

Student name: _____

TRUE/FALSE - Write 'T' if the statement is true and 'F' if the statement is false.

- 1) The mass of a neutron is equal to the mass of a proton plus the mass of an electron.
 true
 false

- 2) All neutral atoms of tin have 50 protons and 50 electrons.
 true
 false

- 3) Copper (Cu) is a transition metal.
 true
 false

- 4) Lead (Pb) is a main group element.
 true
 false

- 5) Almost all the mass of an atom is concentrated in the nucleus.
 true
 false

- 6) When a beam of alpha particles passes between two electrically charged plates, the beam is deflected toward the positive plate.
 true
 false

- 7) J. J. Thomson suggested the term "radioactivity" to describe the spontaneous emission of particles and/or radiation.

- Ⓒ true
- Ⓓ false

MULTIPLE CHOICE - Choose the one alternative that best completes the statement or answers the question.

8) The scientist who determined the magnitude of the electric charge on the electron was

- A) John Dalton
- B) Robert Millikan
- C) J. J. Thomson
- D) Henry Moseley
- E) J. Burdige

9) When J. J. Thomson discovered the electron, what physical property of the electron did he measure?

- A) its charge, e
- B) its charge-to-mass ratio, e/m
- C) its temperature, T
- D) its mass, m
- E) its atomic number, Z

10) Which field of study made a big contribution toward understanding the composition of the atom?

- A) electricity
- B) radiation
- C) solution chemistry
- D) electrochemistry
- E) quantum mechanics

11) Which of the following is a type of radioactive radiation that has no charge and is unaffected by external electric or magnetic fields?

- A) α rays
- B) β rays
- C) γ rays
- D) δ rays
- E) ϵ rays

12) Which of the following is a type of radioactive radiation that consists of positively charged particles and is deflected away from the positively charged plate?

- A) α rays
- B) β rays
- C) γ rays
- D) δ rays
- E) ϵ rays

13) Which of the following is a type of radioactive radiation that consists of electrons and is deflected away from the negatively charged plate?

- A) α rays
- B) β rays
- C) γ rays
- D) δ rays
- E) ϵ rays

14) Which of these scientists developed the nuclear model of the atom?

- A) John Dalton
- B) Robert Millikan
- C) J. J. Thomson
- D) Henry Moseley
- E) Ernest Rutherford

15) Rutherford's experiment with alpha particle scattering by gold foil established that

- A) protons are not evenly distributed throughout an atom.
- B) electrons have a negative charge.
- C) electrons have a positive charge.
- D) atoms are made of protons, neutrons, and electrons.
- E) protons are 1840 times heavier than electrons.

16) J. J. Thomson studied cathode ray particles (electrons) and was able to measure the mass/charge ratio. His results showed that

- A) the mass/charge ratio varied as the cathode material was changed.
- B) the charge was always a whole-number multiple of some minimum charge.
- C) matter included particles much smaller than the atom.
- D) atoms contained dense areas of positive charge.
- E) atoms are largely empty space.

17) Who is credited with measuring the mass/charge ratio of the electron?

- A) Dalton
- B) Chadwick
- C) Thomson
- D) Millikan
- E) Rutherford

18) Who is credited with first measuring the charge of the electron?

- A) Dalton
- B) Gay-Lussac
- C) Thomson
- D) Millikan
- E) Rutherford

19) Millikan's oil-drop experiment

- A) established the charge on an electron.
- B) showed that all oil drops carried the same charge.
- C) provided support for the nuclear model of the atom.
- D) suggested that some oil drops carried fractional numbers of electrons.
- E) suggested the presence of a neutral particle in the atom.

20) Who is credited with discovering the atomic nucleus?

- A) Dalton
- B) Gay-Lussac
- C) Thomson
- D) Chadwick
- E) Rutherford

21) Rutherford bombarded gold foil with alpha (α) particles and found that a small percentage of the particles were deflected. Which of the following was not accounted for by the model he proposed for the structure of the atom?

- A) the small size of the nucleus
- B) the charge on the nucleus
- C) the total mass of the atom
- D) the existence of protons
- E) the presence of electrons outside the nucleus

- 22) Which one of the following statements about atoms and subatomic particles is correct?
- A) Rutherford discovered the atomic nucleus by bombarding gold foil with electrons
 - B) The proton and the neutron have identical masses.
 - C) The neutron's mass is equal to that of a proton plus an electron.
 - D) A neutral atom contains equal numbers of protons and electrons.
 - E) An atomic nucleus contains equal numbers of protons and neutrons.
- 23) Who discovered the neutron, the subatomic particle having a neutral charge?
- A) Millikan
 - B) Dalton
 - C) Chadwick
 - D) Rutherford
 - E) Thomson
- 24) What is the term for the number of protons in the nucleus of each atom of an element? It also indicates the number of electrons in the atom.
- A) isotope number
 - B) mass number
 - C) mass-to-charge ratio
 - D) atomic number
 - E) atomic mass units
- 25) What is the term for the total number of neutrons and protons in the nucleus of each atom of an element?

