PRACTICE C

Transformers

1. A step-down transformer providing electricity for a residential neighborhood has exactly 2680 turns in its primary. When the potential difference across the primary is 5850 V, the potential difference at the secondary is 120 V. How many turns are in the secondary?

2. A step-up transformer used in an automobile has a potential difference across the primary of 12 V and a potential difference across the secondary of 2.0×10^4 V. If the number of turns in the primary is 21, what is the number of turns in the secondary?

3. A step-up transformer for long-range transmission of electric power is used to create a potential difference of 119 340 V across the secondary. If the potential difference across the primary is 117 V and the number of turns in the secondary is 25 500, what is the number of turns in the primary?

4. A potential difference of 0.750 V is needed to provide a large current for arc welding. If the potential difference across the primary of a step-down transformer is 117 V, what is the ratio of the number of turns of wire on the primary to the number of turns on the secondary?

5. A step-down transformer has 525 turns in its secondary and 12 500 turns in its primary. If the potential difference across the primary is 3510 V, what is the potential difference across the secondary?

Real transformers are not perfectly efficient

The transformer equation assumes that no power is lost between the transformer's primary and secondary coils. Real transformers typically have efficiencies ranging from 90 percent to 99 percent. Power is lost because of the small currents induced by changing magnetic fields in the transformer's iron core and because of resistance in the wires of the windings.

The power lost to resistive heating in transmission lines varies as I^2R. To minimize I^2R loss and maximize the deliverable energy, power companies use a high emf and a low current when transmitting power over long distances. By reducing the current by a factor of 10, the power loss is reduced by a factor of 100. In practice, the emf is stepped up to around 230 000 V at the generating station, is stepped down to 20 000 V at a regional distribution station, and is finally stepped down to 120 V at the customer's utility pole. The high emf in long-distance transmission lines makes the lines especially dangerous when high winds knock them down.