PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



EXAM QUESTION PACK

TOPIC 13: ELECTROMAGNETIC INDUCTION

SCORE	PERCENTAGE
/73	%

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Q1.

(i) Figure 17 shows the output from a battery.

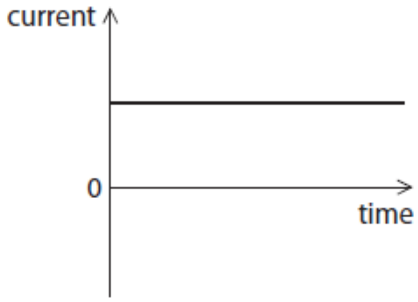


Figure 17

Explain why a transformer will not work with the input current as shown in Figure 17.

(2)

.....

.....

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.....

(ii) A transformer has 30 turns on the primary coil and 150 turns on the secondary coil.

A potential difference of 25 V is applied across the primary coil.

Calculate the potential difference across the secondary coil.

Use an equation selected from the list of equations at the end of this paper.

(3)

potential difference = ... V

(Total for question = 5 marks)

Q2.

This question is about a transformer.

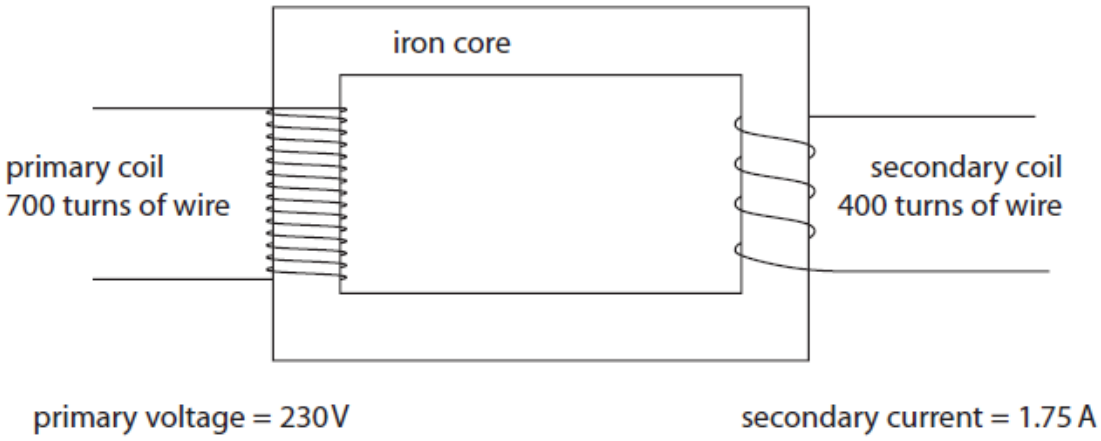


Figure 21

Calculate the current in the primary coil.

Use the information given in Figure 21 and equations selected from the list of equations at the end of this paper.

The transformer is 100% efficient.

(3)

current in the primary coil = ... A

(Total for question = 3 marks)

Q3.

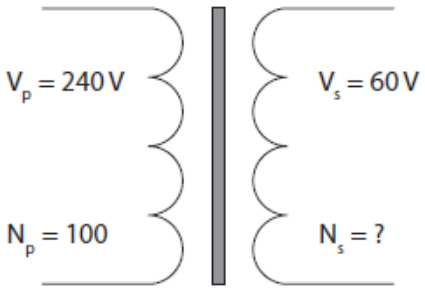


Figure 13

Figure 13 represents a transformer.
Calculate the number of turns in the secondary coil.

Use an equation selected from the list of equations at the end of this paper.

(2)

number of turns .....

(Total for question = 2 marks)

Q4.

The primary coil of a different transformer is connected to the 230 V mains supply.

The voltage across the secondary coil is 15 V.

The primary coil has 600 turns.

Calculate the number of turns on the secondary coil.

Use an equation selected from the list of equations at the end of the paper.

(2)

number of turns = ...

(Total for question = 2 marks)

Q5.

Figure 18 shows a transformer.

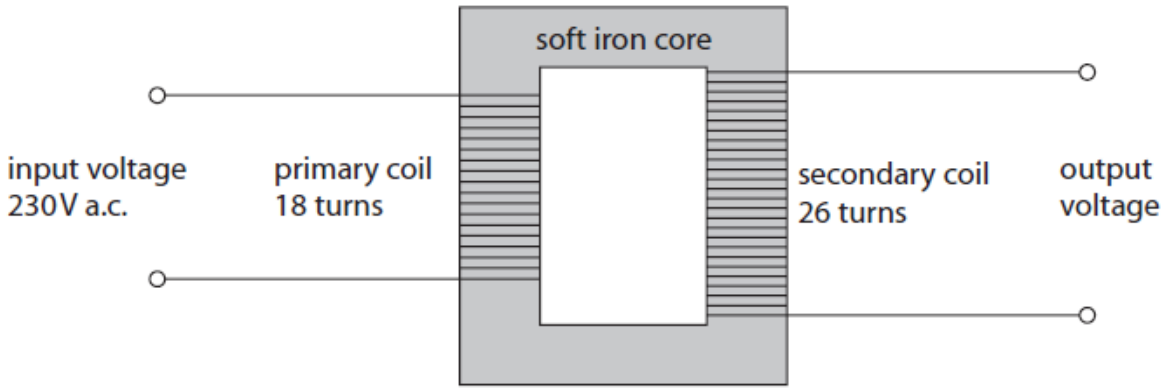


Figure 18

(i) State the purpose of the transformer shown in Figure 18.

(1)

.....

(ii) Calculate the output voltage of the secondary coil.

Use an equation selected from the list of equations at the end of this paper.

(3)

output voltage = ... V

(Total for question = 4 marks)

Q6.

Which of these is designed to convert pressure variations in sound waves into alternating currents in electrical circuits?

(1)

☒ **A** an amplifier

☒ **B** headphones

☒ **C** a loudspeaker

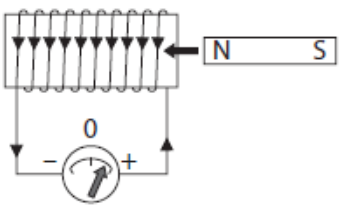
☒ **D** a microphone

(Total for question = 1 mark)

Q7.

