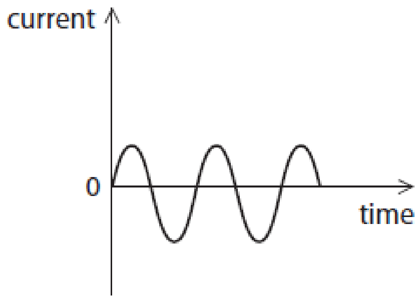
Questions

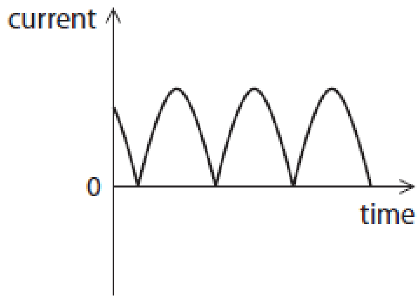
Q1.

Which of these could be the output for a dynamo?

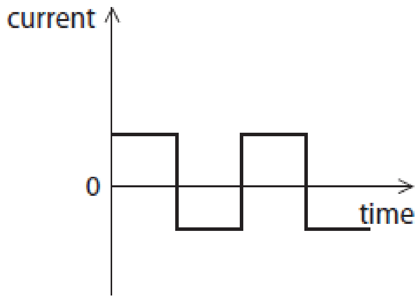
(1)



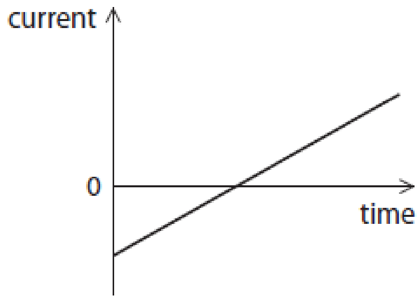
☐ **A**



☐ **B**



☐ **C**



☐ **D**

(Total for question = 1 mark)

Q2.

In a small transformer

- the primary voltage is 230 V
- the primary current is 0.020 A
- the secondary voltage is 5.0 V

Calculate the secondary current.

Use the equation

$$I_s = \frac{V_p \times I_p}{V_s}$$

(2)

secondary current = ... A

(Total for question = 2 marks)

Q3.

Complete the following sentences using one of the phrases from the box below.

efficiency is reduced the national grid a power station heat loss is reduced a transformer

(i) Electrical power is generated at

(1)

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(ii) Electricity is transmitted over long distances by transmission lines that are part of

(1)

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(iii) Electricity is transmitted at high voltages so that

(1)

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(Total for question = 3 marks)

Q4.

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

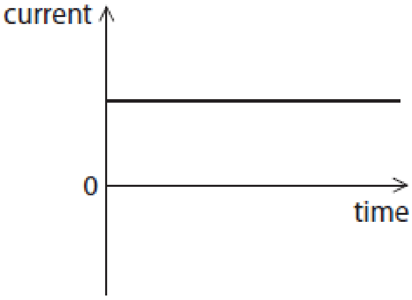

Figure 17

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)

Q5.

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)

Q6.

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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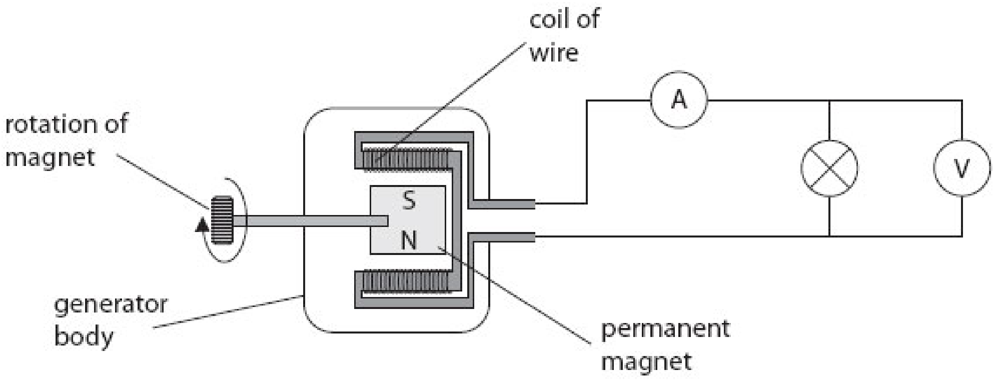
(Total for question = 5 marks)

Q7.

