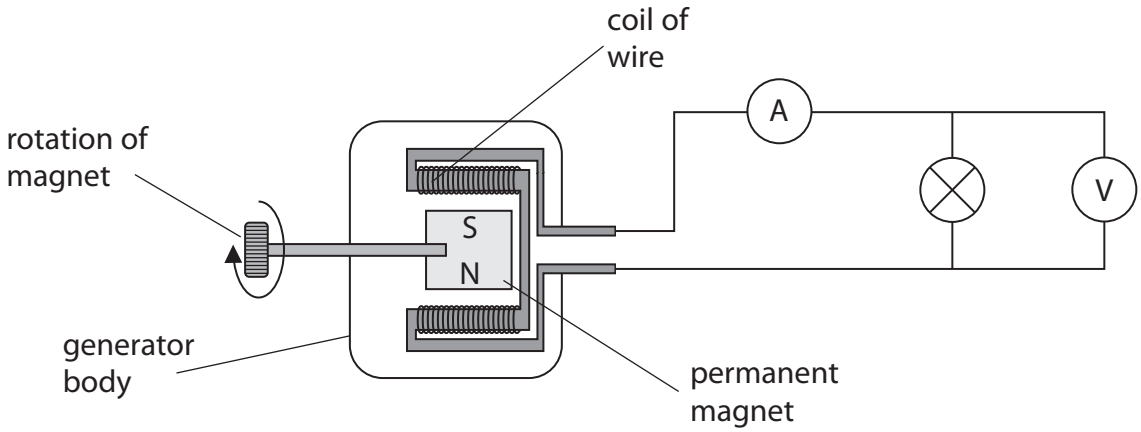
The generation of electricity

1 (a) The diagram shows a simple generator connected to a lamp.



The magnet is made to spin at a steady speed.
The ammeter gives a reading of 1.5 A.
The voltmeter gives a reading of 6 V.

(i) Calculate the output power of the generator.

(2)

output power = ... W

(ii) State two changes to the design of the generator that would give a larger output power for the same speed of rotation.

(2)

1 .....

2 .....

(iii) This generator supplies an alternating current (AC) to the lamp.
Other types of generators supply a direct current (DC).
Describe the difference between charge movement in a direct current and in an alternating current.

(2)

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*(b) The first public power station was built in the centre of New York.

It used generators to supply direct current at 110 V. The cables had to go underground and they could only supply nearby shops and offices.

The electricity was mainly used for electric light.

The development of alternating current generators led to major changes in the way electricity is transmitted and used.

Compare the modern National Grid system with the early system in New York.

(6)

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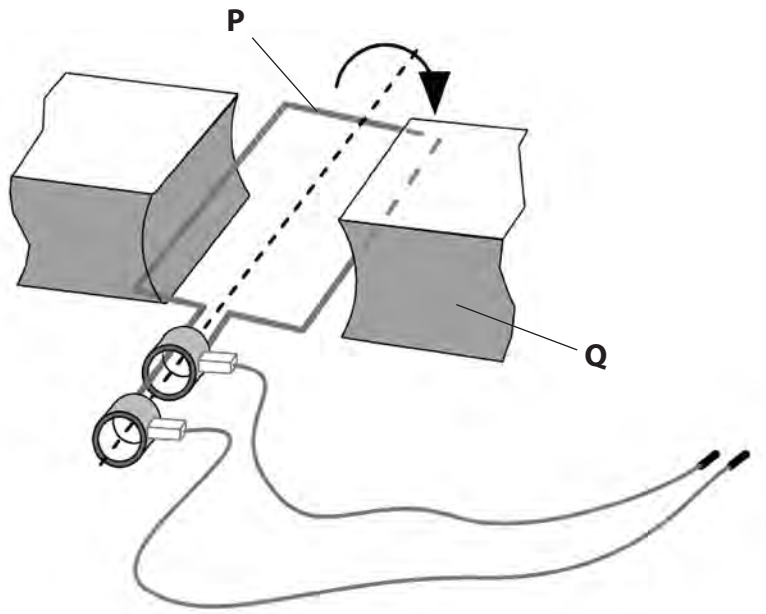
(Total for Question 6 = 12 marks)

2 The diagram shows a generator producing an alternating voltage.



(a) Draw **one** straight line from each letter to its correct label.

