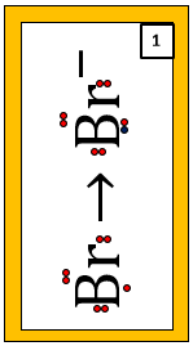



1
$\dot{K} \rightarrow K^+$

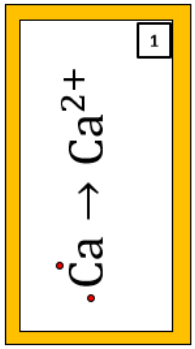

2
$\dot{N}\cdot \rightarrow \ddot{N}^{3-}$

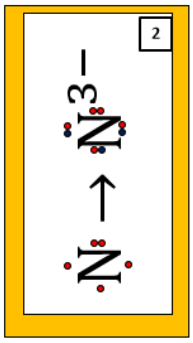

2
K_3N

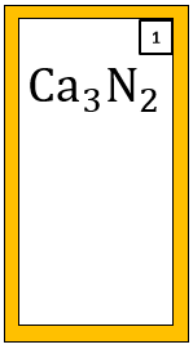

1
$\dot{K} \rightarrow K^+$

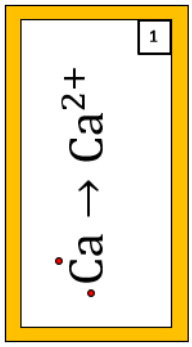

1
$\dot{B}r\cdot \rightarrow \ddot{B}r^-$

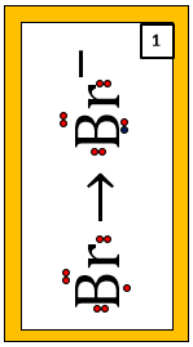

1
KBr


1
$\cdot\dot{C}a \rightarrow Ca^{2+}$

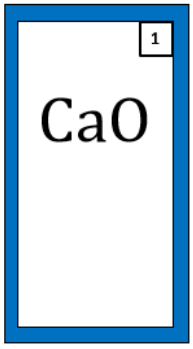

2
$\dot{N}\cdot \rightarrow \ddot{N}^{3-}$

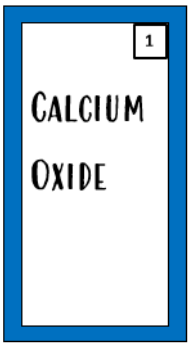

1
Ca_3N_2


1
$\cdot\dot{C}a \rightarrow Ca^{2+}$

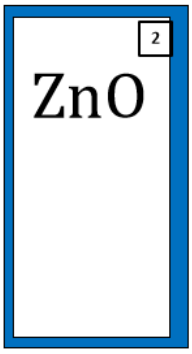

1
$\dot{B}r\cdot \rightarrow \ddot{B}r^-$


2
$CaBr_2$


1
CaO

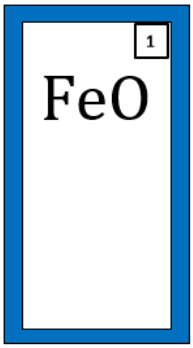

1
Calcium
Oxide

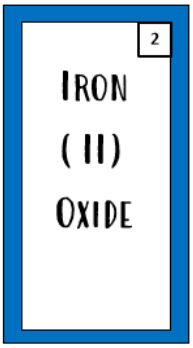

1
Lime, used
as lawn
treatment

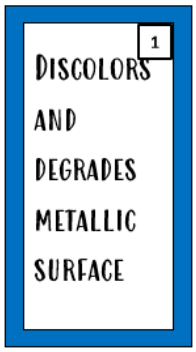

2
ZnO

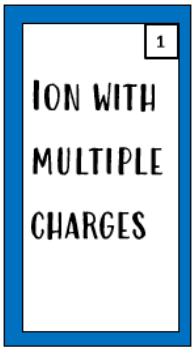

2
Zinc
Oxide

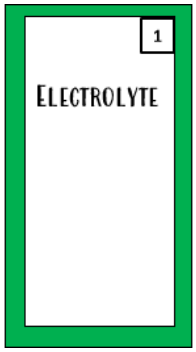

1
Skin
protection

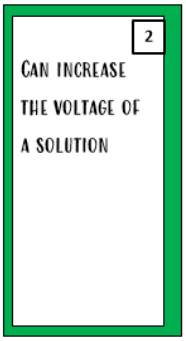

1
FeO


2
Iron
(II)
Oxide

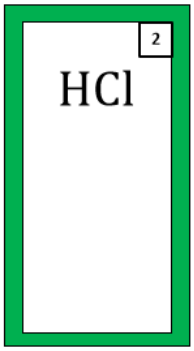

1
Discolors
and
degrades
metallic
surface


1
Ion with
multiple
charges

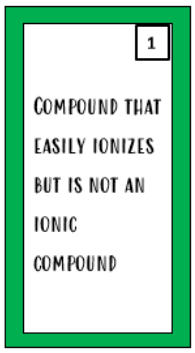

1
ELECTROLYTE

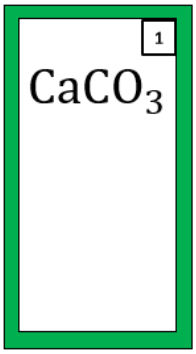

2
CAN INCREASE THE VOLTAGE OF A SOLUTION


1
NaCl

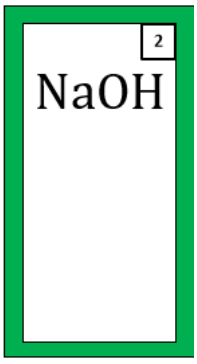

2
HCl

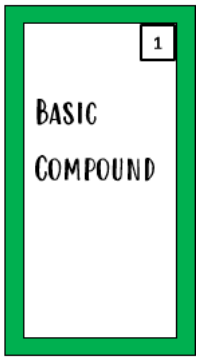

1
ACIDIC COMPOUND


1
COMPOUND THAT EASILY IONIZES BUT IS NOT AN IONIC COMPOUND

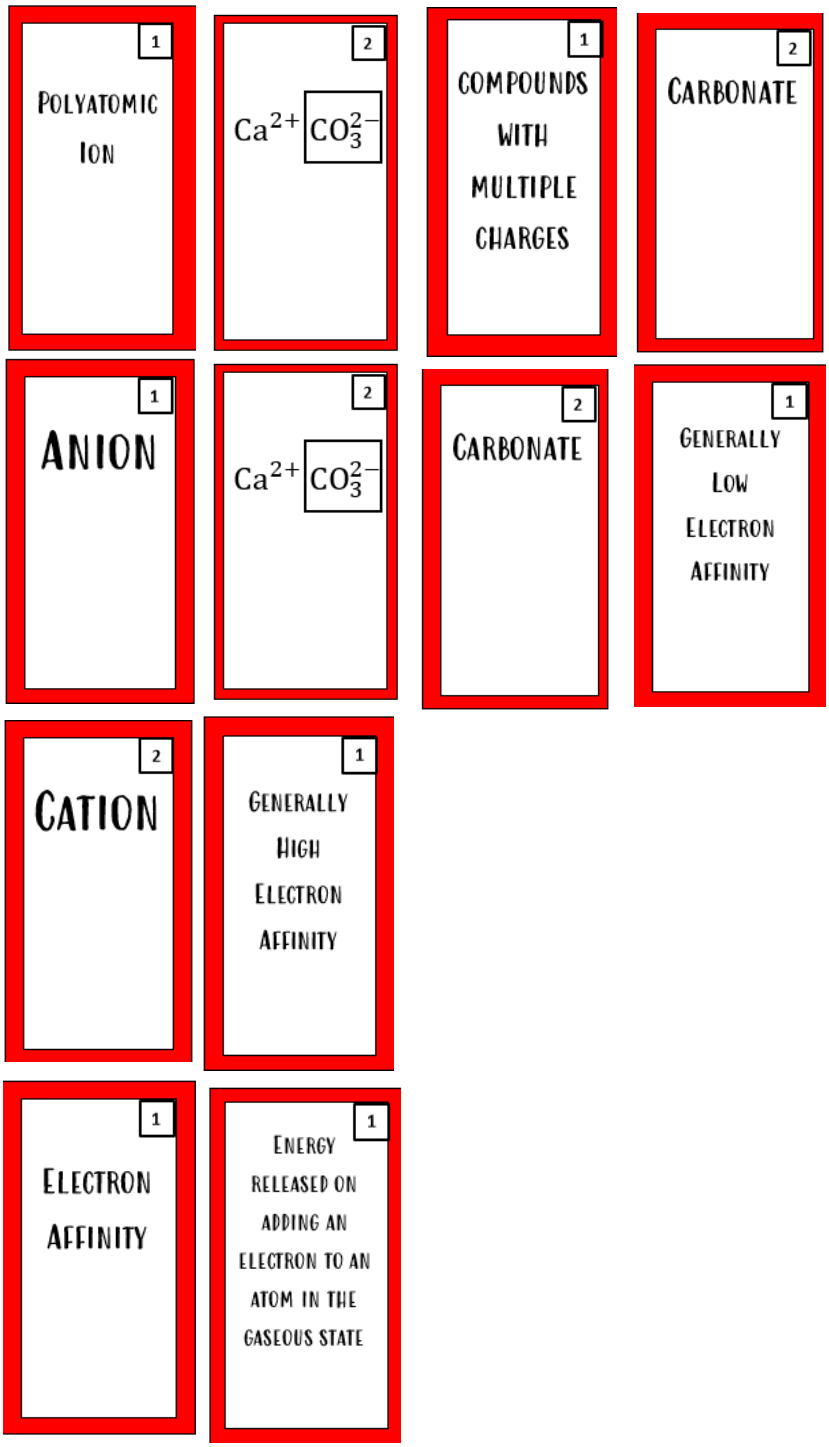

1
CaCO3

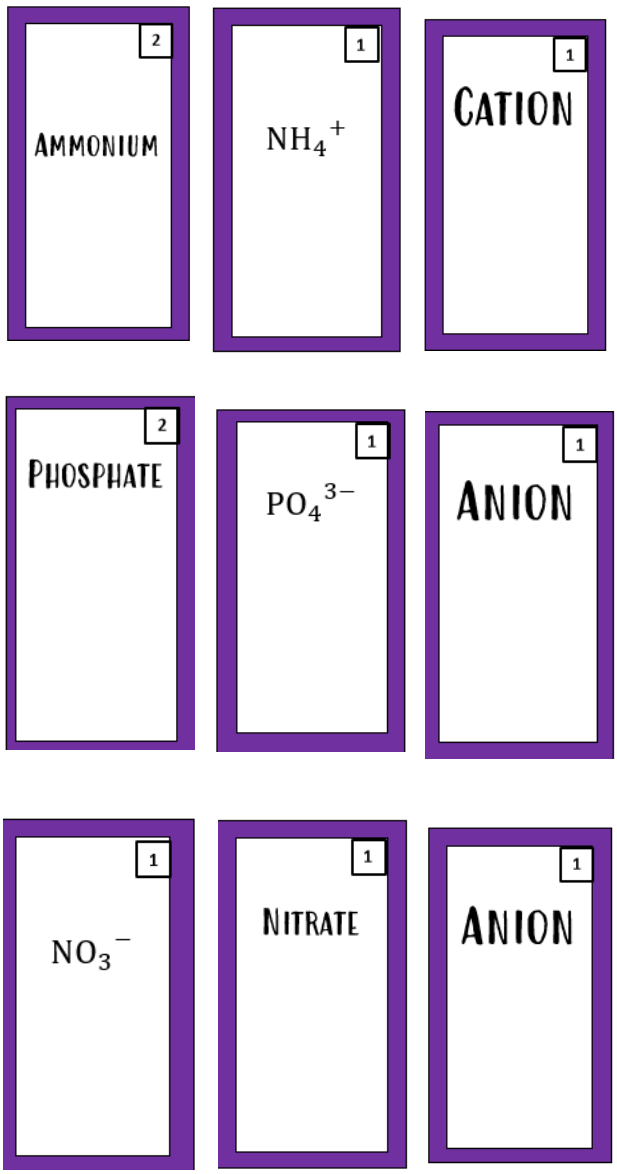

1
A DOCTOR RECOMMENDS WHAT ION TO HELP A PATIENT'S BONE GROWTH?

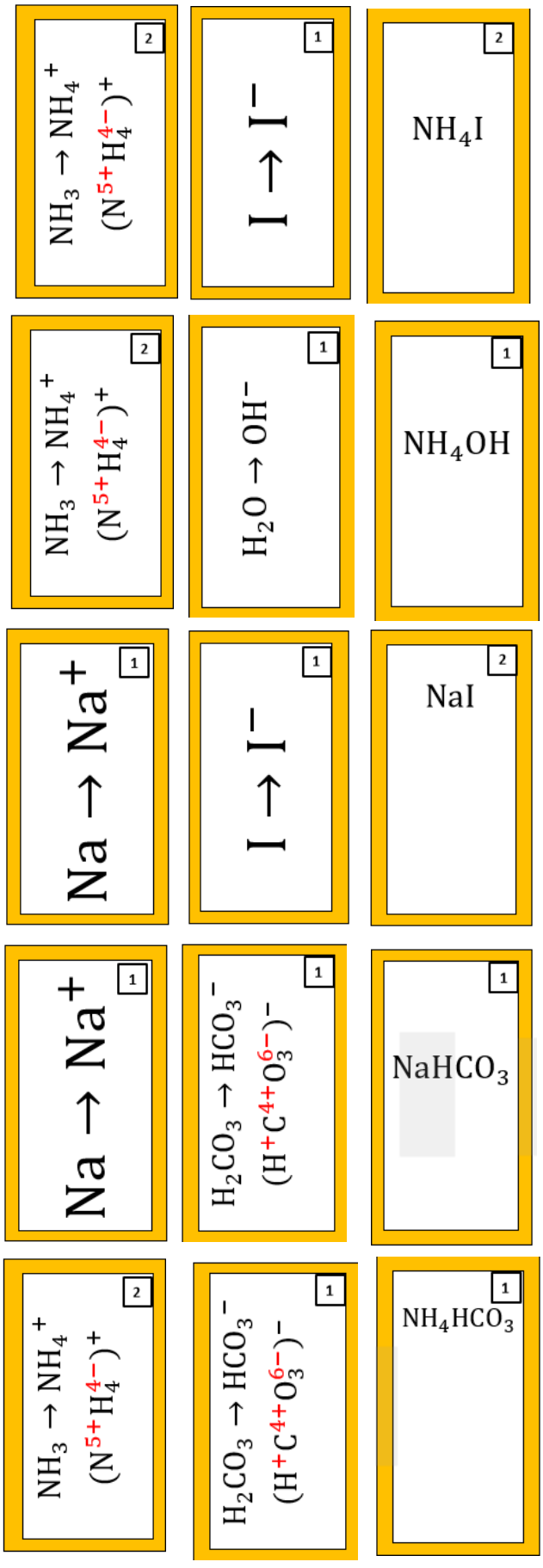

2
NaOH


1
BASIC COMPOUND

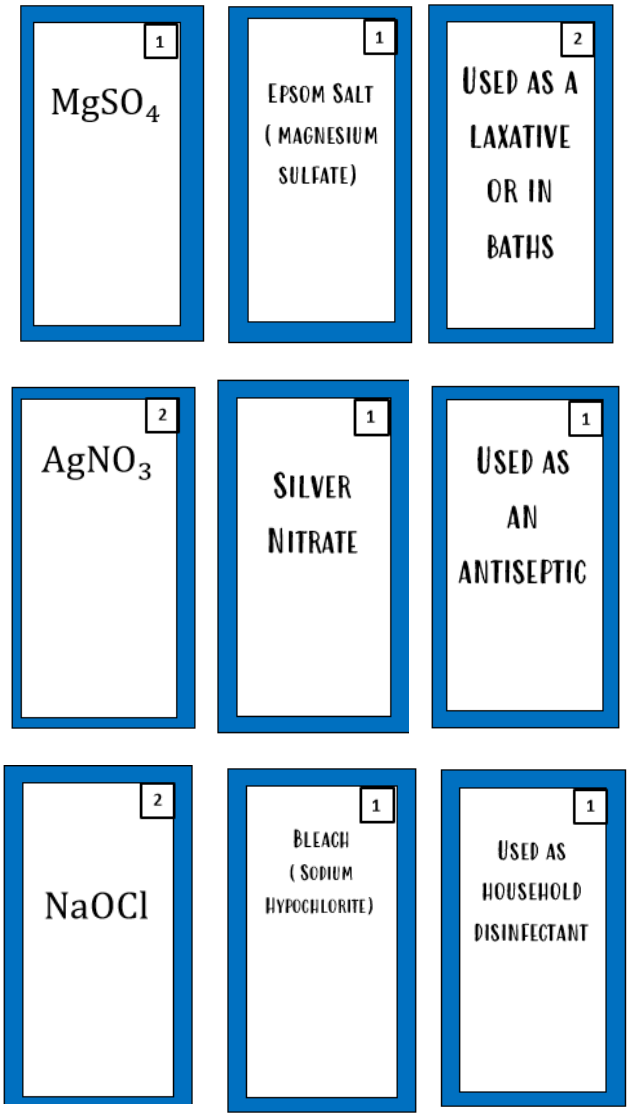
Category 3: Ions (polyatomic)



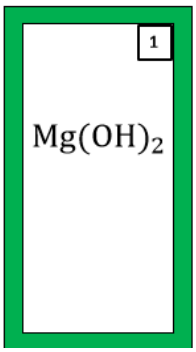

2
AMMONIUM
1
NH_4^+
1
CATION
2
PHOSPHATE
1
PO_4^{3-}
1
ANION
1
NO_3^-
1
NITRATE
1
ANION

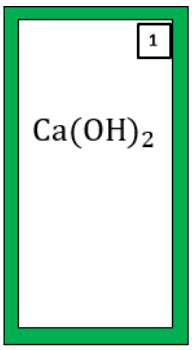

2
$NH_3 \rightarrow NH_4^+$
$(N^{5+}H_4^{4-})^+$
1
$I \rightarrow I^-$
2
NH_4I
2
$NH_3 \rightarrow NH_4^+$
$(N^{5+}H_4^{4-})^+$
1
$H_2O \rightarrow OH^-$
1
NH_4OH
1
$Na \rightarrow Na^+$
1
$I \rightarrow I^-$
2
NaI
1
$Na \rightarrow Na^+$
1
$H_2CO_3 \rightarrow HCO_3^-$
$(H^+C^{4+}O_3^{6-})^-$
1
$NaHCO_3$
2
$NH_3 \rightarrow NH_4^+$
$(N^{5+}H_4^{4-})^+$
1
$H_2CO_3 \rightarrow HCO_3^-$
$(H^+C^{4+}O_3^{6-})^-$
1
NH_4HCO_3