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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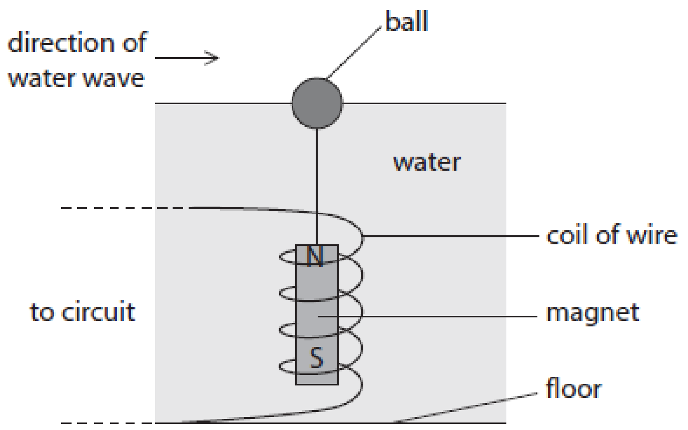
Q8.

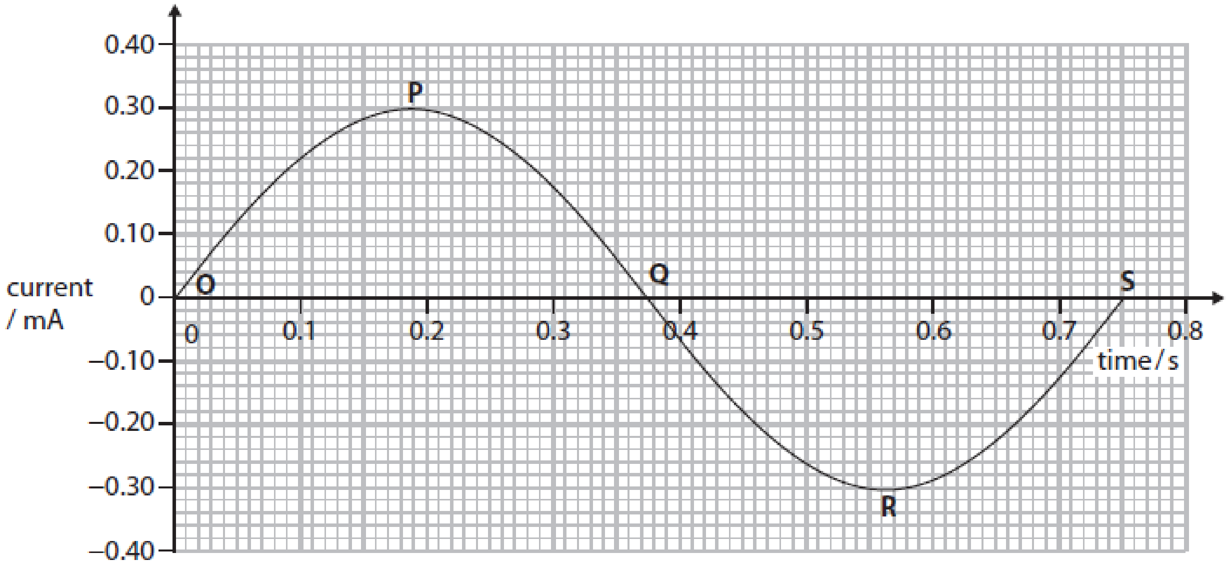
* The diagram shows a model used to generate electricity from water waves in a tank.

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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Q9.

* 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)

Q10.

