Parallel Wires

Consider two parallel current carrying wires. With the currents running in the same direction, the wires are

1. attracted (likes attract?)
2. repelled (likes repel?)
3. pushed in another direction
4. not pushed – no net force
Parallel Wires

Answer: 1. The wires are attracted

I₁ creates a field into the page at I₂. That makes a force to the left.

I₂ creates a field out of the page at I₁. That makes a force to the right.
The coil above will rotate
1. clockwise
2. counterclockwise
3. stay in the orientation shown because the total force is zero
Dipole in Field

Answer: 1. The coil above will rotate clockwise because the $I\, \text{ds} \times B$ forces shown produce a torque $r \times F$ into the page. This implies clockwise rotation.
The current carrying coil above will move
1. upwards
2. downwards
3. stay where it is because the total force is zero
Dipole in Field

Answer: 2. The coil above will move downward because the $I \, ds \times B$ forces shown produce a net force downward
The current-carrying coil above will move
1. upwards
2. downwards
3. stay where it is because the total force is zero
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Free dipoles attract because:
1. The force between dipoles is always attractive independent of orientation.
2. A dipole will always move towards stronger field, independent of orientation.
3. The torque on the dipole aligns it with the local field and the dipole will then move toward stronger field strength.
Answer: 3. Free dipoles attract because the torque on a dipole aligns the dipole with the local field and the dipole then moves toward stronger field strength—that is closer to another dipole. If the dipole were anti-aligned with the local field then it would move toward regions of weaker field strength.