Impacts and emerging technology

LEARNING INTENTION

We are learning to explain the impacts of engineering and to identify emerging technologies.

SUCCESS CRITERIA — I CAN

- ☐ describe social, economic and environmental impacts
- ☐ explain how engineering can limit climate change by reducing greenhouse gases
- ☐ identify a real emerging technology
- ☐ write an 'explain' answer with a cause and an effect

Three kinds of impact

Impact	About	Example: a new hydro scheme
Social	people and communities	+ local jobs; – noise during building
Economic	money, jobs, costs	+ cheaper power over time; – high build cost
Environmental	land, air, water, wildlife	+ low-carbon electricity; – river habitats changed

Impacts can be positive or negative. Say which, and say who or what is affected.

Climate change

Burning fossil fuels releases greenhouse gases such as carbon dioxide. These trap heat and warm the climate.

Engineering limits climate change by cutting greenhouse gas emissions: renewable generation, efficient motors and lighting, insulation, and control systems that switch things off when not needed.

SHORT CIRCUIT

× WHAT EXAMINERS SAW

Many candidates did not relate limiting climate change to greenhouse gases.

✓ THE FIX

Always name greenhouse gases (e.g. carbon dioxide): 'so less CO_2, a greenhouse gas, is released'.

Course report 2024, Question 12(a).

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WORKED EXAMPLE **An 'explain' answer**

1 GIVEN	2 FIND	3 FORMULA	4 SUBSTITUTE	5 ANSWER + UNIT
Question: explain how a tidal turbine helps to limit climate change.	cause → effect	cause: what the technology does effect: on greenhouse gases / climate	It generates electricity without burning fossil fuels (cause) so less carbon dioxide, a greenhouse gas, is released (effect).	**1 cause + 1 linked effect**

Use 'so' or 'which means' to join the cause to the effect.

Emerging technology

An emerging technology is new and still to be tried commercially in a product or system. It may exist in labs or trials only.

Counts as emerging (check it is still emerging when you use it)	Does not count
solid-state batteries in consumer products	artificial intelligence
perovskite solar cells	electric vehicles
airborne wind energy (kites)	self-driving cars
wave-energy arrays	graphene (no longer accepted)
bio-inspired soft robots	smartphones, LED lighting

SHORT CIRCUIT

× WHAT EXAMINERS SAW

Many candidates named something already in commercial use (AI, electric vehicles, self-driving cars) instead of an emerging technology.

✓ THE FIX

Emerging = new and not yet tried commercially in a product or system. AI, EVs and self-driving cars do not count; graphene will no longer be accepted.

Course report 2024, Question 10(e) and Section 3.

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Impacts in pictures

THREE KINDS OF IMPACT

1. **People: health, safety, travel, jobs** — Social
2. **Money: cost, jobs, income** — Economic
3. **Planet: emissions, habitats, waste** — Environmental

Impacts of an electric ski lift



Social: easier access

Environmental: land cleared for

Economic: jobs to run it

Environmental: no exhaust at the

WORKED EXAMPLE Sorting impacts

1 GIVEN	2 FIND	3 FORMULA	4 SUBSTITUTE	5 ANSWER + UNIT
a new electric ski lift at Cairnloch (fictional)	social, economic, environmental	people / money / planet	more visitors can reach the slopes → social new jobs and income → economic no diesel exhaust at the slope → environmental	**One of each type**

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AN EXPLAIN CHAIN: CAUSE → EFFECT → RESULT

1. **Wind turbine** → No fuel burned
2. **Less CO_2** → Fewer greenhouse gases
3. **Slower warming** → Limits climate change

WORKED EXAMPLE Building an 'explain' chain

1 GIVEN	2 FIND	3 FORMULA	4 SUBSTITUTE	5 ANSWER + UNIT
Question: explain how LED street lights help the environment.	2-mark explain	because → so	LEDs use less electrical power for the same light (1) so less electricity is generated and less CO_2 is released (1)	**Two linked steps**

WRONG

It is good for the environment.

No reason given: 0 marks.

RIGHT

No fuel is burned, so less CO_2 is released, which limits climate change.

Two linked steps: 2 marks.

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REAL ENGINEERING · CAIRNLOCH SKI CENTRE

Cairnloch (fictional) uses snow cannons powered from a small hydro scheme on the hill burn.

Socially it keeps winter jobs in the glen. Economically the season is longer. Environmentally the cannons use water and power, but the power is low-carbon, so fewer greenhouse gases are released.

PROBE · QUICK CHECKS

1. Three kinds of impact? _____
2. Gas to name for climate change? _____
3. Is an electric car emerging? _____

EXAM READY · 5 MARKS

1 **Describe** one positive social impact of a new ferry terminal. **[1]**

2 **Explain** how using a wind turbine instead of a diesel generator helps to limit climate change. **[2]**

3 **State** an example of an emerging technology. **[1]**

4 **Describe** one negative environmental impact of building a hydro scheme. **[1]**