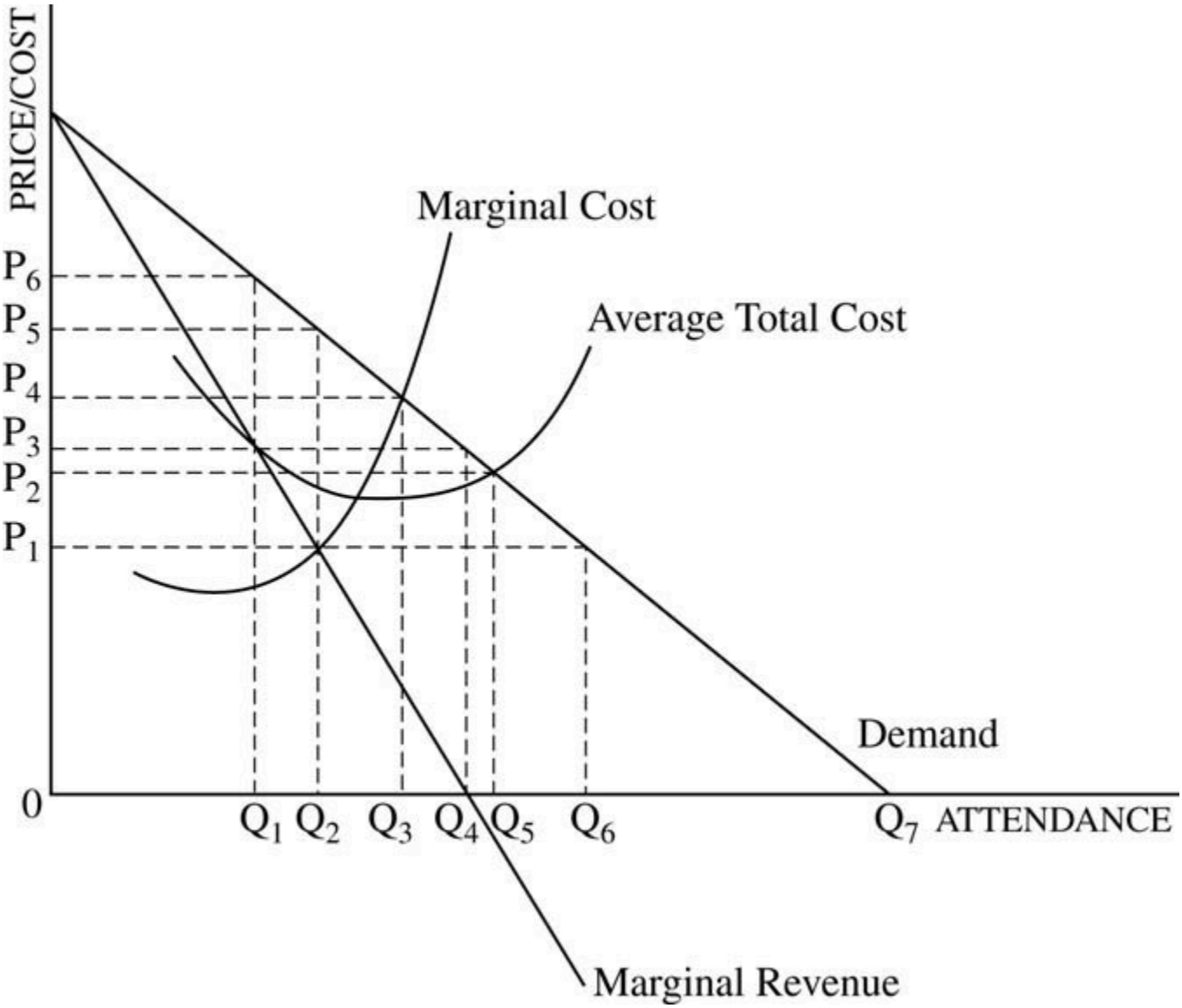
m



There is one art museum on the island of Watsonia. The museum's demand and cost curves are shown in the graph above. The museum currently relies on an admission charge for some of its funding. Its directors are debating about how to set the admission charge.

a. Using the labeling of the graph above, identify the price and quantity associated with the following objectives.

   i. The museum maximizes its profit.

   ii. The museum maximizes its total revenue.

   iii. The museum maximizes the sum of consumer and producer surplus.

   iv. The museum maximizes its attendance, as long as it breaks even.

b. When the attendance is Q_1, is the demand price elastic, inelastic, or unit elastic? Explain.

m

c. Assume that the price is set at P_2. Assuming the existence of an opportunity cost, indicate whether the museum's accounting profits would be positive, negative, or zero. Explain why.

