

Practice:

- 1) Why do atoms have the same number of protons and electrons?

Atoms are neutral: their positive and negative charges balance out. Protons are positively charged and electrons are negatively charged. In order for an atom to be neutral, it needs to have the same number of protons and electrons.

- 2) Explain why you need to subtract atomic number from atomic mass to calculate the number of neutrons in an atom.

Because electrons have such a small mass (basically 0), the mass of an atom comes entirely from its neutrons and protons, which each have a mass of 1. The number of protons can be determined from the atomic number, since the number of protons determines the identity of an element and all atoms of the same element will have the same number of protons. We subtract the atomic number (number of protons) from the atomic mass to determine the number of neutrons because all of the 'leftover mass' must be due to neutrons in the atom.

	protons	neutrons	electrons
N	7	7	7
Br ⁻	35	45	36
Zn ²⁺	30	35	28
Li	3	4	3
argon	18	22	18
calcium ion	20	20	18
nickel(III) ion	28	31	25
potassium	19	20	19

- 3) Why do atoms and ions have the same number of protons and neutrons, but different numbers of electrons?

The only difference between atoms and ions is the number of electrons because an ion is an atom (or molecule) that has gained or lost electrons. Therefore, the number of electrons will be different. Extra note: chemical reactions tend to only involve the shifting around of electrons between atoms. Nuclear reactions, which release a LOT of energy, involve changing the contents of the nucleus.

- 4) Why do ions never have the same number of protons as electrons?

Ions are charged entities. In order to be charged, it must have different numbers of positively charged protons and negatively charged electrons.

- 5) To form an anion, does an atom have to gain or lose electrons? Why?

To form an anion, an atom gains electrons. Electrons are negatively charged. An anion is a negatively charged ion. Therefore, when a neutral atom gains electrons, it becomes a negatively charged ion.

- 6) When a calcium atom becomes an ion, does it have to gain or lose electrons? How many?

Calcium forms the Ca²⁺ ion. A calcium atom becomes an ion by losing two electrons.

- 7) Is the chlorine ion a cation or an anion? Does it form by gaining or losing electrons?

Chlorine forms the Cl⁻ ion. A chlorine atom becomes an ion by gaining one electron.

- 8) Is Cr³⁺ a cation or anion?

Cr³⁺ is a cation because it is positively charged.

- 9) Does arsenic form an ion by gaining or losing electrons? How many? How do you know?

Arsenic forms the As³⁻ ion. It does so by gaining 3 electrons. I know because each electron is negatively charged; when an atom gains 3 more electrons, it will have 3 extra negative charges.

- 10) Why do we call manganese a multivalent element? List 3 other multivalent elements.

Manganese is a multivalent element because it is capable of forming more than one charged ion. Other multivalent elements include: chromium, vanadium, iron...many more!