***Principles of Chemistry: A Molecular Approach***

**Atoms and Elements**

1) Which of the following is an example of the law of multiple proportions?

A) A sample of chlorine is found to contain three times as much Cl-35 as Cl-37.

B) Two different compounds formed from carbon and oxygen have the following mass ratios:

1.33 g O: 1 g C and 2.66 g O: 1 g C.

C) Two different samples of table salt are found to have the same ratio of sodium to chlorine.

D) The atomic mass of bromine is found to be 79.90 amu.

E) Nitrogen dioxide always has a mass ratio of 2.28 g O: 1 g N.

Answer: B

2) Which of the following statements is FALSE according to Dalton's Atomic Theory?

A) Atoms combine in simple whole number ratios to form compounds.

B) All atoms of chlorine have identical properties that distinguish them from other elements.

C) One carbon atom will combine with one oxygen atom to form a molecule of carbon monoxide.

D) Atoms of sodium do not change into another element during chemical reaction with chlorine.

E) An atom of nitrogen can be broken down into smaller particles that will still have the unique properties of nitrogen.

Answer: E

3) Identify the element that has an atomic number of 40.

A) neon

B) calcium

C) zirconium

D) bromine

Answer: C

4) The atomic mass for cadmium is

A) 48

B) 112.41

C) 40.08

D) 20

Answer: B

5) The mass number is equal to

A) the sum of the sum of the electrons and protons.

B) the sum of the sum of the neutrons and electrons.

C) the sum of the number of protons, neutrons, and electrons.

D) the sum of the number of protons and neutrons.

Answer: D

6) What element is defined by the following information?

 p+ = 11 n° = 12 e- = 11

A) sodium

B) vanadium

C) magnesium

D) titanium

Answer: A

7) What element is defined by the following information?

 p+ = 20 n° = 20 e- = 20

A) zirconium

B) calcium

C) potassium

D) neon

E) argon

Answer: B

8) What does "X" represent in the following symbol?

 X

A) mercury

B) chlorine

C) scandium

D) bromine

E) selenium

Answer: D

9) What does "X" represent in the following symbol?

X

A) silicon

B) sulfur

C) zinc

D) ruthenium

E) nickel

Answer: A

10) Which of the following statements about subatomic particles is TRUE?

A) A neutral atom contains the same number of protons and electrons.

B) Protons have about the same mass as electrons.

C) Electrons make up most of the mass of an atom.

D) Protons and neutrons have opposite, but equal in magnitude, charges.

E) Neutrons and electrons are found in the nucleus of an atom.

Answer: A

11) Determine the number of protons, neutrons and electrons in the following:

X

A) p+ = 18 n° = 18 e- = 22

B) p+ = 18 n° = 22 e- = 18

C) p+ = 22 n° = 18 e- = 18

D) p+ = 18 n° = 22 e- = 40

E) p+ = 40 n° = 22 e- = 18

Answer: B

12) Determine the number of protons, neutrons and electrons in the following:

X

A) p+ = 12 n° = 25 e- = 12

B) p+ = 12 n° = 12 e- = 13

C) p+ = 12 n° = 13 e- = 12

D) p+ = 25 n° = 12 e- = 13

E) p+ = 12 n° = 13 e- = 25

Answer: C

13) Determine the number of protons, neutrons and electrons in the following:

X

A) p+ = 36 n° = 29 e- = 36

B) p+ = 29 n° = 29 e- = 36

C) p+ = 36 n° = 36 e- = 29

D) p+ = 29 n° = 36 e- = 29

E) p+ = 29 n° = 36 e- = 36

Answer: D

14) Which of the following statements about isotopes is TRUE?

A) Isotopes of the same element differ only in the number of electrons they contain.

B) An isotope of an atom with a larger number of neutrons is larger than an isotope of the same atom that contains fewer neutrons.

C) Isotopes of the same element have the same mass.

D) Isotopes of the same element don't usually have the same properties.

E) Some elements have 3 or more naturally occurring isotopes.

Answer: E

15) Identify a cation.

A) An atom that has lost an electron.

B) An atom that has gained an electron.

C) An atom that has lost a proton.

D) An atom that has gained a proton.

