Lecture 19: 03/26/2024

- Announcements
  - Practice test is your HW
  - Exam 2 in April 2 (Next Tuesday)
  - Lab this week, magnetic forces
  - Recitation, practice test, Kirchoff's laws
  - Midterm grades – Some review next time

- Last Time
  - Internal resistance
  - EMF
  - Resistance and resistivity

- Today
  - Intro to magnetism

Midterm Grades

- A 7
- A- 11
- B+ 6
- B 3
- B- 2
- C 6
- D 8
- F 4

- If you are doing your homework and coming to class, you should not have less than a “C”.

- Grade option deadline, April 3. P/F requires a C-
  - Not allowed in some majors
- Liberal S/U policy … but no credit

http://kestrel.nmt.edu/~rsonnenf/phys1320/homework/test2_review/

RStest2practice.pdf

File Edit View Go Bookmarks Help

1 of 4

Name:

Physics 1320 – Spring 2024 – Practice Test 2

Instructions:

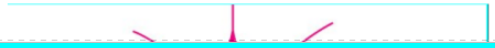
REVIEW SUGGESTIONS: Lectures beginning with Ten.
Written Homeworks 4/5, Online Homeworks 5/6.
These may be found here: `http://kestrel.nmt.edu/~rsonnenf/phys1320/homework/test2_review/`

There are TEN QUESTIONS on this exam.

All answers should be decimal numbers using scientific notation to three significant figures. SI units must be included on all answers. You may use your formula sheet. A scientific calculator, but no cell phones or other computing devices are permitted. If you get stuck on a problem because there is some key piece you do not know, make an assumption. State your assumption, and try to answer the problem anyway for part credit.

Multiple choice problems require *only* an answer. You *may* provide an explanation for multiple choice problems if you want an opportunity for partial credit.

Part 1: Multiple Choice (Circle the best answer)



Power is the product of voltage and current (True for ALL devices)

$$P = I V$$

Ohm's law (resistors only)

$$V = I R$$

Resistor power dissipation

$$P = I^2 R \qquad P = \frac{V^2}{R}$$

Resistance in terms of Resistivity

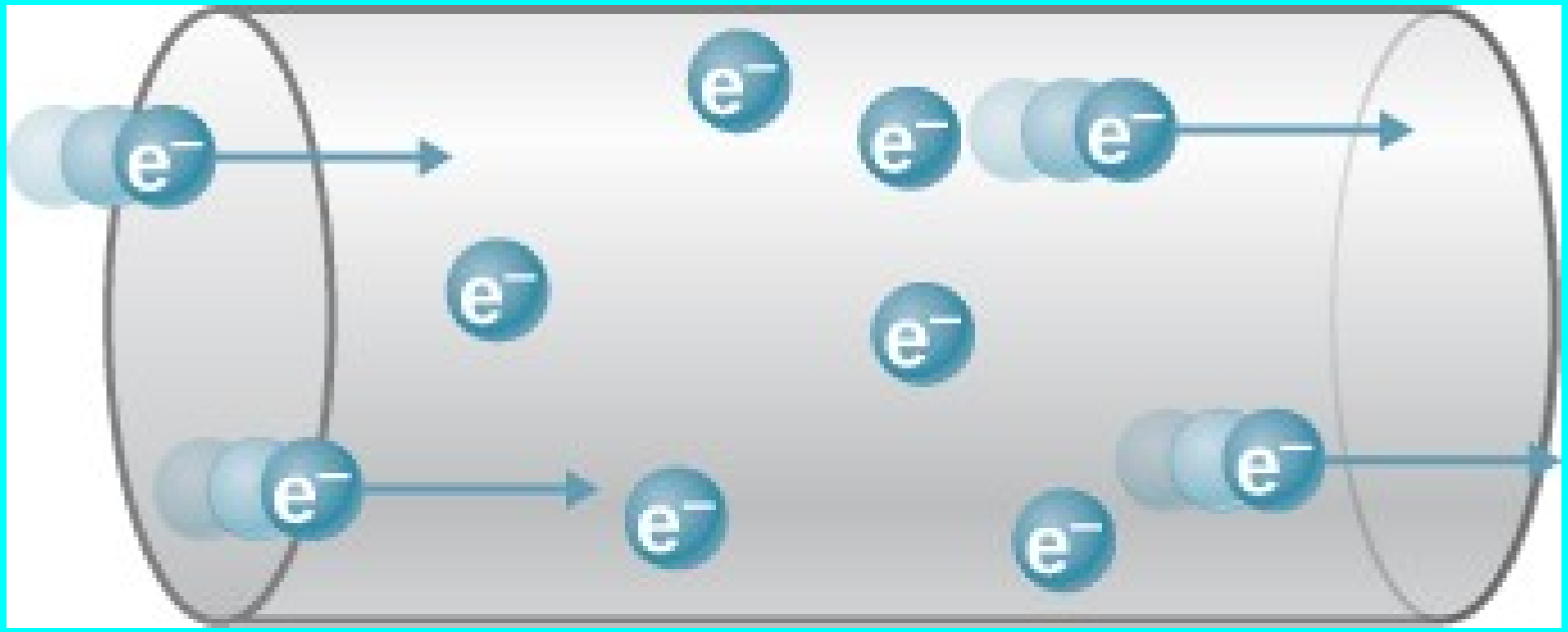
$$R = \rho \frac{L}{A} = \frac{L}{\sigma A}$$

