Induced Potential, Transformers

These practice questions can be used by students and teachers and is

Suitable for GCSE AQA Physics Topic Question 8463

Level: GSCE AQA 8463

Subject: Physics

Exam Board: GCSE AQA

Topic: Induced Potential, Transformers

Q1.

P-waves and S-waves are two types of seismic wave caused by earthquakes.

(a) Which **one** of the statements about P-waves and S-waves is correct?

Tick **one** box.

P-waves and S-waves are transverse. ☐

P-waves and S-waves are longitudinal. ☐

P-waves are transverse and S-waves are longitudinal. ☐

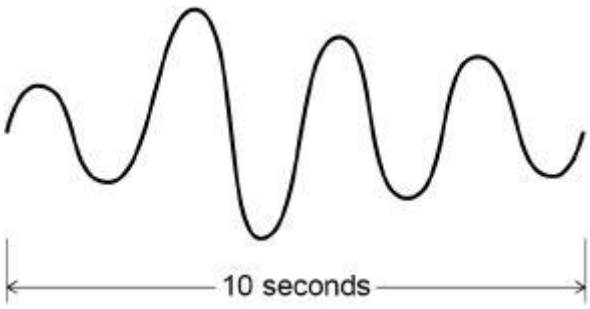
P-waves are longitudinal and S-waves are transverse. ☐

(1)

Seismometers on the Earth's surface record the vibrations caused by seismic waves.

Figure 1 shows the vibration recorded by a seismometer for one P-wave.

Figure 1



(b) Calculate the frequency of the P-wave shown in **Figure 1**.

_____

_____

Frequency = _____ Hz

(1)

(c) Write down the equation which links frequency, wavelength and wave speed.

_____

(1)

(d) The P-wave shown in **Figure 1** is travelling at 7200 m/s.

Calculate the wavelength of the P-wave.

Wavelength = _____ m

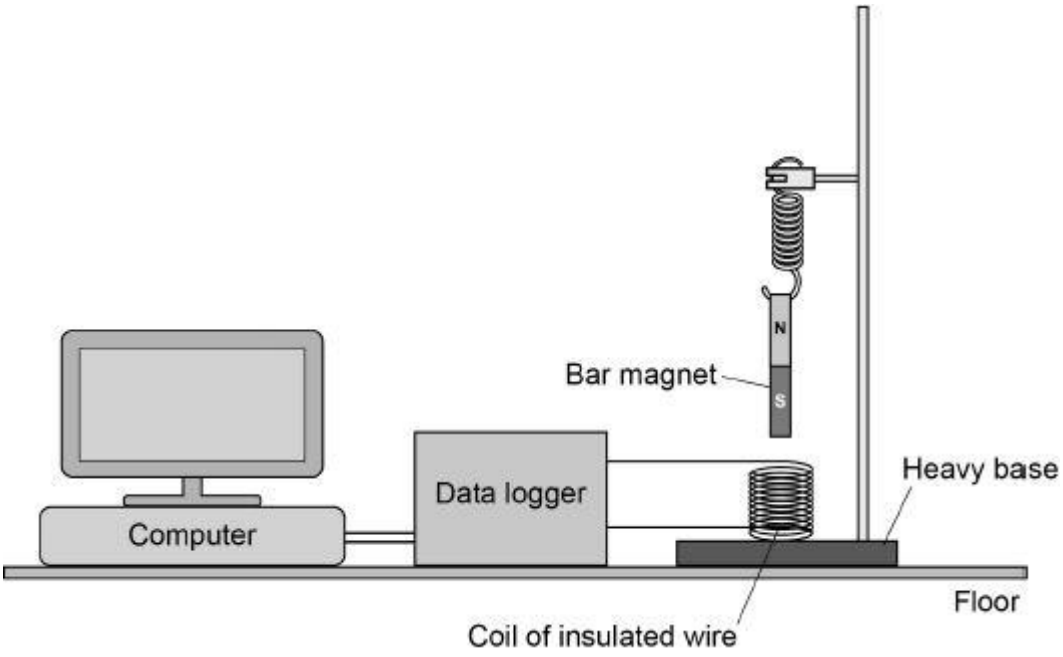
(3)

(e) Explain why the study of seismic waves provides evidence for the structure of the Earth's core.

(2)

Figure 2 shows a simple seismometer made by a student.

Figure 2



To test that the seismometer works, the student pushes the bar magnet into the coil and

then releases the bar magnet.

(f) Why does the movement of the bar magnet induce a potential difference across the coil?

_____

_____

(1)

(g) Why is the induced potential difference across the coil alternating?

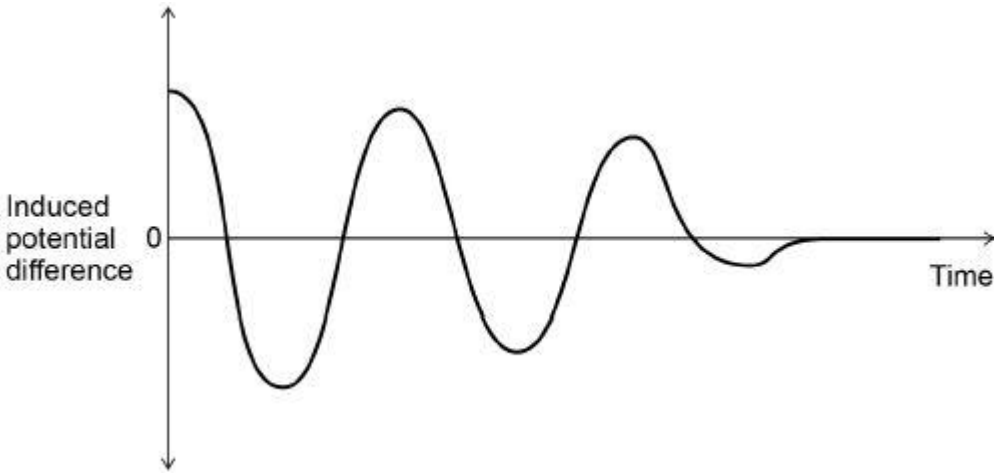
_____

_____

(1)

(h) **Figure 3** shows how the potential difference induced across the coil varies after the bar magnet has been released.

Figure 3



Which statement describes the movement of the magnet when the induced potential difference is zero?

Tick **one** box.

Accelerating upwards. ☐

Constant speed upwards. ☐

Decelerating downwards. ☐

Stationary. ☐

(1)

(i) The seismometer cannot detect small vibrations.

Suggest **two** changes to the design of the seismometer that would make it more sensitive to small vibrations.

1. _____

_____

2. _____

_____

(2)

(Total 13 marks)

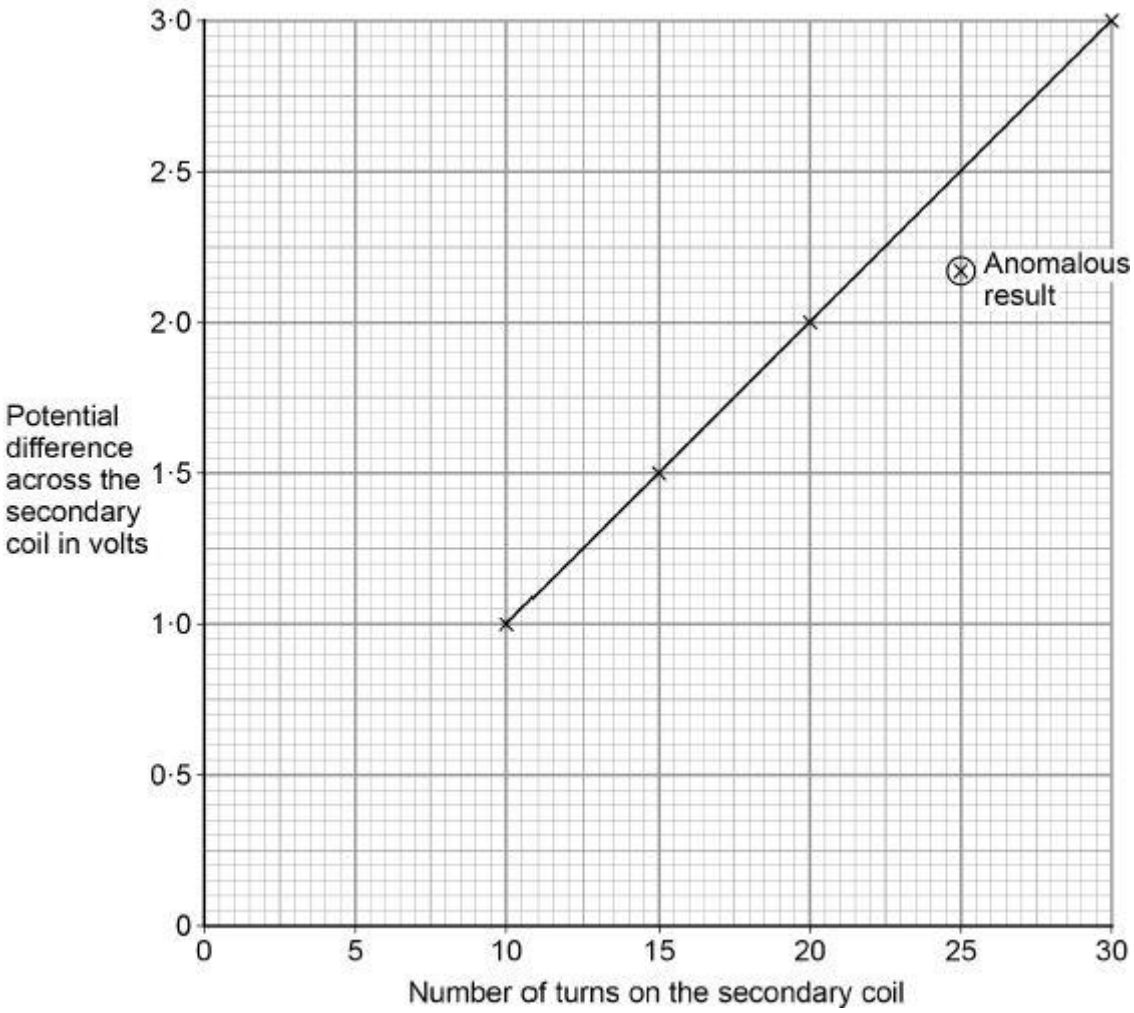
Q2.

A student used a simple transformer to investigate how the number of turns on the secondary coil affects the potential difference (p.d.) across the secondary coil.

The student kept the p.d. across the primary coil fixed at 2V.

Figure 1 shows the results collected by the student.

Figure 1



(a) **Figure 1** contains one anomalous result.

Suggest **one** possible reason why this anomalous result occurred.

_____

_____

(1)

(b) The transformer changes from being a step-down to a step-up transformer.

How can you tell from **Figure 1** that this happens?

_____

_____

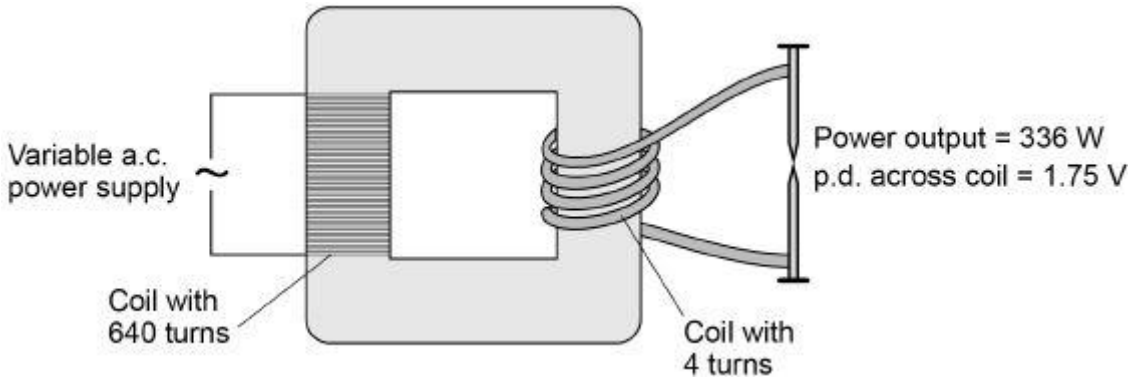
_____

(1)

A spot-welder is a device that uses a transformer to produce a large current to join sheets of metal together.

Figure 2 shows a transformer demonstrating how a large current can heat and join two nails together.

Figure 2



(c) How does the amount of infrared radiation emitted by the nails change when the power supply is switched on?

_____

_____

(1)

(d) Calculate the current from the power supply needed to provide a power output of 336 W.

Use the data in **Figure 2**.

The transformer is 100% efficient.

_____

_____

_____

_____

_____

_____

Current = _____ A

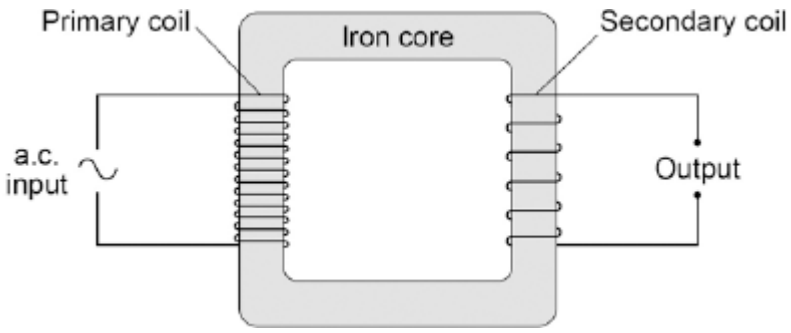
(5)

(Total 8 marks)

Q3.

Figure 1 shows the construction of a simple transformer.

Figure 1



(a) Why is iron a suitable material for the core of a transformer?

Tick **one** box.

It is a metal. ☐

It will not get hot. ☐

It is easily magnetised. ☐

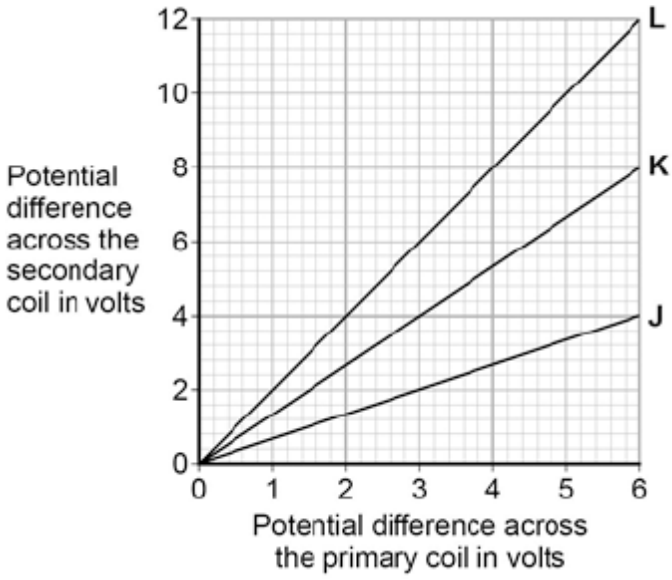
It is an electrical conductor. ☐

(1)

(b) A student makes three simple transformers, **J**, **K** and **L**.

