1.7 National and global energy resources

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS renewable • non-renewable • fossil fuels • nuclear fuel

Objective

Distinguish renewable from non-renewable resources, match resources to uses, argue about reliability and environmental impact, and read trends in resource data. Original questions for spec statement 4.1.3.

1 Key knowledge and worked examples

A renewable resource is one that is replenished (or can be) as it is used. Fossil fuels and nuclear fuel are **non-renewable**.

- Nine resources to know: fossil fuels (coal, oil, gas), nuclear fuel, bio-fuel, wind, hydroelectricity, geothermal, the tides, the Sun, water waves.
- Three uses to compare: transport, electricity generation, heating.
- You do **not** need to explain *how* electricity is generated.

Resource	Renewable?	Reliability	Environmental points
coal, oil, gas (fossil fuels)	no	very reliable	CO_2 → climate change; sulfur dioxide → acid rain
nuclear fuel	no	very reliable	radioactive waste; no CO_2 when running
bio-fuel	yes	reliable	land taken from food; CO_2 when burnt, reabsorbed if replanted
wind	yes	not reliable	no CO_2; noise; large area; birds
hydroelectric	yes	reliable	floods valleys; habitat loss
geothermal	yes	reliable	few suitable places
tides	yes	reliable (timetable)	changes estuaries; cost
the Sun (solar)	yes	not reliable	no CO_2; needs large area; night/clouds
water waves	yes	not reliable	storm damage; hard to build

Reliability means the output is there when needed. Wind and solar depend on weather; nuclear and fossil can run on demand; hydro pumps on demand; tides follow a known timetable.

The credited ending for big-mark discussions: science can *identify* environmental problems, but dealing with them depends on **political, social, ethical or economic** decisions. Use this when asked "why hasn't the problem been solved?".

Comparing resources for a use (the exam's favourite 4-marker): choose the criterion the question names (cost, reliability, environment), apply it to *both* options with a number or fact, and finish with a conclusion sentence.

Worked example (data reasoning). A graph shows a turbine's power rising with wind speed up to a limit.

- Trend sentence: "as wind speed increases, power output increases, up to 15 m/s where it becomes constant."
- Evidence sentence: "power doubles from about 0.4 MW at 6 m/s to 0.8 MW at 9 m/s."
- Limitation sentence: "above 15 m/s the turbine shuts down for protection, so power falls to zero." Three sentences = a complete "give two conclusions" answer.

2 Practice

2.1 State what is meant by a renewable energy resource. [1]

2.2 Sort these into renewable and non-renewable: wind, coal, nuclear fuel, tides, natural gas, bio-fuel. [2]

2.3 Give one energy resource whose output does not change with the weather, and one whose output does. [2]

3 Exam-style questions

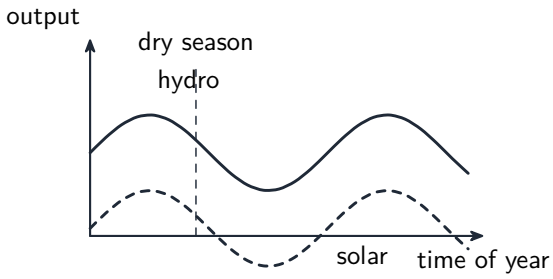
3.1 The UK generated electricity in 2018 using a mix of resources. Transport and electricity generation released the largest amounts of carbon dioxide.

Explain **one** change that would reduce carbon dioxide released by transport, and **one** change that would reduce carbon dioxide released by generating electricity. [4]

3.2 A remote village uses a hydroelectric generator. A graph of its power output across a year shows deep dips in the dry season. Solar panels are added.

(a) Explain why adding solar panels improves the reliability of the village's electricity supply. Use the pattern of the two outputs in your answer. [2]

(b) Give one reason, other than reliability, why the village might prefer hydroelectric to solar power. [1]



3.3 A tidal barrage and a nuclear power station are both proposed to supply 1.6 GW to a coastal city.

(a) Compare the two proposals for reliability of supply. [2]

(b) Compare the two proposals for environmental impact. [4]

(c) The planning decision is delayed for years even though the physics of both is well understood. Explain why the decision is not a scientific one. [2]