

National and Global Energy Resources

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.1 Energy
Sub-Topic	National and Global Energy Resources
Difficulty Level	Silver Level
Booklet	Question Paper 1

Time Allowed: 60 minutes

Score: /59

Percentage: /100

Grade Boundaries:

Q1.Figure 1 shows a battery operated remote control car.

Figure 1



© Brandon Bolin/iStock/Thinkstock

- (a) The car's battery contains a store of energy.

As the car moves, energy from one store is transferred to another store.

Describe how different stores of energy change as the car moves.

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(2)

- (b) The car has a top speed of 12 m / s and a mass of 800 g.

Write down the equation that links kinetic energy, mass and speed.

Equation

(1)

- (c) Calculate the maximum kinetic energy of the car.

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Maximum kinetic energy = J

(2)

- (d) Explain why having a more efficient motor increases the top speed of the car.

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(2)

- (e) **Figure 2** shows an electric car being charged.

Figure 2



By Alan Trotter Electric Car Charging [CC-BY-2.0]via Flickr

A driver wishes to buy a new car.

The table below gives some data about an electric car and one with a petrol engine.

	Electric car	Petrol engine car
Cost (£)	27 000	15 000
Running cost per year (£)	250	2 000
Average lifetime (years)	12	12

Which car would be the most economic over its 12 year lifetime?

Use data from the table above to support your answer.

You should include the difference in cost in your answer.

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(4)
(Total 11 marks)

Q2.Electricity can be generated using various energy sources.

- (a) Give **one** advantage and **one** disadvantage of using nuclear power stations rather than gas-fired power stations to generate electricity.

Advantage

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Disadvantage

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(2)

- (b) (i) A single wind turbine has a maximum power output of 2 000 000 W.
The wind turbine operated continuously at maximum power for 6 hours.
Calculate the energy output in kilowatt-hours of the wind turbine.

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Energy output = kWh

(2)

- (ii) Why, on average, do wind turbines operate at maximum power output for only 30% of the time?

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(1)

- (c) An on-shore wind farm is made up of many individual wind turbines.

They are connected to the National Grid using underground power cables.

Give **one** advantage of using underground power cables rather than overhead power cables.

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(1)

(Total 6 marks)

- Q3.(a)** Iceland is a country that generates nearly all of its electricity from renewable sources.

In 2013, about 80% of Iceland's electricity was generated using hydroelectric power stations (HEP).

Describe how electricity is generated in a hydroelectric power station. Include the useful energy transfers taking place.

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(4)

- (b) The UK produces most of its electricity from fossil fuels.

Many people in the UK leave their televisions in 'stand by' mode when not in use, instead of switching them off.

It is better for the environment if people switch off their televisions, instead of leaving them in 'stand by' mode.

Explain why.

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(3)

- (c) A scientist wrote in a newspaper:

'Appliances that do not automatically switch off when they are not being used should be banned.'

Suggest why scientists alone cannot make the decision to ban these appliances.