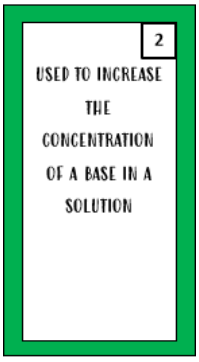
Gamification Answer Guide

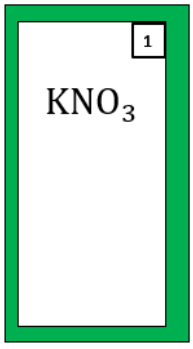


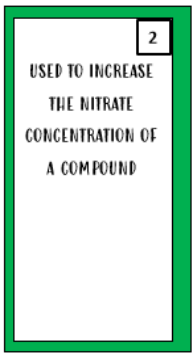
Gamification Answer Guide



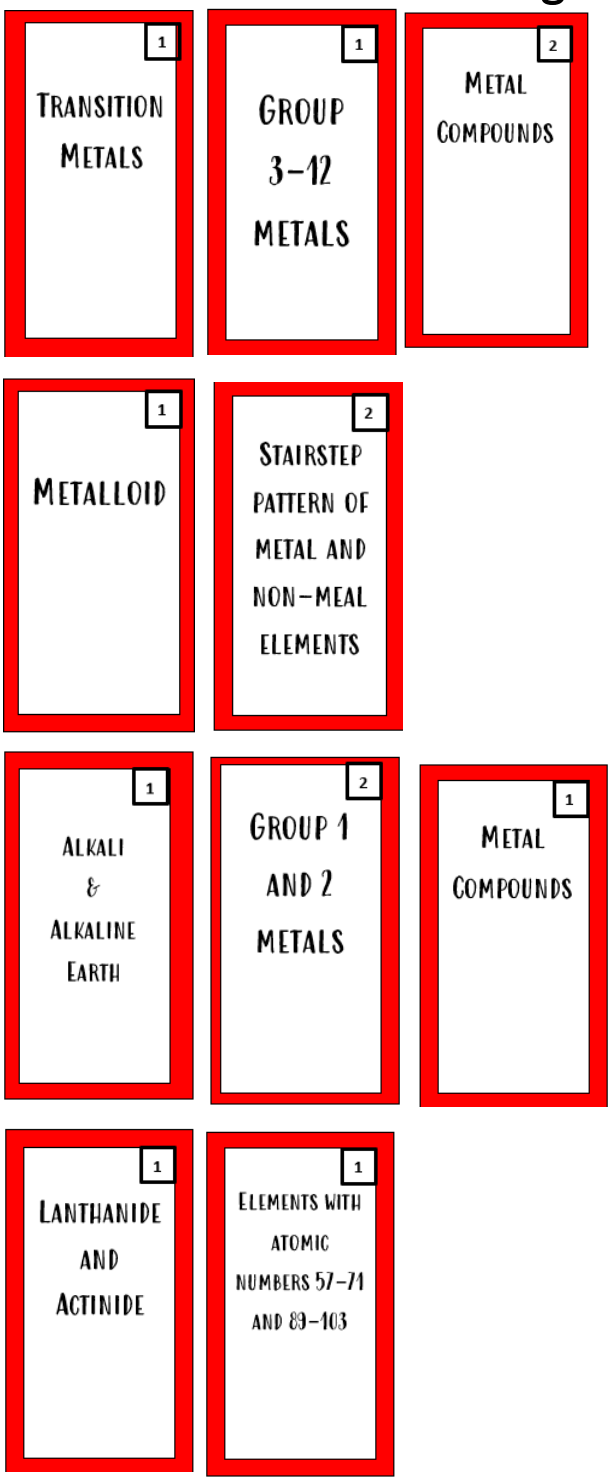




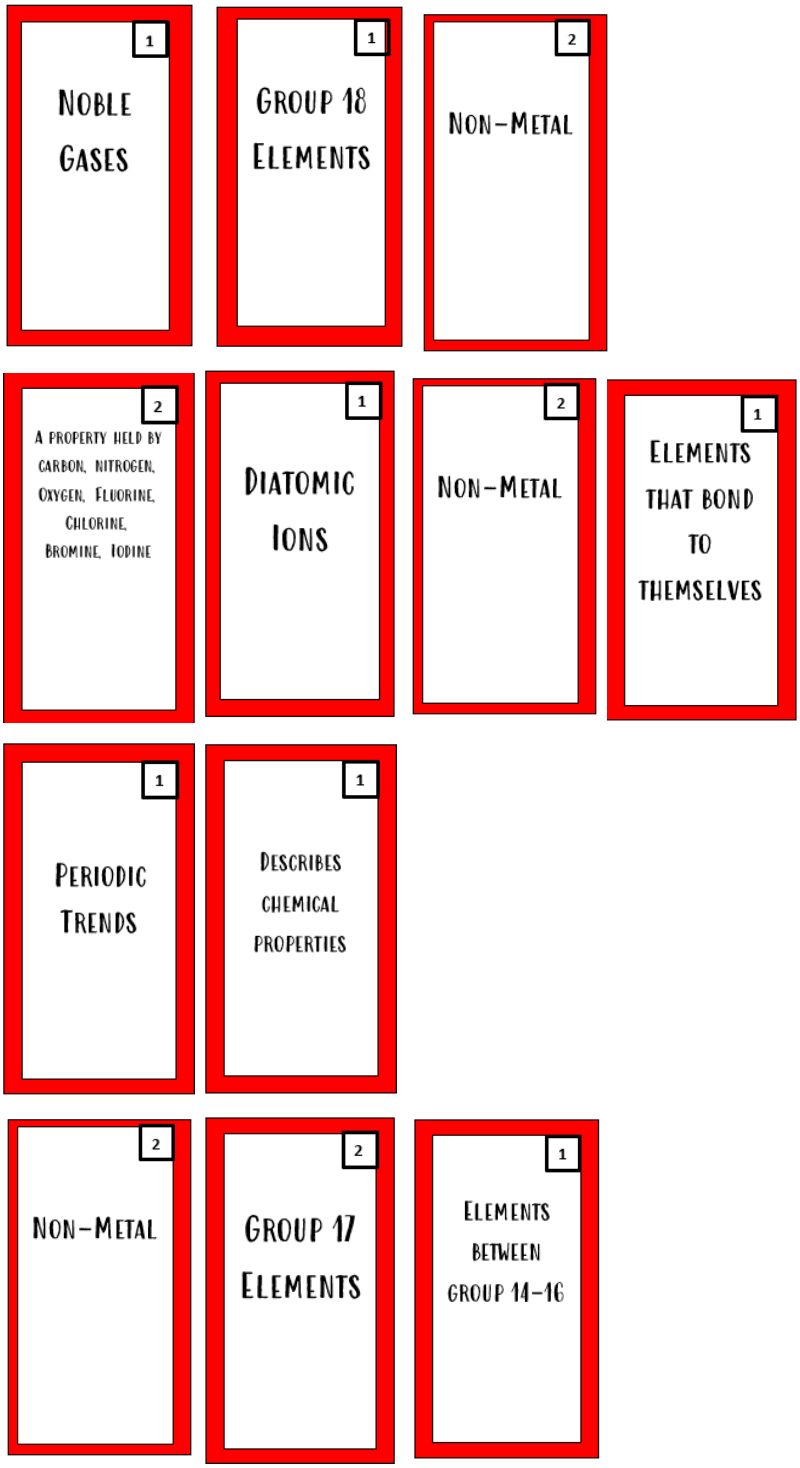




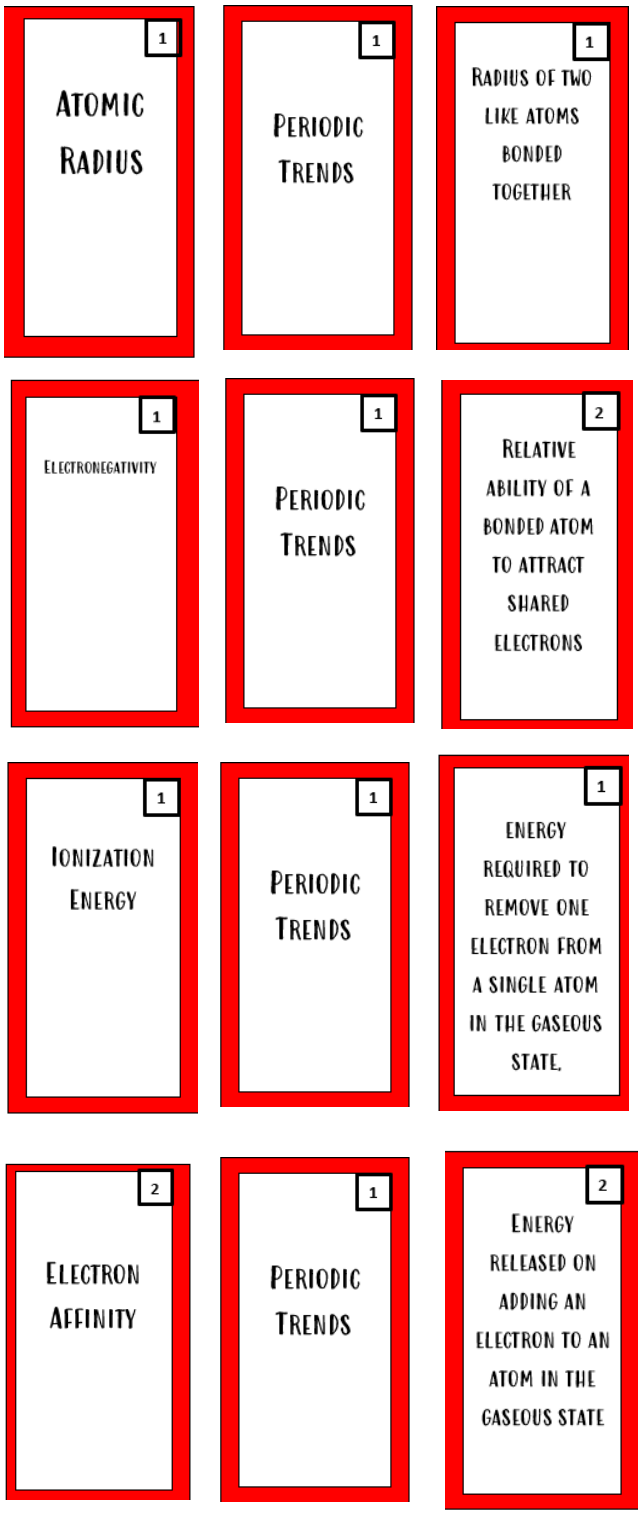
Category 4: Periodic Table

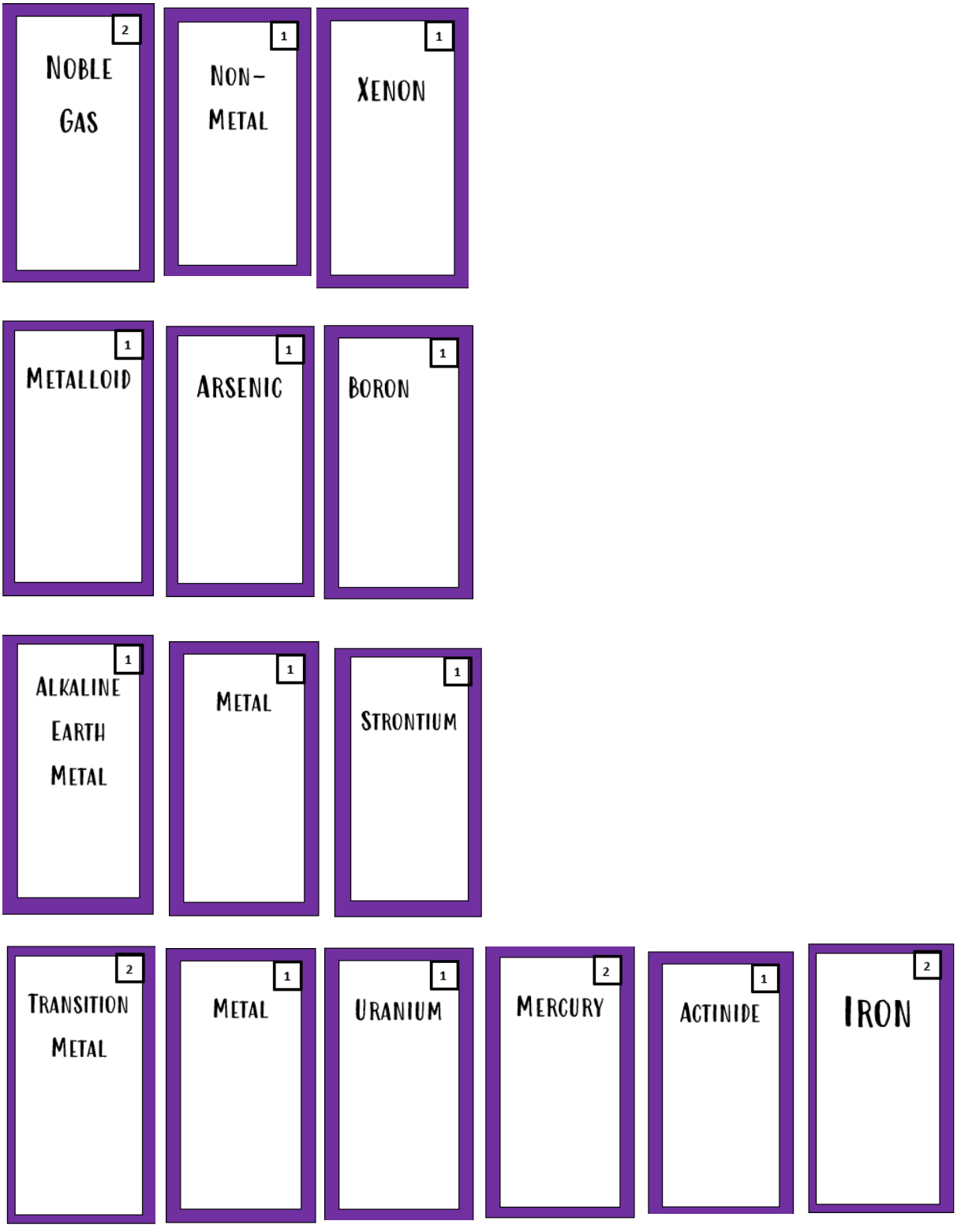


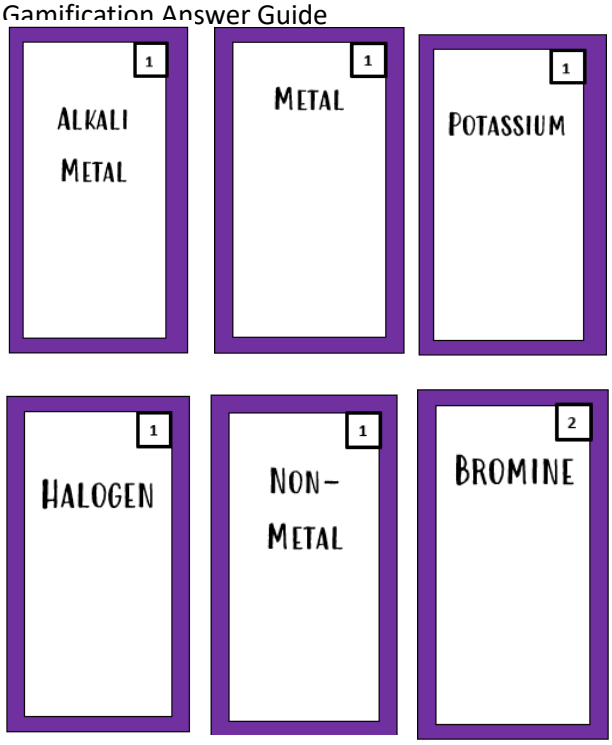
Gamification Answer Guide

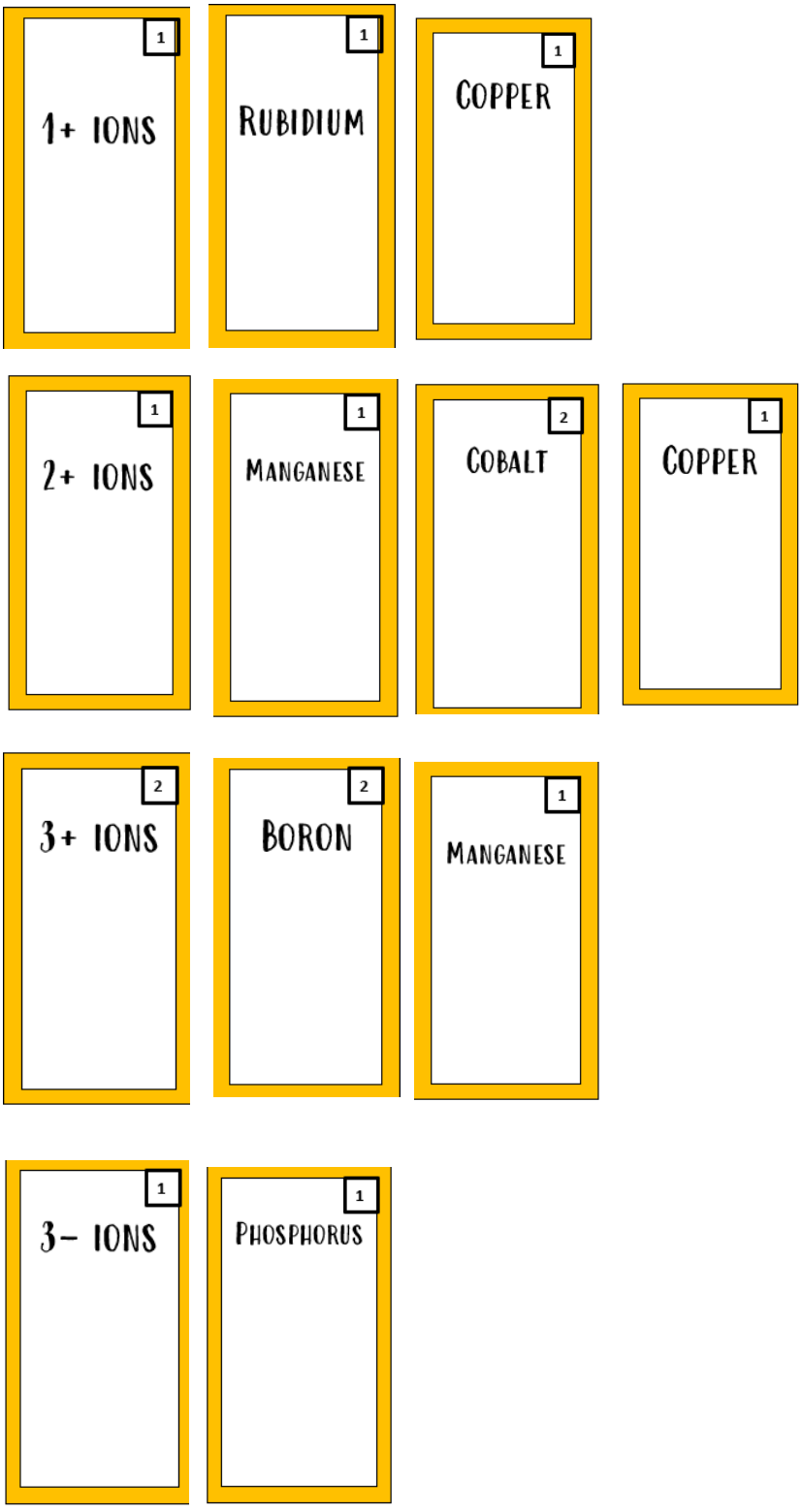


Gamification Answer Guide

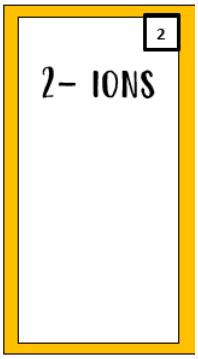


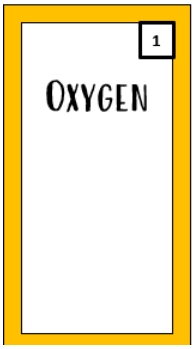

2
NOBLE GAS
1
NON-METAL
1
XENON
1
METALLOID
1
ARSENIC
1
BORON
1
ALKALINE EARTH METAL
1
METAL
1
STRONTIUM
2
TRANSITION METAL
1
METAL
1
URANIUM
2
MERCURY
1
ACTINIDE
2
IRON

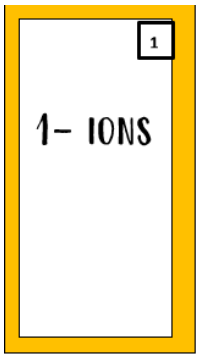

1
ALKALI METAL
1
METAL
1
POTASSIUM
1
HALOGEN
1
NON-METAL
2
BROMINE

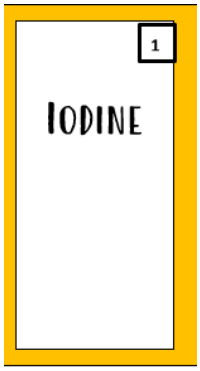

1
1+ IONS
1
RUBIDIUM
1
COPPER
1
2+ IONS
1
MANGANESE
2
COBALT
1
COPPER
2
3+ IONS
2
BORON
1
MANGANESE
1
3− IONS
1
PHOSPHORUS

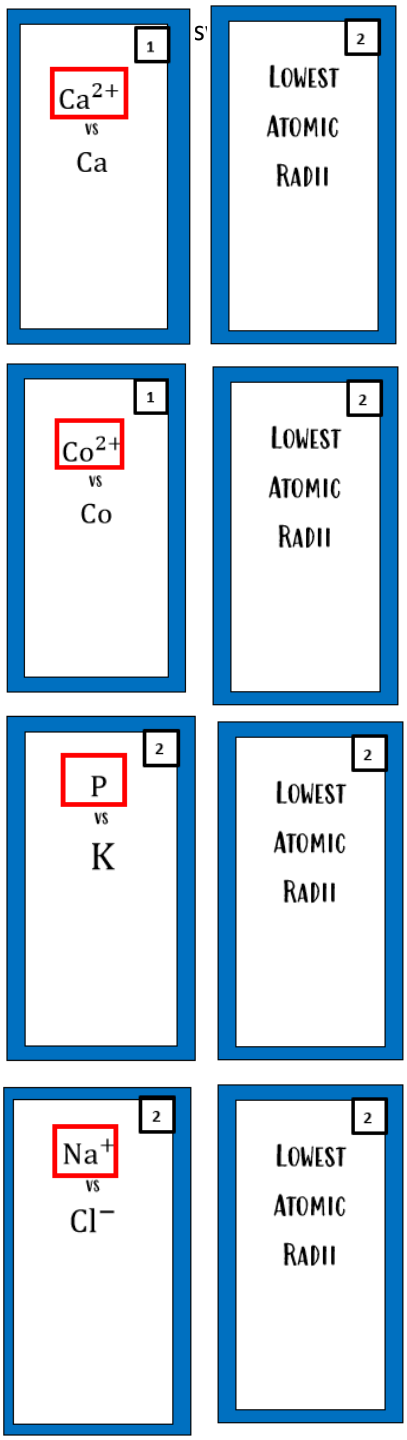
Gamification Answer Guide



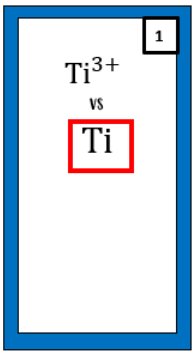


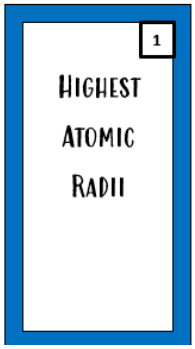


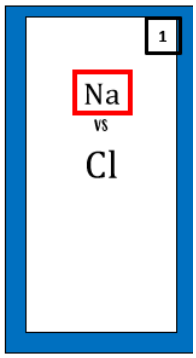


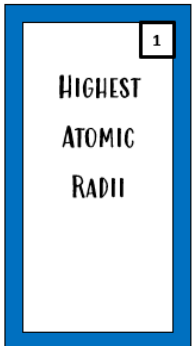

1
Ca^{2+}
vs
Ca
2
Lowest
Atomic
Radii
1
Co^{2+}
vs
Co
2
Lowest
Atomic
Radii
2
P
vs
K
2
Lowest
Atomic
Radii
2
Na^{+}
vs
Cl^{-}
2
Lowest
Atomic
Radii

