1. A person's demand for gizmos is given by the following equation:

$$q = 6 - 0.5p + 0.0002I$$

where, q is the quantity demanded at price p when the person's income is I. Assume initially that the person's income is \$60,000.

a. **At what price will demand fall to zero? (This is sometimes called the choke price because it is the price that chokes off demand.)**
b. **If the market price for gizmos is \$10, how many will be demanded?**
c. **At a price of \$10, what is the price elasticity of demand for gizmos?**
d. **At a price of \$10, what is the consumer surplus?**
e. **If price rises to \$12, how much consumer surplus is lost?**
f. **If income were \$80,000, what would be the consumer surplus loss from a price rise from \$10 to \$12?**

1.a. $q = 6 - 0.5p + 0.0002I$
$q = 6 - 0.5p + 0.0002(60{,}000)$
$q = 18 - 0.5p$

At the choke price, $q = 0$:
$0 = 18 - 0.5p$
$p = \$36$

1.b. $q = 18 - .5(10) = 13$

If the market price is \$10, then the consumer will demand 13 gizmos.

1.c. The price elasticity of demand equals approximately $(\Delta q/\Delta p)(p/q)$. For a linear demand curve, such as the one used in this problem, $\Delta q/\Delta p$ equals the slope of the demand curve, which in this exercise is -0.5. Therefore, the price elasticity of demand equals $(-0.5)(10/9) = -0.556$. That is, when price equals \$10, a one percent rise in price results in a 0.556 percent reduction in quantity demanded. Note that for a linear demand curve, the price elasticity of demand is not constant – its absolute value increases as price increases.

1.d. Thinking of a diagram with price on the vertical axis, consumer surplus is the triangle under the (inverse) demand schedule and above the price. The height of the triangle is the choke price minus the market price (36-10=26) and the base is the amount demanded (13). The area of the triangle is (26)(13)/2 = \$169.

1.e. A price rise to \$12 reduces demand to 12 gizmos. The new consumer surplus is (36-12)(12)/2 = \$144. The reduction in consumer surplus, therefore, is \$169-\$144 = \$25.

An alternative way to calculate the change in consumer surplus is to recognize it as the area of trapezoid resulting from the reduction in the size of the consumer surplus triangle. The trapezoid, in turn, can be thought of as a rectangle with sides equal to the price increase (12-10=2) and the new consumption level (12) and a triangle with a height equal to the price increase (2) and a base equal to the reduction in the quantity demanded (13-12=1). Adding these two areas together, we have (2)(12) + (2)(1)/2 = \$25, which is the same result as that obtained by subtracting the areas of the triangles.

1.f. When income equals \$80,000, the demand for gizmos is given by $q = 6 - 0.5p + (0.0002)(80{,}000) = 22 - 0.5p$.

For p=\$10, q=17; and for p=\$12, q=16. The change in consumer surplus is thus (12-10)(16) + (2)(1)/(2) = \$33. The larger change in consumer surplus for the higher income situation illustrates the dependence of willingness to pay on income.