(2)

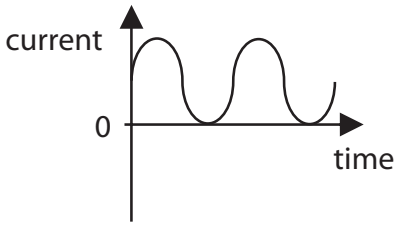
letter	**label**
P	slip ring
Q	coil
	axle
	brush
	magnet

(b) The generator is co
The current in the lamp is alternating.

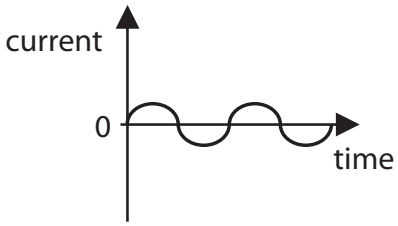
(i) Which of these is an alternating current?

Put a cross (☒) in the box next to your answer.

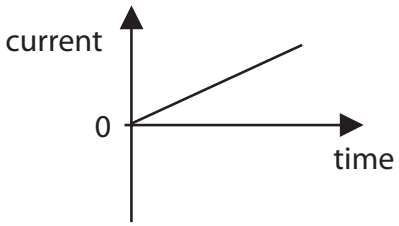
(1)



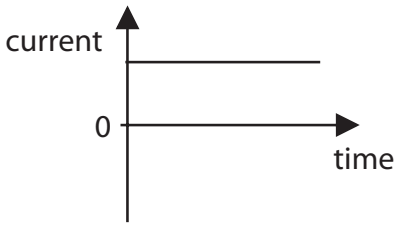
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(ii) The generator is turned faster.

Explain what happens to the lamp.

(2)

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(c) A larger generator produces a current of 2 A at a voltage of 12 V.

Calculate the electrical power generated.
State the unit.

(3)

power generated = ... unit = ...

(d) Transformers are designed to use alternating current.

Describe what change happens when a step-up transformer is used.

(2)

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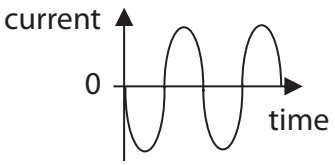
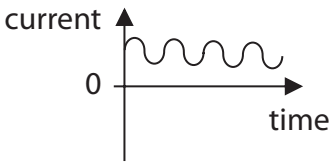
(Total for Question 4 = 10 marks)

Distribution of electricity

3 (a) Scientists say that graph 1 shows an alternating current while graph 2 shows a direct current.



graph 1



graph 2

The two graphs differ in several ways.

State the difference between the currents which makes one alternating and the other direct.

(1)

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(b) A transformer is 100% efficient.

It has 200 turns on the primary coil and 3000 turns on the secondary coil.
The input voltage is 55 V.

(i) Show that the output voltage is about 800 V.

(3)

(ii) Calculate the current in the secondary coil when the current in the primary coil is 0.50 A.

(2)

current in secondary coil = ... A

*(c) The diagram shows how electricity produced at a power station is transmitted to distant houses.

Transformers R and S are not 100% efficient.
By using transformers, energy losses in the transmission lines are reduced.

Explain how this reduction is achieved, even though some energy is wasted in the transformers themselves.

(6)

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(Total for Question 6 = 12 marks)

Transformers

4 A small notebook computer has a power rating of 40 W.
The computer is connected to the mains supply through a step-down transformer.
The mains supply is a.c.

(a) (i) How much energy is supplied to the computer each second?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** 0.025 J
- ☐ **B** 4.0 J
- ☐ **C** 40 J
- ☐ **D** 240 J

(ii) Sketch an alternating current on the axes shown.

(1)

(b) The step-down t

- 2400 turns on the primary coil
- 200 turns on the secondary coil
- a primary voltage of 230 V.

Calculate the voltage output of the secondary coil.

(3)

secondary voltage = ... V

(c) (i) Explain how transformers are used to improve the efficiency of power transmission in the National Grid.

(3)

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(ii) Explain why flying a kite near power lines could be a danger to the person flying the kite.

