

29. (a) By Lenz's law, the induced emf is clockwise. In the rod itself, we would say the emf is directed up the page. Eq. 31-10 leads to

$$\mathcal{E} = BLv = (1.2 \text{ T})(0.10 \text{ m})(5.0 \text{ m/s}) = 0.60 \text{ V} .$$

- (b) By Ohm's law, the (clockwise) induced current is  $i = 0.60 \text{ V}/0.40 \Omega = 1.5 \text{ A}$ .  
(c) Eq. 27-22 leads to  $P = i^2 R = 0.90 \text{ W}$ .  
(d) From Eq. 29-2, we find that the force on the rod associated with the uniform magnetic field is directed rightward and has magnitude

$$F = iLB = (1.5 \text{ A})(0.10 \text{ m})(1.2 \text{ T}) = 0.18 \text{ N} .$$

To keep the rod moving at constant velocity, therefore, a leftward force (due to some external agent) having that same magnitude must be continuously supplied to the rod.

- (e) Using Eq. 7-48, we find the power associated with the force being exerted by the external agent:  $P = Fv = (0.18 \text{ N})(5.0 \text{ m/s}) = 0.90 \text{ W}$ , which is the same as our result from part (c).