Figure 2 shows how the potential difference across the secondary coil of each transformer varies as the potential difference across the primary coil of each transformer is changed.

Figure 2



How can you tell that transformer **J** is a step-down transformer?

_____

_____

(1)

(c) Each of the transformers has 50 turns on the primary coil.

Calculate the number of turns on the secondary coil of transformer **L**.

Use the correct equation from the Physics Equations Sheet.

_____

_____

_____

Number of turns on the secondary coil = _____

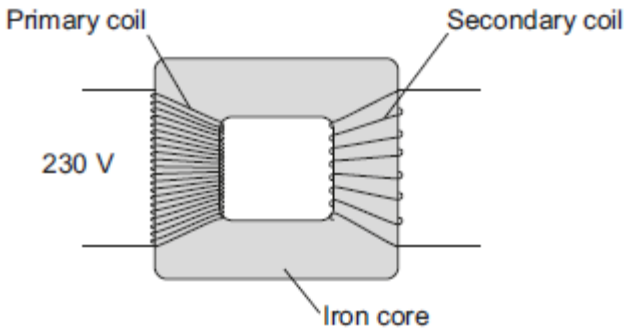
(3)

(Total 5 marks)

Q4.

Figure 1 shows the structure of a traditional transformer.

Figure 1



(a) There is an alternating current in the primary coil of the transformer.

State what is produced in the iron core.

_____

_____

(2)

(b) A transformer has only **one** turn of wire on the secondary coil.
The potential difference across the secondary coil is 11.5 V
The potential difference across the primary coil is 230 V

Calculate the number of turns on the primary coil.

Number of turns on the primary coil = _____

(2)

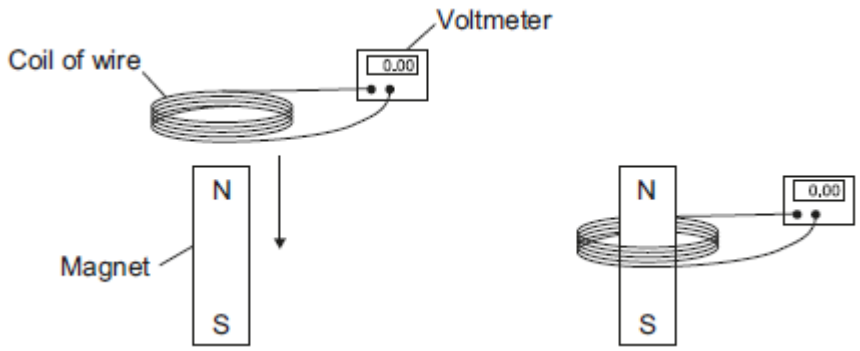
(c) In most transformers, the power output is less than the power input.

State why.

(1)

(d) Two students investigated how magnets can be used to produce a potential difference.
The students held a coil of wire above a magnet. The students quickly lowered the coil so that the magnet was inside the coil, as shown in **Figure 2**.

Figure 2



The students recorded the maximum potential difference for coils with different numbers of turns of wire. The results are shown in the table.

Number of turns of wire in the coil	Maximum potential difference in volts	
	Results from student 1	Results from student 2
5	0.09	0.08
10	0.20	0.15
15	0.31	0.25
20	0.39	0.33
25	0.51	0.39

(i) State the resolution of the voltmeter.

Give **one** reason why the resolution of the voltmeter is suitable for this investigation.

Resolution _____

Reason _____

_____

(2)

(ii) The two students used exactly the same equipment to carry out their investigations.
Both students recorded their results correctly.

Give the reason why student 2 got different results from student 1.

_____

_____

(1)

(iii) The students decided that even though the results were different, there was no need to repeat the investigation.

How do the results show that the investigation is reproducible?

_____

_____

(1)

(iv) State the name of the process which causes the potential difference to be produced in this investigation.

_____

(1)

(e) A transformer has been developed that can be used with many different devices.

Suggest **one** advantage of having a transformer that can be used with many different devices.

_____

_____

(1)

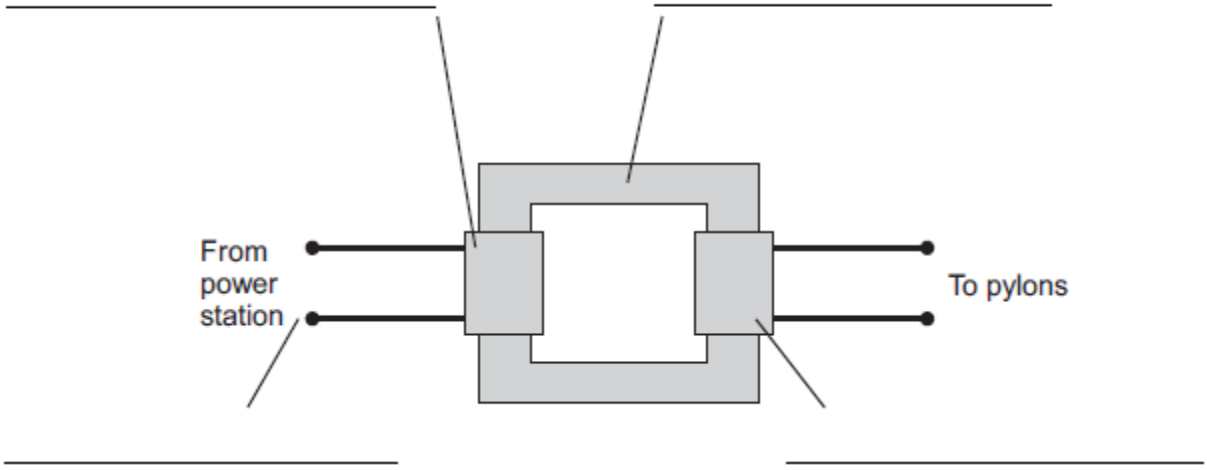
(Total 11 marks)

Q5.

Transformers are used to change potential differences (p.d.) in the National Grid.

Figure 1 shows a step-up transformer that is used at a power station.

Figure 1



(a) (i) Use words from the box to label **Figure 1**.

Input p.d.	**Iron core**	**Output p.d.**
Primary coil	**Secondary coil**	

(4)

(ii) One of the coils in **Figure 1** has a p.d. of 25 kV across it and has 1000 turns.

The other coil has a p.d. of 400 kV across it.

Calculate the number of turns on this other coil.

Number of turns = _____

(2)

(iii) Explain why a step-up transformer is used at a power station.

(3)

(b) **Figure 2** shows a mobile phone charger.

Figure 2

The charger contains a step-down transformer. A switch mode transformer is used rather than a traditional transformer.

Describe the advantages of using a switch mode transformer in the charger rather than a traditional transformer.

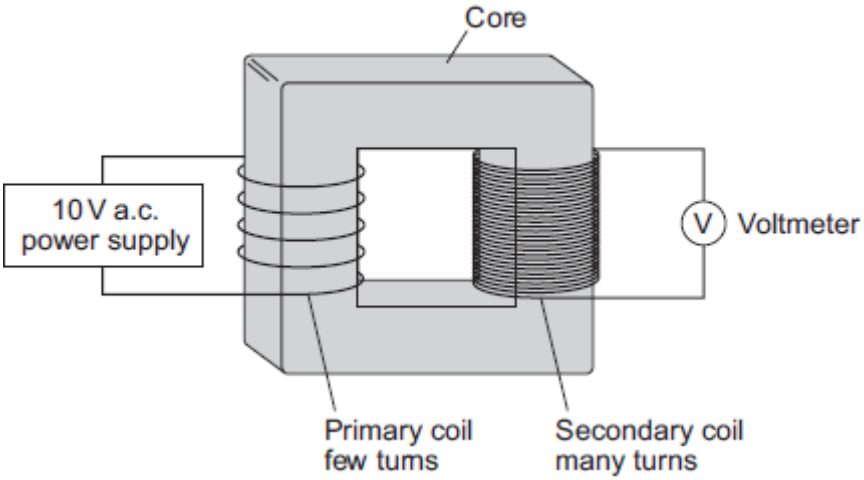
(3)

(Total 12 marks)

Q6.

Figure 1 shows a traditional transformer.

Figure 1



(a) (i) Which metal should the core of the transformer be made from?

Tick (✓) **one** box.

aluminium ☐

copper ☐

iron ☐

(1)

(ii) What would the reading be on the voltmeter shown in **Figure 1**?

Draw a ring around the correct answer.

2 V **10 V** **50 V**

Give the reason for your answer.

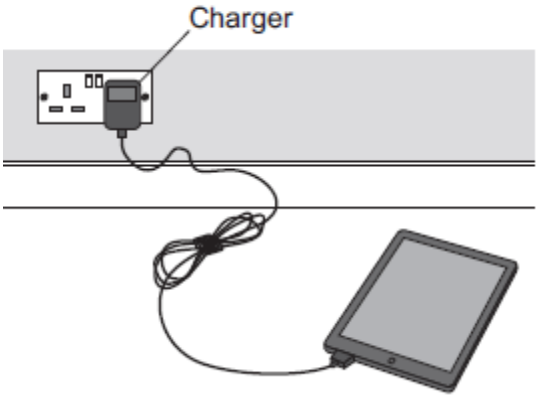
_____

_____

(2)

(b) **Figure 2** shows a tablet computer and its charger.

Figure 2



The charger contains a switch mode transformer.

(i) Use the correct answer from the box to complete the sentence.

200	1000	20 000

Switch mode transformers operate at frequencies

from 50 kHz to _____ kHz.

(1)

(ii) Give **one** advantage of a switch mode transformer over a traditional transformer.

_____

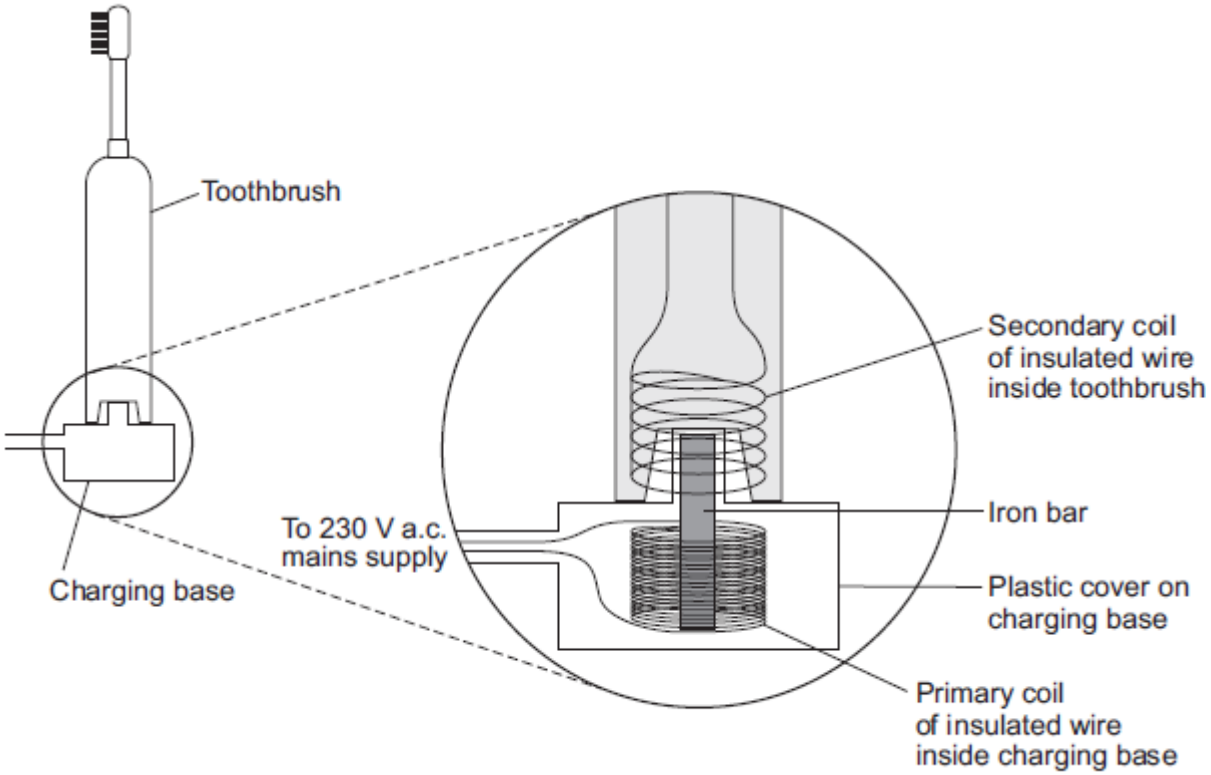
_____

(1)

(Total 5 marks)

Q7.

An electric toothbrush is charged by standing it on a separate charging base.
The diagram shows the inside of the electric toothbrush and the charging base.



(a) An alternating potential difference (p.d.) across the coil in the charging base creates an alternating current in the coil inside the toothbrush.

Explain how.

(3)

(b) When the toothbrush is being charged, the p.d. across the primary coil in the charging base is 230 V.

The charging p.d. across the secondary coil in the toothbrush is 7.2 V.

The primary coil in the charging base has 575 turns of wire on its coil.

Calculate the number of turns on the secondary coil inside the toothbrush.

_____

_____

_____

_____

Number of turns on the secondary coil = _____

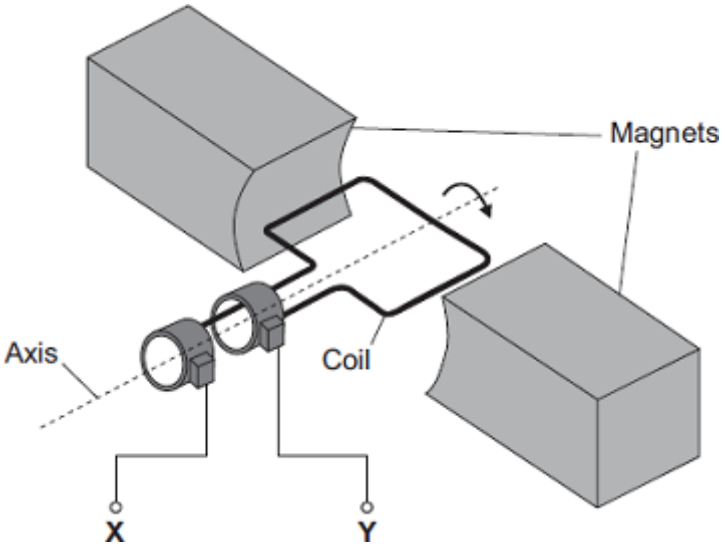
(2)

(Total 5 marks)

Q8.

The diagram shows an a.c. generator.

The coil rotates about the axis shown and cuts through the magnetic field produced by the magnets.



