20. Magnetic fields

Starter Quiz · 课前小测

A-Level Physics Name: _____ Score: _____

1. A magnetic field is a region where:

   ☐ a moving charge or current feels a force

   ☐ any mass feels a force

   ☐ light always bends

   ☐ sound travels faster

2. The force on a current-carrying wire in a magnetic field is:

   ☐ $BIL\sin\theta$

   ☐ $\dfrac{BI}{L}$

   ☐ BIL^2

   ☐ $\dfrac{BL}{I}$

3. A 2.0 C charge moves at 3.0 $\dfrac{\text{m}}{\text{s}}$ at right angles to a 0.50 T field. What is the force?

   _____ N

4. The magnetic field around a long straight wire forms:

   ☐ circles around the wire

   ☐ straight lines along the wire

   ☐ a single point

   ☐ no field at all

5. The magnetic flux through an area A at right angles to a field B is:

   ☐ BA

   ☐ $\dfrac{B}{A}$

   ☐ BA^2

   ☐ $B + A$

6. A magnetic field is a region in which a force acts on which of these? Select **all** that apply.

   ☐ a moving charge

   ☐ a current-carrying conductor

   ☐ a magnetic material

   ☐ a stationary charge

   Tick every correct option.

7. The force on the wire is zero when it lies along the field.

   ☐ True ☐ False

8. For motion at right angles, the magnetic force on a moving charge is $F = BQ$_____.

   _____

9. The right-hand grip rule gives the direction of the field around a current-carrying wire.

   ☐ True ☐ False

10. A 0.50 m^2 coil sits at right angles to a 0.20 T field. What is the flux?

    _____ Wb

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Answers · 答案

A-Level Physics

1. **a moving charge or current feels a force**

   Magnetic forces act only on **moving** charges (and currents) — a charge at rest feels nothing.

2. $BIL\sin\theta$

   Largest when the wire is perpendicular to the field ($\sin 90° = 1$, so $F = BIL$).

3. **3 N**

   $F = BQv = 0.50 \times 2.0 \times 3.0 = 3.0$ N.

4. **circles around the wire**

   Concentric circles, with the direction given by the right-hand grip rule.

5. BA

   $\Phi = BA$ (weber). For a coil of N turns the flux linkage is $N\Phi$.

6. **a moving charge; a current-carrying conductor; a magnetic material**

   A stationary charge feels no magnetic force at all, which is exactly what distinguishes a magnetic field from an electric one.

7. **True**

   With the wire parallel to the field, $\theta = 0$ and $\sin\theta = 0$, so there is no force.

8. **v**

   $F = BQv$ — proportional to the charge's speed.

9. **True**

   Thumb along the current, curled fingers show the way the circular field points.

10. **0.1 Wb**

    $\Phi = BA = 0.20 \times 0.50 = 0.10$ Wb.