Topic 2.3 How can atomic theory explain patterns in the periodic table?

Parts of the Atom, pages 71–72

1. Students should indicate at least one sentence in the paragraph that helps them understand the key concepts. For example, the following sentence may help some students understand what an atomic nucleus is: "Each atom has a tiny, dense nucleus containing neutrons and protons."

2. Answers may vary. For example:

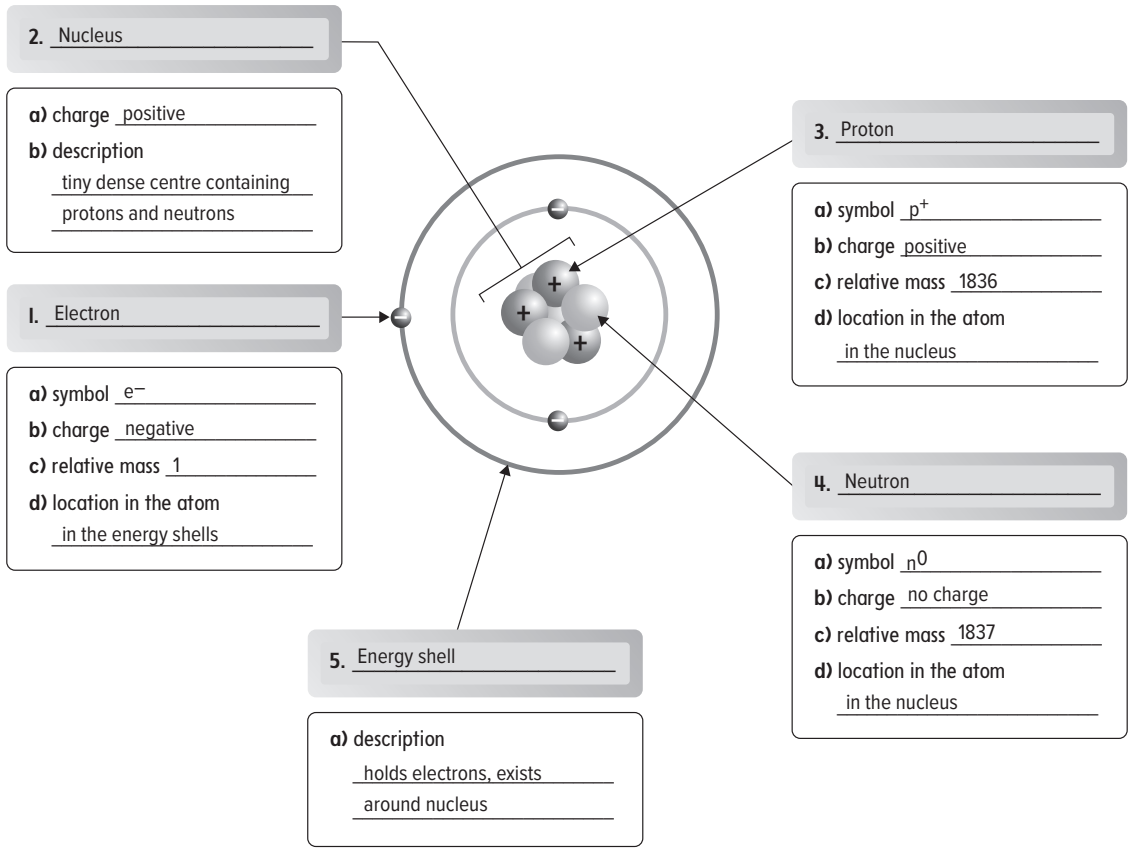
Section of the Textbook	Main Topic	What the Text Says About the Main Topic	Supporting Details
Page 124, "Key Features of Atomic Structure"	Parts of an atom	• the atom is the smallest unit of matter • it has a tiny, dense nucleus • the nucleus has protons and neutrons • electrons are found in energy shells • the nucleus accounts for the mass of the atom	• atoms of different elements all have protons, neutrons, and electrons

Summary Sentence: An atom is made up of three subatomic particles called protons, electrons, and neutrons.

3. a) Answers may vary. For example, if students chose the "Electric Charge" column, they might expect to see "positive," "negative," or "no charge" in that column.

b) Answers may vary. For example, if students chose "e^-," their sentence could be, "An electron is represented by the symbol "e^-."

4.



Bohr Diagrams, page 73

1. a) two-dimensional representation of the arrangements of electrons in energy shells in an atom

b) outermost energy shell of an atom

c) electron found in the outermost energy shell of an atom

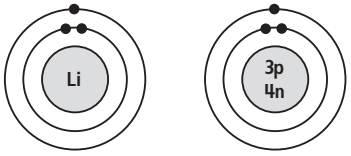
2. a) electrons **b)** energy shells

3. a) The first energy shell has a maximum of 2 electrons.

b) The second energy shell has a maximum of 8 electrons.

c) The third energy shell has a maximum of 8 electrons.

