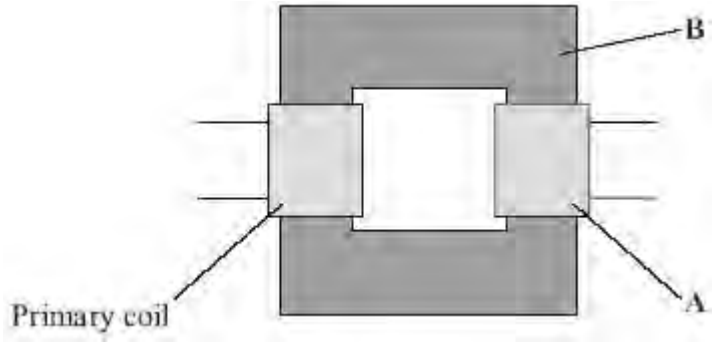
**Q1.** (a) The diagram shows a transformer.




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

.....

**(1)**

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

.....

.....

**(2)**

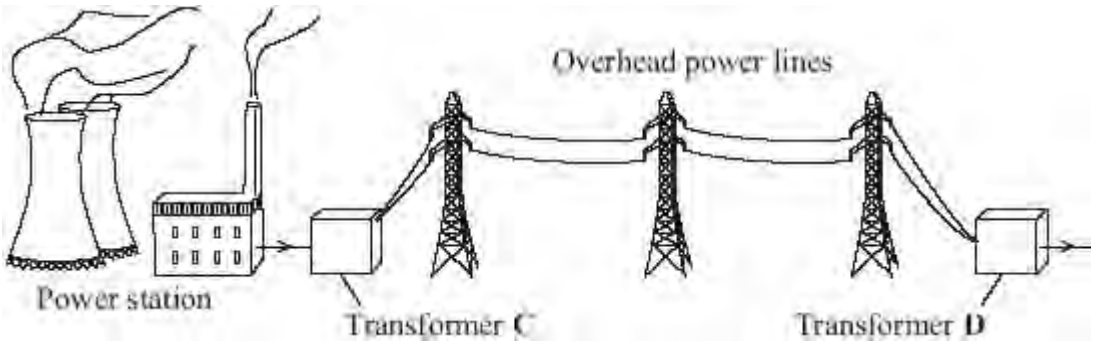
(iii) When there is an alternating current in the primary coil, what is produced in part **B**?

.....

.....

**(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. ☐

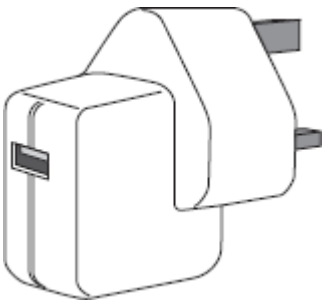
Move each power station to the centre of the nearest city. ☐

Build new power lines away from where people live. ☐

Use more transformers in the National Grid. ☐

**(2)**
**(Total 8 marks)**

**Q2.** 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.

.....

.....

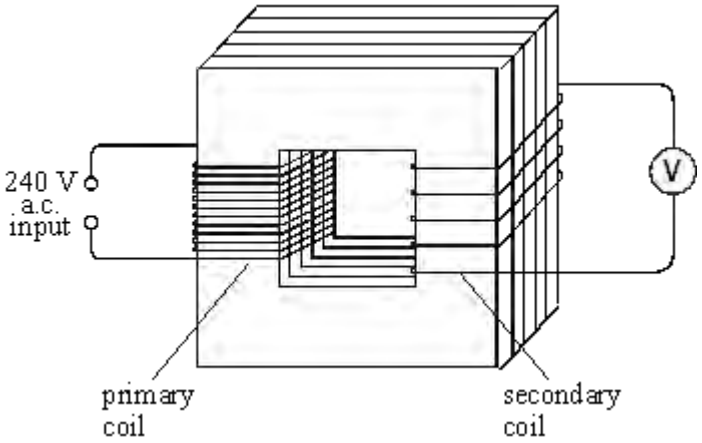
.....

p.d. across the secondary = .....