(a) (i) A potential difference is induced between **X** and **Y**.

Use the correct answer from the box to complete the sentence.

electric	**generator**	**motor**	**transformer**

This effect is called the _____ effect.

(1)

(ii) What do the letters a.c. stand for?

_____

(1)

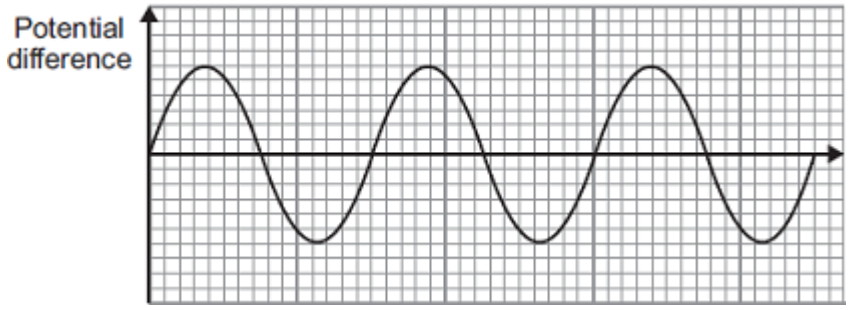
(iii) Name an instrument that could be used to measure the potential difference between **X** and **Y**.

_____

(1)

(b) **Graph 1** shows the output from the a.c. generator.

Graph 1



(i) One of the axes on **Graph 1** has been labelled 'Potential difference'.

What should the other axis be labelled?

_____

(1)

(ii) The direction of the magnetic field is reversed.

On **Graph 1**, draw the output from the a.c. generator if everything else remains the same.

(2)

(c) The number of turns of wire on the coil is increased. This increases the maximum induced potential difference.

State **two** other ways in which the maximum induced potential difference could be increased.

1. _____

_____

2. _____

_____

(2)

(Total 8 marks)

Q9.

The current in a circuit depends on the potential difference (p.d.) provided by the cells and the total resistance of the circuit.

(a) Using the correct circuit symbols, draw a diagram to show how you would connect 1.5 V cells together to give a p.d. of 6 V.

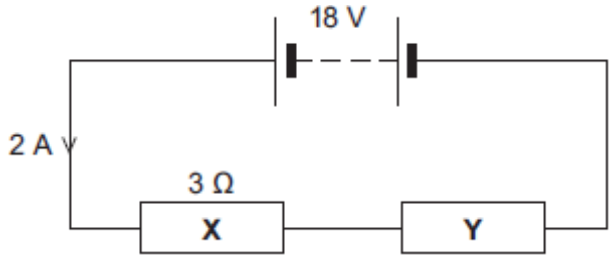
(2)

(b) **Figure 1** shows a circuit containing an 18 V battery.

Two resistors, **X** and **Y**, are connected in series.

- **X** has a resistance of 3 Ω.
- There is a current of 2 A in **X**.

Figure 1



(i) Calculate the p.d. across **X**.

_____

_____

P.d. across **X** = _____ V

(2)

(ii) Calculate the p.d. across **Y**.

_____

_____

_____

P.d. across **Y** = _____ V

(2)

(iii) Calculate the total resistance of **X** and **Y**.

_____

_____

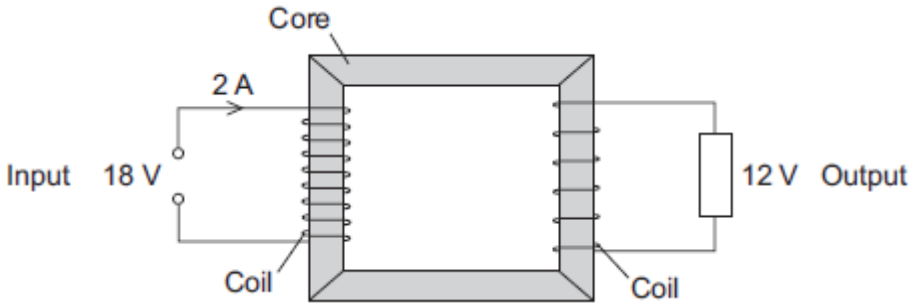
_____

Total resistance of **X** and **Y** = _____ Ω

(2)

(c) **Figure 2** shows a transformer.

Figure 2



(i) An 18 V battery could **not** be used as the input of a transformer.

Explain why.

_____

_____

_____

_____

(2)

(ii) The transformer is 100% efficient.

Calculate the output current for the transformer shown in **Figure 2**.

_____

_____

_____

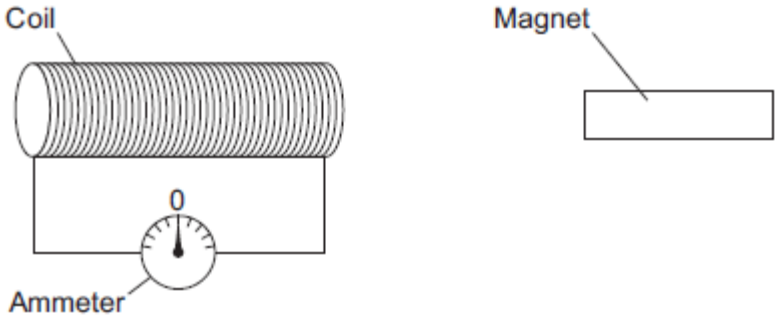
Output current = _____ A

(2)

(Total 12 marks)

Q10.

The figure below shows a coil and a magnet. An ammeter is connected to the coil.



The ammeter has a centre zero scale, so that values of current going in either direction through the coil can be measured.

(a) A teacher moves the magnet slowly towards the coil.

Explain why there is a reading on the ammeter.

(6)

(b) The table below shows some other actions taken by the teacher.

Complete the table to show the effect of each action on the ammeter reading.

Action taken by teacher	**What happens to the ammeter reading?**
Holds the magnet stationary and moves the coil slowly towards the magnet	
Holds the magnet stationary within the coil	
Moves the magnet quickly towards the	

coil	
Reverses the magnet and moves it slowly towards the coil	

(4)

(c) The magnet moves so that there is a steady reading of 0.05 A on the ammeter for 6 seconds.

Calculate the charge that flows through the coil during the 6 seconds.

Give the unit.

_____

_____

_____

Charge = _____

(3)

(Total 13 marks)

Q11.

If a fault develops in an electrical circuit, the current may become too great. The circuit needs to be protected by being disconnected.

A fuse or a circuit breaker may be used to protect the circuit.
One type of circuit breaker is a Residual Current Circuit Breaker (RCCB).

(a) (i) Use the correct answer from the box to complete the sentence.

earth	**live**	**neutral**

A fuse is connected in the _____ wire.

(1)

(ii) Use the correct answer from the box to complete the sentence.

are bigger	**are cheaper**	**react faster**

RCCBs are sometimes preferred to fuses because they _____ .

(1)

(iii) RCCBs operate by detecting a difference in the current between two wires.

Use the correct answer from the box to complete the sentence.

earth and live	earth and neutral	live and neutral

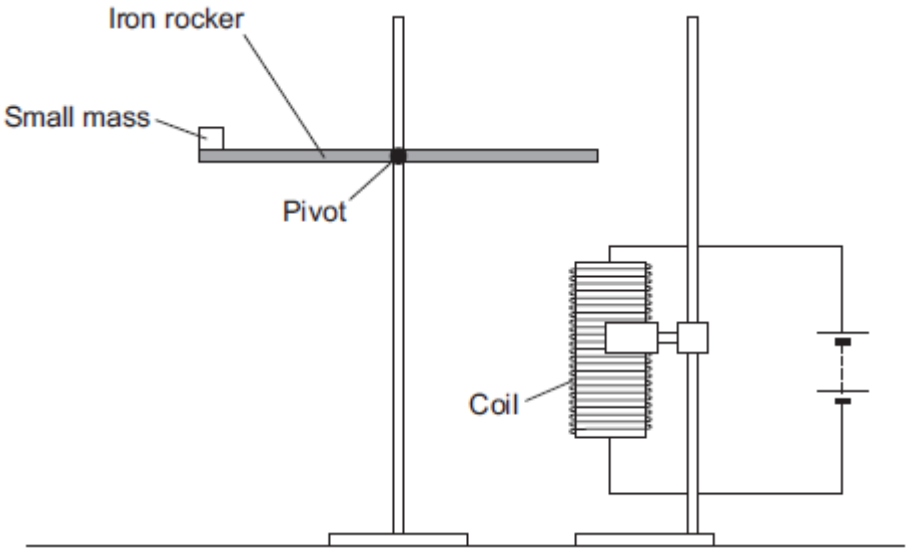
The two wires are the _____ wires.

(1)

(b) An RCCB contains an iron rocker and a coil.

A student investigated how the force of attraction, between a coil and an iron rocker, varies with the current in the coil.

She supported a coil vertically and connected it in an electrical circuit, part of which is shown in the figure below .



She put a small mass on the end of the rocker and increased the current in the coil until the rocker balanced. She repeated the procedure for different masses.

Some of her results are shown in the table below.

Mass in grams	Current needed for the rocker to balance in amps
5	0.5
10	1.0
15	1.5
20	2.0

(i) State **two** extra components that must have been included in the circuit in the figure above to allow the data in the above table to be collected.

Give reasons for your answers.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(ii) A teacher said that the values of current were too high to be safe.

Suggest **two** changes that would allow lower values of current to be used in this investigation.

Change 1 _____

_____

Change 2 _____

_____

(2)

(Total 9 marks)

Q12.

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

There are two types of traditional transformer; step-up and step-down.

Describe the similarities and differences between a step-up transformer and a step-down transformer.

You should include details of:

- construction, including materials used
- the effect the transformer has on the input potential difference (p.d.).

You should **not** draw a diagram.

_____

_____

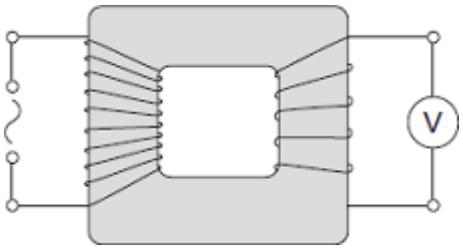
_____

Extra space _____

(Total 6 marks)

Q13.

The diagram shows a transformer with a 50 Hz (a.c.) supply connected to 10 turns of insulated wire wrapped around one side of the iron core.
A voltmeter is connected to 5 turns wrapped around the other side of the iron core.



(a) What type of transformer is shown in the diagram?

Draw a ring around the correct answer.

step-down **step-up** **switch mode**

(1)

(b) The table shows values for the potential difference (p.d.) of the supply and the voltmeter reading.

p.d. of the supply in volts	Voltmeter reading in volts
6.4	3.2
3.2	
	6.4

(i) Complete the table.

(2)

(ii) Transformers are used as part of the National Grid.

How are the values of p.d. in the table different to the values produced by the National Grid?

_____

_____

(1)

(c) Transformers will work with an alternating current (a.c.) supply but will **not** work with a direct current (d.c.) supply.

(i) Describe the difference between a.c. and d.c.

_____

_____

_____

_____

(2)

(ii) Explain how a transformer works.

_____

_____

_____

_____

_____

_____

_____

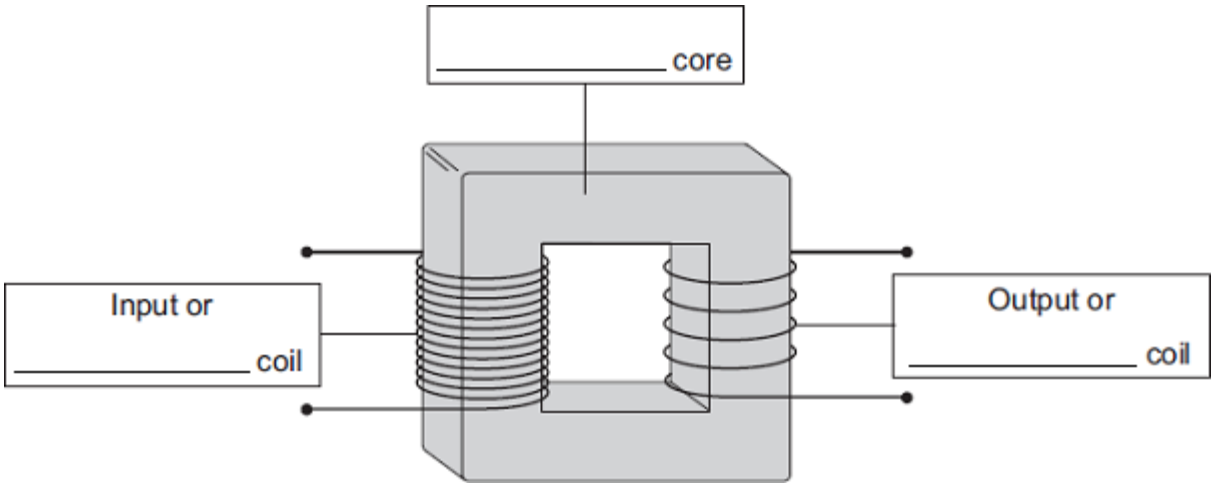
(4)
(Total 10 marks)

Q14.

(a) The diagram shows the structure of a traditional transformer.

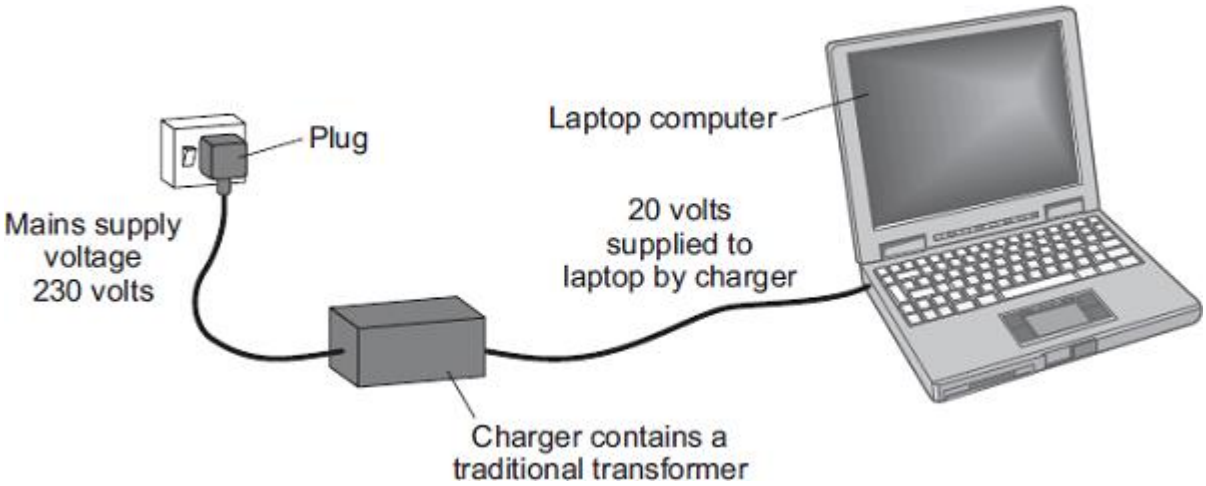
Use words from the box to label the diagram.

aluminium	**brass**	**iron**	**large**	**primary**	**secondary**



(3)

(b) Batteries inside laptop computers are charged using laptop chargers. The laptop charger contains a traditional transformer.



