

Name:

Date:

P1 - Test 3

ENERGY

Beginner

GCSE

PHYSICS

AQA - Triple Science

Mark

Grade

Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

Information

- The marks for the questions are shown in brackets

1.

Iceland is a country that generates most of its electricity using geothermal power stations and hydroelectric power stations.

- (a) (i) Complete the following sentences to describe how some geothermal power stations work.

In regions where volcanoes are active, the ground is hot.

Cold _____ is pumped down into the ground
and is _____ by hot rocks.

It returns to the surface as steam. The steam is used to turn a turbine.

The turbine drives a _____ to produce electricity.

(3)

- (ii) Which **one** of the following statements about geothermal power stations is true?

Tick (✓) **one** box.

Geothermal power stations use fossil fuels.

Geothermal power stations produce carbon dioxide.

Geothermal power stations provide a reliable source of electricity.

(1)

- (b) What is needed for a hydroelectric power station to be able to generate electricity?

Tick (✓) **one** box.

Falling water

A long coastline

Lots of sunny days

(1)

(Total 5 marks)

2.

The picture shows a solar-powered aircraft. The aircraft has no pilot.



By NASA/Nick Galante [Public domain], via Wikimedia Commons

(a) Use words from the box to complete the following sentence.

electrical	heat	light	sound
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Solar cells are designed to transform _____ energy
into _____ energy.

(2)

(b) On a summer day, 175 000 joules of energy are supplied to the aircraft's solar cells every second. The useful energy transferred by the solar cells is 35 000 joules every second.

Use the equation in the box to calculate the efficiency of the solar cells.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

Efficiency = _____

(2)

(c) The aircraft propellers are driven by electric motors.

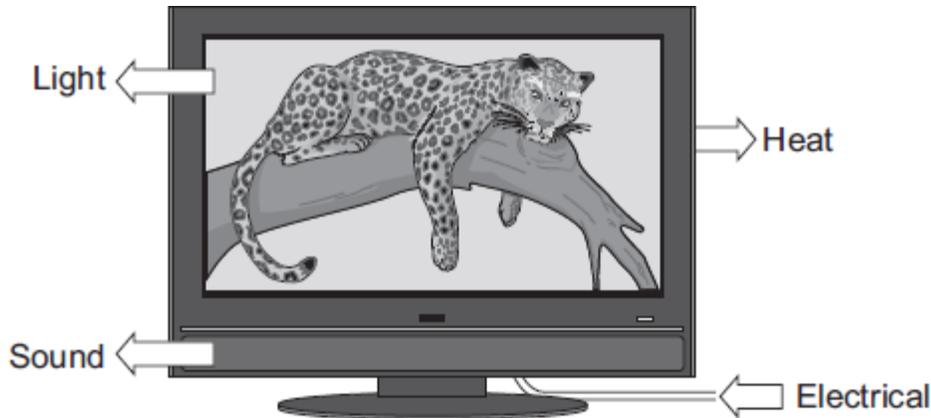
Give **one** environmental advantage of using electric motors to drive the aircraft propellers rather than motors that burn a fuel.

(1)

(Total 5 marks)

3.

(a) The diagram shows the energy transformations produced by a television.



When the television is working, 1200 joules of energy are supplied to the television every second. The useful energy transferred by the television is 720 joules every second.

(i) Use the equation in the box to calculate the efficiency of the television.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

Efficiency = _____

(2)

(ii) Use **one** word from the diagram to complete the following sentence.

The electrical energy that is **not** usefully transformed by the television is wasted as _____ .

(1)

- (b) A homeowner is sent an electricity bill every 3 months. The total amount of electrical energy used during one 3-month period was 800 kilowatt-hours. Electrical energy costs 15p per kilowatt-hour.

Use the equation in the box to calculate the cost of the energy transferred from the mains electricity supply.

$$\text{total cost} = \text{number of kilowatt-hours} \times \text{cost per kilowatt-hour}$$

Show clearly how you work out your answer and give the unit.