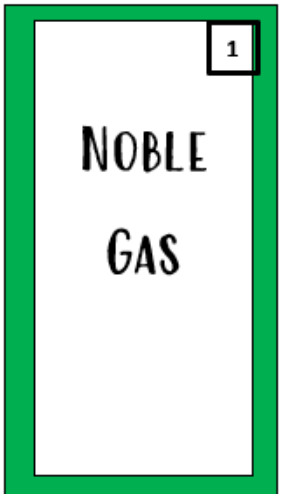
Gamification Answer Guide

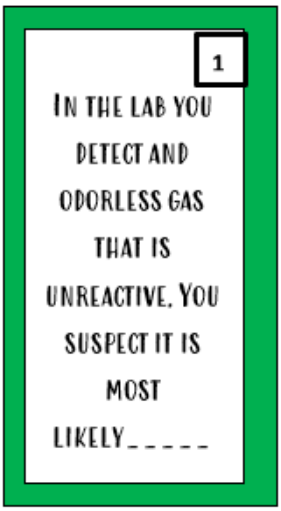




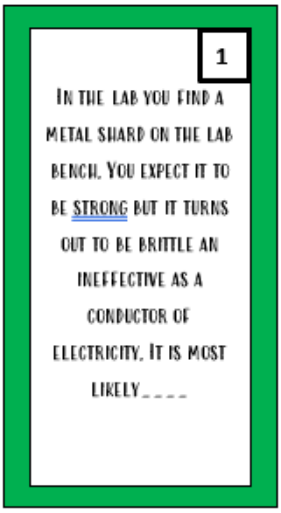




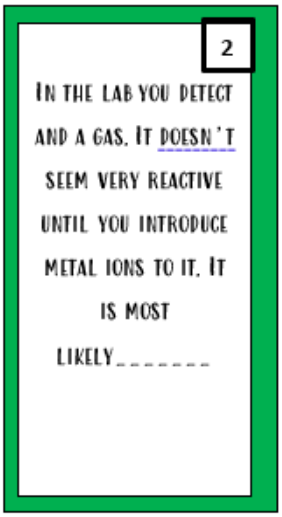

1
NOBLE GAS


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

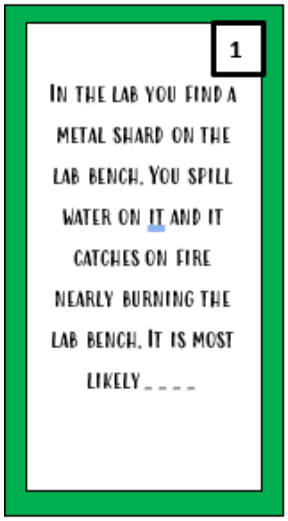

2
METALLOID


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____

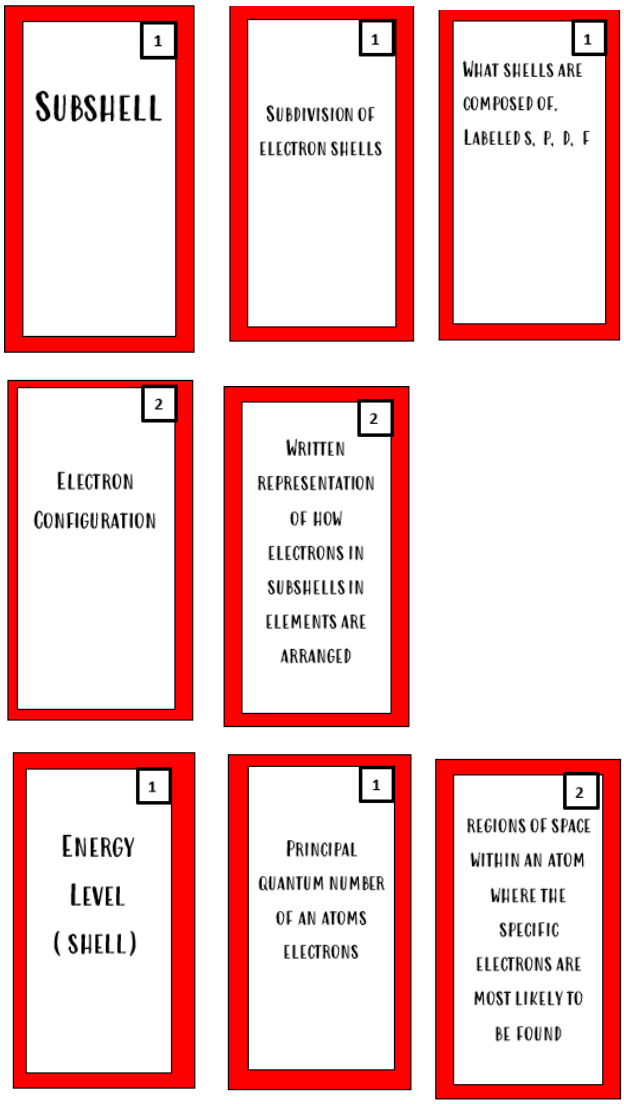

1
HALOGEN

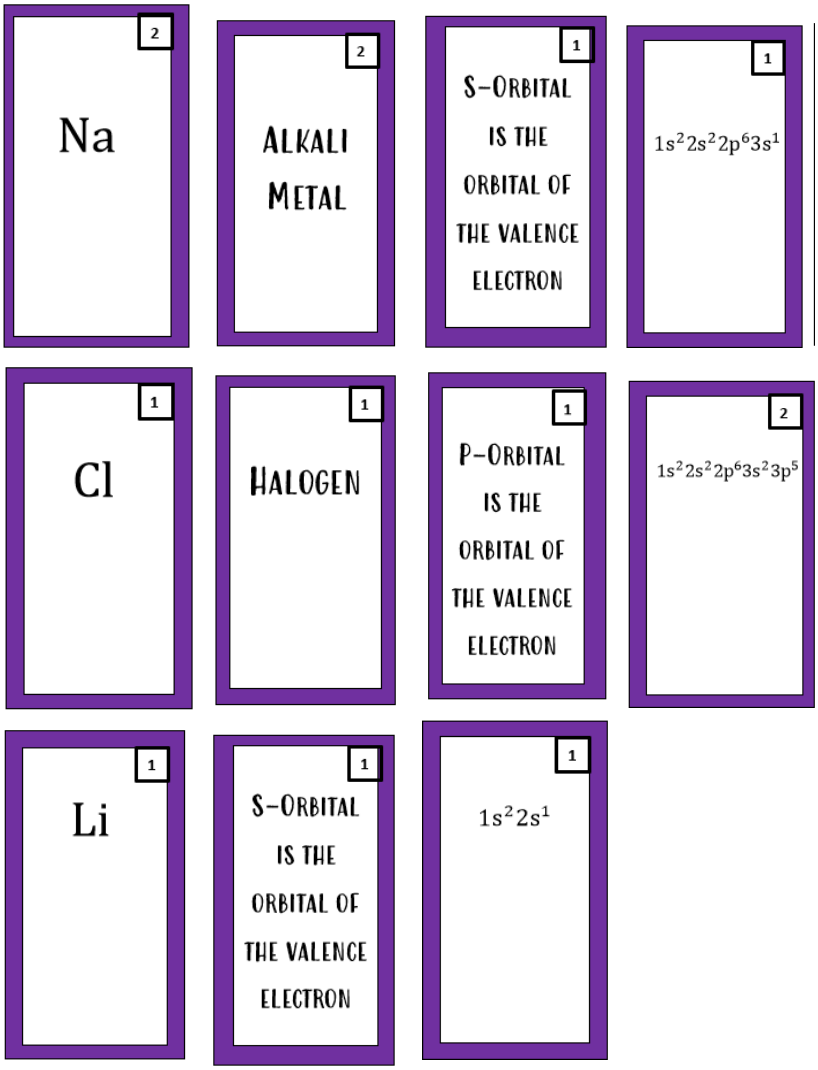

2
IN THE LAB YOU DETECT AND A GAS. IT DOESN'T SEEM VERY REACTIVE UNTIL YOU INTRODUCE METAL IONS TO IT. IT IS MOST LIKELY_____


2
ALKALI
METAL

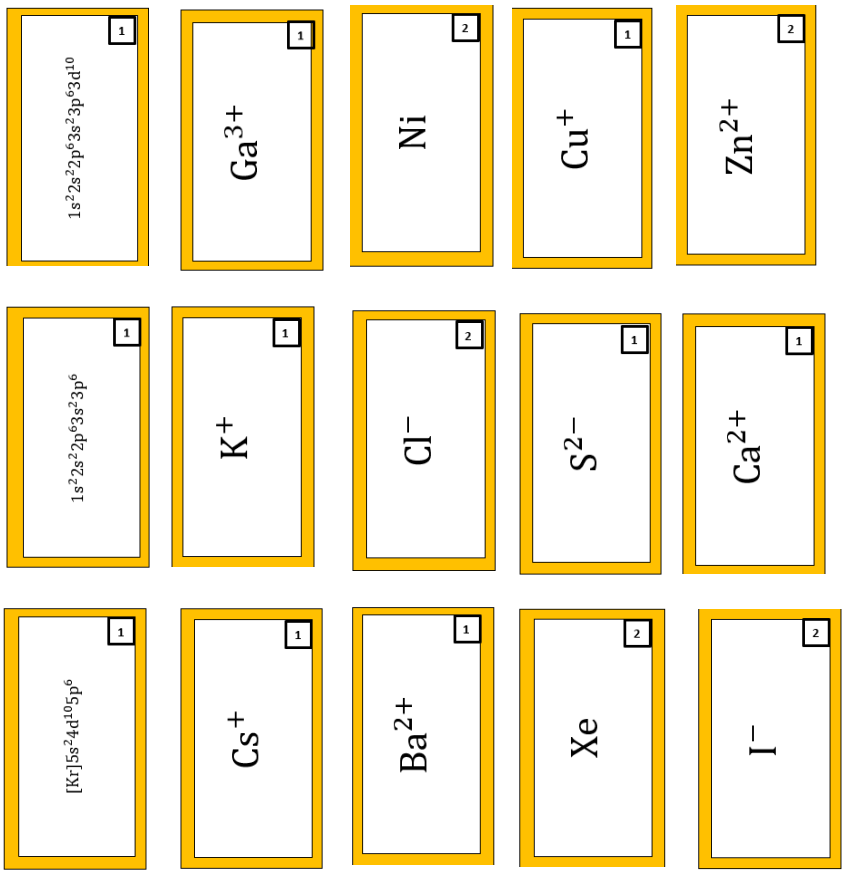

1
IN THE LAB YOU FIND A METAL SHARD ON THE LAB BENCH. YOU SPILL WATER ON IT AND IT CATCHES ON FIRE NEARLY BURNING THE LAB BENCH. IT IS MOST LIKELY _ _ _ _

Category 5: Electronic Structure of Atoms

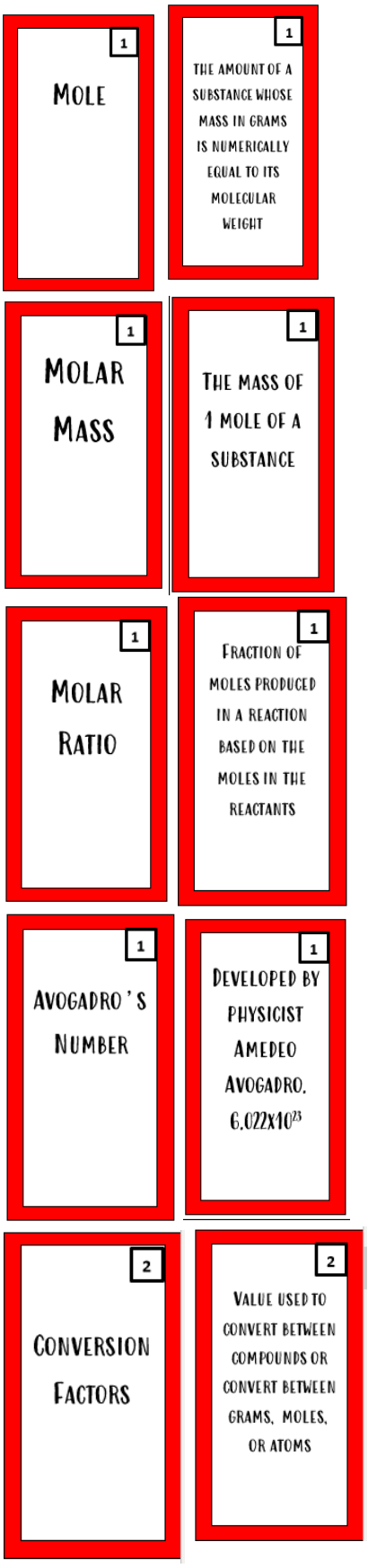


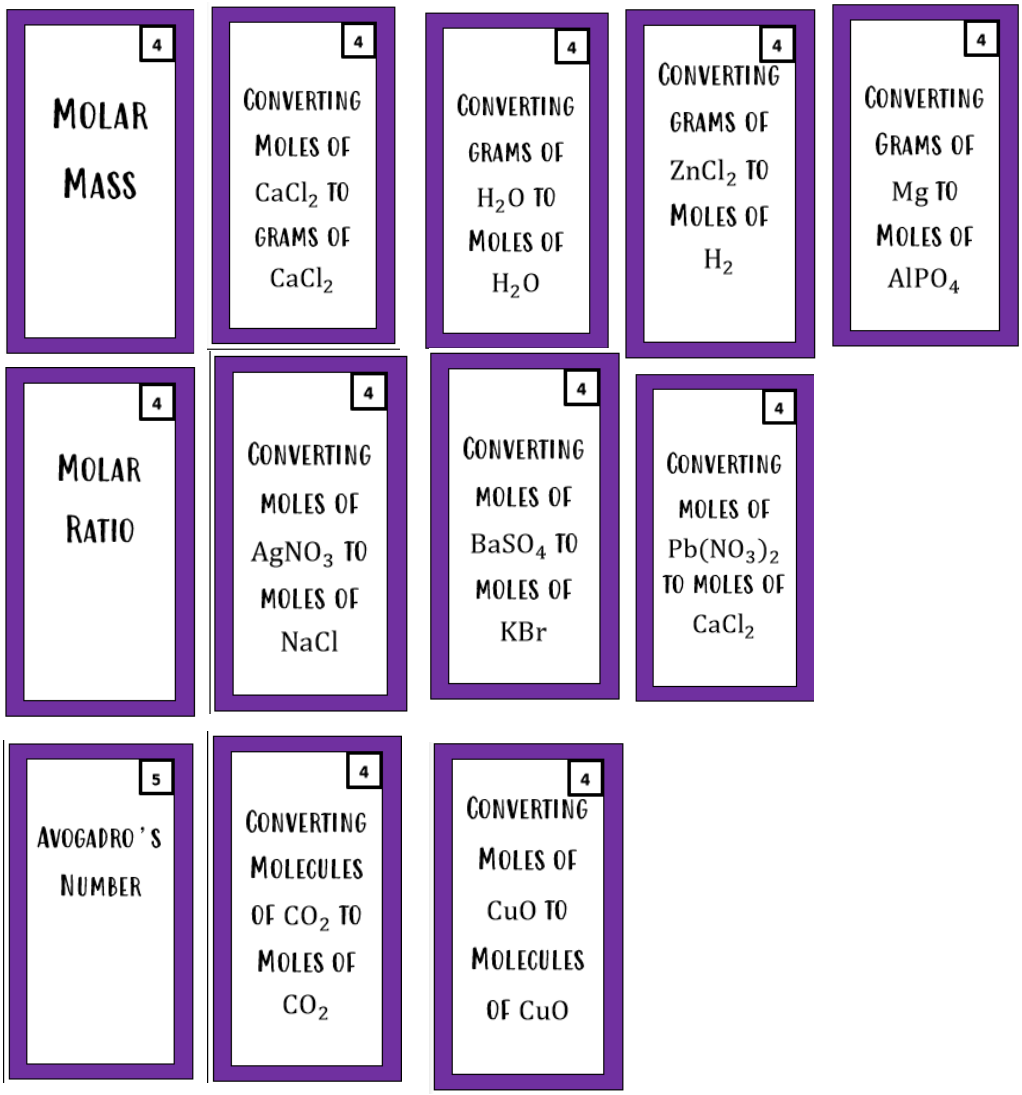

2
Na
2
ALKALI METAL
1
S-ORBITAL IS THE ORBITAL OF THE VALENCE ELECTRON
1
$1s^2 2s^2 2p^6 3s^1$
1
Cl
1
HALOGEN
1
P-ORBITAL IS THE ORBITAL OF THE VALENCE ELECTRON
2
$1s^2 2s^2 2p^6 3s^2 3p^5$
1
Li
1
S-ORBITAL IS THE ORBITAL OF THE VALENCE ELECTRON
1
$1s^2 2s^1$

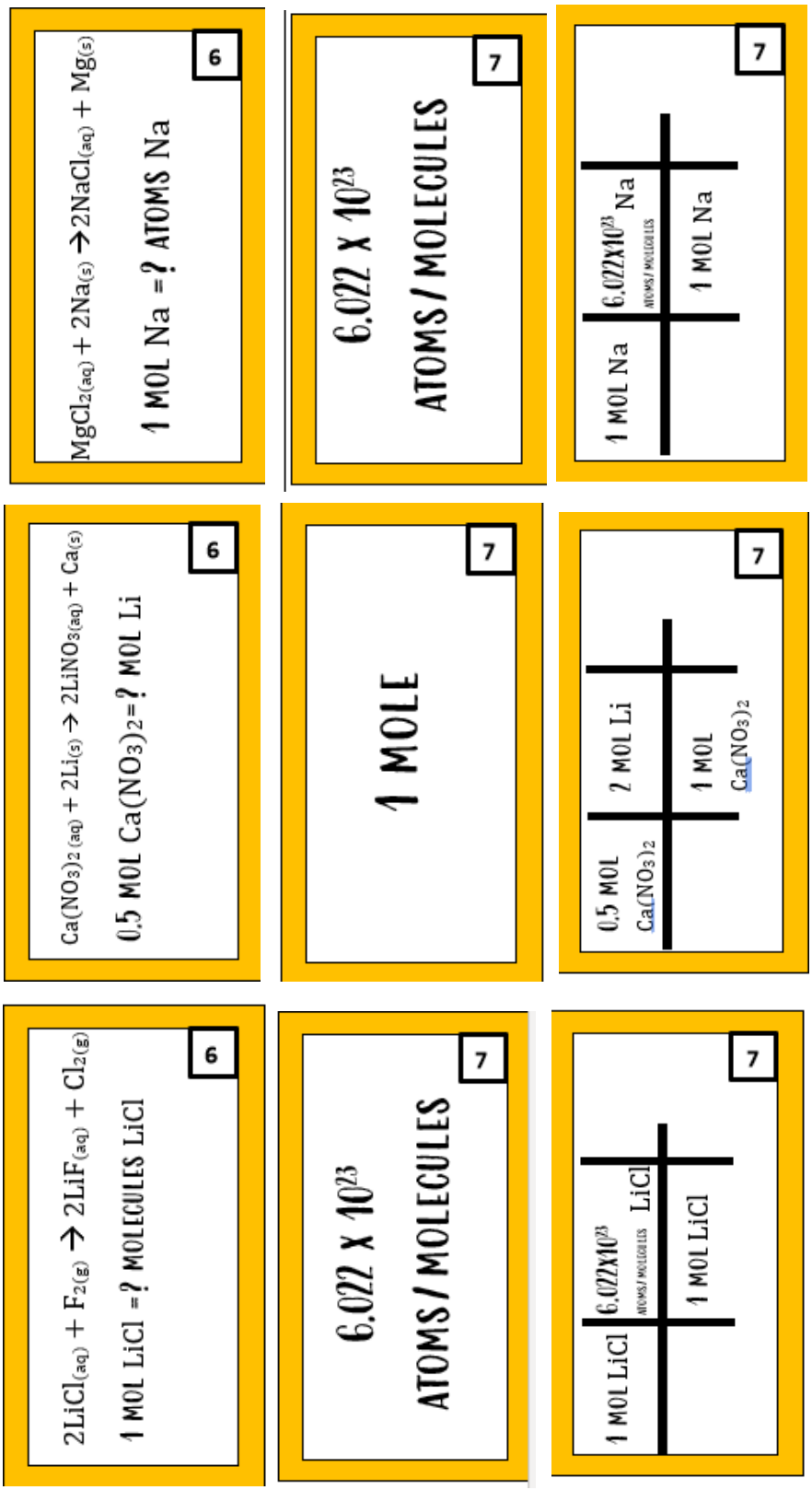
Gamification Answer Guide

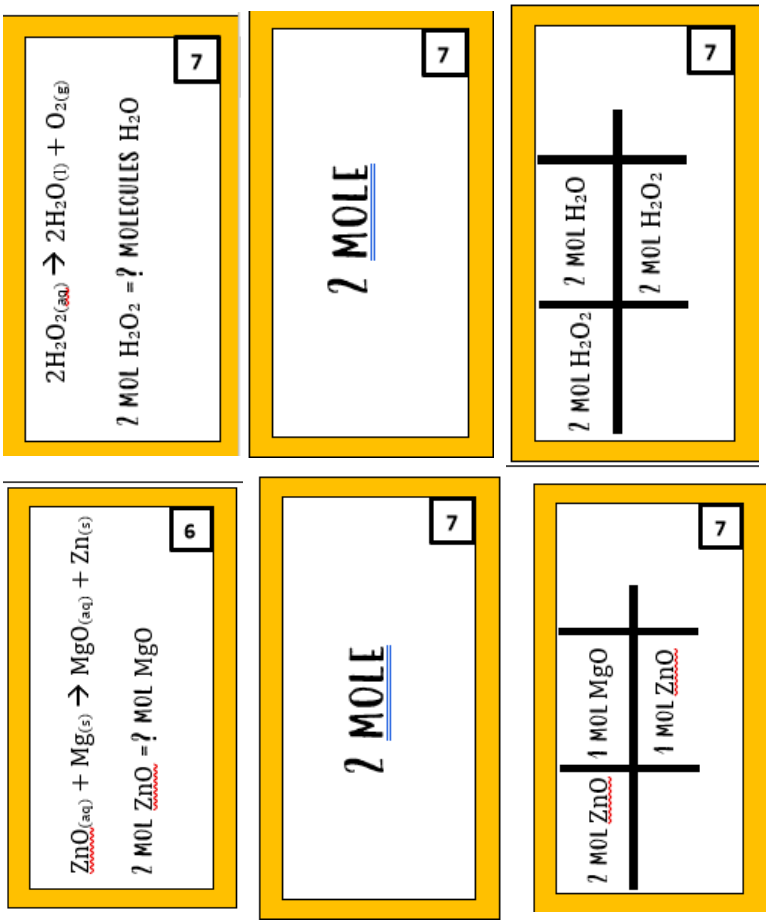


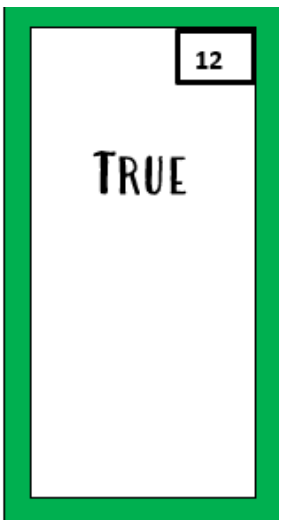
Category 6: Mole & Stoichiometry

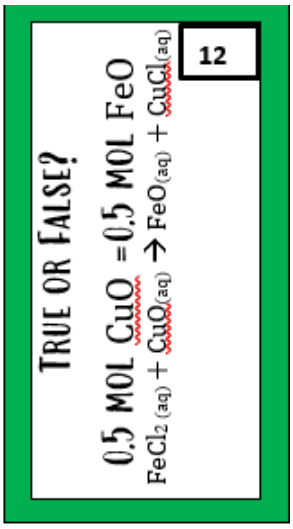



4
MOLAR MASS
4
CONVERTING MOLES OF $CaCl_2$ TO GRAMS OF $CaCl_2$
4
CONVERTING GRAMS OF H_2O TO MOLES OF H_2O
4
CONVERTING GRAMS OF $ZnCl_2$ TO MOLES OF H_2
4
CONVERTING GRAMS OF Mg TO MOLES OF $AlPO_4$
4
MOLAR RATIO
4
CONVERTING MOLES OF $AgNO_3$ TO MOLES OF NaCl
4
CONVERTING MOLES OF $BaSO_4$ TO MOLES OF KBr
4
CONVERTING MOLES OF $Pb(NO_3)_2$ TO MOLES OF $CaCl_2$
5
AVOGADRO'S NUMBER
4
CONVERTING MOLECULES OF CO_2 TO MOLES OF CO_2
4
CONVERTING MOLES OF CuO TO MOLECULES OF CuO