The laptop charger contains a step-down transformer.

What does a step-down transformer do?

_____

(1)

(c) Laptop batteries and mobile phone batteries can only be recharged a limited number of times. When a battery cannot be recharged, it is better to recycle the battery than to throw it away.

Draw a ring around the correct answer to complete the sentence.

The batteries are recycled mainly due to

an environmental
a political
a social

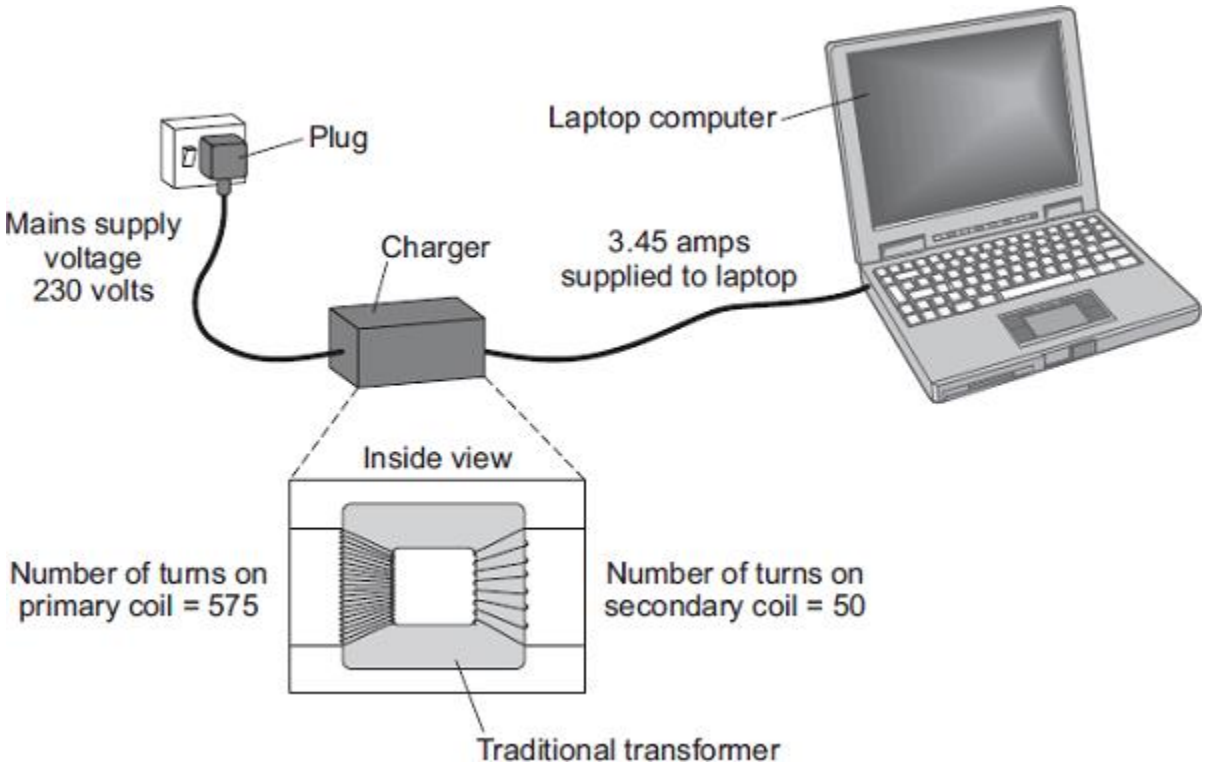
consideration.

(1)

(Total 5 marks)

Q15.

Batteries inside laptop computers are charged using laptop chargers. The laptop charger contains a traditional transformer.



(a) The alternating current flowing through the primary coil of the transformer creates an alternating current in the secondary coil.

Explain how.

(3)

(b) (i) Use information from the diagram to calculate the potential difference the charger supplies to the laptop.

Potential difference = _____ V

(2)

(ii) Calculate the current in the primary coil of the transformer when the laptop is being charged.

Assume the transformer is 100% efficient.

Current = _____ A

(2)

(c) Laptop batteries and mobile phone batteries can only be recharged a limited number of times. After this, the batteries cannot store enough charge to be useful. Scientists are developing new batteries that can be recharged many more times than existing batteries.

Suggest **one** other advantage of developing these new batteries.

_____

(1)

(Total 8 marks)

Q16.

(a) In the National Grid, very large step-up transformers link power stations to the transmission cables.

A transformer used for this purpose has 800 turns on its primary coil and 12 800 turns on its secondary coil. The p.d. (potential difference) across its primary coil is 25 kV.

Use the equation in the box to calculate the p.d. across its secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

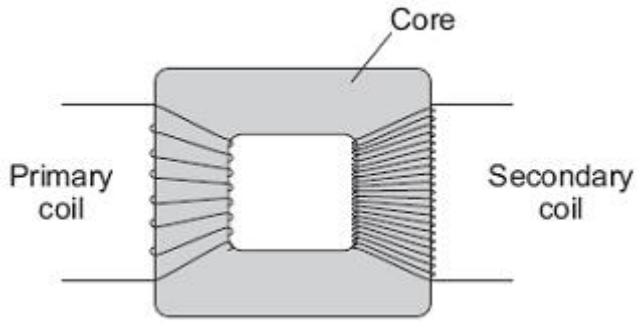
_____

_____

p.d. across secondary coil = _____ volts

(2)

(b) The diagram shows the structure of a transformer.



(i) The primary and secondary coils of a transformer are made of insulated wire.

Why is this insulation necessary?

_____

_____

(1)

(ii) Why is the core made of iron?

_____

_____

(1)

(iii) Explain how the transformer works.

_____

_____

_____

_____

_____

_____

(3)

(c) Before 1926, large towns had their own local power stations. After 1926, these power stations were connected to form the National Grid.

Give **two** advantages of having a National Grid system.

1. _____

_____

2. _____

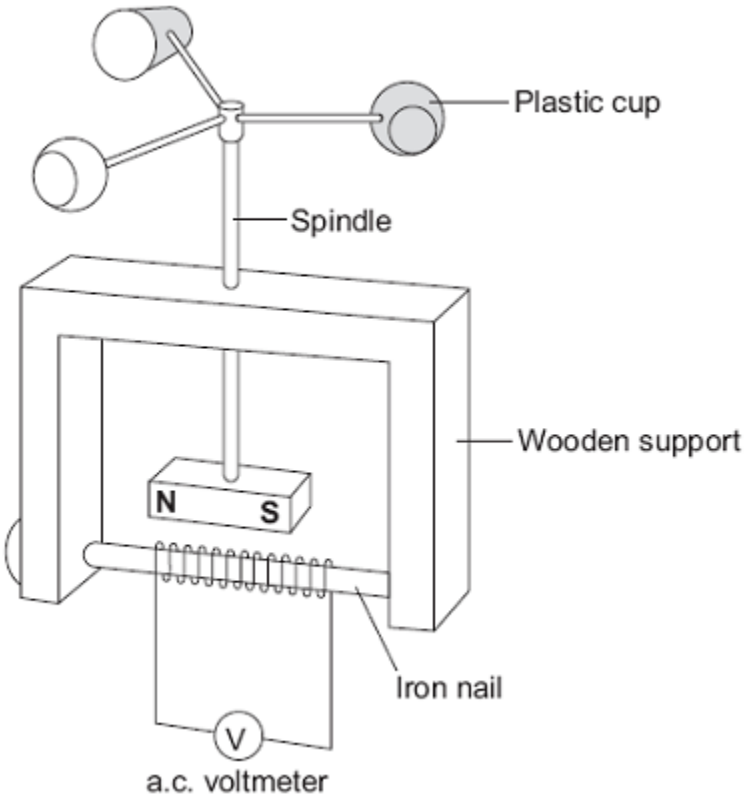
_____

(2)

(Total 9 marks)

Q17.

The diagram shows a student's design for a simple wind speed gauge.



(a) Explain why the wind causes the a.c. voltmeter to give a reading. The explanation has been started for you.

The wind causes the plastic cups to turn _____

_____

_____

_____

_____

_____

_____

(3)

(b) The gauge is not sensitive enough to measure light winds.

Suggest **one** way that the design can be modified to make the gauge more sensitive.

_____

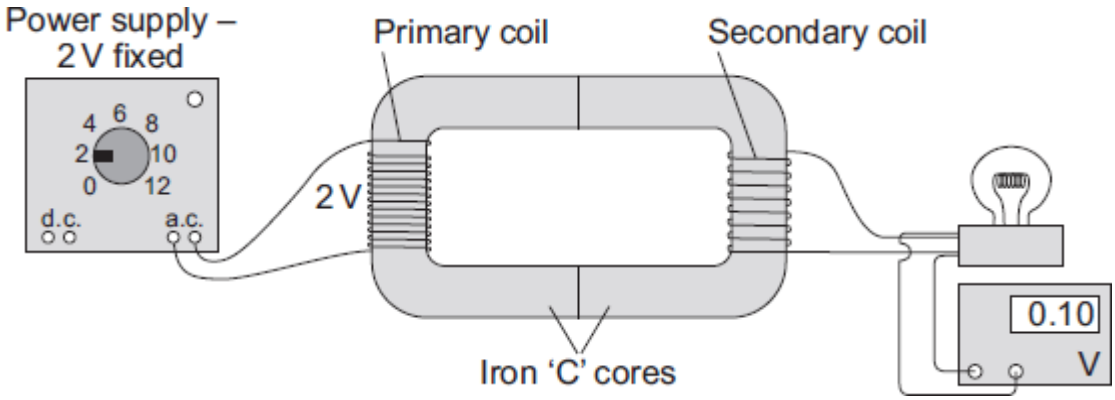
_____

(1)

(Total 4 marks)

Q18.

The diagram shows the apparatus used by a student to investigate a transformer.



(a) The transformer made by the student would not have worked if the core had been made from aluminium and not iron.

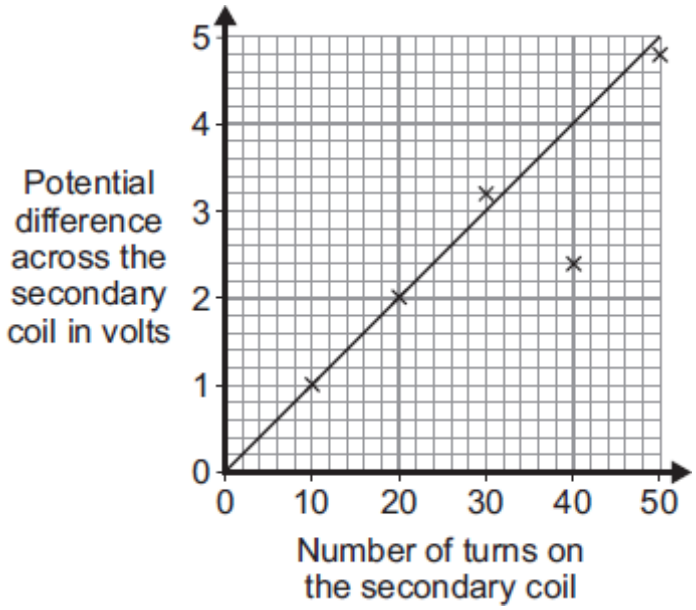
Why?

_____

_____

(1)

(b) The student made changes to the number of turns used to make the secondary coil. He then measured the potential difference across the secondary coil after each change.
The graph shows the student's results.



(i) What range of values was used for the number of turns on the secondary coil?

From _____ to _____

(1)

(ii) When he drew the line of best fit, the student ignored one of the data points.

Why?

_____

_____

(1)

(iii) What is the minimum number of turns needed on the secondary coil for the transformer to act as a step-up transformer?

_____

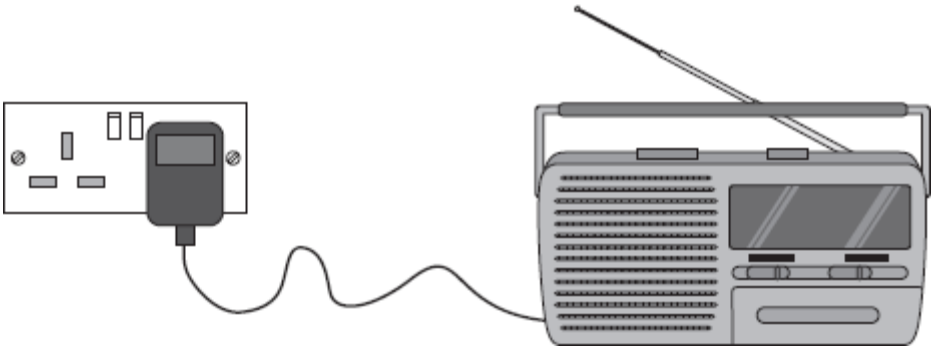
Give a reason for your answer.

_____

_____

(2)

(c) A radio can be used with a 9 V battery or it can be plugged into the 230 V mains electricity supply using an adapter. The mains adapter contains a transformer.



Why must the mains adapter contain a transformer?

_____

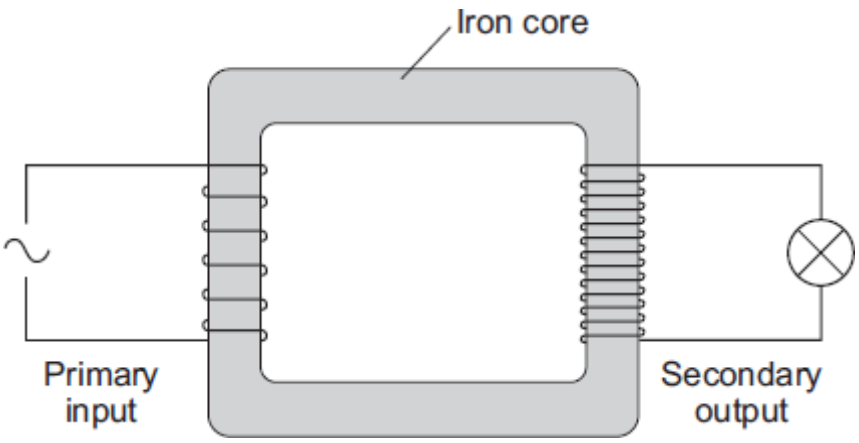
_____

(1)

(Total 6 marks)

Q19.

The diagram shows a transformer.



(a) (i) Is the transformer in the diagram being used as a step-up transformer or as a step-down transformer?

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

a step-up transformer ☐

a step-down transformer ☐

Give a reason for your answer.

_____

_____

(1)

(ii) Why is the core made of iron?

