

***Principles of Chemistry: A Molecular Approach (Tro)***  
**Chapter 2 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

Diff: 1 Page Ref: 2.2

- 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

Diff: 1 Page Ref: 2.2

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

- A) neon
- B) calcium
- C) zirconium
- D) bromine

Answer: C

Diff: 1 Page Ref: 2.5

- 4) The atomic mass for cadmium is

- A) 48
- B) 112.41
- C) 40.08
- D) 20

Answer: B

Diff: 1 Page Ref: 2.5

- 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

Diff: 1 Page Ref: 2.5

6) What element is defined by the following information?

$$p^+ = 11 \quad n^{\circ} = 12 \quad e^- = 11$$

- A) sodium
- B) vanadium
- C) magnesium
- D) titanium

Answer: A

Diff: 1 Page Ref: 2.5

7) What element is defined by the following information?

$$p^+ = 20 \quad n^{\circ} = 20 \quad e^- = 20$$

- A) zirconium
- B) calcium
- C) potassium
- D) neon
- E) argon

Answer: B

Diff: 1 Page Ref: 2.5

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



- A) mercury
- B) chlorine
- C) scandium
- D) bromine
- E) selenium

Answer: D

Diff: 1 Page Ref: 2.5

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



- A) silicon
- B) sulfur
- C) zinc
- D) ruthenium
- E) nickel

Answer: A

Diff: 1 Page Ref: 2.5

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

Diff: 1 Page Ref: 2.5

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



- A)  $p^+ = 18$   $n^\circ = 18$   $e^- = 22$
- B)  $p^+ = 18$   $n^\circ = 22$   $e^- = 18$
- C)  $p^+ = 22$   $n^\circ = 18$   $e^- = 18$
- D)  $p^+ = 18$   $n^\circ = 22$   $e^- = 40$
- E)  $p^+ = 40$   $n^\circ = 22$   $e^- = 18$

Answer: B

Diff: 1 Page Ref: 2.5

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



- A)  $p^+ = 12$   $n^\circ = 25$   $e^- = 12$
- B)  $p^+ = 12$   $n^\circ = 12$   $e^- = 13$
- C)  $p^+ = 12$   $n^\circ = 13$   $e^- = 12$
- D)  $p^+ = 25$   $n^\circ = 12$   $e^- = 13$
- E)  $p^+ = 12$   $n^\circ = 13$   $e^- = 25$

Answer: C

Diff: 1 Page Ref: 2.5

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



- A)  $p^+ = 36$   $n^\circ = 29$   $e^- = 36$
- B)  $p^+ = 29$   $n^\circ = 29$   $e^- = 36$
- C)  $p^+ = 36$   $n^\circ = 36$   $e^- = 29$
- D)  $p^+ = 29$   $n^\circ = 36$   $e^- = 29$
- E)  $p^+ = 29$   $n^\circ = 36$   $e^- = 36$

Answer: D

Diff: 1 Page Ref: 2.5

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

Diff: 1 Page Ref: 2.5

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

Diff: 1 Page Ref: 2.5

16) What element is defined by the following information?

$$p^+ = 17 \quad n^{\circ} = 20 \quad e^- = 17$$

- A) calcium
- B) rubidium
- C) chlorine
- D) neon
- E) oxygen

Answer: C

Diff: 2 Page Ref: 2.5

17) What species is represented by the following information?

$$p^+ = 12 \quad n^{\circ} = 14 \quad e^- = 10$$

- A)  $\text{Si}^{4+}$
- B) Mg
- C) Ne
- D) Si
- E)  $\text{Mg}^{2+}$

Answer: E

Diff: 2 Page Ref: 2.5

18) What species is represented by the following information?

$$p^+ = 47 \quad n^{\circ} = 62 \quad e^- = 46$$

- A)  $\text{Ag}^+$
- B) Nd
- C) Pd
- D) Ag
- E)  $\text{Pd}^+$

Answer: A

Diff: 2 Page Ref: 2.5

19) What species is represented by the following information?