Current density

$$I = \vec{J} \cdot \vec{A} \qquad \vec{J} = \sigma \vec{E}$$

Drude Model

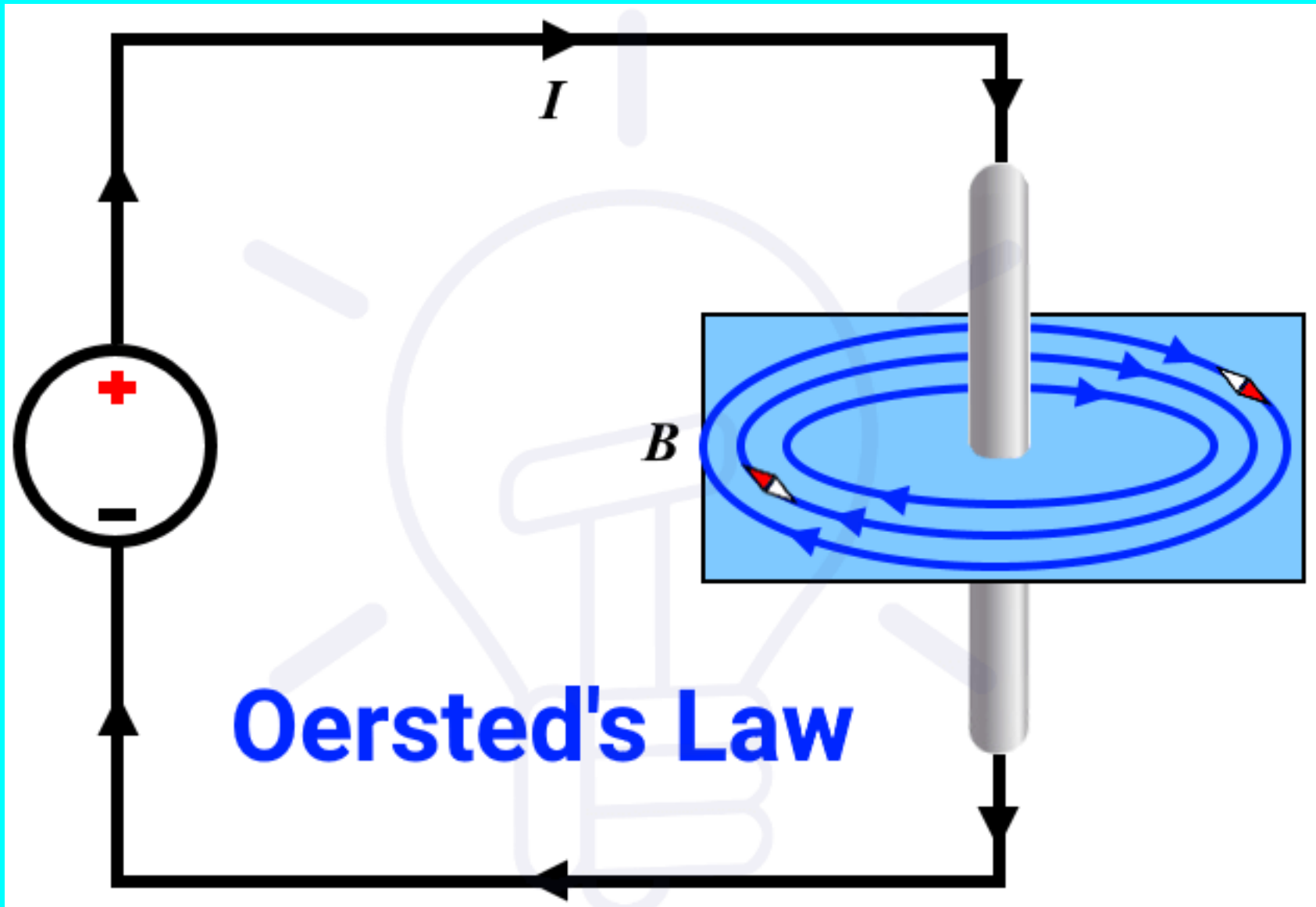
$$\vec{J} = n q \vec{v}_{drift}$$


e⁻
e⁻
e⁻
e⁻
e⁻
e⁻
e⁻
e⁻
e⁻

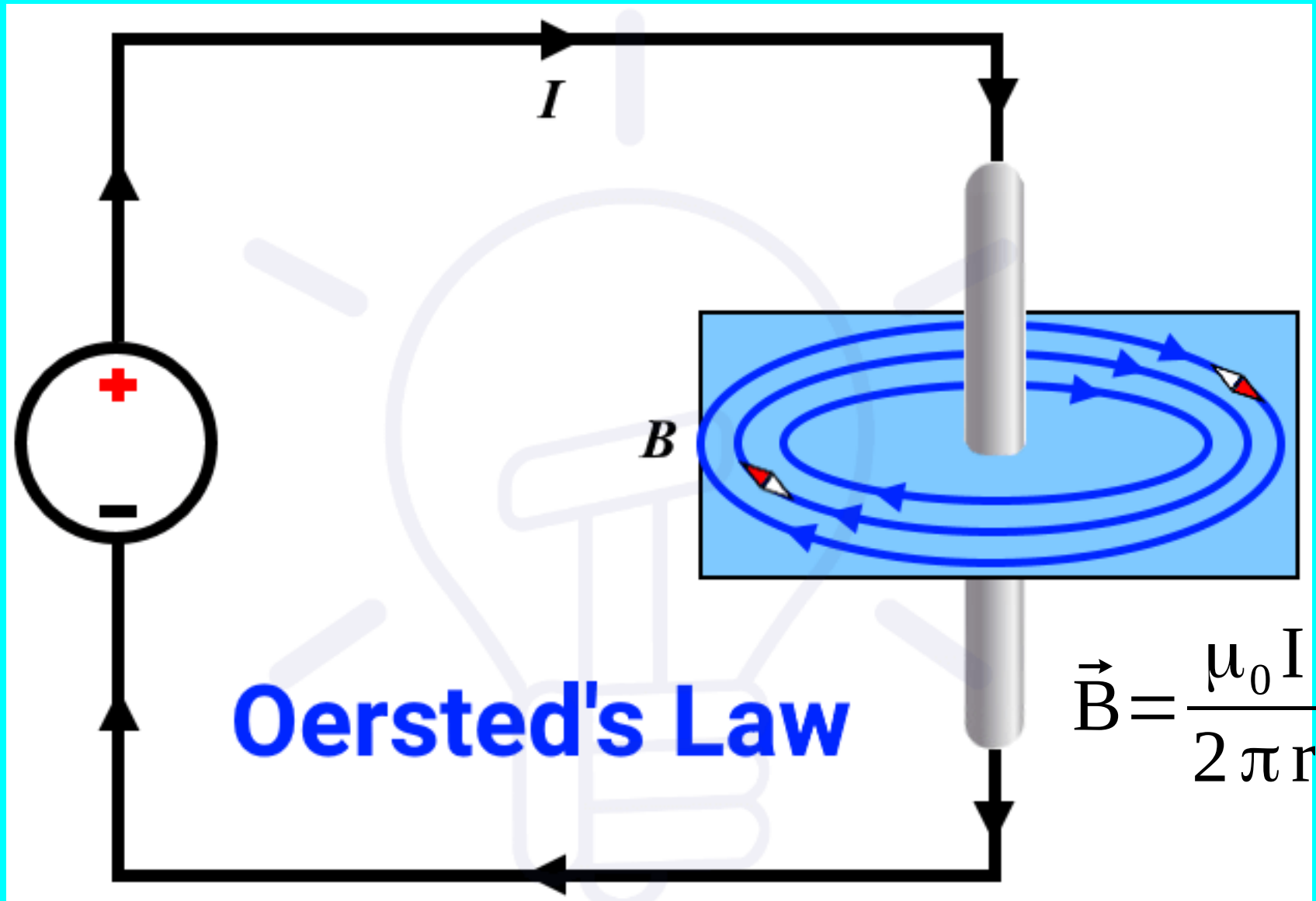
Magnetic Fields vs. Electric Fields

- Electric fields are caused by charges
- Basic law is Gauss's Law/Coulomb's Law
- Fields can "radiate" outward

- Magnetic fields are caused by moving charges.
- Basic Law is Ampere's Law/Bio-Savart Law
