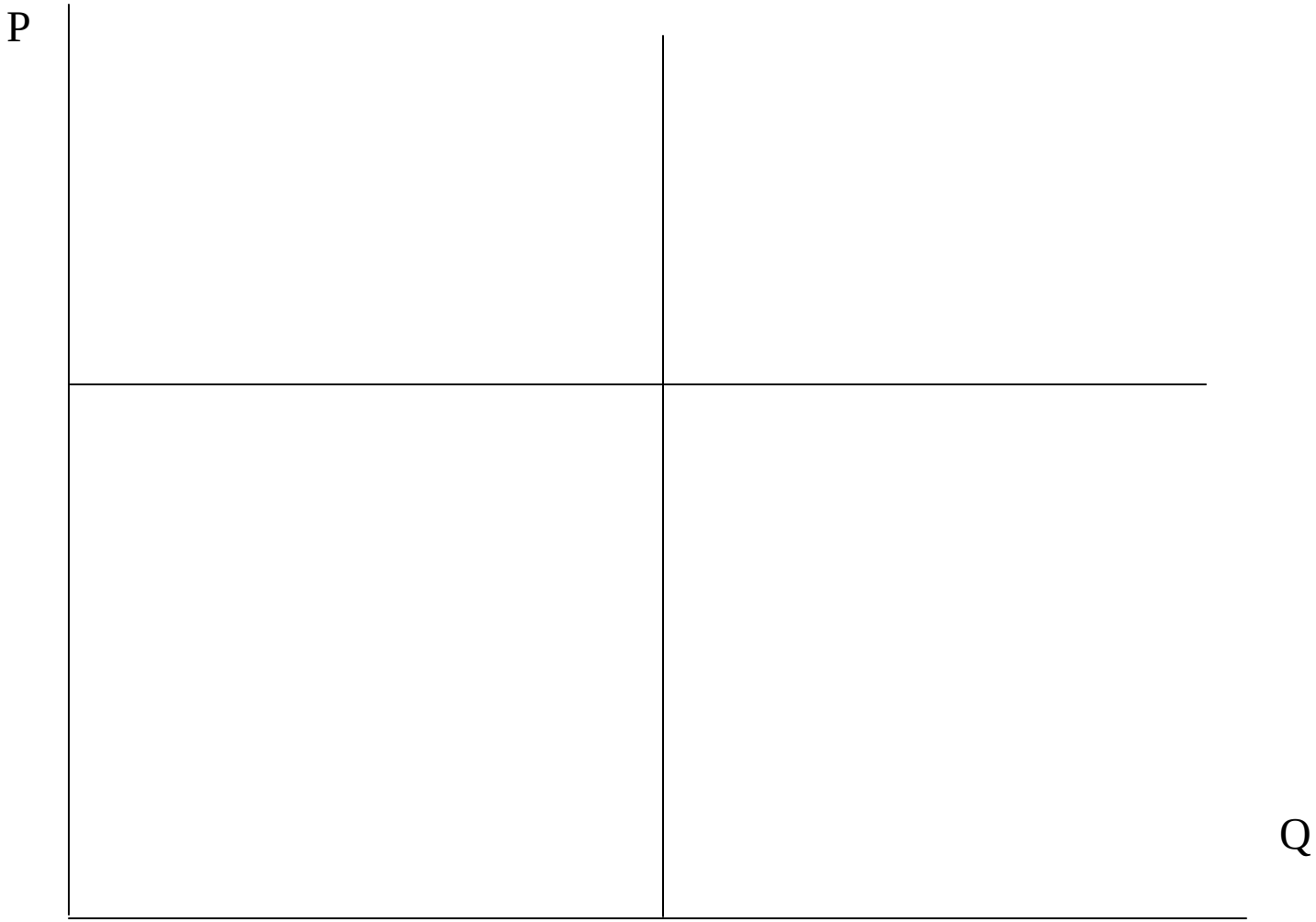
Instructions: You will have 75 minutes for the exam. Do not cheat. Raise your hand if you have a question, but continue to work on the exam while waiting for your question to be answered. Allocate your time like an economist would - do the easy/valuable questions first. Short answer questions should not require more than two lines. Question values are in parentheses. Use the back of the page as scratch paper.

1. Draw and label a market with a perfectly elastic supply and a perfectly inelastic demand.



2. (Short answer) Suppose that, at a price of $10, there are twice as many apples demanded as supplied. How does the price adjustment eliminate the shortage?

At $10, some consumers fail to obtain apples. Sellers can raise prices and still make sales. Increasing prices reduce quantity demanded and increase quantity supplied, eliminating the shortage.

3. (Short answer) Is electricity a normal good? Why or why not?

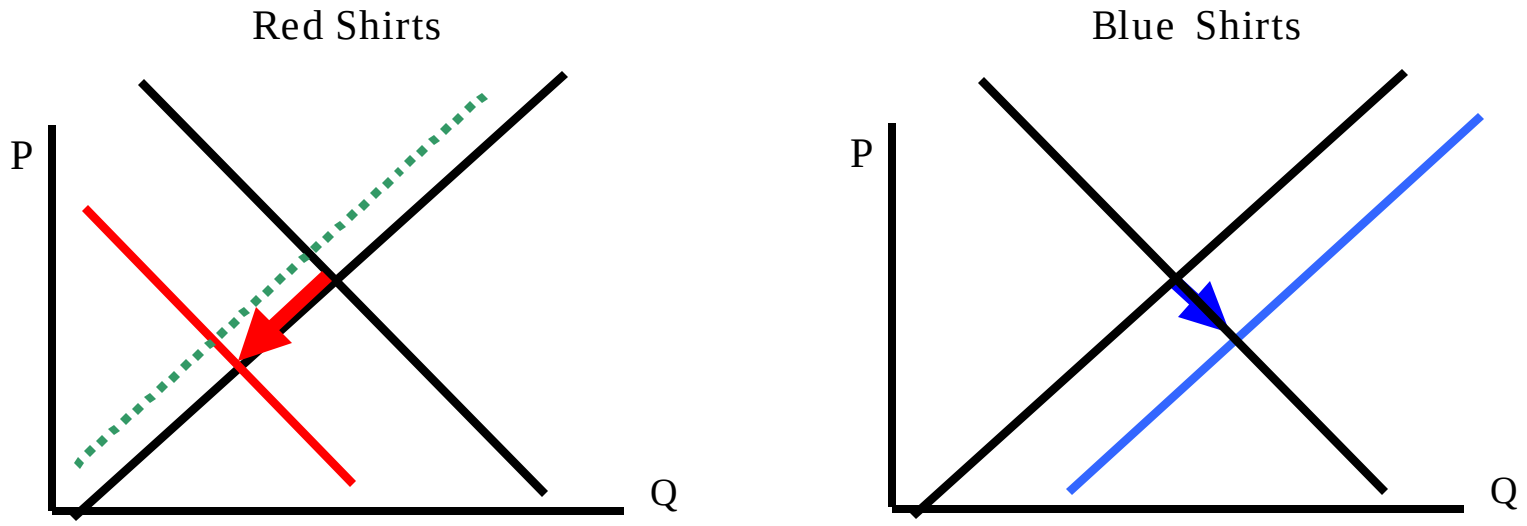
Yes, for richer consumers will buy more electricity. Thus electricity demand rises as income rises, the definition of a normal good.