4. a)



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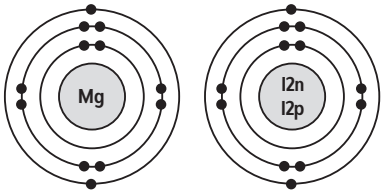

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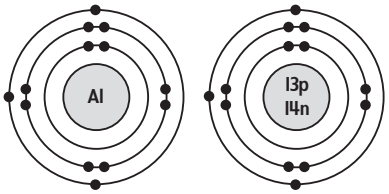

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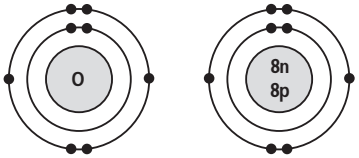

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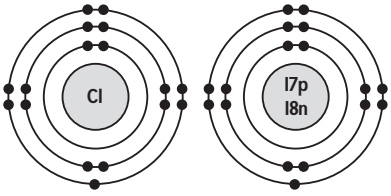

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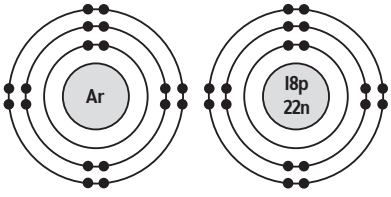
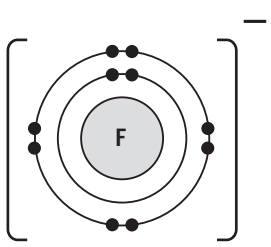
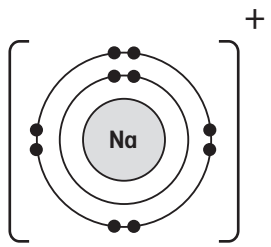
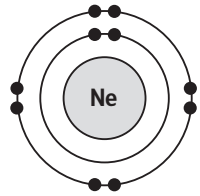


Full Valence Shells, page 72

1. The ion charge of atom indicates the number of electrons an atom tends to lose or gain.

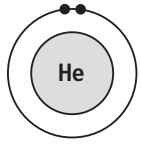
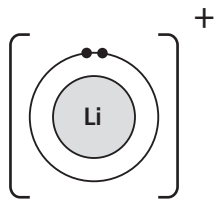
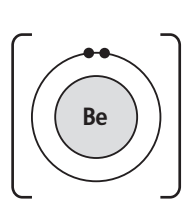
2. Atoms become ions to achieve full valence shells, which makes them more stable.

3. a) and **b)**

Fluorine Ion	Sodium Ion	Noble Gas = Neon
		

c) The ions and the noble gas all have full valence shells.

4. a) and **b)**

Helium Atom	Ion #1 = Lithium Ion	Ion #2 = Beryllium Ion
		

Electron Arrangements Show Patterns, page 75

1. a) They are located in the same row and, therefore, belong to Period 2.

b) The number of occupied energy shells for an atom is to the same as the period number.

2. a) Elements in Group 2 have two electrons in the outermost shell (i.e., they have two valence electrons).

b) The number of valence electrons is given by the group number.

3. a) The noble gases have full valence shells.

b) Helium is the only noble gas with 2 electrons in the outermost shell, while all the other noble gases have 8 electrons in the outermost shell.

4. a) Element I and Element II; Element III and Element IV

b) Element I and Element III; Element IV and Element V; Element II and Element VI

Periodic Trends, pages 76–77

1. The atomic size increases as you move down both groups.

2. The atomic size for halogens would also increase as you move down the column.

3. Atomic size decreases moving left to right across a period. Therefore, the alkali metals (Group 1) have a larger atomic size than the alkaline-earth metals (Group 2).

4. Calcium has four energy shells, while beryllium only has two energy shells. Therefore, the valence electrons in a calcium atom are further away from the nucleus, resulting in a larger atom.

5. a) Potassium is the most reactive, since the diagram indicates greatest reactivity for the elements closest to the top.

b) The reactivity increases as you move down the alkali metal group.

6. Rubidium would react more vigorously in water than potassium because rubidium is further down the group. The valence electron in a rubidium atom is farther away from the nucleus than that of a potassium atom, and therefore the electron is easier to remove.

7. The reactivity decreases as you move from left to right.

8. Lithium would be more reactive than beryllium because it is an alkali metal. It only needs to lose one electron as opposed to two electrons.

2.3 Assessment, pages 78–80

1. E	**8.** A	**15.** B
2. D	**9.** C	**16.** D
3. A	**10.** B	**17.** C
4. F	**11.** B	**18.** C
5. G	**12.** C	**19.** C
6. B	**13.** C	**20.** D
7. C	**14.** D	**21.** D

22. Answers may vary depending on students' learning and prior knowledge. Ensure students have understood what is meant by periodic trend.