- Fields must make closed loops



Experiment for exploring the Magnetic Field around a Current Carrying Conductor



Oersted's Law

$$\vec{B} = \frac{\mu_0 I}{2\pi r}\hat{\phi}$$

Experiment for exploring the Magnetic Field around a Current Carrying Conductor

Magnetic Forces vs. Electric Forces

- Like charges repel
- Opposite charges attract

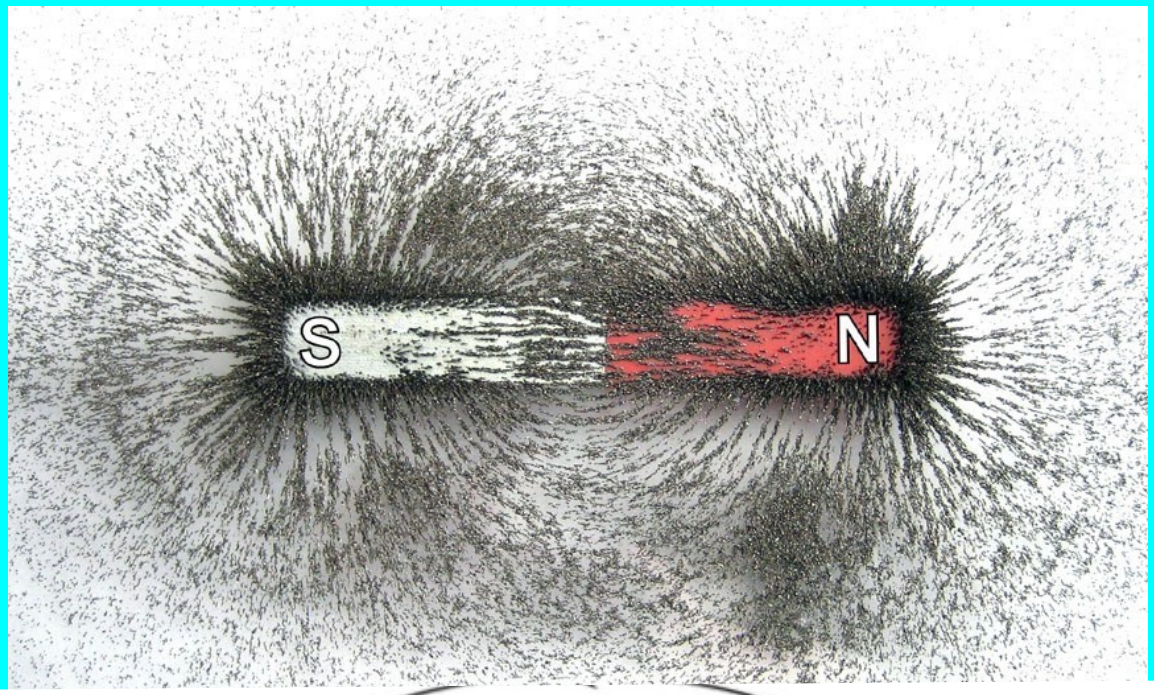
- Like currents attract
- Opposite currents repel