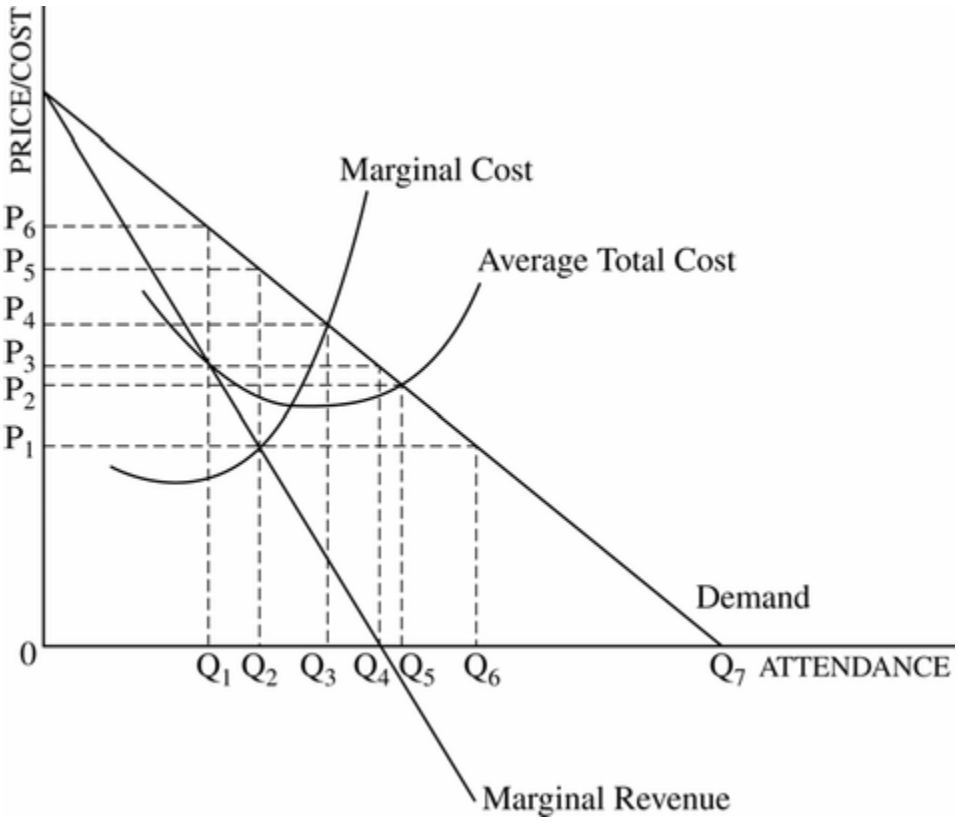
d. Assume that the government decides the museum should charge no admission and agrees to subsidize the museum for any losses.

   i. Using the labeling in the graph, identify the museum's attendance under that circumstance.

   ii. Would the outcome be allocatively efficient? Explain.

1. Respond to all parts of the question.

Part A



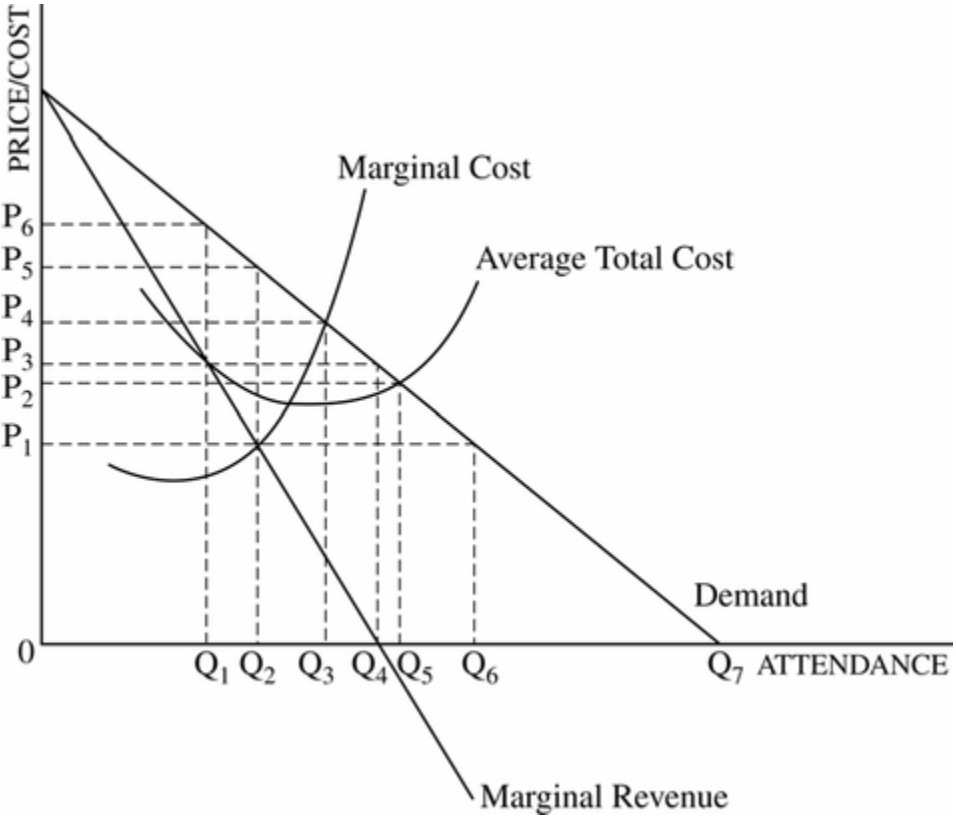
4 points:

- One point is earned for indicating P5, Q2.
- One point is earned for indicating P3, Q4.
- One point is earned for indicating P4, Q3.
- One point is earned for indicating P2, Q5.

m

0	1	2	3	4 ✓

Student receives 4 /4 point(s)



4 points:

- One point is earned for indicating P5, Q2.
- One point is earned for indicating P3, Q4.
- One point is earned for indicating P4, Q3.
- One point is earned for indicating P2, Q5.

Part B

2 points:

- One point is earned for stating that demand is elastic at Q1.
- One point is earned for explaining that MR is greater than zero, OR Q1 is to the left of the midpoint, OR Q1 is in the upper half of the demand curve.

m

0	1	2 ✓

Student receives 2/2 point(s)

2 points:

- One point is earned for stating that demand is elastic at Q1.
- One point is earned for explaining that MR is greater than zero, OR Q1 is to the left of the midpoint, OR Q1 is in the upper half of the demand curve.

Part C

2 points:

- One point is earned for stating that accounting profits are positive.
- One point is earned for explaining that economic profits are zero, opportunity costs exist, and economic profits=accounting profits-opportunity cost.

0	1	2 ✓

Student receives 2/2 point(s)

2 points:

- One point is earned for stating that accounting profits are positive.
- One point is earned for explaining that economic profits are zero, opportunity costs exist, and economic profits=accounting profits-opportunity cost.

Part D

3 points:

- One point is earned for indicating Q7.
- One point is earned for concluding that the outcome is not allocatively efficient.
- One point is earned for explaining that MC>P or MSC>MSB.

