

TEACHER'S EDITION — ERRATA SHEET



Dear Teacher:

Despite a thorough editorial, technical and proofreading process, some errors have appeared in the first editions.

Following is an errata sheet for the first edition of the *Active Physics* Teacher's Edition for *Home*. This sheet indicates errors or improvements we have identified at this point, but were unable to correct or change on the first run.

Page 44

In Background Information, in the second column, fifth paragraph down, is an equation that ends with the letter *L*. Delete the *L* and replace with *d*. The equation:

$$\text{Rate of heat transfer through a material} = kA(\Delta T)/d$$

Page 142

In Background Information, in the second column, under the 10th paragraph is an equation that reads as follows:

$$\begin{aligned} &\text{joules} \\ &= (\text{coulomb/second}) \times (\text{joules/coulomb}) \\ &\quad \times (\text{second}) \\ &= \text{joules.} \end{aligned}$$

Please delete the top reference to joules. The equation should read as follows:

$$\begin{aligned} &= (\text{coulomb/second}) \times (\text{joules/coulomb}) \\ &\quad \times (\text{second}) \\ &= \text{joules.} \end{aligned}$$

Page 202

In Background Information, in the first column, fifth paragraph down, is an equation that ends with $1N/am$. This should be replaced with:

$$1N/(\text{amp})m$$

In the second column, after the fourth paragraph, is an equation that reads $B=mOI/2pd$. The italic *m* should be replaced with the Greek symbol for "mu" and the zero should be subscript. In addition, the letter *p* should be replaced with the Greek symbol for pi. The equation should read as follows:

$$B=m_0 I/2\pi d$$

In the paragraph immediately below, m_0 should be replaced with the Greek symbol for "mu" and the zero should be subscript. (m_0)

In the next equation, which reads $4\pi \times 10^{-7}$ newton/amp², the change should be made to have the equation read:

$$4\pi \times 10^{-7} \text{ newton}/(\text{amp})^2$$

Page 210

In Background Information, in the first column, the bottom equation should have the italic *m* replaced with the Greek symbol for "mu." The equation should read as follows:

$$B = \mu_0 NI/L$$

In the second column, in the first and second paragraphs, there are two additional references to the italic *m*. Both should be replaced by the Greek symbol for "mu." (μ)

Page 211

In the first column, the fourth equation down reads $B = F/A$. The *F* should be replaced with the Greek symbol for "phi." The equation should read as follows:

$$B = \phi / A$$

In the first sentence of the text directly below the equation, the letter *F* appears once again. This letter is also to be replaced by the Greek symbol for "phi." (ϕ)

Page 219

In Background Information, under the second paragraph, is art work. A subhead should appear above the art. It should read:

Arrows Show Motion Of Wire.

The small descriptive phrases under each piece of art should be deleted. Under the left side of the art, the phrase Changes In Flux Linkage should be changed to Wire Cuts Flux. Under the right side of the art, the phrase No Change In Flux Linkage should be changed to Flux Is Not Cut. Under the art work and under the paragraph directly below it is the equation $V = -\Delta\phi/\Delta t$. The *F* should be replaced by the Greek symbol for "phi." (ϕ)

Page 240

Please see the facing page for the following changes. The page has been virtually redesigned and rewritten. In Background Information, the first illustration has been divided into three separate illustrations that have been placed accordingly throughout the text.

Note the slight change in the Left-hand Motor Rule illustration. The drawing of the hand indicates a palm-up position. Also note that all the text should be replaced with the text that follows.

ACTIVITY FIVE

Building an Electric Motor

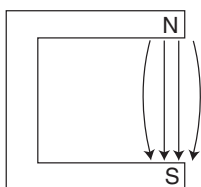
Background Information

Principles of the electric motor are introduced in Activities Five and Six. The background information presented here will serve for both activities and will be limited to the DC motor.

A DC motor can be thought of as a DC generator “running backwards,” and vice versa. Indeed, Gramme’s discovery described in the student text for Activity Five shows that this is true in fact as well as principle.

How an electric motor converts electrical energy into mechanical energy is understood by considering what happens when an electric current travels in a region in which a magnetic field exists.

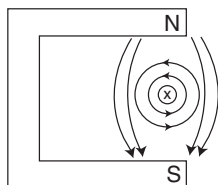
The diagram below shows a permanent “horseshoe” magnet which has a strong magnetic field in the region between the poles of the magnet. Magnet field lines extend from the north pole to the south pole of the magnet, as shown by the arrowheads on the field lines.



The smallest concentric circle in the diagram below represents a segment of wire viewed from one end. The “x” inside the smallest circle indicates that an electric current is flowing in the wire and has a direction away from the reader, into the page. The outer circles, with arrowheads, represent a magnetic field, caused by the current, surrounding the wire in the counterclockwise direction.



Below is shown a model which explains what happens when a current-carrying wire which has its associated circular magnetic field is placed in the magnetic field created by the permanent magnet.



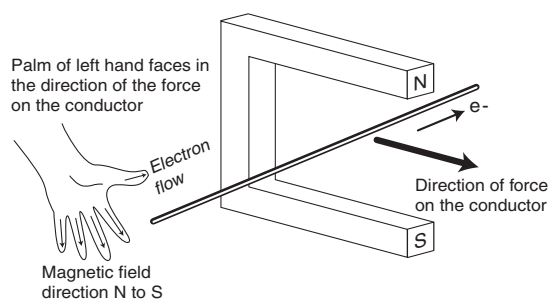
Directly to the left of the wire the magnetic field caused by the current has the same direction (downward) as the field established by the permanent magnet. Directly to the right of the wire the opposite is true; the field lines are in opposite directions. Lenz’s Law suggests that forces arise to prevent changes in magnetic field lines, and, in this case, motion of the wire to the right would tend to preserve uniformity of the magnetic field; an electromagnetic force, F , would move the wire to the right in an attempt to move the high density field to the left of the wire to “fill in” the low density field to the right of the wire in the same way that “nature abhors a vacuum.”

The amount of force on the wire in the simple case when the current passes perpendicularly through the field created by the permanent magnetic is:

$$F = BIL$$

where F is the force on the wire in Newtons, B is the strength of the magnetic field of the permanent magnet in Tesla, I is the current in the wire in amperes, and L is the length in meters along which the wire is embedded in the field.

A convenient “left-hand rule” for predicting the direction of the force in a current-carrying wire travelling through a magnetic field in a direction which is perpendicular to the direction of the magnetic field lines is shown in the diagram below:



Left-hand motor rule

If the wire did indeed move to the right in the above position, it soon would exit the magnetic field, and the force would disappear. Therefore, electric motors are designed to employ a coil which rotates in a magnetic field. The above described motor effect can be applied in a “thought experiment” in which a current is fed into the coil of a DC generator to cause the coil to rotate. It is suggested that you satisfy yourself that motors and generators are basically the same in construction, the difference being that electrical energy is the output for the generator and is the input for the motor.