- A) isotope number
- B) mass number
- C) mass-to-charge ratio
- D) atomic number
- E) atomic mass units

26) Bromine is the only nonmetal that is a liquid at room temperature. Consider the isotope bromine-81, $^{81}_{35}\text{Br}$. Select the combination which lists the correct atomic number, number of neutrons, and mass number, respectively.

- A) 35, 46, 81
- B) 35, 81, 46
- C) 81, 46, 35
- D) 46, 81, 35
- E) 35, 81, 116

27) Atoms X, Y, Z, and R have the following nuclear compositions:

Which of the following are isotopes of the same element?

- A) I & II
- B) I & IV
- C) II & IV
- D) III & IV
- E) I & III

28) Which isotope is not possible?

- A) ^1_1H
- B) ^1_0H
- C) $^{24}_{24}\text{Cr}$
- D) $^{54}_{24}\text{Mn}$
- E) All of these isotopes are possible.

- 29) The principal factor that determines whether a nucleus is stable is the
- A) electron-to-neutron ratio.
 - B) electron-to-proton ratio.
 - C) neutron-to-proton ratio.
 - D) chemical family.
 - E) number of electrons.
- 30) Which of the following is not a magic number?
- A) 20
 - B) 10
 - C) 126
 - D) 82
 - E) 2
- 31) Which combination of neutrons and protons leads to the most number of stable nuclei?
- A) odd number of neutrons and odd number of protons
 - B) even number of neutrons and odd number of protons
 - C) odd number of neutrons and even number of protons
 - D) even number of neutrons and even number of protons
 - E) None of these options results in significantly more stable nuclei.
- 32) As the number of protons increases, stable nuclei will
- A) have an equal number of neutrons and protons.
 - B) have an increased ratio of neutrons to protons.
 - C) have an odd number of neutrons.
 - D) have a decreased ratio of neutrons to protons.
 - E) become the most common type of nuclei.

- 33)** Atoms of the same element with different mass numbers are called
- A) ions.
 - B) neutrons.
 - C) chemical groups.
 - D) chemical families.
 - E) isotopes.
- 34)** How many neutrons are there in an atom of lead whose mass number is 208?
- A) 82
 - B) 126
 - C) 208
 - D) 290
 - E) None of these choices is correct.
- 35)** An atom of the isotope sulfur-31 consists of how many protons, neutrons, and electrons?
(p = proton, n = neutron, e = electron)
- A) 15 p, 16 n, 15 e
 - B) 16 p, 15 n, 16 e
 - C) 16 p, 31 n, 16 e
 - D) 32 p, 31 n, 32 e
 - E) 16 p, 16 n, 15 e
- 36)** Give the number of protons (p), electrons (e), and neutrons (n) in one atom of chlorine-37.

- A) 37 p, 37 e, 17 n
- B) 17 p, 17 e, 37 n
- C) 17 p, 17 e, 20 n
- D) 37 p, 17 e, 20 n
- E) 17 p, 37 e, 17 n

37) Two isotopes of an element differ only in their

- A) symbol.
- B) atomic number.
- C) atomic mass.
- D) number of protons.
- E) number of electrons.

38) The elements in a column of the periodic table are known as

- A) metalloids.
- B) a period.
- C) noble gases.
- D) a group.
- E) nonmetals.

39) Which of these materials are usually poor conductors of heat and electricity?

- A) metals
- B) metalloids
- C) nonmetals
- D) alkaline earth metals
- E) alkali metals

40) Which of these elements is most likely to be a good conductor of electricity?

- A) N
- B) S
- C) He
- D) Cl
- E) Fe

41) Which of the following elements are the least reactive?

- A) alkali metals
- B) noble gases
- C) halogens
- D) alkaline earth metals
- E) metalloids

42) Which of the following is a nonmetal?

- A) lithium, Li, $Z = 3$
- B) bromine, Br, $Z = 35$
- C) mercury, Hg, $Z = 80$
- D) bismuth, Bi, $Z = 83$
- E) sodium, Na, $Z = 11$

43) Which of the following is a metal?

