

Biot-Savart, ampère and magnetic sources

AP Physics C (Mechanics and E&M, calculus-based) · Test

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

This test lasts 45 minutes and is marked out of 20. Show each step, give answers with units and write explanations in full sentences. Use $\mu_0 = 4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$. Draw a sketch if it helps you apply the right-hand rule.

Level: AP Physics C (Mechanics and E&M, calculus-based) · **Curriculum:** AP PC:E&M Unit 12

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

Question 1 Ampère's law (2 marks)

State Ampère's law and give one condition under which it is useful for finding B.

Question 2 Long wire (2 marks)

Calculate the magnetic field 4.0 cm from a long straight wire carrying 6.0 A.

Question 3 Coil (3 marks)

A flat coil has 50 turns of radius 0.10 m and carries 2.0 A. Calculate B at its centre and at a point on its axis 0.10 m from the centre.

Question 4 Solenoid (3 marks)

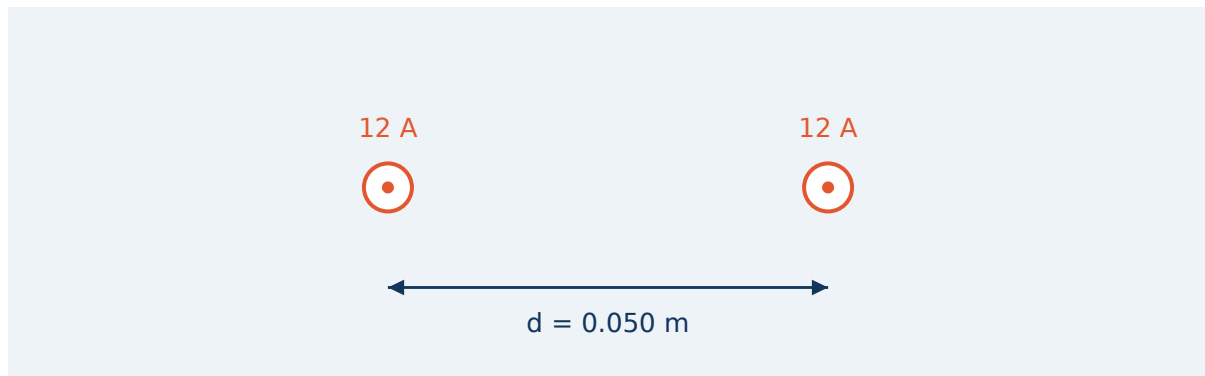
A 0.50 m solenoid has 1500 turns and carries 3.0 A. Calculate n and the field inside, and state the field outside far from the ends.

Question 5 Inside a thick wire (3 marks)

A wire of radius 1.5 mm carries 6.0 A uniformly. Calculate B at $r = 0.50 \text{ mm}$ and at $r = 3.0 \text{ mm}$.

Question 6 Parallel wires (3 marks)

The diagram shows two parallel wires.



Two parallel currents.

Calculate the force per metre on one wire and state whether it is attractive or repulsive.

Question 7 Zero field on the line (2 marks)

Explain, using the Biot-Savart law, why a straight wire produces no field at a point on its own line.

Question 8 Toroid (2 marks)

A toroid has 250 turns and carries 0.80 A. Calculate B at 5.0 cm from its axis, inside the core.