

Design & Technology

Edexcel GCSE

Renewable Energy

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

- Use black ink or ball-point pen
- Try answer all questions
- Use the space provided to answer questions
- Calculators can be used if necessary
- For the multiple choice questions, circle your answer

Advice

- Marks for each question are in brackets
- Read each question fully
- Try to answer every question
- Don't spend too much time on one question

Good luck!

Q1. Which renewable energy source is the most predictable?

- A** Wind
- B** Solar
- C** Tidal

Q2. What do photovoltaic cells convert into electricity?

- A** Sunlight
- B** Wind
- C** Heat from burning fuel

Q3. In a hydroelectric power station, what is used to trap the water?

- A** A turbine
- B** A dam
- C** A generator

Q4. Which of the following is a disadvantage of wind power?

- A** It produces large amounts of carbon dioxide
- B** No electricity is generated when the wind does not blow
- C** It uses a finite fuel

Q5. What is pumped storage?

- A** Using spare electricity to pump water uphill so it can be released later
- B** Storing coal at a power station
- C** Pumping oil from under the sea

Q6. Which one of the following is not a renewable energy source?

- A** Tidal
- B** Hydroelectric
- C** Natural gas

Q7. In 2010 the use of renewable energy in the UK accounted for 6.5% of total energy usage. By 2015 this figure had increased to 25%.

Q7a. Give two reasons for the increase in the use of renewable energy sources. **(2 marks)**

1

2

Q7b. Explain why some people are opposed to the use of renewable energy sources. **(2 marks)**

The amount of renewable energy generated in 2015 was 83.3 Terawatt hours (TWh). The ratio of solar power to other forms of renewable energy was 1:10.

Q7c. What amount of energy was attributed to solar power? Give your answer to 1 decimal place. **(2 marks)**

Q8. Some products, such as calculators, garden lights and phone chargers, use photovoltaic (PV) cells to function.

Q8a. Describe how photovoltaic cells work. **(2 marks)**

Q8b. Explain why products with small photovoltaic cells have not been popular with consumers. **(3 marks)**

Q9. Discuss the advantages and disadvantages of the increasing use of renewable energy sources. Use examples to support your answer.

(8 marks)

[illegible]

Answers

Q1. C

Q2. A

Q3. B

Q4. B

Q5. A

Q6. C

Q7a.

1 mark for each correct reason identified, up to a maximum of 2 marks:

- Government targets to reduce CO₂ emissions
- Increased awareness of environmental issues
- Impact of pressure groups
- Home installation of solar panels, with incentives for these
- Minimising reliance on fossil fuels
- Improved efficiency over time/improved technology

Q7b.

1 mark for a valid reason; 2 marks for a valid and explained reason or two valid reasons. Indicative content:

- Cost (1): high initial investment and long payback period (2)
- Visual intrusion (1): wind and solar farms spoil the landscape and affect views (2)
- Noise pollution (1): the sound of wind turbines affects local residents (2)
- Climate change deniers (1): people do not believe there is a need to avoid traditional energy sources (2)
- Efficiency (1): although technology is improving, not enough energy is generated compared to the cost of installation (2)
- Danger to wildlife (1): risk to birds and marine life through disturbance of habitat (2)

Q7c.

- $1:10 = 1 + 10 = 11$ parts; $83.3 \div 11 = 7.572$ (1)
- Answer = 7.6 TWh (1)

Accept the answer without TWh. Do not accept an answer to two decimal places.

Q8a.

The photovoltaic effect: converting sunlight (1) into electricity (1). Other similar responses (2 marks):

- Light shines on the cell to create an electric field, causing electricity to flow
- Photovoltaic cells are semi-conducting materials producing electricity from sunlight
- Photovoltaic cells generate electricity when exposed to photons (particles of light)
- Photovoltaic cells use solar energy to power or charge appliances

Q8b.

Answers must relate to photovoltaic cell products. 1 mark for a suitable reason, up to a maximum of two reasons, plus 1 mark for a clear explanation (3 marks). For example: PV cell products have low energy efficiency (1) compared to non-renewable energy sources (1) as sunlight is unpredictable (1). Other examples:

- The electricity store is small in area
- You can't always tell how much energy has been stored
- Needs sunlight to function/energy from the sun is unpredictable
- Power is reduced during cloudy or overcast weather
- Can affect the aesthetics of the product
- Can be fragile and damaged easily
- Cumbersome to carry (charger)

Q9.

Candidates should draw on examples of renewable energy sources to support the discussion; if no specific examples are used, do not award higher than Level 1. Discussion could include:

Advantages

- Fossil fuels are finite resources that are running out; using renewable energy will help conserve fossil fuels
- Burning fossil fuels creates carbon pollution, whereas renewable energy is often low or zero carbon; increased use will reduce the effect on the environment and global warming
- Increasing the use of renewable energy will slowly reduce the UK's carbon footprint and help meet government and COP26 targets
- Hydro power uses dams and is very reliable; it can also have a positive impact by creating large reservoirs of water

Disadvantages

- Some renewable sources depend on the weather, e.g. solar power and wind turbines, so can be unpredictable, especially solar power in the UK
- Wind farms can create noise and be an "eye-sore"; they take up space so cannot be used in densely populated areas
- Crops grown to fuel biomass can impact on nature and wildlife
- Tidal barrages and wave power equipment can be damaged in storms

Level	Marks	Descriptor
0	0	No response or no response worthy of credit.
1	1-2	Limited knowledge of renewable energy sources. Any reference is descriptive with little appreciation of the advantages or disadvantages. No analysis or evaluation. Limited structure, detail and examples.
2	3-5	A reasonable understanding of renewable energy sources. A sound discussion explaining some of the advantages and disadvantages; one or two opportunities to refer to different examples are missed. A line of reasoning with some structure, supported by some examples.

3	6-8	A clear understanding of renewable energy sources. A thorough discussion explaining the advantages and disadvantages, clear and well-developed with specific examples. A well-developed, clear and logically structured line of reasoning.
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