**(3)**

**(Total 5 marks)**

**Q3.** 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.

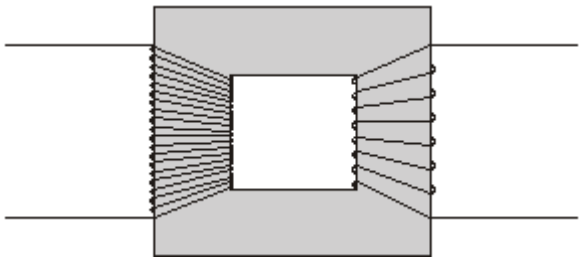
.....

.....

**(1)**

**(Total 4 marks)**

**Q4.** (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.

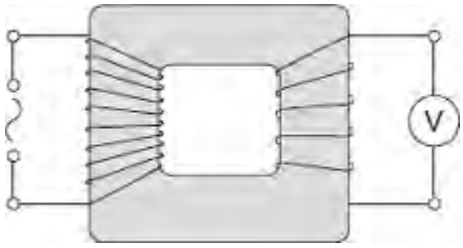
.....

.....

Number of turns = .....

**(2)**
**(Total 7 marks)**

**Q5.** 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.

.....

.....

.....

.....

.....

.....

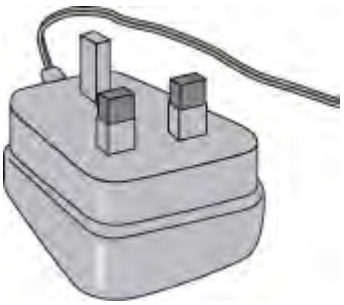
.....

.....

**(4)**

**(Total 10 marks)**

**Q6.** (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)**

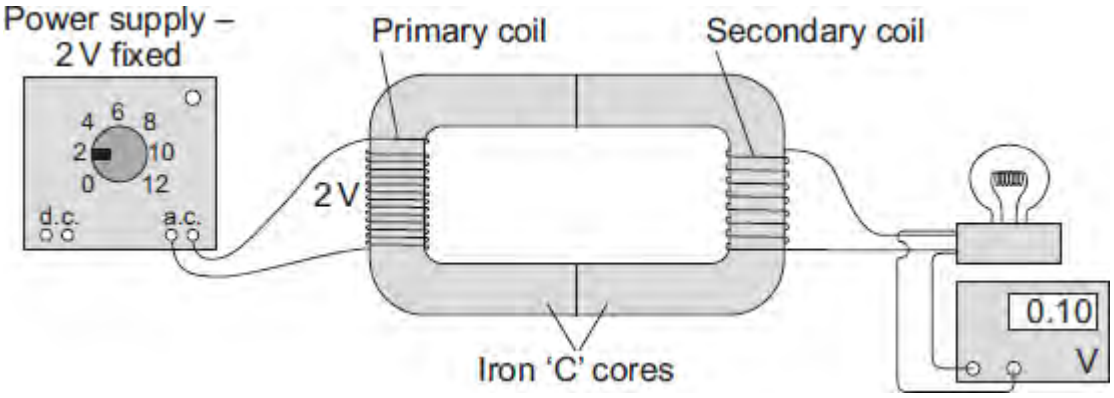
(ii) Why is the core made from this material?

.....

.....