4. (Short answer) Red shirts and blue shirts are substitutes in production.

(i) If the demand for red shirts falls, but the demand for blue shirts is unchanged, what will happen to the prices of red shirts and blue shirts?

Both prices fall. The price of red shirts falls because of the demand decrease, and the price of blue shirts falls because sellers substitute to the more profitable blue shirts, increasing supply.

(ii) Illustrate your answer with supply and demand diagrams:



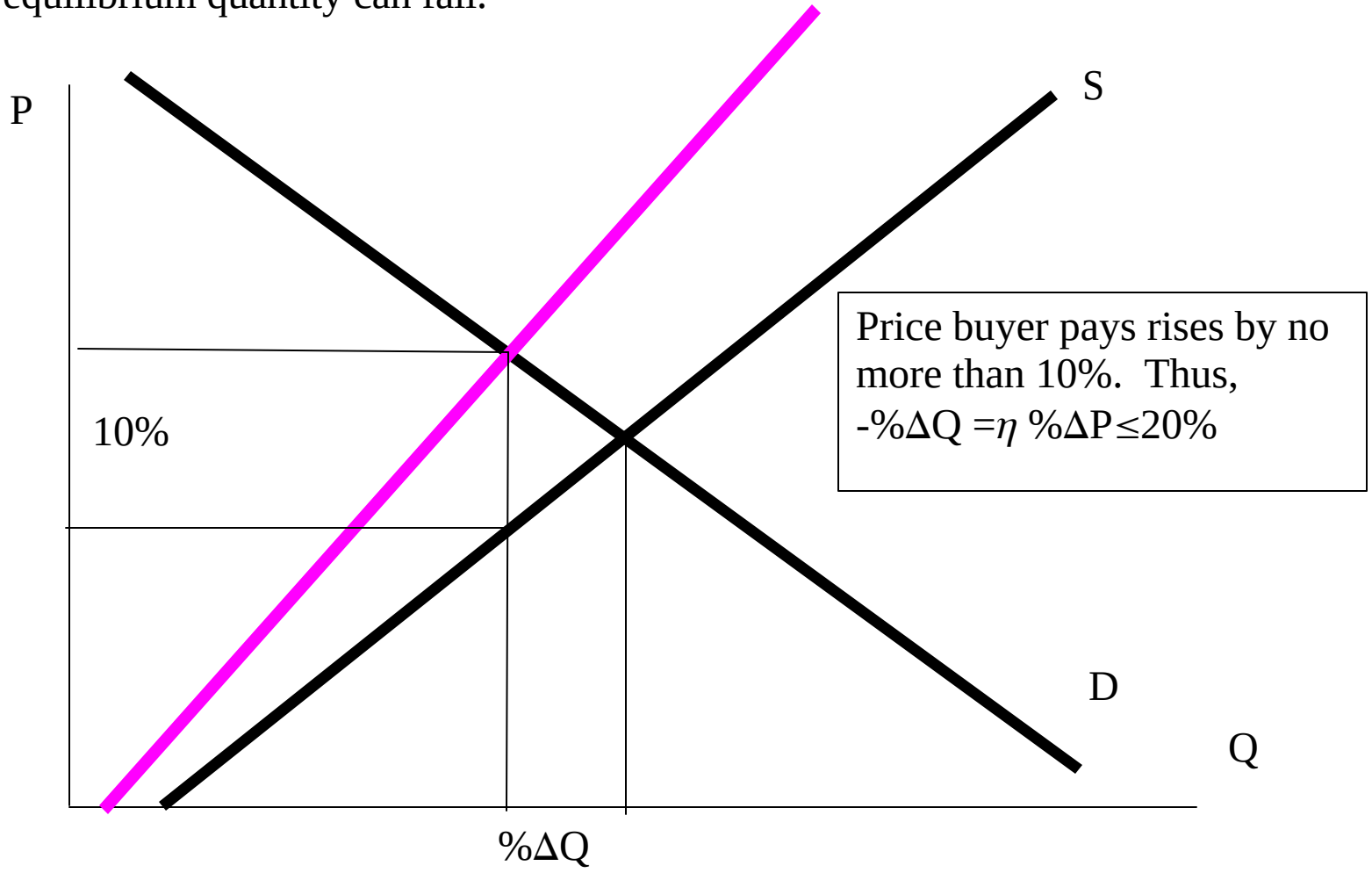
5. (Short answer) Provide two examples of by-products of the production of goods. What does the increase in price of a by-product do to the other good's supply? Why?

Gold and silver, beef and hides, lumber and wood chips (for paper), oil and natural gas.

An increase in the price of the byproduct makes the first good more profitable, increasing the supply.