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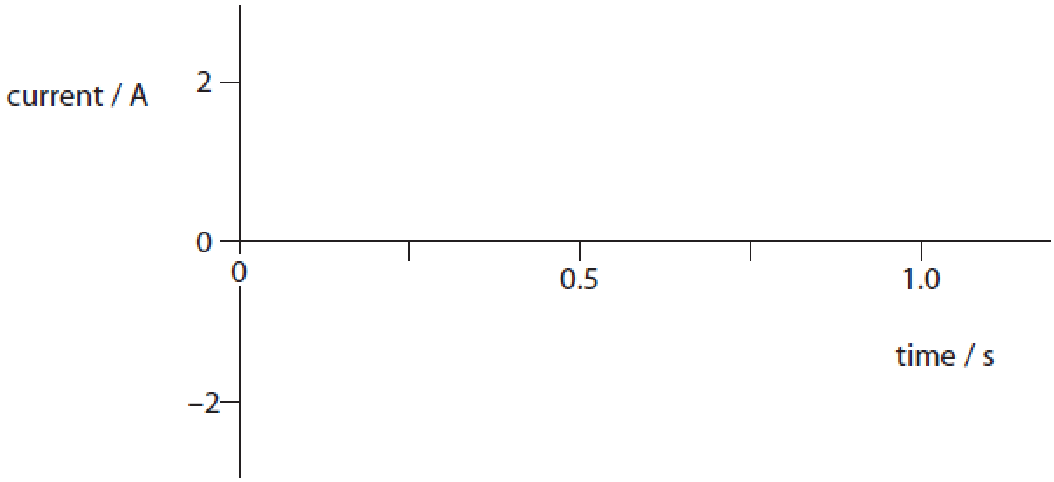
(b) Transformers need alternating current to work properly.
Sketch a graph of an alternating current with a frequency of 2 Hz.

(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.

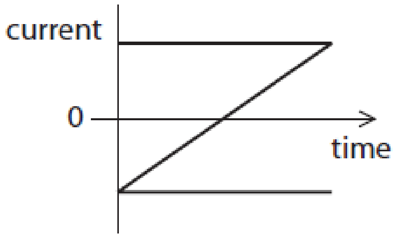
(3)

secondary voltage =.. V

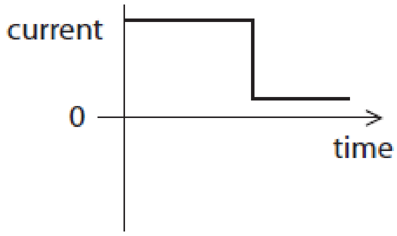
(d) Opening the switch in a circuit produces the opposite magnetic effect to closing the switch.
A scientist connected a switch, a fixed resistor and a battery to the primary coil of a step-up transformer. The scientist also connected a fixed resistor across the secondary coil.
The scientist switched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

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

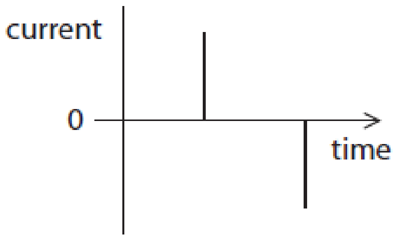
(1)



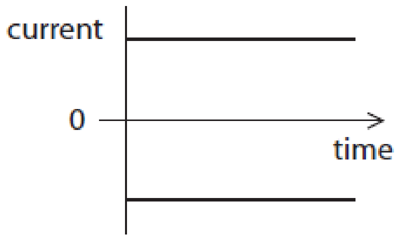
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(Total for Question = 8 marks)

Q11.

