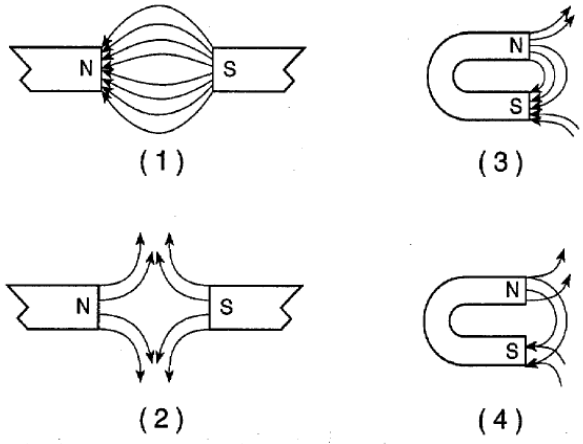
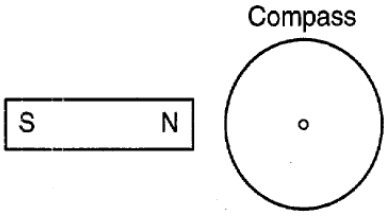
IB Physics SL Y2- CW #1
Magnetic poles and fields

Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must: 1) *Draw a picture or diagram* to visualize the problem; 2) *Show each step of your calculations clearly*; and 3). *Write a few sentences* explaining important steps and discussing the reasonableness of your result. It is ok to collaborate with your peers, but the work must be your own.

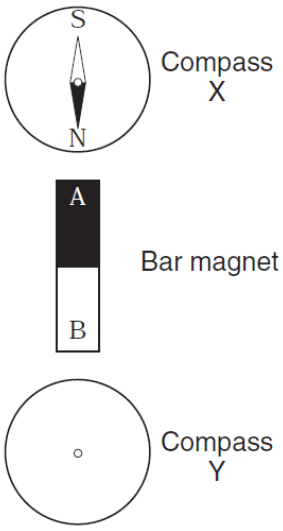
You must take homework seriously to learn physics



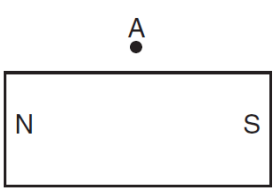
1. Which diagram above correctly shows magnetic field lines? Explain what is incorrect about the other three.



2. The diagram above shows a compass placed near the north pole, N, of a bar magnet.
   - On the diagram above, draw the magnetic field lines due to the bar magnet.
   - Next, draw the position of the compass needle as it responds to the bar magnet. Label the north and south poles on the needle.



3. The diagram above shows two compasses located near the ends of a bar magnet. The north pole of compass X points toward end A of the magnet.
   - On the diagram above, draw the magnetic field due to the bar magnet.
   - Next, draw the correct orientation of the needle of compass Y and label its polarity.



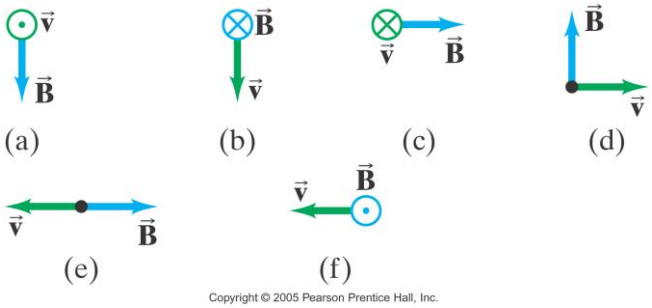
4. The diagram above shows a bar magnet. Which arrow best represents the direction of the needle of a compass placed at point A? Explain.

(1) ↑ (3) →
(2) ↓ (4) ←

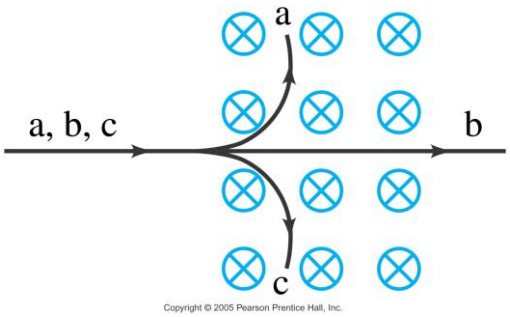
IB Physics SL Y2- CW #2
Right hand rule #1

Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must: 1) *Draw a picture or diagram* to visualize the problem; 2) *Show each step of your calculations clearly*; and 3). *Write a few sentences* explaining important steps and discussing the reasonableness of your result. It is ok to collaborate with your peers, but the work must be your own.