$MgCl_{2(aq)} + 2Na_{(s)} \rightarrow 2NaCl_{(aq)} + Mg_{(s)}$
1 MOL Na =? ATOMS Na
6
6.022 X 10^{23}
ATOMS / MOLECULES
7
1 MOL Na
$6.022x10^{23}$ Na
ATOMS / MOLECULES
1 MOL Na
$Ca(NO_3)_{2\,(aq)} + 2Li_{(s)} \rightarrow 2LiNO_{3(aq)} + Ca_{(s)}$
0.5 MOL $Ca(NO_3)_2$ =? MOL Li
6
1 MOLE
7
0.5 MOL $Ca(NO_3)_2$
2 MOL Li
1 MOL $Ca(NO_3)_2$
7
$2LiCl_{(aq)} + F_{2(g)} \rightarrow 2LiF_{(aq)} + Cl_{2(g)}$
1 MOL LiCl =? MOLECULES LiCl
6
6.022 X 10^{23}
ATOMS / MOLECULES
7
1 MOL LiCl
$6.022x10^{23}$ LiCl
ATOMS / MOLECULES
1 MOL LiCl
7

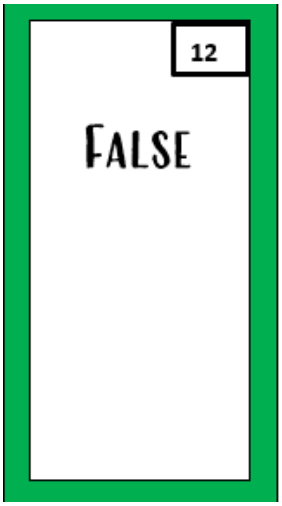

7
$2H_2O_{2(aq)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$
2 MOL H_2O_2 = ? MOLECULES H_2O
7
2 MOLE
7
2 MOL H_2O_2
2 MOL H_2O
2 MOL H_2O_2
6
$ZnO_{(aq)} + Mg_{(s)} \rightarrow MgO_{(aq)} + Zn_{(s)}$
2 MOL ZnO = ? MOL MgO
7
2 MOLE
7
2 MOL ZnO
1 MOL MgO
1 MOL ZnO


12
TRUE

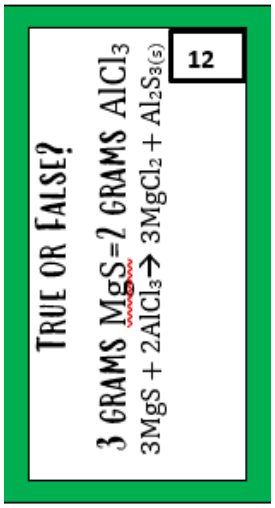

12
TRUE OR FALSE?
0,5 MOL CuO =0,5 MOL FeO
FeCl2 (aq) + CuO(aq) → FeO(aq) + CuCl(aq)


12
TRUE OR FALSE?
2 MOL KI =1 MOL PbI2
2KI(aq) + Pb(NO3)2(aq) → PbI2(s) + 2KNO3(aq)

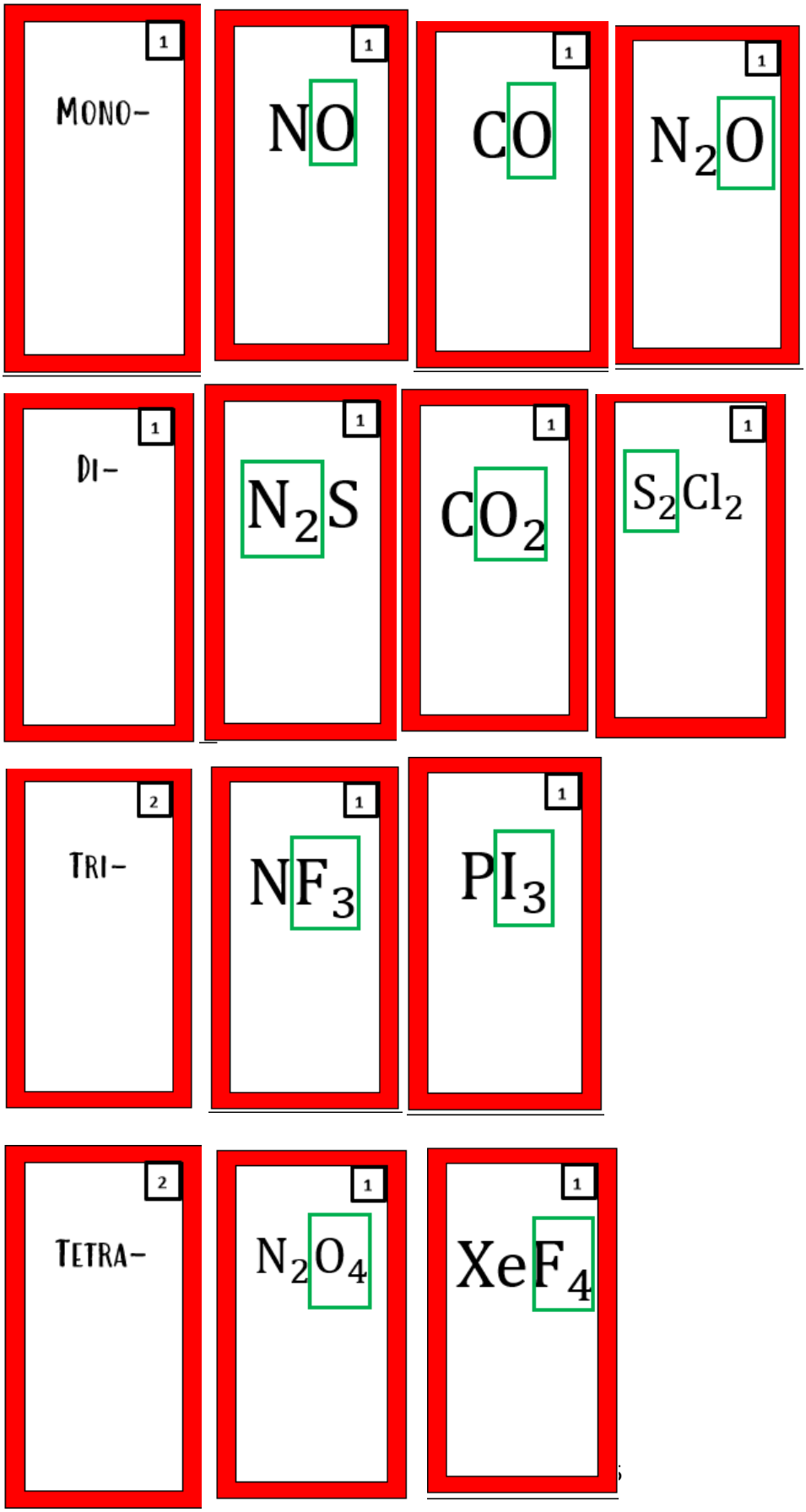

12
TRUE OR FALSE?
1 MOL Pb(NO3)2 =6,022X10^23 MOLECULES CaCl2
Pb(NO3)2(aq) + CaCl2(aq) → Ca(NO3)2(aq) + PbCl2(s)

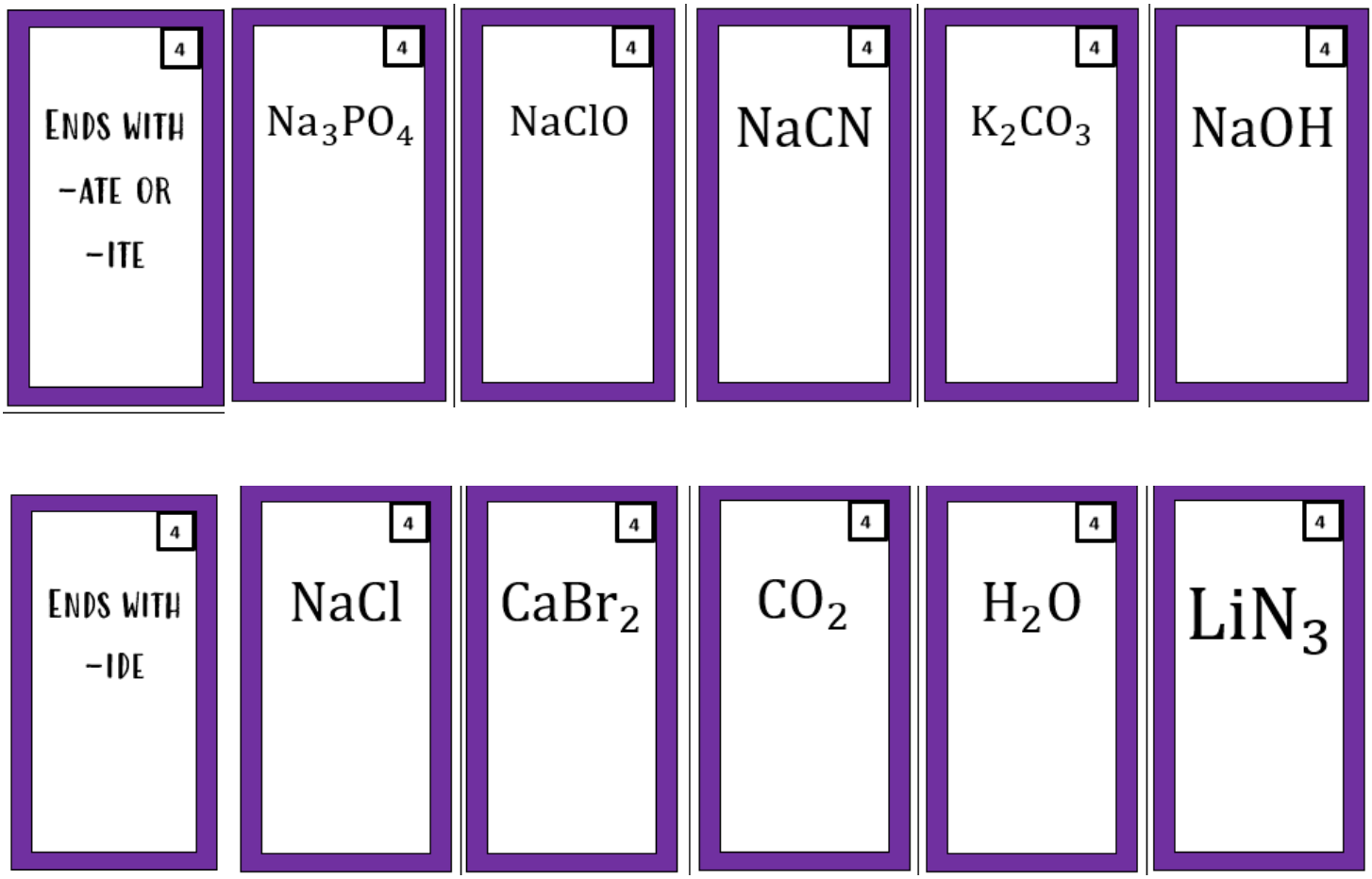

12
FALSE

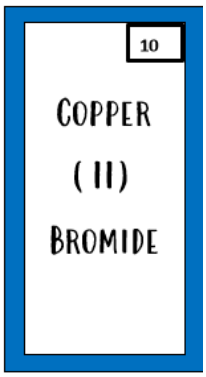

12
TRUE OR FALSE?
1 GRAM AgNO3=1 GRAM AgCl
AgNO3(aq) + NaCl(aq)→ NaNO3(aq)+ AgCl(s)

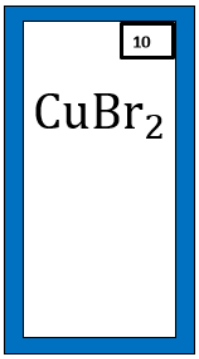

12
TRUE OR FALSE?
3 GRAMS MgS=2 GRAMS AlCl3
3MgS + 2AlCl3→ 3MgCl2 + Al2S3(s)

Category 7: Chemical Naming

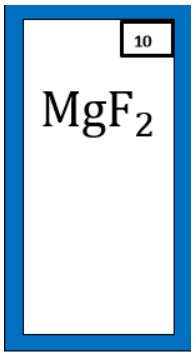


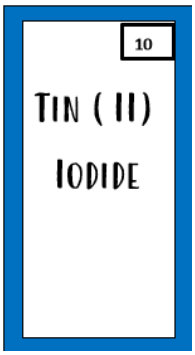

4
ENDS WITH
-ATE OR
-ITE
4
Na_3PO_4
4
NaClO
4
NaCN
4
K_2CO_3
4
NaOH
4
ENDS WITH
-IDE
4
NaCl
4
$CaBr_2$
4
CO_2
4
H_2O
4
LiN_3

