When designing a railroad, the civil engineer needs to consider how to minimize the risks that could cause train accidents, personal injury, and disaster. One important calculation engineers make is the minimum curve radius calculation, which estimates the tightest angle a curve can take which is safe for a train at maximum speed. The equation for minimum curve radius is:

\[ R_{\text{min}} = \frac{V^2}{127 (0.01e_{\text{max}} + f_{\text{max}})} \]

Where:
- \( R_{\text{min}} \) = minimum radius of the curve (in meters)
- \( V \) = velocity (in km/h)
- \( E_{\text{max}} \) = maximum superelevation rate (as %)
- \( F_{\text{max}} \) = maximum side-friction factor

ENGINEER A RAILROAD CURVE

MATERIALS: PAPER, PENCIL

DIRECTIONS

1. Calculate the design velocity using the formula \( v = \text{distance/time} \) for an average circus train traveling from Sarasota to Tampa, a distance of 98 km. If it takes one hour for the train to make that journey, what is the velocity of the train?

2. Calculate the minimum radius for a curve on the railroad on which your circus train is traveling. Assume a constant superelevation rate of 8%, and a constant side-friction factor of 0.5.

3. Hypothesis: If the train is traveling at a slow place, the minimum curve radius will (increase/decrease).

EXPLAIN IT

What would happen if a train takes curves at a higher speed than the minimum curve radius can support? What forces will keep the train in motion?