

GCSE Physics (9 – 1)

Energy Resources

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/6
2	/7
3	/13
4	/9
5	/6
6	/7
7	/13
Total	/61
%	
Grade	

Information

- The maximum mark for this paper is 61 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. Energy resources are the different stores in nature that we harness to generate the electricity used to power our homes and industries.

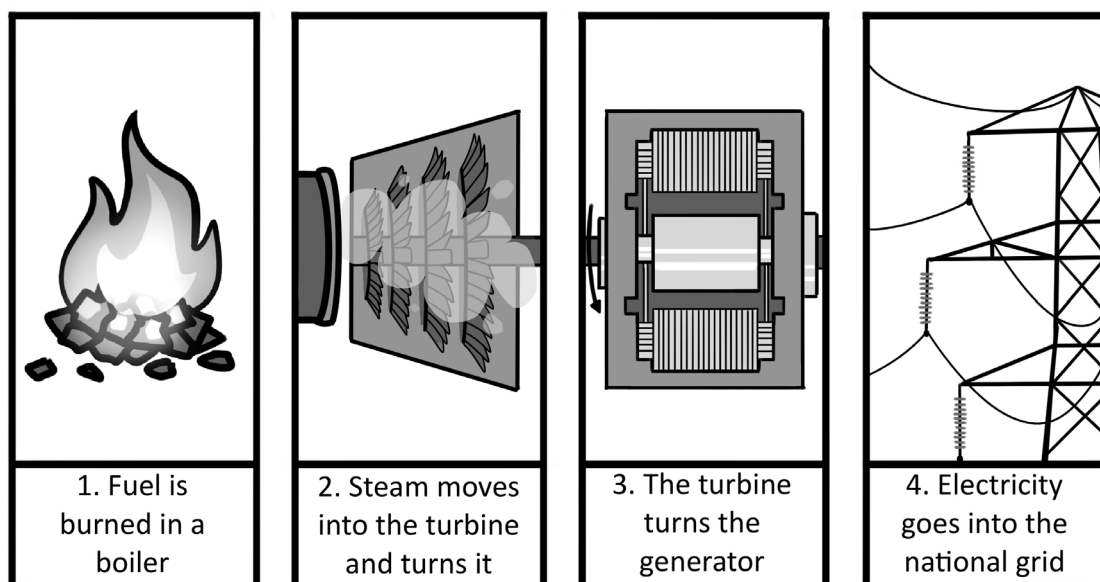
For each of the following questions **circle** the letter of the correct answer.

- a) Which of the following creates the most accurate definition of a **renewable** energy resource?

- A An energy resource that does not release carbon dioxide.
- B An energy resource that can be replenished as it is used.
- C An energy resource that can be recycled.
- D An energy resource that is cheap to produce.

(1 mark)

- b) The flow chart below shows the stages of producing electricity in a fossil fuel power station.



In which specific box does energy shift from a kinetic store to an electrical store?

A

B

C

D

The boiler.

The turbine.

The generator.

The national grid.

(1 mark)

- c) Which gas is released by the burning of coal that is the main contributor to global warming?

A

B

C

D

Sulfur dioxide

Carbon dioxide

Nitrogen

Hydrogen

(1 mark)

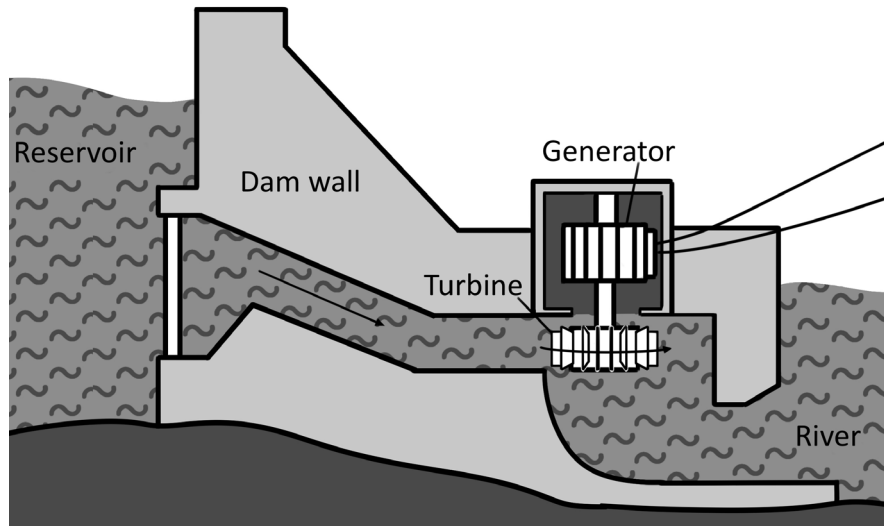
d) Which of the following is classified as a **non-renewable** energy resource?