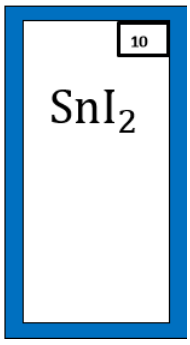

10
COPPER
(II)
BROMIDE

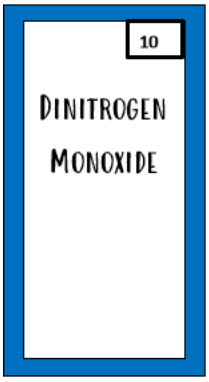

10
$CuBr_2$

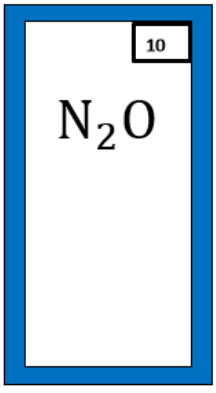

10
MAGNESIUM
FLUORIDE

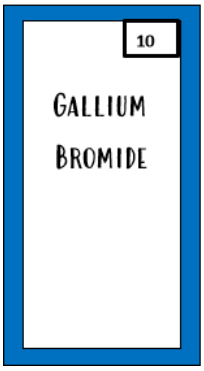

10
MgF_2


10
TIN (II)
IODIDE


10
SnI_2

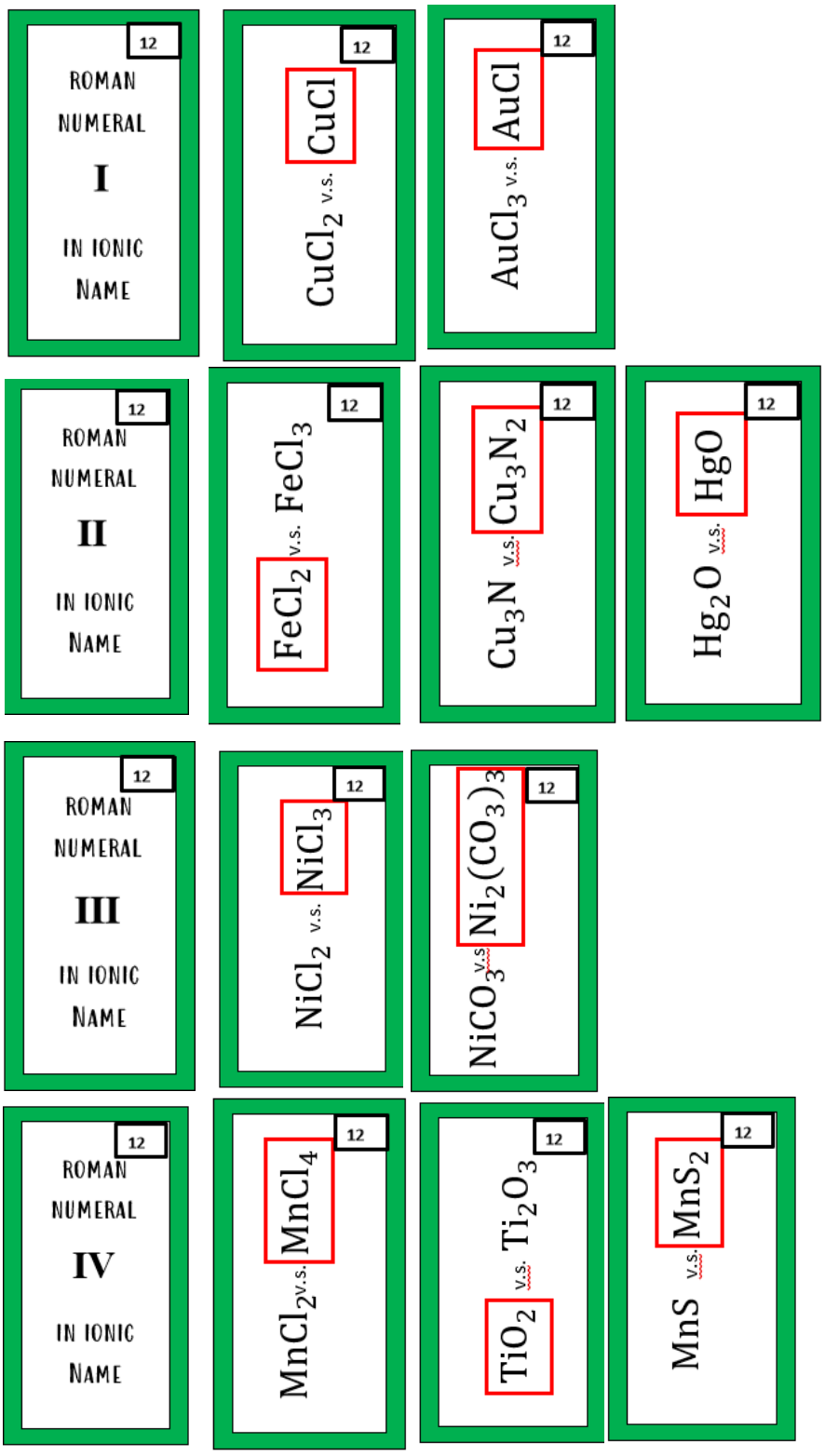

10
DINITROGEN
MONOXIDE


10
N_2O

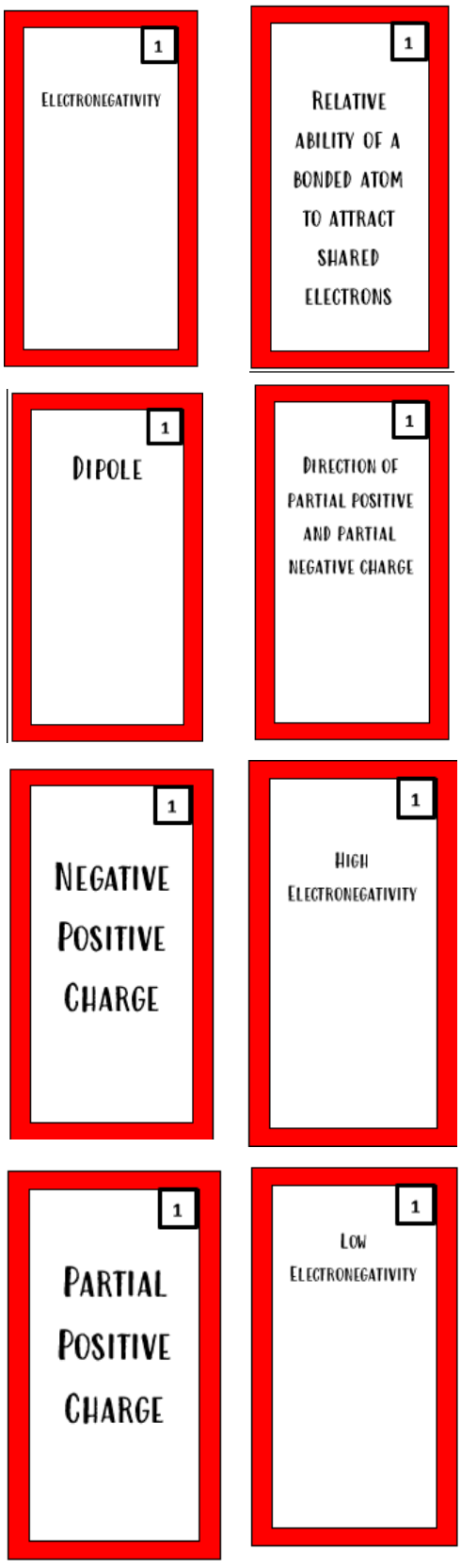

10
GALLIUM
BROMIDE

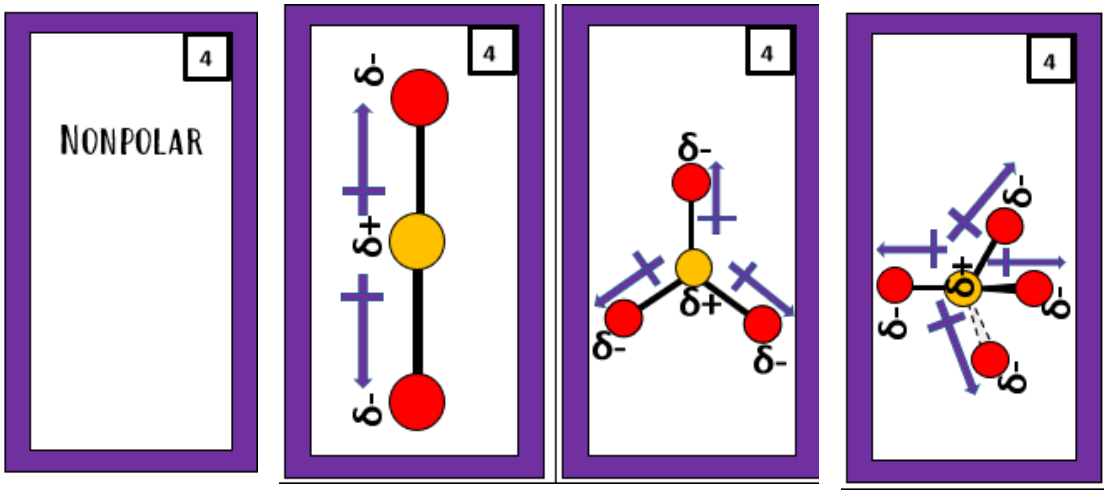

10
$GaBr_3$

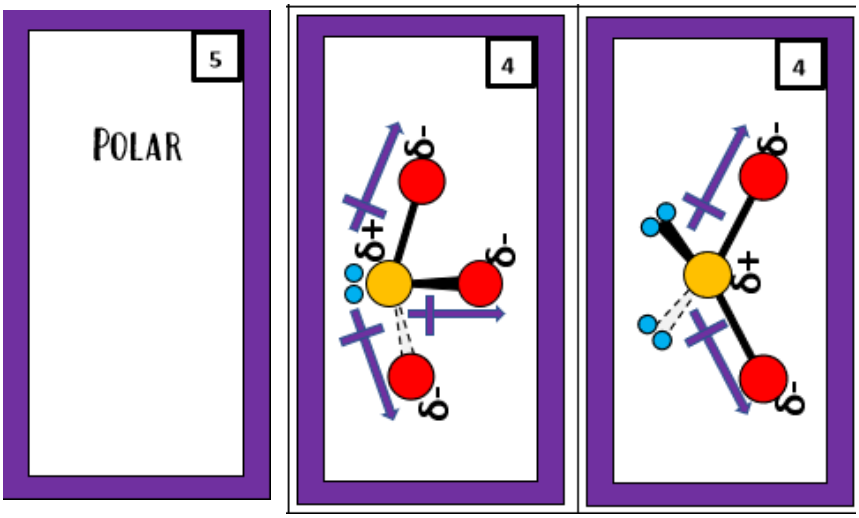
Gamification Answer Guide

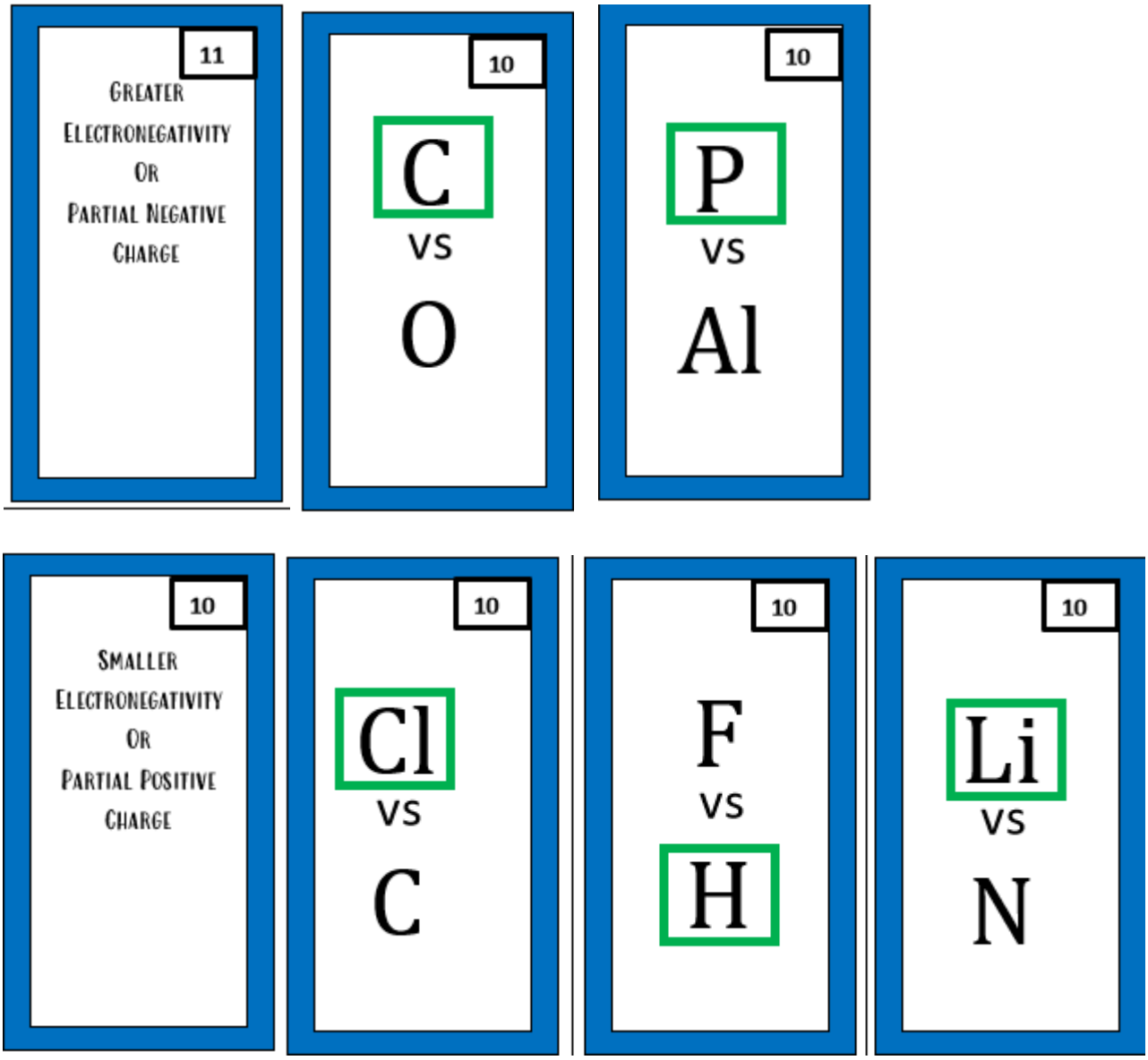


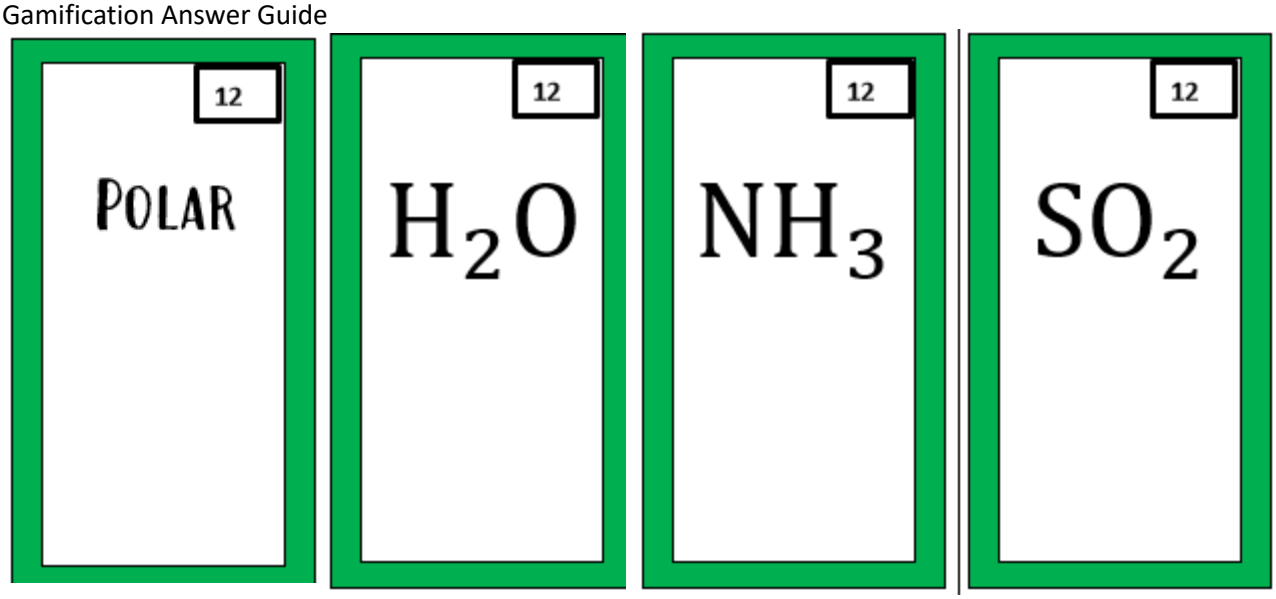
Category 8: Electronegativity Trend & Polarity

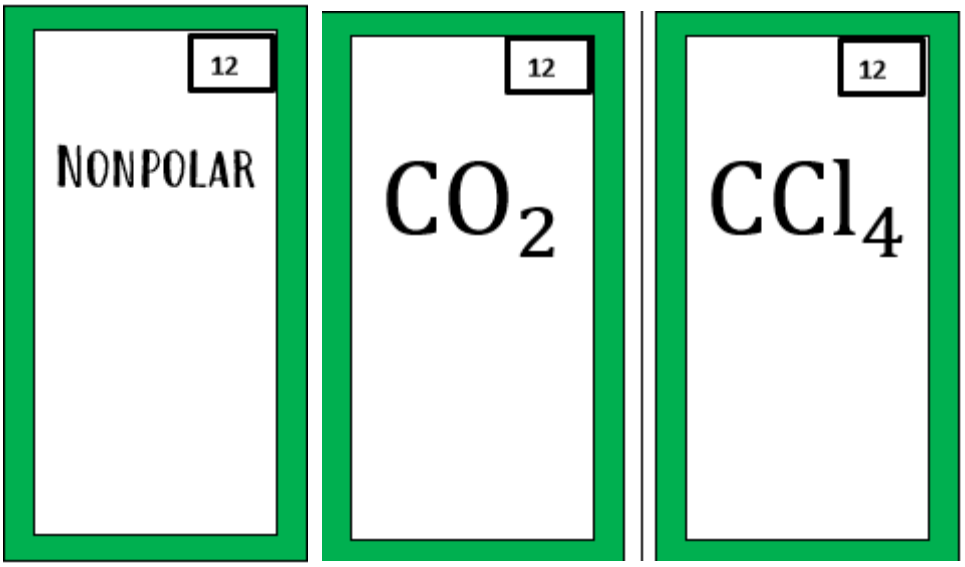



4
NONPOLAR
4
δ-
δ+
δ-
4
δ-
δ+
δ-
δ-
4
δ-
δ-
δ+
δ-
δ-

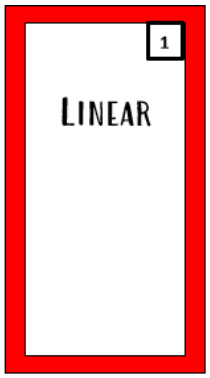

5
POLAR
4
δ-
δ+
δ-
δ-
4
δ-
δ+
δ-

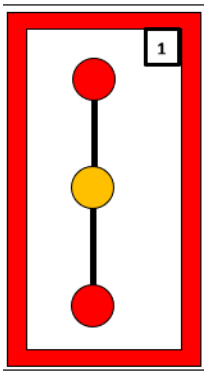

11
GREATER ELECTRONEGATIVITY OR PARTIAL NEGATIVE CHARGE
10
C
VS
O
10
P
VS
Al
10
SMALLER ELECTRONEGATIVITY OR PARTIAL POSITIVE CHARGE
10
Cl
VS
C
10
F
VS
H
10
Li
VS
N

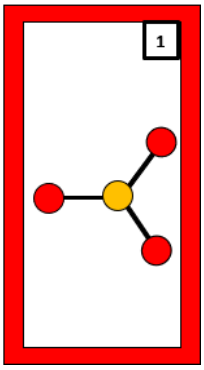

12
POLAR
12
H_2O
12
NH_3
12
SO_2

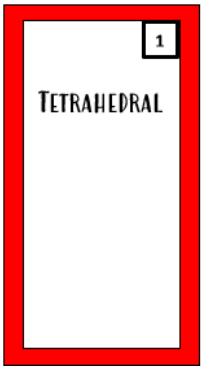

12
NONPOLAR
12
CO_2
12
CCl_4

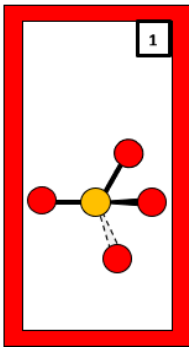
Category 9: Molecular Geometry

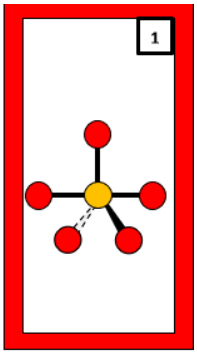


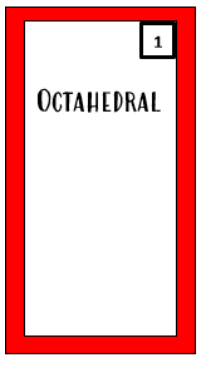


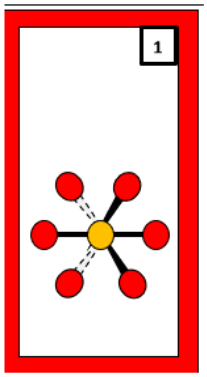








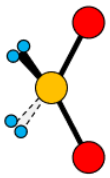




2

BENT/ANGULAR
(4 DOMAINS)

1



2

BENT/ANGULAR
(3 DOMAINS)

1

1

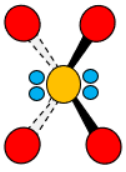
TRIGONAL
PYRAMID

1

1

SQUARE PLANAR

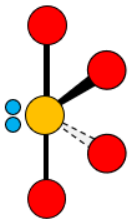
1

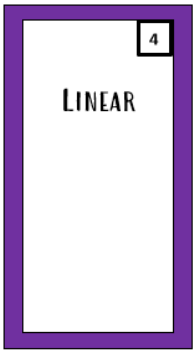


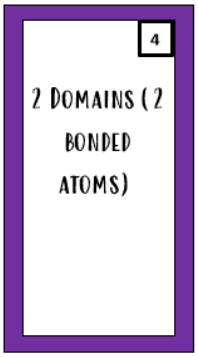
1

SEESAW

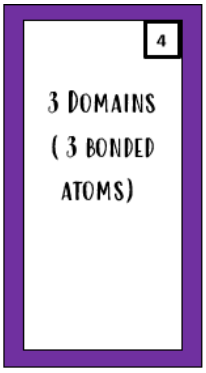
1

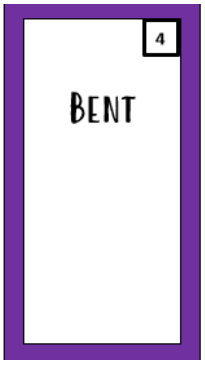


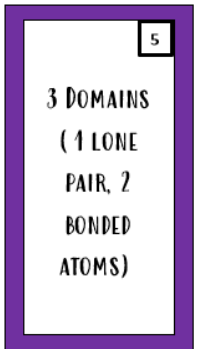

4
LINEAR

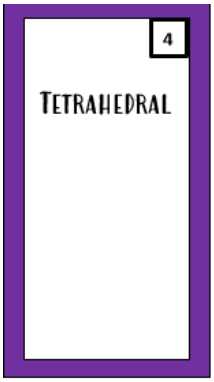

4
2 DOMAINS (2 BONDED ATOMS)

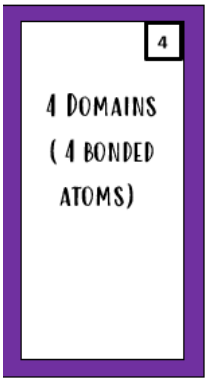

4
TRIGONAL PLANAR

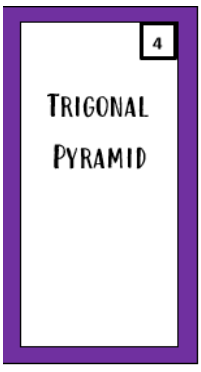

4
3 DOMAINS (3 BONDED ATOMS)

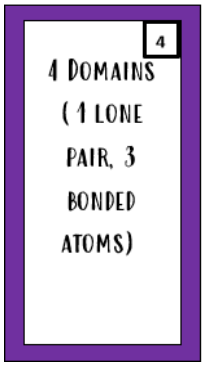

4
BENT

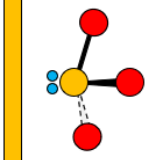
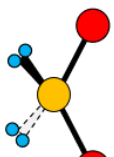
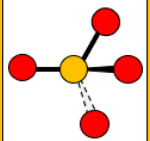
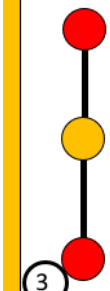

5
3 DOMAINS (1 LONE PAIR, 2 BONDED ATOMS)


4
TETRAHEDRAL


4
4 DOMAINS (4 BONDED ATOMS)


4
TRIGONAL PYRAMID


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

6 NH_3 3	7  3	8 4 ELECTRON DOMAINS (1 LONE PAIR, 3 BONDED ATOMS) 3
6 H_2O 3	7  3	8 4 ELECTRON DOMAINS (2 LONE PAIR, 2 BONDED ATOMS) 3
6 BCl_3 3	7  3	8 3 ELECTRON DOMAINS (3 BONDED ATOMS) 3
6 CH_4 3	7  3	8 4 ELECTRON DOMAINS (4 BONDED ATOMS) 3
6 CO_2 3	7  3	8 2 ELECTRON DOMAINS (2 BONDED ATOMS) 3