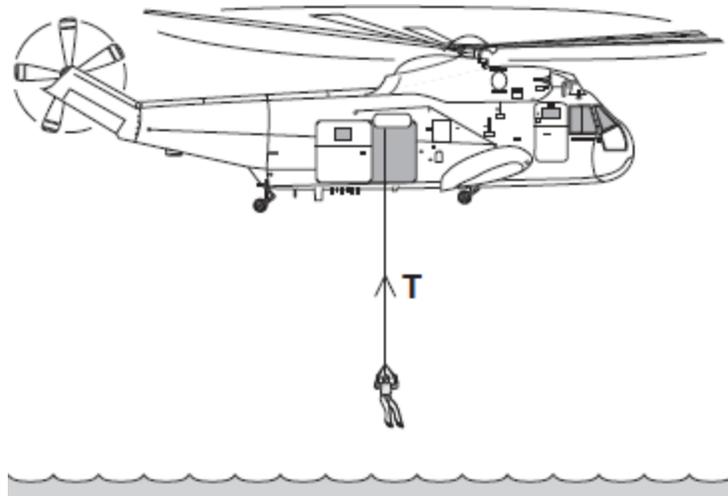
Cost = _____

(2)

(Total 5 marks)

4.

The diagram shows a helicopter being used to rescue a person from the sea.



- (a) (i) The mass of the rescued person is 72 kg.

Use the equation in the box to calculate the weight of the rescued person.

$\text{weight} = \text{mass} \times \text{gravitational field strength}$
--

gravitational field strength = 10 N/kg

Show clearly how you work out your answer.

Weight = _____ N

(2)

- (ii) An electric motor is used to lift the person up to the helicopter.
The motor lifts the person at a constant speed.

State the size of the force, **T**, in the cable.

Force **T** = _____ N

(1)

- (b) To lift the person up to the helicopter, the electric motor transformed 21 600 joules of energy usefully.

- (i) Use a form of energy from the box to complete the following sentence.

gravitational potential	heat	sound
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The electric motor transforms electrical energy to kinetic energy. The kinetic energy is then transformed into useful _____ energy.

(1)

- (ii) It takes 50 seconds for the electric motor to lift the person up to the helicopter.

Use the equation in the box to calculate the power of the electric motor.

$$\text{power} = \frac{\text{energy transformed}}{\text{time}}$$

Show clearly how you work out your answer and give the unit.

Choose the unit from the list below.

coulomb (C)

hertz (Hz)

watt (W)

Power = _____

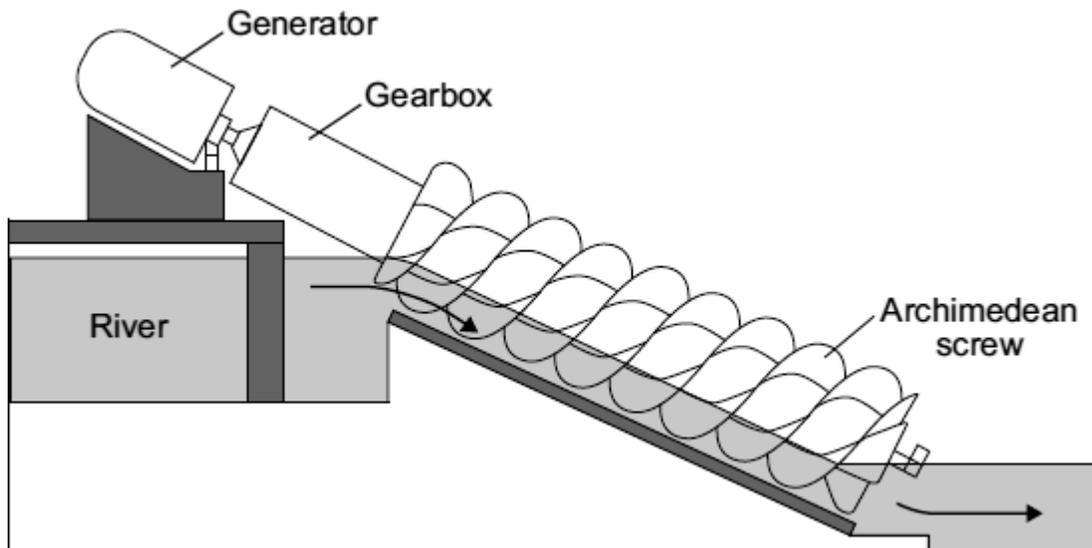
(3)

(Total 7 marks)

5.

