

## Exercises 1

### Exercise 1.1

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

### Exercise 1.2

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

### Exercise 1.3

Considering the different isotopes of carbon and hydrogen, in how many different forms can a stable  $\text{C}_2\text{H}_2$  molecule exist? Among them, how many have different masses?

### Exercise 1.4

What is the ratio of the density of water  $\text{H}_2\text{O}$  to that of heavy water  $\text{D}_2\text{O}$ , 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  $^{13}_6\text{C}$  have?
- b) How many neutrons, protons and what atomic number does the nuclide  $^{238}_{92}\text{U}$  have?
- c) Fill in the blank spaces using a periodic table:

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

### Exercise 1.9

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

### Exercise 1.10

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

Isotop	Abundance	Isotopic mass
$^{79}\text{Br}$	50.5%	78.92 u
$^{81}\text{Br}$	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