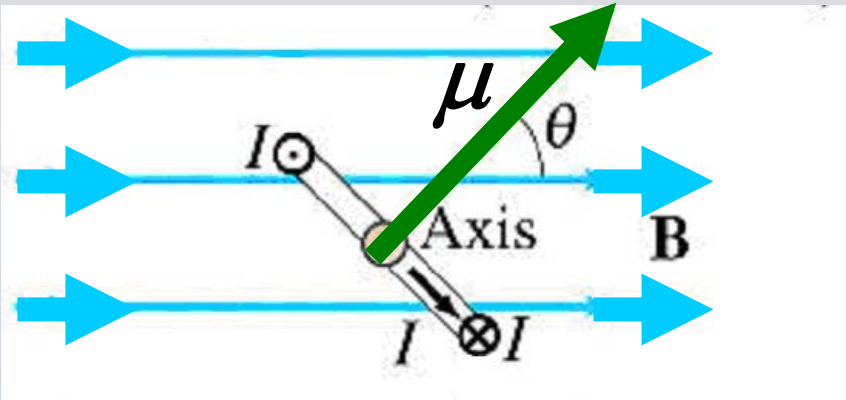
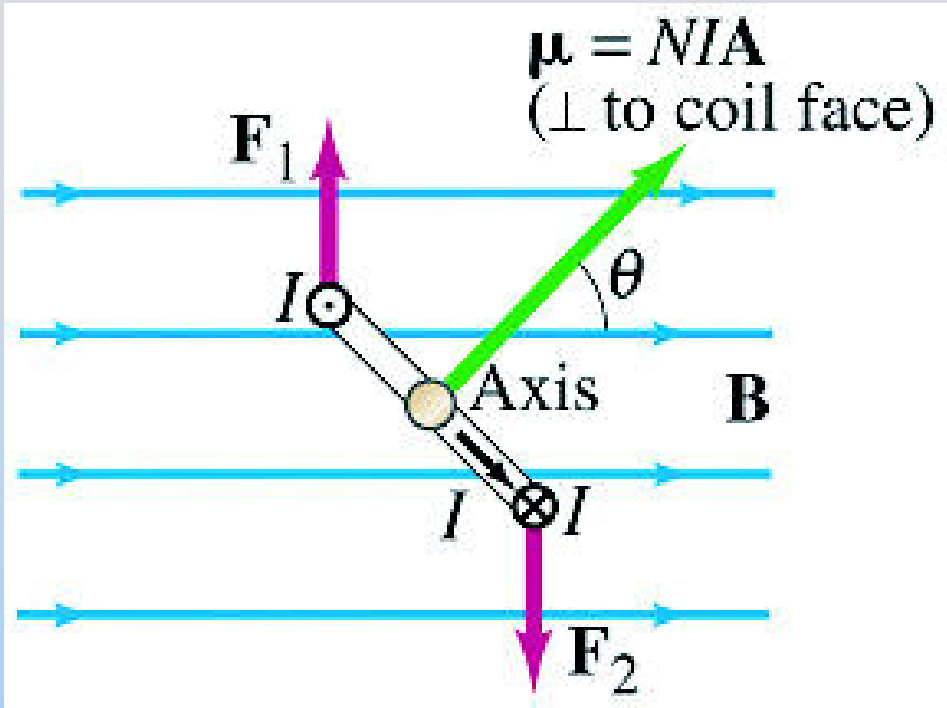
Concept Question: Dipole in Field



From rest, the coil above will:

1. rotate clockwise, not move
2. rotate counterclockwise, not move
3. move to the right, not rotate
4. move to the left, not rotate
5. move in another direction, without rotating
6. both move and rotate
7. neither rotate nor move
8. I don't know

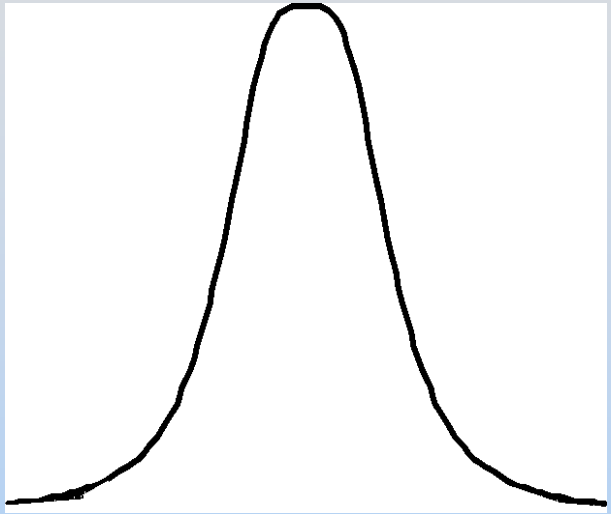
Concept Question Answer: Dipole in Field



Answer: 1. Coil will rotate clockwise (not move)

No net force so no center of mass motion. BUT Magnetic dipoles rotate to align with external field (think compass)

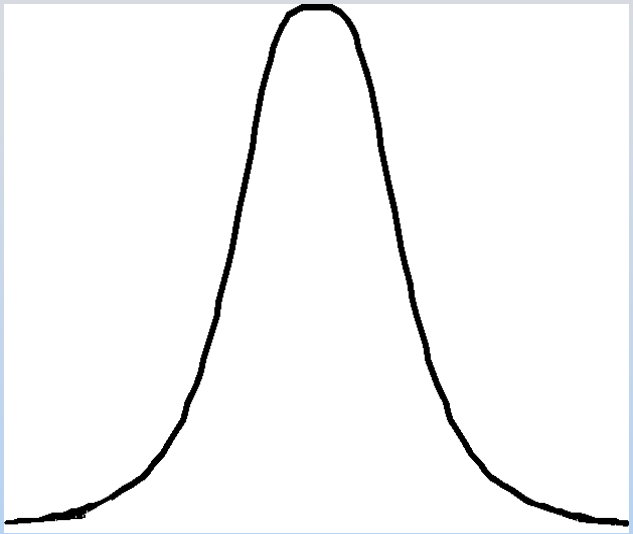
Concept Question: Dipole in Helmholtz



A randomly aligned dipole at the center of a Helmholtz coil will feel:

1. a force but not a torque
2. a torque but not a force
3. both a torque and a force
4. neither force nor torque

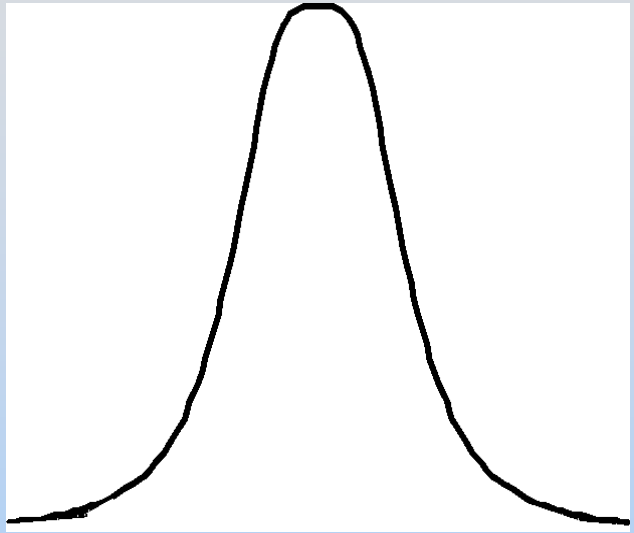
Concept Question Answer: Dipole in Helmholtz



Answer: 2. a torque but not a force

- The Helmholtz coil makes a ***UNIFORM FIELD***
- Dipole feels only torque (need gradient for F)

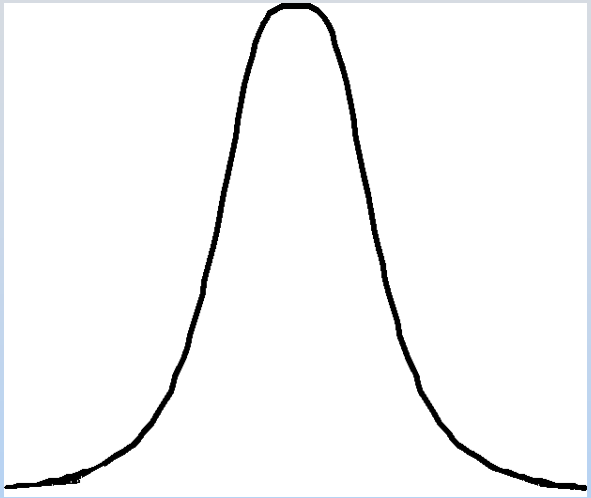
Concept Question: Moving in Helmholtz



When moving through the above field profile, a dipole will:

1. Never rotate
2. Rotate once
3. Rotate twice

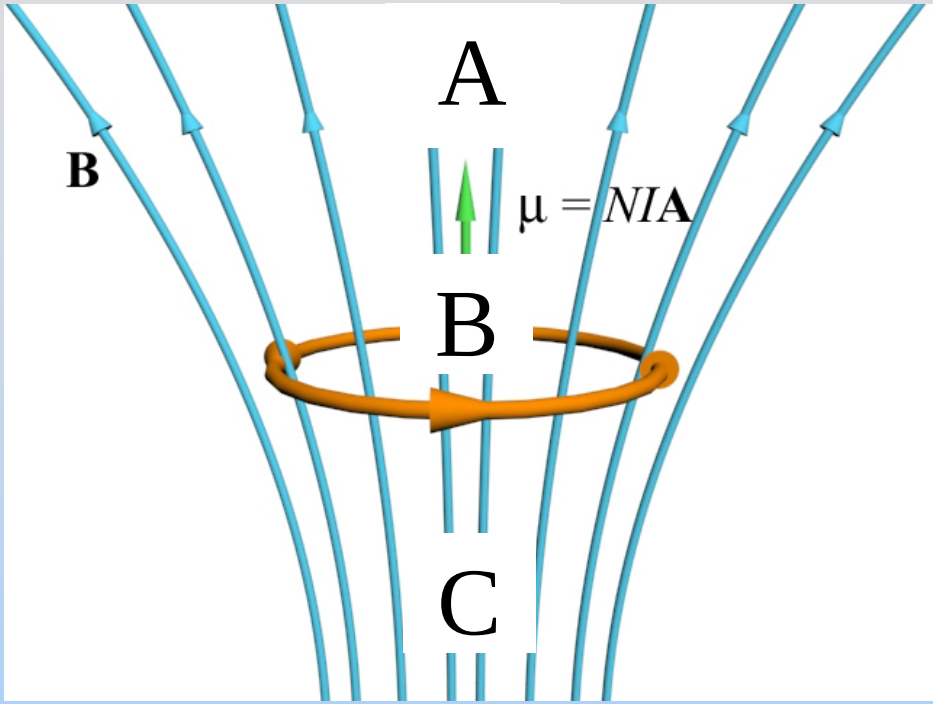
Concept Question Answer: Moving in Helmholtz



Answer: 1. The dipole will never rotate

- The dipole is always aligned with the field so it will never rotate

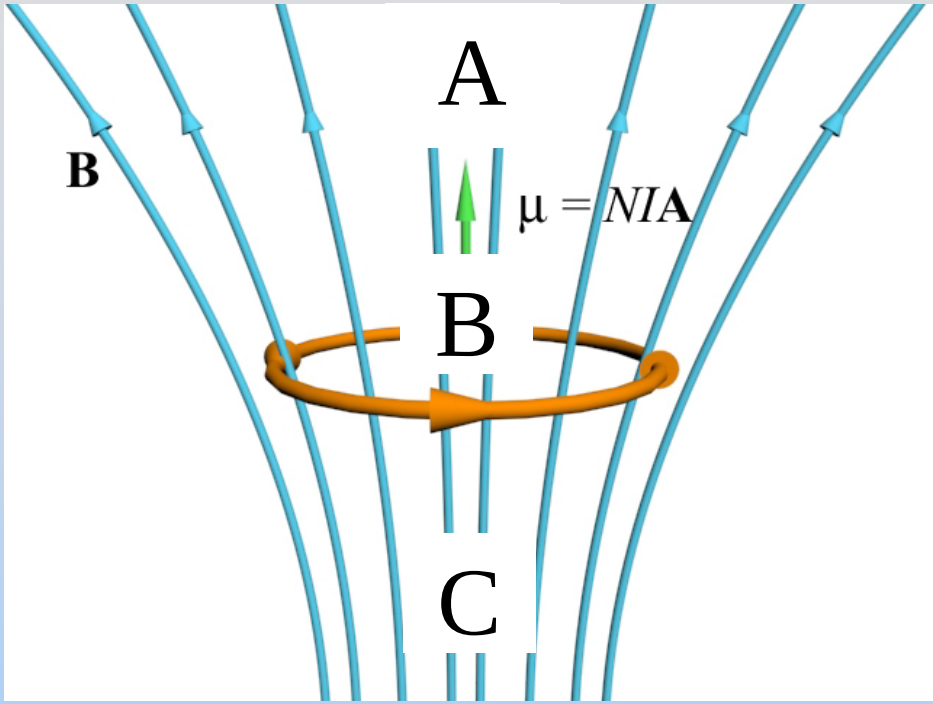
Concept Question: Field Strength



Where is the pictured field the strongest?

1. A
2. B
3. C
4. I don't know

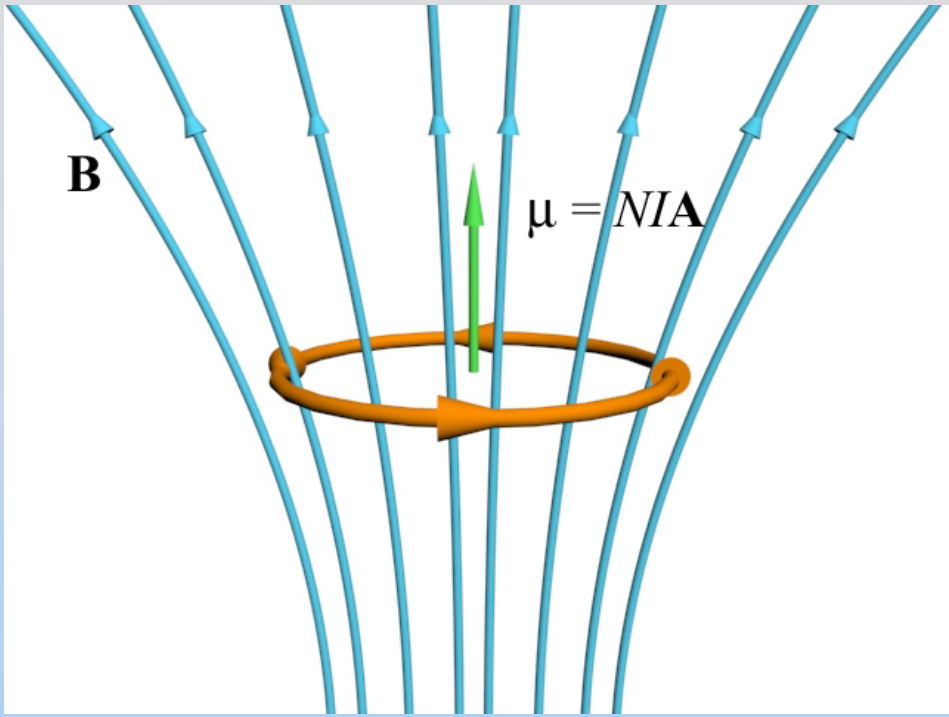
Concept Q. Answer: Field Strength



Answer: 3. The field is the strongest at C

Line density is proportional to field strength

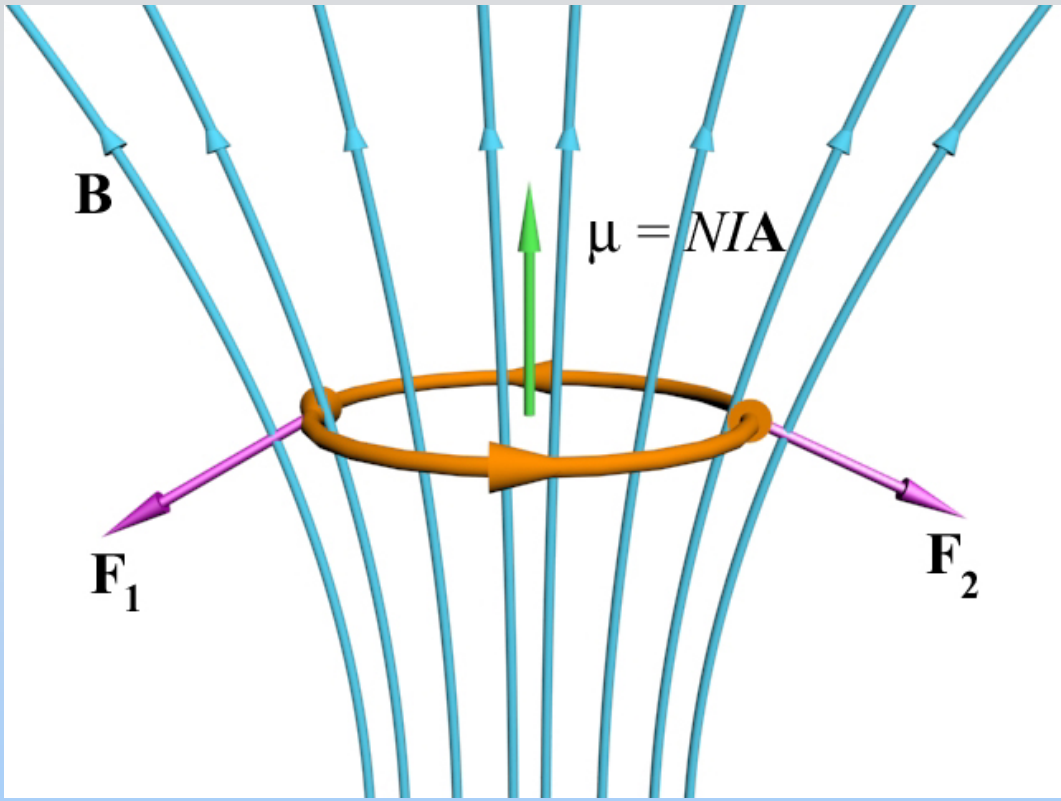
Concept Question: Dipole in Field



The current carrying coil above will feel a net force

1. upwards
2. downwards
3. of zero
4. I don't know

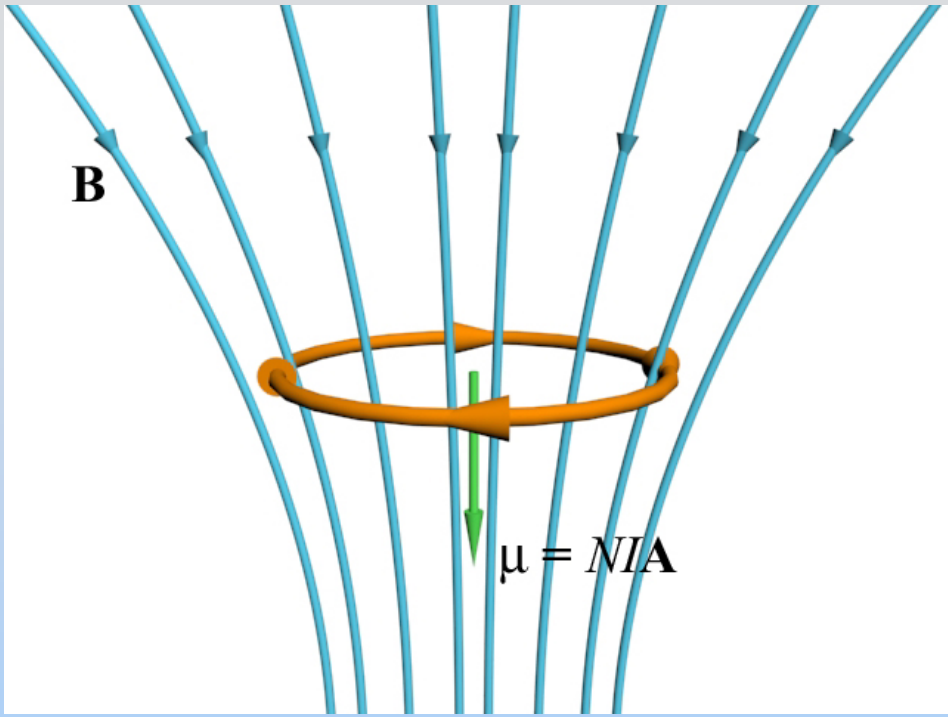
Concept Q. Answer: Dipole in Field



Answer: 2. Feels downward force

The ***I ds x B*** forces shown produce a net downward force

Concept Question: Dipole in Field



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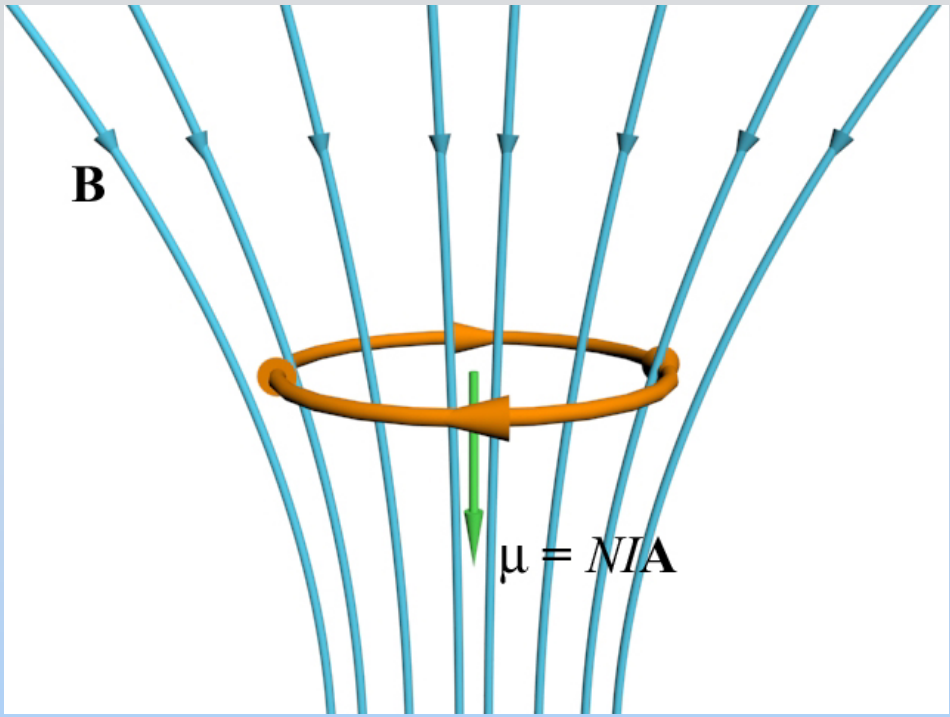
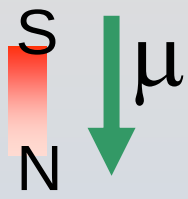
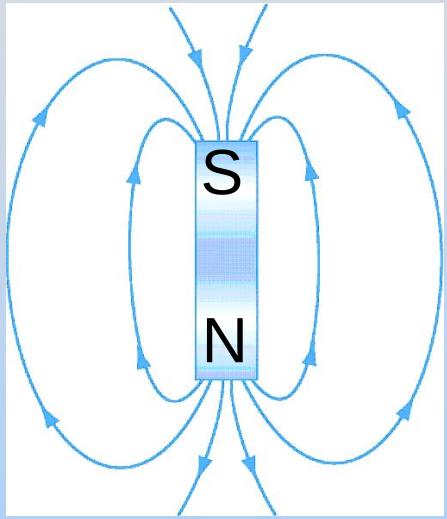
Concept Q. Answer: Dipole in Field