You must take homework seriously to learn physics

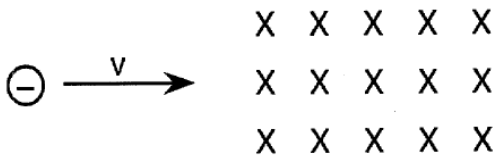


5. Using the right hand rule, find the direction of the force on a positive charge for each diagram shown above, where $\vec{\mathbf{v}}$ (green) is the velocity of the charge and $\vec{\mathbf{B}}$ (blue) is the direction of the magnetic field. (⊗ means the vector points inward. ⊙ means it points outward, toward you.)



6. Three particles, a, b, and c, enter a magnetic field pointing into the page as shown above. What can you say about the charge on each particle?

Base your answers to questions 78 and 79 on the diagram below which represents an electron moving with speed v to the right and about to enter a uniform magnetic field acting into the page.



7.

78 Upon entering the magnetic field, the electron will be deflected

1 into the page
2 out of the page
3 toward the top of the page
4 toward the bottom of the page

8.

79 If the speed of the electron is 3.0×10^3 meters per second and the magnitude of the magnetic field is 3.0×10^{-5} tesla, the magnitude of the magnetic force on the electron is approximately

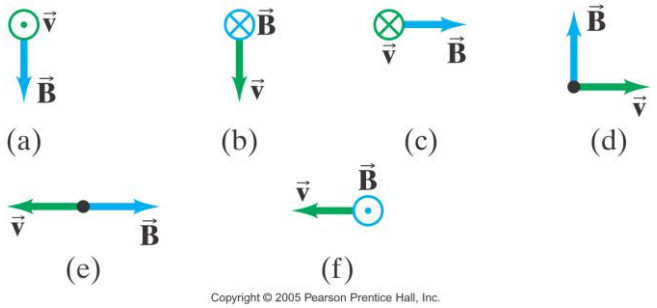
(1) 4.8×10^{-24} N
(2) 1.4×10^{-20} N
(3) 4.8×10^{-16} N
(4) 9.0×10^{-2} N

9. Determine the magnitude and direction of the force on an electron traveling 8.75×10^5 m/s horizontally to the east in a vertically upward magnetic field of strength 0.75 T.

IB Physics SL Y2- CW #3
Motion of charge in B-field

Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must: 1) *Draw a picture or diagram* to visualize the problem; 2) *Show each step of your calculations clearly*; and 3). *Write a few sentences* explaining important steps and discussing the reasonableness of your result. It is ok to collaborate with your peers, but the work must be your own.

You must take homework seriously to learn physics



10. Find the direction of the force on a negative charge for each diagram shown above, where $\vec{v}$ (green) is the velocity of the charge and $\vec{B}$ (blue) is the direction of the magnetic field. ($\otimes$ means the vector points inward. $\odot$ means it points outward, toward you.)

11. Can you set a resting electron into motion with a magnetic field? With an electric field? Explain.

12. Alpha particles of charge q = +2e and mass m = 6.6×10^{-27} kg are emitted from a radioactive source at a speed of 1.6×10^{7} m/s. What magnetic field strength would be required to bend them into a circular path of radius r = 0.25 m?

13. An 8 x 10^{-13} J (kinetic energy) proton enters a 0.20-T field, in a plane perpendicular to the field. What is the radius of its path?

IB Physics SL Y2- CW #4
E-field and B-field

Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must: 1) *Draw a picture or diagram* to visualize the problem; 2) *Show each step of your calculations clearly*; and 3). *Write a few sentences* explaining important steps and discussing the reasonableness of your result. It is ok to collaborate with your peers, but the work must be your own.

You must take homework seriously to learn physics

14. A charged particle moves in a straight line through a particular region of space. Could there be a nonzero magnetic field in this region? If so, give two possible situations.