Figure 11 shows a magnet moving into a coil.

This generates a current.



The meter deflects to the right.

Which one of these would cause a deflection to the left?

(1)

☒ **A** move the north pole to the left more rapidly

☒ **B** keep the magnet still and move the coil to the left

☒ **C** keep the magnet still and move the coil to the right

☒ **D** move the north pole in to the left and then suddenly stop it

(Total for question = 1 mark)

Q8.

There is a changing magnetic field in the core of a transformer.

(i) Describe the cause of the changing magnetic field in the core of the transformer.

(2)

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(ii) A potential difference of 230 V is applied across the primary coil of a transformer.

There is a potential difference of 15 V across the secondary coil.
The primary coil has 2000 turns.

Calculate the number of turns in the secondary coil.

Use an equation selected from the list of equations at the end of this paper.

(3)

..... turns

(Total for question = 5 marks)

Q9.

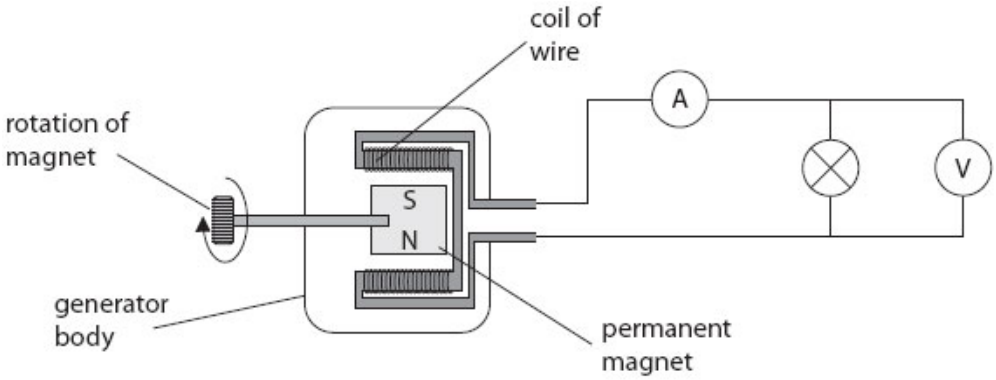
What is the name of the device used to change the size of an alternating voltage?

(1)

.....

Q10.

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.

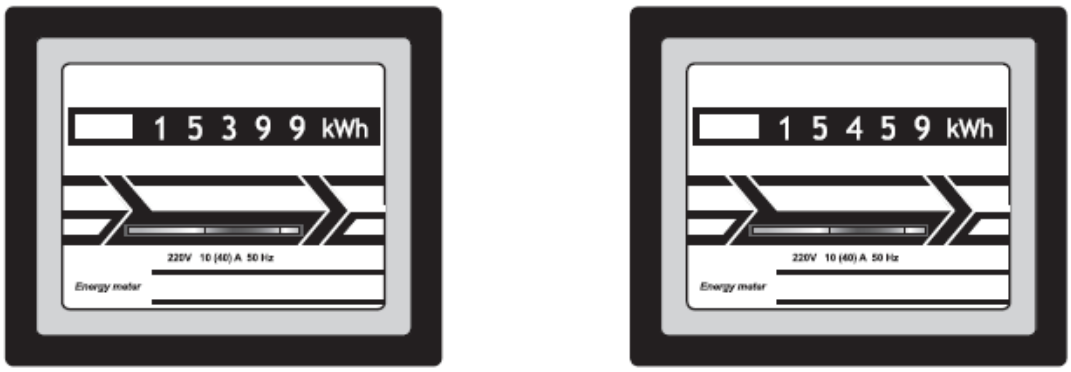
(2)

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Q11.

(a) Electricity costs 20p for each kW h.
The pictures show a domestic electricity meter at two different times.



(i) Calculate the cost of the electricity used between the two readings.

(2)

cost =.....p

(ii) The time between these two readings is 15 hours.

Calculate the average power supplied.

(2)

average power =.....kW

(b) Explain why step-up transformers are used in the transmission of electricity in the National Grid.

(2)

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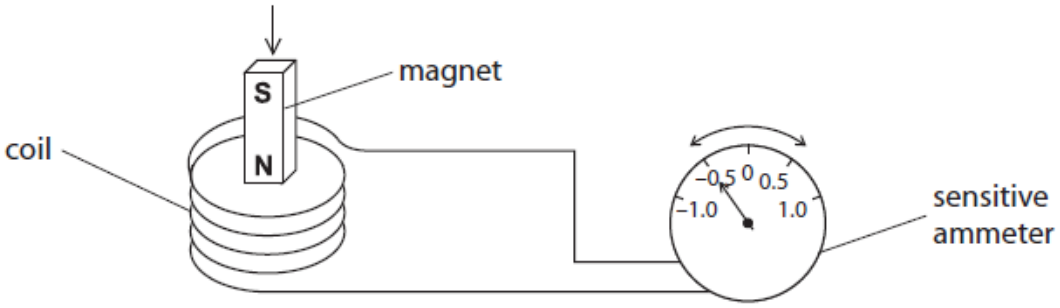
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*(c) The diagram shows a magnet moving into a coil of wire.

The coil of wire is attached to a sensitive ammeter.



The moving magnet and the coil of wire are producing an electric current.

The size and direction of the current can be changed in a number of ways.

Describe changes that can be made to produce different currents and the effect of each change.

(6)

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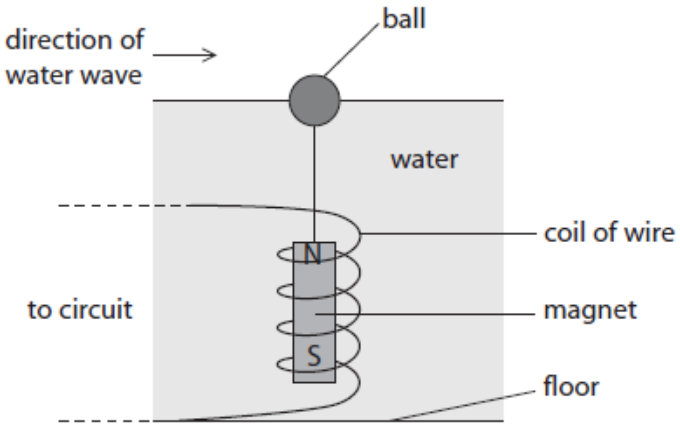
(Total for Question = 12 marks)

Q12.