Answer: A

16) What element is defined by the following information?

 p+ = 17 n° = 20 e- = 17

A) calcium

B) rubidium

C) chlorine

D) neon

E) oxygen

Answer: C

17) What species is represented by the following information?

p+ = 12 n° = 14 e- = 10

A) Si4+

B) Mg

C) Ne

D) Si

E) Mg2+

Answer: E

18) What species is represented by the following information?

p+ = 47 n° = 62 e- = 46

A) Ag+

B) Nd

C) Pd

D) Ag

E) Pd+

Answer: A

19) What species is represented by the following information?

p+ = 17 n° = 18 e- = 18

A) Cl

B) Cl-

C) Ar

D) Ar+

E) Kr

Answer: B

20) Give the number of electrons for carbon-14, with a -2 charge .

A) 7

B) 4

C) 6

D) 8

Answer: D

21) Give the number of neutrons for carbon-14, with a -2 charge .

A) 7

B) 4

C) 6

D) 8

Answer: D

22) What does "X" represent in the following symbol?

X

A) tin

B) copper

C) palladium

D) niobium

E) uranium

Answer: E

23) Predict the charge that an aluminum ion would have.

A) 5-

B) 1+

C) 1-

D) 2+

E) 3+

Answer: E

24) Predict the charge that a calcium ion would have.

A) 6-

B) 2-

C) 3+

D) 2+

E) 1+

Answer: D

25) Predict the charge that an ion formed from sulfur would have.

A) 1-

B) 6+

C) 3-

D) 4+

E) 2-

Answer: E

26) Predict the charge that the ion formed from bromine would have.

A) 1-

B) 2+

C) 1+

D) 4+

E) 2-

Answer: A

27) Identify the largest atom or ion of carbon.

A) p+ = 6 n° = 6 e- = 6

B) p+ = 6 n° = 7 e- = 6

C) p+ = 6 n° = 6 e- = 7

D) p+ = 6 n° = 6 e- = 5

Answer: C

28) Which of the following elements is NOT a metal?

A) Ba

B) Mg

C) Xe

D) Pb

E) Ga

Answer: C

29) Which of the following elements is a metal?

A) As

B) C

C) I

D) Sn

E) Se

Answer: D

30) Which of the following elements is a nonmetal?

A) Zn

B) Cs

C) Ca

D) Co

E) P

Answer: E

31) Which of the following elements is a noble gas?

A) Ar

B) Br

C) N

D) O

E) K

Answer: A

32) Which of the following elements is a halogen?

A) Ne

B) I

C) O

D) Mg

E) K

Answer: B

33) Which of the following elements is an alkaline earth metal?

A) Cs

B) Cu

C) Mg

D) Ti

E) Br

Answer: C

34) Which of the following elements is an alkali metal?

A) Zn

B) Xe

C) F

D) Li

E) Ca

Answer: D

35) Which of the following elements is a metalloid?

A) Al

B) Ge

C) C

D) Sn

Answer: B

36) Which of the following elements is an actinide?

A) U

B) Pm

C) Rf

D) Po

Answer: A

37) Which of the following elements is a lanthinide?

A) U

B) Pm

C) Rf

D) Po

Answer: B

38) Which of the following statements is FALSE?

A) Anions are usually larger than their corresponding atom.

B) Metals tend to form cations

C) Atoms are usually larger than their corresponding cation.

D) The halogens tend to form 1+ ions.

E) Nonmetals tend to gain electrons.

Answer: D

39) Which of the following statements is FALSE?

A) Halogens are very reactive elements.

B) The alkali metals are fairly unreactive.

C) Sulfur is a main group element.

D) Noble gases do not usually form ions.

E) Zn is a transition metal.

Answer: B

40) Which of the following does NOT describe a metal?

A) Good conductor of heat

B) Good conductor of electricity

C) Tends to gain electrons

D) Forms ionic compounds with nonmetals

E) Found on the left side of the periodic table.

Answer: C

41) Which of the following does NOT describe a nonmetal?

A) Tend to gain electrons

B) Found in the upper right hand corner of the periodic table.

C) Poor conductor of electricity

D) Nonmetals are generally unreactive.

E) Poor conductor of heat.

Answer: D

42) Semiconductors usually are

A) metalloids.

B) noble gases.

C) nonmetals.

D) metals.

Answer: A

43) Silver has an atomic mass of 107.868 amu. The Ag-109 isotope (108.905 amu) is 48.16%. What is the amu of the other isotope?

A) 106.905 amu

B) 106.908 amu

C) 106.903 amu

D) 106.911 amu

Answer: A

44) Gallium has an atomic mass of 69.723 amu. The Ga-69 (68.926 amu) is 60.11%. What is the amu of the other isotope?

