

# SC1 – O'Malley SAT II Review (Atomic Structure & Periodic Trends)

For 1 – 5:

- Alkali metals
- Alkaline Earth metals
- Metalloids
- Halogens
- Rare earth metals

- Which of the following is used primarily in semiconductors?
- Which occur as diatomics?
- Which make oxides with the formula  $X_2O$ ?
- Which have large electronegativity values?
- Which have small ionization energies?

For 6 – 9:

- $Na^+$
- Al
- F
- Ti
- B

- Which has seven valence electrons?
- Which has an electron configuration  $1s^2 2s^2 2p^6 3s^2 3p^1$ ?
- Which has the same electron configuration as the neon atom?
- Which has valence electrons in the d orbitals?

For 10 – 14:

- Alkali metals
- Alkaline Earth metals
- Noble gases
- Halogens
- Transition metals

- Which are the most unreactive family of elements?
- Which form negative ions in an ionic bond?

- Which consist of atoms that have valence electrons in a d subshell?
- Which exist as diatomic molecules at room temperature?
- Which group possesses the lowest first ionization energy in their respective period?

For 15 – 17:

- Bohr model
  - deBroglie's wave hypothesis
  - Heisenberg's uncertainty principle
  - Quantum theory
  - Atomic theory
- Which principle provides that all matter may be considered a wave?
  - What views electrons in true orbits around the nucleus?
  - What considers that one cannot know position and velocity of an electron at the same moment?

Q	Statement I	Because	Statement II
18.	The metalloids have similar characteristics	Because	Their valence shells have the same configuration
19.	Metals are good conductors of heat and electricity	Because	The positive nuclei are surrounded by a "sea" of mobile electrons
20.	Elements in a group have similar properties	Because	Their valence shells have the same energy
21.	The first ionization energy for an atom is greater than the second ionization energy	Because	The closer an electron is to the nucleus, the more difficult it is to remove
22.	Sodium has a smaller atomic radius than chlorine	Because	A sodium atom does not have as many valence electrons as a chlorine atom does.
23.	Carbon's electric configuration is $1s^2 2s^2 2p^2$ rather than $1s^2 2s^2 3s^2$	Because	3s electrons are lower in energy than 2p electrons
24.	The properties of phosphorus should be closer to those of sulfur than to those of nitrogen	Because	Phosphorus and nitrogen are in the same row of the periodic table
25.	The halogens, in group VIIA, all form stable diatomic molecules	Because	They each need one electron to fill their outer shells
26.	Metals are good conductors of electricity	Because	They are held together by ionic bonds
27.	Two electrons in the 2s subshell must have opposite spins	Because	The Pauli exclusion principle states that no two electrons in the same atom can have identical quantum numbers
28.	$^{40}Ca$ is a neutral atom	Because	It has the same number of protons and neutrons
29.	The most important factor in determining the chemical properties of an element is the number of electrons in the outermost shell	Because	The number of electrons in the outermost shell determines the bonding characteristics of the element
30.	Iron is an element	Because	It cannot be broken into smaller units and retains its physical and chemical properties
31.	An element (X) with an atomic number of 16 has 14 electrons in $X^{2-}$	Because	It has gained two electrons
32.	Atomic radii increase down a group	Because	The higher the atomic number within a group, the smaller the atom

- The element with atomic number 32 describes
  - A metal
  - A non-metal
  - A metalloid
  - A halogen
  - A noble gas

- How many neutrons are probably in the nucleus of an element of atomic weight 197?
  - 43
  - 79
  - 83
  - 100
  - 118

- The transition metals are characterized by
  - completely filled d subshells
  - completely filled f subshells
  - partially filled d subshells
  - partially filled f subshells
  - both (a) and (c) are correct

- Neutral atoms of F (fluorine) have the same number of electrons as
  - $B^{3-}$
  - $N^+$
  - $Ne^-$
  - $Na^-$
  - $Mg^{3+}$

- Which of the elements in Group 1A of the periodic table has the greatest metallic character?
  - H
  - Li
  - Na
  - K
  - Rb