The diagram shows a small-scale, *micro-hydroelectricity* generator which uses the energy of falling river water to generate electricity. The water causes a device, called an Archimedean screw, to rotate.

The Archimedean screw is linked to the generator by a gearbox.



- (a) Complete the following sentence by drawing a ring around the correct word in the box.

The gravitational potential energy of the falling water is transformed

into the

chemical
electrical
kinetic

 energy of the Archimedean screw.

(1)

- (b) A micro-hydroelectric system generates about 60 kW of electricity, enough for 50 homes. A conventional large-scale hydroelectric power station may generate more than 5 000 000 kW of electricity.

- (i) Give **one** advantage of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system.

(1)

- (ii) Which **one** of the following statements gives a **disadvantage** of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system?

Put a tick (✓) in the box next to your answer.

Energy is wasted as heat and sound.

Large areas of land are flooded.

A constant flow of water is needed.

(1)

- (c) The electricity generated by the micro-hydroelectric system is transferred directly to local homes. The electricity generated by a conventional large-scale hydroelectric power station is transferred to homes anywhere in the country through a system of cables and transformers.

- (i) What name is given to the system of cables and transformers used to transfer electricity to homes anywhere in the country?

(1)

- (ii) Using short cables to transfer electricity to local homes is much more efficient than using very long cables to transfer electricity to homes anywhere in the country.

Why?

(1)

- (d) Nepal is a mountainous country with over 6000 rivers. In Nepal, 9000 kW of electricity are generated using micro-hydroelectric generators.

Suggest **one** reason why in the UK much less electricity is generated using micro-hydroelectric generators, than in Nepal.

(1)

(Total 6 marks)

6.

Four students are talking about the different energy sources used to generate electricity in the areas where they live.

(a) Draw **one** line from where each student lives (**List A**) to the energy source in their area (**List B**).

Draw only **four** lines.

List A

Where each student lives

Where I live is the sunniest part of the country.

Where I live, the land is very flat and it always seems to be windy.

Where I live, it is not safe to swim. The sea is always too rough.

Where I live, you can see steam coming out of the ground.

List B

Energy source

Wind

Waves

Solar

Tides

Geothermal

(4)

(b) All of the energy sources given in part (a) can be used to generate electricity.

What else do all these energy sources have in common?

(1)

(c) In a hydroelectric power station, the energy from falling water is used to generate electricity.

Which **one** of the following gives a **disadvantage** of a hydroelectric power station?

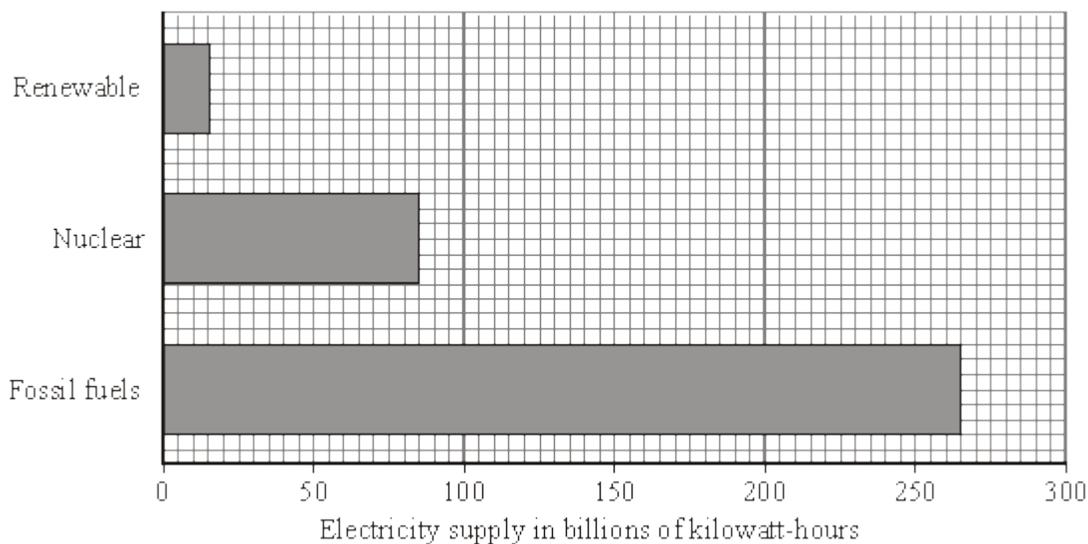
Put a tick (✓) in the box next to your answer.