- | A | B | C | D |
|--------------|----------|------------|------------------|
| Nuclear Fuel | Biofuel | Geothermal | Hydroelectricity |

(1 mark)

e) The figure below shows a section through a hydroelectric dam.

Which energy store is decreasing as the water flows from the top of the dam down toward the turbine?



- | A | B | C | D |
|----------|----------|-------------------------|-------------------|
| Kinetic | Chemical | Gravitational potential | Elastic potential |

(1 mark)

f) Which of the following is the original source of the energy harnessed by a geothermal power station?

- A** Light waves from the Sun.
- B** Gravitational attraction of the Moon.
- C** Friction between tectonic plates.
- D** Radioactive decay of rocks deep underground.

(1 mark)

(Total for Question 1 is 6 marks)

2. An energy company is proposing to build a new power station to supply electricity to a small town. They are deciding between a natural gas power station and a wind farm.

The table below shows the information about the two different methods.

Energy Resource	Startup time	CO ₂ released per kg of fuel	Relative Cost to Build
Natural Gas	Short	High	Medium
Wind Power	N/A	None	High

- a) Wind power is considered a **renewable** energy resource.

What is meant by a renewable energy resource.

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(1 mark)

- b) The energy company decides to build the natural gas power station rather than the wind farm.

Using your own knowledge and the data in the table, suggest **two** reasons why the company chose natural gas, despite it releasing carbon dioxide.

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(2 marks)

- c) Natural gas is a fossil fuel. Name **one** other fossil fuel.

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(1 mark)

- d) The engineer tests a sample of the natural gas. Burning the gas releases 800,000 J of thermal energy. The generator converts this into 280,000 J of useful electrical energy.

Calculate the efficiency of the natural gas power station. Give your answer as a percentage.

Show your working.

Efficiency = ... %

(3 marks)

(Total for Question 2 is 7 marks)

3. An offshore wind farm generates electricity which is transmitted to the mainland.



- a) Wind power is a renewable energy resource.

State **one** disadvantage of using wind turbines to generate electricity compared to a fossil fuel power station.

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(1 mark)

- b) The wind farm generates 450 MW of electrical power.

The wind farm is connected to the national grid by a large cable at a potential difference of 150 kV.

- i. Calculate the current flowing through the transmission cable.

Use the equation: $\text{current} = \text{power} \div \text{potential difference}$

Current = ... A

(3 marks)

- ii. The wind farm is upgraded. The total power output increases from 450 MW to 738 MW.

This increase is achieved by adding 80 new, high-efficiency turbines.

Calculate the power output of one single new turbine. Give your answer in MW.

Power = ... MW

(2 marks)

- iii. The wind turbines are not 100% efficient. Friction occurs inside the turbine gearbox.

State what happens to the energy that is wasted due to friction.

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(1 mark)

- c) A proposal is made to replace the existing transmission cables with new ones operating at a much higher potential difference of 400 kV.

The new cables will be suspended from fewer pylons, but the new pylons will be taller.

The route will cross a National Park.

Discuss the advantages and disadvantages of this proposal.

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(6 marks)

(Total for Question 3 is 13 marks)

4. A homeowner installs a system of solar panels on the roof of their house to generate electricity.



- a) Solar power is a renewable energy resource.
Explain why solar power is **not** considered a reliable energy resource.