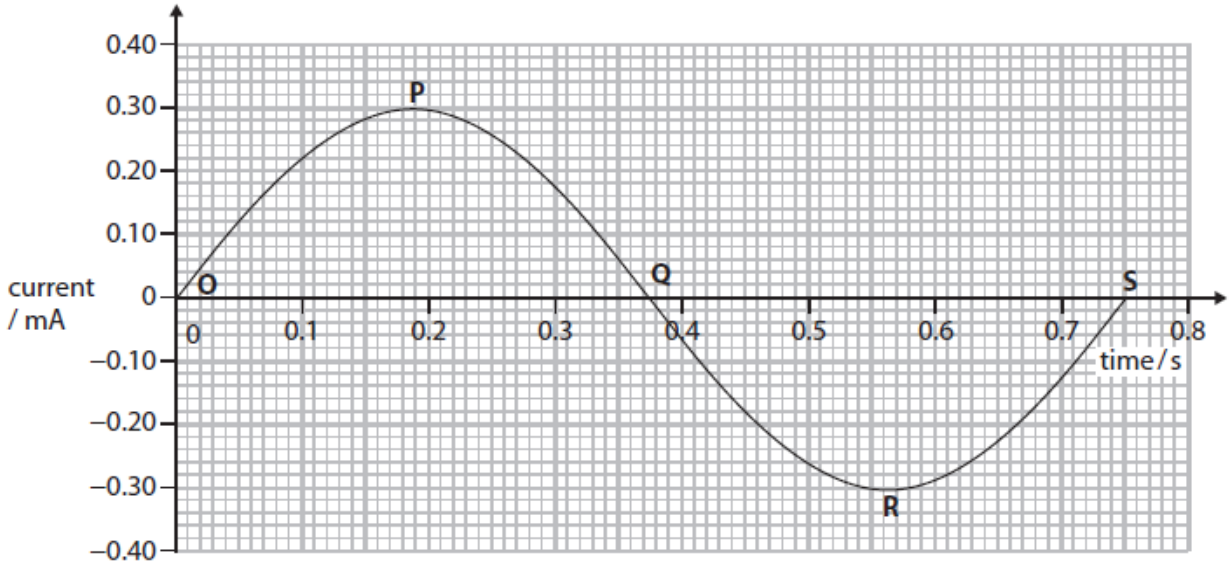
* The diagram shows a model used to generate electricity from water waves in a tank.

A ball floats on the surface of the water in the tank.
A coil of wire is fixed to the floor of the tank.
A magnet is suspended from the ball inside the coil.

When a wave is sent along the surface of the water the ball moves up and down.



The graph shows the current induced in the coil.



Explain how this current is induced in the coil in the model.
You should refer to the model and to the labelled points on the graph in your answer.

(6)

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Q13.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

There is an alternating current of 3 A in the primary coil of a transformer.

There is an alternating current of 6 A in the secondary coil of the transformer.

The transformer is 100% efficient.

(i) The size of the potential difference (voltage) across the secondary coil is

(1)

☒ **A** twice the size of the current in the primary coil

☒ **B** half the size of the current in the primary coil

☒ **C** twice the size of the voltage across the primary coil

☒ **D** half the size of the voltage across the primary coil

(ii) Explain how an alternating current in the primary coil causes an alternating current in the secondary coil of the transformer.

(3)

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(Total for question = 4 marks)

Q14.

Figure 17 is a diagram representing a loudspeaker.

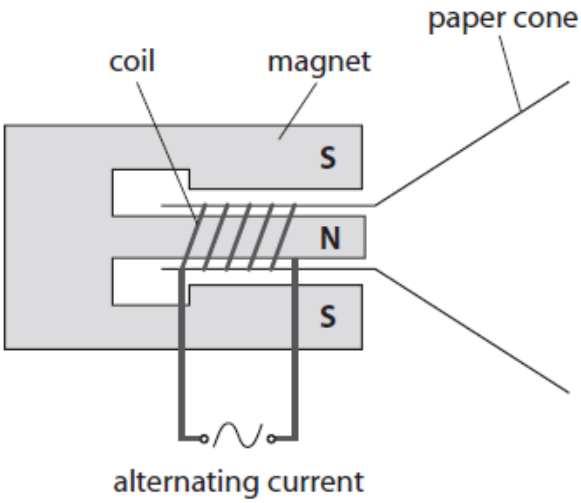


Figure 17

Explain how sound is produced when an alternating current is supplied to the coil of the loudspeaker.

(4)

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(Total for question = 4 marks)

Q15.

Figure 23 shows an electric car connected to a battery charger.



(Source: © Danil Roudenko/123RF)

Figure 23

* The battery charger shown in Figure 23 is connected to the 230 V a.c. domestic mains supply.

The output voltage of the charger is 335 V and it provides a d.c. charging current. Charging stops if the charging current exceeds 15 A.

Explain how electrical components in the charger can be connected together to give this type of output.

(6)

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(Total for question = 6 marks)

Q16.

Figure 22 shows how electricity is delivered efficiently from a power station (P) to homes (T).