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

(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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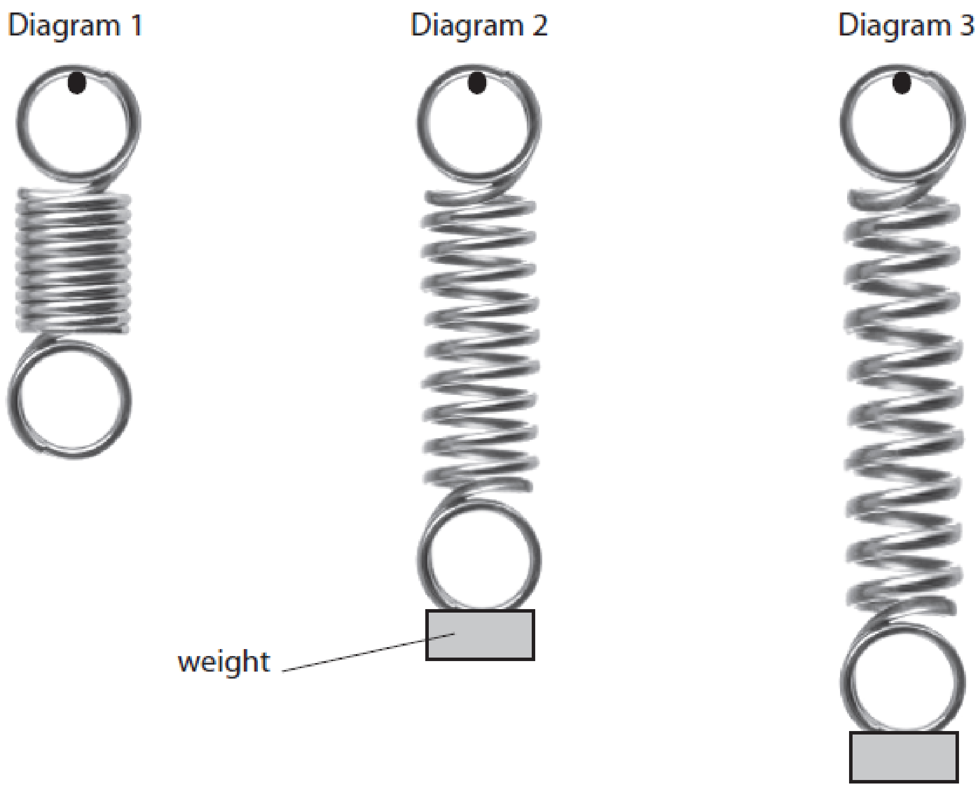
Q12.

(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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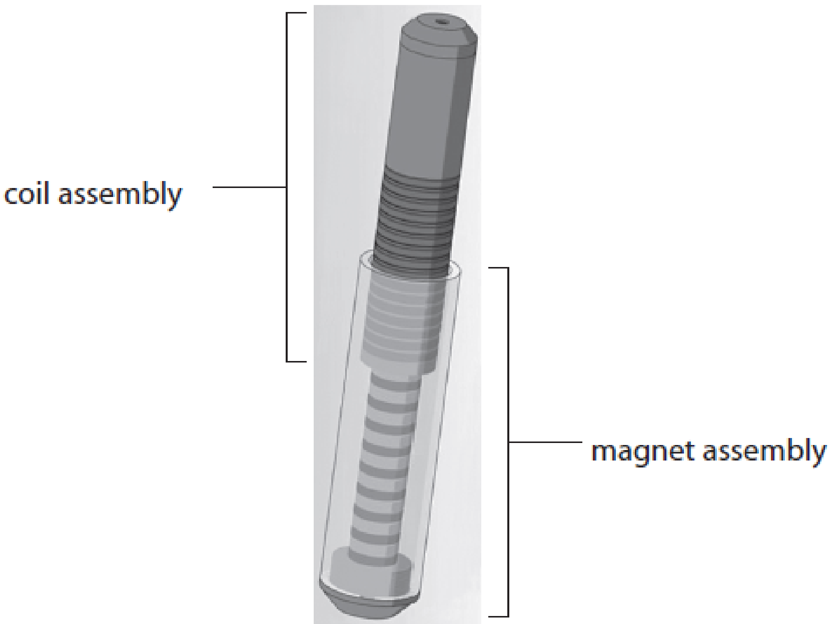
(b) Shock absorbers with springs are used on some motorcycles.
These shock absorbers reduce the bounce on an uneven road.
A new shock absorber has been developed to convert some of the movement energy into another form.
It consists of magnets which slide inside a coil when the motorcycle goes over a 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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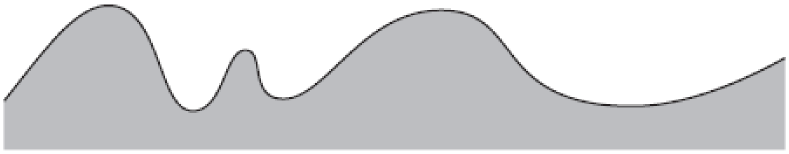
(iii) The diagram shows the bumps on the surface of two roads, L and M.
why the device will transfer more energy on road L than on road M for a motorcycle travelling at the same speed.