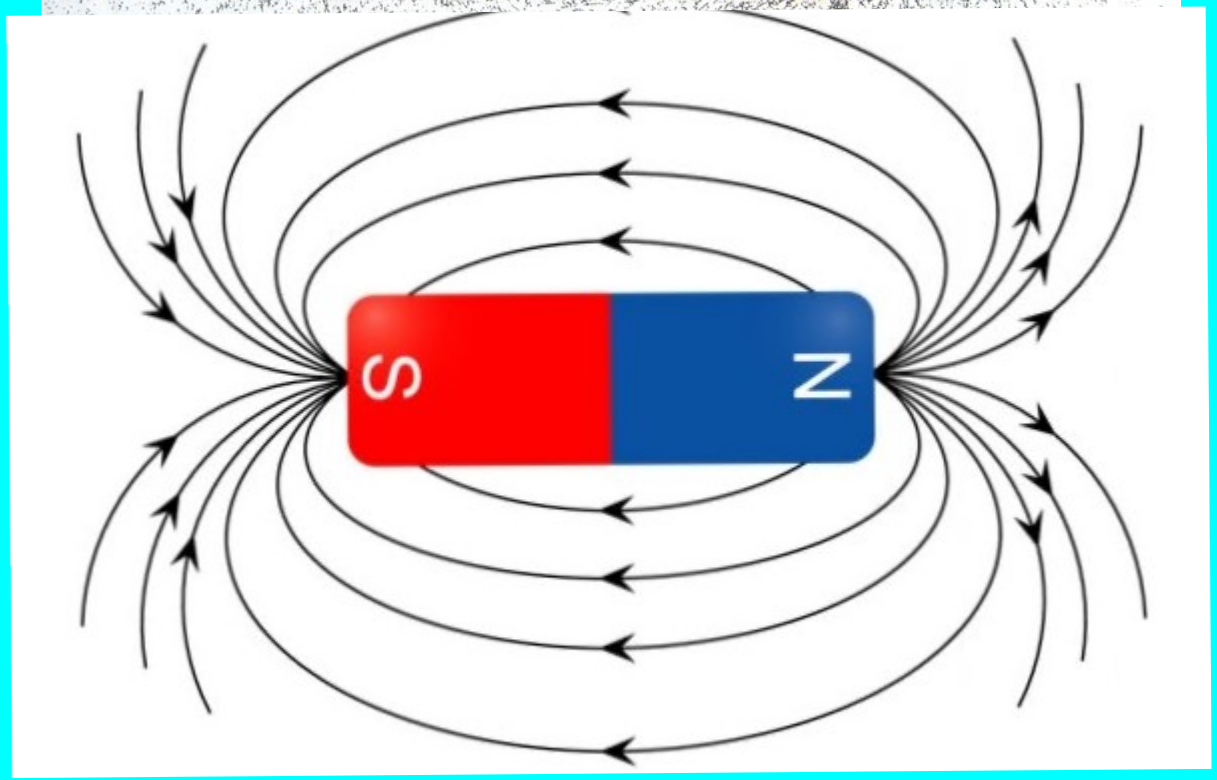
Basic Equations of Magnetism

$$\vec{F} = Q\,\vec{v} \times \vec{B}$$

$$\vec{F} = I\,\vec{L} \times \vec{B}$$

