AQA GCSE Physics | 8463

SPECIFICATION POINT 4.7.3.2

Uses of the generator effect (HT only)

Past-paper questions

Tier	**Higher**
Question groups	**46**
Available paper years	**2004–2024**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

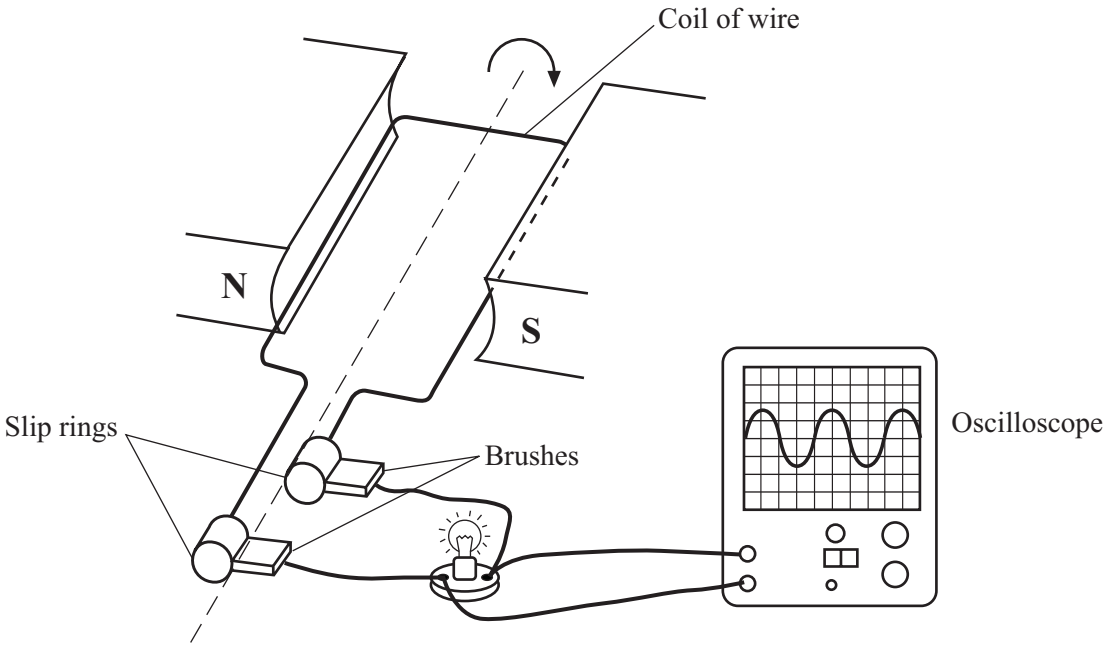
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.7.3.2 Uses of the generator effect (HT only)

Question 01

June 2004 | 3451H | Original Q11 | Legacy

11 (a) The diagram shows a simple generator. The trace on the oscilloscope shows that the generator produces an alternating current.



(i) Explain how the generator works. Include in your answer the reasons why the slip rings and brushes are needed.

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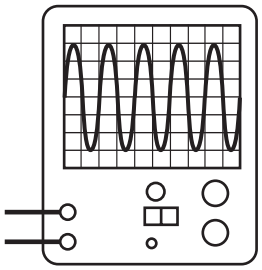
(4 marks)

4.7.3.2 Uses of the generator effect (HT only)

Question 01 · continued

MARGIN BLANK

(ii) What should be done to make the generator give the oscilloscope trace drawn below? Assume the controls on the oscilloscope are unchanged.



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(2 marks)

(b) Explain why electricity is transmitted through the National Grid as alternating current (a.c.) rather than direct current (d.c.).

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(3 marks)

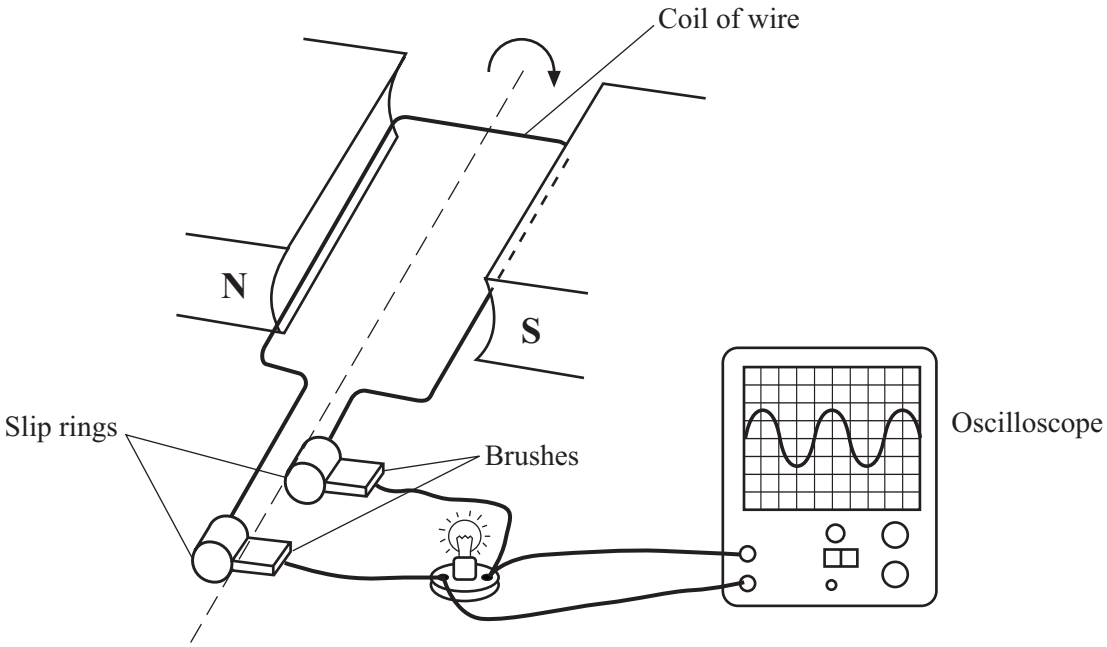
9

4.7.3.2 Uses of the generator effect (HT only)

Question 02

June 2004 | 3462H3 | Original Q9 | Legacy

9 (a) The diagram shows a simple generator. The trace on the oscilloscope shows that the generator produces an alternating current.



(i) Explain how the generator works. Include in your answer the reasons why the slip rings and brushes are needed.

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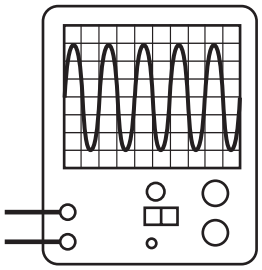
(4 marks)

4.7.3.2 Uses of the generator effect (HT only)

Question 02 · continued

MARGIN BLANK

(ii) What should be done to make the generator give the oscilloscope trace drawn below? Assume the controls on the oscilloscope are unchanged.



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(2 marks)

(b) Explain why electricity is transmitted through the National Grid as alternating current (a.c.) rather than direct current (d.c.).

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(3 marks)

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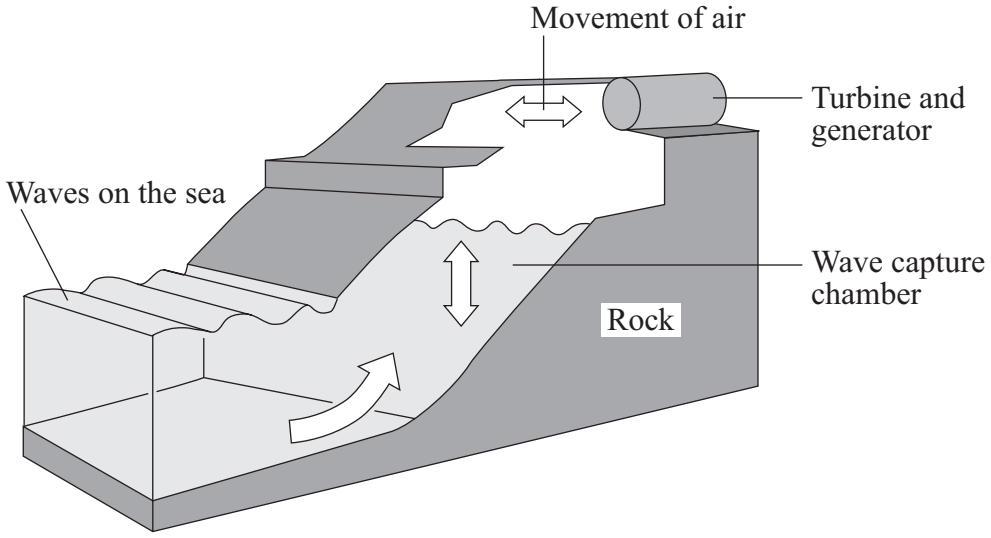
4.7.3.2 Uses of the generator effect (HT only)

Question 03

November 2006 | PHY1A | Original Q7 | Legacy

QUESTION SEVEN

The diagram shows a cross-section through the wave power station on the island of Islay in Scotland.



The wave capture chamber has been built into the rock. As water moves into and out of the chamber, the air above it is pushed up and down, and this drives a special turbine which operates when air flows through it in either direction. The turbine drives a generator with an average power output of 500 kilowatts.

7A The average power input to the wave power station is . . .

1 less than 250 kilowatts.

2 less than 500 kilowatts.

3 500 kilowatts.

4 more than 500 kilowatts.

7B Which one of these statements is true for a wave power station?

1 It cannot be damaged by storms.

2 It does no harm to wildlife.

3 It does not require any maintenance.

4 It does not use fuel.

4.7.3.2 Uses of the generator effect (HT only)

Question 03 · continued

7C The people on another island are thinking about building a wave power station. Not everybody on the island agrees with the suggestion.

The most likely reasons for objections to the wave power station will be noise and . . .

1 atmospheric pollution.

2 chemical pollution.

3 heat pollution.

4 visual pollution.

7D When all the costs for the project have been taken into account, including the cost of borrowing the money, the total cost will be about £3.4 million. The average value of the electricity generated will be about £86 000 per year.

How long will it take for the project to pay for itself?

1 About 25 years

2 About 30 years

3 About 35 years

4 About 40 years

4.7.3.2 Uses of the generator effect (HT only)

Question 04

June 2007 | PHY1A | Original Q4 | Legacy

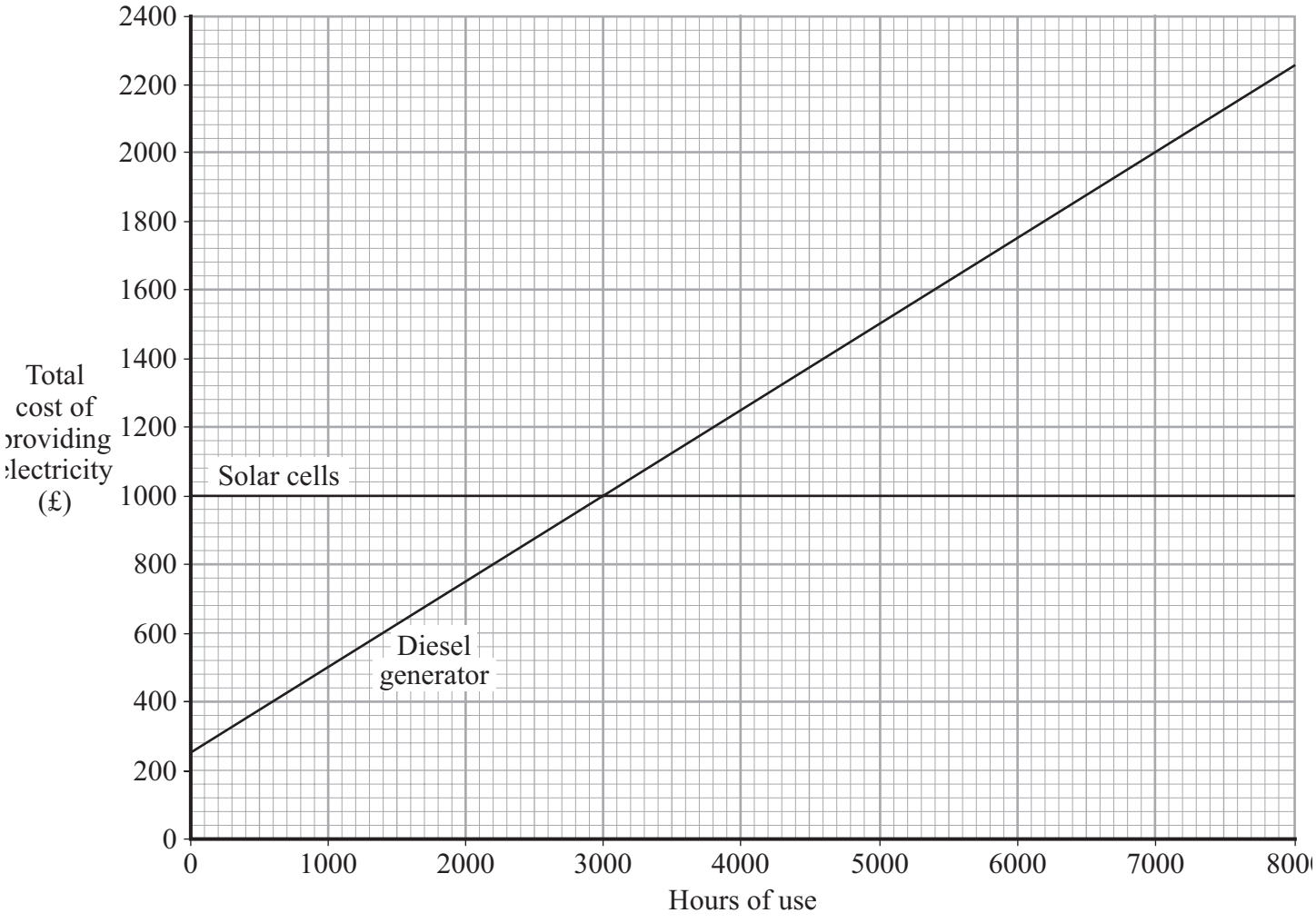
QUESTION FOUR

A remote village in South America is many kilometres from a mains electricity supply.

The villagers plan to pump water from the river and to use some of the water to irrigate fields.

They need an electricity supply to operate the pump.

The graph shows the total cost of two different ways of providing this electricity over time.



4A The graph shows that . . .

1 there are fuel costs but no maintenance costs for the solar cells.

2 there are maintenance costs but no fuel costs for the solar cells.

3 there are no fuel costs and no maintenance costs for the solar cells.

4 there are no fuel costs and no maintenance costs for the diesel generator.

4.7.3.2 Uses of the generator effect (HT only)

4B The price to buy the solar cells, compared with buying the diesel generator, is . . .

1 twice as much.

2 three times as much.

3 four times as much.

4 five times as much.

4C Providing electricity by diesel generator becomes more expensive than by solar cells after . . .

1 1000 hours of use.

2 2000 hours of use.

3 3000 hours of use.

4 4000 hours of use.

4D Maintenance of solar cells costs less than maintenance of the diesel generator mainly because . . .

1 solar cells have no moving parts.

2 solar cells do not produce exhaust gases.

3 solar cells operate at lower temperatures than diesel generators.

4 solar cells work only during the day.

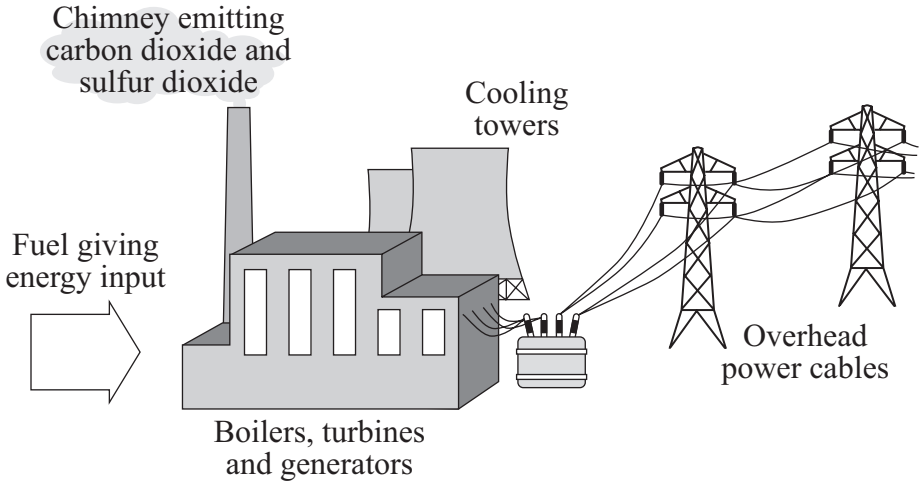
4.7.3.2 Uses of the generator effect (HT only)

Question 05

June 2007 | PHY1A | Original Q5 | Legacy

QUESTION FIVE

The diagram shows a power station.



