

Chem 10 Chapter 4

Atoms and Elements

Additional Practice Questions

Worked solutions at the end

Use your course periodic table and a calculator as needed. Show the setup, include units, and round at the end. Question numbers match the numbers in the solutions. Use heading navigation to move between sections.

Additional Practice Questions

Question 1

Which of the following statements from Dalton's atomic theory is no longer true, according to modern atomic theory?

- A) Elements are made up of tiny particles called atoms.
- B) Atoms are not created or destroyed in chemical reactions.
- C) All atoms of a given element are identical.
- D) Atoms are indivisible in chemical reactions.
- E) All of these statements are true according to modern atomic theory.

Question 2

The first scientist to show that atoms emit any negative particles was

- A) J. J. Thomson
- B) Lord kelvin
- C) Ernest Rutherford
- D) William Thomson
- E) John Dalton

Question 3

The scientist whose alpha-particle scattering experiment led him to conclude that the nucleus of an atom contains a dense center of positive charge is

- A) J. J. Thomson
- B) Lord kelvin
- C) Ernest Rutherford
- D) William Thomson
- E) John Dalton

Question 4

Bromine exists naturally as a mixture of bromine-79 and bromine-81 isotopes. An atom of bromine-79 contains

- A) 35 protons, 44 neutrons, 35 electrons
- B) 34 protons and 35 electrons, only
- C) 44 protons, 44 electrons, and 35 neutrons
- D) 35 protons, 79 neutrons, and 35 electrons
- E) 79 protons, 79 electrons, and 35 neutrons

Question 5

By knowing the number of protons a neutral atom has, you should be able to determine

- A) the number of neutrons in the neutral atom
- B) the number of electrons in the neutral atom
- C) the name of the atom
- D) two of the above
- E) none of the above

Question 6

Which of the following are incorrectly paired?

- A) K, alkali metal
- B) Ba, alkaline earth metal
- C) O, halogen
- D) Ne, noble gas
- E) Ni, transition metal

Question 7

All of the following are characteristics of metals except:

- A) good conductors of heat
- B) malleable
- C) ductile
- D) often lustrous
- E) tend to gain electrons in chemical reactions

Question 8

Which among the following represent a set of isotopes? Atomic nuclei containing: I. 20 protons and 20 neutrons II. 21 protons and 19 neutrons III. 22 neutrons and 18 protons IV. 20 protons and 22 neutrons V. 21 protons and 20 neutrons

- A) I, II, III
- B) III, IV
- C) I, V
- D) I, IV and II, V
- E) No isotopes are indicated.

Question 9

Complete the following table. A dash indicates an entry to find.

Symbol	Protons	Neutrons	Electrons	Net charge
lead-206	—	—	—	—
—	31	38	—	3+
—	52	75	54	—
Mn ²⁺	—	30	—	2+

Question 10

How many protons, neutrons, and electrons, in that order, are present in the anion formed by one atom of selenium-79?

- A) 34, 34, 45
- B) 34, 45, 34
- C) 32, 45, 34
- D) 34, 45, 36
- E) 36, 45, 36

Question 11

A hypothetical element consists of two isotopes of masses 69.95 amu and 71.95 amu with abundances of 25.7% and 74.3%, respectively. What is the average atomic mass of this element?

- A) 70.95 amu
- B) 69.95 amu
- C) 70.5 amu
- D) 71.4 amu
- E) 71.95 amu

Question 12

Naturally occurring copper exists in two isotopic forms: copper-63 and copper-65. The atomic mass of copper is 63.55 amu. What is the approximate natural abundance of copper-63?

- A) 63%
- B) 90%
- C) 70%
- D) 50%
- E) 30%

Question 13

The average mass of a carbon atom is 12.011. Assuming you were able to pick up only one carbon unit, the chances that you would randomly get one with a mass of 12.011 is

- A) 0%
- B) 0.011%
- C) about 12%
- D) 12.011%
- E) greater than 50%

Question 14

For each set of elements, label it as noble gases, halogens, alkali metals, alkaline earth metals, or transition metals.

