Name _____ Date _____ Period _____

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# Honors Physics Unit 8 Study Guide

Electromagnetism

Show equations, substitutions, units, and vector directions. Explain your reasoning. Use sensible rounding.

| | |
|---|---|
| Constants | $e = 1.60 \times 10^{-19}$ C \| B in teslas (T) \| $\Phi$ in webers (Wb) |
| Equations | $F_B = \|q\|vB \sin\theta$ \| $F_{wire} = ILB$ (wire perpendicular to field)<br>$\Phi = BA$ (field perpendicular to loop) \| $\|\varepsilon\| = N\|\Delta\Phi\|/\Delta t$ \| $I = \|\varepsilon\|/R$<br>$V_s/V_p = N_s/N_p$ \| $P = IV$ \| $P_{loss} = I^2R$ |

Use conventional current. A dot means out of the page and a cross means into the page.

## 8.1 Magnetic Fields

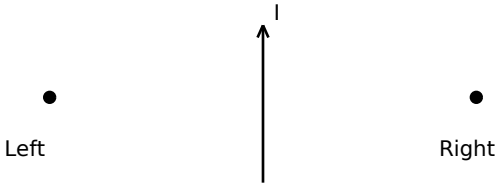
1. Sketch field lines around a bar magnet with N on the left and S on the right. Show field direction outside the magnet. State how a compass's north end aligns with the field.




2. A bar magnet is cut into three pieces. How many north and south poles result? Explain how domain alignment distinguishes a magnetized iron sample from an unmagnetized one.

## 8.2 Magnetic Fields from Currents

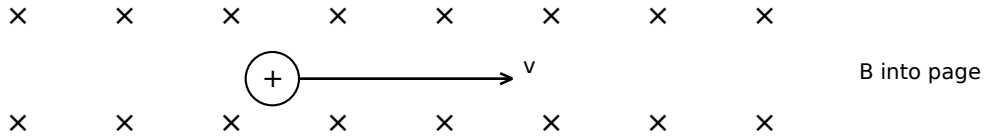
3. A straight wire carries conventional current upward on the page. State the magnetic-field direction on its right and left sides. Then reverse the current and describe the change.




4. A coil is rewound from 100 to 200 turns over the same length and current increases from 1.5 A to 4.5 A. Estimate the factor change in field strength for the same core. Name one other way to strengthen it.

## 8.3 Magnetic Force on Moving Charges

5. A proton moves right at $3.0 \times 10^6$ m/s in a 0.40 T magnetic field into the page. Find force magnitude and direction. What direction would the force have for an electron with the same velocity?




6. A proton travels at $2.0 \times 10^6$ m/s at 30° to a 0.50 T field. Find force magnitude. State the force if the proton is at rest or moving parallel to the field.

7. A 0.25 m wire carries 6.0 A to the right through a 0.40 T magnetic field out of the page. Find force magnitude and direction.

8. A charged particle enters a uniform magnetic field with velocity perpendicular to the field. Explain why its path curves but speed stays constant. State the direction of the magnetic force relative to velocity.

## 8.4 Electromagnetic Induction

9. A magnet’s north pole is pushed into a closed conducting coil. A meter deflects right. Predict its reading when (a) the magnet is held still, (b) the north pole is pulled out, and (c) the south pole is pushed in.

10. A loop is 0.15 m by 0.20 m. A uniform 0.50 T magnetic field passes perpendicular to its plane. Find magnetic flux. What happens to flux if field strength doubles with area fixed?

11. A 200-turn coil has area 0.010 $m^2$ per turn. A perpendicular field increases from 0.10 T to 0.40 T in 0.20 s. Find induced emf magnitude and current if total resistance is 6.0 Ω.

12. Explain why moving a magnet through a closed conducting coil takes work. Predict how induced emf changes when the same flux change occurs in half the time.

## 8.5 Motors and Generators

13. Compare a motor and a generator. State each device’s energy input, energy output, and physical principle. Explain the role of the split-ring commutator in a simple DC motor.

14. An ideal transformer has 800 primary turns and 40 secondary turns. The primary connects to 120 V AC. Find secondary voltage. Is it step-up or step-down? Explain why steady DC does not sustain transformer operation.

## Unit 8 Review

15. An ideal transformer raises 12,000 V to 240,000 V. Its primary has 150 turns. Find the secondary turns. For 480,000 W transmitted power, find current at each voltage.

16. Using Question 15, compare resistive power loss in the same transmission line at the two currents. Explain why a generator requires a continuing mechanical energy supply.