5A What type of power station is this?

1 coal-burning

2 gas-burning

3 geothermal

4 nuclear

5B Which part transforms kinetic energy into electrical energy?

1 boiler

2 cooling tower

3 generator

4 turbine

4.7.3.2 Uses of the generator effect (HT only)

Question 05 · continued

5C After steam has passed through the turbines, it is passed upwards through the cooling towers. Here, the steam condenses to form water vapour.

What types of pollution are caused by the cooling towers?

1 chemical and noise

2 noise and thermal

3 thermal and visual

4 visual and chemical

5D A fossil-fuel power station is going to be built in a part of the country that does not have a power station.

Which one of the following is **not** an advantage to the local economy?

1 Carbon dioxide from the power station can be used in local commercial greenhouses.

2 More jobs will be created.

3 The power station will be connected to the National Grid.

4 Waste heat can be used in nearby buildings.

4.7.3.2 Uses of the generator effect (HT only)

Question 06

June 2007 | PHY1A | Original Q9 | Legacy

QUESTION NINE

The table shows the various costs, per kilowatt-hour, of electricity that is generated in four different ways.

Energy source	Capital cost	Running cost	Decommissioning cost
Nuclear	3.0 p	0.5 p	2.5 p
Gas	1.5 p	2.0 p	0.1 p
Coal	2.0 p	2.5 p	0.1 p
Wind	4.5 p	0.1 p	0.2 p

9A Considering only running cost, how much more does it cost to generate 1000 kilowatt-hours of electricity in a coal-fired power station than in a gas-fired power station?

1 £ 5

2 £ 15

3 £ 20

4 £ 25

9B It costs more to produce electricity from wind farms than from fuel-burning power stations.

This is mainly because wind generators . . .

1 have higher decommissioning costs.

2 have only very recently been developed.

3 have higher running costs.

4 use a dilute energy source.

4.7.3.2 Uses of the generator effect (HT only)

9C In the UK, most new power stations are gas-fired.

This is because, compared with all the other ways of generating electricity shown in the table, . . .

1 they cause less atmospheric pollution.

2 they are cheaper to build and cheaper overall.

3 they have lower running costs.

4 they use a renewable energy source.

9D Which one of the four ways of generating electricity is most suited to meeting short surges in the demand for electricity at any time of the day?

1 coal

2 gas

3 nuclear

4 wind

END OF TEST

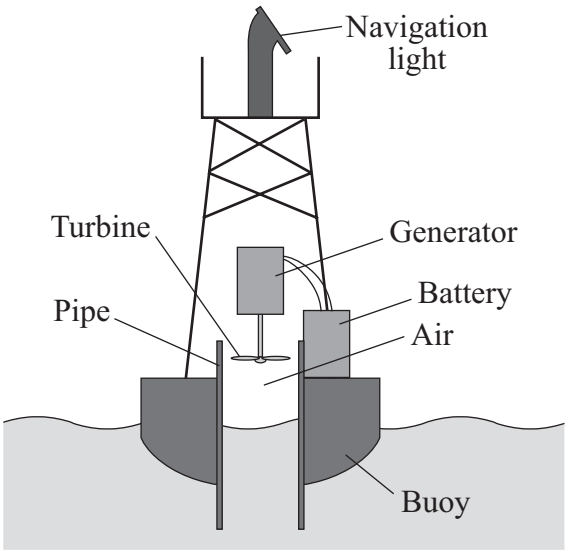
4.7.3.2 Uses of the generator effect (HT only)

Question 07

November 2007 | PHY1A | Original Q2 | Legacy

QUESTION TWO

The diagram shows a wave energy device.



Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A battery

B buoy

C generator

D turbine

Waves move the . . . **1** . . . up and down. This movement causes air to move both in and out of the pipe.

Movement of the air turns the . . . **2** . . . . This turns the . . . **3** . . . which produces electricity.

The electricity is used to charge the . . . **4** . . . .

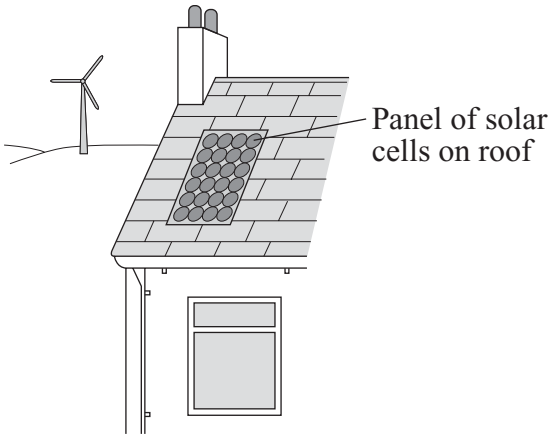
4.7.3.2 Uses of the generator effect (HT only)

Question 08

November 2007 | PHY1A | Original Q5 | Legacy

QUESTION FIVE

A house on a Scottish island uses solar cells to produce some of the electricity needed for lights and for pumping water.



The panel of solar cells cost £300 and has a maximum output of 33 W.

On average, over 24 hours, it produces $\frac{1}{8}$ of its maximum output.

5A How many kilowatt-hours of electricity does the panel of solar cells produce, on average, each 24 hours?

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

1 0.004125

2 0.099

3 0.792

4 356.4

5B The panel of solar cells has an expected life of 10 000 days.

What is the cost of the panel for each day of its life?

1 0.03 p

2 0.3 p

3 3.0 p

4 30 p

4.7.3.2 Uses of the generator effect (HT only)

Question 08 · continued

5C Most of the electricity for the house is produced by a wind generator.

The solar cells are also used . . .

1 because they produce electricity at such a low cost per kilowatt-hour.

2 because they may produce electricity at times when there is no wind.

3 because they will produce electricity all the time.

4 because they produce electricity at times when it is most likely to be needed.

5D Which of the following sentences about solar cells is true?

1 Electricity from solar cells is used to heat water in panels on house roofs.

2 Solar cells use a **non**-renewable energy source.

3 Solar cells will **not** work on cloudy days.

4 Solar cells transform light energy to electrical energy.

4.7.3.2 Uses of the generator effect (HT only)

Question 09

November 2007 | PHY1A | Original Q8 | Legacy

QUESTION EIGHT

Transformers are used in the National Grid.

8A Two types of transformer are used in various parts of the National Grid.

Which row in the table shows the correct locations of the two types of transformer?

	Between generators and power lines	Between power lines and substation	Between substation and people's homes
1	step-down	step-down	step-up
2	step-down	step-up	step-up
3	step-up	step-down	step-down
4	step-up	step-up	step-down

8B Transformers alter the potential difference across the power lines and the current through the power lines. These changes affect the efficiency of the power lines.

Which row in the table is correct?

	Potential difference across power lines	Current through power lines	Efficiency of transmission
1	decreased	decreased	decreased
2	decreased	increased	increased
3	increased	decreased	increased
4	increased	increased	increased

4.7.3.2 Uses of the generator effect (HT only)

Question 09 · continued

8C The table shows the percentage of energy wasted as heat and sound by four different transformers.

Which transformer has the highest efficiency?

Transformer	Percentage of energy supplied to transformer which is wasted as sound	Percentage of energy supplied to transformer which is wasted as heat
1	1.1	7.4
2	1.2	4.7
3	1.3	5.4
4	1.4	6.9

8D The amount of electricity that a device transforms depends on the rate at which the device transforms energy and . . .

1 how long the device is switched on.

2 the current through the device.

3 the potential difference across the device.

4 the power of the device.

4.7.3.2 Uses of the generator effect (HT only)

Question 10

March 2008 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

A geothermal power station uses the energy in hot rocks to produce electricity.

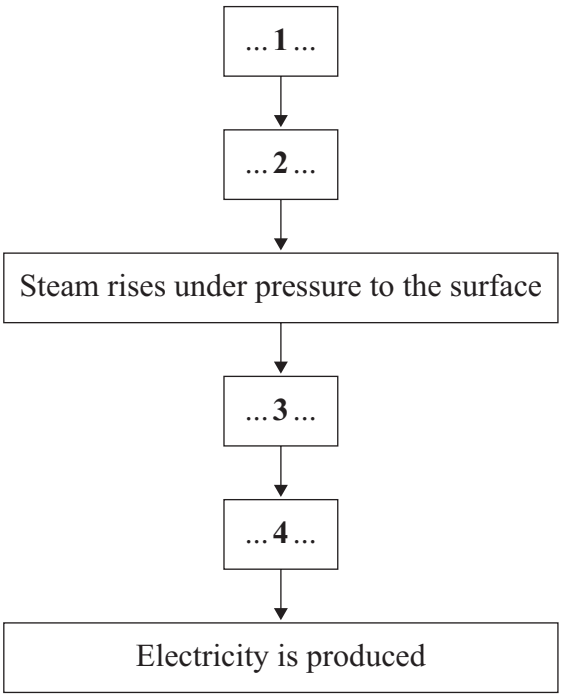
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart to explain how the power station works.

A cold water is pumped into the rocks

B steam drives turbines

C turbines drive generators

D water is heated by radioactive decay



4.7.3.2 Uses of the generator effect (HT only)

Question 11

March 2008 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

An African village is in a remote location.

The Sun shines for at least a few hours nearly every day.

The villagers want a supply of electricity to pump up water from a well for a few hours each day.

The table shows the costs of two different ways of providing the electricity.

The capital cost is the cost of buying the equipment.

	Capital cost	Capital cost* (per kWh)	Fuel cost* (per kWh)	Maintenance cost* (per kWh)
Solar cells	£1000	20 p	zero	zero
Petrol generator	£250	5 p	20 p	10 p

[*These costs are averaged out over the 20 years that the equipment is expected to last.]

6A Which one of the following statements is true?

1 A petrol generator has a higher initial capital cost.

2 A petrol generator has a higher capital cost per kWh.

3 A petrol generator has a higher overall cost per kWh.

4 A petrol generator needs less maintenance.

6B An advantage of the petrol generator is that . . .

1 it will cause less air pollution.

2 it is cheaper to set up the system in the first place.

3 it has no moving parts.

4 it will cost less over a 20-year period.

4.7.3.2 Uses of the generator effect (HT only)

Question 11 · continued

March 2008 | PHY1AP | Original Q6 | Legacy

6C The main reason for choosing the solar cells for pumping water in the African village is that . . .

1 the low voltage from the solar cells is safer than high voltage power supplies.

2 solar cells are cheap to make.

3 solar cells provide a constant source of electricity.

4 the village is a long distance from mains electricity sources.

6D The main disadvantage of using the solar cells for pumping water in the African village is that . . .

1 they require no maintenance.

2 they will not work during the night.

3 they can work out cheaper over a 20-year period.

4 they have a high initial capital cost.

Question 12

June 2008 | PHY3H | Original Q5 | Legacy

5 Ultrasound can be used in industry for detecting internal cracks in metals.

5 (a) State **two** features of ultrasound.

1 .....

2 .....

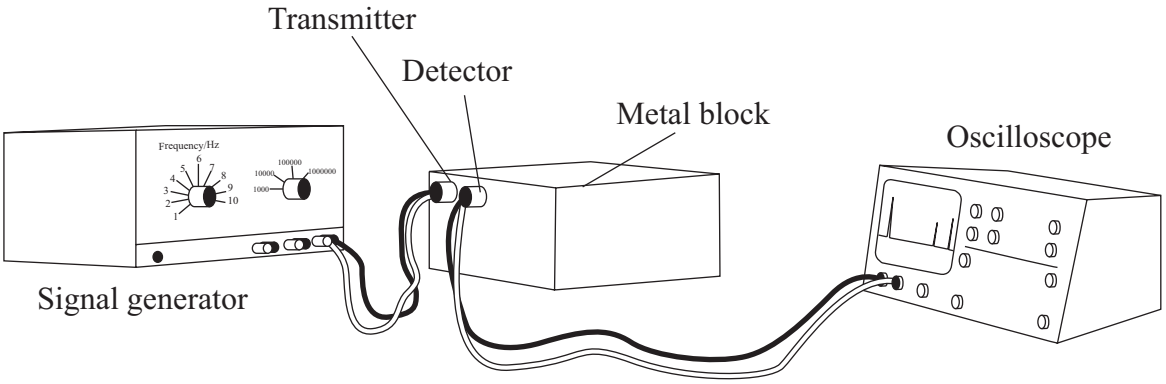
(2 marks)

4.7.3.2 Uses of the generator effect (HT only)

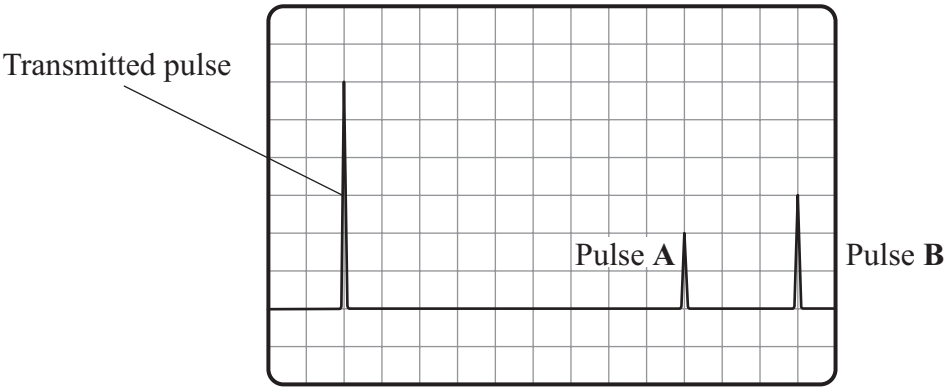
Question 12 · continued

for mark

5 (b) The diagram shows an ultrasound transmitter and detector fixed to the front of a metal block. The block has an internal crack.



The diagram below shows the screen of the oscilloscope connected to the detector.



5 (b) (i) Explain why pulse **A** and pulse **B** occur.

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(2 marks)

5 (b) (ii) The metal block is 120 mm from front to back. What is the distance, in mm, from the front of the block to the internal crack?

Distance = ... mm

(1 mark)

5

4.7.3.2 Uses of the generator effect (HT only)

Question 13

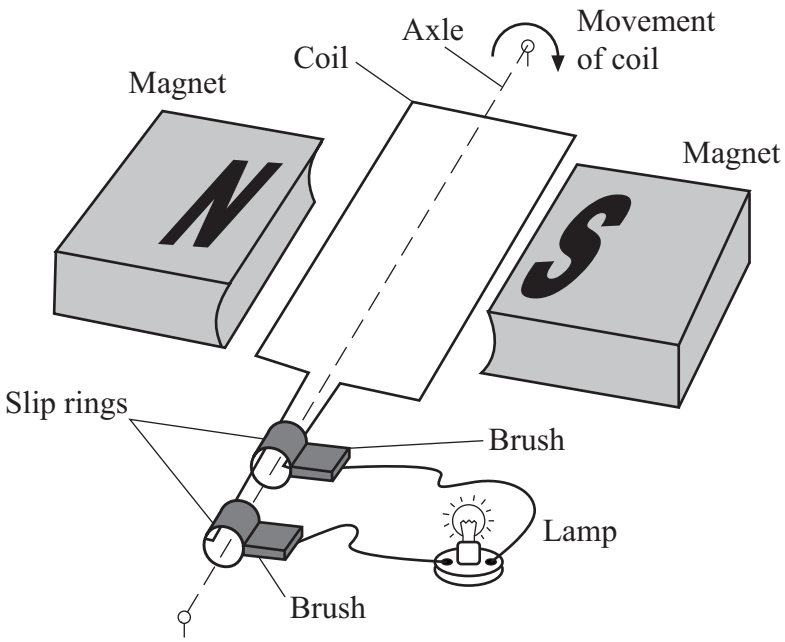
June 2008 | PHY3H | Original Q7 | Legacy

7 A student has an exercise bike.



She wants to connect it to a generator and lamp so that the lamp lights when she pedals fast enough.