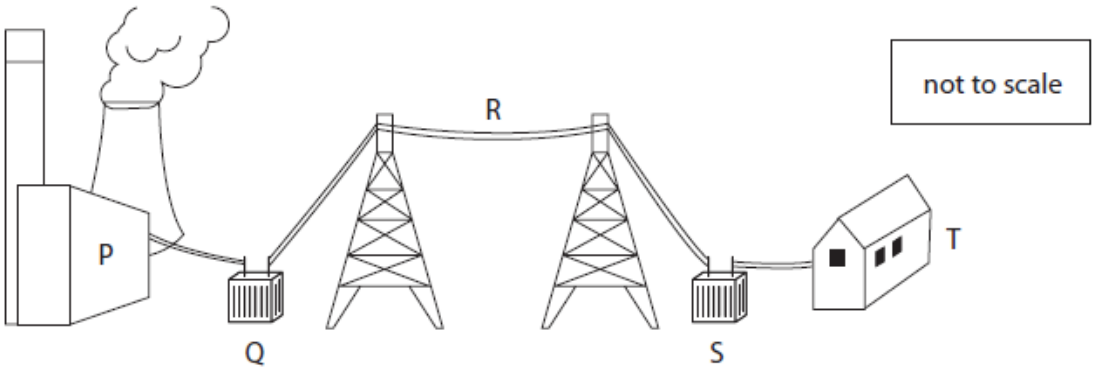


Figure 22

Using Figure 22, explain the stages in the process of delivering electricity efficiently from P to T.

Your answer should include details of the effects that Q, R and S have on efficiency.

(6)

(Total for question = 6 marks)

Q17.

Figure 20 shows a magnet and a coil.

The coil is connected to a sensitive centre-zero ammeter.

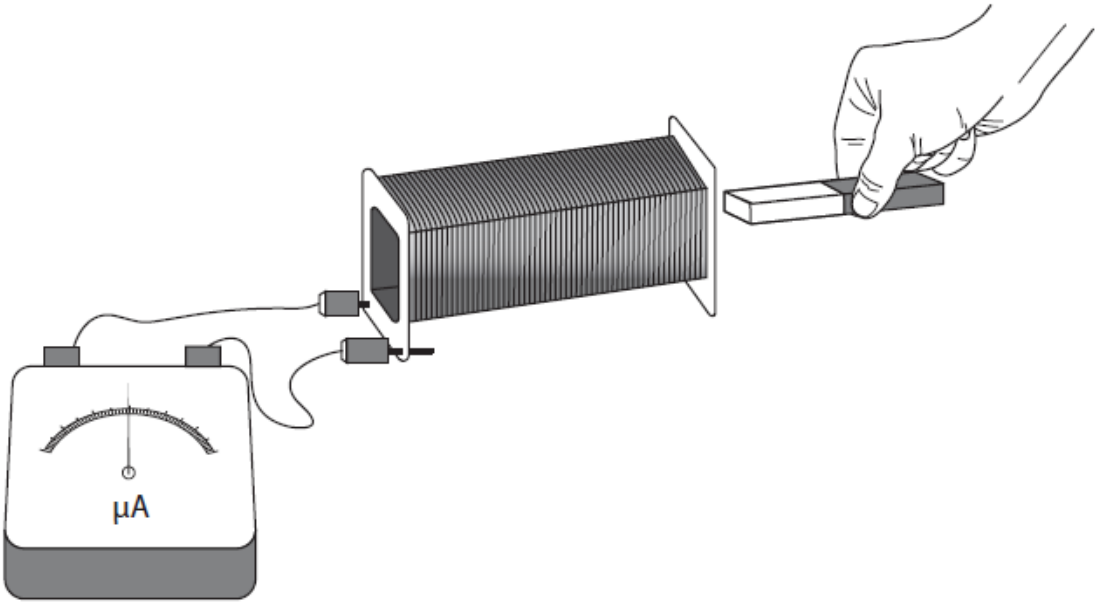


Figure 20

Explain what will be observed on the meter when the magnet is pushed in and pulled out of the coil, repeatedly.

(3)

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(Total for question = 3 marks)

Q18.

* Figure 19 shows a coil of wire that is being rotated between the poles of a magnet.

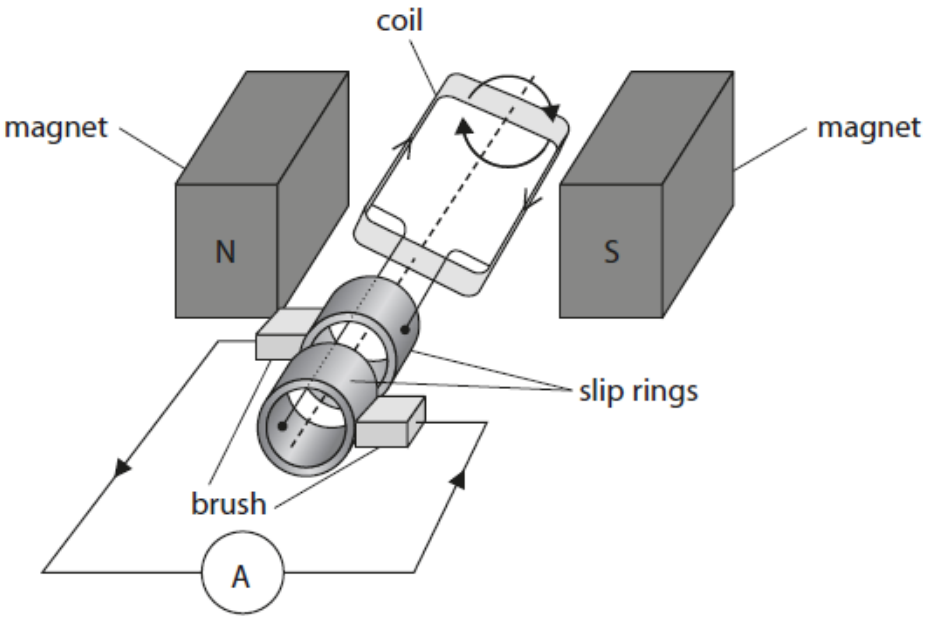


Figure 19

Figure 20 shows how the current in the coil changes during **one** complete rotation of the coil.