$$\vec{B} = \frac{\mu_0 I}{2\pi r}\hat{\phi}$$


S
N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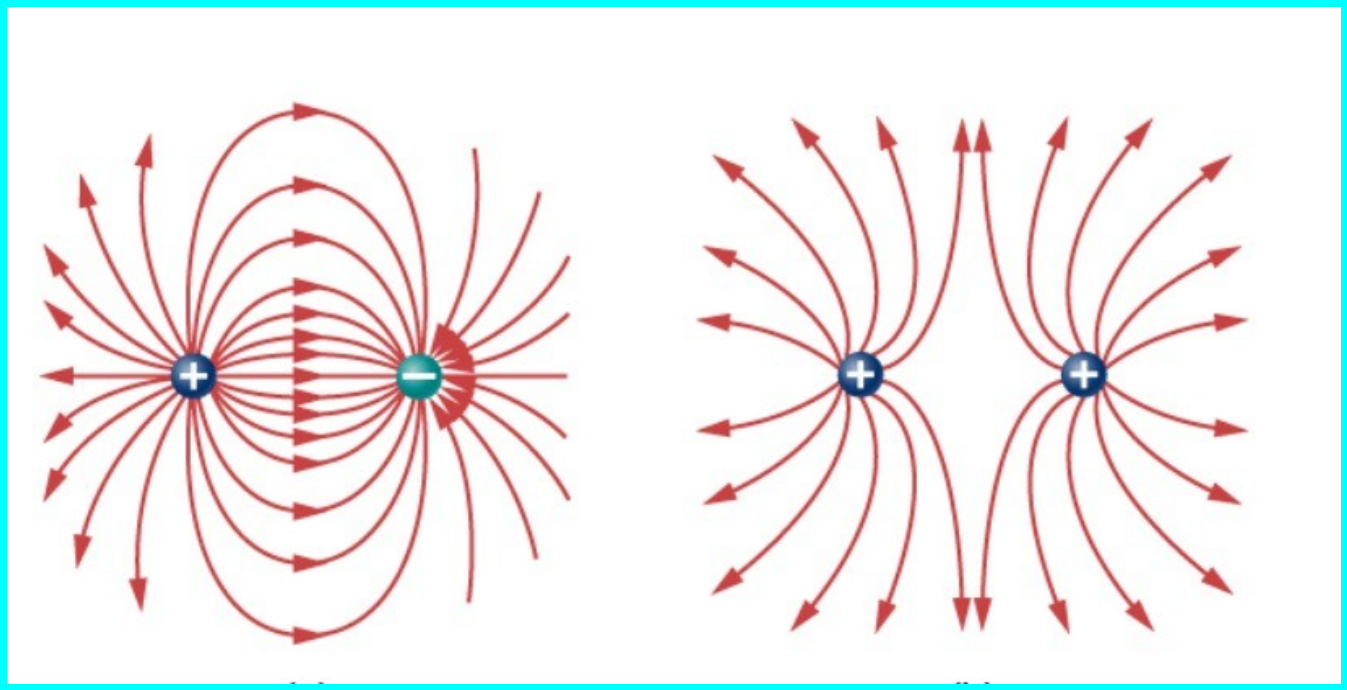
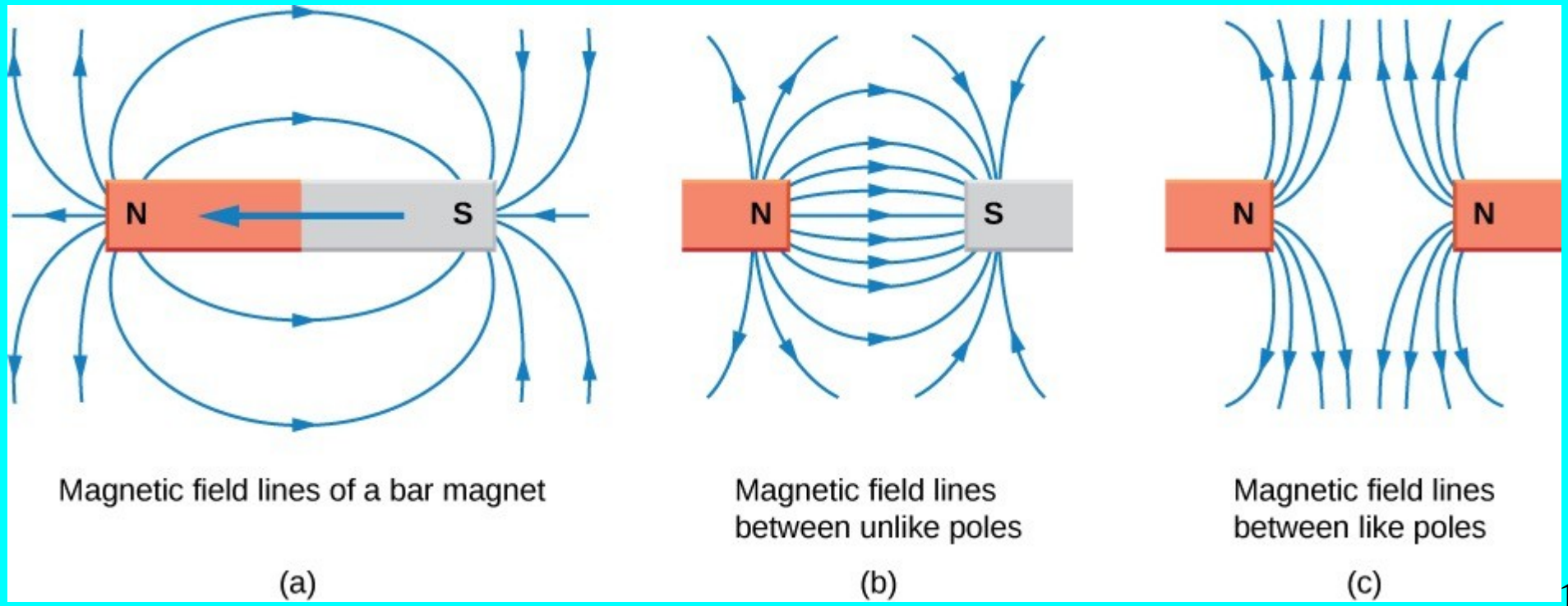