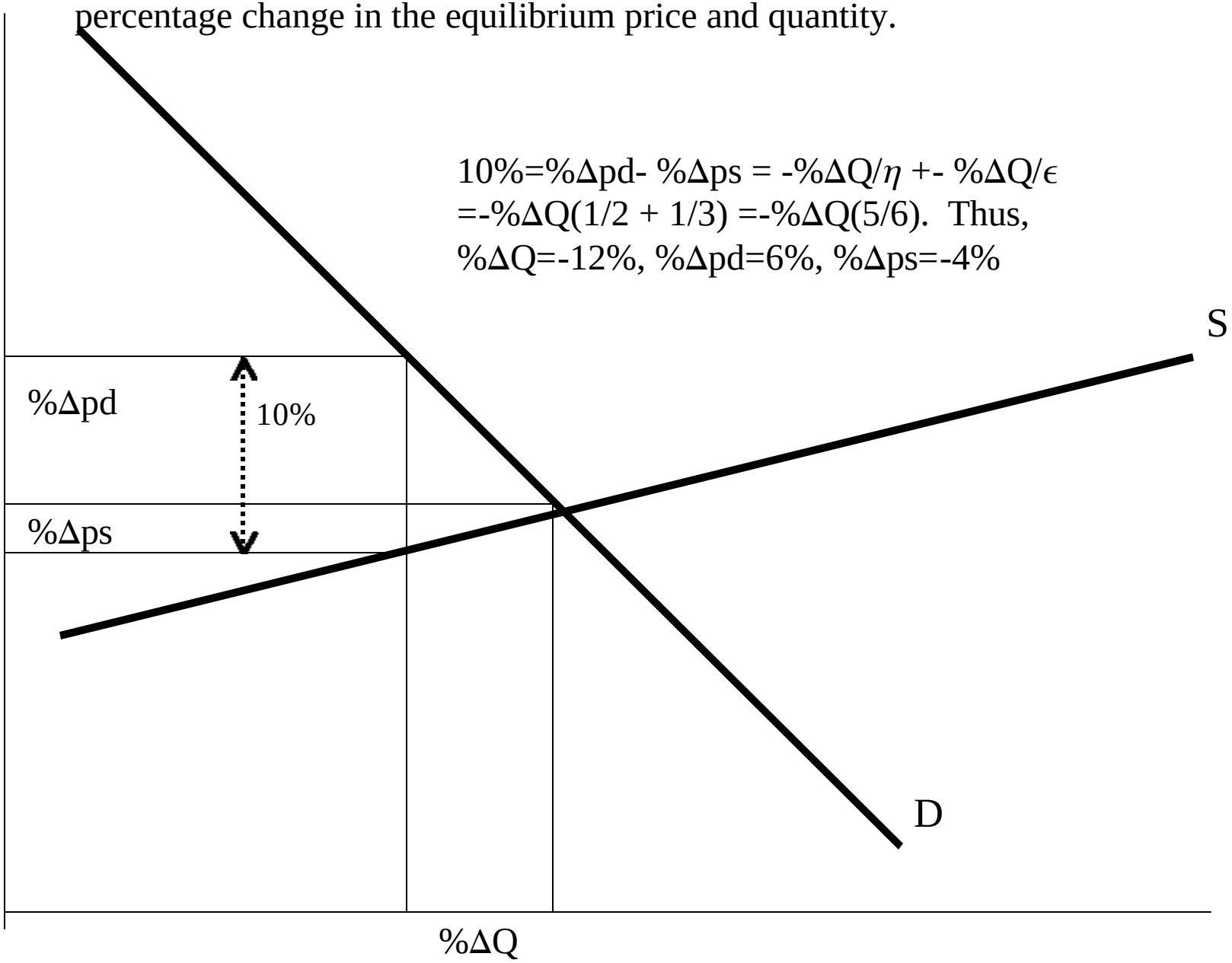
6. Suppose the elasticity of demand for shirts is 2. A 10% tax is imposed, which reduces supply in the following way: for any given quantity on the old supply curve, the required price to obtain the same quantity on the new supply curve is 10% higher.

(i) Using one diagram, illustrate the supply shift, and find the *maximum* that the equilibrium quantity can fall.



(ii) Now assume that the supply elasticity is 3. Using a second diagram, estimate the percentage change in the equilibrium price and quantity.

$10\% = \%\Delta pd - \%\Delta ps = -\%\Delta Q/\eta + - \%\Delta Q/\epsilon$
$= -\%\Delta Q(1/2 + 1/3) = -\%\Delta Q(5/6)$. Thus,
$\%\Delta Q = -12\%$, $\%\Delta pd = 6\%$, $\%\Delta ps = -4\%$



7. (No diagrams are necessary for the answer to this question) Tylenol is a substitute (in demand) for aspirin.

(i) What does the introduction of Tylenol do to the supply and demand for aspirin?

Tylenol, a substitute in demand for aspirin, will reduce demand for aspirin without affecting supply.