_____

_____

(1)

(b) The power supply to a laptop computer contains a transformer designed to change the 230 V mains input to a 15 V output. The transformer has 920 turns on its primary coil.

Use the equation in the box to calculate the number of turns on the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

_____

_____

_____

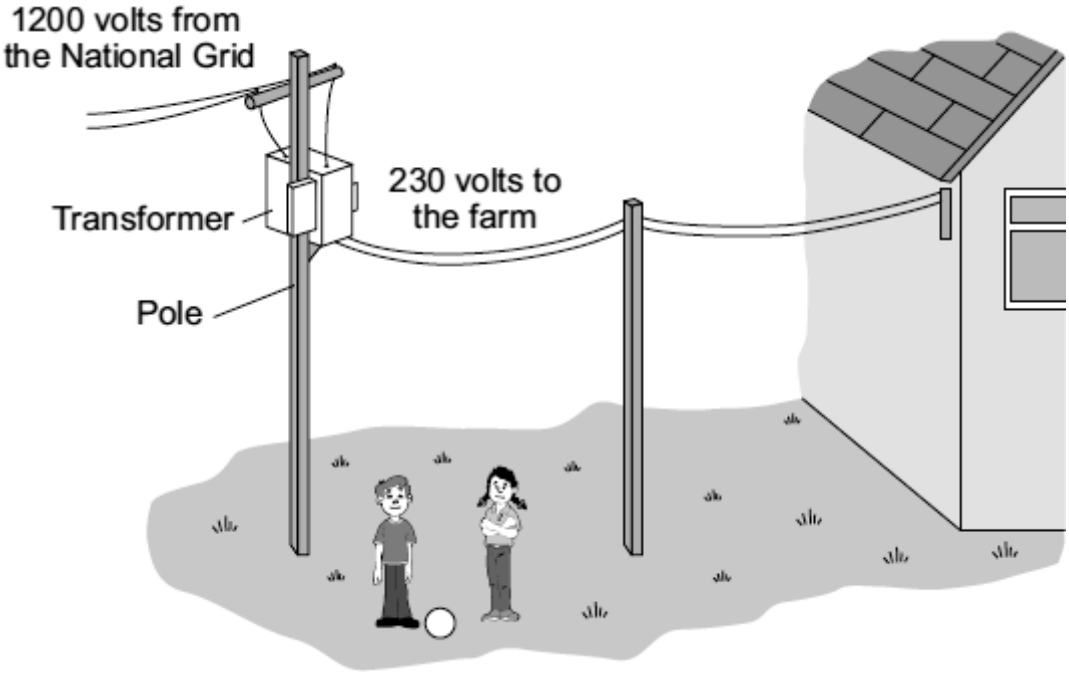
Number of turns on the secondary coil = _____

(2)

(Total 4 marks)

Q20.

The diagram shows part of the system used to supply a farm with electricity.



(a) The core of the transformer is made of metal.

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

The metal used for the core of the transformer is

copper.
iron.
steel.

(1)

(b) (i) What sort of transformer is shown in the diagram?

_____

(1)

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

In this transformer, the number of turns on the secondary coil is

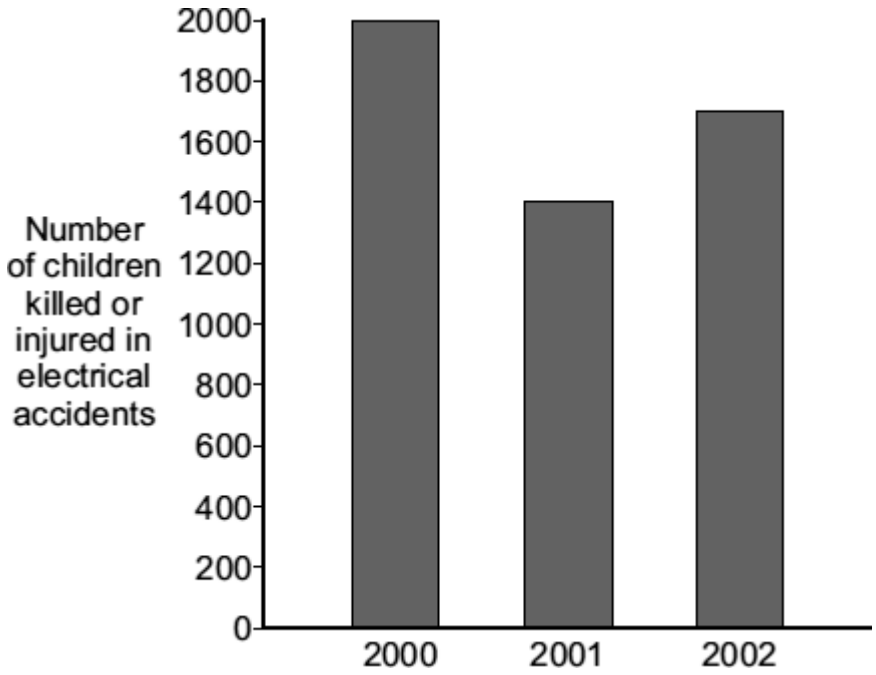
less than
the same as
greater than

the number of turns on the primary coil.

(1)

(c) Transformers and other electrical equipment can be dangerous.

The following bar chart shows the numbers of children, aged 14 or under, killed or injured in electrical accidents in the UK in 2000, 2001 and 2002.



(i) In which of these years were most children killed or injured in electrical accidents?

_____

(1)

(ii) A newspaper claims that the number of children killed or injured by electrical accidents will increase in 2011.

Which of the following gives a reason why the information given in the graph does not support this claim.

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

The pattern shows an upward trend. ☐

The pattern shows a downward trend. ☐

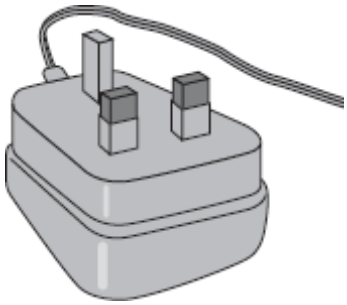
There is no pattern. ☐

(1)

(Total 5 marks)

Q21.

(a) The drawing shows the plug for operating a radio from the mains.



This plug contains a transformer. There are 4600 turns on its primary coil and 200 turns on its secondary coil. The plug is used on the mains supply and has a potential difference (p.d.) of 230 V across its primary coil.

Use the equation in the box to calculate the p.d. across the secondary coil of the transformer.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

_____

_____

_____

_____

p.d. across secondary = _____ V

(2)

(b) The coils of the transformer are made of insulated wire.

Why is the wire insulated?

_____

_____

(1)

(c) (i) What material is the core of a transformer made from?

_____

(1)

(ii) Why is the core made from this material?

_____

_____

(1)

(Total 5 marks)

Q22.

(a) In the National Grid, very large step-up transformers link power stations to the transmission cables.

A transformer used for this purpose has 800 turns on its primary coil and 12 800 turns on its secondary coil. The p.d. (potential difference) across its primary coil is 25 kV.

Use the equation in the box to calculate the p.d. across its secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

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

_____

_____

p.d. across secondary coil = _____

(3)

(b) The primary and secondary coils of a transformer are made of insulated wire.

Why is this insulation necessary?

_____

_____

(1)

(c) Describe what happens when an alternating potential difference is applied across the primary coil of a transformer.

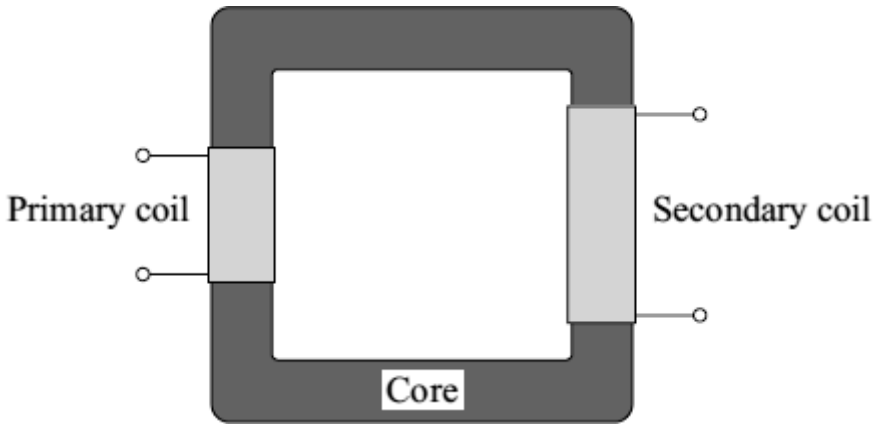
_____

(3)

(Total 7 marks)

Q23.

(a) The diagram shows the basic structure of a step-up transformer.



(i) What is the core made of?

(1)

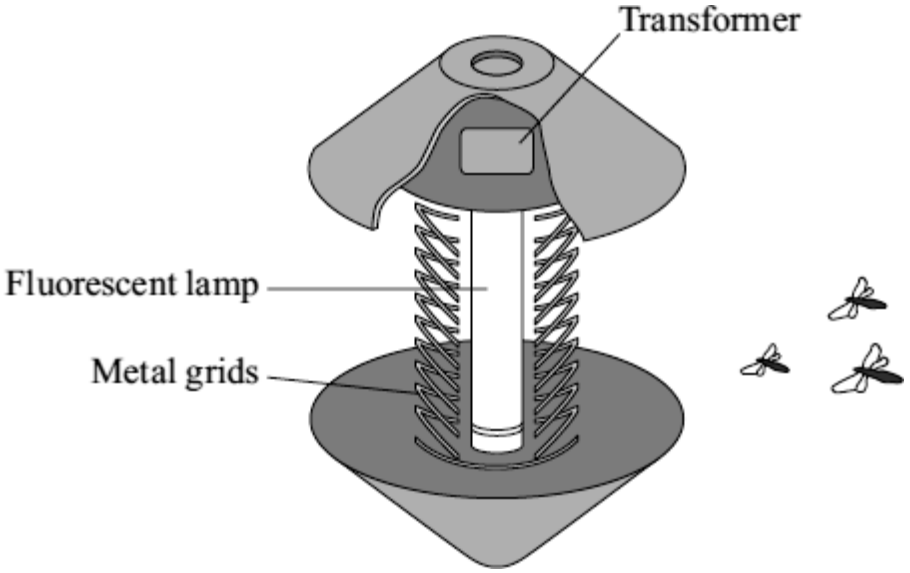
(ii) Explain how an alternating input produces an alternating output.

(3)

(b) Fly killers are used in kitchens and food stores because flying insects carry diseases which cause food poisoning.

The diagram shows the inside of one design. Insects are attracted to a fluorescent lamp. The metal grids have a high potential difference (p.d.) between them. The

insects are killed as they fly between the grids.



A transformer is used in the fly killer. There is a p.d. of 230 V across the primary coil. There are 300 turns of wire on the primary coil and 4000 turns on the secondary coil.

Use the equation in the box to calculate the p.d. across the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

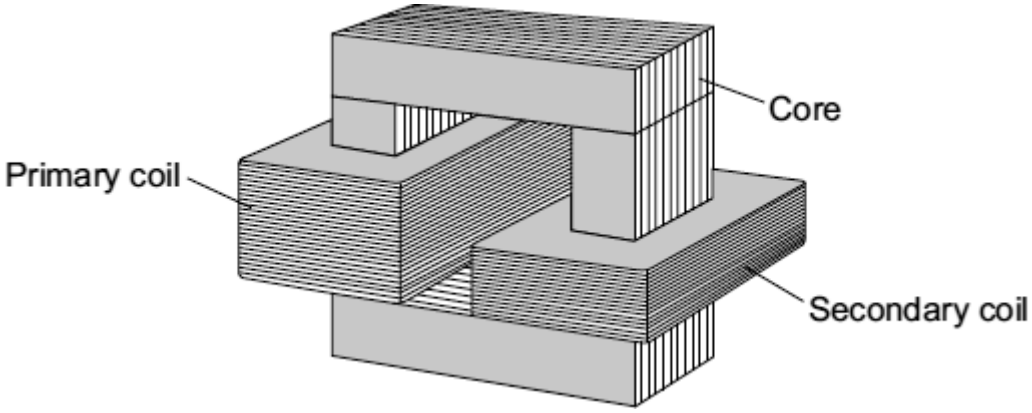
Potential difference = _____ V

(3)

(Total 7 marks)

Q24.

A teacher demonstrates a small transformer.



(a) (i) What is the core made of?

Draw a ring around the correct word in the box.

aluminium	**copper**	**iron**

(1)

(ii) The potential difference (p.d.) across the secondary coil is less than the p.d. across the primary coil.

What sort of transformer is it?

_____

(1)

(b) Where is a step-up transformer used as part of the National Grid?

_____

(1)

(c) The teacher writes a note about the transformer but leaves **five** spaces.

Use the correct words from the box to complete the spaces.

coil	**core**	**current**	**ends**	**field**	**wire**

A transformer works because an alternating _____ in the primary _____ produces a changing magnetic _____ in the _____ and then in the secondary coil.

This induces an alternating potential difference across the _____ of the secondary coil.

(5)

(Total 8 marks)

Q25.

The diagram shows a USB power adapter which plugs into a 230 V a.c. mains socket.

The adapter contains a small step-down transformer.

(a) The core of the transformer is made of laminated soft iron.

Why is iron used?

_____

_____

(1)

(b) The coils of the transformers are made of insulated copper wire.

Why is the wire insulated?

_____

_____

(1)

(c) There are 500 turns on one coil of the transformer and 20 000 turns on the other coil.

Use the equation in the box to calculate the p.d. across the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

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

_____

_____

_____

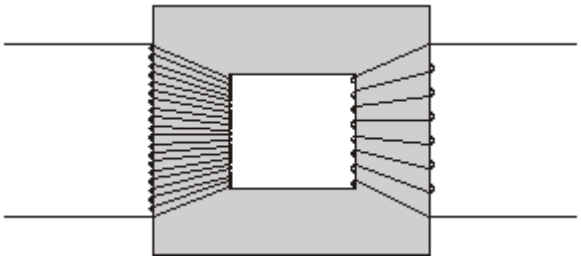
p.d. across the secondary = _____

(3)

(Total 5 marks)

Q26.

(a) The basic structure of a transformer is a primary coil of insulated wire, an iron core and a secondary coil of insulated wire.



(i) Why is the core made of iron?

_____

_____

(1)

(ii) Explain how a transformer works.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(b) A small step-down transformer is used in the charger for an electric screwdriver.

The input to the transformer is 230 V a.c. mains supply and the output is 5.75 V a.c. There are 3200 turns on the primary coil.