Magnetic field lines of a bar magnet

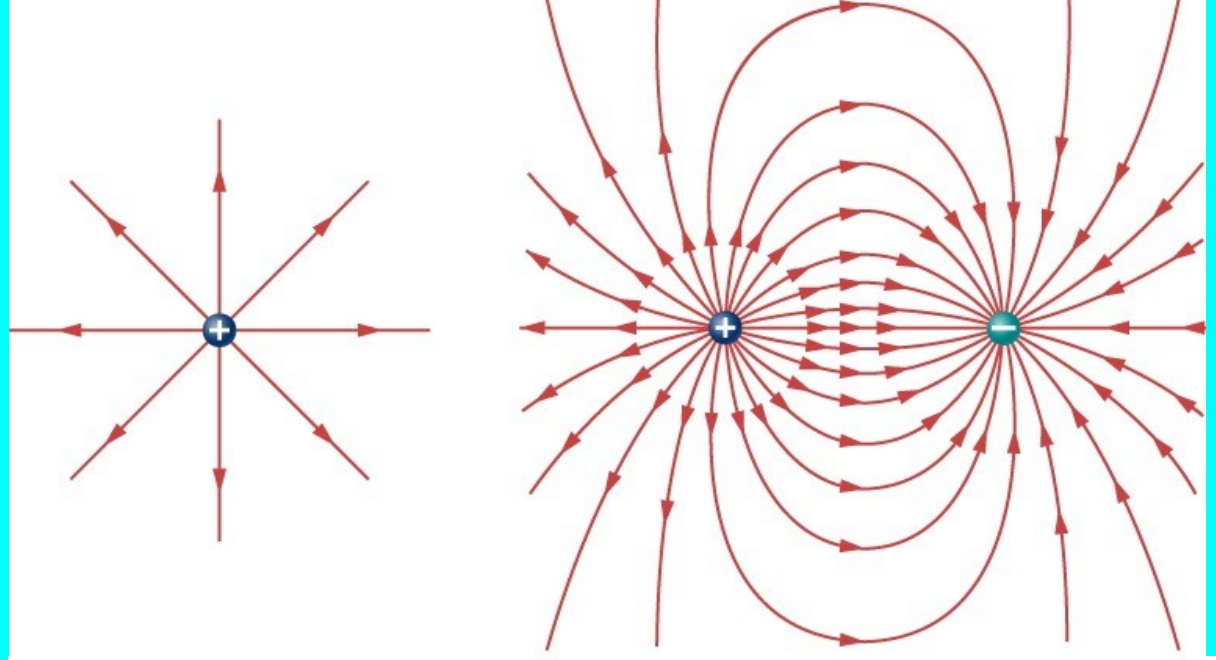
(a)

Magnetic field lines between unlike poles

(b)

Magnetic field lines between like poles

(c)



