

Exercise walk-through

6.6

Nuclear Power

AP Environmental Science

Nuclear power

Nuclear power uses **fission** : a neutron splits a uranium nucleus, releasing huge heat.

- almost no **greenhouse gas**
- but **radioactive waste** lasts 10,000+ years

Low-carbon and steady, but waste storage and accidents are the risks.



Nuclear: steady low-carbon power, long-lived waste

Worked example – radioactive waste and half-life

An isotope has a half-life of 30 years. After 90 years, what fraction of the original waste is left?

- $90/30 = 3$ half-lives
- each halves what remains:
 $1 \rightarrow \frac{1}{2} \rightarrow \frac{1}{4} \rightarrow \frac{1}{8}$
- = $1/8$, i.e. 12.5% still radioactive

Three half-lives is not 'nearly gone'. This is why waste storage is planned in **thousands** of years, not decades.

Exercises 2.1-2.3

2.1 What process generates the heat in a nuclear plant?

[1]

2.2 State one advantage of nuclear power.

[1]

2.3 State one disadvantage.

[1]

Exercises 2.1-2.3

2.1 What process generates the heat in a nuclear plant? [1]

2.1

- Nuclear fission (splitting uranium atoms)
-

2.2 State one advantage of nuclear power. [1]

2.2

- Any one: no CO₂, high energy density, reliable
-

2.3 State one disadvantage. [1]

2.3

- Any one: radioactive waste, accident risk, high cost, thermal pollution

Exercise 3.1

3.1 A climate advantage of nuclear power is that it

[1]

☐

A produces no CO_2 during operation

B burns coal

C releases methane

D needs no fuel

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3.1 A

- produces no CO_2 during operation

Exercise 3.2 (a)

3.2 A country considers building nuclear plants to cut carbon emissions.

(a) State one benefit and one drawback.

[2]

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3.2 A country considers building nuclear plants to cut carbon emissions.

(a) State one benefit and one drawback.

[2]

(a)

- Benefit: low-carbon, energy-dense power; drawback: radioactive waste or accident risk

Exercise 3.2 (b)

3.2 A country considers building nuclear plants to cut carbon emissions.

(b) Explain the main challenge of nuclear waste.

[2]

Exercise 3.2 (b)

3.2 A country considers building nuclear plants to cut carbon emissions.

(b) Explain the main challenge of nuclear waste.

[2]

(b)

- The waste stays radioactive and dangerous for thousands of years, so it must be stored safely for a very long time

Exercise 3.3

3.3 Explain why nuclear power is low-carbon but still not fully renewable.

[2]

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3.3 Explain why nuclear power is low-carbon but still not fully renewable. [2]

3.3

- It emits no CO₂ during operation, but its fuel (uranium) is a finite mined element, so it is nonrenewable