The diagram shows the simple generator which she constructs.



4.7.3.2 Uses of the generator effect (HT only)

Question 13 · continued

for mark

Explain how rotating the coil causes the lamp to light.

Include in your explanation the function of the slip rings and brushes.

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(5 marks)

5

4.7.3.2 Uses of the generator effect (HT only)

Question 14

November 2008 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

This question is about some of the different ways of generating electricity.

7A Some power stations in the UK burn coal to produce heat.

Which row in the table gives the correct order of operations in a coal-fired power station?

1	The turbine heats the boiler	The boiler produces steam	Steam drives the generator which produces electricity
2	The boiler produces steam	Steam turns the blades of the turbine	The turbine produces electricity
3	The boiler produces steam	Steam turns the blades of the turbine	The turbine drives the generator which produces electricity
4	The turbine heats the boiler	The boiler produces steam	Steam from the boiler makes electricity

7B Wind farms can be used to produce electricity.

A wind farm consists of a number of . . .

1 transformers connected to turbines.

2 turbines connected to generators.

3 generators only.

4 turbines only.

4.7.3.2 Uses of the generator effect (HT only)

Question 14 · continued

7C The government wants more nuclear power stations to be built. Nuclear power stations have advantages and disadvantages.

Which of the following statements about nuclear power stations is correct under normal working conditions?

1 They use a renewable energy source, do not release harmful substances into the atmosphere and produce radioactive waste.

2 They use a renewable energy source, do not release harmful substances into the atmosphere and have a long start-up time.

3 They do not release harmful substances into the atmosphere, have a relatively short start-up time and produce radioactive waste.

4 They do not release harmful substances into the atmosphere, have a relatively long start-up time and produce radioactive waste.

7D Solar cells can be used to produce electricity on a large scale in places like Australia and California. At present, they are not used on a large scale in the UK.

Which of the following statements about solar cells used to produce electricity on a large scale is correct?

1 They can be used where the Sun shines every day and they need only a small area of land.

2 They can harness a vast amount of energy from the Sun each day and they need only a small area of land.

3 They need a large area of land because the energy from the Sun is dilute.

4 They need a large area of land because the solar cells are very efficient.

4.7.3.2 Uses of the generator effect (HT only)

Question 15

January 2009 | PHY1H | Original Q4 | Legacy

4 Most elements have some *isotopes* which are *radioactive*.

4 (a) What is meant by the terms:

4 (a) (i) *isotopes*

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.....

(1 mark)

4 (a) (ii) *radioactive*?

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(1 mark)

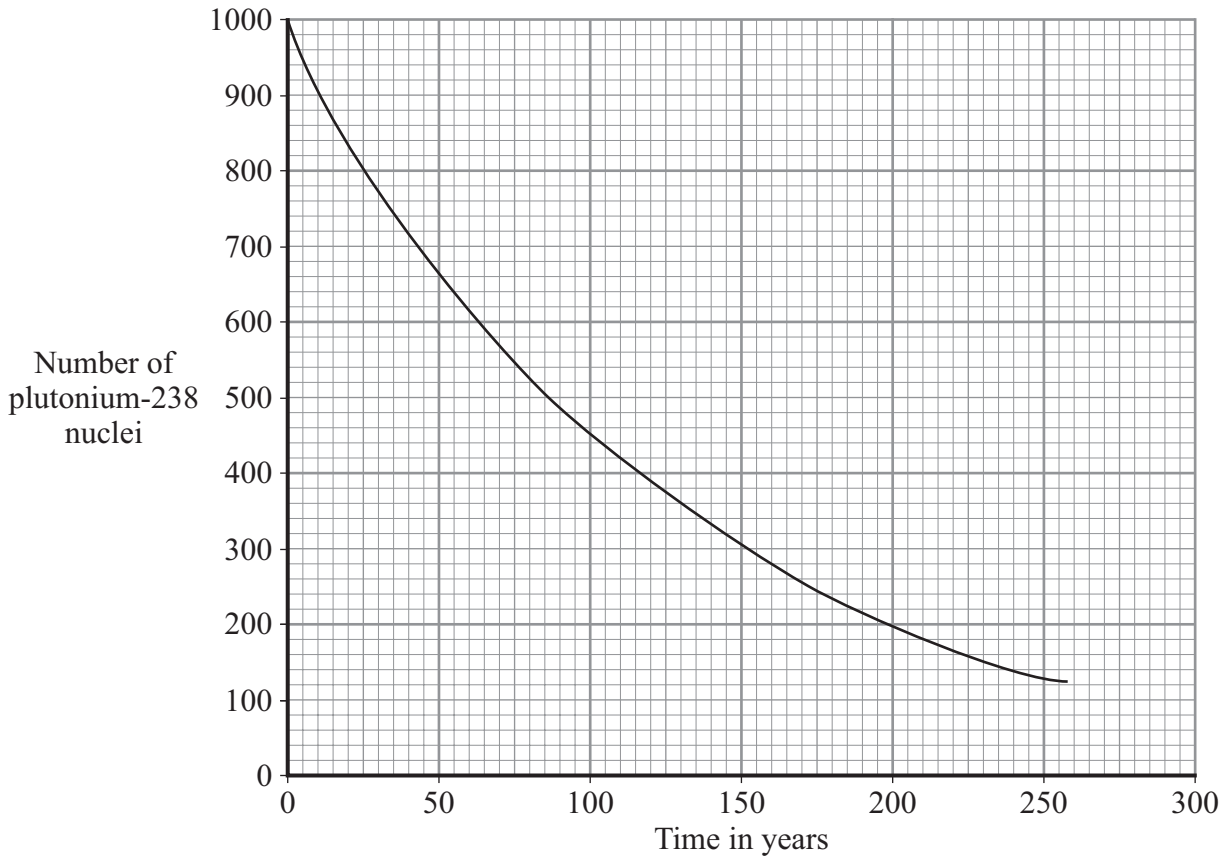
Question 4 continues on the next page

4.7.3.2 Uses of the generator effect (HT only)

Question 15 · continued

for mark

4 (b) The graph shows how the number of nuclei in a sample of the radioactive isotope plutonium-238 changes with time.



Use the graph to find the half-life of plutonium-238.

Show clearly on the graph how you obtain your answer.

Half-life = ... years

(2 marks)

4 (c) The Cassini spacecraft launched in 1997 took seven years to reach Saturn.
The electricity to power the instruments on board the spacecraft is generated using the heat produced from the decay of plutonium-238.

4 (c) (i) Plutonium-238 decays by emitting alpha particles.

What is an alpha particle?

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(1 mark)

4.7.3.2 Uses of the generator effect (HT only)

Question 15 · continued

for mark

4 (c) (ii) During the 11 years that Cassini will orbit Saturn, the output from the generators will decrease.

Explain why.

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(2 marks)

4 (d) Plutonium-238 is highly dangerous. A tiny amount taken into the body is enough to kill a human.

4 (d) (i) Plutonium-238 is unlikely to cause any harm if it is outside the body but is likely to kill if it is inside the body.

Explain why.

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(2 marks)

4 (d) (ii) In 1964, a satellite powered by plutonium-238 was destroyed, causing the release of radioactive material into the atmosphere.

Suggest why some environmental groups protested about the launch of Cassini.

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(1 mark)

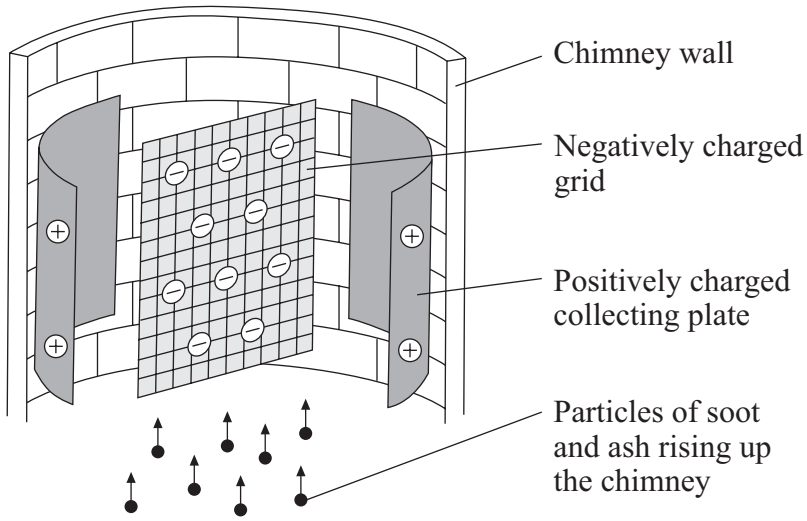
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4.7.3.2 Uses of the generator effect (HT only)

Question 16

January 2009 | PHY2H | Original Q4 | Legacy

4 (a) Burning coal produces soot, ash and waste gases.
The diagram shows an electrostatic precipitator used to separate the particles of soot and ash from the waste gases.



Explain how the electrostatic precipitator separates the particles of soot and ash from the waste gases.

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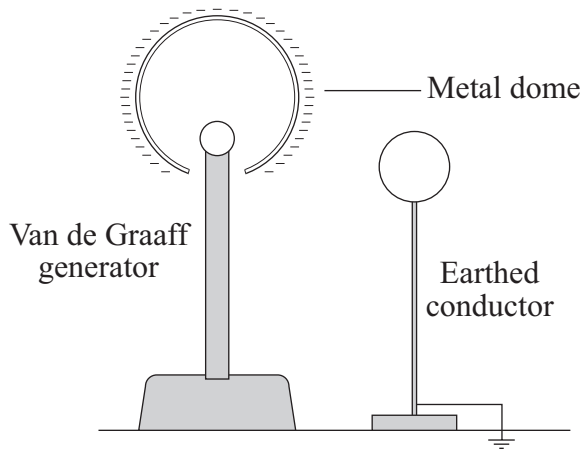
(3 marks)

4.7.3.2 Uses of the generator effect (HT only)

Question 16 · continued

for mark

4 (b) The diagram shows a Van de Graaff generator. When the generator is switched on, the metal dome becomes negatively charged.



Explain what must happen to cause a spark to jump from the dome of the generator to an earthed conductor nearby.

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(2 marks)

5

4.7.3.2 Uses of the generator effect (HT only)

Question 17

March 2009 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about power stations and the distribution of electricity.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A generator

B grid

C transformer

D turbine

In most power stations, steam is used to drive a . . . **1** . . . .

Electricity is produced at a power station by a . . . **2** . . . .

The voltage of the electricity is stepped up by a . . . **3** . . . .

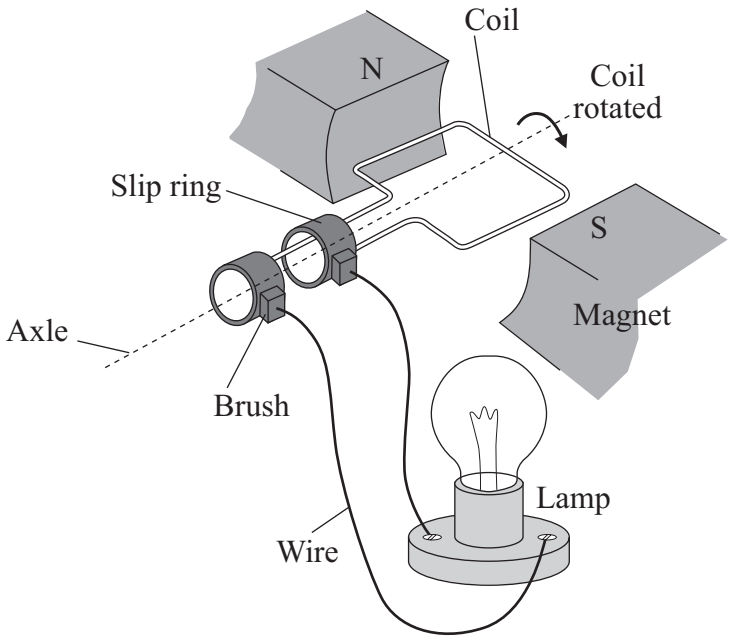
Electricity is transferred from the power station to our homes by the national . . . **4** . . . .

4.7.3.2 Uses of the generator effect (HT only)

Question 18

June 2009 | PHY3H | Original Q7 | Legacy

7 The diagram shows a generator.
When the coil is rotated around the axle, a current is produced and the lamp lights up.



7 (a) Explain the purpose of the slip rings and brushes.

.....

.....

.....

(2 marks)

7 (b) Explain how this generator gives an a.c. rather than a d.c. output.

.....

.....

.....

(2 marks)

7 (c) In this design, the generator effect occurs because the coil rotates in a magnetic field.

How else can a generator effect occur?

.....

.....

(1 mark)

4.7.3.2 Uses of the generator effect (HT only)

Question 19

November 2009 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

This question is about different ways of generating electricity.

7A Some types of power station heat water to produce steam. The steam then drives a turbine connected to an electrical generator.

Which types of power station produce steam?

1 biomass, coal and nuclear

2 biomass, wind and wave

3 coal, nuclear and wave

4 gas, wind and wave

The table gives data for the cost of generating electricity in different types of power station.

Type of power station	Building and operating costs in pence per kWh	Fuel costs in pence per kWh	Total cost in pence per kWh
Biomass	5.9	0.8	6.7
Coal	1.3	1.2	2.5
Gas	0.7	1.5	2.2
Nuclear	1.8	0.4	2.2
Wave	6.6	0.0	6.6
Wind	3.7	0.0	3.7

7B Which one of the following is correct?

1 Electricity generated from fossil fuels is always the cheapest.

2 The fuel cost for all renewable sources is zero.

3 The most expensive electricity comes from renewable sources.

4 Wind power stations produce the cheapest electricity.

4.7.3.2 Uses of the generator effect (HT only)

Question 19 · continued

7C Fossil fuel power stations release polluting gases into the atmosphere. The government has suggested a carbon tax because of this. This tax would add 0.8 p/kWh to coal prices and 0.4 p/kWh to gas prices.

Which type of power station would produce the cheapest electricity if a carbon tax was added?

1 coal

2 gas

3 nuclear

4 wind

7D The total cost per kilowatt-hour of electricity from a wind-powered station is more than the total cost of electricity per kilowatt-hour from a gas-powered station.

By what percentage would the **fuel** cost of gas have to increase to make the **total** costs the same? (Assume that no carbon tax has been added.)

1 15 %

2 41 %

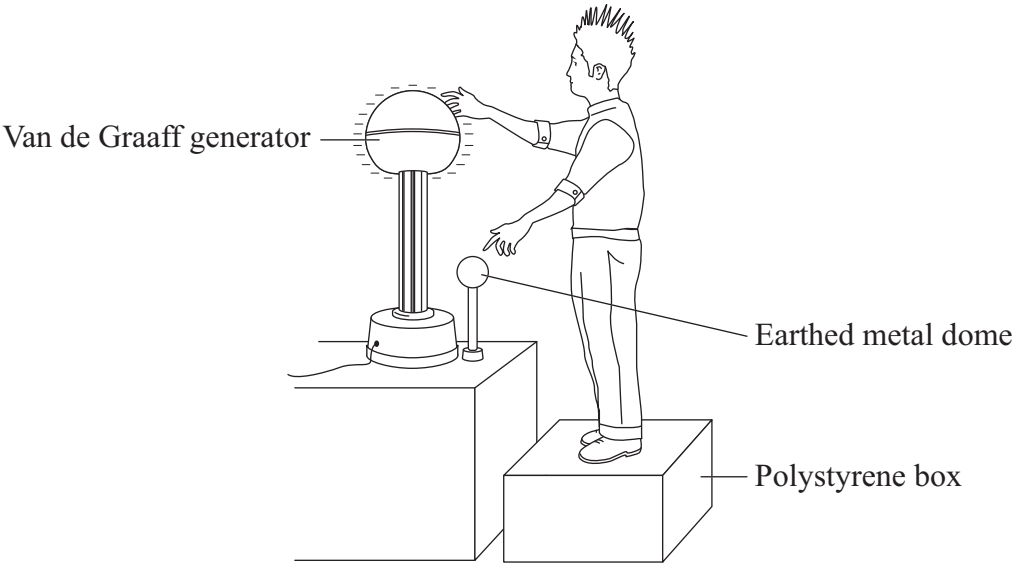
3 68 %

4 100 %

4.7.3.2 Uses of the generator effect (HT only)

Question 20

5 (a) The diagram shows a student touching the metal dome of a Van de Graaff generator. When the generator is switched on, the metal dome becomes negatively charged.