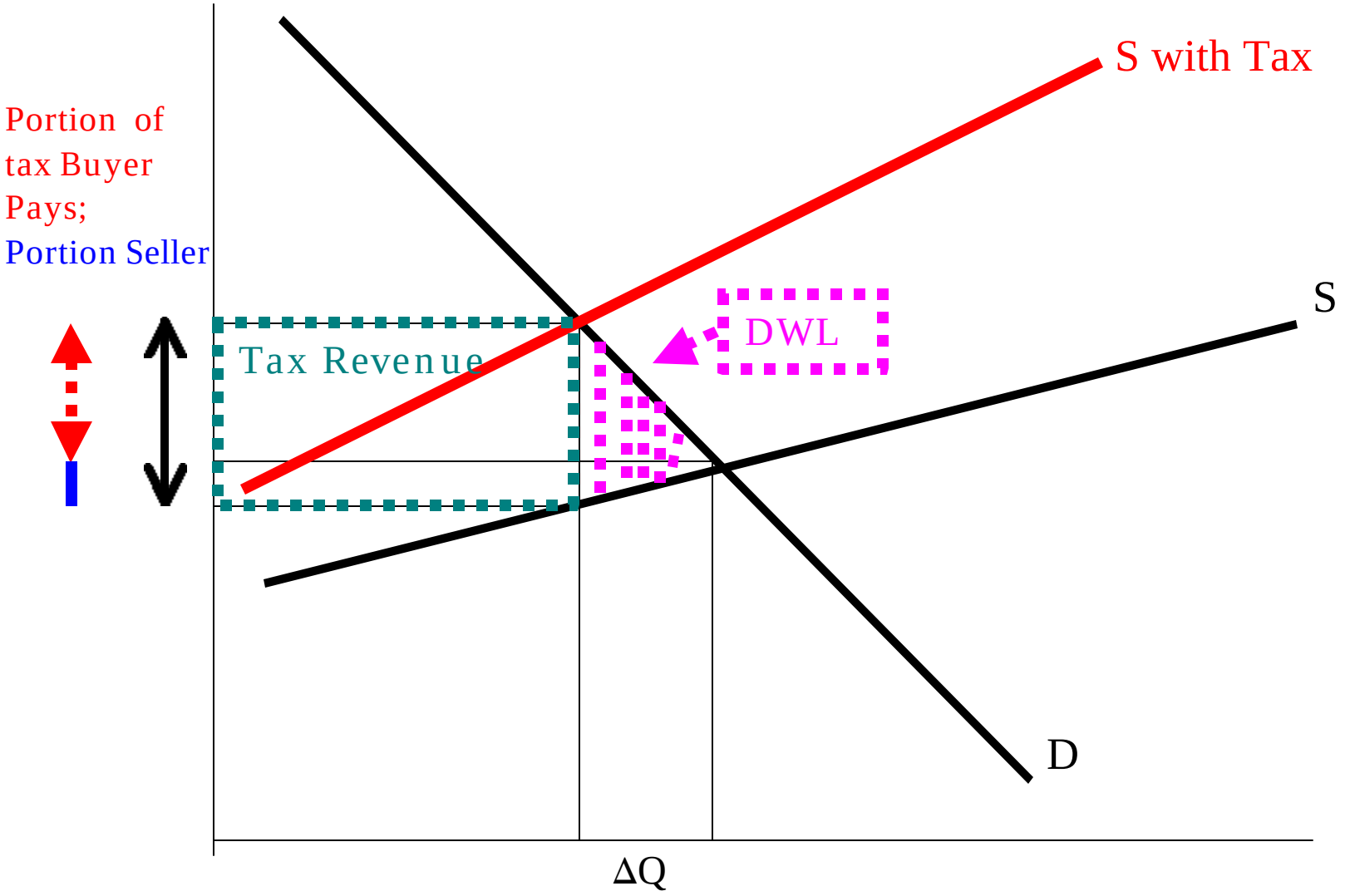
(ii) What happens to the price of aspirin when Tylenol is introduced?

The price of aspirin should fall due to the demand reduction.

(iii) A bottle of poisoned Tylenol causes the company to withdraw Tylenol from the market. What happens to the price and quantity of aspirin traded?

The price and quantity traded should increase, and return to their pre-Tylenol level.

8. Consider the sales tax imposed in experiment 3. Using a supply and demand diagram (you may draw this with smooth curves), show how the tax on suppliers reduces quantity, raises the price paid by consumers by an amount less than the tax, and lowers the price paid to suppliers. On the same diagram, illustrate the dead weight loss, and outline the area corresponding to the total tax revenue collected.



9. Consider experiment 2, where the fishers sometimes caught one, two or three fish.

(i) Explain how an increase in the number of fish caught can reduce the total earnings of fishers.

An increase in the number of fish reduces price, so revenue, which is price times quantity, can fall.

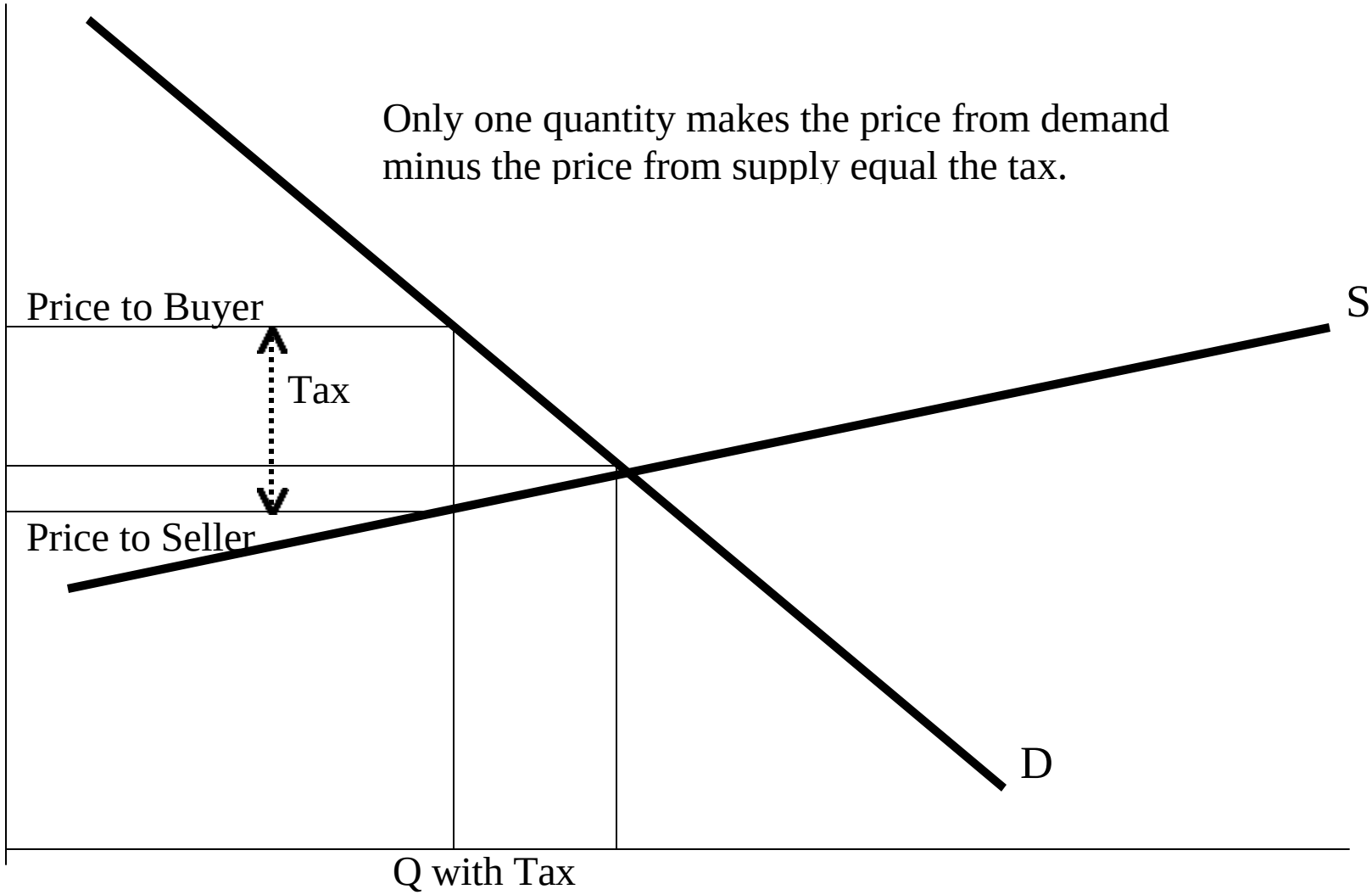
(ii) How does the elasticity of demand affect the earnings of fishers when the number of fish caught increases?