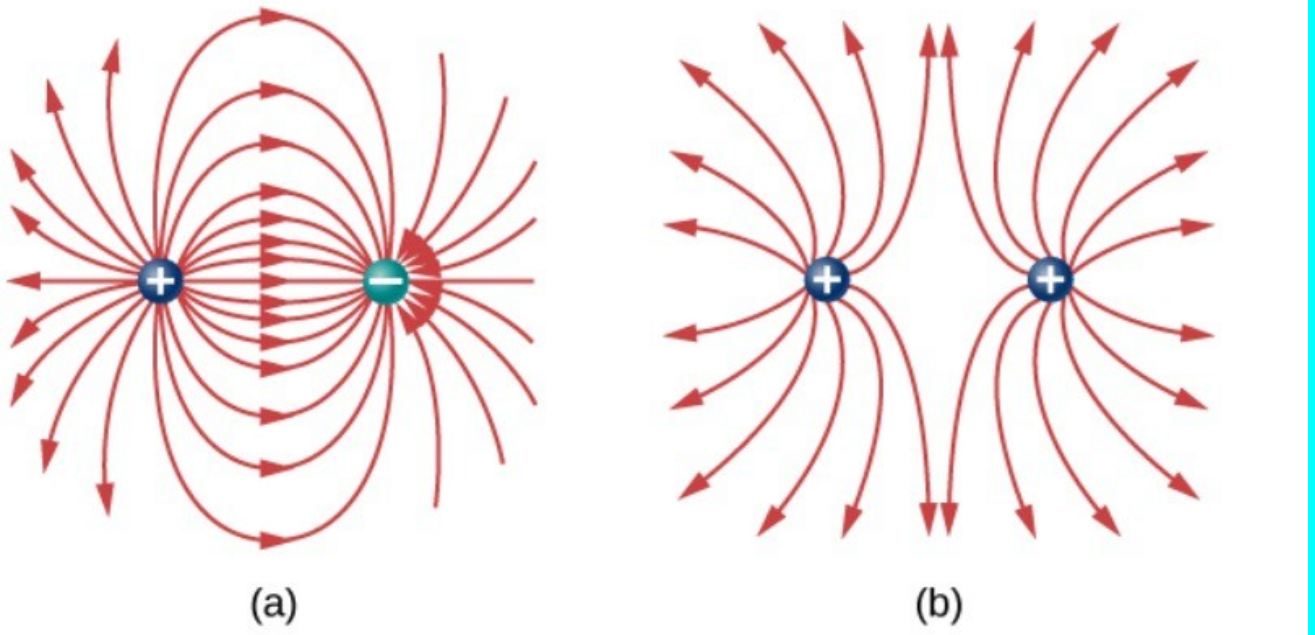
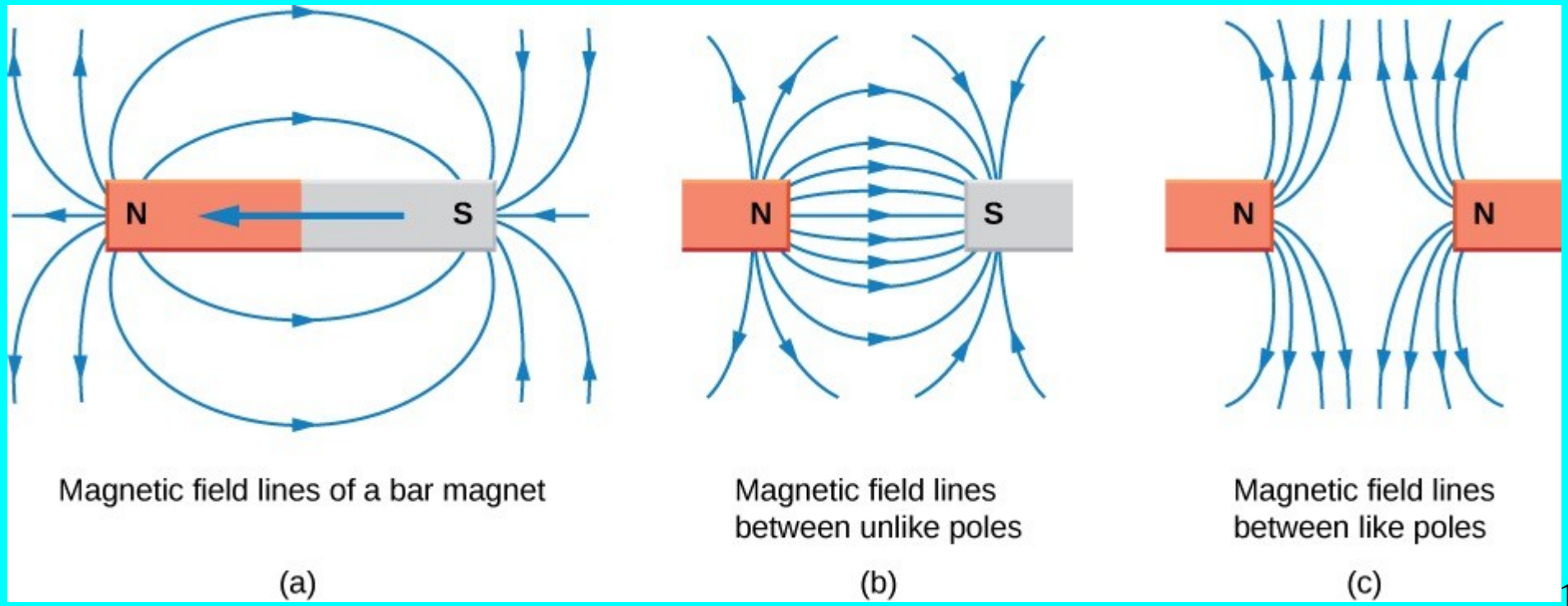


Figure 5.31 Three typical electric field diagrams. (a) A dipole. (b) Two identical charges. (c) Two charg
you tell from the diagram which charge has the larger magnitude?

Magnetic Field lines vs. Electric Field lines

- Electric $\vec{F} = Q\vec{E}$
  - Show direction of field
  - Closer together means stronger field
  - Start on positive charge, end on negative or infinity
  - Charges feel forces along the field
  - Force on charge only depends on charge

- Magnetic $\vec{F} = Q\vec{v} \times \vec{B}$
  - Show direction of field
  - Closer together means stronger field
  - Start on “north” pole, end on “south” pole or infinity
  - Charges feel forces PERPINDICULAR to the field
  - Force on charge depends on charge AND velocity