A) 70.924 amu

B) 70.928 amu

C) 70.932 amu

D) 70.920 amu

Answer: A

45) Calculate the atomic mass of element "X", if it has 2 naturally occurring isotopes with the following masses and natural abundances:

X-45 44.8776 amu 32.88%

X-47 46.9443 amu 67.12%

A) 46.26 amu

B) 45.91 amu

C) 46.34 amu

D) 46.84 amu

E) 44.99 amu

Answer: A

46) Which of the following contains the MOST atoms? You shouldn't need to do a calculation here.

A) 10.0 g Ne

B) 10.0 g He

C) 10.0 g Ar

D) 10.0 g Kr

E) 10.0 g Mg

Answer: B

47) Which of the following contains the FEWEST atoms? You shouldn't need to do a calculation here.

A) 4.0 g Li

B) 4.0 g Na

C) 4.0 g Rb

D) 4.0 g K

E) 4.0 g Ca

Answer: C

48) How many silver atoms are contained in 3.75 moles of silver?

A) 6.23 × 1024 silver atoms

B) 2.26 × 1024 silver atoms

C) 1.61 × 1023 silver atoms

D) 2.44 × 1026 silver atoms

E) 6.50 × 1025 silver atoms

Answer: B

49) How many xenon atoms are contained in 2.36 moles of xenon?

A) 3.92 × 1024 xenon atoms

B) 2.55 × 1023 xenon atoms

C) 1.42 × 1024 xenon atoms

D) 7.91 × 1025 xenon atoms

E) 1.87 × 1026 xenon atoms

Answer: C

50) How many argon atoms are contained in 7.66 x 105 mmol of argon?

A) 4.61 × 1026 Ar atoms

B) 1.84 × 1028 Ar atoms

C) 1.15 × 1028 Ar atoms

D) 7.86 × 1020 Ar atoms

E) 3.24 × 1026 Ar atoms

Answer: A

51) What mass (in g) does 3.99 moles of Kr have?

A) 334 g

B) 476 g

C) 211 g

D) 240 g

E) 144 g

Answer: A

52) How many moles of potassium are contained in 449 g of potassium?

A) 11.5 moles

B) 17.6 moles

C) 69.2 moles

D) 23.9 moles

E) 41.5 moles

Answer: A

53) What mass, in kg, does 5.84 moles of titanium (Ti) have?

A) 0.352 kg

B) 0.122 kg

C) 0.820 kg

D) 0.280 kg

E) 0.632 kg

Answer: D

54) What mass, in mg, does 2.63 moles of nickel have?

A) 44.8 mg

B) 2.23 × 104 mg

C) 129 mg

D) 3.56 x 105 mg

E) 1.54 x 105 mg

Answer: E

55) How many moles of Kr are contained in 398 mg of Kr?

A) 4.75 × 10-3 moles Kr

B) 33.4 moles Kr

C) 2.11 × 10-4 moles Kr

D) 2.99 × 10-3 moles Kr

E) 1.19 × 10-4 moles Kr

Answer: A

56) How many moles of Cs are contained in 595 kg of Cs?

A) 2.23 × 102 moles Cs

B) 4.48 × 103 moles Cs

C) 7.91 × 104 moles Cs

D) 1.26 × 103 moles Cs

E) 5.39 × 102 moles Cs

Answer: B

57) How many Li atoms are contained in 97.9 g of Li?

A) 5.90 × 1025 Li atoms

B) 7.09 × 1021 Li atoms

C) 8.49 × 1024 Li atoms

D) 4.27 × 1022 Li atoms

E) 4.18 × 1024 Li atoms

Answer: C

58) How many iron atoms are contained in 354 g of iron?

A) 2.62 × 1025 Fe atoms

B) 2.13 × 1026 Fe atoms

C) 4.69 × 1024 Fe atoms

D) 3.82 × 1024 Fe atoms

E) 9.50 × 1022 Fe atoms

Answer: D

59) How many phosphorus atoms are contained in 158 kg of phosphorus?

A) 3.07 × 1027 phosphorus atoms

B) 2.95 × 1027 phosphorus atoms

C) 3.25 × 1028 phosphorus atoms

D) 1.18 × 1024 phosphorus atoms

E) 8.47 × 1024 phosphorus atoms

Answer: A

60) Calculate the mass, in g, of 1.9 x 1024 atoms of Pb.