**(1)**
**(Total 5 marks)**

**Q7.**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.

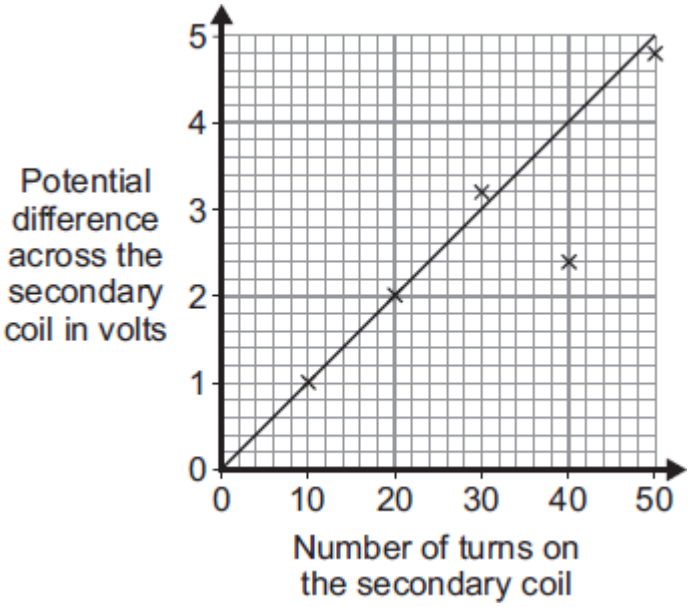
Why?

.....

.....

**(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?

.....

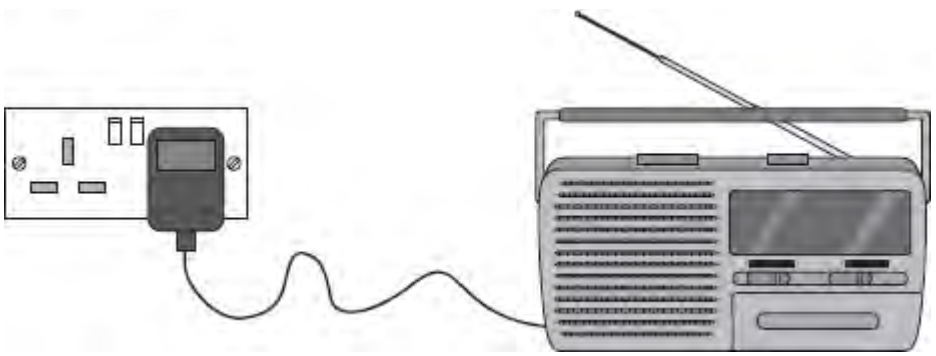
Give a reason for your answer.

.....

.....

**(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)**

**Q8.** 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 |
|---|---|---|

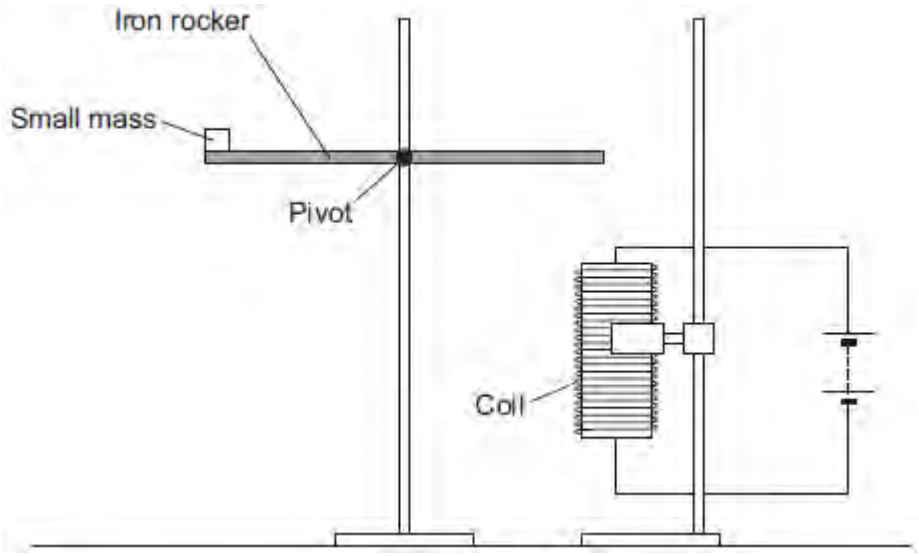
The two wires are the ..... wires.

**(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)**