(3)



road L

road M

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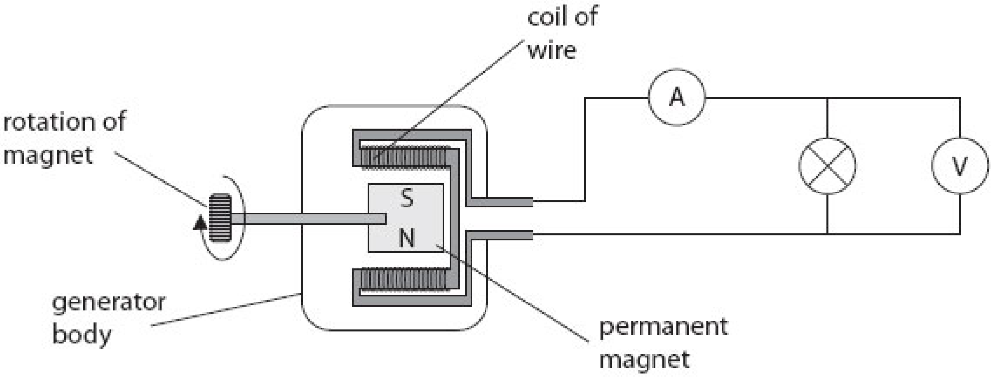
(Total for Question = 10 marks)

Q13.

(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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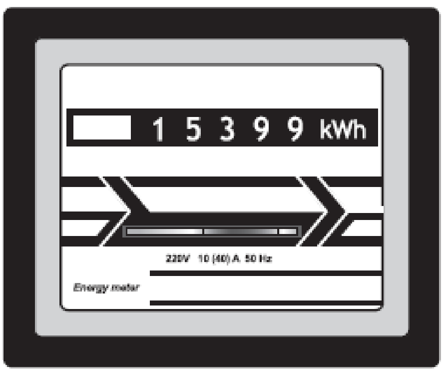
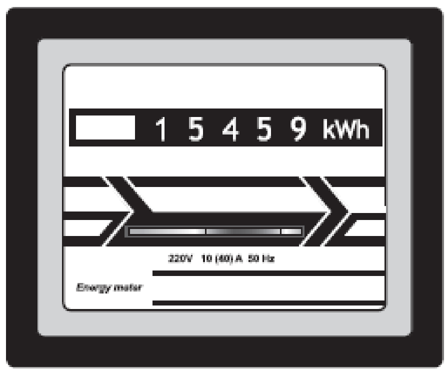
(Total for Question is 12 marks)

Q14.

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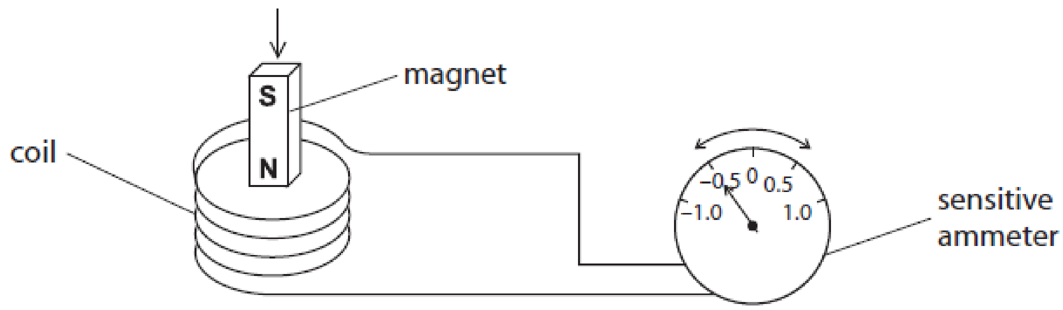
*(c) The diagram shows a magnet moving into a coil of wire.

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)