

Mains Electricity: UK mains is **AC** (Alternating Current) at **230 V** and **50 Hz**.

AC vs DC: AC changes direction periodically; DC flows in one direction only.

Power Loss: $P_{\text{loss}} = I^2 \times R$. To reduce power loss, reduce current (I).

Transformers: $V_p/V_s = N_p/N_s$. Step-up transformers increase voltage, decrease current. Step-down transformers decrease voltage, increase current.

Section A: Key Terms & Components

1. Figure 1 shows a diagram of a standard UK 3-pin plug. Label the three wires with their correct names and colours.

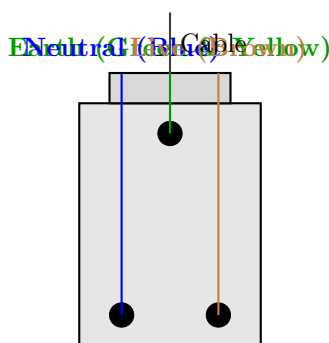


Figure 1: UK 3-pin plug

2. Complete the sentences below using the most appropriate scientific terms:

- Mains electricity in the UK is _____ current (AC) with a frequency of _____ Hz and a potential difference of _____ V.
- The _____ wire carries the alternating potential difference, while the _____ wire is at or close to zero potential.
- The _____ wire is a safety wire that connects the metal casing of an appliance to the ground, providing a _____ path for current in case of a fault.

Section B: Core Concepts & Explanations

3. Answer the following questions related to mains electricity and the National Grid:

- Explain the key difference between alternating current (AC) and direct current (DC).

- Describe the function of the Earth wire in a 3-pin plug and how it protects users from electric shock.

- Explain why the National Grid transmits electricity at very high voltages (e.g., 400 kV) over long distances.

d) Describe the role of step-up transformers in the National Grid.

Section C: Exam Application & Extended Writing

4. A transformer is used to change the voltage of an electrical supply.
- a) A transformer has 200 turns on its primary coil and 1000 turns on its secondary coil. If the input voltage (primary voltage) is 230 V, calculate the output voltage (secondary voltage). Show your working.
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- b) Explain the entire process of how electricity generated at a power station reaches a consumer's home, detailing the role of different components of the National Grid and the energy transfers involved. (6 marks)
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