$$p^+ = 17 \quad n^{\circ} = 18 \quad e^- = 18$$

- A) Cl
- B)  $\text{Cl}^-$
- C) Ar
- D)  $\text{Ar}^+$
- E) Kr

Answer: B

Diff: 2 Page Ref: 2.5

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



- A) tin
- B) copper
- C) palladium
- D) niobium
- E) uranium

Answer: E

Diff: 2 Page Ref: 2.5

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

- A) 5-
- B) 1+
- C) 1-
- D) 2+
- E) 3+

Answer: E

Diff: 2 Page Ref: 2.5

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

- A) 6-
- B) 2-
- C) 3+
- D) 2+
- E) 1+

Answer: D

Diff: 2 Page Ref: 2.5

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

- A) 1-
- B) 6+
- C) 3-
- D) 4+
- E) 2-

Answer: E

Diff: 2 Page Ref: 2.5

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

- A) 1-
- B) 2+
- C) 1+
- D) 4+
- E) 2-

Answer: A

Diff: 2 Page Ref: 2.5

25) Identify the largest atom or ion of carbon.

- A)  $p^+ = 6$   $n^\circ = 6$   $e^- = 6$
- B)  $p^+ = 6$   $n^\circ = 7$   $e^- = 6$
- C)  $p^+ = 6$   $n^\circ = 6$   $e^- = 7$
- D)  $p^+ = 6$   $n^\circ = 6$   $e^- = 5$

Answer: C

Diff: 2 Page Ref: 2.5

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

- A) Ba
- B) Mg
- C) Xe
- D) Pb
- E) Ga

Answer: C

Diff: 1 Page Ref: 2.6

27) Which of the following elements is a metal?

- A) As
- B) C
- C) I
- D) Sn
- E) Se

Answer: D

Diff: 1 Page Ref: 2.6

28) Which of the following elements is a nonmetal?

- A) Zn
- B) Cs
- C) Ca
- D) Co
- E) P

Answer: E

Diff: 1 Page Ref: 2.6

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

- A) Ar
- B) Br
- C) N
- D) O
- E) K

Answer: A

Diff: 1 Page Ref: 2.6

30) Which of the following elements is a halogen?

- A) Ne
- B) I
- C) O
- D) Mg
- E) K

Answer: B

Diff: 1 Page Ref: 2.6

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

- A) Cs
- B) Cu
- C) Mg
- D) Ti
- E) Br

Answer: C

Diff: 1 Page Ref: 2.6

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

- A) Zn
- B) Xe
- C) F
- D) Li
- E) Ca

Answer: D

Diff: 1 Page Ref: 2.6

33) Which of the following elements is a metalloid?

- A) Al
- B) Ge
- C) C
- D) Sn

Answer: B

Diff: 1 Page Ref: 2.6

34) 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

Diff: 1 Page Ref: 2.6

35) 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

Diff: 1 Page Ref: 2.6

36) 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

Diff: 1 Page Ref: 2.6



37) 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

Diff: 1 Page Ref: 2.6

38) Semiconductors usually are

- A) metalloids.
- B) noble gases.
- C) nonmetals.
- D) metals.

Answer: A

Diff: 1 Page Ref: 2.6

39) 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

Diff: 3 Page Ref: 2.7

40) 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

Diff: 3 Page Ref: 2.7

41) 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

Diff: 3 Page Ref: 2.7

42) 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

Diff: 1 Page Ref: 2.8

43) 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

Diff: 1 Page Ref: 2.8

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

- A)  $6.23 \times 10^{24}$  silver atoms
- B)  $2.26 \times 10^{24}$  silver atoms
- C)  $1.61 \times 10^{23}$  silver atoms
- D)  $2.44 \times 10^{26}$  silver atoms
- E)  $6.50 \times 10^{25}$  silver atoms

Answer: B

Diff: 2 Page Ref: 2.8

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

- A)  $3.92 \times 10^{24}$  xenon atoms
- B)  $2.55 \times 10^{23}$  xenon atoms
- C)  $1.42 \times 10^{24}$  xenon atoms
- D)  $7.91 \times 10^{25}$  xenon atoms
- E)  $1.87 \times 10^{26}$  xenon atoms

Answer: C

Diff: 2 Page Ref: 2.8

46) How many argon atoms are contained in  $7.66 \times 10^5$  mmol of argon?

- A)  $4.61 \times 10^{26}$  Ar atoms
- B)  $1.84 \times 10^{28}$  Ar atoms
- C)  $1.15 \times 10^{28}$  Ar atoms
- D)  $7.86 \times 10^{20}$  Ar atoms
- E)  $3.24 \times 10^{26}$  Ar atoms

Answer: A

Diff: 2 Page Ref: 2.8

47) 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

Diff: 2 Page Ref: 2.8

48) 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

Diff: 2 Page Ref: 2.8

49) 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

Diff: 3 Page Ref: 2.8

50) What mass (in mg) does 2.63 moles of nickel have?