(2)

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(Total for Question 4 = 10 marks)

5 (a) Figure 3 shows

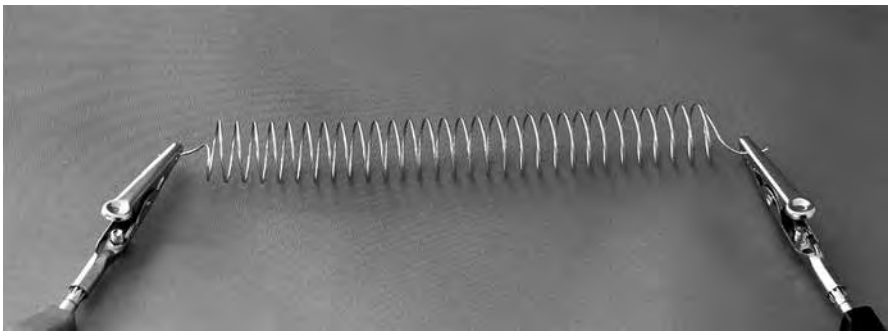

Figure 3

Figure 4 gives information about the magnetic field of a solenoid.

description of the magnetic field	part of magnetic field	
	inside the coil	outside the coil
strong	✓	✗
weak	✗	✓
uniform	✓	✗
non-uniform	✗	✓

Figure 4

(i) Draw lines on Figure 5 to show the shape of the magnetic field **inside** the solenoid.

Use information from Figure 4.

(1)

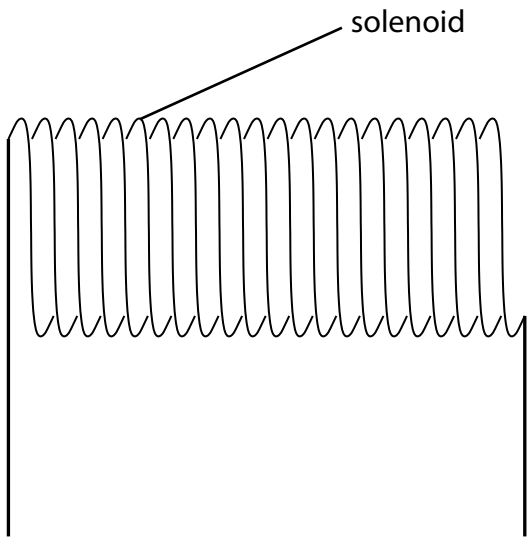

Figure 5

(ii) Describe how a student can determine the shape of the magnetic field around the solenoid.

(2)

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(b) A student investigates the magnetic properties of three rods. Each rod is made of one of the following materials:

- soft iron
- steel
- wood

The student places each rod in a solenoid that is connected to a direct current power supply.

The power supply is switched on for a short time.

The student tests the magnetic strength of each rod by seeing how many paper clips it can pick up as shown in Figure 6.

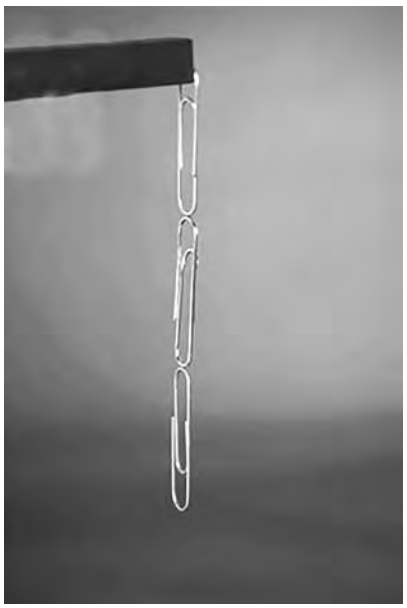

Figure 6

The student's results are shown in Figure 7.

	number of paper clips picked up by rod			
rod	**before rod is placed in solenoid**	**when there is current in solenoid**	**1 minute after current is switched off**	**10 minutes after current is switched off**
A	0	0	0	0
B	0	6	1	0
C	0	8	7	7

Figure 7

Complete the table below to show which material (soft iron, steel or wood) each rod is made from, with the reason why.

Part of the table has been done for you.

Use information from Figure 7.

(3)

rod	material	reason
A		It is not magnetic because it does not pick up paper clips whether there is a current or not.
B		
C		

(Total for Question 2 = 6 marks)