Honors Chemistry
Ms. Ye

Name _____
Date _____ Block _____

Nuclear Quest

Objective of the Game: The goal of Nuclear Quest is to move your nucleus (game piece) along the periodic table until you reach element 110.

Starting the game: Shuffle each card deck and place it facedown. Place your nucleus on Start and roll a die. The player with the highest number goes first. After that, play proceeds to the left.

Moving your nucleus: On your turn, roll the dice and move your nucleus that many spaces on the periodic table, following the order of the atomic numbers

- ***Rolling doubles:*** If you roll doubles, you can double the amount on the two dice and move that many spaces
- ***Space is occupied:*** If you land on a space occupied by another player, nuclear bombardment occurs. The other play must roll one die and move back that many spaces
- ***Going to the Hospital:*** Lose one turn in the hospital. Return to the first element of the period you were in.

Draw a Card: After your move, draw a card from the Nuclear Quest deck and follow the directions. Return the card to the bottom of the pile.

- ***Gamma Radiation Cards:*** If you draw an Alpha Decay card, a Beta Decay card, or a Fission card, you must also draw a card from the Gamma Radiation deck (If you are in the radioactive zone, you must draw *two* cards). You must hold on to the Gamma Radiation cards until you can block them with a Lead Shield, or until you collect 30 roentgens and lose a turn (At that point, you return the cards to the bottom of the Gamma Radiation pile).
- ***Lead Shield Card:*** You can use a Lead Shield at the end of any turn to block up to 25 roentgens of radiation from the Gamma Radiation Cards. Once you have used the Lead Shield card, return it to the bottom of the Nuclear Quest deck. Return the blocked gamma radiation cards to the bottom of the Gamma Radiation deck.
- ***Radiation Sickness Cards:*** If you draw a Radiation Sickness card, you can use it to send any player to the hospital with radiation sickness. They can't block this with a Lead Shield Card.

Winning the Game: The first player to reach element 110 wins the game

- A player does not need to roll the exact number on the dice to land on element 110 (i.e. if the player is 4 spaces away, he/she can win the game by rolling a 4, 5, or 6)
- To win, the player must be free of Gamma Radiation cards. The player may use a Lead Shield card or lose one turn to block the remaining Gamma Radiation cards.

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Nuclear Quest Game Questions:

1. Examine the different types of nuclear quest cards. Which ones causes the nucleus of one element to change into the nucleus of a different element?

   a. From your answers above, which ones change the nucleus of one element into the nucleus of an element with a *larger* atomic number? How do you know?

   b. From your answers above, which ones change the nucleus of one element into the nucleus of an element with a *smaller* atomic number? How do you know?

2. Examine the "alpha decay" card. How does the identity of an element change when it undergoes alpha decay? How does the number of protons change? Is there a change in the mass?

3. Examine the "beta decay" card. How does the identity of an element change when it undergoes beta decay? How does the number of protons change?

4. When does gamma radiation occur? Did picking up or discarding a gamma radiation card change the identity or your element?

5. List 2 things you learned about nuclear fission.

6. List 2 things you learned about nuclear fusion.

7. Based on the game and the information on the nuclear quest cards, describe what you think a nuclear reaction is.

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*(Review): **Isotopes**=_____

They have the _____ but a _____

***Nuclear Reaction:** a reaction that involves a _____ in the _____ of an atom.

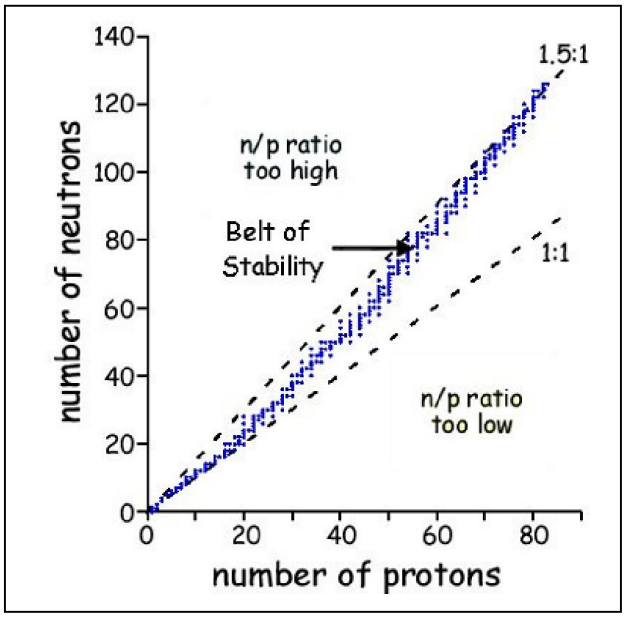
Nuclear reactions occur because the nucleus of an atom is _____

Let's take a closer look inside the nucleus of atoms…

- There are 2 subatomic particles in the nucleus: _____ + _____
  - Protons have a _____charge, whereas neutrons have _____ charge.
  - **As atomic # increases**, the # of protons _____, & nuclear charge _____. This causes more _____ within the nucleus.
  - _____ help _____ by _____ the repulsive forces between protons

Stability of the Nucleus

- Whether a nucleus of an atom is _____ or _____ depends on the ratio of _____ to _____ in the nucleus.
- **<u>General</u> Stable Neutron to Proton ratios (N/P)**
  - For elements 1-19 (Hydrogen to Potassium): _____
  - For elements 20 to 83 (Calcium to Bismuth): _____
  - All elements with atomic number _____ are unstable (and radioactive)



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Practice: Calculate the neutron to proton ratio (n/p) for the following isotopes and determine whether the isotope is stable or unstable

Isotope	**# protons**	**# neutrons**	**n/p ratio**	**Stable or unstable**
K—39	**19**	**20**	20/19 **= 1.05**	**Stable**
H—3				
Na-25				
C—12				
C—14				
Os-188				
Fr-223				

- Atoms with an unstable nucleus undergo nuclear decay or radioactive decay.
- **Radioactivity** refers _____ (given off) as a result of a _____ (breaking down). The following chart includes the common radioactive emissions that we will be talking about

Radiation Type	**Symbol for Particle Emitted**	**Penetrating Power (ability to pass through matter)**
Alpha Particle		
Beta Particle		
Gamma Particle		