Unit 2: Atoms, Moles and the Periodic Table

Chapter 3: Atoms and Moles

(Chapter Review on pg. 107 to 109)

25. **(a)** number of electrons in the 2*p* orbitals **(b)** *s* refer to a type of orbital
(c) 3 represents the energy level of the orbital

26. A mole is an Avogadro's number of particles (atoms or molecules), which equals to 6.022×10^{23}.

28. 196.97 g/mol **30.** 54 neutrons **32.** 9 protons

34. **(a)** $^{234}_{92}\text{U}$ **(b)** $^{235}_{92}\text{U}$ **(c)** $^{238}_{92}\text{U}$

36. **(a)** $^{12}_{6}\text{C}$ and $^{13}_{6}\text{C}$ **38.** $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$ or [Ar] $4s^2 3d^8$ **40.** 6 orbitals (*p* has 3 orbitals)

42. **(a)** 0.500 mol **(b)** 4.7 mol **(c)** 0.100 mol

44. 0.0051 g

46. **(a)** 1.2×10^{24} atoms **(b)** 6.03×10^{23} atoms **(c)** 2.7×10^{24} atoms **47.** 1.30 mol

(Standardize Test Prep on pg. 112 & 113)

1. A **2.** I **3.** A

4. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$ or [Ar] $4s^2 3d^{10} 4p^5$

5. De Broglie suggested that electrons could behave as waves. For evidence, he used the observation that electrons have specific frequencies, and they diffract.

6. No. Xenon is a noble gas, so all of its electron orbitals are filled. Therefore, there can be no unpaired electrons.

7. H **8.** B

9. The current model of the atom would change if new data were found about atoms that could not be explained by the existing model. The new model would explain both the new data and all earlier observations.

10. I **11.** C **12.** G **13.** Atomic number = 22

Chapter 4: The Periodic Table

(Chapter Review on pg. 150 to 153)

14. Moseley arranged the elements according to their atomic numbers, while Mendeleev had arranged them based on their atomic mass.

15. He left gaps for the elements that he predicted would be discovered and which would have certain properties.

16. His success in predicting the properties of elements that had not yet been discovered gave him credibility.

18. It has two valence electrons and six occupied energy levels.

19. With only one proton and one electron, hydrogen does not exhibit the same properties shared by the elements making up any of the groups in the periodic table.

20. All halogens have seven valence electrons and are therefore on electron short of having a full valence shell. As a result, they readily react to acquire this one electron.

21. Noble gases do not normally react with other elements because of the stability resulting from their filled electron configurations.

22. The outer electrons of Group 1 and 2 are in the *s* orbitals. The outer electrons of the transition metals are in *d* orbitals and *s* orbitals.

23. Pure iron is too soft to make nails. Adding carbon produces a harder alloy.

24. Some metals are brittle. Therefore this element may be metal if it is shown to be an excellent conductor of electricity.
25. This arrangement keeps the periodic table conveniently narrow.
26. They exhibit all the properties characteristics of the elements.
27. Ionization energy slightly decreases as you move down a group and increases significantly as you move across a period. Increased distance (more energy levels) from the nucleus allows removal of an electron using less energy as one move down the group. Across the period, the number of core electrons stays the same while the number of protons and valence electrons increase. This decrease the shielding effect and the atoms become smaller. Hence, one has to go deeper to remove an electron, increasing the ionization energy.
29. As electrons are added across a period, they are entering the same principal energy level. The increasing nuclear charge (smaller shielding effect) pulls these electrons closer, making the atoms progressively smaller across a period. As electrons are added down a group, they are entering another principal energy level, thus increasing the size of the atom.
30. Electron affinity generally increases because the effective nuclear charge increases. Electron shielding does not play a role because electrons are not added to inner energy levels.
31. C
32. Electronegativity decreases as you move down a group because of the increasing electron shielding and increases as you move across a period because of the increasing effective nuclear charge.
33. Because the *d*-orbital are completely filled (no unpaired electrons), mercury forms weaker bonds than most of the other elements in Period 6.
51. Helium is a noble gas and unreactive.
52. Mendeleev placed Be, Mg, Zn, and Cd in one group because he noticed that these elements had similar chemical reactivities. The same was true for Ca, Sr, Ba, and Pb.
59. The graph shows how atomic radius changes as you move across the elements in periods 2 through 6 and from hydrogen to helium.
60. Atomic radius, in units of picometres (pm).
61. Group 1.
62. The break indicates that the atomic radii of the transition elements in Groups 3 through 11 are not included in this graph.
63. Period 6.
64. This indicates that the atomic radii for these two elements are almost the same.

(Standardize Test Prep on pg. 154 & 155)

1. C **2.** I **3.** C **4.** H
5. The gaps were significant because they predicted the properties of new elements that would be discovered. Their discovery demonstrated that the table was a useful tool for organizing information about atoms.
6. Because the periodic table is based on atomic number, not atomic mass. The atomic number of iodine is one higher than the atomic number of tellurium.
7. Level 4 **8.** D **9.** G
10. It is easier to determine the column because all the elements in a column have the same outer electron structure and, therefore, similar properties. Properties of elements across a row of the table vary widely.
11. D **12.** G
13. Ionization energy tends to increase from left to right across the table because elements have increasingly more protons so the attraction on the outer electrons is stronger.