

Solutions

2.1 Tiny indivisible spheres → plum pudding model → nuclear model → Bohr orbits → neutrons.

2.2 A ball of positive charge; with negative electrons embedded in it.

2.3 Electrons orbit the nucleus at specific distances (fixed energy levels).

3.1 Plum pudding: positive charge spread through the whole atom with electrons embedded. Nuclear model: nearly all the mass and positive charge concentrated in a tiny central nucleus, with electrons around it.

3.2 (a) The atom is mostly empty space. (b) The alpha particle meets a concentrated region of positive charge and mass; repelling/deflecting it through a large angle requires the charge and mass to be in a tiny nucleus; much smaller than the atom. (c) The plum pudding model predicted small deflections only, because its charge is spread out; the large-angle observations contradict it, so the model had to be replaced by one matching the evidence – the nuclear model.

3.3 Scientific models are explanations that must fit all the experimental evidence; when new evidence (the scattering results) contradicts a model, the model is changed or replaced rather than the evidence ignored; this self-correction – test, compare, revise – is exactly how science develops reliable knowledge.