Use the equation in the box to calculate the number of turns on the transformer's secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

_____

_____

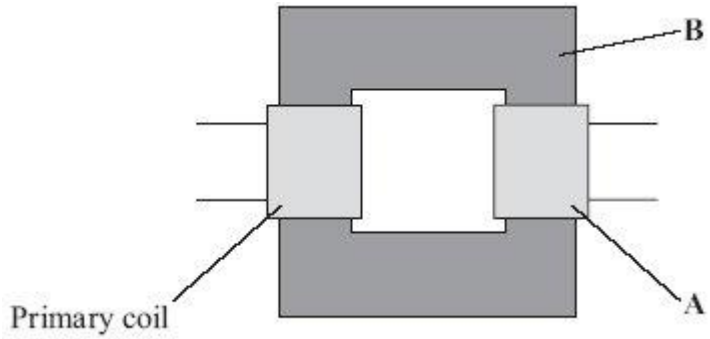
Number of turns = _____

(2)

(Total 7 marks)

Q27.

(a) The diagram shows a transformer.



(i) What is part **A**?

_____

(1)

(ii) What is part **B** and what is it made of?

_____

_____

(2)

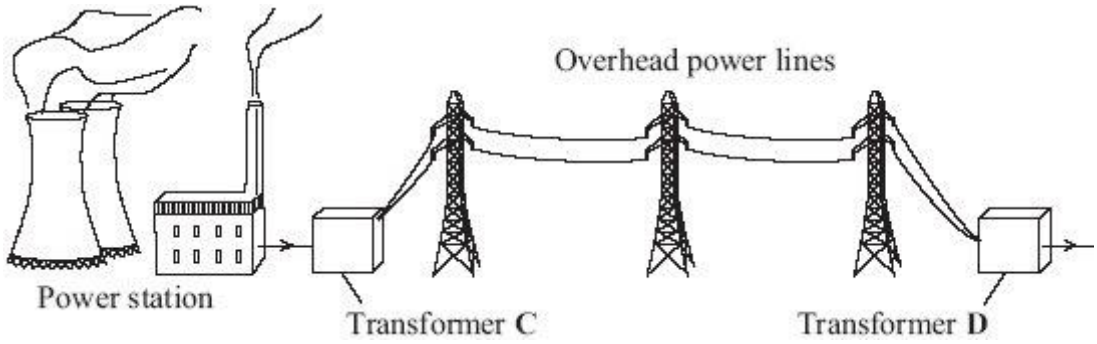
(iii) When there is an alternating current in the primary coil, what is produced in part **B**?

_____

_____

(2)

(b) Transformers are used in the National Grid. The diagram shows part of the National Grid.



Complete the **two** spaces in the sentence.

Transformer **C** is a _____ transformer and transformer **D** is a _____ transformer.

(1)

(c) This is an item from a newspaper.

Health at risk from power lines?

Are high voltage power lines a health risk to people who live near them?

Some scientists think that scientific evidence shows that they are.

Other scientists do not think that the scientific evidence supports this conclusion.

Which **two** suggestions would reduce the possible risk to people's health? Put a tick (✓) in the box next to your answers.

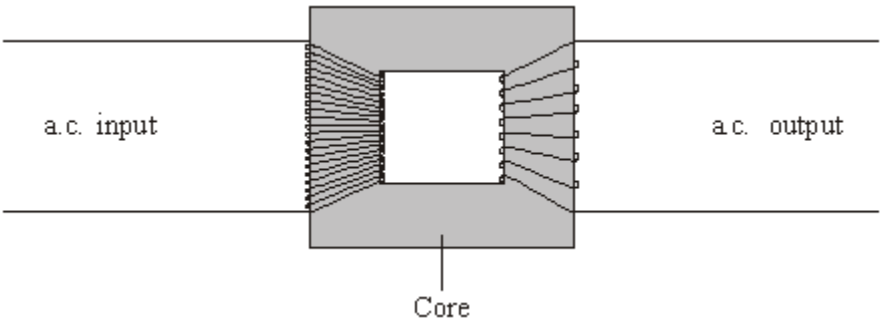
Do not build new houses near to existing power lines.	☐
Move the power lines so that they take the shortest routes.	☐
Move each power station to the centre of the nearest city.	☐
Build new power lines away from where people live.	☐
Use more transformers in the National Grid.	☐

(2)

(Total 8 marks)

Q28.

(a) The diagram shows a transformer.



(i) Is the transformer in the diagram being used as a step-up transformer or as a step-down transformer?

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

a step-up transformer ☐

a step-down transformer ☐

Explain your answer.

_____

_____

(1)

(ii) Why is insulated wire, and not uninsulated wire, used to make the coils?

_____

_____

(1)

(iii) Why is the core made of iron?

_____

_____

(1)

(b) A transformer has 500 turns on its primary coil and 7500 turns on its secondary coil. The potential difference across the primary coil is 150 volts.

Use the equation in the box to calculate the potential difference across the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

Potential difference across the secondary coil = _____ volts

(2)

(c) Step-down transformers are used between power lines and people's houses.

Explain why.

(2)

(d) Before 1926, large towns had their own local power stations. After 1926, these power stations were connected to form the National Grid.

Explain the advantage of having a National Grid system.

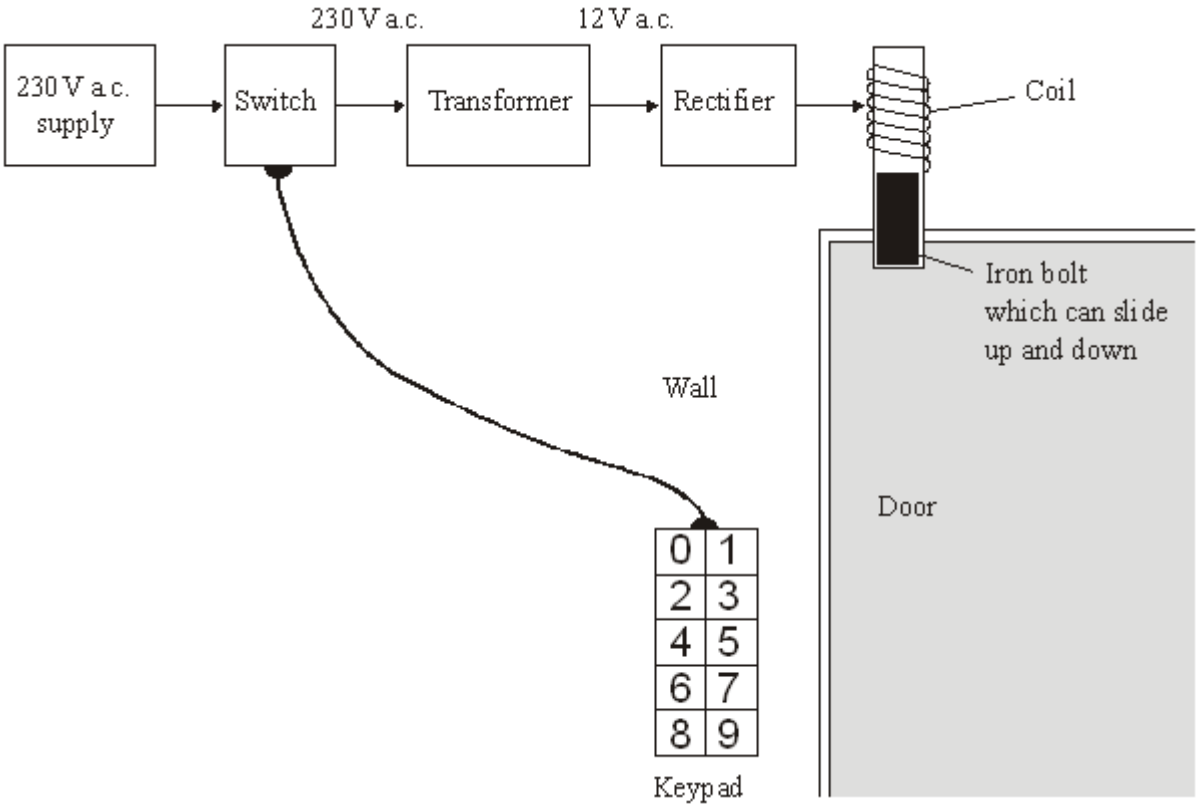
(2)

(Total 9 marks)

Q29.

The diagram shows the design for a remotely controlled door bolt.

When the correct numbers are entered into the keypad the transformer switches on. Then the door can be opened.



(a) What kind of transformer is shown in the diagram?

_____

(1)

(b) What does the abbreviation a.c. stand for?

_____

(1)

(c) Complete the sentences using the correct words from the box.

attracts	**downwards**	**magnet**	**reflects**	**repels**
sideways	**switch**	**transformer**	**upwards**	

(i) When a current flows in the coil, the coil becomes a _____ .

(ii) The coil _____ the iron bolt which moves _____

(3)

(Total 5 marks)

Q30.

(a) This notice is on the back of a television set.

The transformer used in the television set has 75 turns on its primary coil. The potential difference (p.d.) across the primary coil is 230 volts and the p.d. across the secondary coil is 32 200 volts.

Use the equation below to calculate the number of turns on the secondary coil.

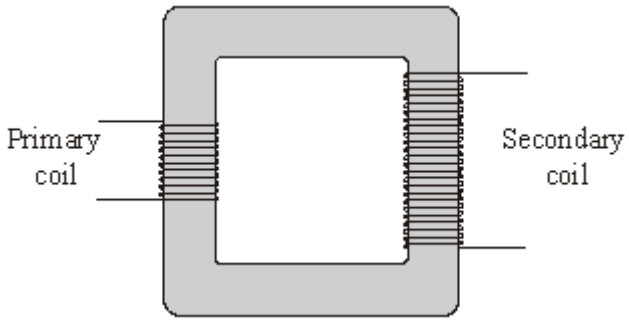
$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

Number of turns on the secondary coil = _____

(2)

(b) The diagram shows the structure of a transformer.



Explain how the transformer works.

_____

_____

(3)

(Total 5 marks)

Q31.

A transformer is used to reduce the 230 V a.c. mains to the 12 V supply required for the lighting system. The transformer has 1150 turns on its primary coil.

Calculate the number of turns on the secondary coil of the transformer. Show clearly how you work out your answer.

_____

_____

_____

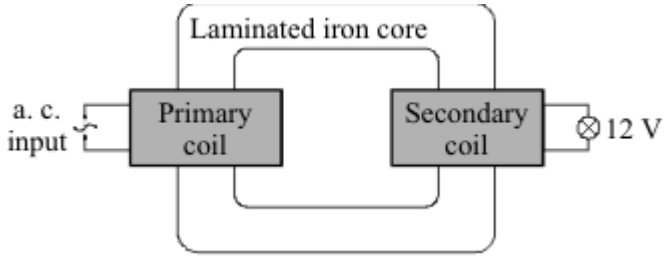
number of turns on the secondary coil = _____

(2)

(Total 2 marks)

Q32.

(a) The diagram represents a simple transformer used to light a 12 V lamp. When the power supply is switched on the lamp is very dim.



(i) Give **one** way to increase the voltage at the lamp without changing the power supply.

_____

_____

(1)

(ii) What is meant by the iron core being *laminated*?

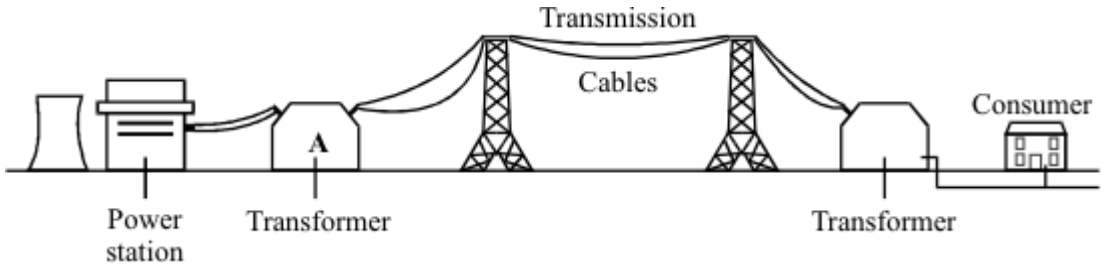
_____

_____

(1)

(b) Electrical energy is distributed around the country by a network of high voltage

cables.



(i) For the system to work the power is generated and distributed using alternating current rather than direct current. Why?

_____

_____

(1)

(ii) Transformers are an essential part of the distribution system. Explain why.

_____

_____

_____

(2)

(iii) The transmission cables are suspended high above the ground. Why?

_____

(1)

(c) The power station generates 100 MW of power at a voltage of 25 kV. Transformer **A**, which links the power station to the transmission cables, has 44 000 turns in its 275 kV secondary coil.

(i) Write down the equation which links the number of turns in each transformer coil to the voltage across each transformer coil.

_____

_____

(1)

(ii) Calculate the number of turns in the primary coil of transformer **A**. Show clearly how you work out your answer.

_____

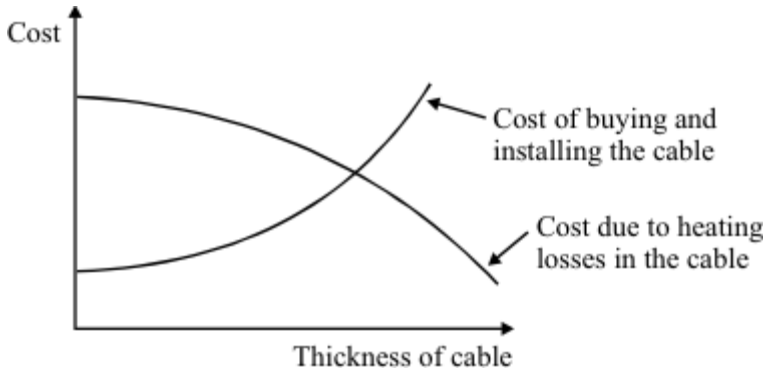
_____

_____

Number of turns = _____

(2)

(d) The diagram shows how the cost of transmitting the electricity along the cables depends upon the thickness of the cable.



(i) Why does the cost due to the heating losses go down as the cable is made thicker?

_____

(1)

(ii) By what process is most heat energy lost from the cables?

_____

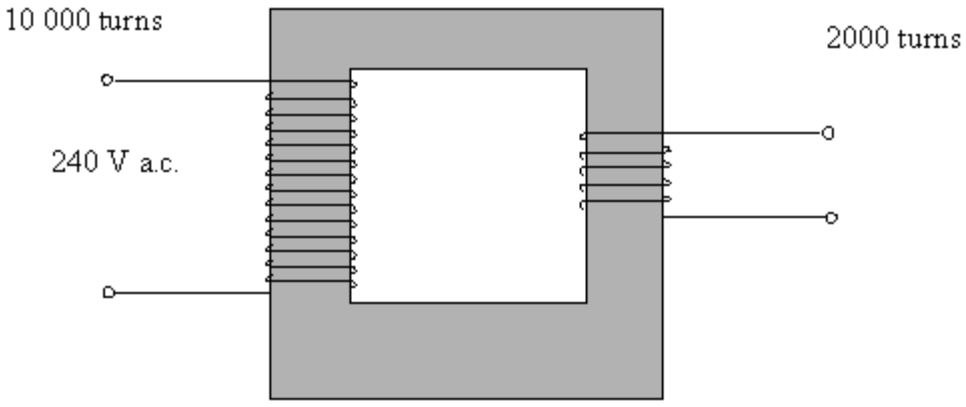
(1)

(Total 11 marks)

Q33.