Revenue falls when the quantity increases if demand is inelastic.

(iii) Fishers paid ★10 to run their boats. If prices fall to ★1, these fishers lose money. How many would you expect them to exit the industry? What should happen to prices?

Enough should exit so that prices increases to the level that makes fishing profitable. Since some are exiting, the price should equal average cost.

10. Using supply and demand diagrams, show that the effect of a ★15 per unit sales tax on buyers and sellers is the same when the buyer pays the tax as when the seller pays the tax. How does this claim accord with your experimental findings? Did it matter who paid the tax?



11. (i) Why does demand give marginal value of the good?

Consumers are willing to pay up to their value for the good. Thus, the marginal consumer values the good at the price.

(ii) What is consumer surplus? Illustrate with a demand diagram.

Consumer surplus is the net gains from trade earned by consumers.

12. If *a* and *b* are complementary goods (in consumption) and the price of *a* increases, we will observe

a. an increase in the price and the quantity traded of *b*.
b. a decrease in the price and the quantity traded of *b*.
c. an increase in the price but a decrease in the quantity traded of *b*.
d. a decrease in price but an increase in the quantity traded of *b*.

b. Demand complements (think "consumed together") mean that as the price of *a* increases, the demand for *b* falls. Thus both price and quantity of *b* should fall.

13. If *a* and *b* are substitutes in production and the price of *a* falls, the supply of *b* will

a. increase, and thus the price of *b* will increase.
b. increase, and thus the price of *b* will decrease.
c. decrease, and thus the price of *b* will decrease.
d. decrease, and thus the price of *b* will increase.

b. With substitutes in production, an decrease in the price of *a* makes producing *a* less profitable, so sellers produce more *b*, shifting supply of *b* out. Thus price of *b* falls and quantity rises.

14. An increase in income will
    a. increase the demand for turnips if turnips are inferior goods.
    b. increase the demand for turnips if turnips are normal goods.
    c. increase the supply of turnips.
    d. decrease the supply of turnips.

***b*.** An increase in income increases demand for normal goods.

15. If the production of good *a* is a by-product of the production of good *b*, then an increase in the price of *a* will cause
    a. an increase in the supply of *a*.
    b. a decrease in the supply of *a*.
    c. an increase in the supply of *b*.
    d. a decrease in the supply of *b*.

c. An increase in the price of *a* increases the value of producing *a* and *b*, thus shifting out the supply of *b*.

16. Silver and gold are complements in supply and substitutes in demand. A new kind of film is developed that has the direct effect of reducing the demand for silver, affecting the gold market only through substitution. The price of gold _____ and the quantity of gold traded ____.

a. increases, decreases
b. is indeterminate, decreases
c. decreases, is indeterminate
d. decreases, increases

b. The shift in the demand for silver decreases the price of silver. As a demand substitute, this reduces the demand for gold (decreasing both price and quantity of gold). As a supply complement, the decrease in the price of silver decreases the supply of gold (increasing price and decreasing quantity of gold). Thus, the quantity falls, but the price could go up or down.

17. Suppose a decrease in the price of peanuts due to an increase in supply occurs, and both the price and quantity traded increase for chicken. Which of the following would explain this observation?

a. chicken and peanuts are substitutes in supply.
b. chicken and peanuts are complements in demand.
c. chicken and peanuts are substitutes in demand.
d. chicken and peanuts are complements in supply.

b. Price and quantity both increasing requires an increase in demand. Thus, chicken and peanuts would have to be demand complements.

18. The demand for a good is inelastic if

a. an increase in price results in an increase in total revenue.
b. a decrease in price results in a decrease in total revenue.
c. an increase in price results in a decrease in total revenue.
d. the good is a luxury.

a. Think perfectly inelastic, or vertical. An increase in price increases total revenue.

19. A demand curve that has a price elasticity of
    a. 0 will be vertical.
    b. 0 will be horizontal.
    c. 1 will be vertical.
    d. 1 will be horizontal.

a. Zero elasticity – no change in quantity with a change in price – is vertical.

20. A 10 percent increase in the quantity of good *a* demanded results from a 20 percent decline in its price. The price elasticity of demand for good *a* is
    a. 10.0 b. 20.0 c. 2 d. 0.5.

d. $h = -\dfrac{\%\Delta Q}{\%\Delta P} = -\dfrac{10\%}{-20\%}$

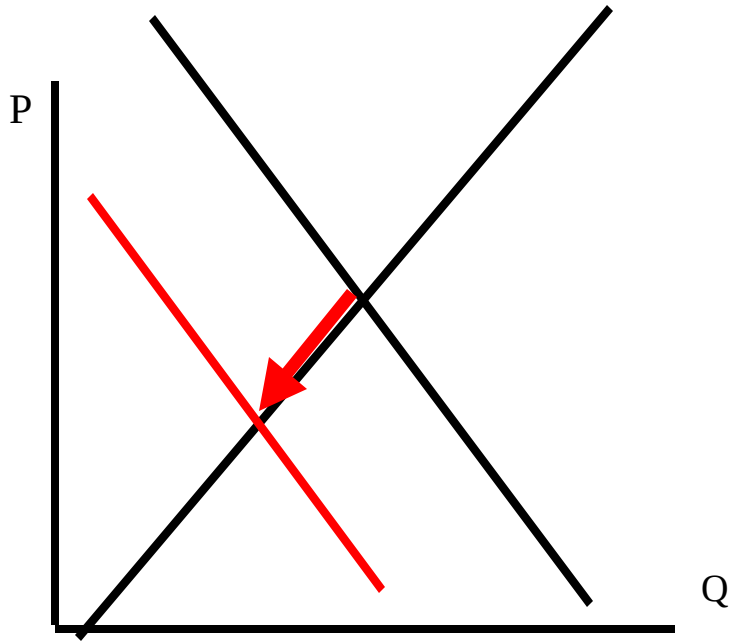
21. If the price elasticity of demand is 3, a 15% increase in price will cause a
    a. 45% decrease in quantity demanded.
    b. 5% decrease in quantity demanded.
    c. 15% decrease in quantity demanded.
    d. It cannot be determined without knowing the supply elasticity.

a. $3 = \boldsymbol{h} = -\dfrac{\%\Delta Q}{\%\Delta P} = -\dfrac{\%\Delta Q}{15\%}$

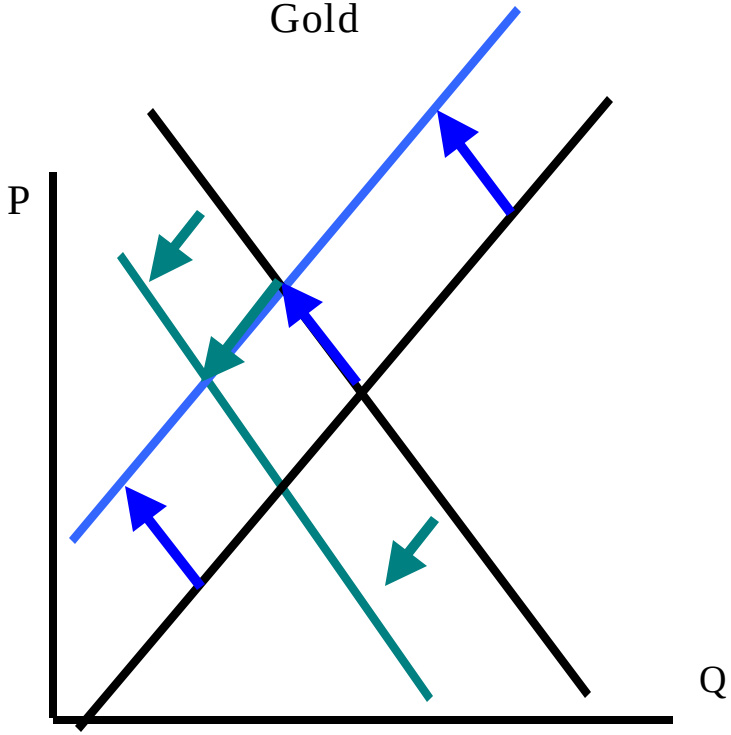
22. Silver and gold are complements in supply and substitutes in demand. A new kind of film is developed that has the direct effect of reducing the demand for silver, affecting the gold market on through substitution effects. Illustrate the effect of the silver demand reduction on the gold market.

The reduction in the demand for silver reduces the price of silver. This causes a decrease in demand for gold (buyers substitute to the cheaper silver), and a decrease in the supply of gold (prospecting is less rewarding). The decrease in the demand reduces price and quantity. The decrease in supply increases price and reduces quantity.

Silver



Gold



24. Consider a competitive market with 18 consumers, each of whom will buy at most one unit of the good, and 8 sellers, each of whom can sell up to two units.

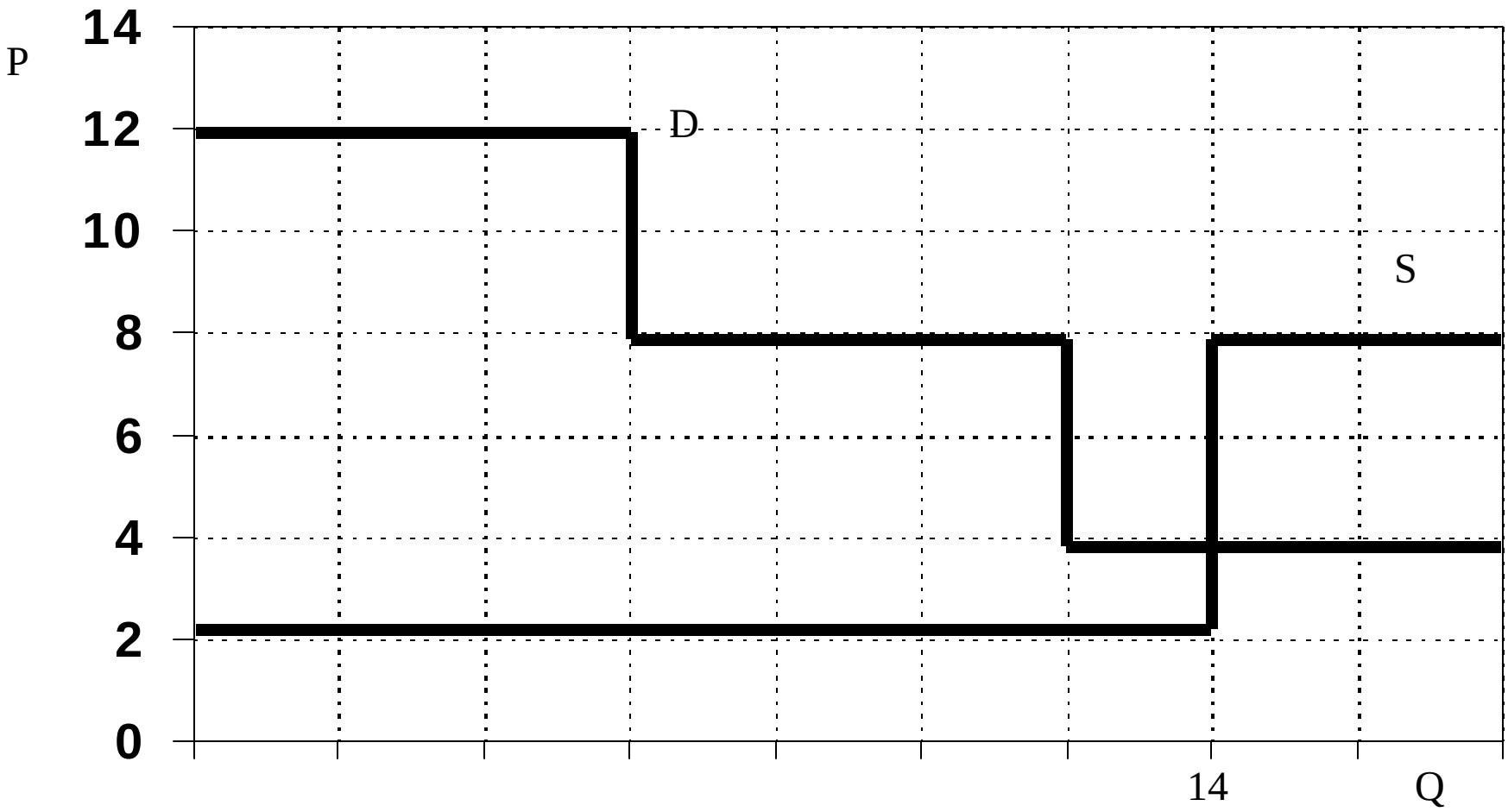
The distribution of buyer values (or buyer reservation prices) is as follows:

Buyer Value	Number of Buyers
$4	6
$8	6
$12	6

The distribution of seller costs (or seller reservation prices) is as follows:

Seller Per Unit Cost	Number of Sellers	Number of Units
$2	7	14
$8	2	4

24 (i). Draw the supply and demand diagram.



24 (ii) In this market, what price (P) and quantity (Q) would arise in a competitive equilibrium?

P = 4, Q = 14

24 (iii) What are the equilibrium price and quantity if buyers are required to pay a tax of $8 for each unit of the good sold?

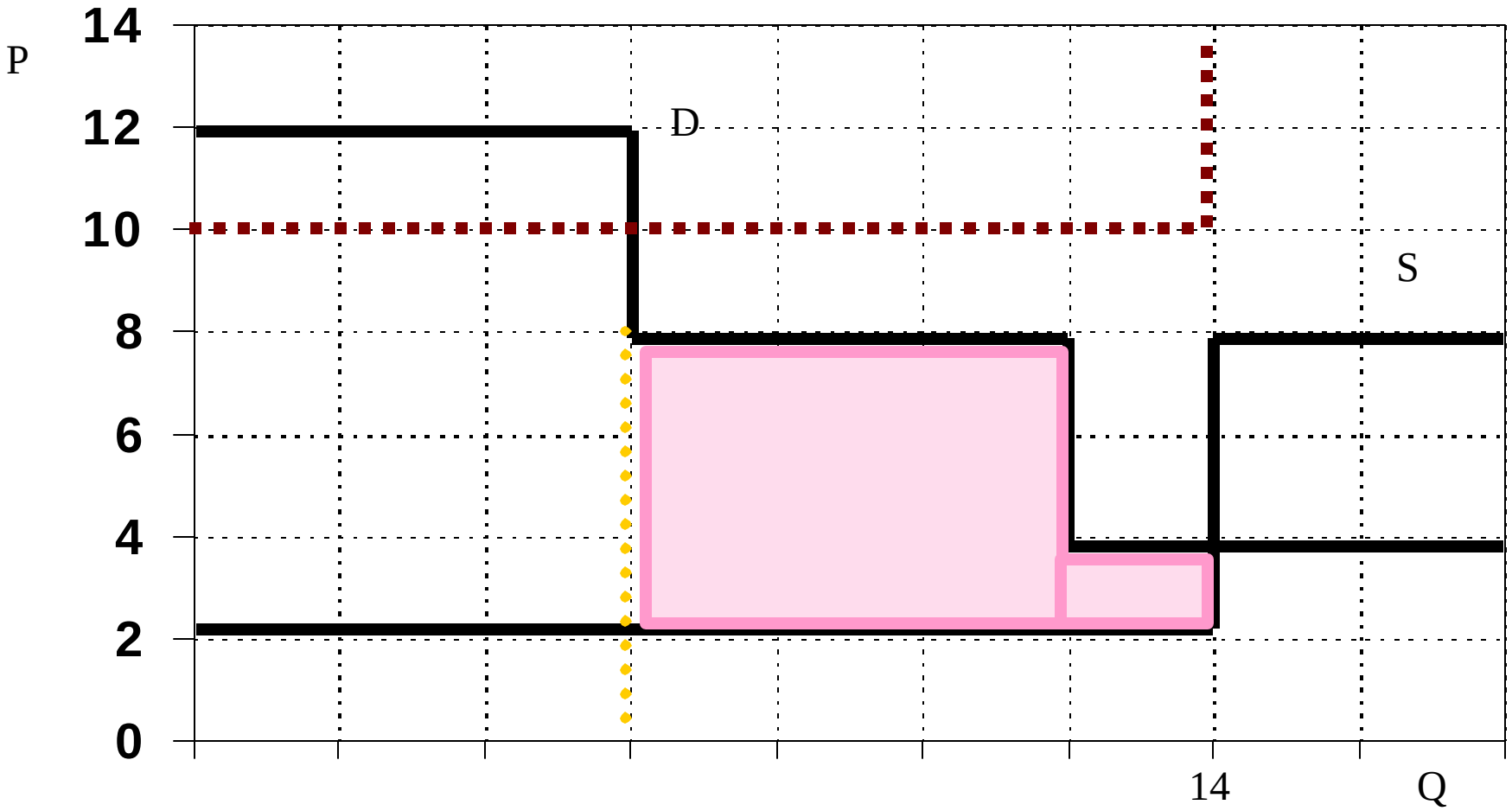
P = 10, Q = 6

24 (iv). How much tax revenue is raised by this $8 per unit tax paid by buyers?

