

Solutions

2.1

: atomic number counts protons.: mass number counts protons plus neutrons.

2.2

: $N = A - Z = 23 - 11 = 12$.: $N = 24 - 11 = 13$.

2.3

: Na^+ has 10 electrons.: Cl^- has 18 electrons.: Na loses one electron while retaining 11 protons, or Cl gains one while retaining 17 protons, giving the stated imbalance.

2.4

: both have 11 protons.: proton number identifies the element.: neutron counts/mass numbers differ, 12 versus 13 neutrons.

3.1

each: ionic attraction is between opposite charges; transfer describes ion formation rather than the whole bond; covalent H_2 involves a shared pair; supplied hydrogen-1 has no neutron; main-group similarities relate to outer electron arrangements; group elements have different proton numbers/full structures and are not identical.

3.2

Local analytic rubric, 8 ×: define proton identity; give sodium neutron counts; retain same element; correct Na^+ electron count; correct Cl^- electron count; distinguish attraction from transfer; identify covalent sharing; recognise hydrogen-1 exception; coherent truthful 80–110 word response. Example: “Atomic number counts protons, while mass number counts protons and neutrons. Sodium-23 therefore has twelve neutrons and sodium-24 thirteen. Both remain sodium because each has eleven protons. A neutral sodium atom has eleven electrons; losing one produces Na^+ with ten. Neutral chlorine has seventeen electrons; gaining one produces Cl^- with eighteen. Electron transfer explains formation of these ions, while their opposite charges produce ionic attraction. In the supplied hydrogen molecule, an electron pair is shared, giving a covalent model. Not every atom contains a neutron: hydrogen-1 has one proton and no neutron.”