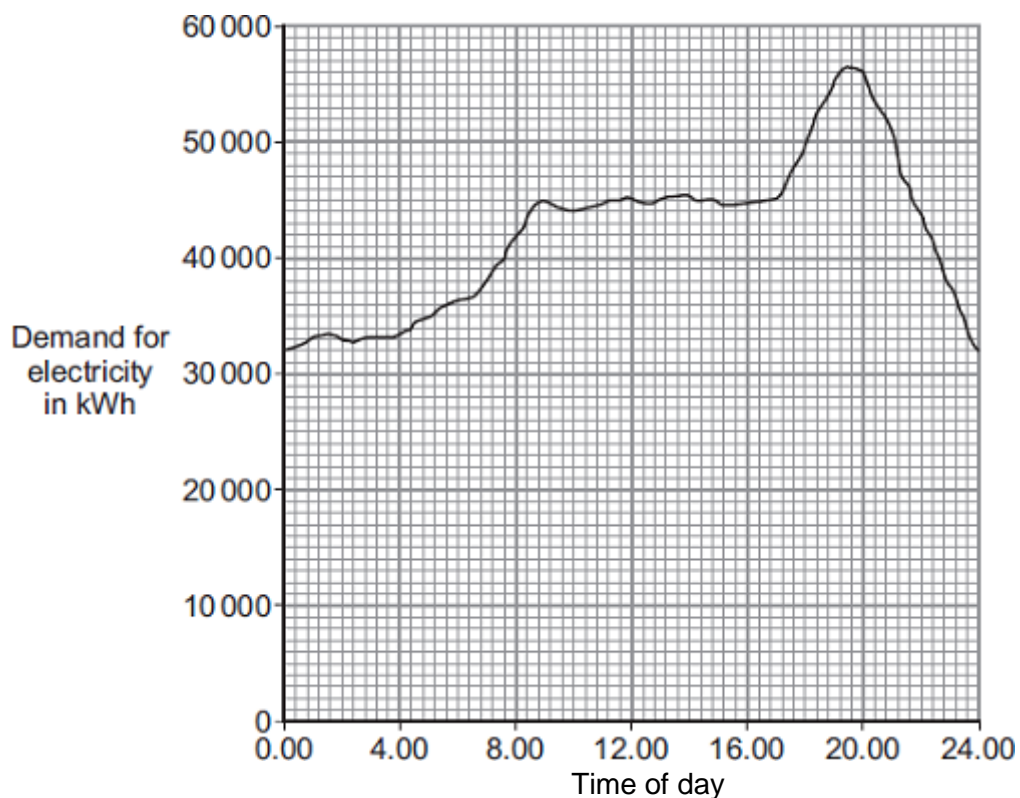
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(1)

(Total 8 marks)

- Q4.(a)** The graph shows how the demand for electricity in the UK changes during one 24-hour period.



The table gives the start-up times for two types of power station.

Type of power station	Start-up time
Gas	A few minutes
Nuclear	Several days

How would these two types of power station be used to meet the demand for electricity during this 24-hour period?

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- (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

A farmer plans to generate all the electricity needed on her farm, using either a biogas generator or a small wind turbine.

The biogas generator would burn methane gas. The methane gas would come from rotting the animal waste produced on the farm. When burnt, methane produces carbon dioxide.

The biogas generator would cost £18 000 to buy and install. The wind turbine would cost £25 000 to buy and install.

The average power output from the wind turbine would be the same as the continuous output from the biogas generator.

Evaluate the advantages and disadvantages of the two methods of generating electricity.

Conclude, with a reason, which system would be better for the farmer to buy and install.

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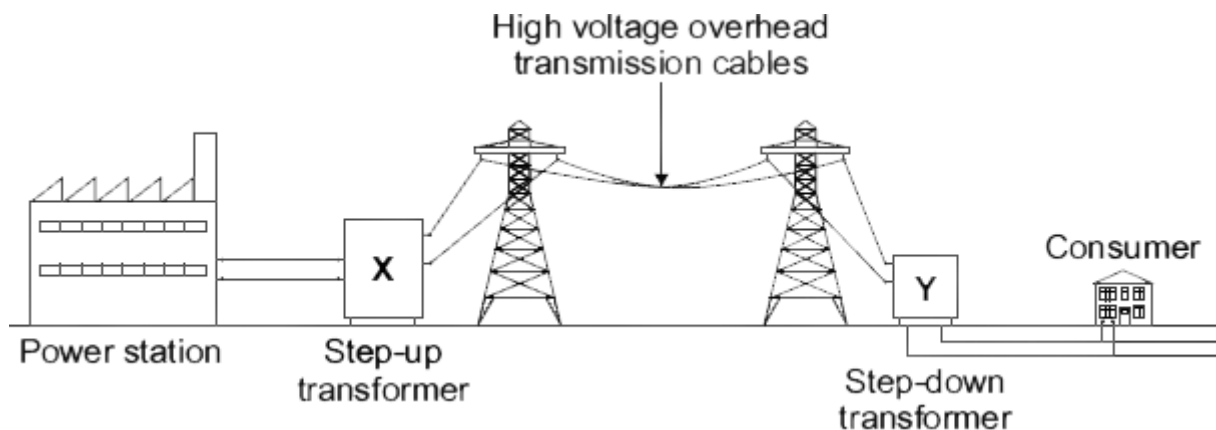
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(6)
(Total 9 marks)

Q5. The diagram shows the National Grid system.