$8 × 6 = 48

24 (v). What is the excess burden or dead weight loss of this $8 per unit tax paid by sellers?

2 trades worth $2, and 6 trades worth $6 is a loss of $40.


P
14
12
10
8
6
4
2
0
D
S
14
Q

24 (vi). What are the equilibrium price and quantity if buyers, instead of sellers, are required to pay the tax of $8 for each unit of the good sold?

Price buyer pays is the same, so market price is $2, the price the seller gets.

24 (vii) What is the excess burden or dead weight loss if buyers, instead of sellers, are required to pay the tax of $8 for each unit of the good sold?

Same

Exercises with elasticities.

1. The demand elasticity is 3 and the supply elasticity is 7. A 20% tax is imposed. How do the buyer's price, the seller's price and the quantity change?

Answer: From the definition of the demand elasticity η:

$$3 = h = -\frac{\%\Delta Q}{\%\Delta P_d} \text{ and thus } \%\Delta Q = 3(-\%\Delta P_d) = -3\,\%\Delta P_d$$

From the definition of the supply elasticity ϵ:

$$7 = e = \frac{\%\Delta Q}{\%\Delta P_s} \text{ and thus } \%\Delta Q = 7\,\%\Delta P_s$$

Put these together to obtain: $7\,\%\Delta P_s = \%\Delta Q = -3\,\%\Delta P_d$

Or $\%\Delta P_s = -\frac{3}{7}\%\Delta P_d$

The tax change is the difference between the change in the buyer's price and the seller's price, so

$$20\% = \%\Delta P_d - \%\Delta P_s = \%\Delta P_d + \frac{3}{7}\%\Delta P_d = \frac{10}{7}\%\Delta P_d$$

$$\text{Thus, } \%\Delta P_d = \frac{7}{10}20\% = 14\%$$

$$\%\Delta P_s = -\frac{3}{7}\%\Delta P_d = -\frac{3}{7}14\% = -6\%$$

$$\%\Delta Q = -3\,\%\Delta P_d = -3\times 14\% = -42\%.$$

2. The demand elasticity is 0.5 and the supply elasticity is 1.5. A 12% tax is imposed. How do the buyer's price, the seller's price and the quantity change?

Answer: From the definition of the demand elasticity η:

$$.5 = \eta = -\frac{\%\Delta Q}{\%\Delta P_d} \text{ and thus } \%\Delta Q = 0.5(-\%\Delta P_d) = -0.5\,\%\Delta P_d$$

From the definition of the supply elasticity ϵ:

$$1.5 = \epsilon = \frac{\%\Delta Q}{\%\Delta P_s} \text{ and thus } \%\Delta Q = 1.5\,\%\Delta P_s$$

Put these together to obtain: $1.5\%\Delta P_s = \%\Delta Q = -0.5\,\%\Delta P_d$

Or $\%\Delta P_s = -\frac{0.5}{1.5}\,\%\Delta P_d = -\frac{1}{3}\,\%\Delta P$

The tax change is the difference between the change in the buyer's price and the seller's price, so

$$15\% = \%\Delta P_d - \%\Delta P_s = \%\Delta P_d + \frac{1}{3}\%\Delta P_d = \frac{4}{3}\%\Delta P_d$$

$$\text{Thus, } \%\Delta P_d = \frac{3}{4}12\% = 9\%$$

$$\%\Delta P_s = -\frac{1}{3}\,\%\Delta P_d = -\frac{1}{3}9\% = -3\%$$

$$\%\Delta Q = -0.5\,\%\Delta P_d = -0.5 \times 9\% = -4.5\%.$$

3. The demand elasticity is $\eta$and the supply elasticity is ϵ. A t% tax is imposed. How do the buyer's price, the seller's price and the quantity change?

Answer: From the definition of the demand elasticity η:

$$\eta = -\frac{\%\Delta Q}{\%\Delta P_d} \text{ and thus } \%\Delta Q = \eta(-\%\Delta P_d) = -\eta\,\%\Delta P_d$$

From the definition of the supply elasticity ϵ:

$$\epsilon = \frac{\%\Delta Q}{\%\Delta P_s} \text{ and thus } \%\Delta Q = \epsilon\,\%\Delta P_s$$

Put these together to obtain: $\epsilon\%\Delta P_s = \%\Delta Q = -\eta\%\Delta P_d$

Or $\%\Delta P_s = -\frac{\eta}{\epsilon}\%\Delta P_d$

The tax change is the difference between the change in the buyer's price and the seller's price, so

$$t\% = \%\Delta P_d - \%\Delta P_s = \%\Delta P_d + \frac{\eta}{\epsilon}\%\Delta P_d = \frac{\epsilon+\eta}{\epsilon}\%\Delta P_d$$

Thus, $\%\Delta P_d = \frac{\epsilon}{\epsilon+\eta}t\%$

$$\%\Delta P_s = -\frac{\eta}{\epsilon}\%\Delta P_d = -\frac{\eta}{\epsilon}\times\frac{\epsilon}{\epsilon+\eta}t\% = -\frac{\eta}{\epsilon+\eta}t\%$$

$$\%\Delta Q = -\eta\,\%\Delta P_d = -\eta\frac{\epsilon}{\epsilon+\eta}t\% = \frac{-\eta\epsilon}{\epsilon+\eta}t\%$$

25. Suppose that $\eta = 2$ and the price is increased by 10%. What happens to total revenue?

$2 = \eta = -\frac{\%\Delta Q}{\%\Delta P_d} = -\frac{\%\Delta Q}{10\%}$ Thus, quantity falls by 20%, to 80% of its former level.

The effect on revenue is New Revenue = (1.1 P) × (.8 Q) = .88 PQ, or 88% of the previous level.

26. Suppose that $\eta = 1/2$ and the price is decreased by 10%. What happens to total revenue?

$\frac{1}{2} = \eta = -\frac{\%\Delta Q}{\%\Delta P_d} = -\frac{\%\Delta Q}{-10\%}$ Thus, quantity increases by 5%, to 105% of its former level.

The effect on revenue is New Revenue = (0.9 P) × (1.05 Q) = 0.945 PQ, or 94.5% of the previous level.