- A) nitrogen, N, $Z = 7$
- B) phosphorus, P, $Z = 15$
- C) arsenic, As, $Z = 33$
- D) thallium, Tl, $Z = 81$
- E) silicon, Si, $Z = 14$

44) Which of the following is a metalloid?

- A) carbon, C, $Z = 6$
- B) sulfur, S, $Z = 16$
- C) germanium, Ge, $Z = 32$
- D) iridium, Ir, $Z = 77$
- E) bromine, Br, $Z = 35$

45) A row of the periodic table is called a(n)

- A) group.
- B) period.
- C) isotopic mixture.
- D) family.
- E) subshell.

46) Silicon, which makes up about 25% of Earth's crust by mass, is used widely in the modern electronics industry. It has three naturally occurring isotopes, ^{28}Si , ^{29}Si , and ^{30}Si . Calculate the atomic mass of silicon.

Isotope	Isotopic Mass (amu)	Abundance %
^{28}Si	27.976927	92.22
^{29}Si	28.976495	4.69
^{30}Si	29.973770	3.09

- A) 29.2252 amu
- B) 28.9757 amu
- C) 28.7260 amu
- D) 28.0855 amu
- E) 27.9801 amu

47) Lithium forms compounds which are used in dry cells, storage batteries, and in high-temperature lubricants. It has two naturally occurring isotopes, ^6Li (isotopic mass = 6.015123 amu) and ^7Li (isotopic mass = 7.016005 amu). Lithium has an atomic mass of 6.9412 amu. What is the percent abundance of lithium-6?

- A) 92.53%
- B) 86.65%
- C) 49.47%
- D) 7.47%
- E) 6.015%

48) In the periodic table, atoms are arranged in order of

- A) increasing atomic mass.
- B) increasing atomic number.
- C) physical properties.
- D) periodicity.
- E) chemical reactivities.

49) The elements in Group 17 are known by what name?

- A) transition metals
- B) halogens
- C) alkali metals
- D) alkaline earth metals
- E) noble gases

50) The elements in Group 2 are known by what name?

- A) transition metals
- B) halogens
- C) alkali metals
- D) alkaline earth metals
- E) noble gases

51) The alkali metal elements are found in _____ of the periodic table.

- A) group 1
- B) group 2
- C) group 13
- D) period 7
- E) period 1

52) What term defines a mass which is exactly equal to 1/12 the mass of one carbon-12 atom?

- A) isotope number
- B) mass number
- C) mass-to-charge ratio
- D) atomic number
- E) atomic mass unit

53) Which of these elements is chemically similar to magnesium?

- A) sulfur
- B) calcium
- C) iron
- D) nickel
- E) potassium

54) Which of these elements is chemically similar to oxygen?

- A) sulfur
- B) calcium
- C) iron
- D) nickel
- E) potassium

55) Which of these elements is chemically similar to potassium?

- A) calcium
- B) arsenic
- C) phosphorus
- D) cerium
- E) cesium

56) How many atoms are in 0.534 mol of nickel, Ni?

- A) 1.13×10^{24} atoms
- B) 1.48×10^{25} atoms
- C) 2.44×10^{22} atoms
- D) 3.22×10^{23} atoms
- E) 6.98×10^{21} atoms

57) How many atoms are in 7.12 mol of gold, Au?

- A) 1.18×10^{-23} atoms
- B) 4.29×10^{24} atoms
- C) 8.46×10^{22} atoms
- D) 4.70×10^{24} atoms
- E) 3.34×10^{26} atoms

58) How many moles are in 8.73×10^{25} atoms of boron, B?

- A) 145 moles
- B) 3.84×10^{27} moles
- C) 1.45 moles
- D) 5.04×10^{-25} moles
- E) 6.90×10^{-3} moles

- 59) How many moles are present in 17.4 g of lead?
- A) 0.0994 moles
 - B) 1.05×10^{25} moles
 - C) 0.0840 moles
 - D) 10.06 moles
 - E) 11.9 moles
- 60) How many grams are present in 0.885 moles of manganese?
- A) 62.1 g
 - B) 48.6 g
 - C) 21.5 g
 - D) 27.5 g
 - E) 0.016 g
- 61) Determine the mass of hydrogen (in grams) that contains 5.08×10^{15} hydrogen atoms.
- A) 5.12×10^{15} g
 - B) 3.06×10^{39} g
 - C) 3.06×10^{-9} g
 - D) 8.50×10^{-9} g
 - E) 8.5×10^{15} g
- 62) What element is represented by X in the atomic symbol notation ${}_{78}^{193}\text{X}$?
- A) iridium
 - B) platinum
 - C) palladium
 - D) selenium
 - E) magnesium

63) A rock contains an element with a molar mass of 40.08 g/mol. If 9.28×10^{24} atoms of this element were found in the rock, how many grams of the unknown element are present in the rock?

