Teach the particle clues

An original 45-minute introduction for learners who can add and subtract whole numbers. Adapt the language and pace for your class.

Learning goals

- Match proton, neutron and electron to their electric charge.
- Use atomic number and mass number to count particles.
- Distinguish an isotope change from a change in electric charge.

Atomic number: proton count.	**Mass number:** protons + neutrons in one nucleus.
Neutral atom: protons = electrons.	**Monatomic ion charge:** protons - electrons, in units of elementary charge.

A lesson you can adapt

1. **5 minutes / notice.** Ask whether changing the neutron count changes an element's identity. Save initial explanations for comparison later.
2. **10 minutes / model.** Use 6 proton counters, 7 neutron counters and 6 electron counters for neutral carbon-13. Count aloud: atomic number 6, mass number 13, net charge 0. A counter layout is a counting model, not a scale drawing or an electron-orbit map.
3. **15 minutes / investigate.** Complete student page 1, then discuss why carbon-12 and carbon-13 are the same element. Move to page 2 once proton and neutron counts are clear.
4. **10 minutes / explain.** Compare sodium +1 and chloride -1 using the provided proton counts. Ask which count changes during ordinary ion formation and which stays fixed.
5. **5 minutes / exit check.** An atom has 8 protons, 10 neutrons and 10 electrons. Ask for atomic number, mass number and charge. Expected: 8, 18, -2. Use explanations to choose the next lesson.

Support, challenge and care

Provide a charge word bank and a worked subtraction. Let learners give spoken, drawn or written explanations. For extension, ask learners to invent an isotope pair with the same proton count. No chemicals, practical experiment or personal learner data are needed.

Mass number is a whole-number count for one isotope, not the periodic table's average atomic mass. Gaining or losing electrons changes charge; ordinary ion formation does not change the nucleus. This pack does not teach electron configurations or nuclear reactions.

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Answers with reasons

Keep this page separate from learner copies. Short digital answers accept the shown digits only; the printed explanations are for discussion.

1. Neutron

A neutron has no electric charge. A proton is positive and an electron is negative.

2. 6

Neutral charge requires equal proton and electron counts, so it has 6 electrons.

3. 10

Neutrons = mass number - atomic number = 18 - 8 = 10.

4. False

Both are carbon, with 6 protons. Carbon-12 has 6 neutrons; carbon-13 has 7.

5. 15

Mass number counts protons and neutrons together: 7 + 8 = 15. It is not a relative atomic mass.

6. Proton number

An element is defined by its proton number. Isotopes and ions can have different neutron or electron counts.

7. 10

Charge in elementary-charge units = protons - electrons. Here, 11 - 10 = +1.

8. 18

A -1 charge means one more electron than proton: 17 - 18 = -1.

9. True

Gaining or losing electrons changes charge, not the nucleus or the element. This statement is about ordinary ion formation, not nuclear reactions.

10. (8, 8) and (8, 10)

Isotopes have the same proton number and different neutron numbers. Only the pair with 8 protons in each fits.

11. 10

A +2 ion has lost two electrons compared with the neutral atom: 12 - 2 = 10. Its 12 neutrons do not affect this charge calculation.

12. It lost negative electrons.

Losing negative electrons leaves more protons than electrons. Ordinary ion formation does not add protons to the nucleus.

Fact-check sources

- OpenStax Chemistry 2e, 2.3 Atomic Structure and Symbolism
- OpenStax Chemistry 2e, 2.6 Ionic and Molecular Compounds

Sources support the particle rules, isotope definitions and ordinary ion formation. Questions, explanations, layout and illustration are original, not copied from the sources. No publisher or exam-board endorsement is implied. Facts checked November 10, 2026.

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