- (a) The National Grid includes step-up transformers.

Explain why.

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(2)

- (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Over the next 10 years, more than 300 kilometres of new high voltage transmission cables are to be added to the National Grid. Most of the new cables will be suspended from pylons and run overhead while the rest will be buried underground.

Outline the advantages and disadvantages of both overhead transmission cables and underground transmission cables.

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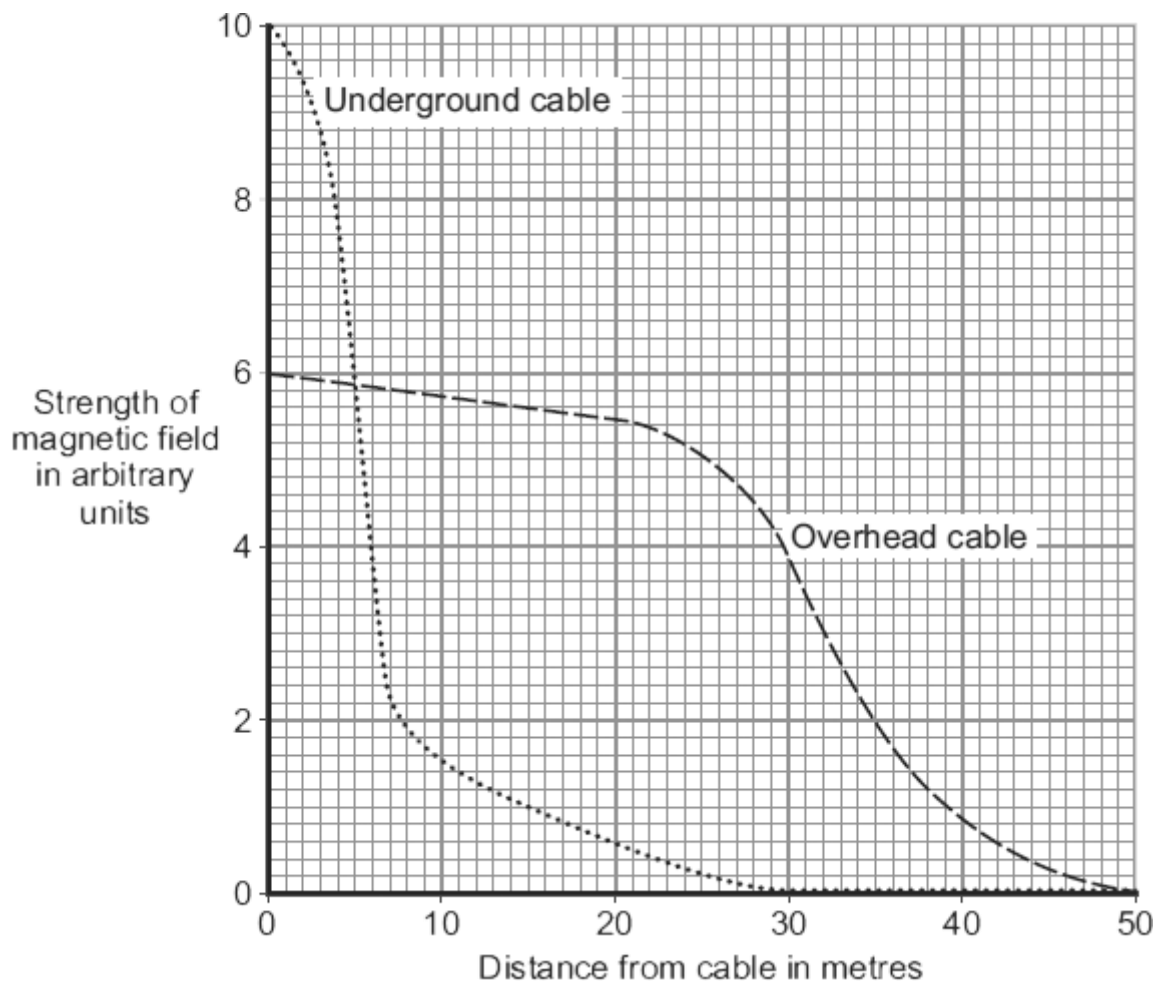
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(6)

- (c) When an electric current flows through a transmission cable, a magnetic field is produced.