Explain why the student's hair stands on end when the generator is switched on.

.....

.....

.....

(2 marks)

5 (b) When the potential difference between the student and a nearby earthed metal dome reached 15 kV, a spark jumped between the student and the earthed dome. The spark transformed 30 mJ of energy into heat, light and sound. (1 mJ = 0.001 J)

Use the equation in the box to calculate the charge carried by the spark.

energy transformed = potential difference × charge

.....

.....

Charge transferred = ... coulombs

(2 marks)

5 (c) What name is given to the rate of flow of charge?

.....

(1 mark)

5

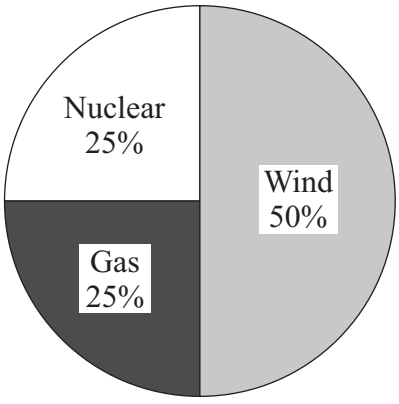
4.7.3.2 Uses of the generator effect (HT only)

Question 21

March 2010 | PHY1AP | Original Q8 | Legacy

QUESTION EIGHT

An electricity company claims to generate its electricity from environmentally friendly energy sources. Its sources are shown below.



The table shows the cost of generating one kilowatt-hour of electricity using each energy source.

Energy source	Cost in pence per kilowatt-hour
Gas	2.2
Nuclear	2.2
Wind	3.6

8A The average cost per kilowatt-hour for the electricity company is . . .

1 2.5p

2 2.7p

3 2.9p

4 3.1p

8B How much of the company's electricity is produced by sources that do not release polluting gases?

1 25%

2 50%

3 75%

4 100%

4.7.3.2 Uses of the generator effect (HT only)

Question 21 · continued

8C Pumped storage hydroelectric power stations have two reservoirs of water. One reservoir is at a high level, the other at a low level. Water can be released from the high reservoir to flow through turbines to the low reservoir. The turbines drive electrical generators. At night, when demand for electricity is low, water is pumped back to the high reservoir.

The electricity company buys a pumped storage hydroelectric power station.

When is the company likely to use this power station to generate electricity?

1 when the demand for electricity is low

2 when there is a sudden increase in demand for electricity

3 when the wind is blowing at a steady speed

4 when a constant increase in generating capacity is needed

8D The government wants 20% of all electricity to be generated from renewable sources by 2020. It is considering building more wind farms, tidal and wave-powered generators and nuclear power stations.

Why would a scientist consider this statement to be wrong?

1 Coal will continue to be available for another 200 years.

2 Nuclear energy should not be included as a renewable source.

3 The decision should be made by scientists, not politicians.

4 These renewable energy sources are not reliable.

4.7.3.2 Uses of the generator effect (HT only)

Question 22

March 2010 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

In the south of Spain, there is an electricity generator which is powered by the Sun.

- Mirrors reflect the Sun's radiation onto a container of water at the top of a tower.
- The water is changed to steam.
- The steam is used to turn a generator.

9A The main source of energy for this generator is . . .

1 infra red.

2 light.

3 microwave.

4 ultraviolet.

9B Which row in the table gives a correct advantage and disadvantage for this generator?

	Advantage	Disadvantage
1	It cannot be used continuously over a 24-hour period.	It has low running costs.
2	It has low running costs.	It produces atmospheric pollution.
3	It produces no atmospheric pollution.	It uses non-renewable energy.
4	It uses renewable energy.	It cannot be used continuously over a 24-hour period.

9C The electricity is transferred to a nearby city using overhead cables.

At the power station, a transformer is used to . . .

1 increase the current, decrease the power and reduce energy losses.

2 increase the energy, increase the power and reduce energy losses.

3 increase the power, decrease the current and reduce energy losses.

4 increase the voltage, decrease the current and reduce energy losses.

4.7.3.2 Uses of the generator effect (HT only)

The maximum output of the generator is 11 000 000 watts.

9D A typical household needs 2 kW of electrical power.

If the solar generator is working at 60 % of its maximum output, the number of typical households that could be supplied is . . .

1 3 300

2 198 000

3 3 300 000

4 198 000 000

END OF TEST

4.7.3.2 Uses of the generator effect (HT only)

Question 23

March 2010 | PHY1BP | Original Q4 | Legacy

QUESTION FOUR

There are two types of communication signal: analogue and digital.

4A Which pair of diagrams correctly shows the patterns for digital and analogue signals?

	Digital signal pattern	Analogue signal pattern
1		
2		
3		
4		

4B One reason for using digital signals rather than analogue signals for communication is that . . .

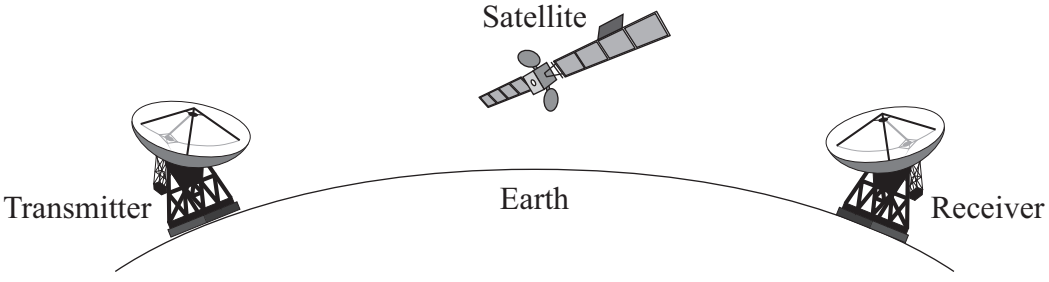
1 analogue signals are less prone to interference.

2 analogue signals can have only two values.

3 digital signals are continuously variable.

4 digital signals can be easily processed by computers.

4C Satellites in orbit around the Earth receive and transmit microwave signals for international telephone communication.



Microwaves are used because . . .

1 they are the only type of electromagnetic wave that can travel through a vacuum.

2 they are not absorbed by the Earth's atmosphere.

3 they follow the curvature of the Earth.

4 they travel faster than radio waves.

4.7.3.2 Uses of the generator effect (HT only)

Question 23 · continued

4D Properties of waves are often demonstrated in schools using waves on water.

wave speed (metre/second, m/s)	=	frequency (hertz, Hz)	×	wavelength (metre, m)

A wave generator with a frequency of 50 Hz produces water waves with a wavelength of 2 cm.

At what speed do the waves travel?

1 1 m/s

2 25 m/s

3 100 m/s

4 2500 m/s

Turn over for the next question

4.7.3.2 Uses of the generator effect (HT only)

Question 24

March 2010 | PHY1BP | Original Q9 | Legacy

QUESTION NINE

This question is about electromagnetic radiation.

9A Electromagnetic radiations are . . .

1 disturbances in an electric field.

2 disturbances of the air between source and receiver.

3 waves caused by pressure changes in a vacuum.

4 waves of very high frequency.

9B When electromagnetic radiation reaches a substance, . . .

1 all wavelengths will be absorbed by the substance.

2 all wavelengths will be reflected by the substance.

3 all wavelengths will be transmitted through the substance.

4 some wavelengths may be absorbed, some reflected and some transmitted.

wave speed (metre/second, m/s)	=	frequency (hertz, Hz)	×	wavelength (metre, m)

All electromagnetic waves travel at 300 000 km/s.

9C Most schools have microwave generators that produce microwaves with a wavelength of 3 cm.

What is the frequency of these microwaves?

1 900 kHz

2 10 000 kHz

3 900 000 kHz

4 10 000 000 kHz

9D BBC Radio 4 transmits radio waves at a frequency of 200 kHz.

What is the wavelength of Radio 4?

1 1.5 m

2 600 m

3 1500 m

4 60 km

END OF TEST

4.7.3.2 Uses of the generator effect (HT only)

Question 25

June 2010 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

Hydroelectric schemes use falling water to produce electricity.

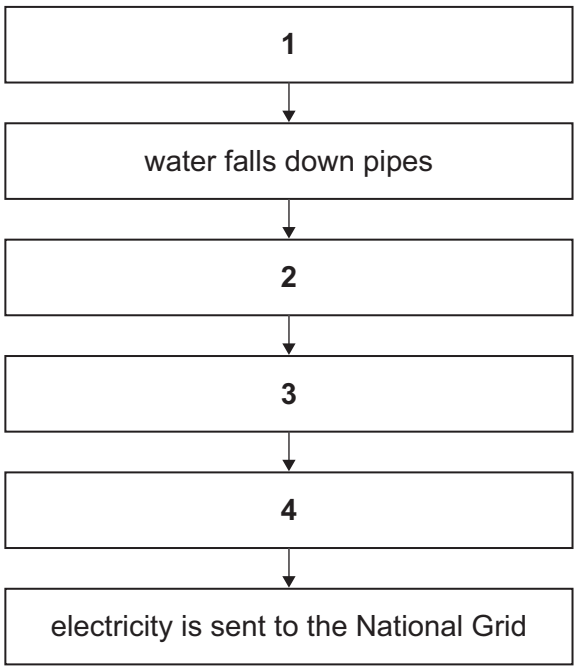
Match statements, **A**, **B**, **C**, and **D**, with the boxes **1–4** in the flow chart to show how a hydroelectric scheme works.

A electricity is produced

B moving water drives turbines

C turbines drive generators

D water collects in a reservoir

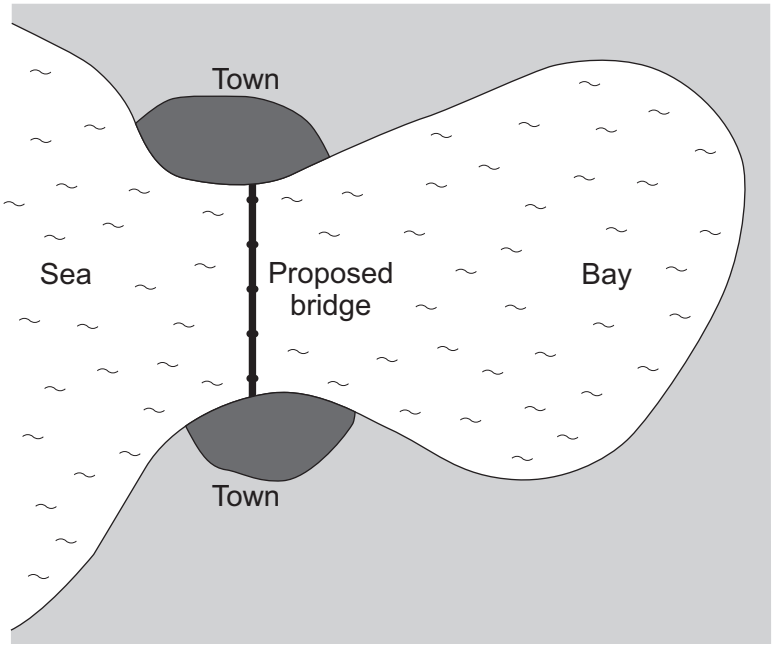


4.7.3.2 Uses of the generator effect (HT only)

Question 26

June 2010 | PHY1H | Original Q5 | Legacy

5 The map shows the positions of two towns on either side of a very large coastal bay in England. The map also shows where a bridge may be built to link the towns. The road journey from one town to the other is about 60 kilometres at present.



5 (a) It is estimated that building turbines and generators inside the legs of the bridge would produce enough electricity for both towns. In addition, enough electricity would be generated to run electric buses over the bridge between the two towns.

5 (a) (i) If the bridge is built, what form of renewable energy will be used to generate the electricity?

.....

(1 mark)

5 (a) (ii) Most people living in the area are in favour of the proposed bridge.

Suggest **three** reasons why people would be in favour of building the bridge and the associated electricity generating scheme.

Reason 1 .....

.....

Reason 2 .....

.....

Reason 3 .....

.....

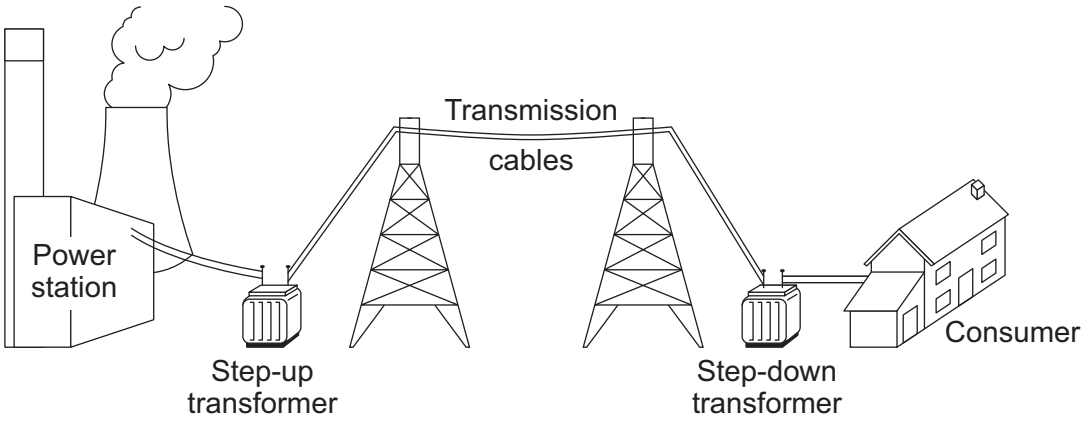
(3 marks)

4.7.3.2 Uses of the generator effect (HT only)

Question 26 · continued

5 (b) Even with the proposed bridge, the two towns will need to stay connected to the National Grid.

The diagram shows part of the National Grid.



5 (b) (i) Give **one** reason why the towns need to stay connected to the National Grid.

.....

.....

(1 mark)

5 (b) (ii) Explain how the step-up transformer increases the efficiency of the National Grid.

.....

.....

.....

.....

(2 marks)

7

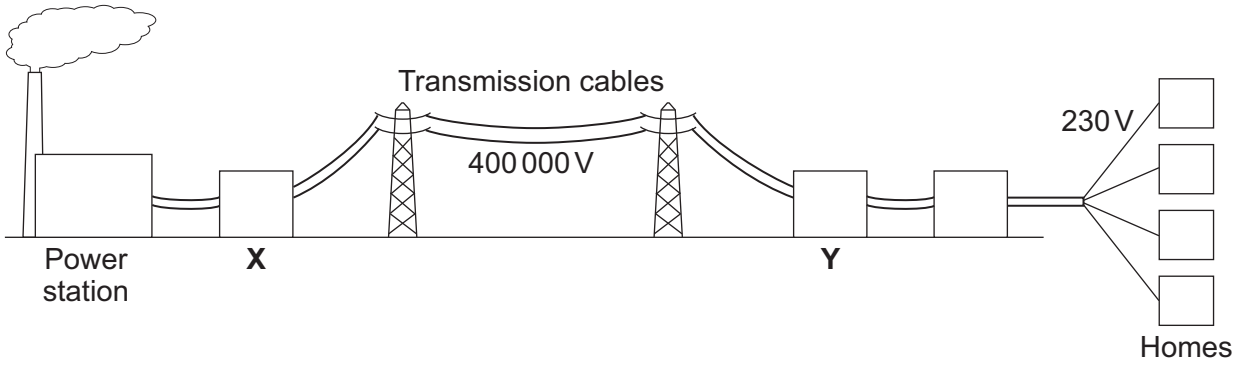
4.7.3.2 Uses of the generator effect (HT only)

Question 27

November 2010 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

The diagram shows a power station connected to the National Grid. The National Grid distributes the electrical energy to homes.