- A) 618 g
- B) 1.49×10^{28} g
- C) 2.24×10^{50} g
- D) 0.38 g
- E) 3.80 g

64) Five vials each contain 12 grams of a solid metal sample. The samples include calcium, platinum, barium, gold, and silver. Which vial has the most metal atoms?

- A) calcium
- B) barium
- C) gold
- D) silver
- E) platinum

65) Five vials each contain 12 grams of a solid metal sample. The samples include calcium, platinum, barium, gold, and silver. Which vial has the fewest moles of metal atoms?

- A) calcium
- B) barium
- C) gold
- D) silver
- E) platinum

66) Determine the number of electrons and identify the correct symbol for an atom with 17 protons and 18 neutrons.

- A) 17 electrons, ${}^{37}_{17}\text{Cl}$
- B) 18 electrons, ${}^{38}_{18}\text{Ar}$
- C) 17 electrons, ${}^{37}_{18}\text{Cl}$
- D) 17 electrons, ${}^{35}_{17}\text{Cl}$
- E) 18 electrons, ${}^{36}_{18}\text{Ar}$

67) Determine the number of protons, electrons, and neutrons for the isotope gold-118. The symbol for gold is Au.

- A) 118 protons, 118 electrons, 79 neutrons
- B) 79 protons, 79 electrons, 118 neutrons
- C) 79 protons, 79 electrons, 39 neutrons
- D) 118 protons, 118 electrons, 39 neutrons
- E) 79 protons, 39 electrons, 118 neutrons

68) Determine the number of protons and identify the correct symbol for an atom with 20 neutrons and 20 electrons.

- A) 20 protons, ${}^{40}_{20}\text{Ca}$
- B) 20 protons, ${}^{20}_{20}\text{Ca}$
- C) 20 protons, ${}^{40}_{40}\text{Ca}$
- D) 40 protons, ${}^{40}_{20}\text{Ca}$
- E) 40 protons, ${}^{40}_{40}\text{Ca}$

69) The elements in Group 18 are called the _____.

- A) alkali metals
- B) alkaline earth metals
- C) transition metals
- D) halogens
- E) noble gases

70) The elements in Group 2 are called the _____.

- A) alkali metals
- B) alkaline earth metals
- C) transition metals
- D) halogens
- E) noble gases

71) The elements in Group 17 are called the _____.

- A) alkali metals
- B) alkaline earth metals
- C) transition metals
- D) halogens
- E) noble gases

72) The elements in Group 1 are called the _____.

- A) alkali metals
- B) alkaline earth metals
- C) transition metals
- D) halogens
- E) noble gases

73) Which group is given the name chalcogens?

- A) 1
- B) 2
- C) 12
- D) 16
- E) 17

74) The table below describes four atoms.

	Atom A	Atom B	Atom C	Atom D
Number of protons	79	80	80	79
Number of neutrons	118	120	118	120
Number of electrons	79	80	80	79

Which atoms represent the same element?

- A) A and B; C and D
- B) A and C; B and D
- C) A and D; B and C
- D) None of the these choices is correct.

Answer Key

Test name: Atoms2

- 1) FALSE
- 2) TRUE
- 3) TRUE
- 4) TRUE
- 5) TRUE
- 6) FALSE
- 7) FALSE
- 8) B
- 9) B
- 10) B
- 11) C
- 12) A
- 13) B
- 14) E
- 15) A
- 16) B
- 17) C
- 18) D
- 19) A
- 20) E
- 21) C
- 22) D
- 23) C
- 24) D
- 25) B
- 26) A

- 27) E
- 28) D
- 29) C
- 30) B
- 31) D
- 32) B
- 33) E
- 34) B
- 35) B
- 36) C
- 37) C
- 38) D
- 39) C
- 40) E
- 41) B
- 42) B
- 43) D
- 44) C
- 45) B
- 46) D
- 47) D
- 48) B
- 49) B
- 50) D
- 51) A
- 52) E
- 53) B
- 54) A
- 55) E
- 56) D

- 57) B
- 58) A
- 59) C
- 60) B
- 61) D
- 62) B
- 63) A
- 64) A
- 65) C
- 66) A
- 67) C
- 68) B
- 69) E
- 70) B
- 71) D
- 72) A
- 73) D
- 74) C