15. Protons move in a circle of radius 5.10 cm in a 0.566-T magnetic field. What value of electric field could make their paths straight? In what direction must it point?

16. What is the velocity of a beam of electrons that go undeflected (straight path) when passing through perpendicular electric and magnetic fields of magnitude 8.8×10^{3} V/m and 3.5×10^{-3} T respectively?

17. In the previous problem, the electric field is suddenly turned off. What is the radius of the electron orbit?

IB Physics SL Y2- CW #5
Current-carrying wire in B-field

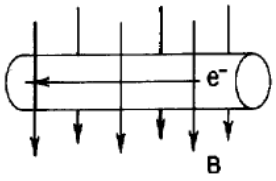
Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must: 1) *Draw a picture or diagram* to visualize the problem; 2) *Show each step of your calculations clearly*; and 3). *Write a few sentences* explaining important steps and discussing the reasonableness of your result. It is ok to collaborate with your peers, but the work must be your own.

You must take homework seriously to learn physics

18. How much current is flowing in a wire 4.80 m long if the maximum force on it is 0.750 N when placed in a uniform 0.0800-T field?

19.

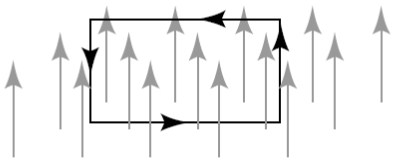
The diagram at the right represents a conductor carrying an electron current in magnetic field *B*. The direction of the magnetic force on the conductor is



1 into the page
2 out of the page
3 toward the top of the page
4 toward the bottom of the page

20.

A rectangular loop is placed in a uniform magnetic field with the plane of the loop parallel to the direction of the field. If a current is made to flow through the loop in the sense shown by the arrows, the field exerts on the loop:



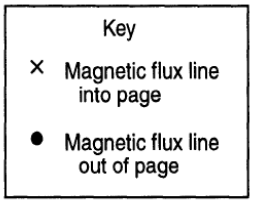
1. a net force.
2. a net torque.
3. a net force and a net torque.
4. neither a net force nor a net torque.

IB Physics SL Y2- CW #6

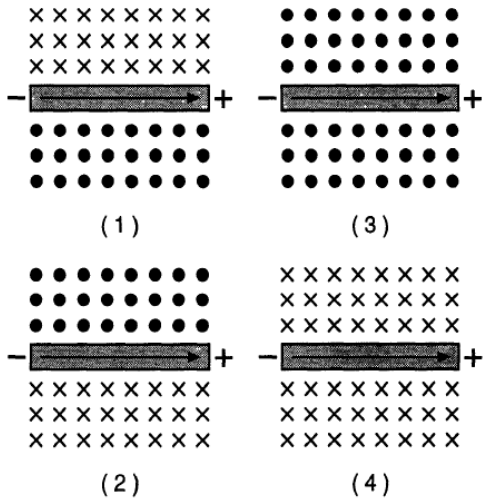
B-field of a current-carrying wire (Ampere's Law)

Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must: 1) *Draw a picture or diagram* to visualize the problem; 2) *Show each step of your calculations clearly*; and 3). *Write a few sentences* explaining important steps and discussing the reasonableness of your result. It is ok to collaborate with your peers, but the work must be your own.

You must take homework seriously to learn physics



21. Which diagram best represents the magnetic field around a straight wire in which electrons are flowing from left to right?



22. A jumper cable used to start a stalled vehicle carries a 65-A current. How strong is the magnetic field 6.0 cm away from it? Compare to the Earth's magnetic field.

IB Physics SL Y2- CW #7

Force on a charge/wire near current-carrying wire

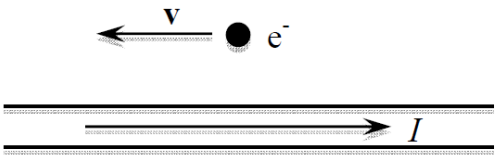
Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must: 1) *Draw a picture or diagram* to visualize the problem; 2) *Show each step of your calculations clearly*; and 3). *Write a few sentences* explaining important steps and discussing the reasonableness of your result. It is ok to collaborate with your peers, but the work must be your own.

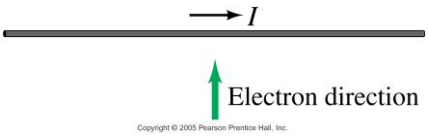
You must take homework seriously to learn physics

23.

A wire has a conventional current *I* directed to the right. At the instant shown in the figure, an electron has a velocity directed to the left. The magnetic force on the electron at this instant is

(A) zero.
(B) directed out of the plane of the page.
(C) directed into the plane of the page.
(D) directed toward the top of the page.
(E) directed toward the bottom of the page.



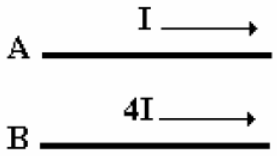


24. An electron is approaching a wire as shown above. There is current flowing through the wire from left to right.
- In what direction is the B-field below the wire?
- In what direction is the magnetic force on the electron?
- If the electron has a speed of 500 m/s, and the current is 0.1A, what is the force on the electron when it is 1 cm from the wire?

25.

Two parallel wires are carrying different electric currents in the same direction as shown in the diagram. How does the magnitude of the force on A from B compare to the force on B from A?

A) $F_{\text{on A from B}} = 4\, F_{\text{on B from A}}$
B) $F_{\text{on A from B}} = \frac{1}{4}\, F_{\text{on B from A}}$
C) $F_{\text{on A from B}} = 2\, F_{\text{on B from A}}$
D) $F_{\text{on A from B}} = \frac{1}{2}\, F_{\text{on B from A}}$
E) $F_{\text{on A from B}} = F_{\text{on B from A}}$

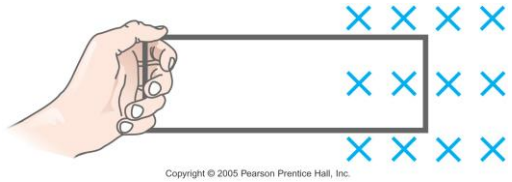


26. What direction is the force on the wire carrying the *4I* current in the problem above?

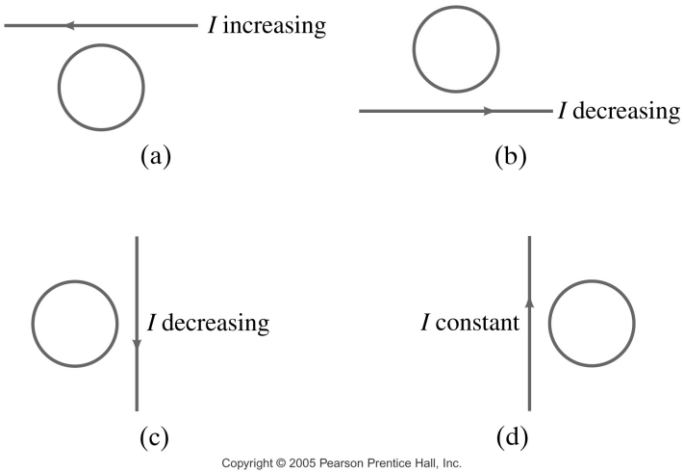
IB Physics SL Y2- CW #8
Flux and Lenz's law

Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must: 1) *Draw a picture or diagram* to visualize the problem; 2) *Show each step of your calculations clearly*; and 3). *Write a few sentences* explaining important steps and discussing the reasonableness of your result. It is ok to collaborate with your peers, but the work must be your own.

You must take homework seriously to learn physics



27. The rectangular loop shown above is pushed into the magnetic field which points into the page. In what direction is the induced current in the loop?



28. What is the direction of the induced current in the circular loop due to the changing current in the straight wire?

29. A rectangular wire loop in the plane of the page has sides of length 6.0 cm and 2.5 cm. If a 5.0-T magnetic field points into the page, what is the magnetic flux through the loop?

30. A magnetic field of strength 12.5 Teslas is directed perpendicular to a circular loop of wire with a diameter of 50.0 mm. What is the flux through the loop of wire?