7A Which row in the table correctly describes the transformers **X** and **Y**?

	X	Y
1	step-down	step-down
2	step-down	step-up
3	step-up	step-down
4	step-up	step-up

7B Why is the voltage (potential difference) across the transmission cables of the National Grid very high?

1 so that the electricity travels faster

2 so that the electric current is large

3 to make the transmission of electricity safe

4 to reduce energy loss from the cables

7C A transformer changes both the voltage and the current.

Which row in the table correctly describes the changes of current in transformers **X** and **Y**?

	X	Y
1	decrease	decrease
2	decrease	increase
3	increase	decrease
4	increase	increase

4.7.3.2 Uses of the generator effect (HT only)

Question 27 · continued

7D In the power station, the boiler has an efficiency of 0.75. The turbine and generator system have an efficiency of 0.80.

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

For every 1000 J of energy supplied to the boiler, what is the useful output energy from the turbine and generator system?

1 600 J

2 750 J

3 800 J

4 1670 J

Turn over for the next question

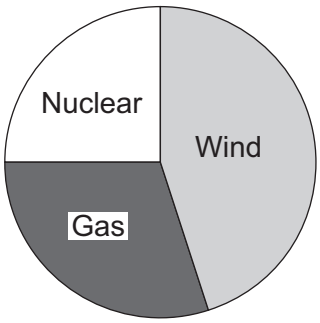
4.7.3.2 Uses of the generator effect (HT only)

Question 28

January 2011 | PHY1H | Original Q3 | Legacy

3 (a) An electricity company claims to generate all of its electricity from environmentally friendly energy sources.

The energy sources used by the company are shown in the pie chart.



Do you think that the claim made by the company is correct?

Draw a ring around your answer.

Yes **No** **Maybe**

Explain the reasons for your answer.

.....

.....

.....

.....

(2 marks)

3 (b) The government is committed to increasing the amount of electricity generated from renewable sources. A newspaper reported that:

More wind farms, wave powered generators, solar generators and nuclear power stations would need to be built

Why is the statement made in the newspaper incorrect?

.....

.....

(1 mark)

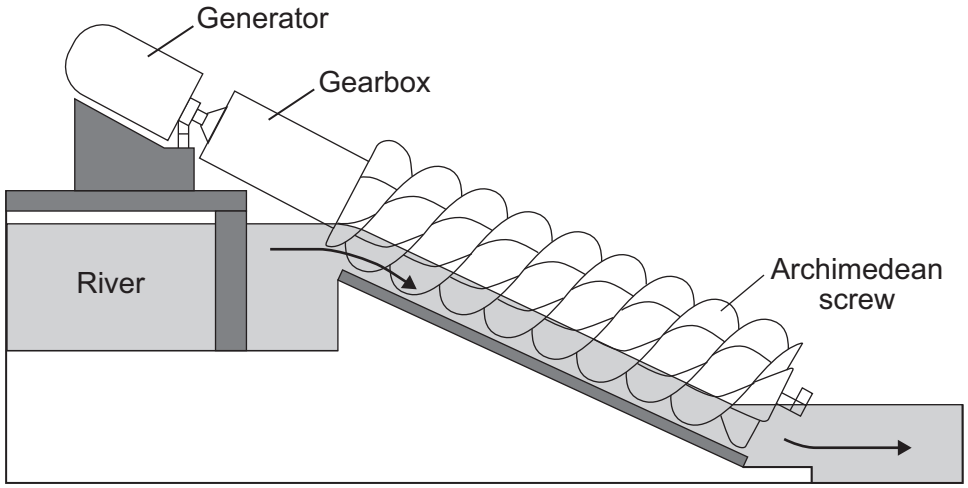
3

4.7.3.2 Uses of the generator effect (HT only)

Question 29

January 2011 | PHY1H | Original Q4 | Legacy

4 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.



4 (a) Each second, the *micro-hydroelectricity* generator transforms 80 000 joules of gravitational potential energy into 60 000 joules of electrical energy.

4 (a) (i) Fill in the missing word to complete the energy transformation diagram.

Gravitational potential energy of the falling water	→ ..... energy of the Archimedean screw	→ Electrical energy generated

(1 mark)

4 (a) (ii) Use the equation in the box to calculate the efficiency of the *micro-hydroelectricity* generator.

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

4.7.3.2 Uses of the generator effect (HT only)

Question 29 · continued

4 (b) The power output from a conventional large-scale hydroelectric power station is 100 000 times more than the power output from a micro-hydroelectric system.

Give **one** disadvantage of a conventional large-scale hydroelectric power station compared to the micro-hydroelectric system.

.....

.....

(1 mark)

4 (c) The electricity generated by a micro-hydroelectric system is transferred via a transformer directly to local homes. The electricity generated by a conventional large-scale hydroelectric power station is transferred to the National Grid, which distributes the electricity to homes anywhere in the country.

4 (c) (i) What is the National Grid?

.....

.....

(1 mark)

4 (c) (ii) Explain why transferring the electricity directly to local homes is more efficient than using the National Grid to distribute the electricity.

.....

.....

.....

.....

(2 marks)

7

4.7.3.2 Uses of the generator effect (HT only)

Question 30

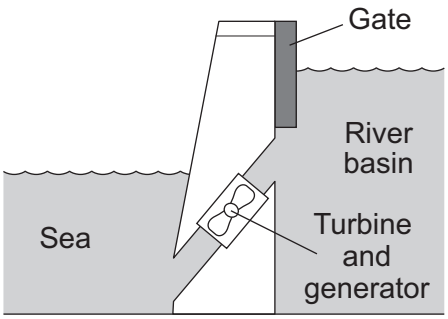
March 2011 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

It is estimated that the total energy available from the world's tides could provide about 5 % of the electricity generated worldwide.

One method of using the energy of tides is to build a barrage across a river.

The diagram shows a tidal barrage.



Tide going out

- As the tide rises, the gate is opened to let seawater into the river basin.
- At high tide the gate is closed, trapping water in the river basin.
- As the tide goes out, the gate is opened and water flows through the turbine.

3A Which energy transformations take place as the water flows from the river basin through the turbine and the generator to the sea?

1 gravitational potential to electrical to kinetic

2 gravitational potential to kinetic to electrical

3 kinetic to electrical to gravitational potential

4 kinetic to gravitational potential to electrical

4.7.3.2 Uses of the generator effect (HT only)

Question 30 · continued

3B From the information above, one of the advantages of a tidal barrage over a wind farm is that it . . .

1 can be built anywhere.

2 generates electricity all the time.

3 has low building costs.

4 uses a predictable energy source.

3C Environmentalists claim that one of the **disadvantages** of tidal power stations is that they . . .

1 cause noise pollution.

2 destroy the habitat of wading birds.

3 produce gases that pollute the atmosphere.

4 produce radioactive waste.

3D A cheaper way to use tidal energy is to use underwater currents to drive turbines. This is the same idea as a wind farm, but it works under water.

One report states that electricity generated by underwater currents would be four times as expensive as electricity generated by a wind farm.

The cost of electricity, from cheapest to most expensive, would be . . .

1 tidal barrage, underwater current, wind farm.

2 underwater current, wind farm, tidal barrage.

3 wind farm, tidal barrage, underwater current.

4 wind farm, underwater current, tidal barrage.

4.7.3.2 Uses of the generator effect (HT only)

Question 31

June 2011 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

Some dairy farmers have installed electrical generators that run on methane gas.

- Methane gas is produced from rotting vegetation and animal waste.
- On farms, the rotting process takes place in a digester.
- Methane produced in this way is a biofuel called biogas.
- Burning methane produces carbon dioxide and water.
- The electrical generators can be installed in a farm building.

3A Methane is called a biofuel because . . .

1 it is a renewable fuel.

2 it comes from living things.

3 it produces carbon dioxide and water.

4 it is made in a digester.

3B Farmers have been encouraged to install their own biogas generators because . . .

1 this would reduce the amount of fuel used in power stations.

2 this would reduce the amount of animal waste produced.

3 biogas is a non-renewable fuel.

4 this would use less electricity.

3C A farmer's weekly electricity bill using the mains supply is £290. The biogas generator costs £15 000 to install.

The biogas generator provides all of the farmer's electricity.

What is the pay-back time?

1 1.0 years

2 4.3 years

3 5.2 years

4 58 years

4.7.3.2 Uses of the generator effect (HT only)

3D It would have been cheaper for the farmer to install a wind turbine generator.

What is the advantage of the biogas generator over the wind turbine generator?

1 It uses a renewable energy source.

2 It produces water.

3 It can work all the time.

4 It does not require any space.

Turn over for the next question

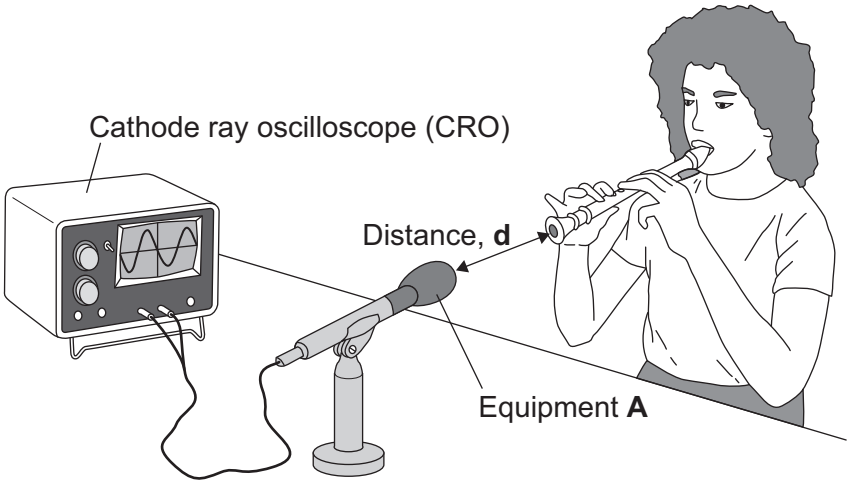
4.7.3.2 Uses of the generator effect (HT only)

Question 32

June 2011 | PHY3H | Original Q1 | Legacy

1 A group of students investigates sound waves.

The diagram shows part of their investigation.



1 (a) Identify the equipment labelled **A**.

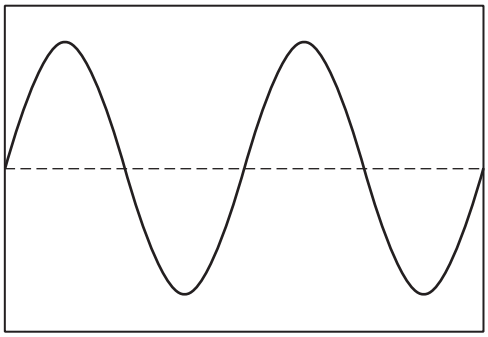
.....

(1 mark)

1 (b) The student plays the same note in the same way at different distances from equipment **A**.

Another student records the amplitude of the wave shown on the cathode ray oscilloscope (CRO).

1 (b) (i) Label this wave to show its amplitude.



(1 mark)

1 (b) (ii) Complete the sentence.

Increasing the amplitude of a sound wave will increase the .....

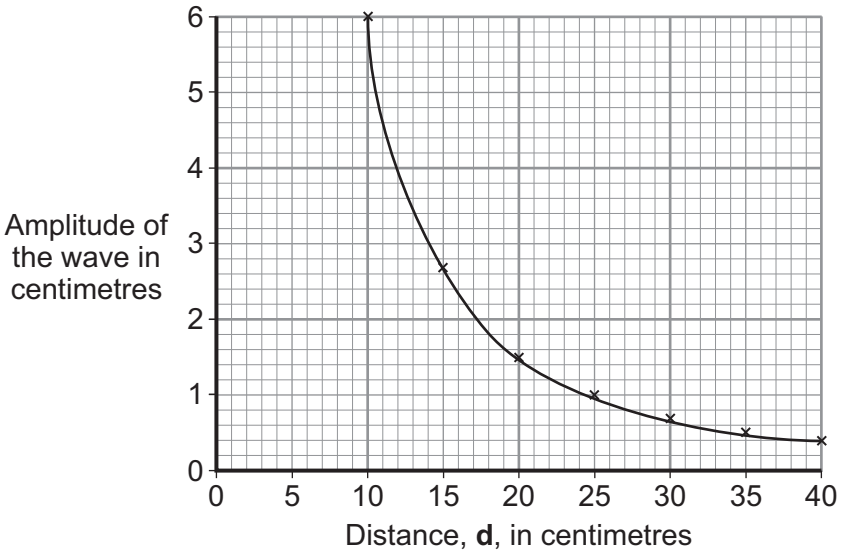
of the sound.

(1 mark)

4.7.3.2 Uses of the generator effect (HT only)

Question 32 · continued

1 (c) The graph shows the students' average results from several sets of measurements.



Use the graph to find the distance, **d**, in centimetres, at which the average amplitude is likely to be 2 centimetres.

Distance = ... cm.

(1 mark)

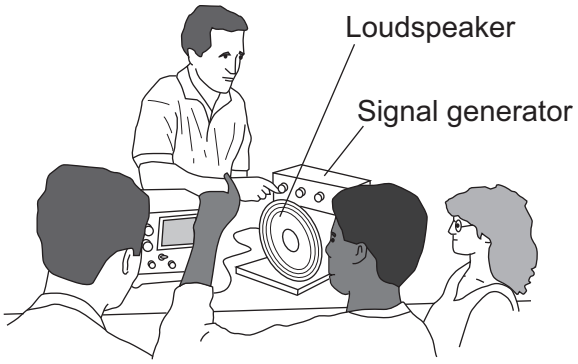
1 (d) Write a conclusion for this investigation.

.....

.....

(1 mark)

1 (e) A physics teacher uses a signal generator and a loudspeaker to demonstrate the range of hearing of a group of students.



What is the range of frequencies most humans can hear?

Most humans can hear from ..... Hz to ..... Hz.

(2 marks)

7

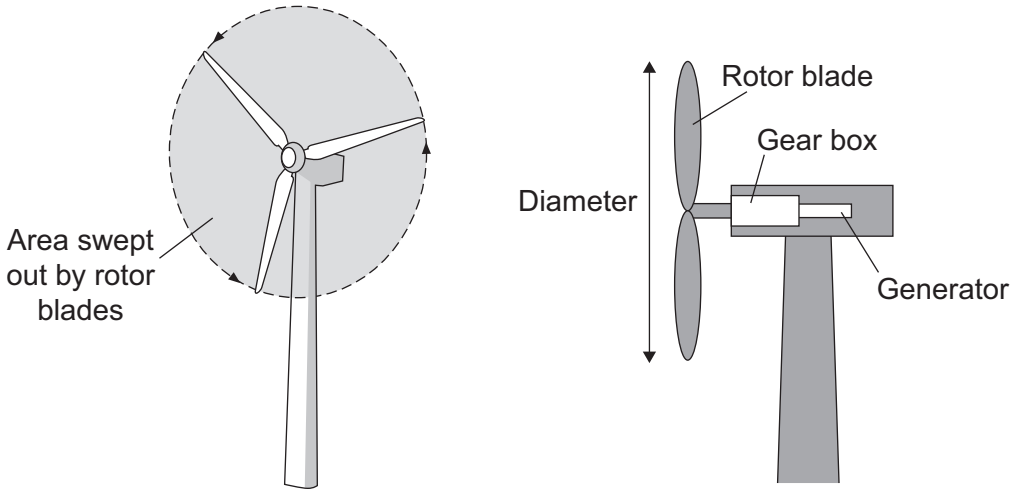
4.7.3.2 Uses of the generator effect (HT only)

Question 33

November 2011 | PHY1AP | Original Q8 | Legacy

QUESTION EIGHT

A wind turbine is an electrical generator. The rotor blades are connected to the generator through a gear box.



