MR SULLY UNFOLDS PHYSICS ANSWERS

Nuclear fission and fusion

AQA 4.4.4
Atomic structure · Paper 1
Physics only

Name _____ Class _____ Date _____

Huge amounts of energy can be released from the nucleus, either by splitting a large and unstable nucleus (**fission**) or by joining two light nuclei to form a heavier nucleus (**fusion**).

KEY IDEAS

- **Fission**: a large and unstable nucleus (e.g. uranium-235) usually absorbs a neutron, then splits into two smaller nuclei, roughly equal in size, releasing 2 or 3 neutrons, gamma rays and energy.
- The released neutrons can cause more fissions: a **chain reaction**. Controlled in a reactor; uncontrolled in a nuclear weapon.
- **Fusion**: two **light nuclei** join to form a heavier nucleus. Some mass may be converted into the energy of radiation. Fusion powers stars.

Section A · Recall

Grade 4–5

1 What is nuclear fission? [2]

The splitting of a large and unstable nucleus (e.g. uranium or plutonium)

into two smaller nuclei, roughly equal in size (releasing energy).

2 What is nuclear fusion? [2]

The joining of two light nuclei

to form a heavier nucleus (releasing energy).

3 Name two elements used as fuel in fission reactors. [2]

Uranium and plutonium

Section B · Explain

Grade 5–6

4 Describe what usually has to happen before a uranium-235 nucleus undergoes fission. [1]

It must absorb a neutron.

5 Describe the products of a fission reaction. [3]

Two smaller nuclei of roughly equal size,

two or three neutrons and gamma rays,

all with kinetic energy (energy is released).

6 Draw a labelled diagram to show how a chain reaction happens. [3]

Neutron hits nucleus (1); nucleus splits releasing 2–3 neutrons (1); released neutrons hit further nuclei (1).

Section C · Stretch

Grade 7+

7 Explain the difference between the chain reaction in a nuclear reactor and in a nuclear weapon. [2]

In a reactor the chain reaction is controlled, so energy is released at a steady rate.

In a weapon it is uncontrolled, causing an explosion.

Exam-style question

AQA style

8 Stars like the Sun are powered by nuclear fusion.

a Describe what happens in nuclear fusion in the Sun. [2]

Two light nuclei (hydrogen) join together

to form a heavier nucleus (helium), releasing energy.

b Compare nuclear fusion with nuclear fission. [4]

Fission splits a large and unstable nucleus; fusion joins two light nuclei to form a heavier nucleus.

Fission usually needs a neutron to be absorbed first; fusion doesn't.

Fission releases neutrons that can cause a chain reaction.

Both release energy; fission is used in power stations, fusion powers stars.

Total: _____ / 21

How confident am I?	Not yet	Nearly	Got it
I can describe nuclear fission and a chain reaction	☐	☐	☐
I can describe nuclear fusion of light nuclei	☐	☐	☐
I can compare fission and fusion	☐	☐	☐