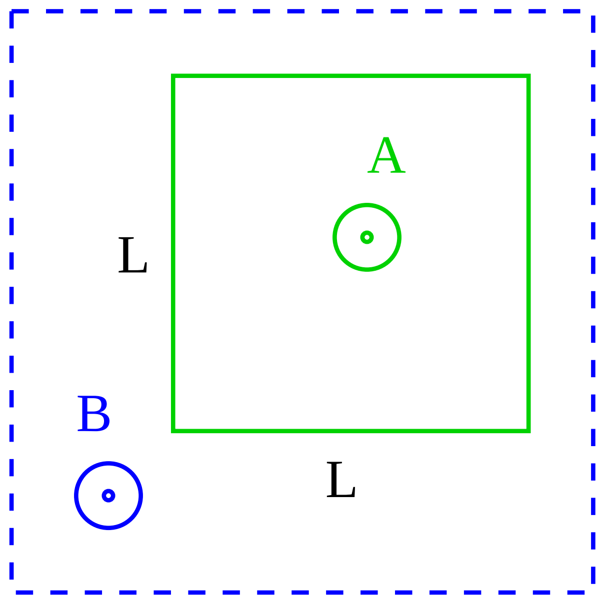
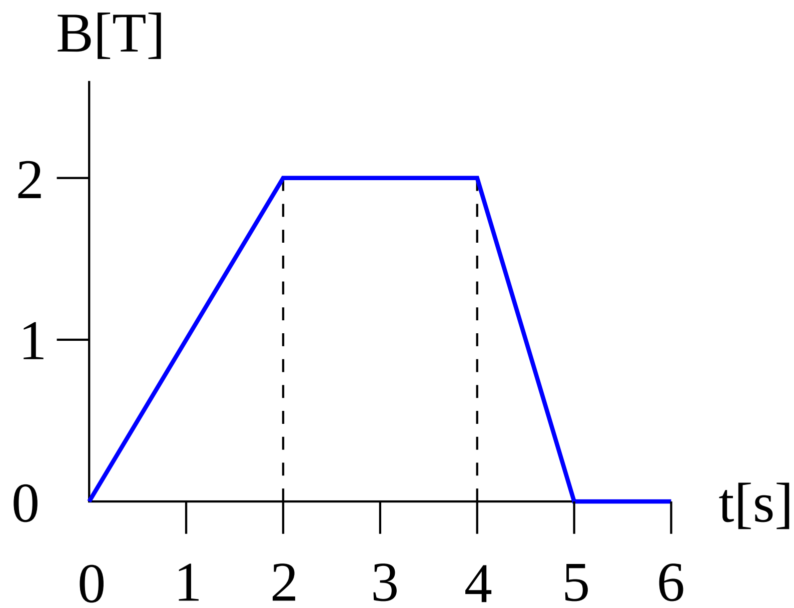
Magnetic Induction: Application (10)

Consider a conducting square frame with sides of length $L = 2$m in a magnetic field $\vec{B}$. The resistance of the square is $R = 4\Omega$ and the magnitude of $\vec{B}$ varies with time as shown in the graph.

(a) Find magnitude and direction of the induced current I at times $t = 1$s, 3s, 4.5s.

(b) Consider instead a magnetic field with the following time-dependence: $B(t) = B_0 \sin^2(\omega t)$.





Magnetic Induction: Application (13)

A rod of length ℓ, mass m, and negligible resistance slides without friction down a pair of parallel conducting rails, which are connected at the top of the incline by a resistor with resistance R. A uniform vertical magnetic field $\vec{B}$ exists throughout the region.

(a) Identify the forces acting on the rod when it slides down with velocity v.

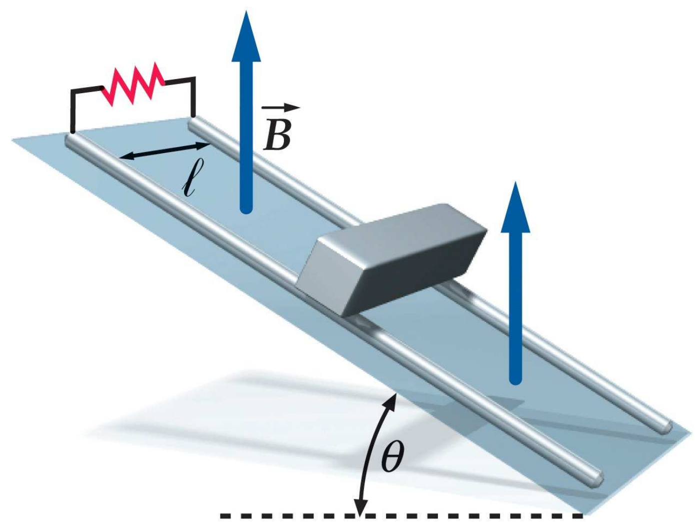
(b) Determine the velocity for which all forces acting on the rod are in balance.