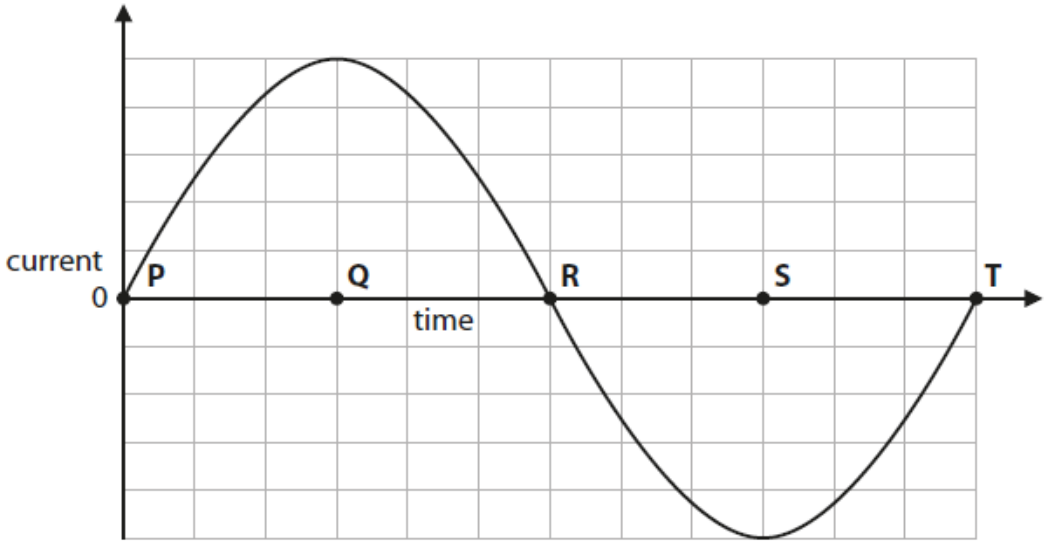


Figure 20

Explain why the current changes in the way shown by the graph in Figure 20.

Your answer should include details of the position of the coil relative to the magnet at each of the times labelled P, Q, R, S and T.

You may use diagrams to help your answer.

(6)

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(Total for question = 6 marks)

Q19.

(a) The picture shows a wind-powered generator used to produce electricity for a house.



© The Wall Street Journal

(i) The table shows some electrical components.

Put ticks in the table next to the **two** components the generator must contain.

(2)

component	✓
ammeter	
coil of wire	
battery	
magnet	
voltmeter	

(ii) Explain why the voltage produced by this wind-powered generator is not always the same.

(2)

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(iii) It would cost the homeowner 15 p to buy 1.0 kW h of electrical energy from the National Grid.

His generator has a maximum power of 2.0 kW.
The generator produces energy at this maximum power for 3 hours.

Calculate how much it would cost to buy the same amount of energy from the National Grid.

(2)

cost = ... p

(b) An electric kettle is plugged into a 230 V mains supply.
It has a power of 2.5 kW.

Use this equation to calculate the current in the kettle.

$$\text{current (in amps)} = \frac{\text{power (in watts)}}{\text{voltage (in volts)}}$$

(3)

current = ... A

(c) Suggest why a 2 kW wind-powered generator may not supply all the electrical energy needed in a house.

(1)

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Q20.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 15 shows three stages of a magnet moving into and then out of a coil of wire.

The coil is connected to a milliammeter.

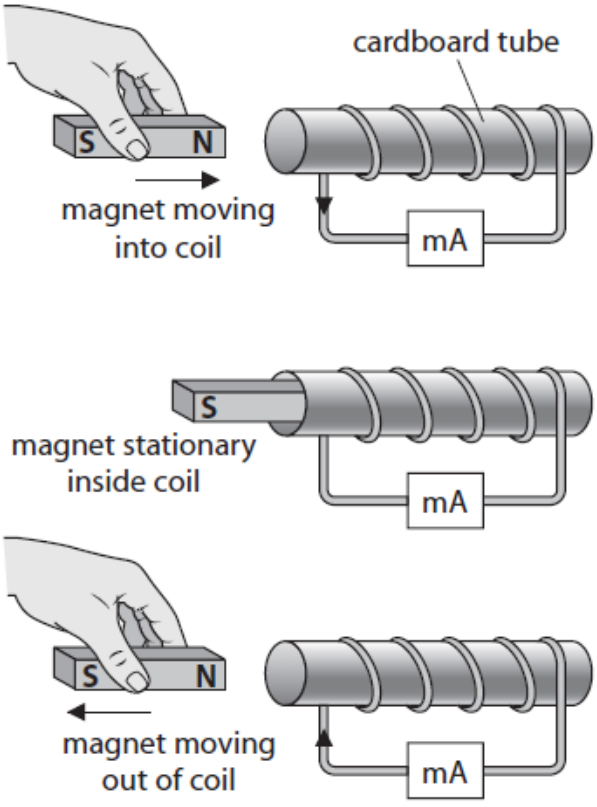


Figure 15

(i) Which row of the table shows the deflection on the milliammeter for the three stages in Figure 15?

(1)

	magnet moving into coil	magnet stationary inside coil	magnet moving out of coil
☒ A			
☒ B			
☒ C			
☒ D			

Figure 16

(ii) Give **two** ways of increasing the deflections on the milliammeter shown in Figure 16.

(2)

1 .....

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2 .....

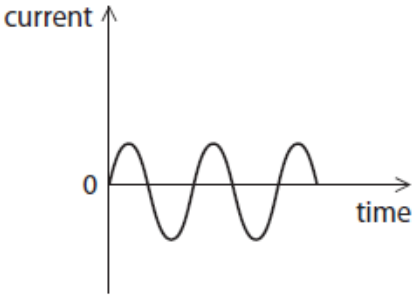
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(Total for question = 3 marks)

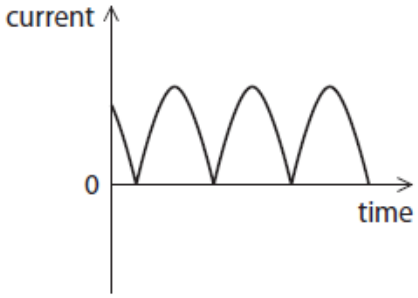
Q21.

Which of these could be the output for a dynamo?

