

1. Where is almost all of an atom's mass?
 - ☐ in the tiny central nucleus
 - ☐ spread evenly through the atom
 - ☐ in the electrons
 - ☐ in the empty space
2. Nuclear fission is when:
 - ☐ a heavy nucleus splits into two smaller nuclei, releasing neutrons and energy
 - ☐ two light nuclei join together
 - ☐ an atom gains an electron
 - ☐ a nucleus gives out a gamma ray only
3. Radioactive decay is spontaneous and random. This means:
 - ☐ you cannot predict when a particular nucleus will decay, or speed it up
 - ☐ it can be sped up by heating
 - ☐ every nucleus decays at the same instant
 - ☐ it only happens in a laboratory
4. The half-life of a radioactive isotope is the time taken for:
 - ☐ half the unstable nuclei in a sample to decay
 - ☐ all the nuclei to decay
 - ☐ the sample to double
 - ☐ the radiation to travel 1 metre
5. An atom that loses an electron becomes a positive ion.
 - ☐ True ☐ False
6. Nuclear fusion is when:
 - ☐ two light nuclei join to make a heavier one, releasing energy
 - ☐ a heavy nucleus splits
 - ☐ a neutron turns into a proton
 - ☐ electrons jump between orbits

7. A source reads 250 counts/min. The background is 30 counts/min. What is the corrected count rate, in counts/min?

_____ counts/min

8. A source reads 800 counts/min and has a half-life of 3 hours. What is the count rate after 6 hours, in counts/min?

_____ counts/min

9. How many neutrons are in a nucleus of $^{14}_6\text{C}$?

10. In $^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{141}_{56}\text{Ba} + {}^{92}_{36}\text{Kr} + x {}^1_0\text{n}$, how many neutrons x are released?

IGCSE Physics

1. **in the tiny central nucleus**

Almost all the mass is concentrated in the tiny, dense nucleus; the rest of the atom is mostly empty space.

2. **a heavy nucleus splits into two smaller nuclei, releasing neutrons and energy**

Fission = splitting a heavy nucleus (after it absorbs a neutron) into two smaller nuclei, plus 2–3 neutrons and energy.

3. **you cannot predict when a particular nucleus will decay, or speed it up**

Spontaneous = not triggered and not controllable; random = you cannot say which nucleus decays next or exactly when.

4. **half the unstable nuclei in a sample to decay**

Each half-life, half of the remaining unstable nuclei decay, so the count rate halves.

5. **True**

Losing a negative electron leaves the atom with more positive charge — a positive ion.

6. **two light nuclei join to make a heavier one, releasing energy**

Fusion = joining two light nuclei into a heavier one, releasing energy. It powers the Sun.

7. **220 counts/min**

Corrected = measured – background = $250 - 30 = 220$ counts/min.

8. **200 counts/min**

6 hours is two half-lives: $800 \rightarrow 400 \rightarrow 200$ counts/min.

9. **8**

Neutrons = $A - Z = 14 - 6 = 8$.

10. **3**

Nucleon numbers must balance: $235 + 1 = 141 + 92 + x$, so $236 = 233 + x$ and $x = 3$.