- A) 44.8 mg
- B)  $2.23 \times 10^4$  mg
- C) 129 mg
- D)  $3.56 \times 10^5$  mg
- E)  $1.54 \times 10^5$  mg

Answer: E

Diff: 3 Page Ref: 2.8

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

- A)  $4.75 \times 10^{-3}$  moles Kr
- B) 33.4 moles Kr
- C)  $2.11 \times 10^{-4}$  moles Kr
- D)  $2.99 \times 10^{-3}$  moles Kr
- E)  $1.19 \times 10^{-4}$  moles Kr

Answer: A

Diff: 3 Page Ref: 2.8

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

- A)  $2.23 \times 10^2$  moles Cs
- B)  $4.48 \times 10^3$  moles Cs
- C)  $7.91 \times 10^4$  moles Cs
- D)  $1.26 \times 10^3$  moles Cs
- E)  $5.39 \times 10^2$  moles Cs

Answer: B

Diff: 3 Page Ref: 2.8

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

- A)  $5.90 \times 10^{25}$  Li atoms
- B)  $7.09 \times 10^{21}$  Li atoms
- C)  $8.49 \times 10^{24}$  Li atoms
- D)  $4.27 \times 10^{22}$  Li atoms
- E)  $4.18 \times 10^{24}$  Li atoms

Answer: C

Diff: 3 Page Ref: 2.8

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

- A)  $2.62 \times 10^{25}$  Fe atoms
- B)  $2.13 \times 10^{26}$  Fe atoms
- C)  $4.69 \times 10^{24}$  Fe atoms
- D)  $3.82 \times 10^{24}$  Fe atoms
- E)  $9.50 \times 10^{22}$  Fe atoms

Answer: D

Diff: 3 Page Ref: 2.8

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

- A)  $3.07 \times 10^{27}$  phosphorus atoms
- B)  $2.95 \times 10^{27}$  phosphorus atoms
- C)  $3.25 \times 10^{28}$  phosphorus atoms
- D)  $1.18 \times 10^{24}$  phosphorus atoms
- E)  $8.47 \times 10^{24}$  phosphorus atoms

Answer: A

Diff: 3 Page Ref: 2.8

56) Calculate the mass (in g) of  $1.9 \times 10^{24}$  atoms of Pb.

- A)  $3.9 \times 10^2$  g
- B)  $2.4 \times 10^2$  g
- C)  $3.2 \times 10^2$  g
- D)  $1.5 \times 10^2$  g
- E)  $6.5 \times 10^2$  g

Answer: E

Diff: 3 Page Ref: 2.8

57) Calculate the mass (in kg) of  $4.87 \times 10^{25}$  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 Page Ref: 2.8

58) Calculate the mass (in ng) of  $2.33 \times 10^{20}$  atoms of oxygen.

- A)  $6.19 \times 10^6$  ng
- B)  $1.62 \times 10^7$  ng
- C)  $2.25 \times 10^3$  ng
- D)  $3.73 \times 10^6$  ng
- E)  $4.69 \times 10^7$  ng

Answer: A

Diff: 4 Page Ref: 2.8

*Match the following.*

59) magnesium

Diff: 1 Page Ref: 2.5

A) C

B) Fe

60) carbon

Diff: 1 Page Ref: 2.5

C) Si

61) potassium

Diff: 1 Page Ref: 2.5

D) K

E) Mg

62) iron

Diff: 1 Page Ref: 2.5

63) silicon

Diff: 1 Page Ref: 2.5

59) E 60) A 61) D 62) B 63) C

64) 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.

Diff: 2 Page Ref: 2.4

65) 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.

Diff: 1 Page Ref: 2.5

66) 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.

Diff: 1 Page Ref: 2.5

67) 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.

Diff: 1 Page Ref: 2.5

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

Answer: sodium

Diff: 2 Page Ref: 2.5

69) Describe the difference between ions and isotopes.

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

Diff: 2 Page Ref: 2.5

70) 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.

Diff: 1 Page Ref: 2.6

71) 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.

Diff: 1 Page Ref: 2.6