8A Which is the correct energy transformation for the wind turbine generator?

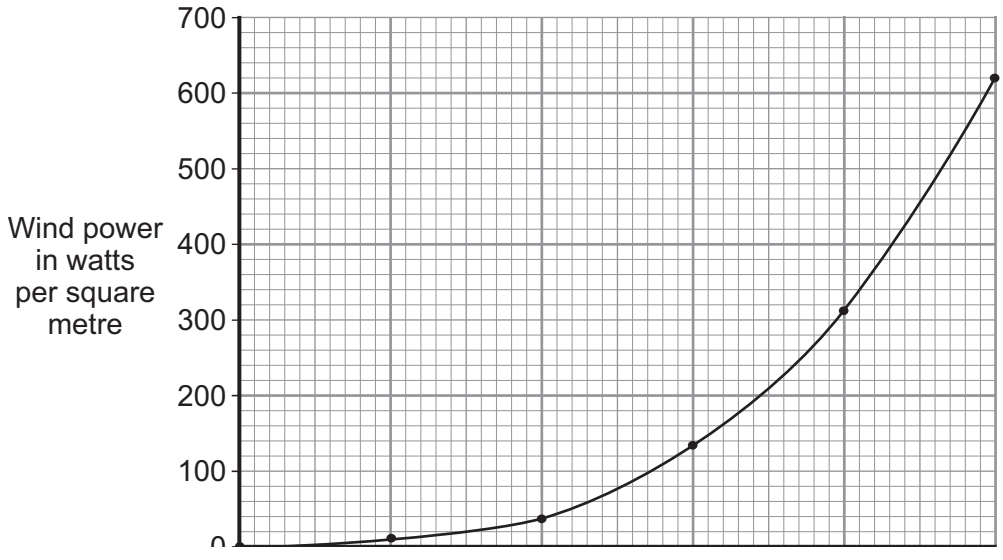
1 potential → electrical, thermal and sound

2 potential → kinetic, electrical and thermal

3 kinetic → electrical, thermal and sound

4 kinetic → chemical, electrical and thermal

8B The graph shows the power developed by the wind at different wind speeds. The power is measured in watts per square metre of area swept out by the rotor blades.



Question 33 · continued

What wind power is developed by a wind speed of 5.5 metres per second when the rotor blades sweep out an area of 5 square metres?

1 20 W

2 27.5 W

3 100 W

4 500 W

8C The table shows how the power output of a wind turbine changes with the diameter of the rotor blade.

Rotor blade diameter in metres (m)	Power output in kilowatts (kW)
1	0.4
2	1.6
3	3.6
4	6.4
6	14.4
8	25.6
10	40.0

Which of the following statements is correct?

1 decrease the rotor blade diameter and the power output increases

2 double the rotor blade diameter and the power output doubles

3 double the rotor blade diameter and the power output trebles

4 double the rotor blade diameter and the power output quadruples

8D A small wind turbine on the roof of a house has an average power output of 1 kW. The average demand for a household is 10 kW.

Large wind farms can produce an average power output of 5 MW.

One of the **disadvantages** of using wind farms to provide all the electricity for a large city is that . . .

1 wind farms develop far too much power for a large city.

2 large numbers of turbines are needed, taking up a lot of land.

3 large numbers of turbines will produce a lot of carbon dioxide.

4 wind farms produce a lot of noise that is very harmful to birds.

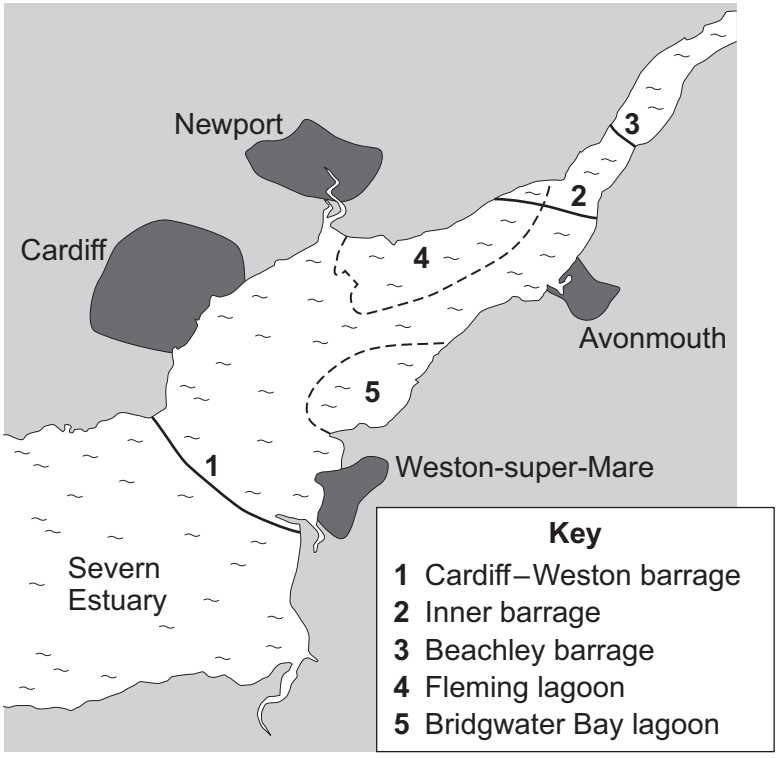
4.7.3.2 Uses of the generator effect (HT only)

Question 34

November 2011 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

The UK government is considering five schemes for generating electricity from the tides in the Severn estuary. Three of the schemes involve building a barrage across the estuary. The barrage would contain turbines and generators. The other two schemes would be lagoons, which enclose large areas of water, rather than having a barrier across the estuary.



9A The table gives some information about the five schemes.

	Estimated building cost in billions of £	Maximum power produced in millions of watts (MW)	Annual carbon dioxide emission savings in millions of tonnes
Cardiff–Weston barrage	21.0	8.64	7.2
Inner barrage	3.2	1.05	1.2
Beachley barrage	2.3	0.62	0.7
Fleming lagoon	4.5	1.36	1.0
Bridgwater Bay lagoon	3.8	1.36	1.1

From the information in the table, which of the following statements is correct?

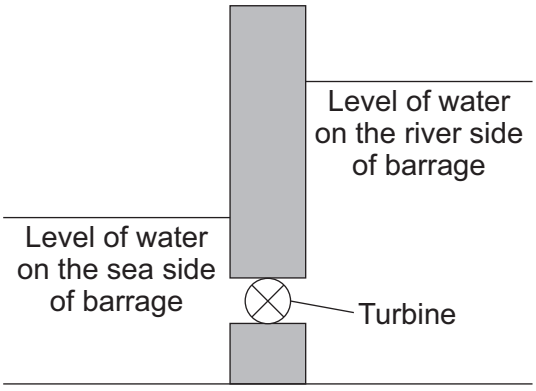
1 The Bridgwater Bay lagoon would produce the cheapest electricity and would be the cheapest to build.

2 The Beachley barrage would be the cheapest to build and would be the best at reducing global warming.

3 The Cardiff–Weston barrage would be the most expensive to build, would produce the most energy and would be the best at reducing global warming.

4 The Fleming lagoon would be the most expensive to build, would produce the most energy and would be the best at reducing global warming.

9B The diagram shows a section through a barrage.



As the tide comes in, water is trapped behind the barrage. Later, water is released to flow back through the turbine.

What is the main energy transformation as water is released to flow through the turbine?

1 electrical energy to gravitational potential energy

2 electrical energy to kinetic energy

3 gravitational potential energy to kinetic energy

4 kinetic energy to gravitational potential energy

Question 9 continues on the next page

4.7.3.2 Uses of the generator effect (HT only)

Question 34 · continued

9C There are many arguments for and against the Cardiff–Weston barrage scheme.

Which row in the table of statements for and against the scheme gives two correct **environmental** issues?

	For the scheme	Against the scheme
1	It will increase the number of ships using Cardiff docks.	It will provide only a small percentage of the UK's electricity.
2	It will provide up to 1500 extra jobs.	It will cost many billions of pounds to build.
3	It will reduce the total harmful emissions from UK power stations.	It will destroy wildlife habitats and block fish migration routes.
4	It will reduce the amount of salt in the water in the Severn estuary.	It will attract more tourists to the area.

9D The UK uses about 360 terawatt-hours (TWh) of electricity each year. A barrage across the Severn estuary is expected to generate 18 TWh of electricity each year.

1 terawatt-hour is a very large unit of energy

What percentage of the UK's electricity would the barrage generate each year?

1 2 %

2 5 %

3 20 %

4 80 %

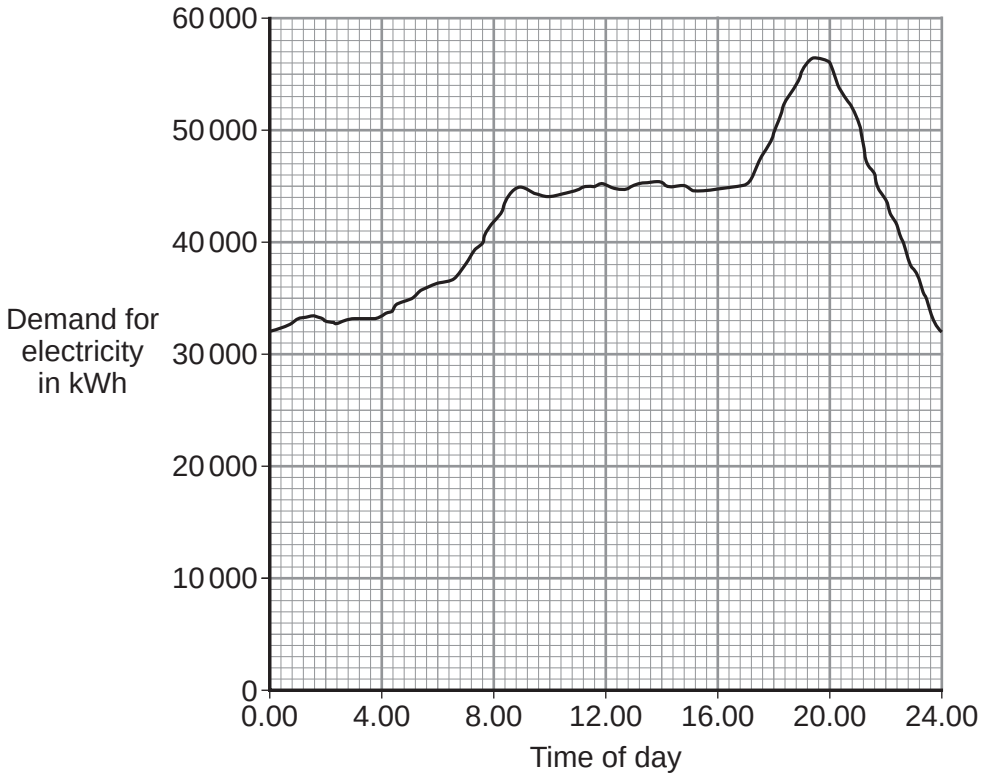
END OF TEST

4.7.3.2 Uses of the generator effect (HT only)

Question 35

January 2013 | PH1HP | Original Q3 | Legacy

3 (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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(3 marks)

4.7.3.2 Uses of the generator effect (HT only)

Question 35 · continued

3 (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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(6 marks)

9

4.7.3.2 Uses of the generator effect (HT only)

Question 36

January 2013 | PH1HP | Original Q6 | Legacy

6 About half of the UK's electricity is generated in coal-burning power stations and nuclear power stations.

6 (a) Coal-burning power stations and nuclear power stations provide a reliable way of generating electricity.

What is meant by *a reliable way of generating electricity*?

.....

.....

(1 mark)

6 (b) Over the next few years, most of the older nuclear power stations in the UK will be closed down, and the process of decommissioning will start.

What does it mean to *decommission* a nuclear power station?

.....

.....

(1 mark)

6 (c) Climate change has been strongly linked to the emission of carbon dioxide. Many governments around the world are committed to reducing carbon dioxide emissions.

Generating electricity can increase carbon dioxide emissions.

The companies generating electricity could reduce carbon dioxide emissions.

Give **two** ways the companies could do this.

1 .....

.....

2 .....

.....

(2 marks)

4.7.3.2 Uses of the generator effect (HT only)

Question 36 · continued

6 (d) Electricity is distributed from power stations to consumers along the National Grid.

The voltage across the overhead cables of the National Grid needs to be much higher than the output voltage from the power station generators.

Explain why.

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(3 marks)

7

Turn over for the next question

4.7.3.2 Uses of the generator effect (HT only)

Question 37

June 2013 | PH2HP | Original Q4 | Legacy

4 (a) The stopping distance of a vehicle is made up of two parts, the thinking distance and the braking distance.

4 (a) (i) What is meant by *thinking distance*?

.....

.....

(1 mark)

4 (a) (ii) State **two** factors that affect thinking distance.

1 .....

.....

2 .....

.....

(2 marks)

4 (b) A car is travelling at a speed of 20 m/s when the driver applies the brakes. The car decelerates at a constant rate and stops.

4 (b) (i) The mass of the car and driver is 1600 kg.

Calculate the kinetic energy of the car and driver before the brakes are applied.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Kinetic energy = ... J

(2 marks)

4 (b) (ii) How much work is done by the braking force to stop the car and driver?

Work done = ... J

(1 mark)

4.7.3.2 Uses of the generator effect (HT only)

Question 37 · continued

4 (b) (iii) The braking force used to stop the car and driver was 8000 N.

Calculate the braking distance of the car.

Use the correct equation from the Physics Equations Sheet.

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Braking distance = ... m

(2 marks)

4 (b) (iv) The braking distance of a car depends on the speed of the car and the braking force applied.

State **one** other factor that affects braking distance.

.....

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(1 mark)

4 (b) (v) Applying the brakes of the car causes the temperature of the brakes to increase.

Explain why.

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(2 marks)

Question 4 continues on the next page

4.7.3.2 Uses of the generator effect (HT only)

Question 37 · continued

4 (c) Hybrid cars have an electric engine and a petrol engine. This type of car is often fitted with a regenerative braking system. A regenerative braking system not only slows a car down but at the same time causes a generator to charge the car's battery.

State and explain the benefit of a hybrid car being fitted with a regenerative braking system.

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(3 marks)

14

4.7.3.2 Uses of the generator effect (HT only)

Question 38

June 2014 | PH2HP | Original Q6 | Legacy

6 (a) There are many isotopes of the element molybdenum (Mo).

What do the nuclei of different molybdenum isotopes have in common?

[1 mark]

.....

6 (b) The isotope molybdenum-99 is produced inside some nuclear power stations from the nuclear fission of uranium-235.

6 (b) (i) What happens during the process of nuclear fission?

[1 mark]

.....

.....

6 (b) (ii) Inside which part of a nuclear power station would molybdenum be produced?

[1 mark]

.....

6 (c) When the nucleus of a molybdenum-99 atom decays, it emits radiation and changes into a nucleus of technetium-99.

$$^{99}_{42}\text{Mo} \longrightarrow {}^{99}_{43}\text{Tc} + \text{Radiation}$$

What type of radiation is emitted by molybdenum-99?

[2 marks]

.....

Give a reason for your answer.

.....

.....

Question 6 continues on the next page

4.7.3.2 Uses of the generator effect (HT only)

Question 38 · continued

6 (d) Technetium-99 has a short half-life and emits gamma radiation.

What is meant by the term 'half-life'?

[1 mark]

.....

