

Solutions

Each answer shows the steps, then the **result**.

2.1

- a neutron is uncharged
- relative charge 0

2.2

- calcium has 20 electrons: fill shells 2, 8, 8, 2
- 2, 8, 8, 2

2.3

- proton number is 13, so **13 protons**
- neutrons = $27 - 13 = 14$
- 3+ means three electrons lost, so electrons = $13 - 3 = 10$
- fewer electrons than protons because the atom **lost** three electrons

2.4

- three outer-shell electrons → **Group III**
- three occupied shells → **Period 3**

2.5

- chemical properties depend on the **arrangement of electrons**
- isotopes have the same proton number, so the **same electrons**

3.1 B

- outer shell 7 → **Group VII**; three shells → **Period 3**
- A mixes group and period; C is Period 2; D is Group III

3.2

(a)

- protons = **13**
- neutrons = $27 - 13 = 14$
- electrons = **13**

(b)

- 13 electrons fill 2, 8, 3
- 2, 8, 3

3.3

- equal numbers of protons (+1) and electrons (−1)
- the charges **cancel**, so the atom is **neutral**

3.4

(a)

- **W**: 11 p, 12 n, 11 e
- **X**: 11 p, 13 n, 11 e
- **Y**: 17 p, 18 n, 18 e
- **Z**: 12 p, 12 n, 10 e

(b)

- **W and X**
- same proton number (11) but **different numbers of neutrons**

(c)

- configuration 2, 8, 1
- one outer electron → **Group I**
- three shells → **Period 3**

(d)

- **Z** is magnesium that has **lost two electrons**
- 12 protons but only 10 electrons → charge 2+

(e)

- chemical properties depend on **outer-shell electrons**
- **W** and **X** both have 2, 8, 1; they differ only in **neutrons**, which do not bond