- (a) Ti, Fe, Ag
- (b) Mg, Sr, Ba
- (c) Li, K, Rb
- (d) Ne, Kr, Xe
- (e) F, Br, I

Question 15

Write the atomic symbol with mass number A and atomic number Z for each isotope.

- (a) 27 protons and 31 neutrons
- (b) boron with mass number 10
- (c) $Z = 12$, $A = 23$
- (d) atomic number 53 and 79 neutrons
- (e) $Z = 20$ and 27 neutrons
- (f) 29 protons and mass number 65

Solutions

Find the solution with the same question number.

Question 1 Solution

C. Isotopes of an element have the same number of protons but different numbers of neutrons. Thus all atoms of an element are not identical in mass.

Question 2 Solution

A. J. J. Thomson identified negatively charged particles, electrons, using cathode rays.

Question 3 Solution

C. Rutherford's alpha-particle scattering experiment showed that positive charge is concentrated in a very small, dense nucleus.

Question 4 Solution

A. Bromine has atomic number 35: 35 protons and, for a neutral atom, 35 electrons.
Neutrons = $79 - 35 = 44$.

Question 5 Solution

D. Both B and C follow. A neutral atom has as many electrons as protons, and its proton count determines its element. Neutrons can vary among isotopes.

Question 6 Solution

C. Oxygen is in Group 6A (16), not the halogen group. Halogens are in Group 7A (17).

Question 7 Solution

E. Metals tend to lose electrons and form cations. The other statements describe typical metallic properties.

Question 8 Solution

D. We are looking for atoms that have the same number of protons and different numbers of neutrons. I and IV both have 20 protons, but have 20 and 22 neutrons. II and V both have 21 protons, but have 19 and 20 neutrons.

Question 9 Solution

Use the atomic number for the proton count. Mass number is protons plus neutrons. A positive charge means fewer electrons than protons; a negative charge means more.

Symbol	Protons	Neutrons	Electrons	Net charge
lead-206	82	124	82	0
Ga ³⁺	31	38	28	3+
Te ²⁻	52	75	54	2-

Symbol	Protons	Neutrons	Electrons	Net charge
Mn ²⁺	25	30	23	2+

Question 10 Solution

D. Selenium has atomic number 34, i.e. 34 protons. For selenium-79, neutrons = $79 - 34 = 45$. Se is a nonmetal in Group 6A, two positions away from the noble gases, so it forms divalent anions with charge 2⁻. Electrons = $34 + 2 = 36$. Therefore: 34 protons, 45 neutrons, 36 electrons.

Question 11 Solution

D. Use the weighted average of the isotopic masses.

$$\text{Average mass} = (0.257)(69.95 \text{ u}) + (0.743)(71.95 \text{ u}) = 71.4 \text{ u}$$

Question 12 Solution

C. We already know the weighted average of the isotopic masses: 63.55 u. When we have only two isotopes making up an element, we can find the abundance of one from the other because abundance 1 + abundance 2 = 1, or 100%. So if x is the abundance of the first isotope, the abundance of the second is $1 - x$.

We are not given the exact isotopic masses, but mass number is a good approximation.

$$x(63) + (1 - x)(65) = 63.55$$

$$x = 0.725 \approx 70\%$$

The nearest choice is 70%; the mass-number approximation gives 72.5%.

Question 13 Solution

A. The value 12.011 u is a weighted average of the masses of carbon isotopes. It is not the mass of an individual carbon atom, so the probability is 0%.

Question 14 Solution

- (a) Ti, Fe, Ag: transition metals.
- (b) Mg, Sr, Ba: alkaline earth metals.
- (c) Li, K, Rb: alkali metals.
- (d) Ne, Kr, Xe: noble gases.
- (e) F, Br, I: halogens.

Question 15 Solution

- (a) Cobalt-58:



(b) Boron-10:



(c) Magnesium-23:



(d) Iodine-132:



(e) Calcium-47:



(f) Copper-65:

