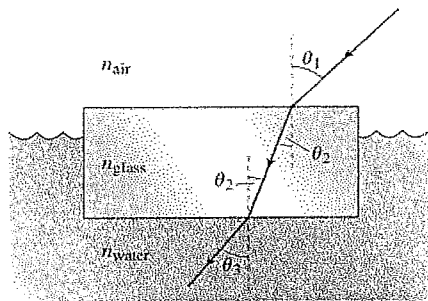


Question 1. A transformer steps down the voltage from house current at 120 VAC to 6 VAC to recharge a cellphone battery. The charger requires 7.0 Watts of power.

- What is the current in the primary?
- What is the primary:secondary turns ratio?
- What is the secondary current?
- What is the minimum power and the peak power?

Question 2. A plate of glass with parallel faces having a refractive index of $n_{\text{glass}} = 1.57$ is resting on the surface of water in a tank. A ray of light coming from above in air makes an angle of incidence $\theta_1 = 37.0^\circ$ with the normal to the top surface of the glass.

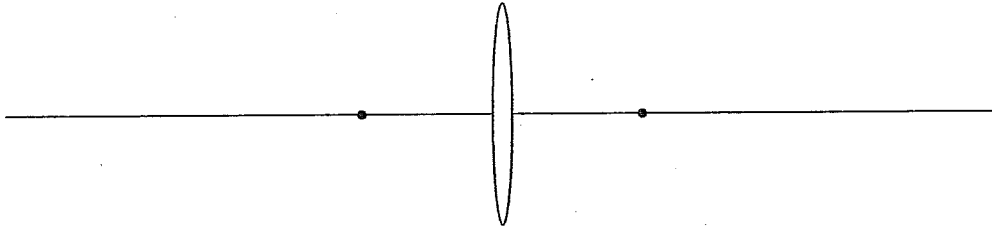


a. Find θ_2 the angle of refraction of the ray in the glass

b. Find θ_3 , the angle of refraction into the water. Use $n = 1.33$ for the index of refraction of water.

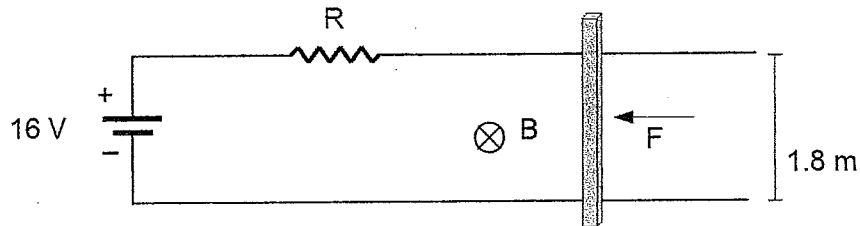
Question 3. There is a candle on the table a distance 25 cm from a lens. The candle is 12 cm tall. The focal length of the lens is 10 cm.

- What is the distance of the candle image from the lens?
- What is the size of the candle's image?
- Draw a ray diagram for the source - lens - image using Geometrical Optics.



d. The image is (**circle the correct ones**) :
 (upright real virtual inverted magnified de-magnified)

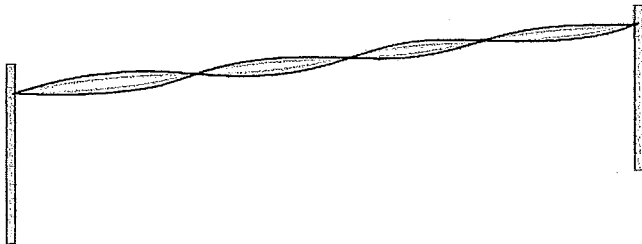
Question 4. A railgun is operated from a 15 V source. The B-field is 2.0 T. The rail separation is 1.8 m.



a. First the rail is held motionless by an outside force $F = 1080 \text{ N}$. What is the resistance R in the circuit?

b. Next the rail is let go and allowed to achieve it's free-running speed, v . What is the value of v ?
 (Hint: How much does the area increase in 1 second? Use Faraday's Law.)

Question 5. A strong wind blows the powerline between two poles, and sets up a standing wave on the wire, as indicated in the drawing. The distance between the poles is 200 m.



a. What is the wavelength of this standing wave?

b. The transverse wave speed in the wire is 20 m/s. What is the frequency of the vibration of the wire?