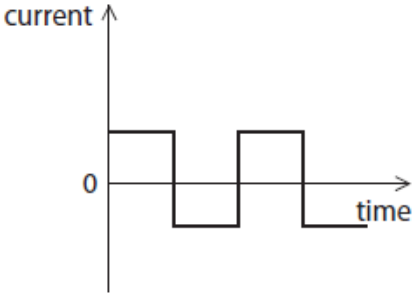
(1)



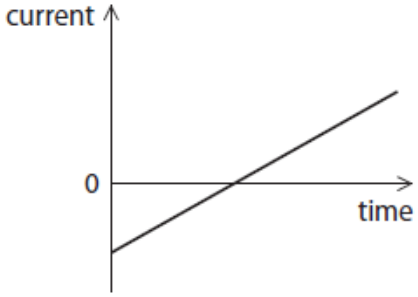
☒ A



☒ B



☒ C



☒ D

(Total for question = 1 mark)

Q22.

A teacher is demonstrating electromagnetic induction.
The teacher has a bar magnet, a coil of wire and a sensitive voltmeter.

(i) Draw a diagram to show how the teacher should arrange the apparatus.

(1)

(ii) Explain how the teacher could use this apparatus to demonstrate the factors

affecting the size and direction of the induced potential difference.

(4)

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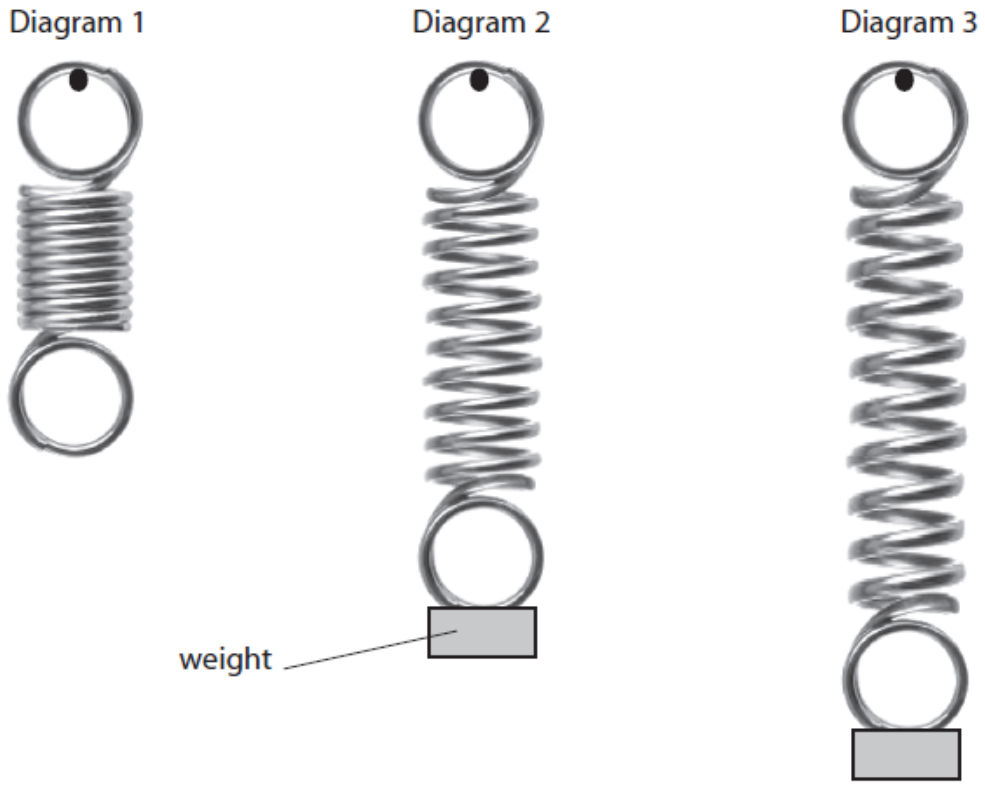
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(Total for question = 5 marks)

Q23.

(a) The diagrams show a spring hanging from a nail.

- In Diagram 1 there is no weight on the spring.
- Diagram 2 shows the spring after a weight is added.
- Diagram 3 shows the spring after the weight has been pulled down slightly.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

When held stationary as in Diagram 3,

(1)

☒ **A** the spring has zero elastic potential energy

☒ **B** the weight has equal amounts of elastic potential and kinetic energy

☒ **C** the weight has more kinetic energy than gravitational potential energy

☒ **D** the spring has more elastic potential energy than the weight has kinetic energy

(ii) The spring is stretched from the position shown in Diagram 2 to the position shown in Diagram 3.
The spring is then released.
Describe the energy changes that take place until the spring stops vibrating.

(3)

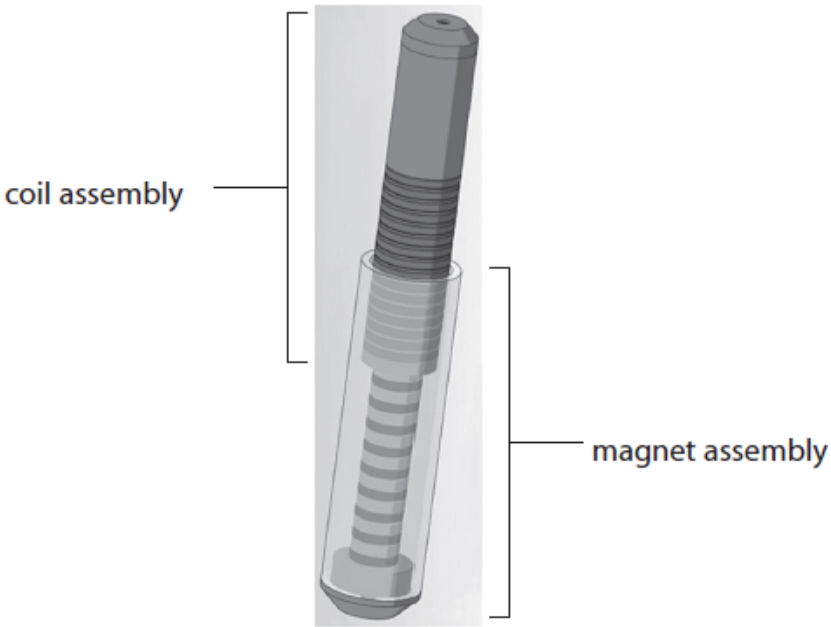
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(b) Shock absorbers with springs are used on some motorcycles.
These shock absorbers reduce the bounce on an uneven road.
A new shock absorber has been developed to convert some of the movement energy into another form.
It consists of magnets which slide inside a coil when the motorcycle goes over a bump.



