

Magnetic flux, Faraday's law and Lenz's law

AP Physics 2 (algebra-based) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test covers magnetic flux, Faraday's law, Lenz's law and motional emf. It lasts 45 minutes and is worth 20 points. A calculator is allowed. Show the formula, the substitution and the unit for each calculation.

Level: AP Physics 2 (algebra-based) · **Curriculum:** AP P2 Unit 12

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Flux through a coil (2 marks)

A rectangular coil measures 12 cm by 8.0 cm. The coil is in a uniform field of 0.25 T, and the normal makes an angle of 40° with the field.

Calculate the magnetic flux through one turn. (2 marks)

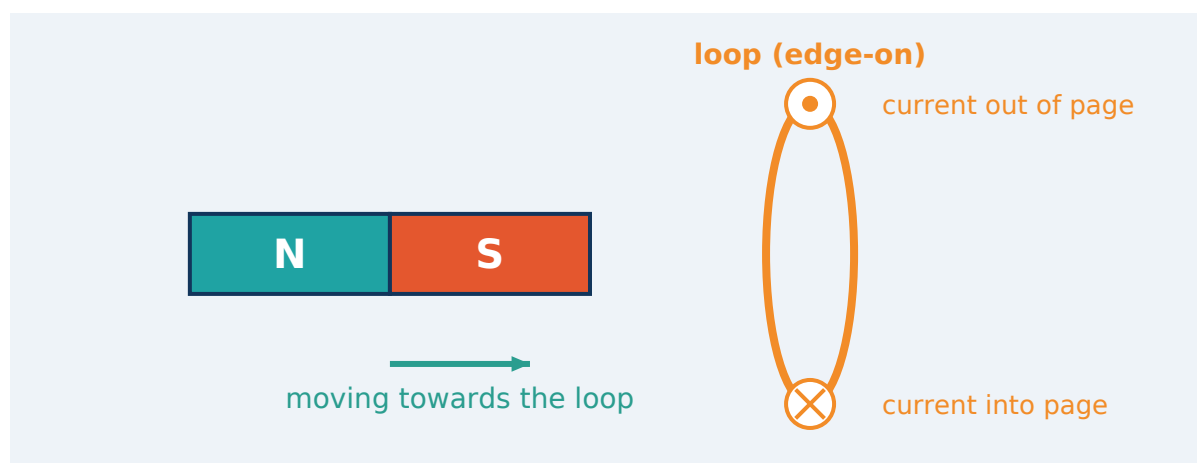
Question 2 Induced emf (3 marks)

A coil of 300 turns has the flux through each turn fall from 4.0 mWb to 1.0 mWb in 0.050 s.

- Calculate the change in flux. (1 mark)
- Calculate the average emf. (1 mark)
- State what happens to the emf if the same change takes place in 0.025 s. (1 mark)

Question 3 Approaching south pole (3 marks)

A south pole moves towards a loop as shown.



Magnet and loop for the question.

- a. State the direction of the induced current as seen from the magnet side. (1 mark)
- b. Use Lenz's law to explain your answer. (2 marks)

Question 4 Rod on rails (4 marks)

A rod of length 0.60 m moves at 2.5 m/s on rails in a field of 0.35 T. The circuit has total resistance 1.5 Ω .

- a. Calculate the emf. (1 mark)
- b. Calculate the current. (1 mark)
- c. Calculate the force needed to keep the speed constant. (1 mark)
- d. Calculate the power supplied by the force. (1 mark)

Question 5 Slow fall in a tube (2 marks)

A magnet falls more slowly through an aluminium tube than through a plastic tube of the same size. Explain why. (2 marks)

Question 6 Faraday's law in words (2 marks)

State Faraday's law of electromagnetic induction and explain what the minus sign represents. (2 marks)

Question 7 Units (2 marks)

Show that the unit Wb/s is equivalent to the volt. (2 marks)

Question 8 Loop leaving a field (2 marks)

A square loop moves out of a region of uniform field directed into the page, at constant speed.

- a. State the direction of the induced current. (1 mark)
- b. State what happens to the emf if the speed is doubled. (1 mark)