CHEM1405 Worksheet 1 – Answers to Critical Thinking Questions

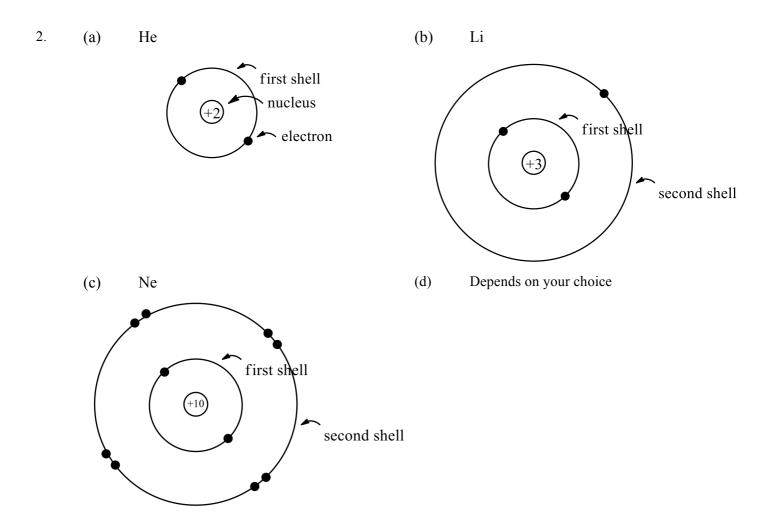
The worksheets are available in the tutorials and form an integral part of the learning outcomes and experience for this unit

Model 1: Bohr's Atomic Model

1. In the Bohr model, the atom is made up of a small positively charged nucleus with electrons that travel around it in circular orbits. It is often described as have the structure of the solar system with the nucleus replacing the Sun and the electrons replacing the planets.

In this model, the speed of the electrons is sufficient to prevent them from being pulled into the nucleus by the attraction to it but insufficient to allow them to escape.

The electrons can only have certain speeds which means that only discrete orbits are possible. Each orbit can only hold a certain number of electrons. After an orbit is full, the next level is used. These orbits correspond to *shells*. The first shell can hold 2 electrons. The second shell can hold 8 electrons. The third shell can hold 18 electrons. The fourth shell can hold 32 electrons.



3. The first shell (n = 1) can contain 2 electrons. The second shell (n = 2) can contain 8 electrons. The third shell (n = 3) can contain 18 electrons. The fourth shell (n = 4) can contain 32 electrons.

Number of electrons in a shell = $2n^2$.

Model 2: The Periodic Table

- 1. The elements are grouped in blocks which are 2, 6, 10 and 14 elements in width.
- 2. The first row has 2 members.

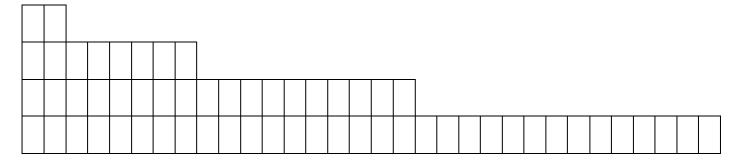
The second *and* third rows have 8 members, split into a group of 2 and a group of 6.

The fourth and fifth rows have 18 members, split into groups of 2, 6 and 10.

The sixth and seventh rows have 32 members, split into groups of 2, 6, 10 and 14.

- 3. The number of electrons in a shell in the Bohr model is related to the number of elements in a row.
- 4. The patterns are *different* to those in the Bohr model, which would suggest rows of 2, 8, 18 and 32 rather than 2, 8, 8, 18, 18, 32 and 32.

If the Bohr model were true, the Periodic Table would have the shape below.



In addition, the Bohr model does not predict the splitting of the elements in each row into blocks.

The Periodic Table was drawn up from experimental evidence accumulated over many centuries. Any model we have of the atom should explain the patterns it shows.

Although quite simple to understand, Bohr's model is not consistent with the Periodic Table. A better model is needed.