Solution

16. a. The marginal revenue is $40 - Q$:

$$MR = 40 - Q = 5 = MC$$

$$Q = 35$$

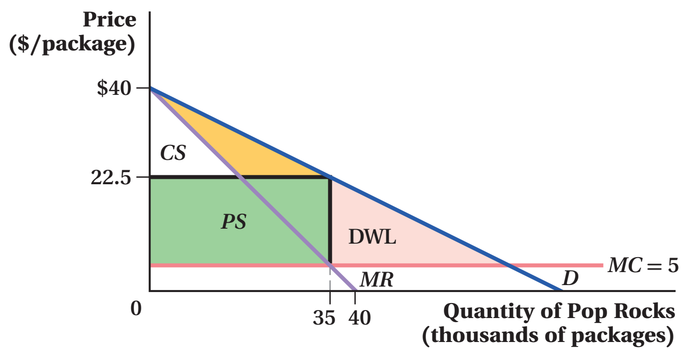
The unregulated monopolist will sell 35 flux capacitors.

b. The price ceiling is also the marginal revenue for the first 68 units; that is, $MR = 6$ because consumers are willing to pay \$6 or more. However, selling the 69th unit requires reducing the price to \$5.50. Thus, the total revenue from selling 68 units is $\$6 \times 68 = \$408$, and the total revenue from selling 69 units is $\$5.50 \times 69 = \$379.50$. Therefore, the marginal revenue of the 69th unit is $-\$28.50$.

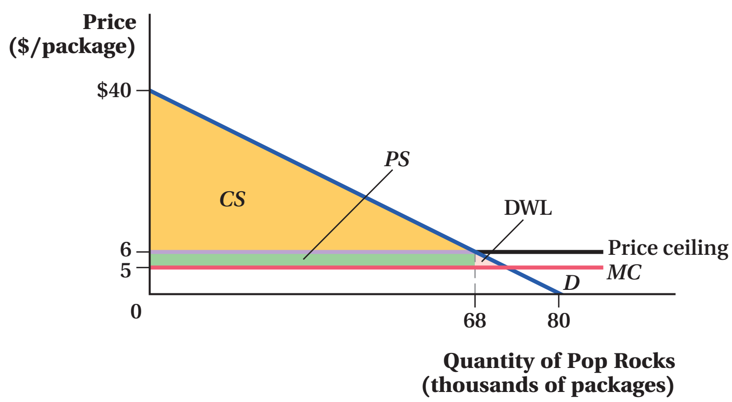
c. The monopolist will sell the first 68 units at a price of \$6, since the marginal revenue exceeds the marginal cost. The monopolist will not sell the 69th unit because the marginal cost is greater than the marginal revenue.

d. As shown in the diagrams below, the price ceiling indeed reduces the deadweight loss.

Case 1: Unregulated Monopoly



Case 2: Price Ceiling



e. We first need the revenue function. To get this, we can plug the inverse demand curve into revenue for P:

$$TR = PQ = (40 - 0.5Q)Q = 40Q - 0.5Q^2$$

Then,

$$MR = \frac{dMR}{dQ} = 40 - Q$$

f. Revenue is increasing when $\frac{dMR}{dQ} > 0$. Here, $40 - Q > 0$. Therefore, $Q < 40$.

g. The monopolist's profit-maximization problem is

$$\max_{Q} \pi = TR - TC = 40Q - 0.5Q^2 - 5Q = 35Q - 0.5Q^2$$

Solving,

$$\frac{d\pi}{dQ} = 35 - Q = 0$$

$$Q = 35$$

Subbing into the demand equation to derive price, we get $P = 40 - 0.5Q = 40 - 0.5(35) = 22.5$.

h. Since the second derivative of the profit function is $\frac{d^2\pi}{dQ^2} = -1 < 0$, the quantity identified in part (g) represents a maximum.