A) 3.9 × 102 g

B) 2.4 × 102 g

C) 3.2 × 102 g

D) 1.5 × 102 g

E) 6.5 × 102 g

Answer: E

61) Calculate the mass, in kg, of 4.87 x 1025 atoms of Zn.

A) 5.29 kg

B) 1.89 kg

C) 8.09 kg

D) 1.24 kg

E) 1.09 kg

Answer: A

Diff: 4

62) Calculate the mass (in ng) of 2.33 x 1020 atoms of oxygen.

A) 6.19 × 106 ng

B) 1.62 × 107 ng

C) 2.25 × 103 ng

D) 3.73 × 106 ng

E) 4.69 × 107 ng

Answer: A

Diff: 4

*Match the following.*

A) Fe

B) C

C) Mg

D) Si

E) K

63) magnesium

Diff: 1

64) carbon

Diff: 1

65) potassium

66) iron

67) silicon

Answers: 63) C 64) B 65) E 66) A 67) D

68) Describe an atom and what it is made up of according to modern atomic theory.

Answer: An atom is made up of a nucleus surrounded by electrons. The nucleus contains protons (positively charged particles) and neutrons (neutral particles) and is where most of the mass of an atom comes from, but is a tiny fraction of an atom's volume. The nucleus is surrounded by negatively charged electrons, the same number as there are protons in the nucleus. An atom is therefore neutral overall.

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69) Why do the isotopes of the same element have the same atomic size?

Answer: Isotopes only differ in the number of neutrons contained within the nucleus. Since the size of an atom is determined by the electrons, isotopes of the same element should be the same size.

70) Why doesn't a mass spectrum of silver have a peak at 107.9 amu?

Answer: The average atomic mass of silver is 107.9 amu, but there are no atoms of silver that weigh 107.9 amu. One isotope weighs more and another weighs less.

71) Are anions typically larger or smaller than their corresponding atom? Why?

Answer: Anions are larger than their corresponding atom because the anion contains more electrons than the atom. Since electrons repel one another AND determine the size of the atom or ion, adding electrons to the atom to form an anion makes it larger.

72) Give the name of the element whose symbol is Na.

Answer: sodium

73) Describe the difference between ions and isotopes.

Answer: Ions have the loss or gain of electrons; isotopes differ in the number of neutrons.

74) Why do elements in the same group tend to have similar chemical properties?

Answer: Since elements in the same group have the same number of valence electrons (similar electron configurations) they tend to have similar chemical reactivity, since chemical reactions typically involve valence electrons.

75) What group of elements in the periodic table are the most unreactive and why?

Answer: The noble gases are the most unreactive since they do not combine with other elements to form compounds.

76) Define atomic mass.

Answer: The atomic mass represents the average mass of the isotopes that compose that element weighted according to the natural abundance of each isotope.

77) An atom of 14C contains \_\_\_\_\_\_\_\_ protons.

A) 6

B) 20

C) 8

D) 10

E) 14

Answer: A

78) An atom of 131Xe contains \_\_\_\_\_\_\_\_ electrons.

A) 131

B) 185

C) 77

D) 123

E) 54

Answer: E

79) The atomic number of an atom of 80Br is \_\_\_\_\_\_\_\_.

A) 115

B) 35

C) 45

D) 73

E) 80

Answer: B

80) An ion has 8 protons, 9 neutrons, and 10 electrons. The symbol for the ion is \_\_\_\_\_\_\_\_.

A) 17O2-

B) 17O2+

C) 19F+

D) 19F-

E) 17Ne2+

Answer: A

81) How many electrons does the Al3+ ion possess?

A) 16

B) 10

C) 6

D) 0

E) 13

Answer: B

82) How many protons does the Br- ion possess?

A) 34

B) 36

C) 6

D) 8

E) 35

Answer: E

83) Predict the charge of the most stable ion of bromine.

A) 2+

B) 1+

C) 3+

D) 1-

E) 2-

Answer: D

84) Predict the charge of the most stable ion of potassium.

A) 3+

B) 1-

C) 2+

D) 2-

E) 1+

Answer: E

85) What is the chemical symbol for titanium?

A) Th

B) Ti

C) Tl

D) Tm

Answer: B

86) What is the chemical symbol for mercury?

A) Ag

B) Au

C) Hg

D) Pb

Answer: C

87) What is the chemical symbol for copper?