Determine the direction of the induced current from

(c) the magnetic force acting on the charge carriers in the rod,

(d) from the change in magnetic flux through the conducting loop,

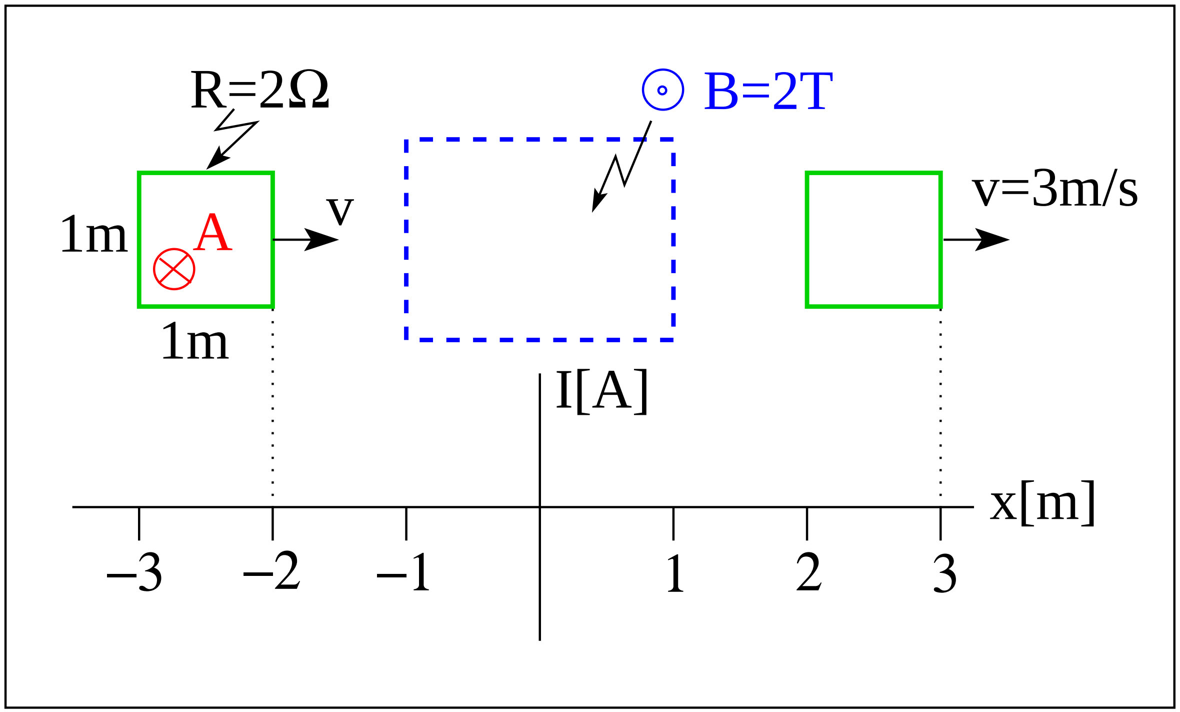
(e) from Lenz's law.



Magnetic Induction: Application (6)

A conducting square frame is moved at constant velocity $\vec{v}$ across a rectangular region of uniform magnetic field $\vec{B}$ pointing out of the plane.

- Plot the induced current I versus position x of the square. Take the positive current direction to be clockwise (area vector $\vec{A}$ into plane).