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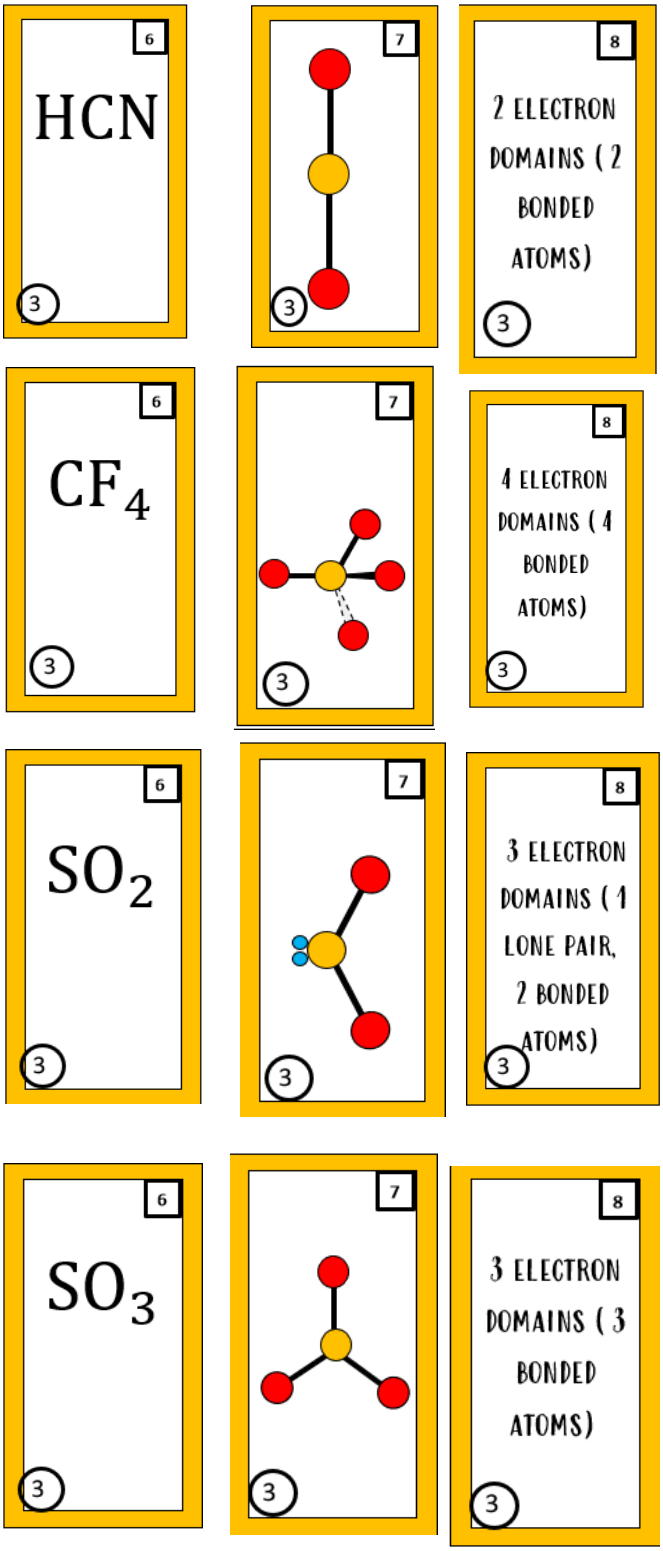
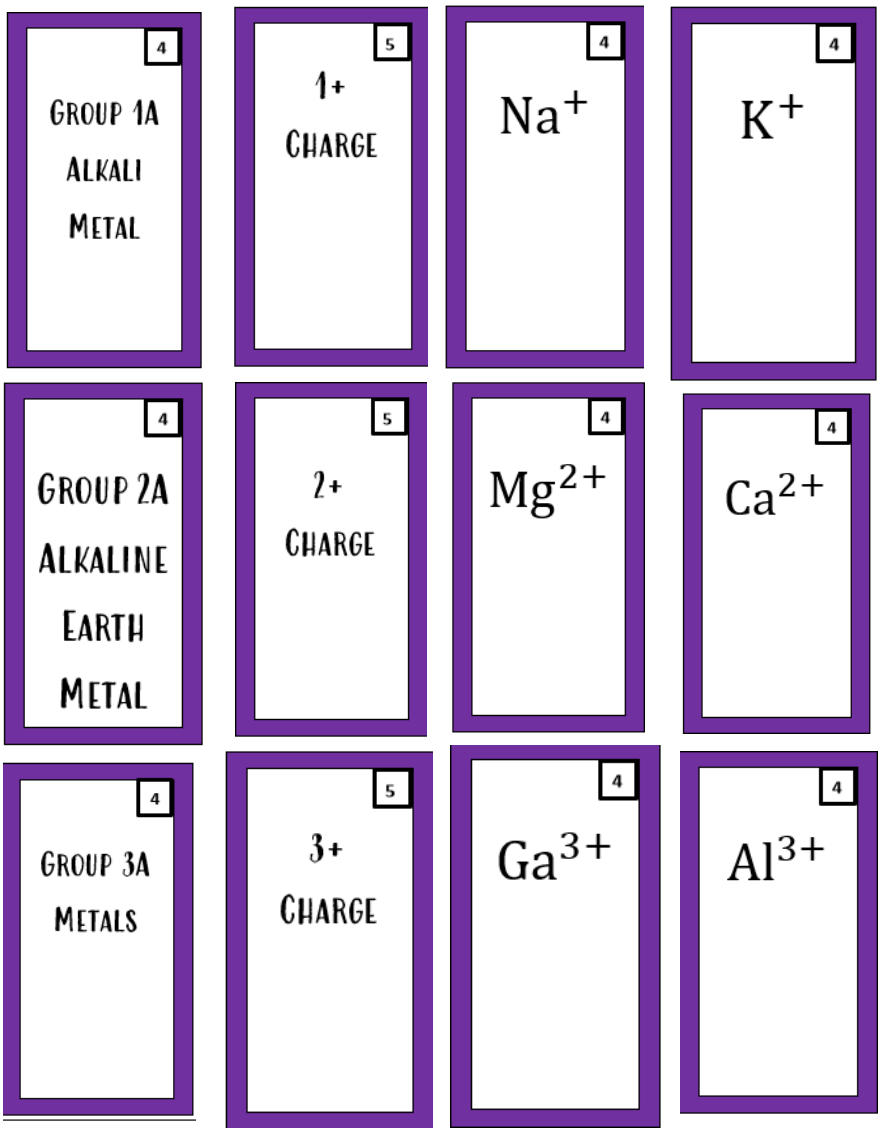
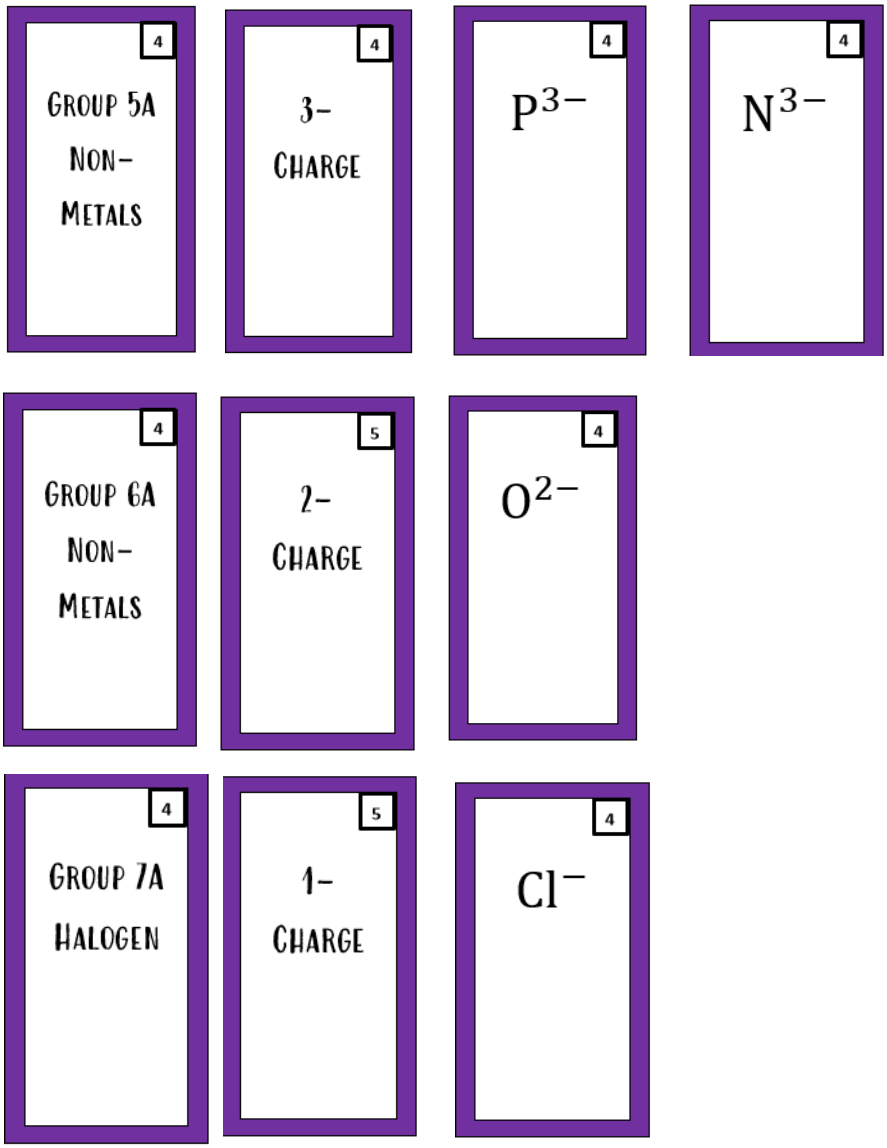


Category 10: Ionic Bonding




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

2

1

NON-POLAR BOND

2

ELECTRONEGATIVITY DIFFERENCE 0.4–1.8

1

COVALENT BOND

1

ELECTRONS ARE SHARED BETWEEN ELEMENTS / COMPOUNDS

1

DIHYDROGEN MONOXIDE

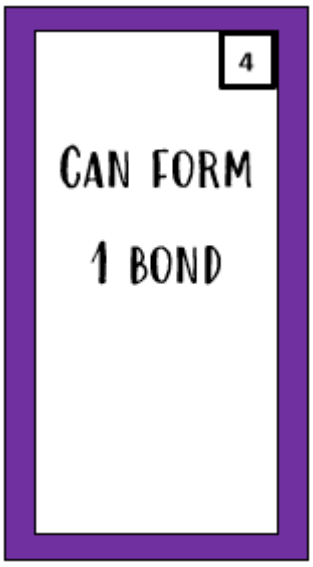
2

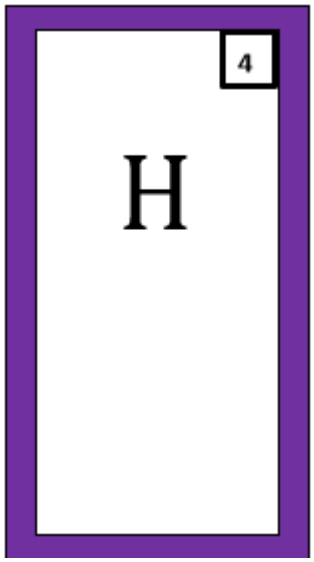
1

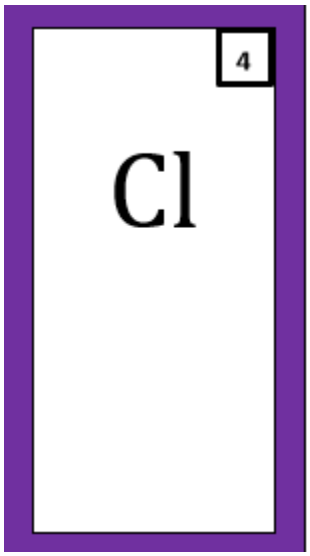
IONIC BOND

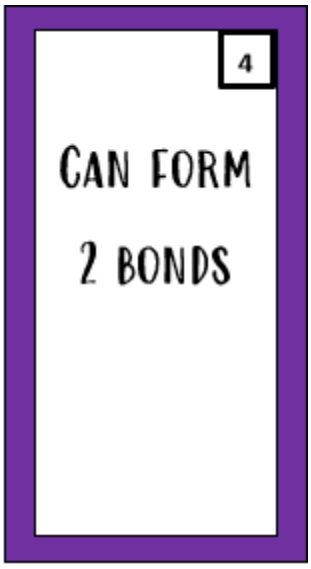
1

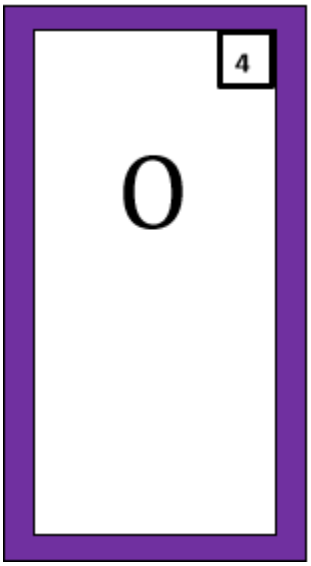
MORE ELECTRONEGATIVE ELEMENT TAKES ELECTRON PAIR

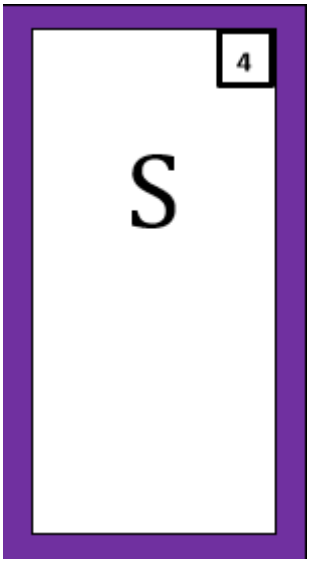

4
CAN FORM
1 BOND

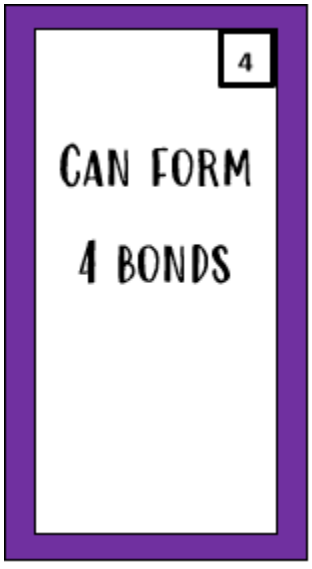

4
H

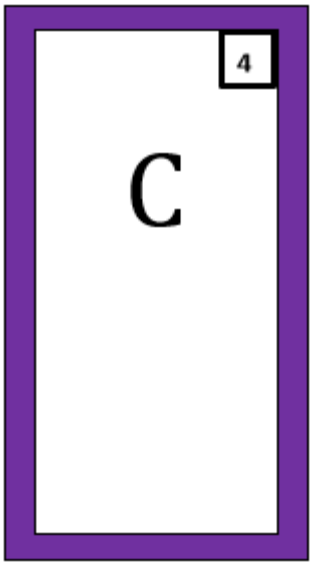

4
Cl


4
CAN FORM
2 BONDS

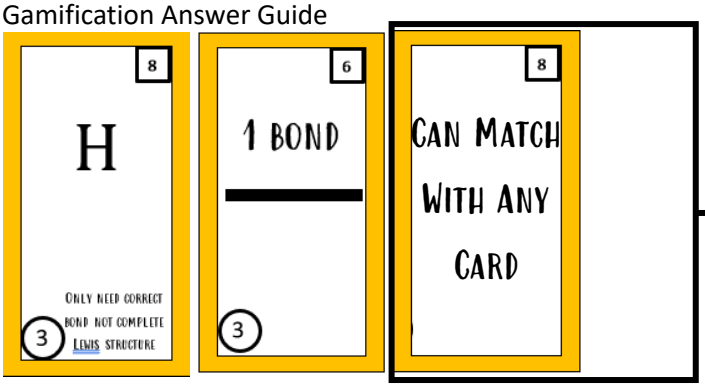

4
O


4
S

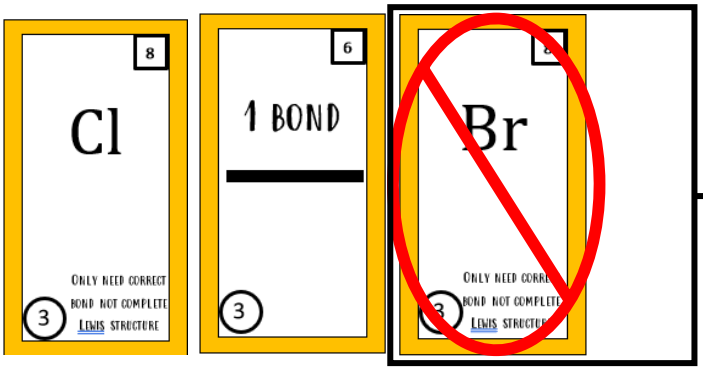

4
CAN FORM
4 BONDS


4
C

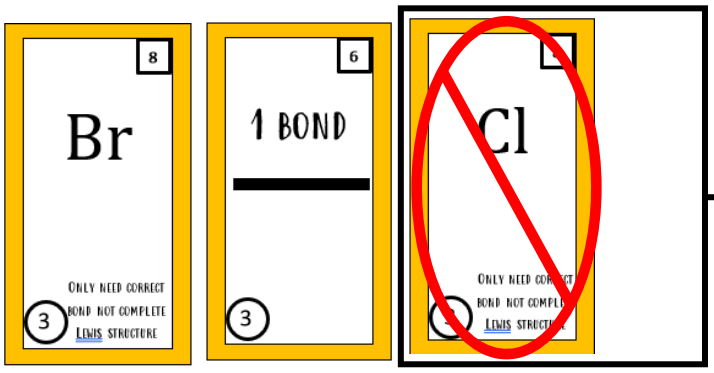
Gamification Answer Guide



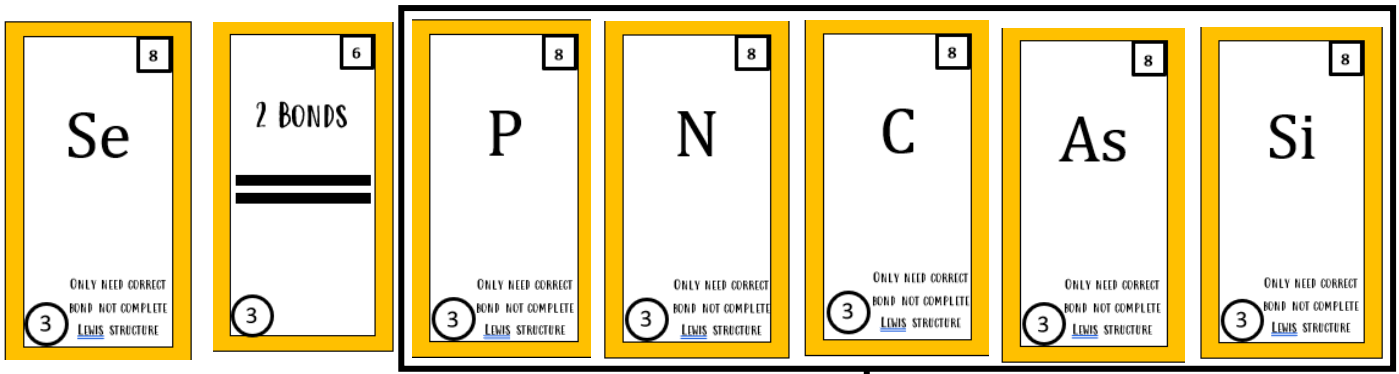
Any card played with the previous two will result in a correct match



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

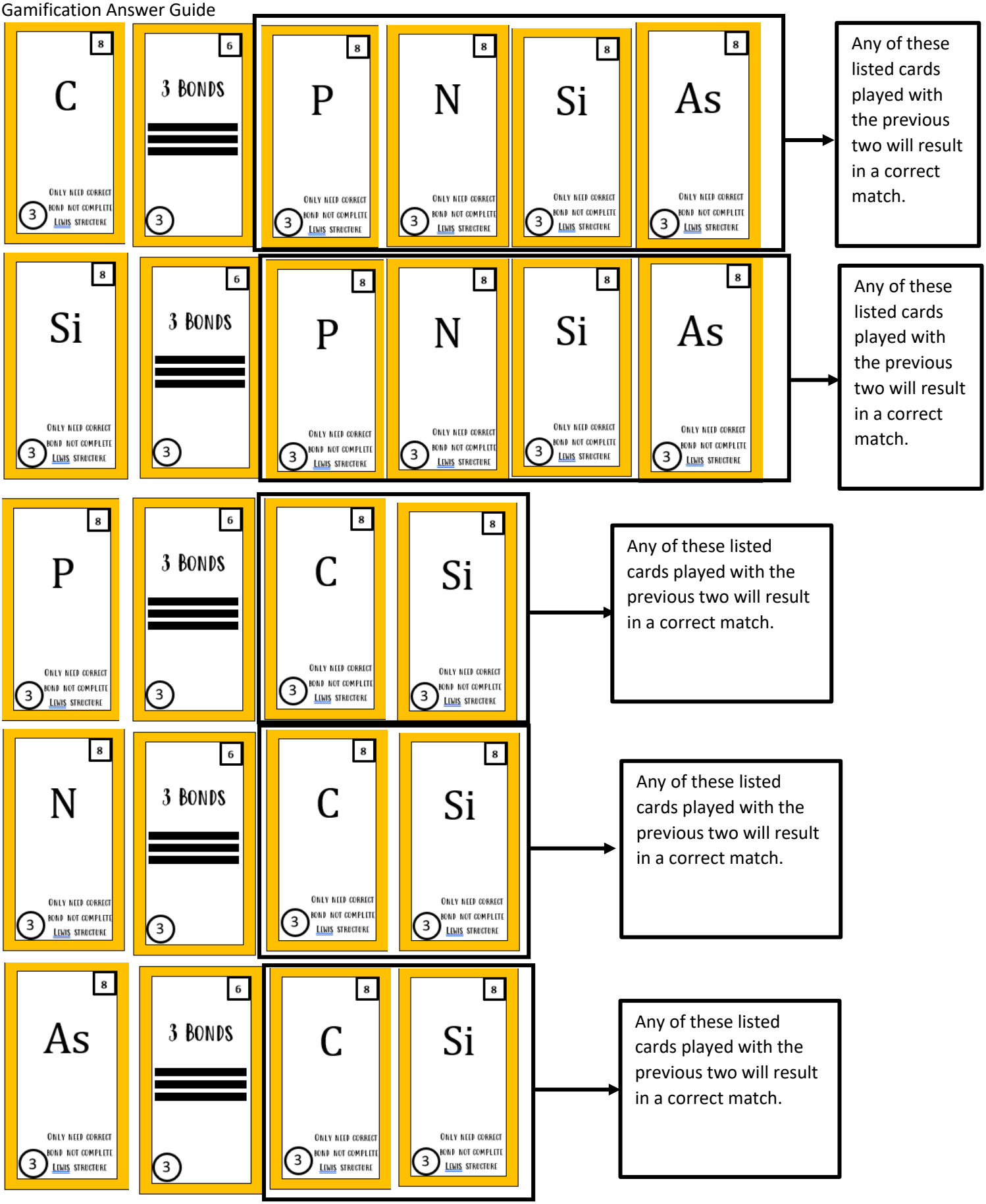


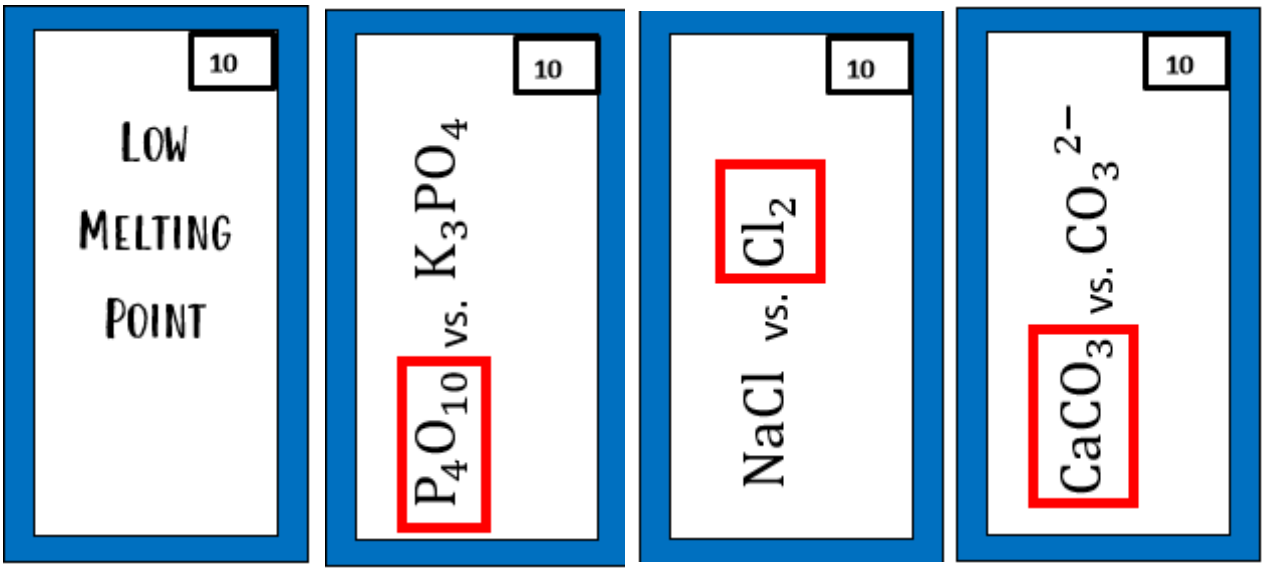
Any card played with the previous two will result in a correct match EXCEPT Cl.