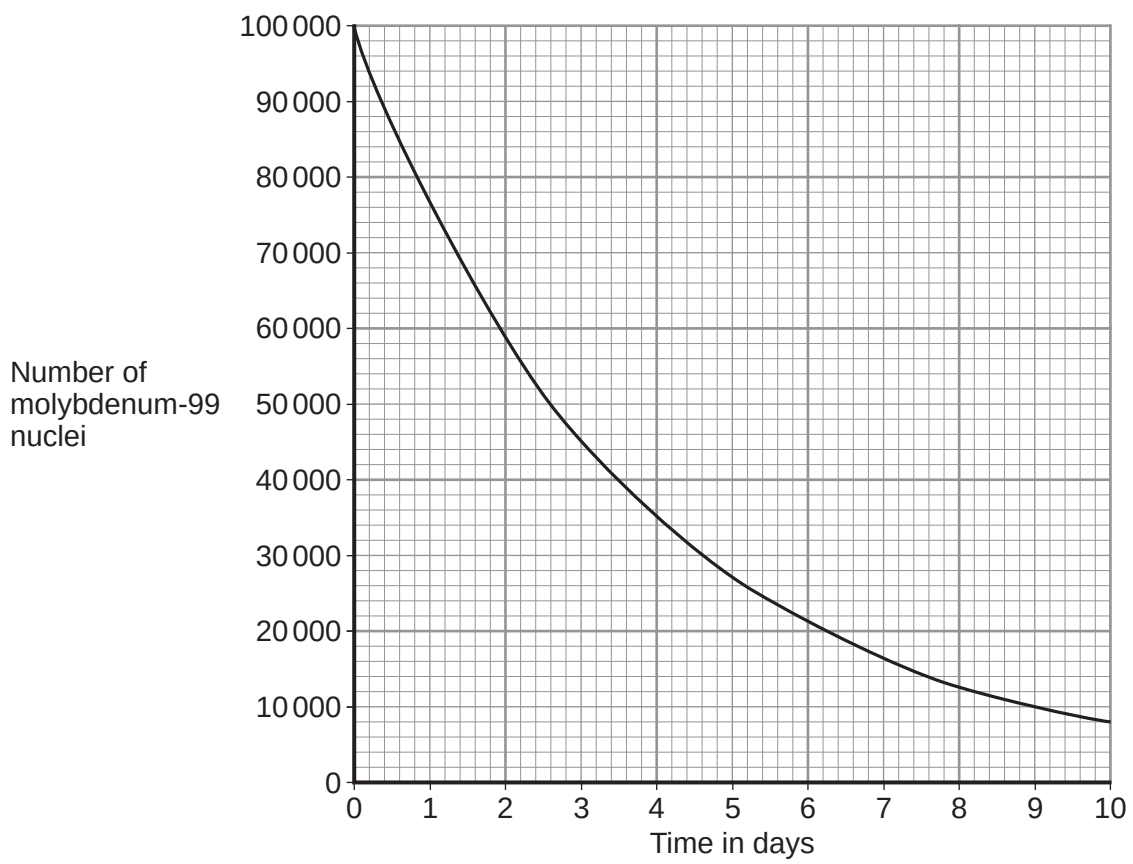
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6 (e) Technetium-99 is used by doctors as a medical tracer. In hospitals it is produced inside a technetium generator by the decay of molybdenum-99 nuclei.

6 (e) (i) **Figure 7** shows how the number of nuclei in a sample of molybdenum-99 changes with time as the nuclei decay.

Figure 7



4.7.3.2 Uses of the generator effect (HT only)

Question 38 · continued

A technetium generator will continue to produce sufficient technetium-99 until 80% of the original molybdenum nuclei have decayed.

After how many days will a source of molybdenum-99 inside a technetium-99 generator need replacing?

Show clearly your calculation and how you use the graph to obtain your answer.

[2 marks]

.....

.....

.....

Number of days = ...

6 (e) (ii) Medical tracers are injected into a patient's body; this involves some risk to the patient's health.

Explain the risk to the patient of using a radioactive substance as a medical tracer.

[2 marks]

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6 (e) (iii) Even though there may be a risk, doctors frequently use radioactive substances for medical diagnosis and treatments.

Suggest why.

[1 mark]

.....

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11

4.7.3.2 Uses of the generator effect (HT only)

Question 39

June 2016 | PH1HP | Original Q2 | Legacy

2 A small community of people live in an area in the mountains.
The houses are not connected to the National Grid.

The people plan to buy an electricity generating system that uses either the wind or the flowing water in a nearby river.

Figure 2 shows where these people live.

Figure 2



2 (a) It would not be economical to connect the houses to the National Grid.
Give **one** reason why.

[1 mark]

_____

_____

_____

_____

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

Information about the two electricity generation systems is given in **Figure 3**.

Figure 3

The wind turbine costs £50 000 to buy and install. The hydroelectric generator costs £20 000 to buy and install. The average power output from the wind turbine is 10 kW. The hydroelectric generator will produce a constant power output of 8 kW.

4.7.3.2 Uses of the generator effect (HT only)

Question 39 · continued

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

Use your knowledge of energy sources as well as information from **Figure 3**.

[6 marks]

Extra space

7

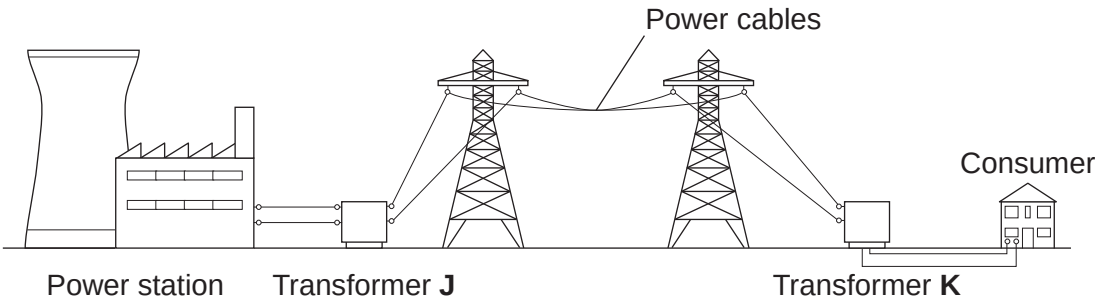
4.7.3.2 Uses of the generator effect (HT only)

Question 40

June 2017 | PH1HP | Original Q7 | Legacy

7 **Figure 7** shows how the National Grid connects power stations to consumers.

Figure 7



7 (a) Explain the role of the two transformers, **J** and **K**, in the power transmission process and the reasons for their use.

[4 marks]

4.7.3.2 Uses of the generator effect (HT only)

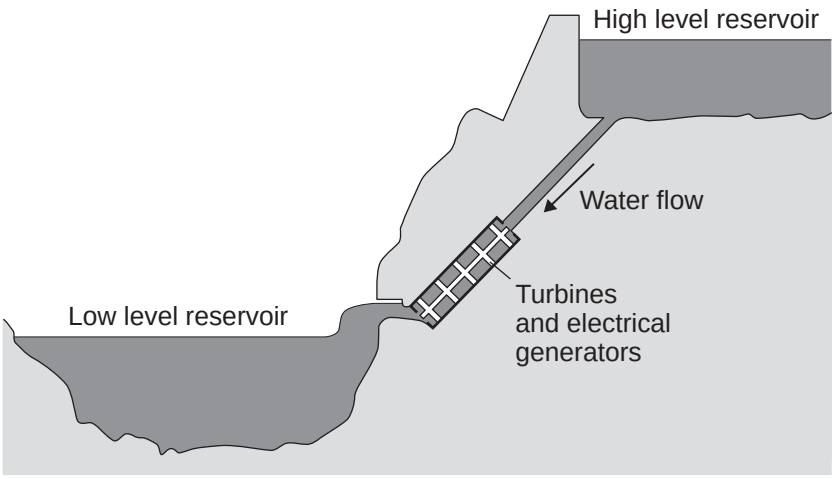
Question 40 · continued

7 (b) In a pumped storage power station, water flows from a high level reservoir to a low level reservoir turning turbines and generating electricity.

Pumped storage power stations do not supply electricity to the National Grid at all times of the day.

Figure 8 shows a pumped storage power station.

Figure 8



7 (b) (i) Explain how pumped storage power stations store energy for later use.

[4 marks]

7 (b) (ii) Explain why pumped storage power stations are able to meet sudden large demands for electricity.

[2 marks]

10

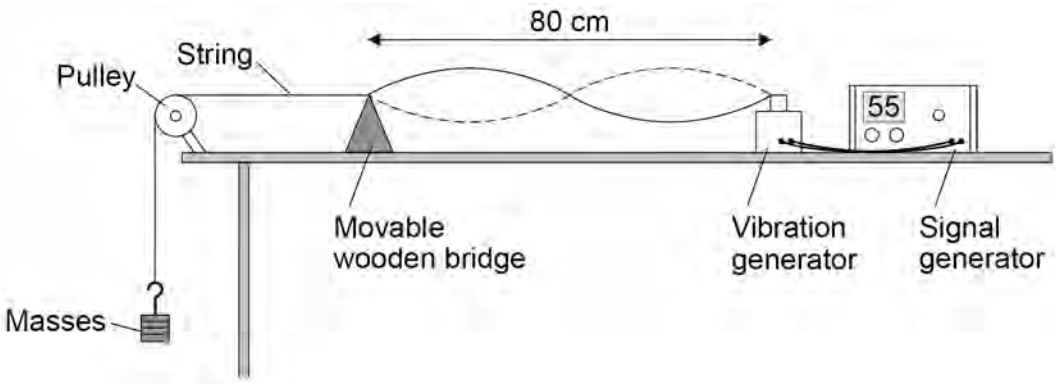
4.7.3.2 Uses of the generator effect (HT only)

Question 41

June 2019 | 8463/2H | Original Q2

0 2 **Figure 4** shows the apparatus used to investigate the waves in a stretched string.

Figure 4



The frequency of the signal generator is adjusted so that the wave shown in **Figure 4** is seen.

At this frequency the string vibrates between the two positions shown in **Figure 4**.

0 2 . 1 The wavelength of the wave shown in **Figure 4** was measured as 80 cm

What piece of apparatus would have been suitable for measuring this wavelength?

[1 mark]

0 2 . 2 Write down the equation which links frequency, wavelength and wave speed.

[1 mark]

0 2 . 3 The string in **Figure 4** vibrates at 55 Hz

Calculate the wave speed of the wave shown in **Figure 4**.

Use data given in **Figure 4**.

[3 marks]

Wave speed = _____ m/s

4.7.3.2 Uses of the generator effect (HT only)

Question 41 · continued

0 2 . 4 The frequency of the signal generator is increased.

This makes the wavelength of the wave change.

The wave speed stays the same.

Describe how the apparatus could be adjusted to show one complete wave without reducing the frequency.

[2 marks]

0 2 . 5 A student wants to investigate how the speed of a wave on a stretched string depends on the tension in the string.

The student uses the apparatus in **Figure 4**.

Describe a method the student could use for this investigation.

[4 marks]

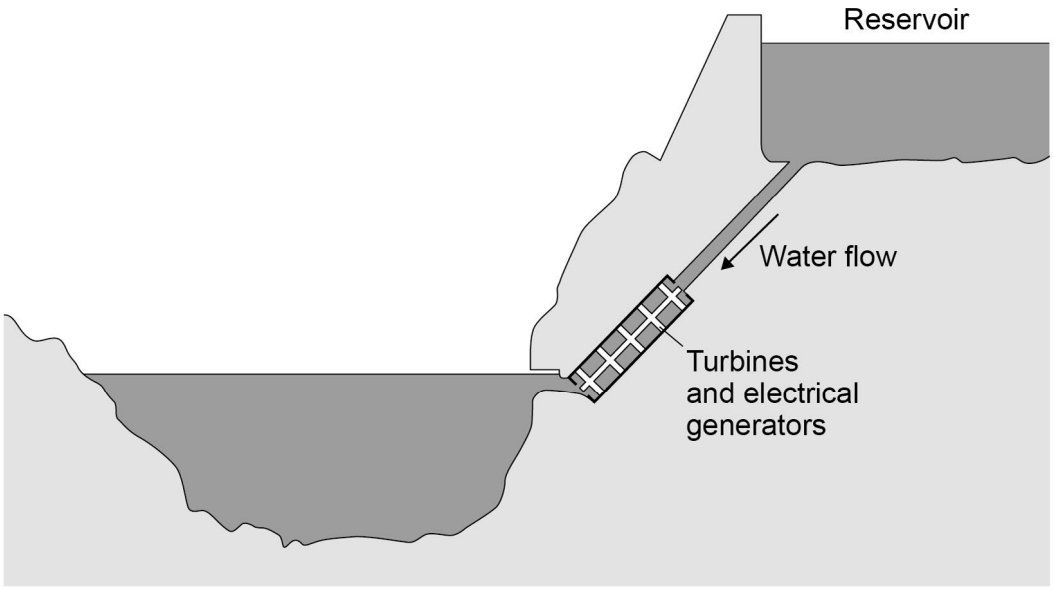
4.7.3.2 Uses of the generator effect (HT only)

Question 42

November 2020 | 8463/1H | Original Q3

0 3 **Figure 4** shows a hydroelectric power station.

Figure 4



Electricity is generated when water from the reservoir flows through the turbines.

0 3 . 1 Write down the equation which links density (ρ), mass (m) and volume (V).

[1 mark]

0 3 . 2 The reservoir stores 6 500 000 m^3 of water.

The density of the water is 998 kg/m^3.

Calculate the mass of water in the reservoir.

Give your answer in standard form.

[4 marks]

Mass (in standard form) = _____ kg

4.7.3.2 Uses of the generator effect (HT only)

Question 42 · continued

0 3 . 3 Write down the equation which links energy transferred (*E*), power (*P*) and time (*t*).

[1 mark]

0 3 . 4 The electrical generators can provide 1.5×10^9 W of power for a maximum of 5 hours.

Calculate the maximum energy that can be transferred by the electrical generators.

[3 marks]

Energy transferred = _____ J

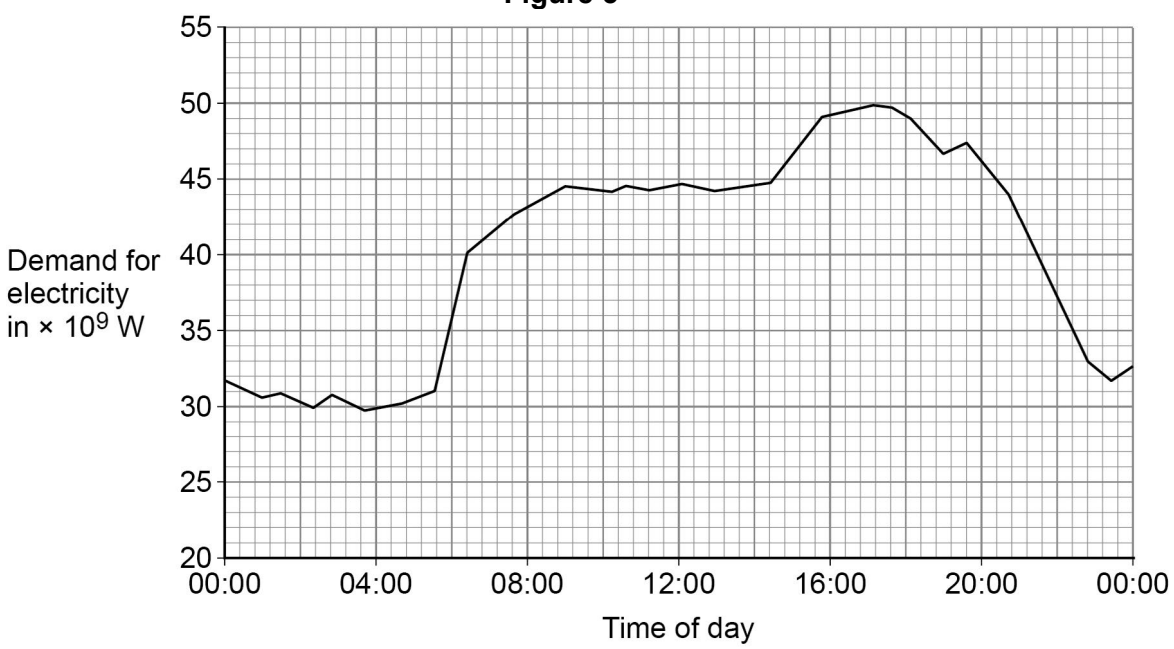
Question 3 continues on the next page

4.7.3.2 Uses of the generator effect (HT only)

Question 42 · continued

0 3 . 5 **Figure 5** shows how the UK demand for electricity increases and decreases during one day.