(a) An appliance in a house has a transformer. The transformer is used to reduce the voltage to the level needed by the appliance.

The diagram shows the transformer.



(i) Name the material used for the core of the transformer.

_____

(1)

(ii) The transformer has 10 000 turns on the input side and 2000 turns on the output side. If the mains voltage of 240 volts is applied to the input, calculate the output voltage. You may find the following information helpful:

$$\frac{\text{output voltage}}{\text{input voltage}} = \frac{\text{number of turns on output coil}}{\text{number of turns on input coil}}$$

(3)

(b) Explain, in terms of magnetic fields, how a transformer works.

(4)

(c) A 12 V car battery is connected to the input leads of the transformer. It is hoped to reduce the voltage to 2.4 V in order to run a small motor. When the output voltage is measured it is found to be zero.

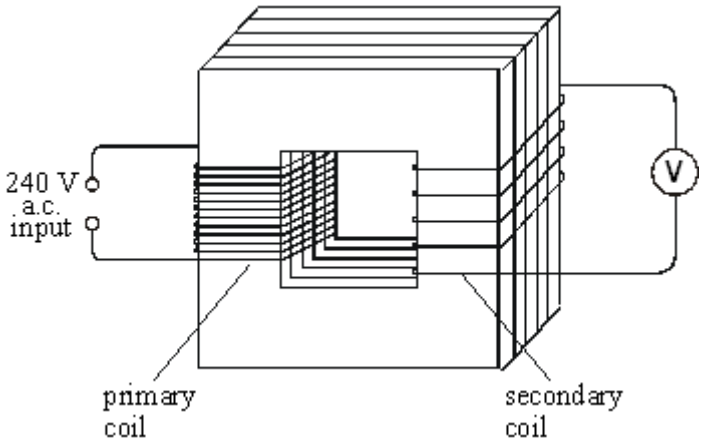
Explain why the output voltage is zero.

(2)

(Total 10 marks)

Q34.

The diagram below shows a transformer.



(i) Name the material used to make the core of the transformer.

_____

(1)

(ii) The primary coil has 48 000 turns and the secondary coil 4000 turns.

If the input voltage is 240 V a.c., calculate the output voltage.

_____

_____

Answer _____ V

(2)

(iii) Explain how the use of such a transformer could be adapted to transform a low voltage into a higher voltage.

_____

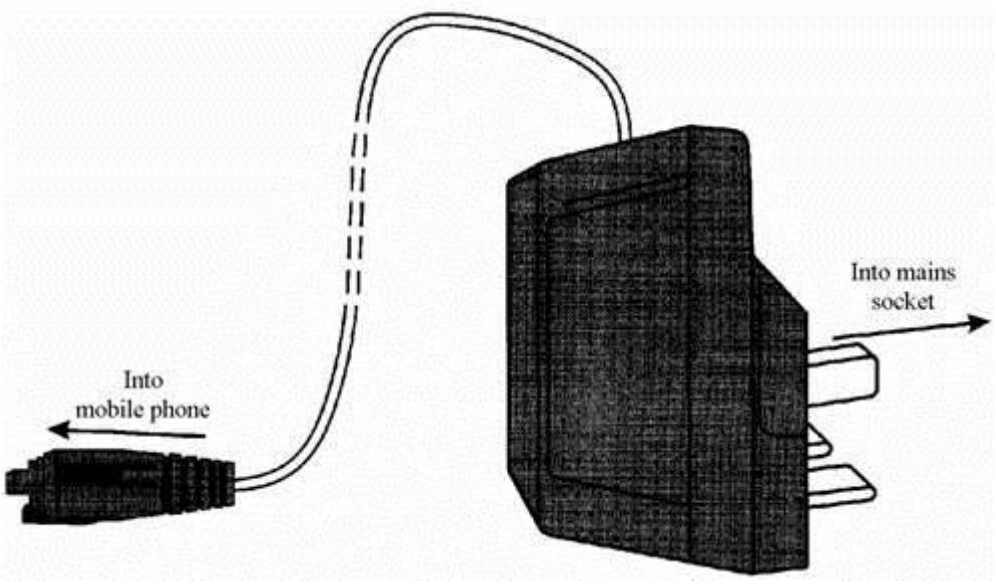
_____

(1)

(Total 4 marks)

Q35.

(a) The drawing shows a small transformer used to recharge the battery in a 4.2 V mobile phone from a 230 V mains supply.



Explain how you know that this is a *step-down* transformer.

_____

_____

(1)

(b) A transformer consists of an insulated coil of wire, called the primary coil, on one side of a core. Another coil of insulated wire, called the secondary coil, is on the other side.

Give **two** features of the *core*.

1. _____

2. _____

(2)

(Total 3 marks)

Mark schemes

Q1.

(a) P-waves are longitudinal and
S-waves are transverse

1

(b) 0.4

1

(c) wave speed = frequency × wavelength

allow $v = f\lambda$

1

(d) 7200 = 0.4 × wavelength

1

$$\text{wavelength} = \frac{7200}{0.4}$$

1

wavelength = 18 000 (m)

allow up to full marks for ecf using their answer to part ***(b)***

a method shown as
7200 × 2.5 = 18 000
scores ***0*** *marks*

1

an answer 18 000 scores ***3*** *marks*

(e) because S-waves cannot travel through a liquid

1

and S-waves do not travel through the (outer) core

allow some (seismic) waves cannot travel through a liquid and do not go through the core for ***1*** *mark*

1

(f) magnetic field around the coil changes
or
the magnetic field (lines) cut by the coil

allow the generator effect

1

(g) because the magnet changes direction

1

(h) stationary

1

(i) any **two** from:

- stronger magnetic field

allow stronger magnet
allow heavier magnet
bigger magnet is insufficient

- more turns on the coil
  bigger coil is insufficient
  *do **not** accept more coils of wire*

- turns pushed closer together

- spring with a lower spring constant
  allow less stiff spring
  allow weaker spring
  *do **not** accept add an iron core*

2

[13]

Q2.

(a) any **one** from:

- too few turns / coils on the secondary
  allow number of turns / coils on the primary was increased

- p.d. across the primary was reduced
  ignore human error

1

(b) the p.d. (across the secondary) goes above 2V
allow p.d. across secondary is higher than p.d. across primary after 20 turns

1

(c) it increases (until the nails reach a constant temperature)

1

(d) $\frac{640}{4} = \frac{V_p}{1.75}$

1

$V_p = \frac{640 \times 1.75}{4}$

1

$V_p = 280$ (V)

1

$280 \times I_p = 336$
allow their calculated
$V_p \times I_p = 336$

1

$I_p = 1.2$ (A)

allow an answer that is consistent with their calculated value of V_p

1

or

$336 = I_s \times 1.75$ (1)

$$I_s = \frac{336}{1.75} \quad (1)$$

$I_s = 192$ (A) (1)

$$I_p = 192 \times \frac{4}{640} \quad (1)$$

allow

$$I_p = \text{their calculated } I_s \times \frac{4}{640}$$

$I_p = 1.2$ (A) (1)

allow an answer that is consistent with their calculated value of I_s

*an answer of 1.2 (A) scores **5** marks*

[8]

Q3.

(a) It is easily magnetised.

1

(b) p.d. across the secondary coil is smaller (than p.d. across the primary coil)

1

(c) ratio $\frac{V_p}{V_s} = \frac{6}{12}$

accept any other correct ratio taken from the graph

1

$\frac{6}{12} = \frac{50}{N_p}$

use of the correct turns ratio and substitution or correct transformation and substitution

1

$N_p = 100$

*allow 100 with no working shown for **3** marks*

1

[5]

Q4.

(a) a magnetic field

accept electromagnetic field

heat is insufficient

1

that is alternating / changing

1

(b) 20

*allow **1** mark for correct substitution, ie*

$$\frac{230}{11.5}$$

provided no subsequent step

2

(c) (most) transformers are not 100% efficient

allow energy / power is lost to the surroundings

allow energy / power is lost as heat / sound

power is lost is insufficient

1

(d) (i) 0.01 (V)

1

because there is a change in p.d. each time (the number of turns changes)

allow because all the results (to 2 decimal places) are different

accept if results were to 1 decimal place, there might not be a difference

1

(ii) student 2 moved the coil more slowly (than student 1)

accept student 2 moved the coil at a different speed to student 1

do not accept student 2 moved the coil faster (than student 1)

1

(iii) both sets of results show the same pattern

accept trend for pattern

results are similar is insufficient

results follow a pattern is insufficient

1

(iv) (electromagnetic) induction

accept it is induced

do not accept electric / magnetic induction

1

(e) any **one** from:

- more economical / cheaper for the consumer

allow more convenient

- easier/cheaper to replace if broken/lost
  allow in case one gets lost

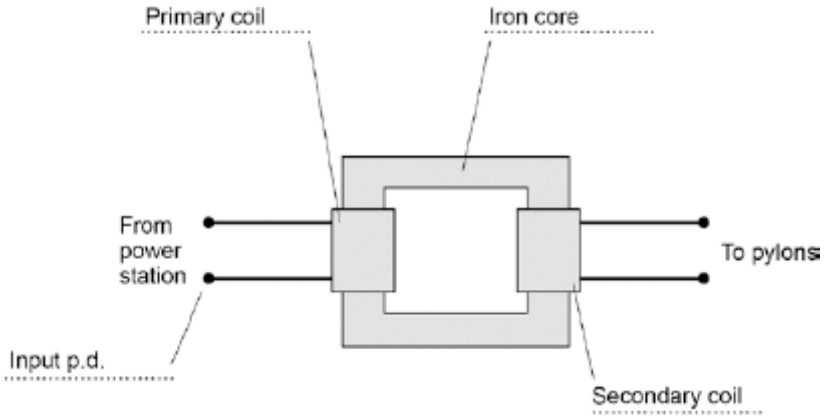
- since fewer transformers need to be made less resources are used
  allow fewer plug sockets are needed
  allow fewer transformers are needed
  environmentally friendly is insufficient

1

[11]

Q5.

(a) (i)



1
1
1
1

(ii) 16 000
allow 1 mark for correct substitution
ie 400 ÷ 25 = n ÷ 1000

2

(iii) p.d. increased (by transformer at power station)
do not accept energy increased

1

so current decreases

1

this reduces energy / power loss (in cables)
allow heat for energy
allow increases the efficiency
*do **not** accept no energy losses*

1

(b) smaller / lighter

1

uses little power / energy

1

when left switched on with no load applied

dependent on second marking point

1

[12]

Q6.

(a) (i) Iron

1

(ii) 50

ignore references to current

reason only scores if 50 chosen

1

there are more turns on the secondary coil (than the primary coil)

accept it is a step-up transformer

not more coils

1

(b) (i) 200

1

(ii) any **one** from:

- Lighter
- smaller
- use very little power / current (when switched on with no load / phone attached).

accept more efficient

do not accept uses no power / current

a disadvantage of a traditional transformer is insufficient on its own

1

[5]

Q7.

(a) an alternating current through the primary coil (in the charging base)

it must be clear which coil is being referred to

1

causes a changing / alternating magnetic field in / around the (iron) bar

1

which <u>induces</u> an (alternating) p.d. across the secondary coil (in the toothbrush)

accept <u>induces</u> an (alternating) current in the secondary coil

1

(b) 18

*allow **1** mark for correct substitution, ie*

$$\frac{230}{7.2} = \frac{575}{n_s}$$

2

[5]

Q8.

(a) (i) generator

1

(ii) alternating current

1

(iii) voltmeter / CRO / oscilloscope / cathode ray oscilloscope

1

(b) (i) time

1

(ii) peaks and troughs in opposite directions

1

amplitude remains constant

dependent on first marking point

1

(c) any **two** from:

- increase speed of coil
- strengthen magnetic field
- increase area of coil

*do **not** accept larger*

2

[8]

Q9.

(a) *attempt to draw four cells in series*

1

correct circuit symbols

circuit symbol should show a long line and a short line, correctly joined together

example of correct circuit symbol:

1

(b) (i) 6 (V)

*allow **1** mark for correct substitution, ie*

*V = 3 × 2 scores **1** mark*

provided no subsequent step

2

(ii) 12 (V)

ecf from part (b)(i)
18 – 6
or
*18 – their part (b)(i) scores **1** mark*

2

(iii) 9 (Ω)

ecf from part (b)(ii) correctly calculated
3 + their part (b)(ii) / 2
or
*18 / 2 scores **1** mark*
provided no subsequent step

2

(c) (i) need a.c.

1

battery is d.c.

1

(ii) 3 (A)

*allow **1** mark for correct substitution, ie*
*18 × 2 = 12 × I_s scores **1** mark*

2

[12]

Q10.

(a) *there is a* magnetic field *(around the magnet)*

1

(this magnetic field) changes / moves

1

and cuts through coil
accept links with coil

1

so a p.d. *induced* across coil

1

the coil forms *a* complete circuit

1

so a current (*is* induced)

1

(b) ammeter reading does not change
must be in this order
accept ammeter has a small reading / shows a current

1

zero

1

greater than before

accept a large(r) reading

1

same as originally but in the opposite direction

accept a small reading in the opposite direction

1

(c) 0.30

*allow **1** mark for correct substitution, ie 0.05 = Q / 6*

2

C / coulomb

allow A s

1

[13]

Q11.

(a) (i) live

1

(ii) react faster

1

(iii) live and neutral

1

(b) (i) ammeter

1

to measure current

accept to measure amps

1

plus any **one** from:

- *variable resistor* (1)
  to vary current (1)
  accept variable power supply
  accept change or control

- *switch* (1)
  to stop apparatus getting hot / protect battery
  or
  to reset equipment (1)

- fuse (1)
  to break circuit if current is too big (1)

2

(ii) any **two** from:

- use smaller mass(es)
- move mass closer to pivot
- reduce gap between coil and rocker
- more turns (on coil)*coil / loop*
- iron core in coil

accept use smaller weight(s)

2

[9]

Q12.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks
No relevant / correct content.

Level 1 (1–2 marks)
Either there is an attempt at a description of the construction of a transformer

or

a correct statement of the effect of one type of transformer on the input p.d.

Level 2 (3–4 marks)
There is a description of the construction of a transformer
and
a correct statement of the effect of one type of transformer on the input p.d.

Level 3 (5–6 marks)
There is a clear description of the construction of a transformer
and
there is a correct description of how transformers affect the input p.d.

details of construction:

extra information

a (laminated) core

core is made from a magnetic material / iron

2 coils

the coils are made from an electrical conductor / copper

the coils are covered in plastic / insulation

the coils are (usually) on opposite sides

step-up transformer has more turns on secondary coil than (its) primary (or vice versa)

step-down transformer has fewer turns on secondary coil than (its) primary (or vice

versa)

effect on input p.d. :

step-up transformer, the output p.d. is greater (than the input p.d.)

accept voltage for p.d.

step-down transformer, the output p.d. is lower (than the input p.d.)