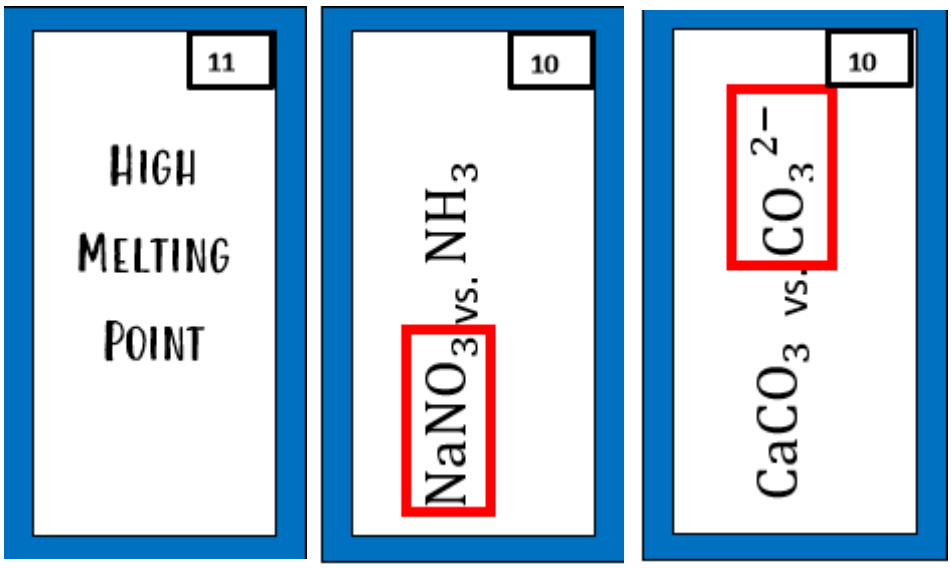


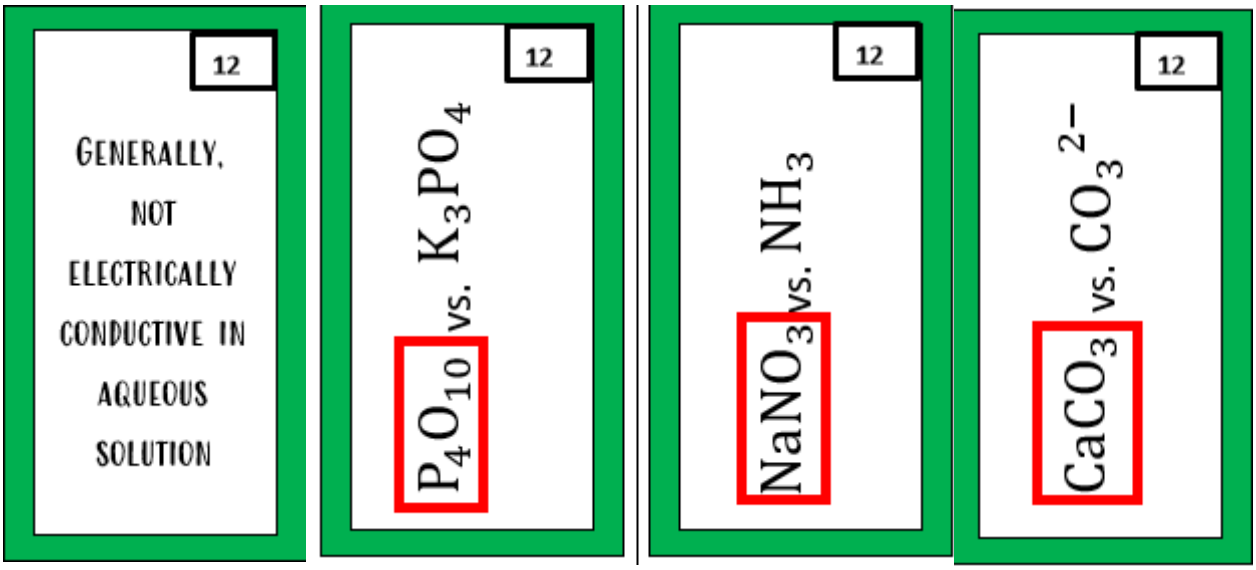
Any of these listed cards played with the previous two will result in a correct match.

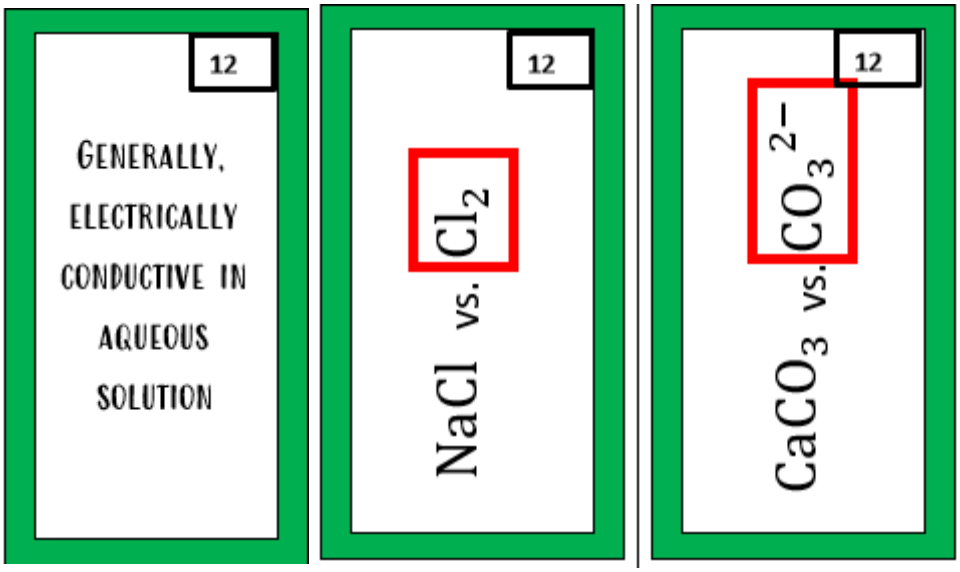
Gamification Answer Guide



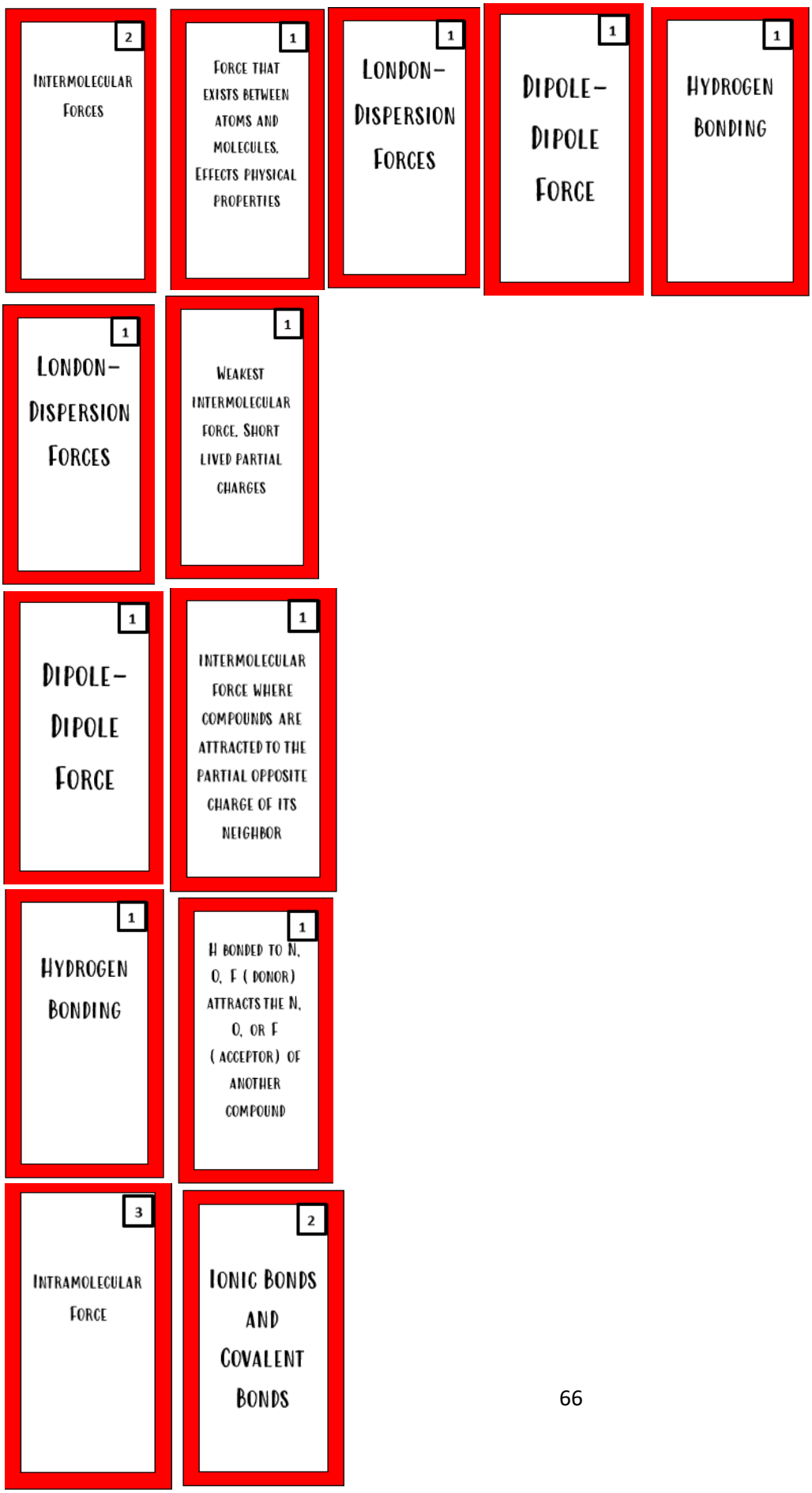

10
LOW MELTING POINT
10
P_4O_{10} vs. K_3PO_4
10
NaCl vs. Cl_2
10
$CaCO_3$ vs. CO_3^{2-}


11
HIGH MELTING POINT
10
$NaNO_3$ vs. NH_3
10
$CaCO_3$ vs. CO_3^{2-}

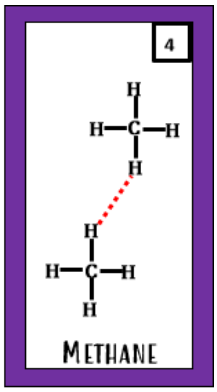

12
GENERALLY, NOT ELECTRICALLY CONDUCTIVE IN AQUEOUS SOLUTION
12
P_4O_{10} vs. K_3PO_4
12
$NaNO_3$ vs. NH_3
12
$CaCO_3$ vs. CO_3^{2-}