38. The ionization energy of an element is
- a measure of its mass
  - the energy required to remove an electron from the element in its gaseous state
  - the energy released by the element in forming an ionic bond
  - the energy released by the element upon receiving an additional electron
  - none of the above
39. Elements in a row have the same
- Atomic weight
  - Maximum azimuthal quantum number (l)
  - Maximum principal quantum number (n)
  - Valence electron structure
  - Atomic number
40. Which of the following has the largest radius?
- Sr
  - P
  - Mg
  - $\text{Al}^{3+}$
  - $\text{Mg}^{2+}$
41. Which of the following elements has the lowest electronegativity?
- Cesium
  - Strontium
  - Calcium
  - Barium
  - Potassium
42. Which of the following is biggest in size?
- Ca
  - $\text{Ca}^+$
  - $\text{Ca}^{2+}$
  - $\text{Ca}^-$
  - $\text{Ca}^{2-}$
43. The order of the elements in the periodic table is based on
- the number of neutrons
  - the radius of the atom
  - the atomic number
  - the atomic weight
  - the number of oxidation states
44. The elements within each column of the Periodic Table
- have similar valence electron configurations
  - have similar atomic radii
  - have the same principal quantum number
  - will react to form stable elements
  - have no similar chemical properties
45. Which of the following has the highest 1st ionization energy?
- Ga
  - Ba
  - Ru
  - F
  - N
46. Which of the following has the lowest electronegativity?
- Ca
  - Cl
  - Cs
  - P
  - Zn
47. Which element has the greatest electronegativity?
- Chlorine
  - Oxygen
  - Sulfur
  - Phosphorus
  - Fluorine
48. Transition metal compounds generally exhibit bright colors because
- The electrons in the partially filled d orbitals are easily promoted to excited states
  - The metals become complexed with water
  - The metals conduct electricity, producing colored light
  - The electrons in the d orbitals emit energy as they relax
  - Their valence electrons cause them to bind to other metals
49. Which of the following is a non-metal?
- Fr
  - Pd
  - I
  - Sc
  - Sr
50. Which of the following has the greatest affinity for electrons?
- F
  - Cl
  - Br
  - K
  - C
51. Which of the following is the most electronegative element?
- He
  - I
  - N
  - O
  - C
52. Which of the following is not a property of Group IA elements?
- Low ionization energies
  - Low electronegativities
  - High melting points
  - Metallic bonding
  - Electrical conductivity
53. Arrange the following elements in order of decreasing nonmetallic character: Ge, Sn, Pb, Si
- Pb, Sn, Ge, Si
  - Ge, Sn, Pb, Si
  - Si, Ge, Sn, Pb
  - They all have equal nonmetallic character since they are all in the same column of the Periodic Table
  - None of the above
54. Electron affinity is defined as
- the change in energy when a gaseous atom in its ground state gains an electron
  - the pull an atom has on the electrons in a chemical bond
  - the energy required to remove a valence electron from a neutral gaseous atom in its ground state
  - the energy difference between an electron in its ground state and its excited state
  - none of the above
55. Which of the following is an incorrect association?
- Mendeleev-periodic table
  - Faraday-electrolytic cells
  - Millikan-charge of electrons
  - Rutherford-photoelectric effect
  - They are all correct
56. Members of group 1 have similar reactivity because they have
- the same number of protons
  - the same number of electrons
  - similar outer shell configurations
  - valence electrons with the same quantum numbers
  - the same number of neutrons
57. Boron found in nature has an atomic weight of 10.811 and is made up of the isotopes  $^{10}\text{B}$  (mass 10.013 amu) and  $^{11}\text{B}$  (mass 11.0093 amu). What percentage of naturally occurring boron is made up of  $^{10}\text{B}$  and  $^{11}\text{B}$  respectively?
- 30:70
  - 25:75
  - 20:80
  - 15:85
58. The modern periodic table is ordered on the basis of
- atomic mass
  - atomic radius
  - atomic charge
  - atomic number
  - number of neutron
59. The electron configuration  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$  represents an atom of the element
- Br
  - Co
  - Cd
  - Ga
  - Mg
60. A neutral atom whose electron configuration is  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6$  is
- Highly reactive
  - A noble gas
  - A positively charged ion
  - A transition metal
  - A lanthanide element

- |     |       |
|-----|-------|
| 1.  | C     |
| 2.  | D     |
| 3.  | A     |
| 4.  | D     |
| 5.  | A     |
| 6.  | C     |
| 7.  | B     |
| 8.  | A     |
| 9.  | D     |
| 10. | C     |
| 11. | D     |
| 12. | E     |
| 13. | D     |
| 14. | A     |
| 15. | B     |
| 16. | A     |
| 17. | C     |
| 18. | TF    |
| 19. | TT CE |
| 20. | TF    |
| 21. | FT    |
| 22. | FT    |
| 23. | TF    |
| 24. | FF    |
| 25. | TT CE |
| 26. | TF    |
| 27. | TT CE |
| 28. | TT    |
| 29. | TT CE |
| 30. | TT CE |
| 31. | FF    |
| 32. | TF    |
| 33. | C     |
| 34. | B     |
| 35. | C     |
| 36. | E     |
| 37. | E     |
| 38. | B     |
| 39. | C     |
| 40. | A     |
| 41. | A     |
| 42. | E     |
| 43. | C     |
| 44. | A     |
| 45. | D     |
| 46. | C     |
| 47. | E     |
| 48. | A     |
| 49. | C     |
| 50. | B     |
| 51. | D     |
| 52. | C     |
| 53. | A     |
| 54. | A     |
| 55. | D     |
| 56. | C     |
| 57. | C     |
| 58. | D     |
| 59. | B     |
| 60. | B     |