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Design & Technology
AQA GCSE

Energy storage systems including batteries

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 of the following is part of a kinetic pumped storage system?

A Turbine

B Alkaline battery

C Photovoltaic cell

Q2. Water is pumped to the higher reservoir during low demand

A True

B False

Q3. What is a major limitation of pumped hydro storage?

A Requires flat terrain

B Needs specific geographic features (elevation + water)

C Cannot store large amounts of energy

Q4. Which battery type is typically non-rechargeable?

A Lithium-ion

B Lead-acid

C Alkaline

Q5. Explain how pumped hydro storage works and discuss one advantage and one limitation of this technology **(4 marks)**

Q6. Compare alkaline and lithium-ion batteries, giving one advantage of each for specific applications **(4 marks)**

Answers

Q1. A
Q2. A
Q3. B
Q4. C

Q5.

1. **Working Principle (2 marks):**
    - During periods of **low electricity demand** (or excess renewable generation), water is pumped **from a lower reservoir to an upper reservoir** using cheap/off-peak electricity.
    - During **peak demand**, water is released back downhill through **turbines** to generate electricity.
2. **Advantage (1 mark):**
    - Provides **large-scale energy storage** (GW-scale)
    - **Long lifespan** (50+ years)
    - **High efficiency** (70-85%)
3. **Limitation (1 mark):**
    - Requires **specific geography** (elevation difference + water source)
    - **High construction costs**
    - **Environmental impact** (flooding ecosystems)

Q6.

1. **Alkaline Battery Advantage (1 mark):**
    - **Low cost** (ideal for disposable devices like remote controls)
    - **Long shelf life** (leak-resistant, stable for years)
2. **Lithium-ion Battery Advantage (1 mark):**
    - **Rechargeable** (suitable for smartphones/laptops)
    - **High energy density** (compact size for EVs)
3. **Clear Comparison (2 marks):**
    - Award 1 mark for **identifying a key difference** (e.g., rechargeability, energy density).
    - Award 1 mark for **linking the advantage to a real-world application** (e.g., "Li-ion is better for EVs due to its rechargeability").