How to write long answers for electricity questions.

Question: **Mains electricity is distributed by the National Grid. Explain the main features of the National Grid.**

When writing a long answer, you need to tell a story and include scientific content. It is not enough just to put down several bullet points. The best way to start, is to **define** any key terms in the question. In this question, the key term is **the National Grid.**

The National Grid consists of a network of step-up transformers and step-down transformers connected by a network of cables.

Next you want the essay to follow a logical **sequence.** In this case describe the flow of electricity from the power station to the home. So, your sequence will be: step up transformer - cables – step down transformer.

Because this is an **explain** question, after describing each part of the sequence, explain why this happens.

So, let's start with the step-up transformer.

Electricity from a power station goes through a step-up transformer. The step-up transformer increases the voltage to 400000V and lowers the current.

You have described the role of the step-up transformer, now you need to explain why this happens.

This is done to prevent energy being lost as heat as the electricity travels along the cables. When the current in a cable is higher, more energy is dissipated to the surroundings through heating. As a high current wastes more energy than a low current, electrical power is transported around the grid at a high voltage and a low current

Now describe the cables...

The cables are good conductors of electricity and are insulated.

...and explain why.

This also prevents energy being lost as the electricity travels along the cable by reducing resistance and preventing heat loss.

Finally finish the sequence with the step-down transformer...

The electricity goes through a step-down transformer. This reduces the voltage to 230V...

...and explain the reason.

...which is then safe to use in houses.

The whole answer looks like this...

The National Grid consists of a network of step up transformers and step down transformers connected by a network of cables. Electricity from a power station goes through a step-up transformer. The step-up transformer increases the voltage to 400000V and lowers the current. This is done to prevent energy being lost as heat as the electricity travels along the cables. When the current in a cable is higher, more energy is dissipated to the surroundings through heating. As a high current wastes more energy than a low current, electrical power is transported around the grid at a high voltage and a low current

The cables are good conductors of electricity and are insulated. This also prevents energy being lost as the electricity travels along the cable by reducing resistance and preventing heat loss. The electricity goes through a step-down transformer. This reduces the voltage to 230V which is then safe to use in houses.

Variations of the question.

Explain the voltage changes that occur across the National Grid.

Question: **Explain, in atomic terms, how an electric current flowing through a resistor causes the resistor to heat up?**

In this question, you need to talk about what is happening at an atomic level. As we know electrical current is caused by the movement of delocalised electrons. So, we will start off with this

Electrical current is caused by the movement of delocalised electrons in a conductor.

Now we need to develop a story to explain why electrons flowing through a resistor would cause it to heat up. Again, we need to keep our explanation to an atomic level.

Delocalised electrons are attracted to the positive terminal. As they move through the wire they bump into the metals atomic nuclei in the resistor. These collisions make the metal atoms vibrate more.

Now we need to explain the effect of the increased collisions...

The more an atom vibrates, the more kinetic energy it will have. As a result, the temperature will increase.

To finish off we will explain the difference we would see in a conductor and a resistor...

In a conductor, the electrons can flow freely and there are few collisions. In a resistor, it is harder for the electrons to flow and so there are more collisions.

The whole answer looks like this...

Electrical current is caused by the movement of delocalised electrons in a conductor. Delocalised electrons are attracted to the positive terminal. As they move through the wire they bump into the metals atomic nuclei in the resistor. These collisions make the metal atoms vibrate more. The more an atom vibrates, the more kinetic energy it will have. As a result, the temperature will increase.
In a conductor, the electrons can flow freely and there are few collisions. In a resistor, it is harder for the electrons to flow and so there are more collisions.

Variations of the question.
Explain in terms of electrons, the difference between a resistor and a conductor.

Question: **Explain the differences between the live, earth and neutral wires, and their uses, when connected to a kettle.**

There is a lot of information that needs to be included in this answer. It is important that you include a structure to your answer so that it does not simply become a list of information. To help us do this we will tell a story of the flow of electricity through the kettle and describe and explain what each part does. Because this is an **explain** question, after describing each part of the sequence, explain why this happens. It may seem silly to have to write down the colour of the wire, but this will often be included in mark schemes so it is worth including.

First we start with the electricity entering the plug of the kettle...
The live wire carries voltage from the power station. The live wire is brown.

Then we can describe the fuse...
The electricity then passes through a fuse. The fuse will protect the kettle if the current becomes too high.

Then we describe the kettle...
The current then passes through the kettle. The earth wire is connected to the metal case of the kettle. If there is a fault, the earth wire prevents the metal case become live and electrocuting somebody. The earth wire is green and yellow.

Now we need to describe the return journey of the current...
The current leaves the kettle and passes through the neutral wire which provides a path back to the power station. The neutral wire is blue.

A description of the potential differences of the wires completes the description
The potential difference between the live wire and earth (0 V) is about 230 V. Because of this a live wire may be dangerous even when a switch in the mains circuit is open. The neutral wire is at, or close to, earth potential (0 V). The earth wire is at 0 V, it only carries a current if there is a fault.

The whole answer will look like this.
The live wire carries voltage from the power station. The live wire is brown. The electricity then passes through a fuse. The fuse will protect the kettle if the current becomes to high.
The current then passes through the kettle. The earth wire is connected to the metal case of the kettle. If there is a fault, the earth wire prevents the metal case become live and electrocuting somebody. The earth wire is green and yellow.
The current leaves the kettle and passes through the neutral wire which provides a path back to the power station. The neutral wire is blue.
The potential difference between the live wire and earth (0 V) is about 230 V. Because of this a live wire may be dangerous even when a switch in the mains circuit is open. The neutral wire is at, or close to, earth potential (0 V). The earth wire is at 0 V, it only carries a current if there is a fault.

Variations of the question.
Explain the functions of the different wires in a plug.
Compare the roles of the fuse and the earth wire in a plug.