**Atomic Structure**

**Objective:**

1. Use Bohr models and the periodic table to identify and calculate the number of subatomic particles in atoms for elements 1-20.
2. Differentiate between atomic number and atomic mass.
3. Recognize isotopes and ions for elements 1-20.

**Procedure:** Use your reading, periodic table, and bohr model flash cards to help you answer the following questions.

**I. Protons:**

1. Use the Bohr model cards and periodic table to help you fill out the following tables:

|  |  |  |
| --- | --- | --- |
|  | **Use Bohr Model** | **Use Periodic Table** |
| **Element**  **Symbol** | **How many protons are there?** | **What is the atomic number?** |
| H |  |  |
| He |  |  |
| Li |  |  |
| Be |  |  |
| B |  |  |
| C |  |  |
| N |  |  |
| O |  |  |
| F |  |  |

|  |  |  |
| --- | --- | --- |
|  | **Use Bohr Model** | **Use Periodic Table** |
| **Element Symbol** | **How many protons are there?** | **What is the atomic number?** |
| Ne |  |  |
| Na |  |  |
| Mg |  |  |
| Al |  |  |
| Si |  |  |
| P |  |  |
| S |  |  |
| Cl |  |  |
| Ar |  |  |

2. How are the number of protons and the atomic number related?

3. The full chemical symbol for each element is located on the back of each Bohr model card. Where is the atomic number for each element ALWAYS written in relation to the chemical symbol? Where is the atomic mass for each element written?

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Use Bohr Model** | **Use Periodic Table** | **Use Bohr Model** | **Use your head** | **Use Periodic Table** | **Use Back of Bohr Model** |
| **Element**  **Symbol** | **How many protons are there?** | **What is the atomic number?** | **How many neutrons are there?** | **What is the sum total of protons and neutrons?** | **Write the mass # as it appears on the table** | **Write the mass number as it appears on the card** |
| Na |  |  |  |  |  |  |
| Mg |  |  |  |  |  |  |
| Al |  |  |  |  |  |  |
| Si |  |  |  |  |  |  |
| P |  |  |  |  |  |  |
| S |  |  |  |  |  |  |
| Cl |  |  |  |  |  |  |
| Ar |  |  |  |  |  |  |
| K |  |  |  |  |  |  |
| Ca |  |  |  |  |  |  |

4. Based on your observations, describe why the number of protons in an atom identifies it as an atom of a particular element.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Use Bohr Model** | **Use Periodic Table** | **Use Bohr Model** | **Use your head** | **Use Periodic Table** | **Use Back of Bohr Model** |
| **Element**  **Symbol** | **How many protons are there?** | **What is the atomic number?** | **How many neutrons are there?** | **What is the sum total of protons and neutrons?** | **Write the mass # as it appears on the table** | **Write the mass number as it appears on the card** |
| H |  |  |  |  |  |  |
| He |  |  |  |  |  |  |
| Li |  |  |  |  |  |  |
| Be |  |  |  |  |  |  |
| B |  |  |  |  |  |  |
| C |  |  |  |  |  |  |
| N |  |  |  |  |  |  |
| O |  |  |  |  |  |  |
| F |  |  |  |  |  |  |
| Ne |  |  |  |  |  |  |

**II. Neutrons:**

1. Use the Bohr model cards and periodic table to help you fill out the following tables:

5. Look at the mass numbers you copied from your periodic table for each element.

a. How do these values compare to the mass numbers as they appear on the back of the Bohr model for each element?

b. Why are the atomic masses for each element represented as decimals instead of whole numbers (Hint: use your reading to help you with this)?

6. Using your chart, write an equation for determining the atomic mass of an element.

Atomic Mass =

**III. Isotopes**

7. Open the baggie labeled Isotopes. Use the back of the Bohr models to locate the following isotopes.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Use Bohr Model** | **Use Periodic Table** | **Use Bohr Model** | **Use your head** |
| **Naturally occurring Isotopes** | **How many protons are there?** | **What is the atomic number?** | **How many neutrons are there?** | **What is the sum total of protons and neutrons?** |
| H-1 |  |  |  |  |
| H-2 |  |  |  |  |
| H-3 |  |  |  |  |
| C-12 |  |  |  |  |
| C-13 |  |  |  |  |
| C-14 |  |  |  |  |

8. a. Compare the number of protons and neutrons in H-1 to H-2 to H-3. List any similarities and differences.

b. Compare the number of protons and neutrons in C-12 to C-13 to C-14. List any similarities and differences.

9. The full chemical symbol for each element is located on the back of each Bohr model. What do the numbers after each chemical symbol represent?

10. Based on the patterns in your chart, define **isotope**.

**IV. Electrons**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Use Bohr Model** | **Use Periodic Table** | **Use Bohr Model** |
| **Element**  **Symbol** | **How many protons are there?** | **What is the atomic number?** | **How many electrons are there?** |
| H |  |  |  |
| He |  |  |  |
| Li |  |  |  |
| Be |  |  |  |
| B |  |  |  |
| C |  |  |  |
| N |  |  |  |
| O |  |  |  |
| F |  |  |  |
| Ne |  |  |  |

11. Use the Bohr model cards and periodic table to help you fill out the following tables:

|  |  |  |  |
| --- | --- | --- | --- |
| Na |  |  |  |
| Mg |  |  |  |
| Al |  |  |  |
| Si |  |  |  |
| P |  |  |  |
| S |  |  |  |
| Cl |  |  |  |
| Ar |  |  |  |
| K |  |  |  |
| Ca |  |  |  |

12. If protons are positively charged and electrons are negatively charged particles. What is the overall charge for each element listed above?

13. Suppose you do not have access to the Bohr models for the above elements. Describe how you can determine the number of electrons for a neutral element just by looking at the periodic table.

**V. Ions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Use Bohr Model** | **Use Periodic Table** | **Use Bohr Model** | **Use back of Bohr Model Card** |
| **Element**  **Symbol** | **How many protons are there?** | **What is the atomic number?** | **How many electrons are there?** | **What is the charge for each ion?** |
| Li |  |  |  |  |
| Li+ |  |  |  |  |
| Ca |  |  |  |  |
| Ca 2+ |  |  |  |  |
| S |  |  |  |  |
| S2- |  |  |  |  |
| F |  |  |  |  |
| F 1- |  |  |  |  |

14. Open the baggie labeled Ions. Use the back of the Bohr Model cards and the periodic table to fill out the following table.

15. Compare the neutral Li atom to the charged Li+ ion. What is the only difference between the two models?

16. Compare the neutral S atom to the charged S2- ion. What is the only difference between the two models?

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Use Bohr Model** | **Use Periodic Table** | **Use Bohr Model** |
| **Element**  **Symbol** | **How many protons are there?** | **What is the atomic number?** | **How many electrons are there?** |
| Li |  |  |  |
| Li+ |  |  |  |
| **Did Li gain or lose an electron(s)? How many?** | | | |
| S |  |  |  |
| S2- |  |  |  |
| **Did S gain or lose electron(s)? How many?** | | | |
| F |  |  |  |
| F 1- |  |  |  |
| **Did F gain or lose electron(s)? How many?** | | | |

17. Compare the neutral F atom to the charged F1- ion. What is the only difference between the two models?