Solutions

Each answer shows the steps, then the **result**.

2.1

- magnets and moving charges (currents)

2.2

- closed (loops)

2.3

- every magnet has both a north and a south pole; splitting it just makes two smaller magnets

3.1 B

- form closed loops.

3.2 B

- a moving charge.

3.3

(a)

- each half becomes a complete magnet with its own north and south pole

(b)

- magnetic poles always come in pairs – there are no monopoles – so a new pair of poles appears at the cut

3.4

(a)

- the **iron** rod (iron is ferromagnetic, with a very large permeability)

(b)

- iron contains domains, small regions in which atomic magnetic moments are already aligned
- the solenoid's field turns the domains to line up with it, so their fields add to the solenoid's own field

(c)

- copper (diamagnetic) is very weakly **repelled** by the solenoid
- aluminum (paramagnetic) is very weakly **attracted**

(d)

- it may stay weakly magnetized (induced magnetism becomes permanent), because some domains stay aligned after the field is removed