A) Co

B) Cr

C) Cu

D) C

Answer: C

88) Which element has the chemical symbol, Ru?

A) rubidium

B) ruthenium

C) rutherfordium

D) rhodium

Answer: B

89) Which element has the chemical symbol, S?

A) selenium

B) silicon

C) sulfur

D) scandium

Answer: C

90) Which are isotopes? An atom that has an atomic number of 20 and a mass number of 42 is an isotope of an atom that has

A) an atomic number of 21 and a mass number of 42.

B) an atomic number of 20 and a mass number of 40.

C) 22 neutrons and 20 protons.

D) 22 protons and 20 neutrons.

Answer: B

91) Which of the following represent isotopes?



A) A and B

B) A and C

C) A and D

D) C and D

Answer: B

92) How many protons (p) and neutrons (n) are in an atom of Sr?

A) 38 p, 52 n

B) 38 p, 90 n

C) 52 p, 38 n

D) 90 p, 38 n

Answer: A

93) How many protons (p) and neutrons (n) are in an atom of barium-130?

A) 56 p, 74 n

B) 56 p, 130 n

C) 74 p, 56 n

D) 130 p, 56 n

Answer: A

94) What is the element symbol for an atom that has 5 protons and 6 neutrons?

A) B

B) C

C) H

D) Na

Answer: A

95) How many electrons are in a neutral atom of bromine-81?

A) 1

B) 35

C) 36

D) 81

Answer: B

96) Identify the chemical symbol of element Q in Q.

A) Br

B) Hg

C) Pd

D) Se

Answer: D

97) An atom of 118Xe contains \_\_\_\_\_\_\_\_ neutrons.

A) 54

B) 172

C) 64

D) 110

E) 118

Answer: C

98) The mass number of an atom of 128Xe is \_\_\_\_\_\_\_\_.

A) 54

B) 182

C) 74

D) 128

E) 120

Answer: D

99) What is the identity of element Q if the ion Q2+ contains 10 electrons?

A) C

B) O

C) Ne

D) Mg

Answer: D

100) How many electrons are in the ion, Cu2+?

A) 27

B) 29

C) 31

D) 64

Answer: A

101) How many electrons are in the ion, P3-?

A) 12

B) 18

C) 28

D) 34

Answer: B

102) In which of the following sets do all species have the same number of electrons?

A) F-, Ne, Mg2+

B) Ge, Se2-, Br-

C) K+, Rb+, Cs+

D) Br, Br-, Br+

Answer: A

103) In which of the following sets do all species have the same number of protons?

A) F-, Ne, Mg2+

B) Ge, Se2-, Br-

C) K+, Rb+, Cs+

D) Br, Br-, Br+

Answer: D

104) Cesium belongs to the \_\_\_\_\_\_\_\_ group of the periodic table.

A) alkali metal

B) alkaline earth metal

C) halogen

D) noble gas

Answer: A

105) Iodine belongs to the \_\_\_\_\_\_\_\_ group of the periodic table.

A) alkali metal

B) alkaline earth metal

C) halogen

D) noble gas

Answer: C

106) Argon belongs to the \_\_\_\_\_\_\_\_ group of the periodic table.

A) alkali metal

B) alkaline earth metal

C) halogen

D) noble gas

Answer: D

107) Barium belongs to the \_\_\_\_\_\_\_\_ group of the periodic table.

A) alkali metal

B) alkaline earth metal

C) halogen

D) noble gas

Answer: B

108) Which of the following elements has chemical properties similar to tellurium?

A) fluorine

B) hydrogen

C) nitrogen

D) sulfur

Answer: D

109) Which of the following elements is a gas at room temperature?

A) bromine

B) carbon

C) helium

D) sodium

Answer: C

110) Which of the following elements is **not** a solid at room temperature?

A) Ag

B) Al

C) Xe

D) Fe

Answer: C

111) Which of the following elements is classified as a semimetal?

A) calcium

B) boron

C) fluorine

D) uranium

Answer: B

112) Which of the following elements is a good conductor of heat and electricity?

A) carbon

B) chlorine

C) neon

D) aluminum

Answer: D

113) Which one of the following elements is a **poor** conductor of heat and electricity?

A) copper

B) fluorine

C) iron

D) lead

Answer: B

114) All of the following elements are nonmetals except

A) barium.

B) carbon.

C) hydrogen.

D) oxygen.

Answer: A