- has a fast start-up time
- large areas of land are flooded
- polluting gases are produced

(1)
(Total 6 marks)

7.

The bar chart shows the different energy sources used to generate the UK's electricity in 2007.



(a) (i) The wind is a renewable energy source.

Name **one** more renewable energy source used to generate electricity.

(1)

- (ii) Complete the following sentence by drawing a ring around the correct line in the box.

Using less fossil fuels to generate electricity will

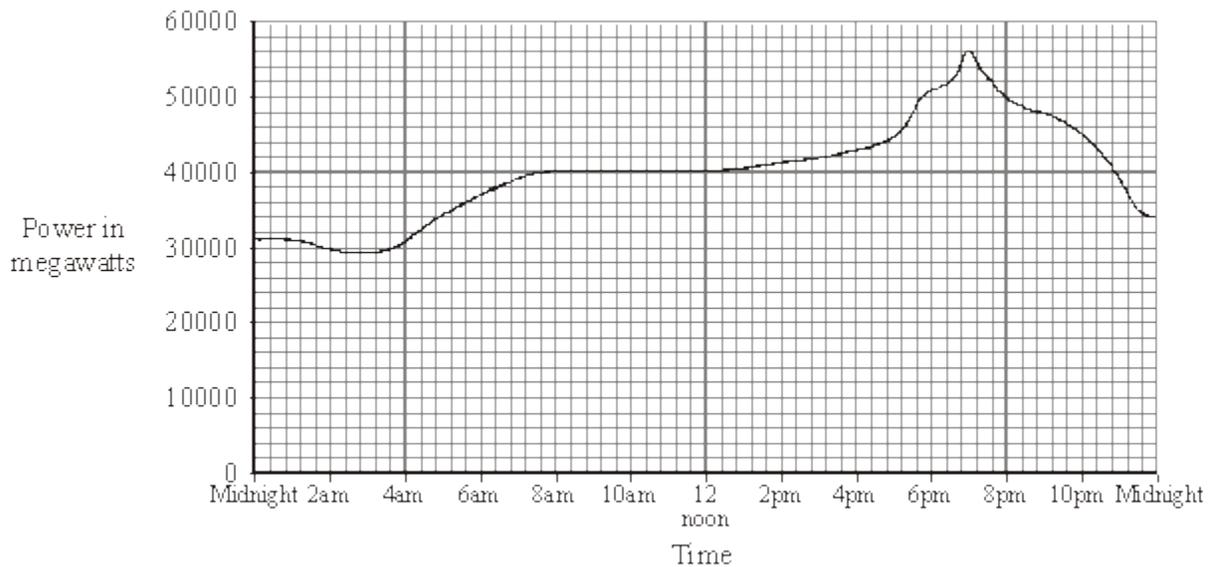
decrease
not change
increase

the

amount of carbon dioxide emitted into the atmosphere.

(1)

- (b) The graph shows how the demand for electricity in the UK varied over one day in the winter.



- (i) Describe how the demand for electricity varied between 4.00 am and 10.00 am.

(2)

- (ii) Which type of power station has the fastest start-up time?