Figure 5



The hydroelectric power station in **Figure 4** can provide 1.5×10^9 W of power for a maximum of 5 hours.

Give **two** reasons why this hydroelectric power station is not able to meet the increase in demand shown between 04:00 and 16:00 in **Figure 5**.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

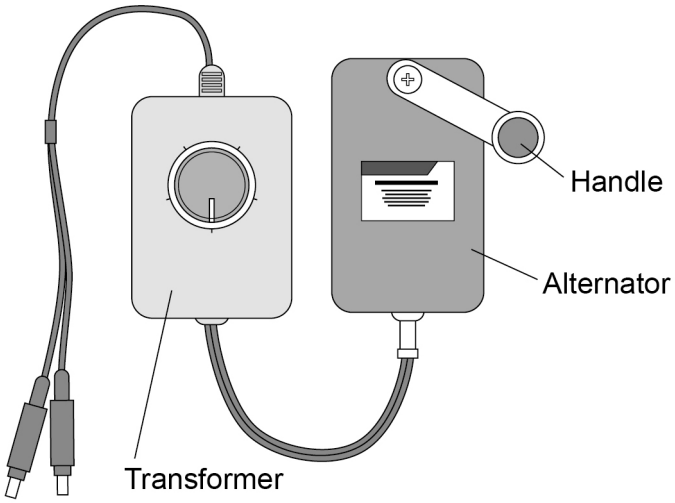
11

4.7.3.2 Uses of the generator effect (HT only)

Question 43

0 7 **Figure 10** shows a portable power supply.

Figure 10



0 7 . 1 The portable power supply has an alternator connected to a transformer.

The transformer can be adjusted to have different numbers of turns on the secondary coil.

Suggest why.

[2 marks]

4.7.3.2 Uses of the generator effect (HT only)

Question 43 · continued

0 7 . 2 A lamp is connected to the power supply.

The lamp requires an input potential difference of 5.0 V.

The alternator generates a potential difference of 1.5 V.

The primary coil of the transformer has 150 turns.

Calculate the number of turns needed on the secondary coil.

[3 marks]

Number of turns on the secondary coil = _____

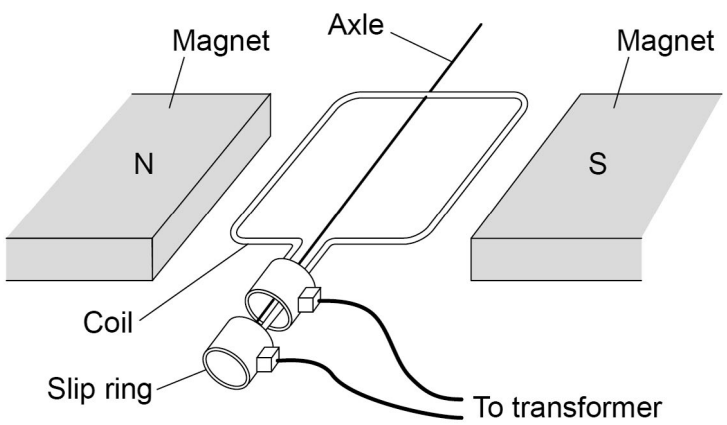
Question 7 continues on the next page

4.7.3.2 Uses of the generator effect (HT only)

Question 43 · continued

Figure 11 shows the inside parts of the alternator.

Figure 11



0 7 . 3 The handle of the alternator is turned, causing the coil to rotate.

Explain why an alternating current is induced in the coil.

[5 marks]

4.7.3.2 Uses of the generator effect (HT only)

Question 43 · continued

0 7 . 4 Suggest the purpose of the slip rings.

[1 mark]

0 7 . 5 The alternator from the portable power supply is disconnected from the transformer and lamp.

Explain why the handle of the alternator becomes much easier to turn.

[3 marks]

14

4.7.3.2 Uses of the generator effect (HT only)

Question 44

June 2023 | 8463/1H | Original Q4

0 4 A remote village in the UK uses a hydroelectric generator to provide electricity.

0 4 . 1 In one day, 2 500 000 kg of water passes through the hydroelectric generator.

The change in gravitational potential energy of the water is 367.5 MJ.

gravitational field strength = 9.8 N/kg

Calculate the mean change in vertical height of the water as it moves through the hydroelectric generator.

Use the Physics Equations Sheet.

[4 marks]

Mean change in vertical height = _____ m

4.7.3.2 Uses of the generator effect (HT only)

Question 44 · continued

0 4 . 2 The generator transfers 3.0 kW of electrical power.

Calculate the time taken for the generator to transfer 2.16×10^7 J of energy.

Use the Physics Equations Sheet.

Give your answer in standard form.

[5 marks]

Time taken (in standard form) = _____ s

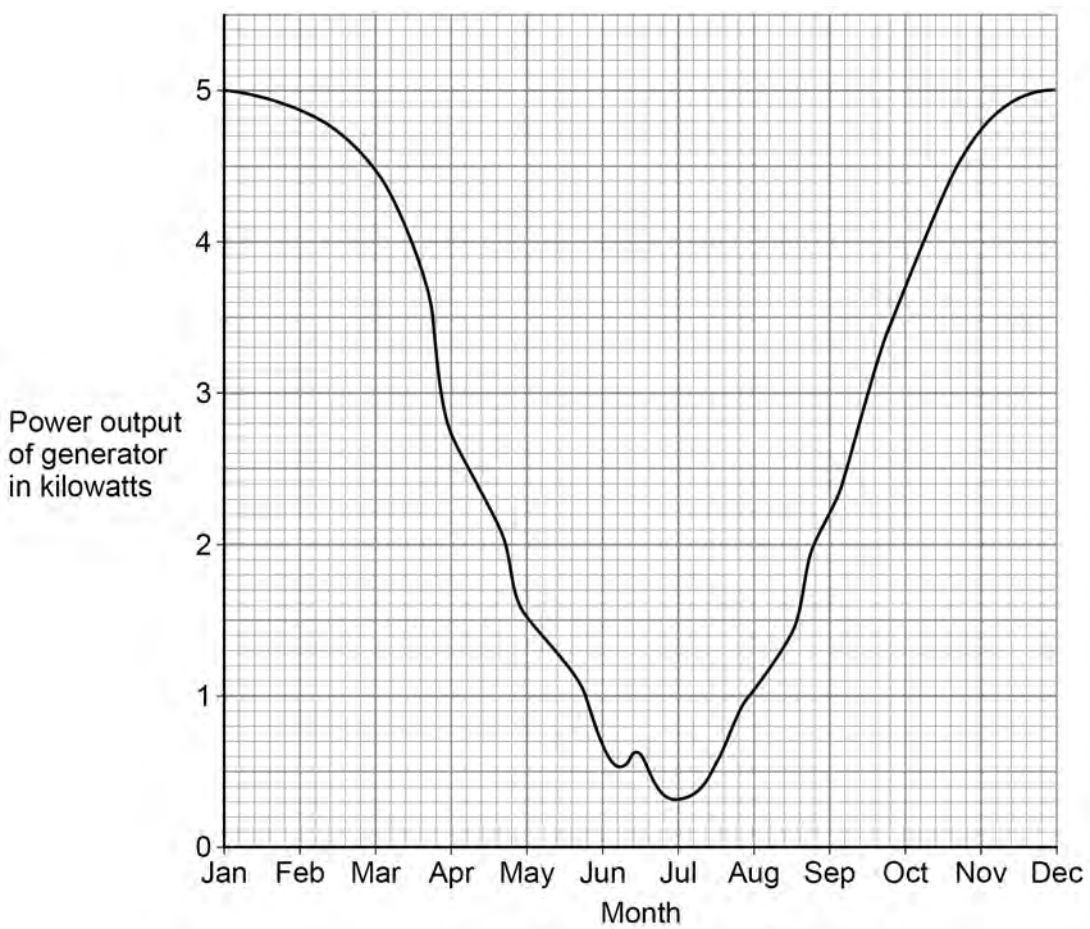
Question 4 continues on the next page

4.7.3.2 Uses of the generator effect (HT only)

Question 44 · continued

0 4 . 3 **Figure 5** shows how the power output of the generator varied during one year.

Figure 5



A solar power system is installed in the remote village in addition to the hydroelectric generator.

Explain why this improves the reliability of the electricity supply to the village.

Use information from **Figure 5**.

[2 marks]

11

4.7.3.2 Uses of the generator effect (HT only)

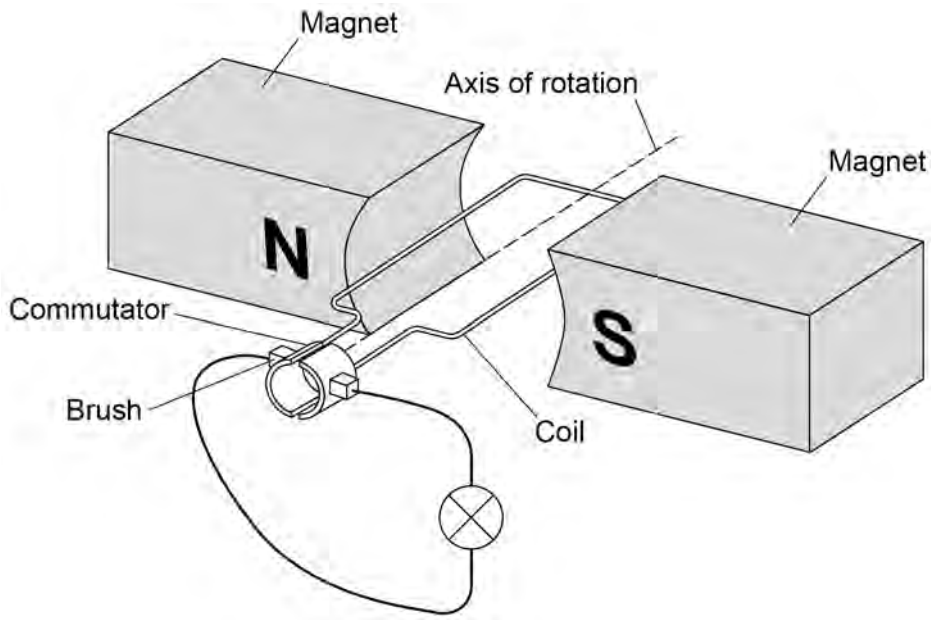
Question 45

June 2023 | 8463/2H | Original Q9

0 9 A dynamo is used to generate an electric current.

Figure 22 shows the inside parts of the dynamo connected to a lamp.

Figure 22



0 9 . 1 The coil is rotated.

Explain why a direct current is induced in the coil.

[5 marks]

4.7.3.2 Uses of the generator effect (HT only)

Question 45 · continued

0 9 . 2 Sketch a graph on **Figure 23** to show how the potential difference generated across the lamp varies for **two** complete revolutions of the dynamo coil.

[1 mark]

Figure 23



0 9 . 3 The lamp is disconnected from the dynamo.

Explain why the dynamo becomes much easier to turn.

[3 marks]

9

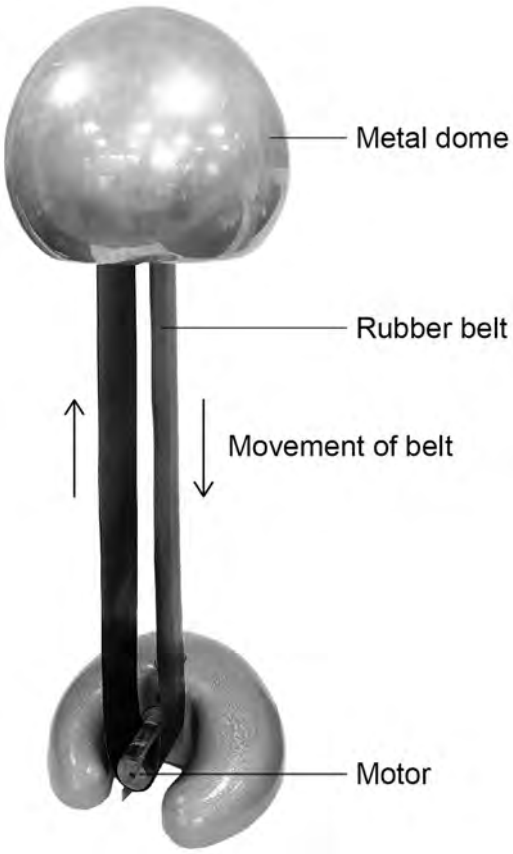
4.7.3.2 Uses of the generator effect (HT only)

Question 46

June 2024 | 8463/1H | Original Q4

0 4 **Figure 4** shows a static electricity generator.

Figure 4



The rubber belt is turned by a motor.

As the rubber belt moves, charge is transferred from the rubber belt to the metal dome.

Question 4 continues on the next page

4.7.3.2 Uses of the generator effect (HT only)

Question 46 · continued

0 4 . 1 **Figure 5** shows a student touching the metal dome of the static electricity generator.

The dome is negatively charged.

Figure 5



Explain why the student's hair stands up on end.

[3 marks]

4.7.3.2 Uses of the generator effect (HT only)

Question 46 · continued

The charged metal dome creates an electric field.

0 4 . 2 What is an electric field?

[1 mark]

0 4 . 3 How does the electric field strength vary as the distance from the charged metal dome increases?

[1 mark]

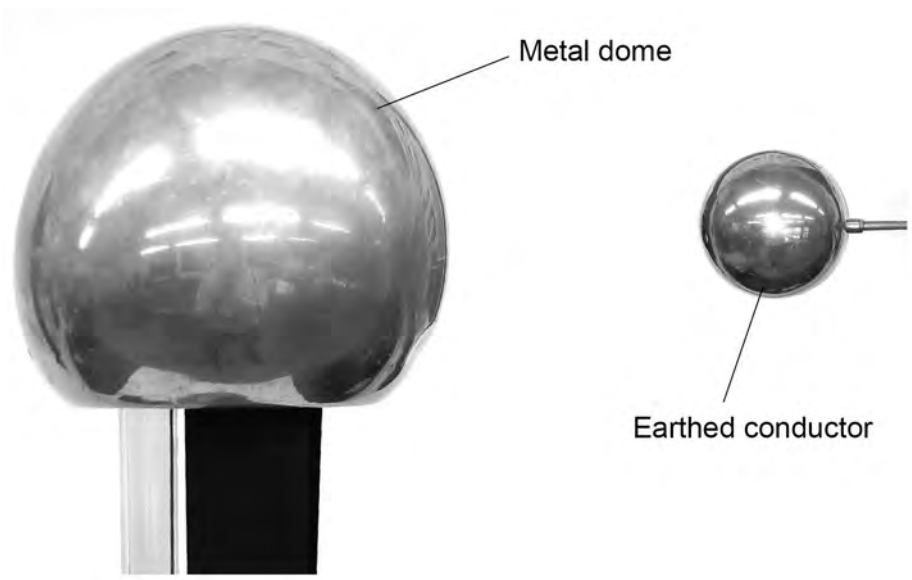
Question 4 continues on the next page

4.7.3.2 Uses of the generator effect (HT only)

Question 46 · continued

Figure 6 shows the negatively charged metal dome and an earthed conductor.

Figure 6



When the earthed conductor is moved towards the metal dome, there is a spark between the dome and the earthed conductor.

0 4 . 4 The spark transfers 0.60 J of energy, and 2.0 μC of charge is transferred from the dome to the earthed conductor.

Calculate the potential difference between the metal dome and the earthed conductor.

Use the Physics Equations Sheet.

[4 marks]

Potential difference = _____ V

4.7.3.2 Uses of the generator effect (HT only)

Question 46 · continued

0 4 . 5 Which of the following changes would increase the distance a spark can jump between the dome and the earthed conductor?

[1 mark]

Tick (✓) **one** box.

- Decreased charge on the metal dome ☐
- Decreased electric field strength ☐
- Decreased electrical resistance of air ☐
- Decreased potential difference ☐

10

Turn over for the next question