6

[6]

Q13.

(a) step-down

1

(b) (i) 1.6

correct order only

1

12.8

1

(ii) values of p.d. are smaller than 230 V

1

(c) (i) a.c. is constantly changing direction

accept a.c. flows in two / both directions

accept a.c. changes direction(s)

a.c. travels in different directions is insufficient

1

d.c. flows in one direction only

1

(ii) an alternating current / p.d. in the primary creates a changing / alternating magnetic field

1

(magnetic field) in the (iron) core

current in the core negates this mark

accept voltage for p.d.

1

(and so) an alternating p.d.

1

(p.d.) is induced across secondary coil

1

[10]

Q14.

(a) iron

correct positions only

1

primary

1

secondary

1

(b) (it) decreases the p.d.

accept it would increase current
accept voltage for p.d.
the voltage goes from 230(V) to 20(V) is insufficient
*do **not** accept decreases current / energy / power*
*do **not** accept decreases p.d. / voltage and current*

1

(c) an environmental

1

[5]

Q15.

(a) (the alternating current creates) a <u>changing / alternating magnetic field</u>

1

(magnetic field) in the (iron) core

accept that links with the secondary coil
current in the core negates this mark

1

(causing a) potential difference (to be) <u>induced</u> in / across secondary coil

accept voltage for p.d.

1

(b) (i) 20

*allow **1** mark for correct substitution, ie* $\frac{230}{V_s} = \frac{575}{50}$

or $\frac{V_s}{230} = \frac{50}{575}$

2

(ii) 0.3

or

correct calculation using $230 \times I_p$ = their (b)(i) × 3.45

*allow **1** mark for correct substitution, ie*
$230 \times I_p = 20 \times 3.45$
allow ecf from (b)(i) for 20
OR

substitution into this equation $\frac{I_p}{I_s} = \frac{N_s}{N_p}$

2

(c) any **one** from:

- fewer (waste) batteries have to be sent to / buried in land-fill
- the soil is polluted less by batteries in land-fill
- fewer (waste) batteries have to be recycled
- fewer batteries have to be made
- less raw materials are used in making batteries
- customers have to replace their batteries less often
  longer lifetime is insufficient
- customers have to buy fewer (replacement) batteries
  it costs less is insufficient

1

[8]

Q16.

(a) 400 000

*allow **1** mark for correct substitution ie*

$\frac{25000}{?} = \frac{800}{12800}$

or

$\frac{25}{?} = \frac{800}{12800}$

2

(b) (i) any **one** from:

*do **not** accept any response in terms of heat insulation, safety or electric shock*

- (so that there is) no short circuit
- (so that the) current goes around the coil
  *do **not** accept electricity for current*
- (so that the) current does not enter the core

1

(ii) (easily) magnetised (and demagnetised)

accept '(it's) magnetic'
*do **not** accept 'because it's a conductor'*

1

(iii) alternating current in the primary (coil)

1

produces a changing magnetic field (in the core)

1

this induces an (alternating) potential difference across the secondary (coil)

1

(c) any **two** from:

- if the (local) power station breaks down / fails / demand / load exceeds supply
- electricity / power can be switched from elsewhere in the system / from other power station(s)
- electricity can be generated in places remote from customers
- (in total) fewer power stations are needed
- power available in rural / remote areas
- National Grid allows for (better) control of supply and demand

2

[9]

Q17.

(a) which causes the magnet to turn / spin / rotate

1

(magnetic) field / lines of force / flux rotate(s) / move(s) / through / in / cut(s) the coil

*do **not** credit the idea that movement 'creates' the magnetic field*

1

potential difference / p.d. / voltage induced across the coil

*do **not** credit just 'current induced'*

1

(b) any **one** from:

- more powerful / stronger / lighter magnet

  *do **not** credit 'a bigger magnet'*
- larger / more / bigger / lighter cups / with a bigger surface area
- longer arms
- lubricate the spindle
- add more turns to the coil

1

[4]

Q18.

(a) aluminium cannot be magnetised

accept aluminium is not magnetic
"it" refers to aluminium
*do **not** accept aluminium is not easily magnetised*
reference to conduction and aluminium negates mark
iron can be magnetised is insufficient

1

(b) (i) 10 to 50

either order

1

(ii) (data is) anomalous

*accept does **not** fit the pattern*
it is an error is insufficient

1

(iii) 21

accept 22
*do **not** accept any fraction of a turn ie 20.1*

1

secondary p.d. (just) larger than primary p.d.

accept output (just) larger than input/2V

or

there must be more turns on the secondary coil than primary coil

*do **not** accept coil for turns*

1

(c) to reduce/step-down the (input) p.d./voltage

mains p.d. is too high is insufficient
step-down transformer is insufficient
*answers in terms of changing/ stepping-up current **or** fuse blowing **or** not working with 230 volts are insufficient*
any mention of step-up negates mark
*stepping down both voltage/p.d. **and** current negates mark*

1

[6]

Q19.

(a) (i) step-up

both parts required

more turns on the secondary / output (coil)

*do **not** accept coils for turns*

'secondary output is greater than primary input' is insufficient

1

(ii) (easily) magnetised (and demagnetised)

accept (it's) magnetic

it's a conductor negates answer

1

(b) 60

*allow **1** mark for correct substitution, ie* $\frac{230}{15} = \frac{720}{N_s}$

2

[4]

Q20.

(a) iron

accept any unambiguous correct indication

1

(b) (i) step-down (transformer)

*do **not** accept down step or a description*

1

(ii) less than

accept any unambiguous correct indication

1

(c) (i) 2000

1

(ii) There is no pattern.

1

[5]

Q21.

(a) 10

*allow **1** mark for correct substitution ie* $\frac{230}{V_s} = \frac{4600}{200}$

2

(b) any **one** from:

- to prevent short circuiting
- to ensure that the current flows / goes round the coil
- to prevent the current entering the core

*do **not** accept electrocution*

*do **not** accept electricity for current*

answers including heat / energy loss negate mark

1

(c) (i) (soft) iron

*do **not** accept 'steel'*

1

(ii) can be magnetised

because it is magnetic

answers including it's a conductor negate mark

1

[5]

Q22.

(a) 400 000

*allow **1** mark for correct substitution ie*

$$\frac{25000}{?} = \frac{800}{12800}$$

or

$$\frac{25}{?} = \frac{800}{12800}$$

2

volt(s) / V

*an answer 400 gains **2** marks*

*an answer 400 kilovolts / kV gains **3** marks*

*although the unit mark is independent to gain **3** marks it must be consistent with the numerical value*

1

(b) any **one** from:

*do **not** accept any response in terms of heat insulation, safety or electric shock*

- (so that there is) no short circuit
- (so that the) current goes round the coil

  *do **not** accept electricity for current*
- (so that the) current does not enter the core

1

(c) (the alternating p.d. in the primary causes) an (alternating) current in the primary

reference to the current in the core negates this mark

1

(causes an) <u>alternating / changing</u> (magnetic) field in the (iron) core

1

<u>induces</u> (alternating) p.d. across the <u>secondary</u> (coil)

accept in / through or similar for across
accept current for p.d.
accept output (coil) for secondary (coil)
*to gain **3** marks the sequence must be correct*

1

[7]

Q23.

(a) (i) (laminated soft) iron

*do **not** accept steel*

1

(ii) produces a magnetic field

accept magnetic flux

which is alternating / changing / varying

and which induces / produces an alternating / changing potential difference across the secondary coil

accept current / voltage

3

(b) 3067 (V)

*allow all **3** marks for 3060 to 3070 (V)*

$V = \frac{230 \times 4000}{300}$ *gains **2** marks*

$\frac{230}{V} = \frac{300}{4000}$ *gains **1** mark*

3

[7]

Q24.

(a) (i) iron

1

(ii) step-down (transformer)

1

(b) any **one** from:

- after the power station
- after the generator
- before the power lines
- before the pylons

1

(c) each correct (1)

in its correct place

current

coil

field

core

ends

5

[8]

Q25.

(a) (it is) magnetic

or *will carry (an alternating) magnetic field*
or *magnetises and demagnetises (easily)*
reference to conduction negates the mark

1

(b) so the current / electricity does not flow through the iron / core

accept 'so the current / electricity / wires do not short (circuit)'
responses in terms of heat insulation negate the mark
ignore references to safety

1

(c) 5.75 or 5.8 or 6(.0)

*allow for **1** mark **either***

$$\frac{230}{p.d.} = \frac{20\,000}{500}$$

or

$p.d. = 230 \div 40$

2

V / volt(s)

1

[5]

Q26.

(a) (i) (quickly) becomes magnetized

or *(quickly) loses its magnetism*
or *'it's (a) magnetic (material)'*
any reference to conduction of electricity/heat nullifies the mark

1

(ii) any **four** from:

- insulation prevents electricity/current flowing through the iron/core

or *'insulation so electricity/current only flows in the wires/turns/coils'*

- alternating current/a.c. in the primary (coil)
- produces a changing magnetic field (in the iron/core)
- (and hence magnetic) field in the secondary (coil)
- induces/generates/produces an alternating potential difference/p.d./voltage across the secondary (coil)
- (and hence) alternating current/a.c. in the secondary (coil)

4

(b) 80 (turns)

or *credit (1) for any equation which if correctly evaluated would give 80 example*

example

$$\frac{230}{5.75} = \frac{3200}{number\ of\ turns}$$

2

[7]

Q27.

(a) (i) secondary(coil) / output (coil)

*do **not** accept just coil*

1

(ii) core

*do **not** accept for either mark it is made out of iron ore*

1

(laminated soft) iron

*allow **1** mark for 'it is made out of iron core'*

1

(iii) magnetic field

accept magnetism / magnetic force

1

(which is) changing / alternating

direction (of field) changes / strength (of field) varies

scoring second mark is dependent on first mark

1

(b) ...step-up .... step-down ...

both in the correct order

1

(c) Do not build new houses ....

1

Build new power lines away ....

*deduct **1** mark for any other(s) to a minimum total of (0)*

1

[8]

Q28.

(a) (i) step-down (transformer) because fewer turns on the output/secondary (coil)

no credit for just 'step-down transformer'

accept '…less turns…'
*do **not** credit '…fewer coils…'*

***or** 'the p.d. across the input / primary will be greater than the p.d. across the output / secondary'*

1

(ii) to prevent a short (circuit)(through the turns of wire or through the core

*do **not** credit references to safety **or** heat (insulation)*

1

(iii) (easily) magnetised (and demagnetised)

accept '(it's) magnetic'
*do **not** accept 'because it's a conductor'*

1

(b) 2250

correct substitution

eg $\frac{150}{p.d.across secondary} = \frac{500}{7500}$ *gains **1** mark*

***or** appropriate transformation*

eg (p.d. across secondary =) $\frac{number of turns on secondary}{number of turns on primary}$
*× p.d. across primary gains **1** mark*

2

(c) any **two** from:

- <u>to reduce the voltage</u> / p.d. (of the domestic supply)

  ***or** to reduce to 230 V*
  allow 'to reduce to 240 V'
  *do **not** credit 'reduce <u>current</u> to 230V'*

- higher voltage difficult to insulate

- higher voltage (would) result in (fatal) electric shock

  ***not** just 'less dangerous'*

- domestic appliances are not designed for (very) high voltage (input) / (are designed) for 230V

  *do **not** credit 'to increase efficiency' / 'to save energy' do **not***

credit just 'it's safer'

2

(d) any **two** (1) each

- if the (local) power station breaks down / fails / demand / load exceeds supply

1

or words to that effect

- electricity / power can be switched from elsewhere in the system / from other power station(s)

***or** words to that effect*

- electricity can be generated in places remote from customers

***or** words to that effect*

- (in total) fewer power stations are needed
- power available in rural / remote areas
- National Grid allows for (better) control of supply and demand

*do **not** credit just cheaper / more efficient / safer*

1

[9]

Q29.

(a) step-down (transformer)

1

(b) alternating current

accept minor misspellings but
*do **not** credit 'alternative current'*

1

(c) (i)(ii) magnet

attracts

upwards

correct order essential
accept 'up'

3

[5]

Q30.

(a) 10 500

*allow **1** mark for 75 × 32 200 ÷ 230*

2

(b) any **three** from:

- alternating current (a.c.) in the primary (coil)
- produces a **changing** magnetic field / flux (in the core)
- which is made of (laminated soft) iron
- this induces
  must be idea of inducing something in the secondary coil
- an alternating potential difference across the secondary coil
  accept voltage for potential difference

3

[5]

Q31.

60

*allow **1** mark for correct transformation*

2

[2]

Q32.

(a) (i) **one** of the following:

- increase number of turns on the secondary coil
- decrease number of turns on the primary coil

1

(ii) constructed in (thin) layers

1

(b) (i) transformers only work with a c

1

(ii) used to increase **or** decrease **or** change voltage **or** current

reducing the energy **or** heat **or** power loss (along the cables)

1

or reduce to safe domestic level
must be consistent with first answer

1

(iii) (several metres of) air gives good electrical insulation (between cables and earth)
or reduce chance of earthing **or** sparks **or** arcing
or to avoid people touching it

1

(c) (i) $$\frac{\text{voltage across primary}}{\text{voltage across secondary}} = \frac{\text{no of turns in primary}}{\text{no of turns in secondary}}$$

accept $\frac{VP}{VS} = \frac{NP}{NS}$

or $\frac{Vin}{Vout} = \frac{Nin}{Nout}$

1

(ii) Np = 4000

$\frac{25(000)}{275(000)} = \frac{NP}{44000}$ *for **1** mark*

2

(d) (i) resistance of cable decreases

1

(ii) convection (to the air)
or
conduction (to the air)
not radiation

1

[11]

Q33.

(a) (i) Iron

for 1 mark

1

(ii) V/240 = 2000/10 000
V = 48
V

for 1 mark each

3

(b) changing current in primary causes changing (magnetic) field in core links to secondary inducing voltage (emf) in secondary (**NOT** current) secondary voltage/current is alternating

for 1 mark each

4

(c) magnetic field not changing/no electromagnetic induction because direct current

for 1 mark each

2

[10]

Q34.

(i) iron

for 1 mark

1

(ii) 20

gains 2 marks

else working

gains 1 mark

2

(iii) reverse input/output

for 1 mark

or increase secondary turns

1

[4]

Q35.

(a) output voltage less than (the) input voltage

*or p.d. across output less that p.d. across input **or** output is (only) 4.2 V (whereas) the input is 230V*
or WTTE (words to that effect)

1

(b) any **two** from

(made of soft) iron

laminated

***or** designed to reduce eddy currents*
***or** made of thin slices with slices of insulating material between them*

core(s) joined to make a ring

2

[3]