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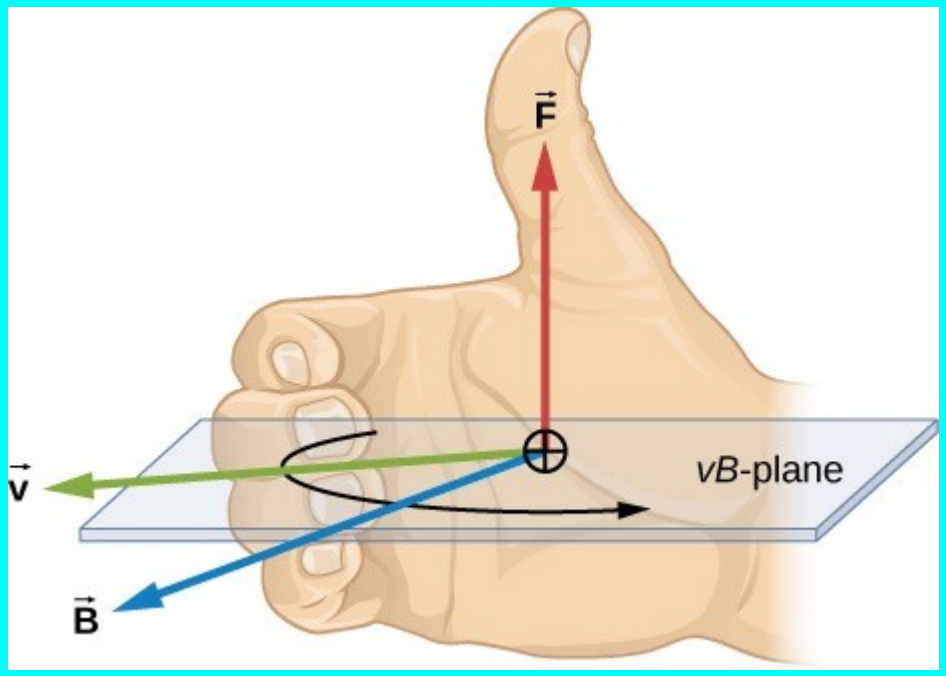
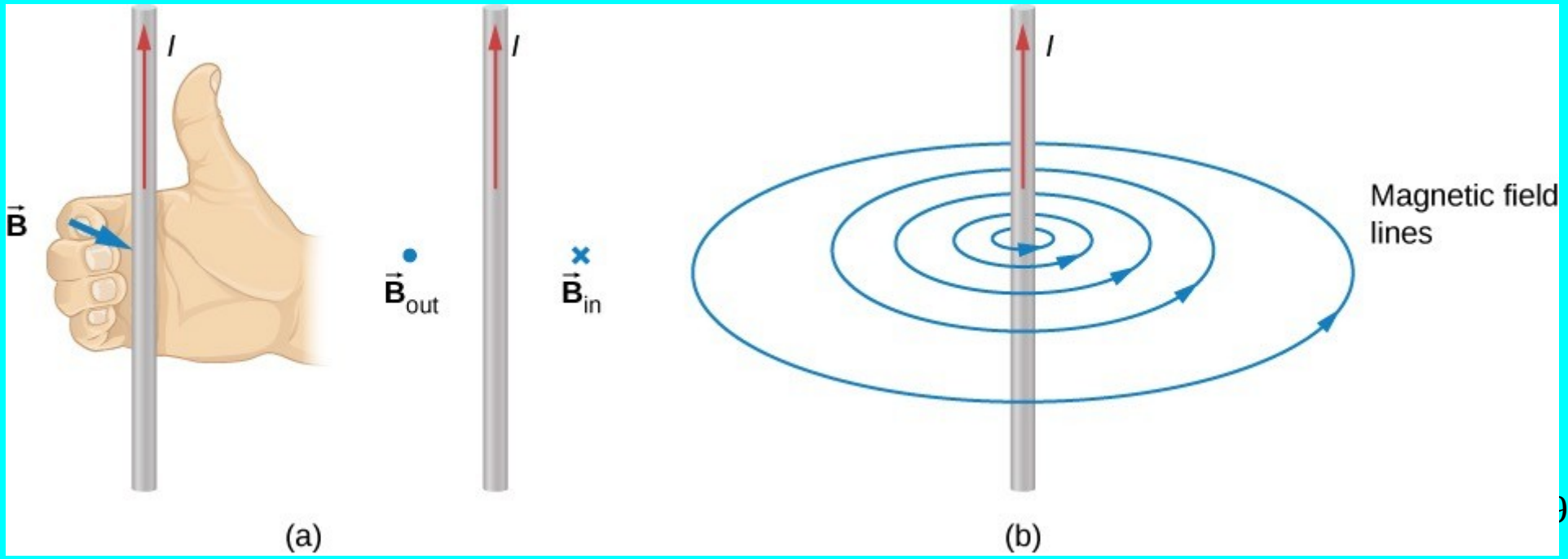

$\vec{F}$
$\vec{v}$
$\vec{B}$
vB-plane


I
$\vec{B}$
$\vec{B}_{out}$
I
$\vec{B}_{in}$
(a)
I
Magnetic field lines
(b)

Problem

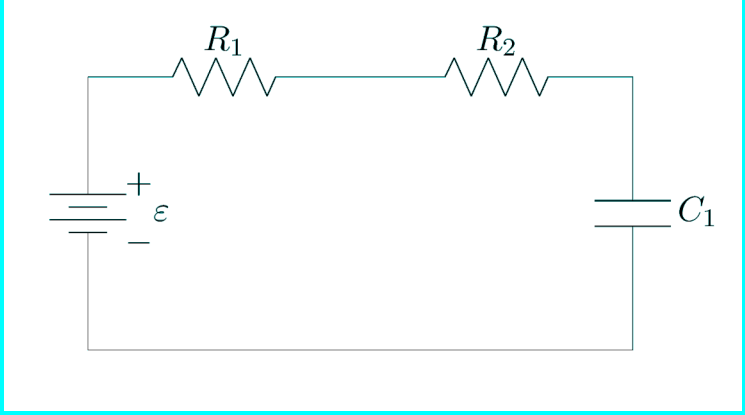
- Two wires carry 15 Amperes in the same direction and are separated by 1 cm. What is the force between them?

LECTURE 19 RECAP

- EMF and Voltage
- How Kirchoff's Rules lead to parallel/series formulae
- Internal Resistance
- Resistance and Resistivity
- Drude Model of Conduction

What is the voltage across C1?

$$\varepsilon = 10\,\mathrm{V};\ I_1 = 2\,\mathrm{A};\ R_1 = 1\,\Omega,\ R_2 = 2\,\Omega$$



(A) 1 V

(B) 2 V

(C) 4 V

(D) 6 V

(E) 10 V