Draw a ring around your answer.

coal **natural gas** **nuclear** **oil**

(1)

(Total 5 marks)

8.

(a) Water waves are a renewable energy source.

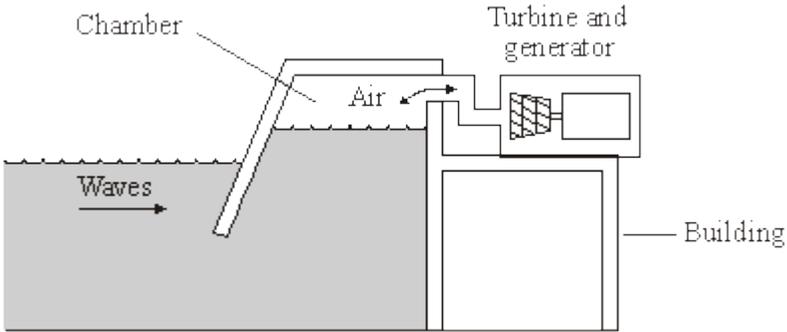
The government wants more electricity to be generated from renewable energy sources. Some people do not think this is a good idea.

What reasons could a government scientist give to show people that using more renewable energy sources is a good idea?

Four horizontal lines for writing an answer.

(2)

(b) The diagram shows a wave-powered generator. The generator transforms kinetic energy from the waves to electrical energy.



AQA GCSE SCIENCE CORE FOUNDATION STUDENT'S BOOK by Graham Hill, Nigel Heslop, Christine Woodward, Steve Witney and Toby Houghton. Published by Hodder and Stoughton 2006 © Reproduced by permission of John Murray (Publishers) Ltd

The following sentences describe how the wave generator works. The sentences are in the wrong order.

- R Waves push air up and down a chamber inside the building.
- S The turbine turns the generator.
- T The generator transforms kinetic energy to electrical energy.
- U The air rushes through a turbine making it spin.
- V Strong waves move towards the wave-powered generator.

Arrange these sentences in the correct order. Start with letter V.

V
→

→

→

→

(3)

(Total 5 marks)

9.

(a) Different energy sources are used to generate electricity.

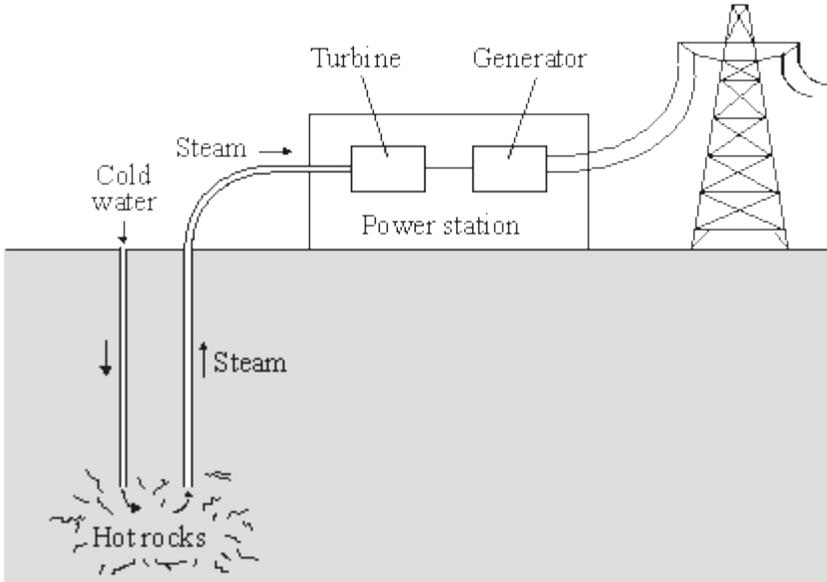
Which **two** of the energy sources in the box are likely to be used up first?