Some of the energy which would otherwise be wasted can be recovered and so fuel is saved.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

☒ **A** increase the thermal energy obtained from the fuel

☒ **B** increase the efficiency of the motorcycle

☒ **C** decrease the speed of the motorcycle

☒ **D** decrease the braking power of the motorcycle

(ii) Explain how this new type of shock absorber can provide electrical energy.

(2)

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(iii) The diagram shows the bumps on the surface of two roads, L and M.
why the device will transfer more energy on road L than on road M for a motorcycle travelling at the same speed.

(3)



road L



road M

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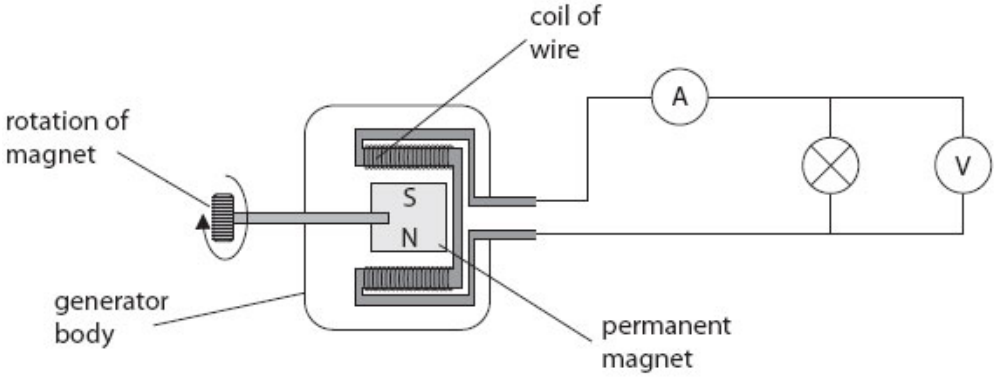
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(Total for Question = 10 marks)

Q24.

(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 is 12 marks)

Q25.

* High voltage transmission cables and transformers are used in the national grid.

Explain how using high voltage transmission cables and transformers allows the distribution of electrical power around the United Kingdom to be as efficient as possible.

Refer to the following equations in your answer.

$$P = I^2 \times R$$

$$V_p \times I_p = V_s \times I_s$$

(6)

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(Total for question = 6 marks)

Q26.

The photograph shows a step-down transformer.



(a) Explain why step-down transformers are used in the transmission of electricity in the National Grid.

(2)

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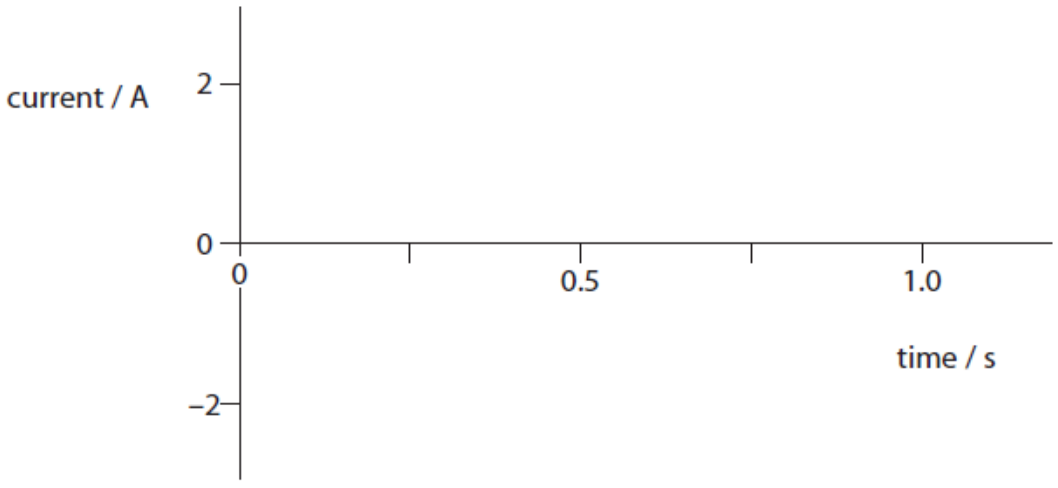
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(b) Transformers need alternating current to work properly.
Sketch a graph of an alternating current with a frequency of 2 Hz.

(2)



(c) A transformer has 2400 turns on the primary coil and 100 turns on the secondary coil.

Calculate the secondary voltage if the primary voltage is 12 V.

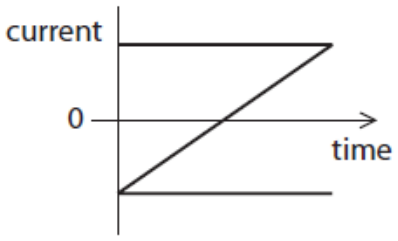
(3)

secondary voltage =..... V

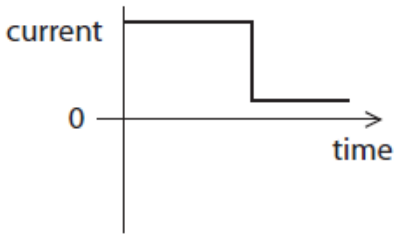
(d) Opening the switch in a circuit produces the opposite magnetic effect to closing the switch.
A scientist connected a switch, a fixed resistor and a battery to the primary coil of a step-up transformer. The scientist also connected a fixed resistor across the secondary coil.
The scientist switched the circuit on and then later switched it off.

Which of these best represents the current in the secondary coil?

