Year 13 Science: Inductors, Faraday's law and transformers

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. A 0.250 T field passes at right angles through a loop of area 0.0400 m². Find the flux.

2. That flux falls to zero in 0.100 s through a 500-turn coil. Find the average induced EMF.

3. The current in a 0.200 H inductor changes at 30.0 A s^{-1}. Find the size of the back EMF.

4. A transformer has 920 primary turns on a 230 V supply. How many secondary turns give 10.0 V, and what is the primary current when the secondary supplies 2.30 A, if it is ideal?

Exam-style question: a coil on a battery

A large coil has an inductance of 2.50 H and a resistance of 5.00 Ω. It is connected through a switch to a 10.0 V battery of negligible internal resistance.

5. Calculate the final current and the time constant.

6. Calculate the rate at which the current starts to increase, and explain why the current does not jump straight to its final value.

7. Calculate the EMF across the inductor 0.300 s after the switch is closed.

8. Calculate the energy stored once the current is steady, and explain why a large voltage appears across the switch when it is opened.

Fix the mistake

9. Correct this statement: "A strong magnet sitting still inside a coil induces a large EMF."

10. Correct this statement: "When the switch closes, the current jumps to ε ÷ R and the inductor's voltage is zero."

11. Correct this statement: "A step-up transformer gives you more power, because the voltage goes up."

12. Correct this statement: "A transformer connected to a car battery will step 12 V up to 230 V."