Draw a ring around each of your answers.

gas	oil	Sun	tides	waves	wind
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(2)

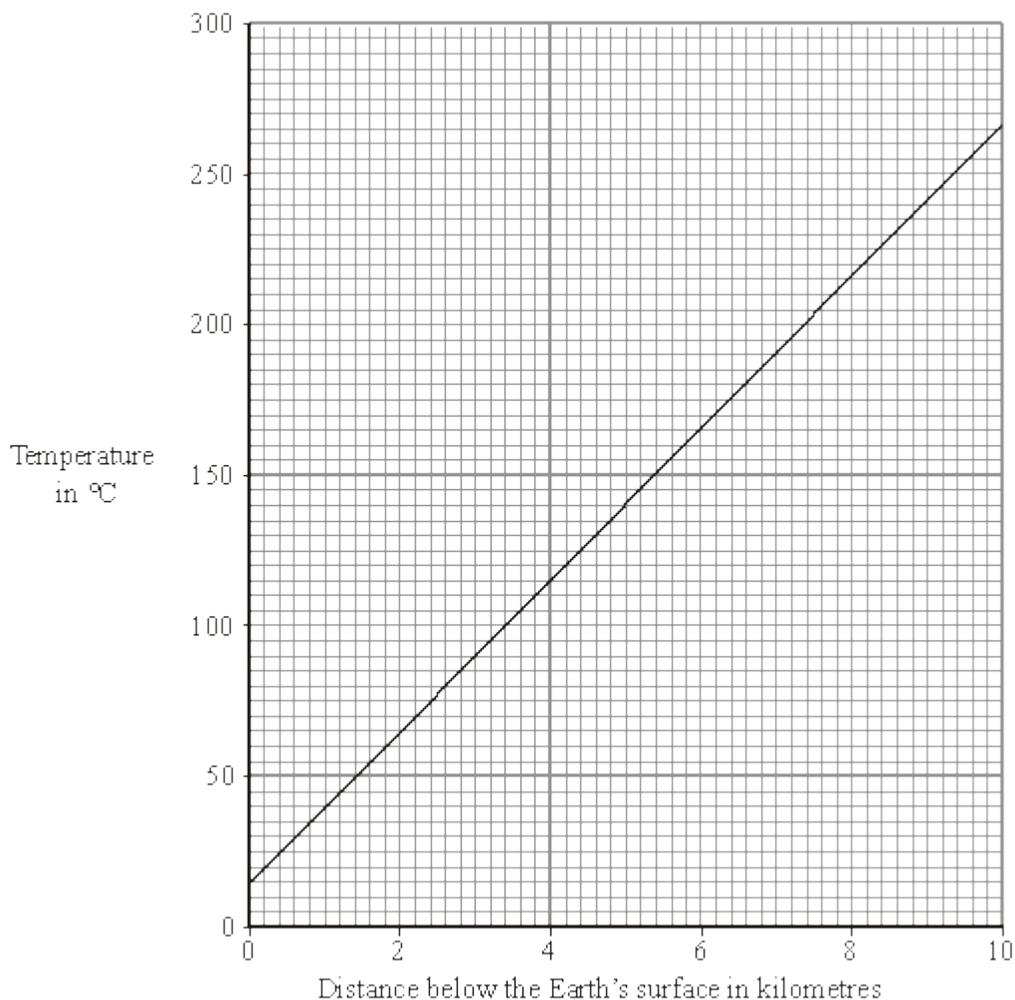
(b) The diagram shows a geothermal power station. Hot rocks in the Earth's crust heat water to produce steam. The steam is used to drive turbines that turn electrical generators.



How is the way in which a geothermal power station generates electricity the same as the way in which a coal burning power station generates electricity?

(1)

- (c) The graph shows how the temperature of the rocks in the Earth's crust depends on how far the rocks are below the Earth's surface.



Estimate the temperature of the rocks 5 kilometres below the Earth's surface.

Show clearly how you have used the graph to get your answer.

Temperature = _____ °C

(2)

- (d) Scientists have estimated that one quarter of the world's electricity could be generated using geothermal energy.

Give **one** reason that scientists might use to persuade a government to spend large amounts of money building geothermal power stations.

(1)

(Total 6 marks)