IB Physics SL Y2- CW #9
Induced emf

Instructions: Complete these problems on separate paper. On ALL questions (yes, even multiple choice), you must: 1) *Draw a picture or diagram* to visualize the problem; 2) *Show each step of your calculations clearly*; and 3). *Write a few sentences* explaining important steps and discussing the reasonableness of your result. It is ok to collaborate with your peers, but the work must be your own.

You must take homework seriously to learn physics

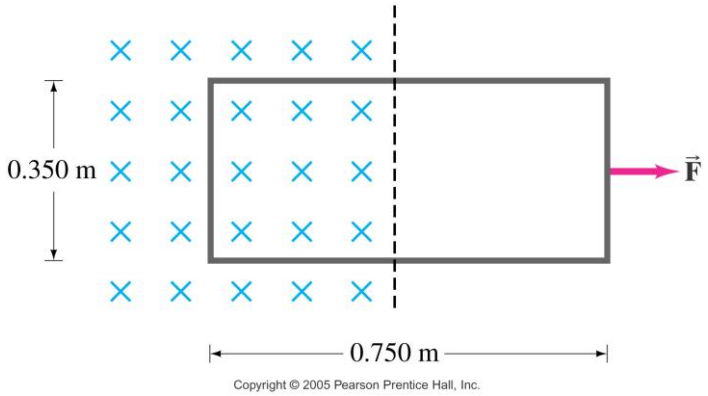
31. A 9.6-cm-diameter circular loop of wire is in a 1.10-T magnetic field. The loop is removed from the field in 0.15 s. What is the average induced emf?

32. A 12.0-cm-diameter loop of wire is initially oriented perpendicular to a 1.5-T magnetic field. The loop is rotated so that its plane is parallel to the field direction in 0.20 s. What is the average induced emf in the loop?

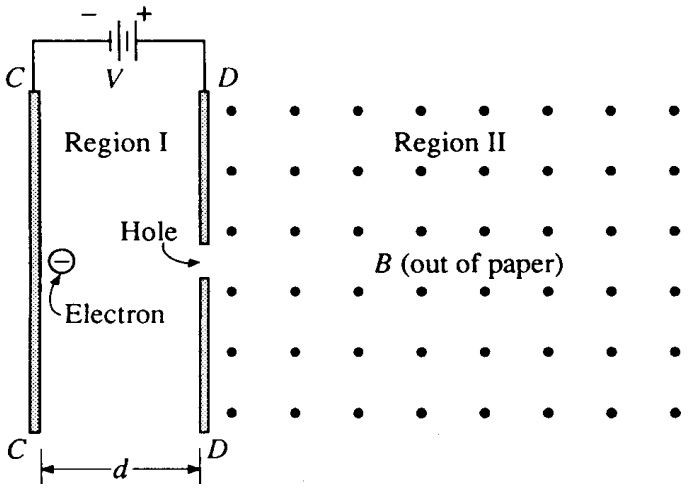
33. A circular loop in the plane of the paper lies in a 0.75-T magnetic field pointing into the paper. If the loop's diameter changes from 20.0 cm to 6.0 cm in 0.50 s, (*a*) what is the direction of the induced current, (*b*) what is the magnitude of the average induced emf, and (*c*) if the coil resistance is 2.5 Ω, what is the average induced current?

IB Physics SL Y2- CW #10
Magnetism Review

Instructions: Answer all questions in the space provided. Show all work and explain when necessary.
You must take homework seriously to learn physics.



1. Part of a single rectangular loop of wire with dimensions shown above is situated inside a region of uniform magnetic field of 0.550 T. The total resistance of the loop is 0.23Ω Calculate the force required to pull the loop from the field (to the right) at a constant velocity of 3.4 m/s. Neglect gravity.