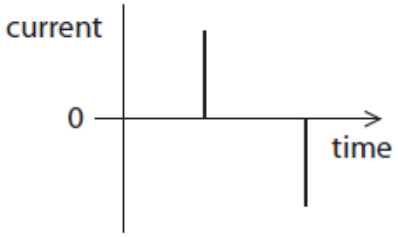
(1)



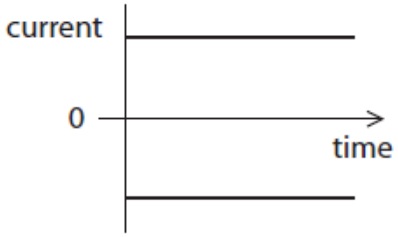
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(Total for Question = 8 marks)

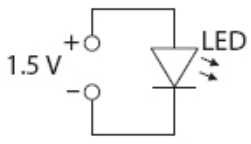
Q27.

(a) What is the name of the device used to change the size of an alternating voltage?

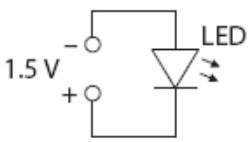
(1)

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(b) A light emitting diode (LED) can only emit light when connected correctly to a potential difference.

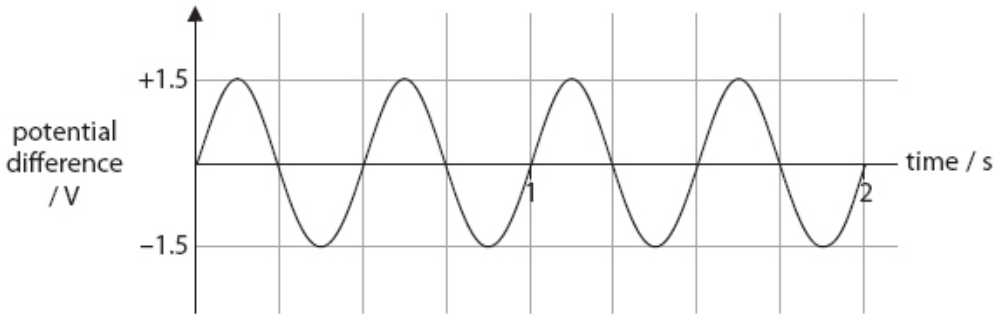


LED emits light



LED does **not** emit light

Use this information to suggest what happens when this alternating voltage is connected across the LED.



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(c) A LED lamp has a power rating of 3 W.
The voltage across the lamp is 12 V.
Calculate the current in the lamp.

(3)

current in the lamp =.....A

*(d) Some research has been carried out into replacing fluorescent lamp fittings with LED fittings.



photo of stairwell with fluorescent fitting



photo of stairwell with LED fitting

The data in the table is taken from the report of a trial using LEDs to light stairwells and corridors in a large building.

total energy saved each year by using LEDs	3 000 kW h
LED fitting cost	£2 000
CO_2 saving each year by using LEDs	1.6 tonnes
change in lighting levels by using LEDs	200%
average price of electrical energy	14 p / kW h
average lifetime of LED fittings	50 000 hours
average lifetime of fluorescent fittings	10 000 hours

Use the information to discuss the benefits of replacing fluorescent fittings with LED fittings.

(6)

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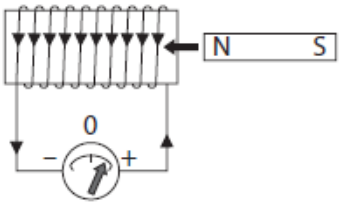
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(Total for Question = 12 marks)

Q28.

Figure 11 shows a magnet moving into a coil.

This generates a current.



The magnet is now dropped through three identical coils as shown.

The coils are connected to a data logger that can produce the graph shown in Figure 12.

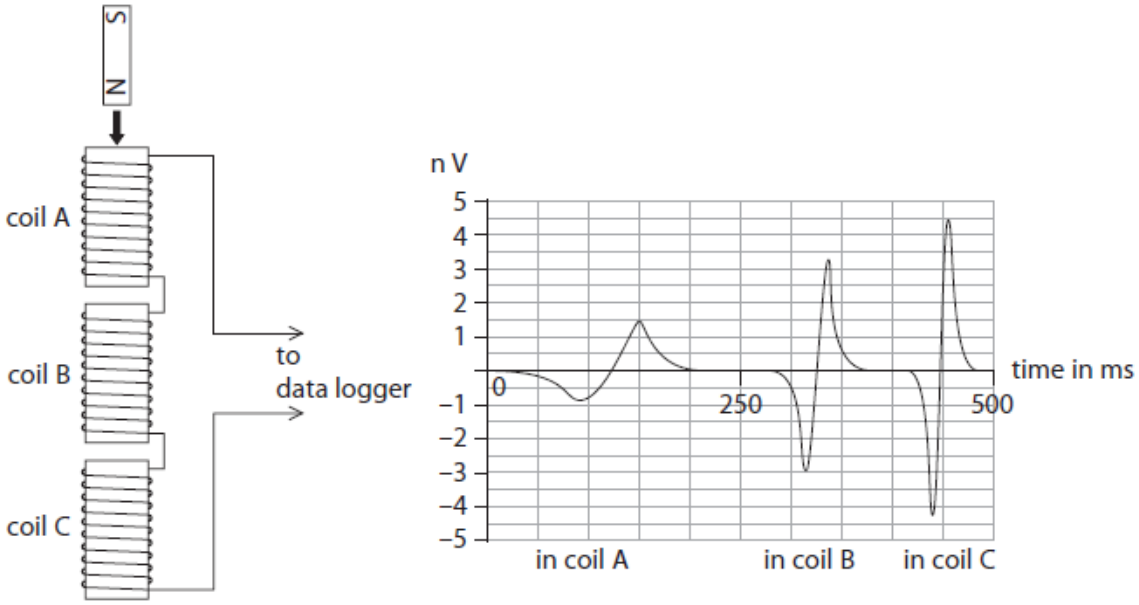


Figure 12

(i) State and explain **two** ways in which the voltage-time graph shows you that the magnet accelerated as it travelled through the coils.

(4)

1 .....

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2 .....

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(ii) Explain why the meter in Figure 11 could not be used to obtain the data for the graph in Figure 12.

(2)

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(Total for question = 6 marks)