

Exercises 1

Exercise 1.1

How many protons, neutrons, and electrons are there in an atom of ^{56}Fe ?

Exercise 1.2

If the mass of a nitrogen atom is $15 \cdot 1.67 \cdot 10^{-27} \text{ kg}$ ($\cong 15 \text{ u}$), which isotope of nitrogen is it?

Exercise 1.3

Taking into account the different isotopes of carbon and hydrogen, in how many different forms can a stable C_2H_2 molecule exist? Among them, how many have different masses?

Exercise 1.4

What is the ratio of the density of water H_2O to that of heavy water D_2O , given that these two molecules have the same volume?

Exercise 1.5

An atom has 48 protons and 63 neutrons. What nuclide is it?

Exercise 1.6

What is the atomic number and molar mass of calcium? What is the atomic number and mass number of the most common isotope of chlorine?

Exercise 1.7

You've been presented with three unknown samples, each from a different element. Using a mass spectrometer, you find that:

- Sample A has three isotopes with masses of 19.99 amu, 20.99 amu, and 21.99 amu.
- Sample B has two isotopes with masses of 34.97 amu and 36.97 amu.
- Sample C has one isotope with a mass of 4.00 amu.

Identify each sample by its element. Explain how the presence of these isotopes influences the average atomic mass of the elements.

Exercise 1.8

- a) How many neutrons, protons and what atomic number does the nuclide ^{13}C have?
- b) How many neutrons, protons and what atomic number does the nuclide ^{238}U have?
- c) Fill in the blank spaces using a periodic table:

Atom	Z	N	A
^{40}Ar			
^{127}I			
Si			
Cs			

Exercise 1.9

Find isotopes and isobars from the following nuclides: ^{12}C , ^{13}C , ^{14}N , ^{14}C , ^3H , ^3He , ^1H .

Exercise 1.10

Calculate the average atomic mass of bromine from the isotopic masses.

Isotop	Abundance	Isotopic mass
^{79}Br	50.5%	78.92 u
^{81}Br	49.5%	80.92 u

Exercise 1.11

Read each statement carefully and decide whether it is True or False.

- The atomic number of an element is equal to the number of neutrons in its nucleus.
True / False
- Isotopes of an element have different chemical properties because they have different numbers of neutrons
True / False
- The atomic number determines the identity of an element.
True / False
- Isobars are atoms of different elements that have the same number of protons.
True / False
- Isotopes have the same atomic number but different mass numbers.
True / False
- All isotopes of an element are stable.
True / False
- Isobars have different atomic numbers but the same atomic mass.
True / False
- The number of protons in the nucleus of an atom can vary in isotopes of the same element.
True / False