

GCSE Physics

Worksheet: Nuclear fusion

TIME 20 min	TOTAL 20 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Nuclear fusion

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

0 1 . 1

Which statement describes nuclear fusion?

Tick (✓) **one** box.

Two light nuclei join together to form a heavier nucleus, releasing energy

☐

A heavy nucleus splits into two smaller nuclei, releasing energy

☐

A nucleus emits a beta particle, becoming a different element

☐

A nucleus absorbs a neutron and becomes a different isotope

☐

[1 mark]

0 2

0 2 . 1

What is nuclear fusion?

Tick (✓) **one** box.

The joining of two light nuclei to form a heavier nucleus

☐

The splitting of a heavy nucleus into two lighter nuclei

☐

The emission of radiation from an unstable nucleus

☐

The absorption of a neutron by a nucleus

☐

[1 mark]

0 2 . 2

Where does nuclear fusion happen naturally?

.....

.....

.....

.....

[1 mark]

0 2 . 3

In a fusion reaction, some of the mass of the nuclei is converted into another form.

What is it converted into?

.....

.....

.....

.....

[1 mark]

0 2 . 4

Give **one** similarity between nuclear fission and nuclear fusion.

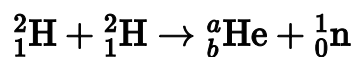
.....

.....

[1 mark]

0 3

Two deuterium nuclei (hydrogen-2) fuse to form helium-3 and a neutron:



0 3 . 1

Determine the values of a and b.

.....

.....

.....

.....

.....

[2 marks]

0 4

0 4 . 1

Explain why fusion is often described as a potential 'clean' energy source, in terms of the waste it produces and the fuel it uses, and give one reason why it has not yet been used to generate electricity commercially.

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[3 marks]

0 5

0 5 . 1

Give **two** differences between nuclear fission and nuclear fusion.

.....

.....

.....

.....

[2 marks]

0 5 . 2

Explain why very high temperatures are needed for fusion to happen.

.....

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.....

.....

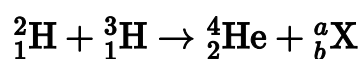
.....

.....

[3 marks]

0 6

The equation shows a fusion reaction that scientists hope to use in future power stations.



0 6 . 1

Determine the values of a and b, and identify particle X.

.....

.....

.....

.....

[2 marks]

0 6 . 2

The total mass of the particles after the reaction is less than the total mass before the reaction.

Explain what has happened to the missing mass.

[1 mark]

0 6 . 3

The two hydrogen nuclei in the equation are isotopes of hydrogen.

Describe how they are different.

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Physics · Worksheet: Nuclear fusion · 20 marks

Question 1 (1 mark)

01.1 [1 mark]

Correct: Two light nuclei join together to form a heavier nucleus, releasing energy

Question 2 (4 marks)

02.1 [1 mark]

Correct: The joining of two light nuclei to form a heavier nucleus

02.2 [1 mark]

Answer: In stars, such as the Sun

- in stars / in the Sun (1)
-

02.3 [1 mark]

Answer: Energy (radiation)

- energy (of radiation) (1)
-

02.4 [1 mark]

Answer: Both release energy.

- both release energy (1)
 - both are nuclear reactions / change the nuclei of atoms (1)
-

Any 1 of the points above.

Question 3 (2 marks)

03.1 [2 marks]

Answer: $a = 3$, $b = 2$

- $a = 2 + 2 - 1 = 3$ (1)
 - $b = 1 + 1 - 0 = 2$ (1)
-

Question 4 (3 marks)

04.1 [3 marks]

Answer: It produces no long-lived radioactive waste and uses abundant fuel, but the extreme conditions needed have not yet been sustained efficiently enough for commercial net energy gain.

- fusion does not produce long-lived radioactive waste, unlike fission (1)
 - the fuel is plentiful (e.g. deuterium, an isotope of hydrogen, can be extracted from seawater) (1)
 - however, the extremely high temperatures and pressures needed have not yet been maintained for long enough, or achieved efficiently enough, to produce more energy than is put in on a commercial scale (1)
-

Question 5 (5 marks)

05.1 [2 marks]

Answer: Fission splits a heavy nucleus; fusion joins light nuclei. Fission is started by neutrons; fusion needs extremely high temperatures.

- fission splits a large (heavy) nucleus, but fusion joins two small (light) nuclei (1)
- fission is usually started by a neutron, but fusion needs very high temperatures (and pressures) (1)
- fission is used in power stations now, but fusion power stations are still being developed (1)
- fission products are radioactive (long-lived waste), but fusion produces little long-lived radioactive waste (1)
- fusion is the energy source of stars, but fission is not (1)

Any 2 of the points above.

05.2 [3 marks]

Answer: The positive nuclei repel each other; only at extreme temperatures do they move fast enough to get close enough to fuse.

- nuclei are positively charged, so they repel each other (1)
 - at very high temperatures the nuclei move very fast / have a lot of kinetic energy (1)
 - so they can get close enough (overcoming the repulsion) to join together (1)
-

Question 6 (5 marks)

06.1 [2 marks]

Answer: $a = 1$, $b = 0$: X is a neutron

- $a = 1$ and $b = 0$ (1)
 - X is a neutron (1)
-

06.2 [1 mark]

Answer: It has been converted into energy.

- it has been converted into energy (of radiation / kinetic energy of the products) (1)
-

06.3 [2 marks]

Answer: Both have one proton, but hydrogen-2 has one neutron and hydrogen-3 has two.

- both have one proton (1)
 - hydrogen-2 has one neutron but hydrogen-3 has two neutrons (1)
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