Answer: 2. The coil feels a force down

Many ways to know this:

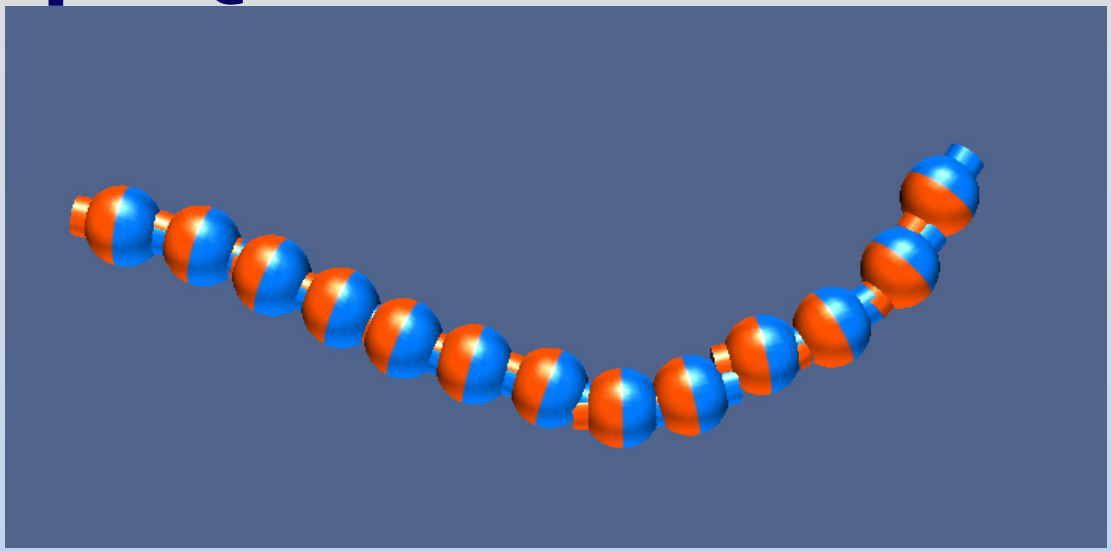
- ***I ds x B*** forces
- Energy (aligned seeks high B)
- Equivalent bar magnets

Concept Question: Free Dipoles

If a number of dipoles are randomly scattered through space, after a while they

1. Attract (move together)
2. Repel (move apart)
3. Basically stay put
4. I don’t know

Concept Q. Answer: Free Dipoles



Answer: 1. Free Dipoles Attract

- Torque on dipole aligns it with the local field
- Dipole then moves toward stronger field — closer to another dipole

Link to Shockwave

8.02SC Physics II: Electricity and Magnetism

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