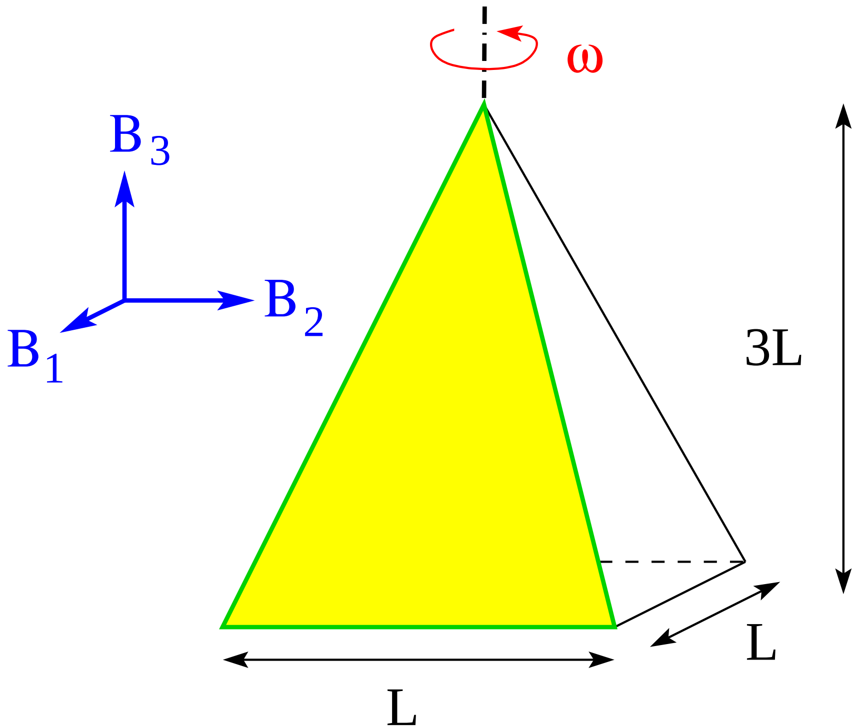
Magnetic Induction: Application (11)

The pyramid is positioned in one of three magnetic fields $\vec{B}_1, \vec{B}_2, \vec{B}_3$ of 1T magnitude in the directions shown and rotates about its vertical axis with angular velocity ω.
The green triangular face is a conducting frame.

At the instant pictured here, determine...

(a) which field produces the largest/smallest magnetic flux through the triangle,

(b) what the direction of the current induced in the triangle by each field is (cw,ccw,zero).

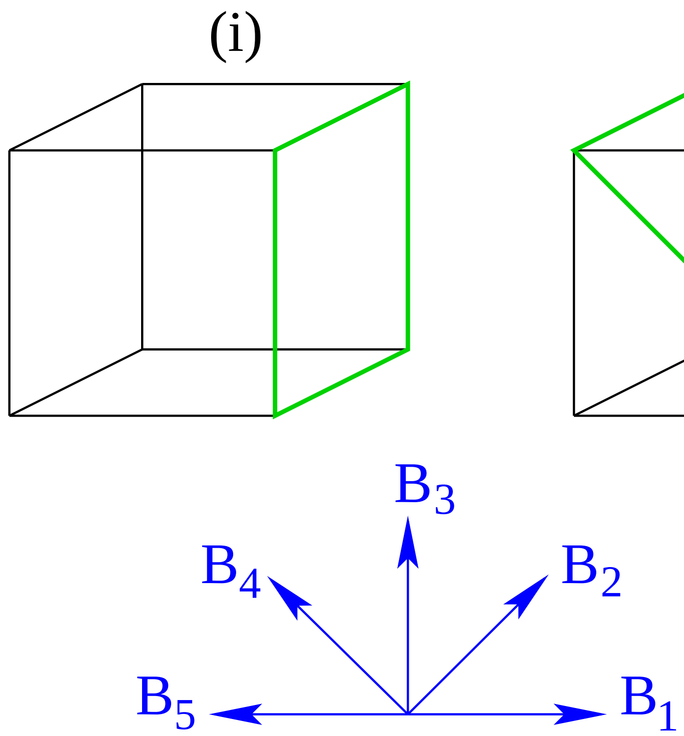


Magnetic Induction: Application (12)

Consider two conducting loops (i) and (ii) (indicated by green lines in cubes of sides $L = 2$m). Each loop is placed in a region of uniform magnetic field with linearly increasing magnitude, $B(t) = bt, b = 2$T/s, and one of the five directions indicated.

(a) Find the magnetic flux through each loop as produced by each field.

(b) Find the magnitude and direction of the emf induced by each field in each loop.



Magnetic Induction: Application (2)

A conducting sphere attached to the pivot by a thin conducting wire is released from rest in position 1. There is a uniform magnetic field pointing out of the plane.

When the sphere has reached position 2...

(a) which is at the higher gravitat. potential: pivot/sphere?

(b) which is at the higher electrical potential: pivot/sphere?

(c) what is the induced EMF between pivot and sphere?