

Magnetic fields of wires and forces on moving charges

AP Physics 2 (algebra-based) · Test

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

This test covers the field of a wire, the magnetic force on moving charges and wires, circular motion in a field and the force between parallel currents. It lasts 45 minutes and is worth 20 points. Use $\mu_0 = 4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$ and $e = 1.6 \times 10^{-19} \text{ C}$.

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

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

Question 1 Field near a cable (2 marks)

A long straight cable carries 25 A.

- Calculate the magnetic field 4.0 cm from the cable. (1 mark)
- State the field at 8.0 cm when the current is doubled to 50 A. (1 mark)

Question 2 Direction of force (2 marks)

A proton moves north through a uniform field that points east.

- State the direction of the force on the proton. (1 mark)
- State the direction of the force on an electron with the same velocity. (1 mark)

Question 3 Proton in a uniform field (4 marks)

A proton moves at $1.2 \times 10^6 \text{ m/s}$ at right angles to a field of 0.80 T.

- Calculate the magnetic force on the proton. (1 mark)
- Calculate the radius of its circular path. (2 marks)
- State the effect on the radius of doubling the speed. (1 mark)

Question 4 Force on a wire (3 marks)

A 0.80 m wire carries 6.0 A in a uniform field of 0.15 T.

- Calculate the force when the wire is at right angles to the field. (1 mark)
- Calculate the force when the angle is 40° . (1 mark)

- c. Explain why the force is zero when the wire is parallel to the field. (1 mark)

Question 5 Parallel wires (3 marks)

Two long parallel wires 3.0 cm apart carry 12 A and 8.0 A in the same direction.

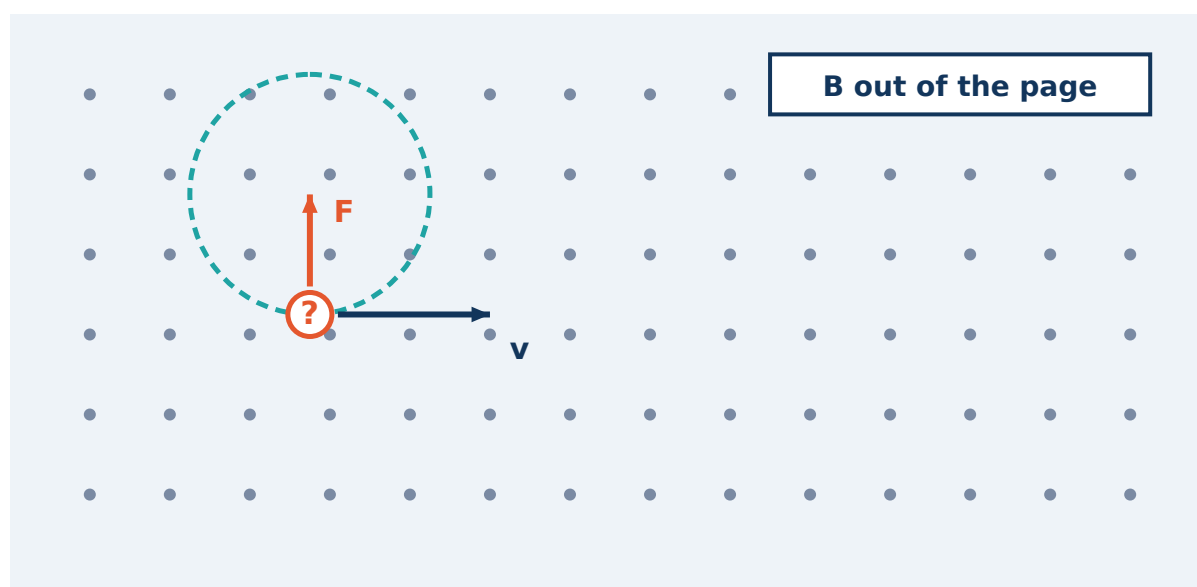
- Calculate the force per metre of length. (2 marks)
- State whether the wires attract or repel. (1 mark)

Question 6 Work done (2 marks)

Explain why a magnetic field cannot change the speed of a charged particle. (2 marks)

Question 7 Sign of the charge (2 marks)

The diagram shows a particle moving to the right in a field directed out of the page. Its path curves upward.



Path of the particle for the question.

Determine the sign of the charge and justify your answer. (2 marks)

Question 8 Undeflected beam (2 marks)

A beam passes undeflected through an electric field of 6.0×10^3 V/m and a perpendicular magnetic field of 0.030 T.

- Calculate the speed of the particles. (1 mark)
- State what happens to a faster particle of the same charge. (1 mark)