

Exercise walk-through

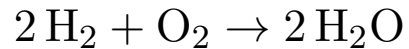
6.7

Energy from Biomass

AP Environmental Science

Biomass, hydrogen, conservation

Biomass burns stored
chemical energy; ferment crops to
ethanol . A **hydrogen fuel**
cell makes only water:

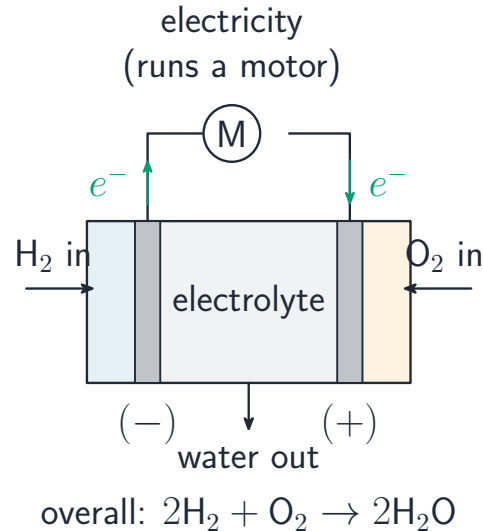


The cleanest energy is the
energy we never use – **energy**
conservation .



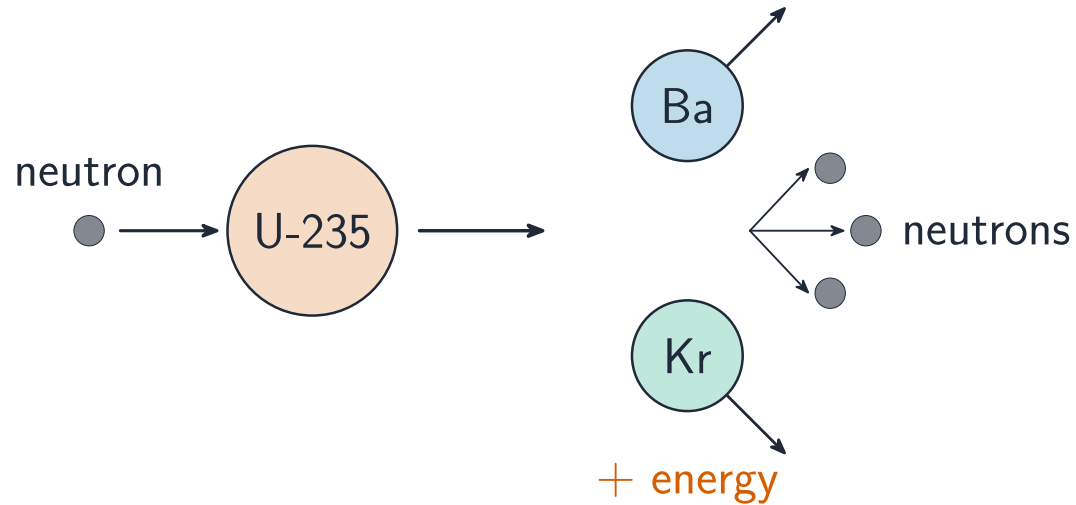
Conservation + renewables: efficiency first

A hydrogen-oxygen fuel cell makes electricity



A hydrogen-oxygen fuel cell makes electricity, with water as the only product

Nuclear Power, continued



Nuclear fission of a uranium-235 nucleus releases energy

Exam tips

- Separate **renewable** (sun, wind, water) from **non-renewable** (fossil fuels, nuclear) and weigh each source's trade-offs.
- Fossil fuels are energy-dense but emit CO_2 ; **nuclear** emits no CO_2 but leaves long-lived waste.
- Do **half-life** math: after n half-lives a fraction $(\frac{1}{2})^n$ remains.
- Note that solar and wind are **intermittent** and need storage or backup.

Exam tips (continued)

- **Conservation** (efficiency) is often the cheapest, cleanest option – the energy not used needs no fuel.
- Know the **coal ranks** (peat → lignite → bituminous → anthracite; more heat/pressure/burial → higher energy) and the unconventional fuels **fracking** (shale oil/gas; groundwater + VOC pollution) and **tar sands** (bitumen, energy-intensive).
- **Ethanol** adds no net CO₂ but has a **low EROEI**; **cogeneration** (combined heat and power) captures waste heat so one fuel gives both electricity and heat.

Exercises 2.1-2.3

2.1 Give one example of biomass energy.

[1]

2.2 Why can biomass be roughly carbon neutral?

[1]

2.3 State one disadvantage of biofuel crops.

[1]

Exercises 2.1-2.3

2.1 Give one example of biomass energy.

[1]

2.1

- Any one: burning wood/crop waste, ethanol, biodiesel
-

2.2 Why can biomass be roughly carbon neutral?

[1]

2.2

- Growing it absorbs the same CO₂ that burning releases
-

2.3 State one disadvantage of biofuel crops.

[1]

2.3

- Any one: competes with food, uses land/water/fertilizer, air pollution

Exercise 3.1

3.1 Biomass can be considered carbon neutral because growing it

[1]

☐

A releases CO_2

B absorbs the CO_2 that burning releases

C produces no gases

D uses fossil fuels

Exercise 3.1

3.1 Biomass can be considered carbon neutral because growing it

[1]

☐

A releases CO_2

B absorbs the CO_2 that burning releases

C produces no gases

D uses fossil fuels

3.1 B

- absorbs the CO_2 that burning releases

Exercise 3.2 (a)

3.2 A country grows corn to make ethanol fuel.

(a) State one benefit and one drawback.

[2]

Exercise 3.2 (a)

3.2 A country grows corn to make ethanol fuel.

(a) State one benefit and one drawback.

[2]

(a)

- Benefit: renewable and near carbon-neutral; drawback: competes with food or causes air pollution

Exercise 3.2 (b)

3.2 A country grows corn to make ethanol fuel.

(b) Explain why biomass is renewable only if managed well.

[2]

Exercise 3.2 (b)

3.2 A country grows corn to make ethanol fuel.

(b) Explain why biomass is renewable only if managed well.

[2]

(b)

- It is renewable only if the plants are regrown as fast as they are burned; otherwise the resource is depleted

Exercise 3.3

3.3 Explain why burning biomass is often considered better for the climate than burning coal. [2]

Exercise 3.3

3.3 Explain why burning biomass is often considered better for the climate than burning coal. [2]

3.3

- Biomass returns recently-absorbed CO_2 (near carbon-neutral), while coal releases carbon stored for millions of years, adding new CO_2 to the atmosphere