The graph shows how the strength of the magnetic field varies with distance from both overhead and underground transmission cables that carry the same current.



What conclusions may be drawn from this graph?

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(2)

- (d) Some people think that, because of the magnetic fields, living close to transmission cables is dangerous to health. Laboratory studies on mice and rats exposed to magnetic fields for two or more years found that the magnetic fields had no effect on the animals' health.

Draw a ring around the correct answer in the box to complete the sentence.

economic

Using animals in scientific research raises

environmental issues.

ethical

(1)
(Total 11 marks)

Q6. (a) Geothermal energy and the energy of falling water are two resources used to generate electricity.

(i) What is geothermal energy?

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(1)

(ii) Hydroelectric systems generate electricity using the energy of falling water.

A pumped storage hydroelectric system can also be used as a way of storing energy for future use.

Explain how.

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(2)

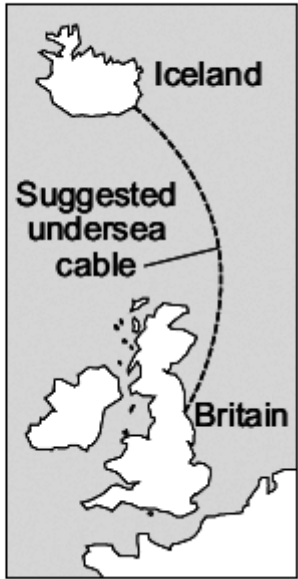
- (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Read the following extract from a newspaper.

Britain may be switched on by Iceland

Iceland is the only country in the world generating all of its electricity from a combination of geothermal and hydroelectric power stations. However, Iceland is using only a small fraction of its energy resources. It is estimated that using only these resources, the amount of electricity generated could be increased by up to four times.

To help supply the future demand for electricity in Britain, there are plans to build thousands of new offshore wind turbines. It has also been suggested that the National Grid in Britain could be linked to the electricity generating systems in Iceland. This would involve laying a 700 mile undersea electricity cable between Iceland and Britain.



The map shows the outline of Iceland to the northwest of Britain. A dashed line, labeled 'Suggested undersea cable', connects the two landmasses across the North Atlantic Ocean. The labels 'Iceland' and 'Britain' are placed next to their respective landmasses.

Discuss the advantages and disadvantages of the plan to build thousands of offshore wind turbines around Britain **and** the suggested electricity power link between Britain and Iceland.

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(6)
(Total 9 marks)

- Q7.** A farmer has installed a biogas electricity generator on his farm. This device generates electricity by burning the methane gas produced from rotting animal waste. Methane is a greenhouse gas. When methane burns, carbon dioxide and water are produced.

The animal waste rots in an anaerobic digester. The digester and the generator are kept inside a farm building and cannot be seen from the outside.

- (a) The animal waste used in the anaerobic digester is a *renewable* energy source.

What is meant by an energy source being *renewable*?

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(1)

- (b) Suggest **one** reason why farmers have been encouraged to install their own biogas generators.

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(1)

- (c) The farmer's monthly electricity bill using the mains electricity supply was £300. The biogas generator cost the farmer £18 000 to buy and install.

Assuming the biogas generator provides all of the farmer's electricity, what is the pay-back time for the generator?

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Pay-back time =

(1)

- (d) It would have been cheaper for the farmer to have bought and installed a small wind turbine.

Give **two** advantages of using the biogas generator rather than a wind turbine, to generate the electricity used on the farm.

1

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(2)

(Total 5 marks)