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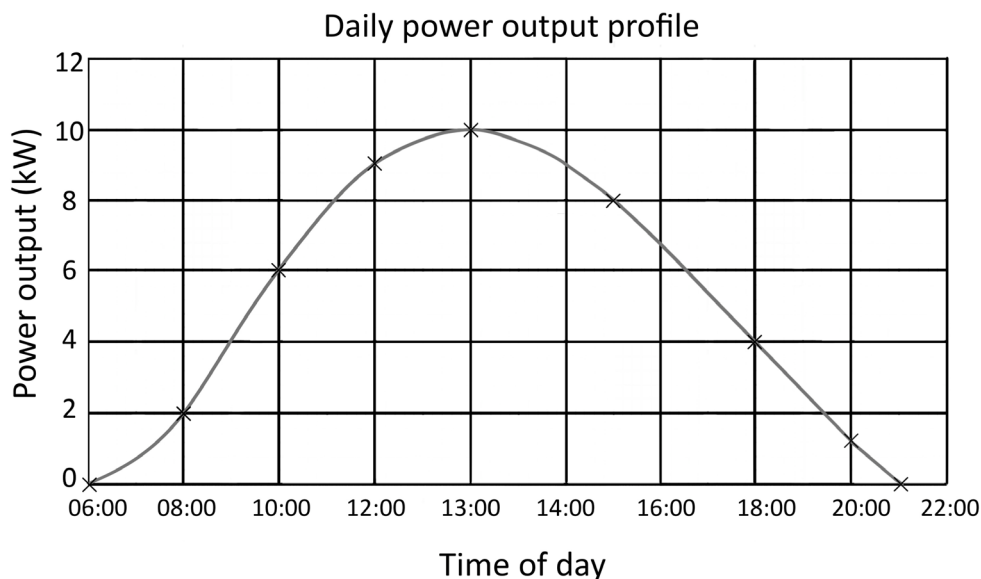
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(2 marks)

- b) The graph below shows the power output of the solar panels on a typical summer day.



- i. At what time of day do the solar panels produce the maximum electrical power?

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(1 mark)

- ii. Suggest **one** reason why the power output is lower at 16:00 than it is at 13:00.

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(1 mark)

- c) At 12:00 pm, the solar panels are producing a constant power output of 3.2 kW.
Calculate the total energy transferred by the panels in 30 minutes. Give your answer in Joules.
Use the equation: energy transferred = power $\times$ time

Energy = ... J
(4 marks)

- d) Even though solar panels do not release carbon dioxide while generating electricity, they are not completely **carbon neutral**. Explain why.

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(1 mark)

(Total for Question 4 is 9 marks)

5. The government is looking to reduce the country's dependence on fossil fuels. They are debating between investing in biofuel power stations or nuclear power stations.

Compare the advantages and disadvantages of using biofuels and nuclear power to generate electricity.

In your answer, you should refer to:

- The environmental impact, including waste and emissions.
- The reliability and availability of the fuel.

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(6 marks)

(Total for Question 5 is 6 marks)

6. Iceland generates a significant amount of its electricity using geothermal power stations.

The figure below shows a geothermal power station.



a) Describe the source of the thermal energy used in geothermal power stations.

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(2 marks)

b) Explain how this thermal energy is used to generate electricity in a geothermal power station.

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(4 marks)

c) Suggest **one** reason why geothermal power stations are not built in many parts of the UK.

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(1 mark)

(Total for Question 6 is 7 marks)

7. A company proposes building a tidal barrage across a river estuary to generate electricity for a coastal town. The figure below shows a tidal barge system.



- a) State the primary energy store involved in holding the water back behind the barrage when the tide is high.

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(1 mark)

- b) Critics argue that tidal power is not a continuous energy source. Explain why tidal power is predictable but not continuous.

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(2 marks)

- c) Compare tidal power to wind power in terms of reliability.

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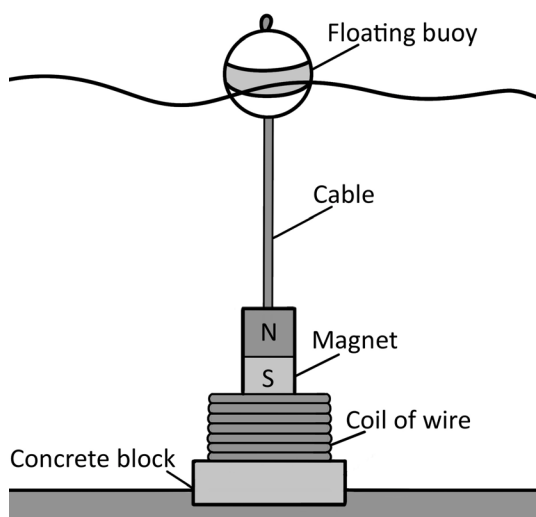
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(2 marks)

A remote island community is testing a new device to generate electricity from the sea. The diagram below shows the device anchored to the sea floor.



- d) As waves pass the device, the floating ball moves up and down. Explain how this movement causes an alternating current to be generated in the coil of wire.

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(4 marks)

- e) The engineers want to modify the device so it generates a higher voltage for the same height of waves. Suggest **two** changes to the design of the device that would achieve this.

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(2 marks)

- f) This device generates electricity using waves. Other marine systems generate electricity using tides. Explain why tidal power systems are considered more reliable than wave power systems.

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(2 marks)

(Total for Question 7 is 13 marks)