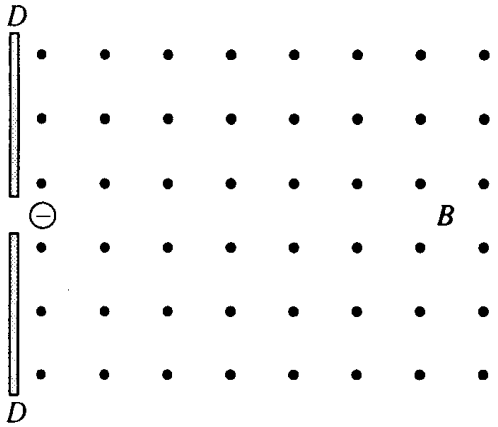
1991B2. In region I shown above, there is a potential difference V between two large, parallel plates separated by a distance d. In region II, to the right of plate D, there is a uniform magnetic field B pointing perpendicularly out of the paper. An electron, charge –e and mass m, is released from rest at plate C as shown, and passes through a hole in plate D into region II. Neglect gravity.

a. In terms of e, V, m, and d, determine the following.
   i. The speed v_o of the electron as it emerges from the hole in plate D
   ii. The acceleration of the electron in region I between the plates

b. On the diagram below do the following.

i. Draw and label an arrow to indicate the direction of the magnetic force on the electron as it enters the constant magnetic field.

ii. Sketch the path that the electron follows in region II.



c. In terms of e, B, V, and m, determine the magnitude of the acceleration of the electron in region II.

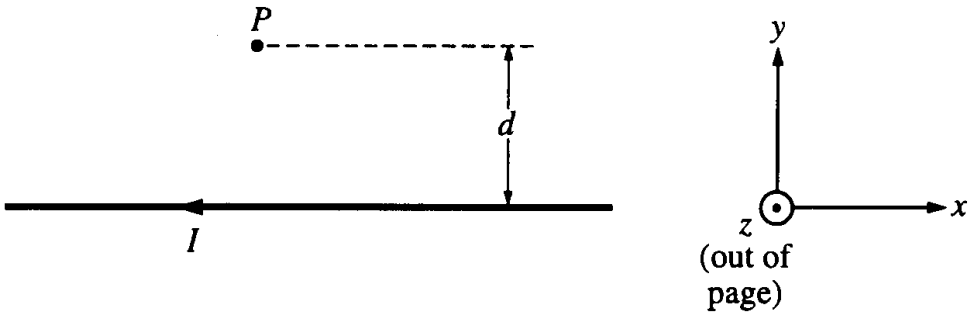


Figure 1

1998B8. The long, straight wire shown in Figure 1 above is in the plane of the page and carries a current I. Point P is also in the plane of the page and is a perpendicular distance d from the wire. Gravitational effects are negligible.

a. With reference to the coordinate system in Figure 1, what is the direction of the magnetic field at point P due to the current in the wire?

A particle of mass m and positive charge a is initially moving parallel to the wire with a speed v_o when it is at point P. as shown in Figure 2 below.

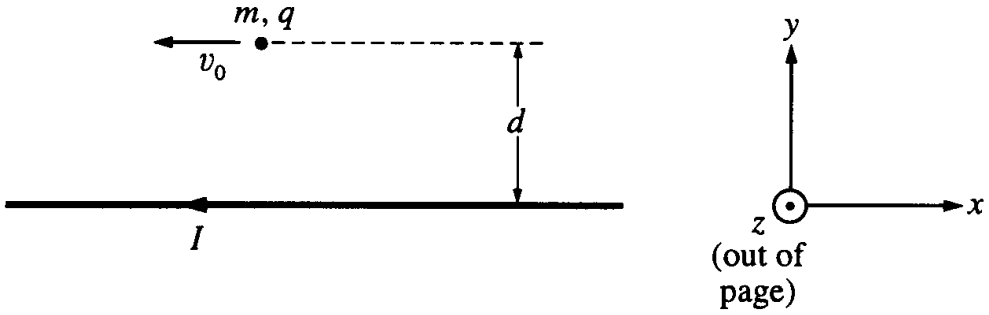


Figure 2

b. With reference to the coordinate system in Figure 2, what is the direction of the magnetic force acting on the particle at point P ?

c. Determine the magnitude of the magnetic force acting on the particle at point P in terms of the given quantities and fundamental constants.

d. An electric field is applied that causes the net force on the particle to be zero at point P.
   i. With reference to the coordinate system in Figure 2, what is the direction of the electric field at point P that could accomplish this?
   ii. Determine the magnitude of the electric field in terms of the given quantities and fundamental constants.