

Chapter 15 Problem 40 †

Given

$$l = 40 \text{ cm} = 0.40 \text{ m}$$

$$w = 55 \text{ cm} = 0.55 \text{ m}$$

$$P_{in} = 0.77 \text{ atm}$$

$$P_{out} = 0.22 \text{ atm}$$

Solution

Find the force required to pull the window inward.

The forces acting on the window are the outside pressure and the inside pressure.

$$F = F_{in} - F_{out} = AP_{in} - AP_{out}$$

$$F = A(P_{in} - P_{out}) = lw(P_{in} - P_{out})$$

Substitute in the known values gives

$$F = (0.40 \text{ m})(0.55 \text{ m})(.77 \text{ atm} - .22 \text{ atm})$$

$$F = 0.121 \text{ atm} \cdot \text{m}^2$$

Convert the atmospheres into Pascal's gives

$$F = 0.121 \text{ atm} \cdot \text{m}^2 \left(\frac{1.013 \times 10^5 \text{ N/m}^2}{1 \text{ atm}} \right)$$

$$F = 1.23 \times 10^4 \text{ N}$$

No Worries! The passenger will not be able to exert this kind of force.

†Problem from Essential University Physics, Wolfson