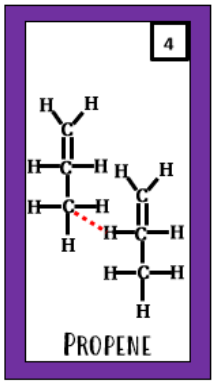

12
GENERALLY, ELECTRICALLY CONDUCTIVE IN AQUEOUS SOLUTION
12
NaCl vs. Cl_2
12
$CaCO_3$ vs. CO_3^{2-}

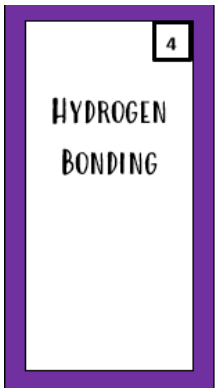
Category 12: Intermolecular Forces

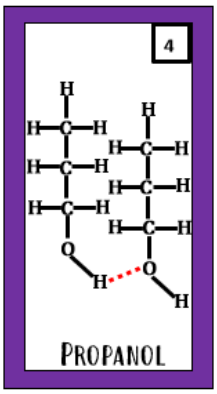


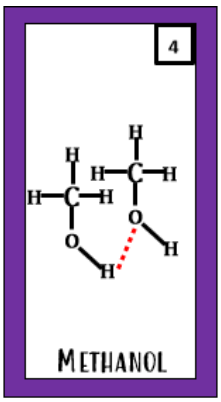
Gamification Answer Guide

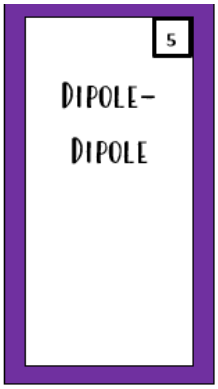


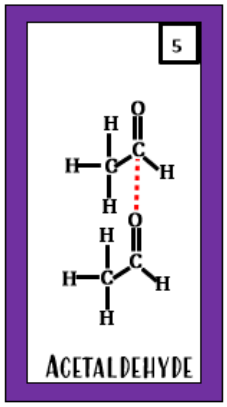






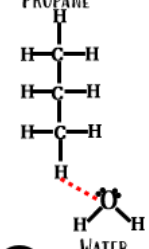






7

PROPANE



WATER

3

6

POLAR AND POLAR COMPOUNDS

3

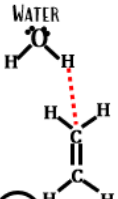
9

SOLUBLE TOGETHER

3

7

WATER



ETHYLENE

3

6

POLAR AND POLAR COMPOUNDS

3

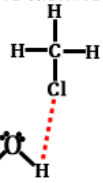
9

SOLUBLE TOGETHER

3

8

METHYL CHLORIDE



WATER

3

6

POLAR AND POLAR COMPOUNDS

3

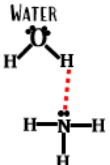
9

SOLUBLE TOGETHER

3

7

WATER



AMMONIA

3

6

POLAR AND POLAR COMPOUNDS

3

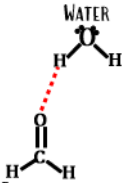
9

SOLUBLE TOGETHER

3

7

WATER



FORMALDEHYDE

3

6

POLAR AND POLAR COMPOUNDS

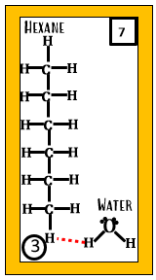
3

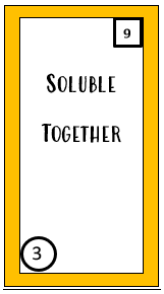
9

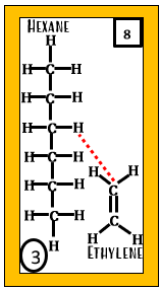
SOLUBLE TOGETHER

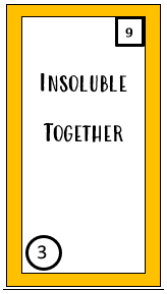
3

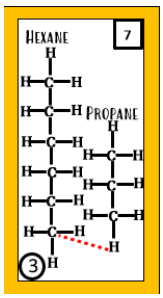
Gamification Answer Guide

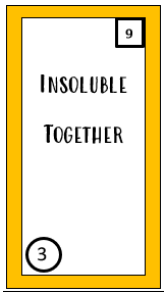


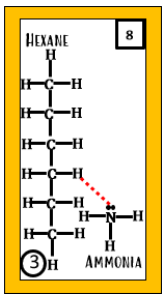


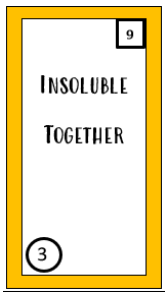


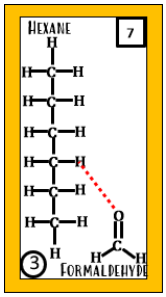


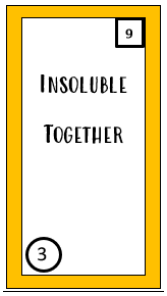


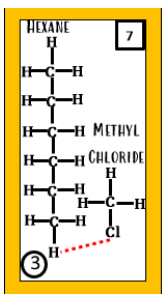


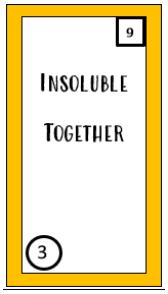


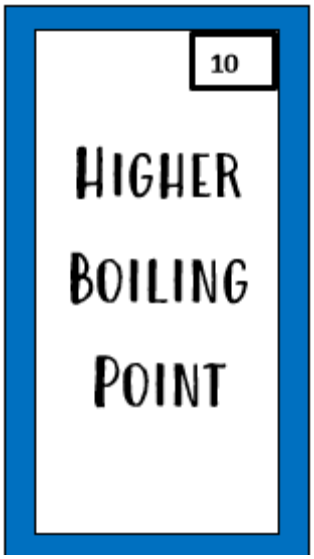


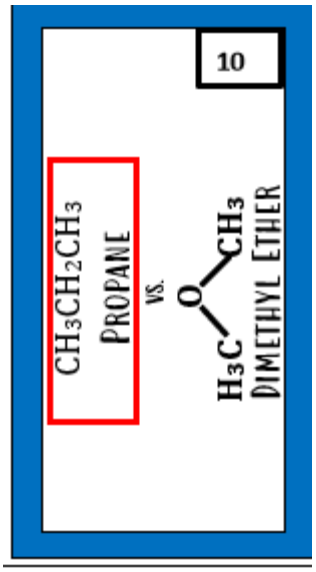


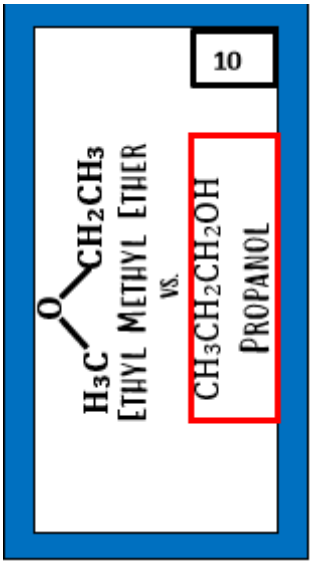


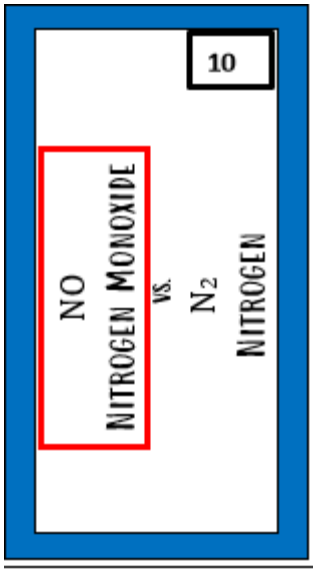


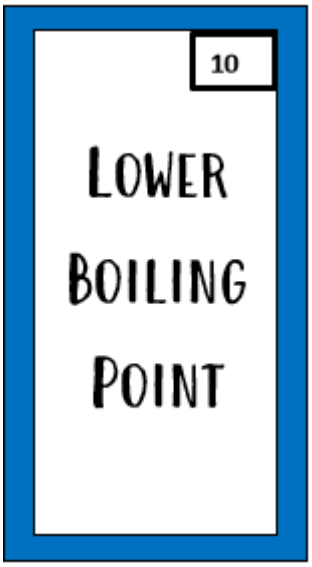


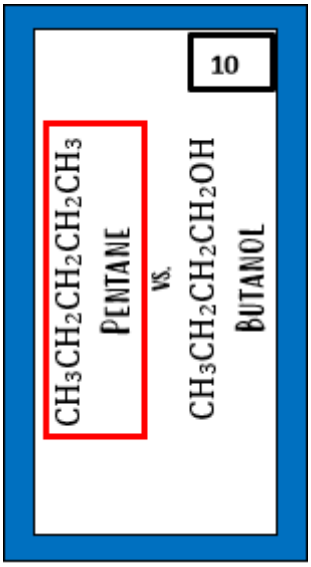

10
HIGHER BOILING POINT

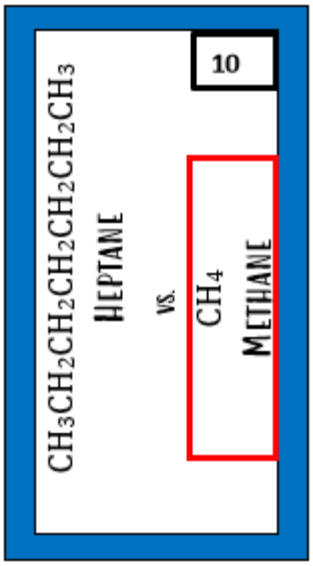

10
CH3CH2CH3
PROPANE
vs.
H3C
O
CH3
DIMETHYL ETHER

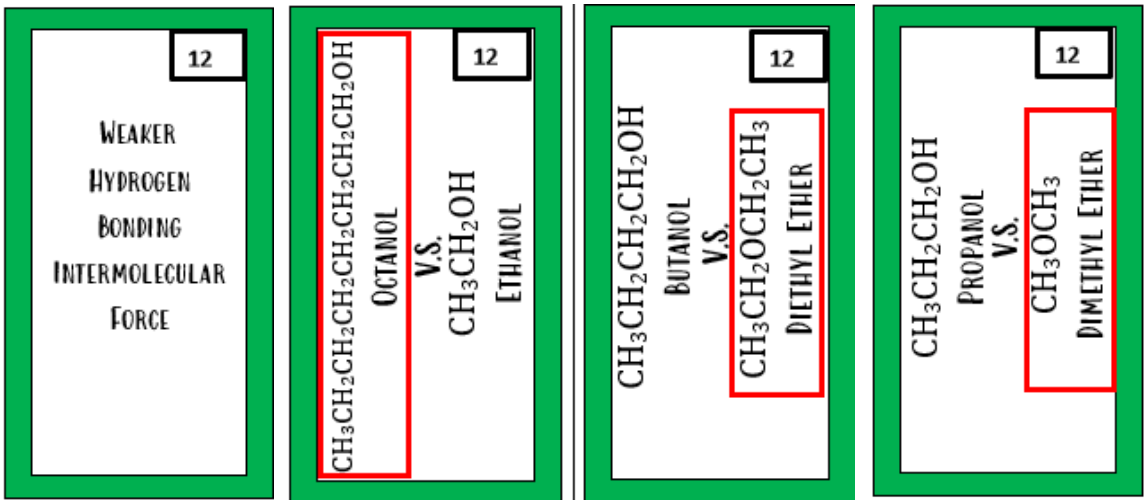

10
H3C
O
CH2CH3
ETHYL METHYL ETHER
vs.
CH3CH2CH2OH
PROPANOL

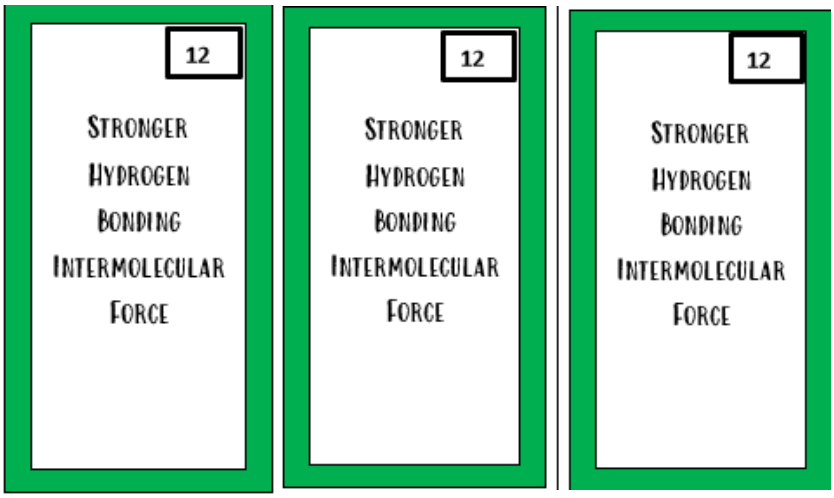

10
NO
NITROGEN MONOXIDE
vs.
N2
NITROGEN


10
LOWER BOILING POINT

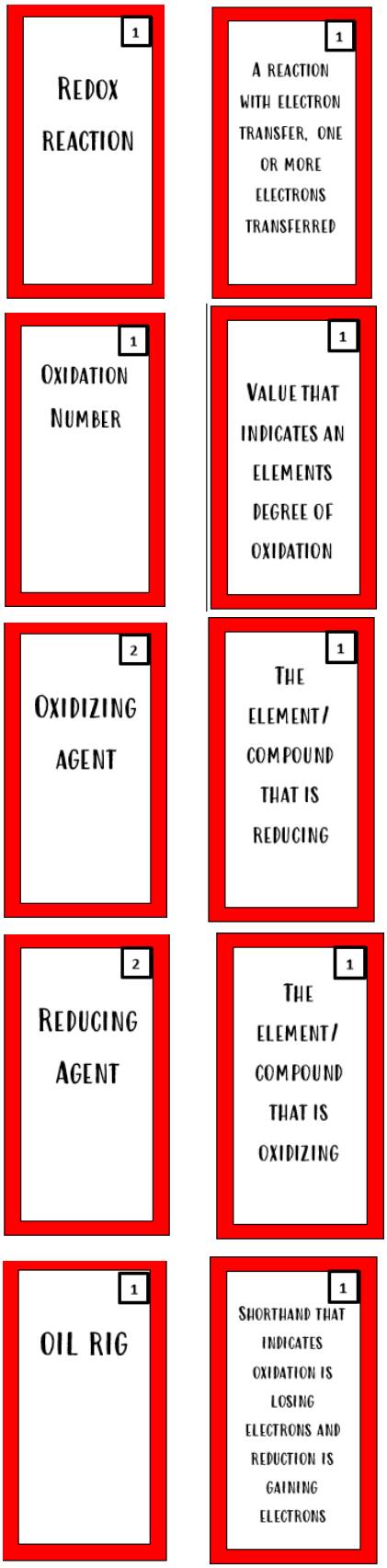

10
CH3CH2CH2CH2CH3
PENTANE
vs.
CH3CH2CH2CH2OH
BUTANOL

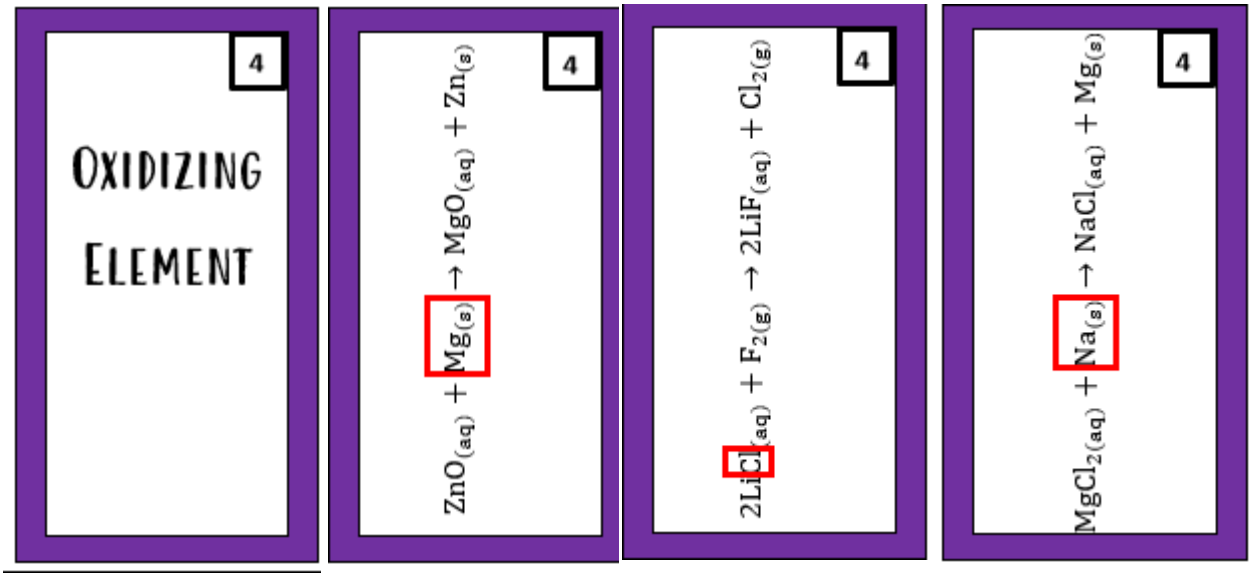

10
CH3CH2CH2CH2CH2CH2CH3
HEPTANE
vs.
CH4
METHANE

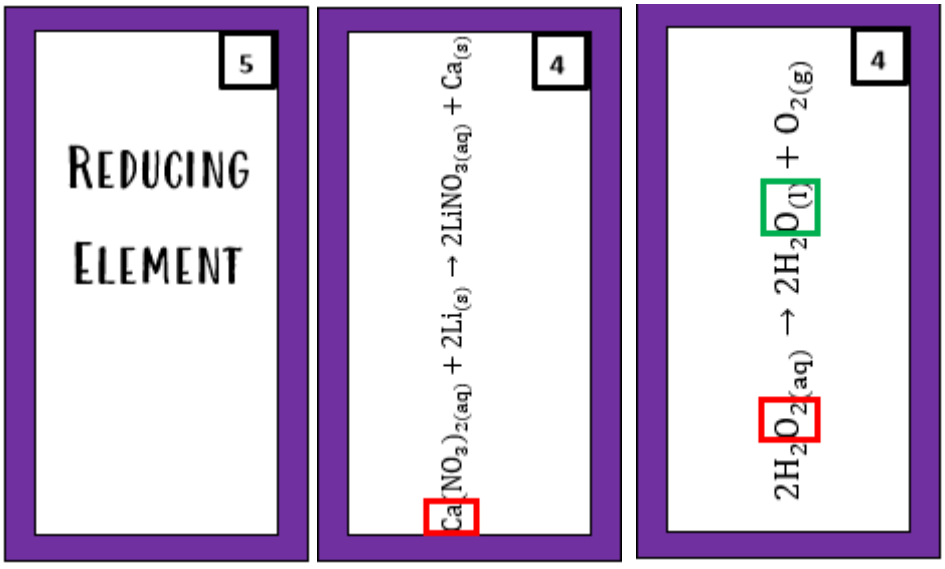

12
Weaker
Hydrogen
Bonding
Intermolecular
Force
12
$CH_3CH_2CH_2CH_2CH_2CH_2CH_2OH$
Octanol
V.S.
CH_3CH_2OH
Ethanol
12
$CH_3CH_2CH_2CH_2OH$
Butanol
V.S.
$CH_3CH_2OCH_2CH_3$
Diethyl Ether
12
$CH_3CH_2CH_2OH$
Propanol
V.S.
CH_3OCH_3
Dimethyl Ether


12
Stronger
Hydrogen
Bonding
Intermolecular
Force
12
Stronger
Hydrogen
Bonding
Intermolecular
Force
12
Stronger
Hydrogen
Bonding
Intermolecular
Force

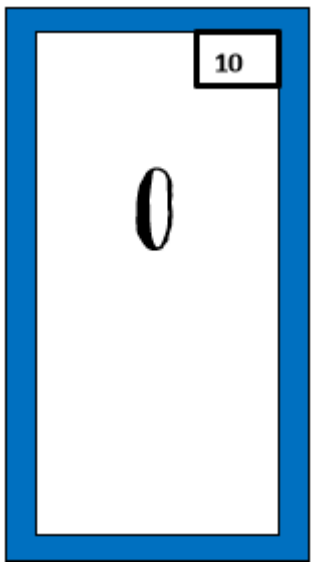
Category 13: Redox Reaction




4
OXIDIZING ELEMENT
4
$ZnO_{(aq)} + Mg_{(s)} \rightarrow MgO_{(aq)} + Zn_{(s)}$
4
$2LiCl_{(aq)} + F_{2(g)} \rightarrow 2LiF_{(aq)} + Cl_{2(g)}$
4
$MgCl_{2(aq)} + Na_{(s)} \rightarrow NaCl_{(aq)} + Mg_{(s)}$


5
REDUCING ELEMENT
4
$Ca(NO_3)_{2(aq)} + 2Li_{(s)} \rightarrow 2LiNO_{3(aq)} + Ca_{(s)}$
4
$2H_2O_{2(aq)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$

3
$2H_2O_{(l)} + 2Na_{(s)}$
REACTANTS
6
3
$2NaOH_{(aq)}$
PRODUCT
8
3
$H_2(g)$
PRODUCT
8
3
$Cu(NO_3)_{2(aq)} + Mg_{(s)}$
REACTANTS
6
3
$Mg(NO_3)_{2(aq)}$
PRODUCT
8
3
$Cu(s)$
PRODUCT
8
3
$AlPO_{4(aq)} + Mg_{(s)}$
REACTANTS
6
3
$Mg_3(PO_4)_{2(aq)}$
PRODUCT
8
3
$Al(s)$
PRODUCT
8
3
$2NaCl_{(aq)} + F_{2(g)}$
REACTANTS
6
3
$Cl_2(g)$
PRODUCT
8
3
$2NaF_{(aq)}$
PRODUCT
8
3
$2HCl_{(aq)} + Zn_{(s)}$
REACTANTS
6
3
$ZnCl_2(aq)$
PRODUCT
8
3
$H_2(g)$
PRODUCT
8


10
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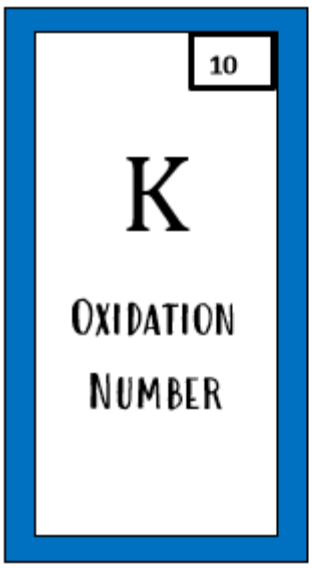
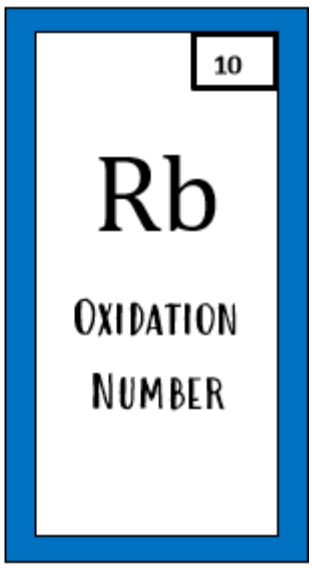
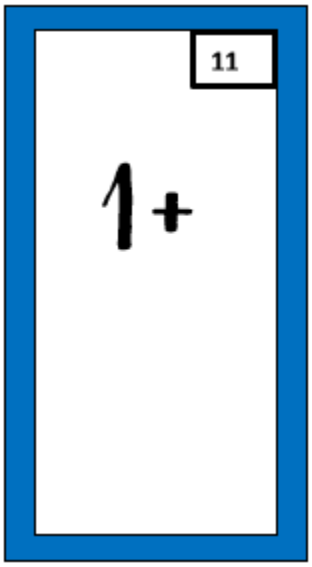
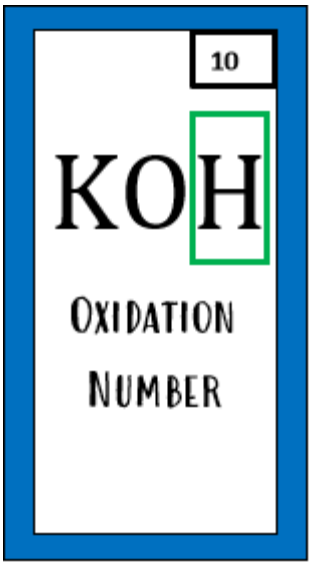
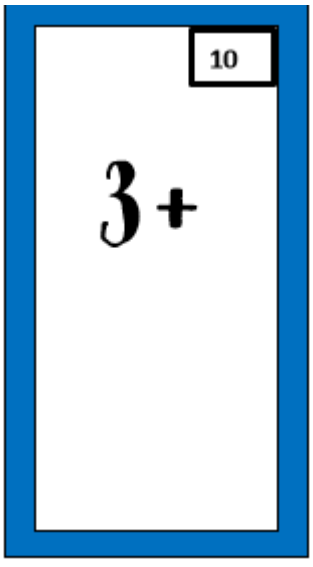
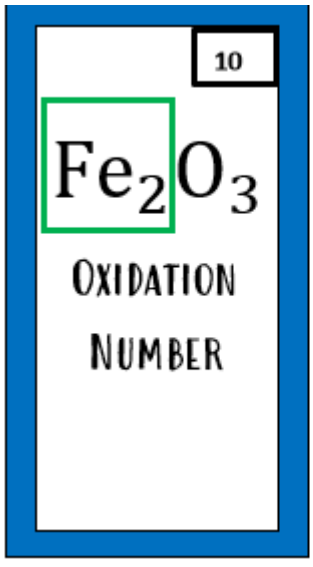

10
K
Oxidation
Number

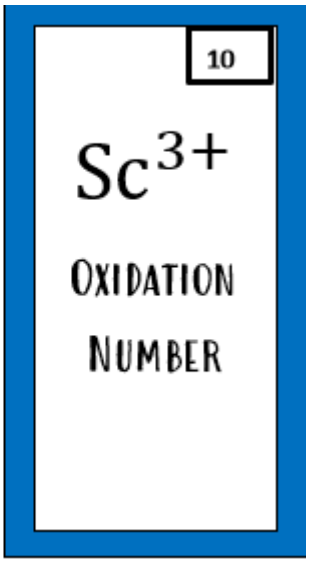

10
Rb
Oxidation
Number


11
1+

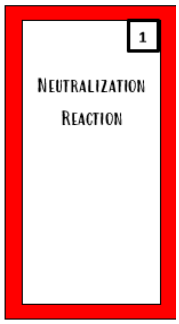

10
KOH
Oxidation
Number

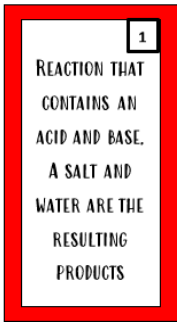

10
3+

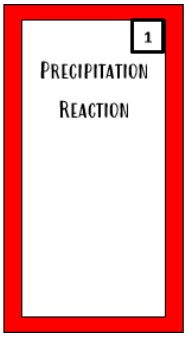

10
Fe2O3
Oxidation
Number

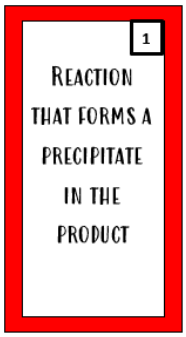

10
Sc3+
Oxidation
Number

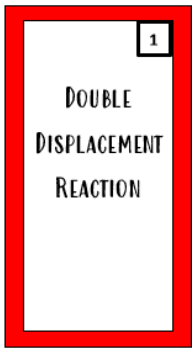
Category 14: Double Displacement

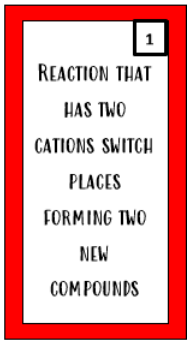


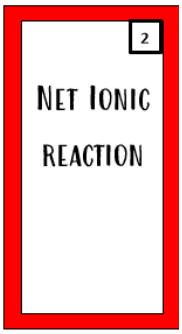


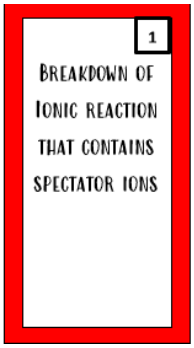


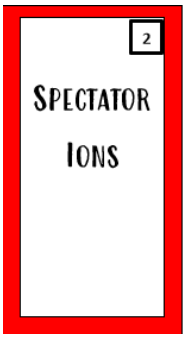


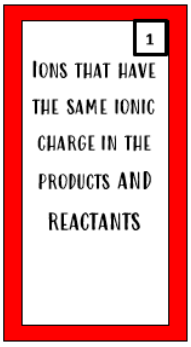




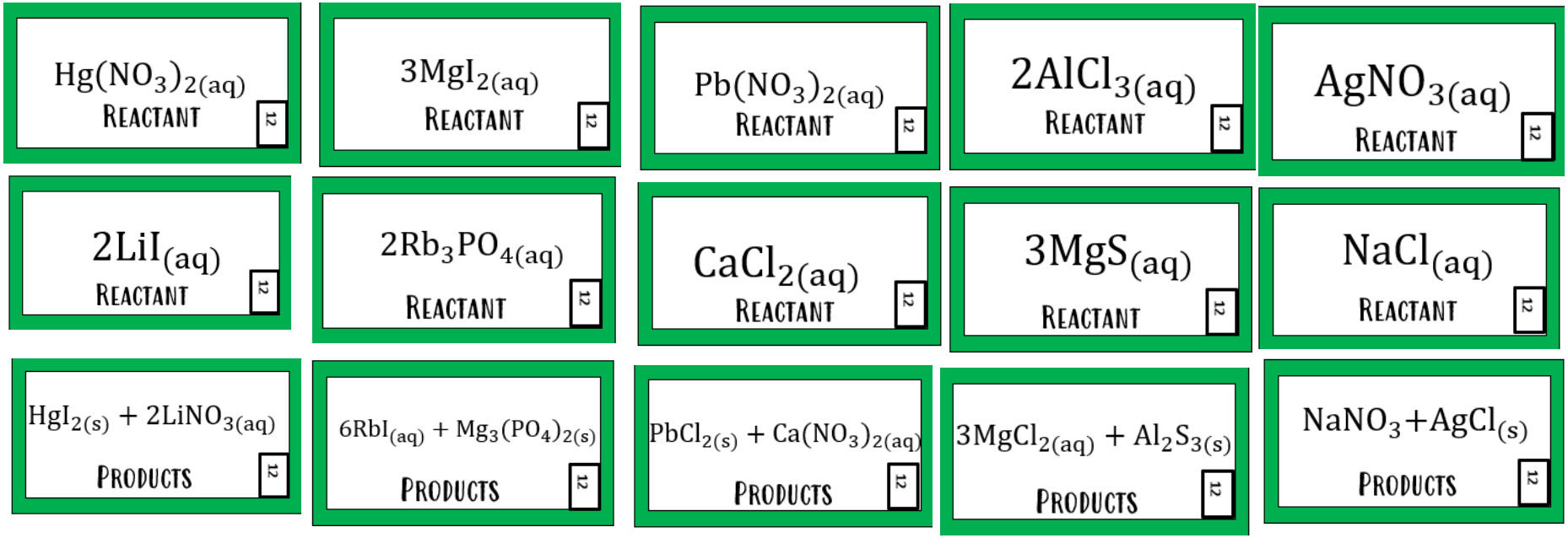








3
$Na_2CO_{3(aq)} + LiCl_{(aq)}$
REACTANTS
6
3
$NaCl_{(aq)}$
PRODUCTS
8
3
$Li_2CO_{3(aq)}$
PRODUCTS
8
3
$HNO_{3(aq)} + Mg(OH)_{2(aq)}$
REACTANTS
6
3
$H_2O_{(aq)}$
PRODUCTS
8
3
$MgNO_{3(aq)}$
PRODUCTS
8
3
$BaSO_{4(aq)} + KCl_{(aq)}$
REACTANTS
6
3
$BaCl_{(aq)}$
PRODUCTS
8
3
$KSO_{4(aq)}$
PRODUCTS
8
3
$CuO_{(aq)} + FeCl_{2(aq)}$
REACTANTS
6
3
$FeO_{(aq)}$
PRODUCTS
8
3
$CuCl_{2(aq)}$
PRODUCTS
8
3
$Pb(NO_3)_{2(aq)} + 2KI_{(aq)}$
REACTANTS
6
3
$2KNO_{3(aq)}$
PRODUCTS
8
3
$PbI_{2(s)}$
PRODUCTS
8


$Hg(NO_3)_{2(aq)}$
Reactant
12
$3MgI_{2(aq)}$
Reactant
12
$Pb(NO_3)_{2(aq)}$
Reactant
12
$2AlCl_{3(aq)}$
Reactant
12
$AgNO_{3(aq)}$
Reactant
12
$2LiI_{(aq)}$
Reactant
12
$2Rb_3PO_{4(aq)}$
Reactant
12
$CaCl_{2(aq)}$
Reactant
12
$3MgS_{(aq)}$
Reactant
12
$NaCl_{(aq)}$
Reactant
12
$HgI_{2(s)} + 2LiNO_{3(aq)}$
Products
12
$6RbI_{(aq)} + Mg_3(PO_4)_{2(s)}$
Products
12
$PbCl_{2(s)} + Ca(NO_3)_{2(aq)}$
Products
12
$3MgCl_{2(aq)} + Al_2S_{3(s)}$
Products
12
$NaNO_3 + AgCl_{(s)}$
Products
12