

40. **REASONING AND SOLUTION**

a. From Right-Hand Rule No. 1, if we extend the right hand so that the fingers point in the direction of the magnetic field, and the thumb points in the direction of the current, the palm of the hand faces the direction of the magnetic force on the current.

The springs will stretch when the magnetic force exerted on the copper rod is downward, toward the bottom of the page. Therefore, if you extend your right hand with your fingers pointing out of the page and the palm of your hand facing the bottom of the page, your thumb points left-to-right along the copper rod. Thus, the current flows left - to - right in the copper rod.

b. The downward magnetic force exerted on the copper rod is, according to Equation 21.3

$$F = ILB \sin \theta = (12 \text{ A})(0.85 \text{ m})(0.16 \text{ T}) \sin 90.0^\circ = 1.6 \text{ N}$$

According to Equation 10.1, the force  $F_x^{\text{Applied}}$  required to stretch each spring is  $F_x^{\text{Applied}} = kx$ , where  $k$  is the spring constant. Since there are two springs, we know that the magnetic force  $F$  exerted on the current must equal  $2F_x^{\text{Applied}}$ , so that  $F = 2F_x^{\text{Applied}} = 2kx$ . Solving for  $x$ , we find that

$$x = \frac{F}{2k} = \frac{1.6 \text{ N}}{2(75 \text{ N/m})} = \boxed{1.1 \times 10^{-2} \text{ m}}$$