m

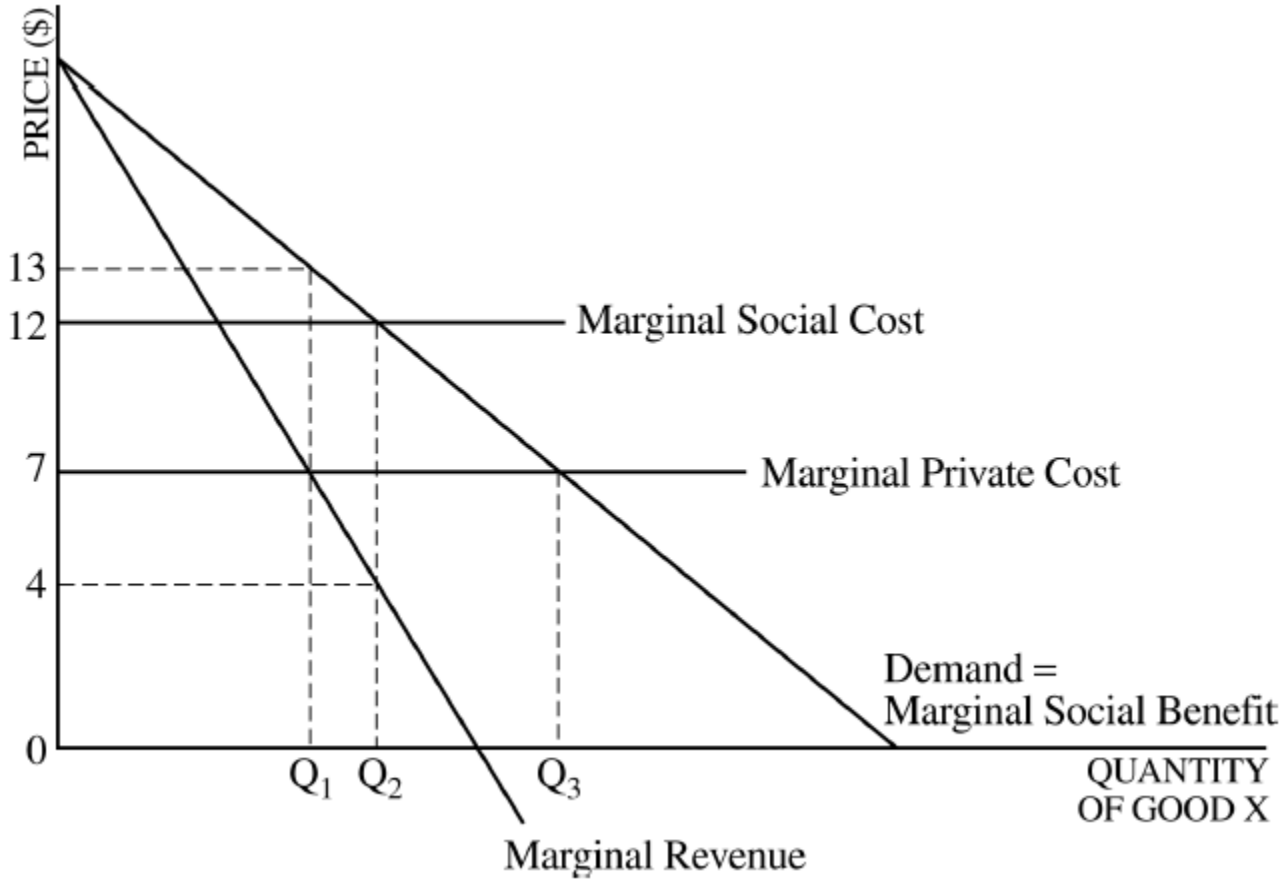
0	1	2	3 ✓

Student receives 3/3 point(s)

3 points:

- One point is earned for indicating Q7.
- One point is earned for concluding that the outcome is not allocatively efficient.
- One point is earned for explaining that MC>P or MSC>MSB.

m



The production of good X creates an externality. The following questions are based on the graph above, which shows the marginal revenue, marginal social benefit, marginal private cost, and marginal social cost associated with the production of good X.

a. Is the externality positive or negative? Explain.

b. Using labeling from the graph above, identify the socially optimum output. Explain how you determined your answer.

c. Suppose that good X is produced by a profit-maximizing monopoly. Answer each of the following.

   i. Using labeling from the graph above, identify the unregulated firm's output. Explain how you determined your answer.

   ii. To produce the socially optimum output, indicate whether the government should tax or subsidize the firm.

   iii. Calculate the dollar value of the needed per-unit tax or subsidy.

d. Suppose that good X is produced in a perfectly competitive industry. Answer each of the following.

m

i. Using labeling from the graph on the previous page, identify equilibrium output in the absence of regulation. Explain how you determined your answer.

ii. To produce the socially optimum output, indicate whether the government should tax or subsidize the firms in the industry.

iii. Calculate the dollar value of the needed per-unit tax or subsidy.

2. Respond to all parts of the question.

Part A

As shown on the graph, MSC>MPC indicates the existence of a negative externality.

1 point - Identifying negative externality

1 point - (Marginal) social cost is higher than (marginal) private cost, (M)SC>(M)PC

0	1	2 ✓

Student receives 2/2 point(s)

1 point - Identifying negative externality

1 point - (Marginal) social cost is higher than (marginal) private cost, (M)SC>(M)PC

Part B

Student receives 0/2 point(s)

The socially optimal quantity is Q_2 because MSB=MSC at this output level.

1 point - Identifying Q_2

1 point - Marginal social benefit equals marginal social cost (D=MSC or P=MSC)

0	1	2 ✓

Student receives 2/2 point(s)

1 point - Identifying Q_2

m

1 point - Marginal social benefit equals marginal social cost (D=MSC or P=MSC)

Part C

Student receives 0/4 point(s)

The profit-maximizing quantity is Q_1 because MR=MPC at this output level. To produce the socially optimum quantity, the government should grant the monopolist a per-unit subsidy of $3.00.

(i)

1 point - Identifying Q_1

1 point - At Q_1, marginal private cost equals marginal revenue (MPC=MR or MC=MR)

(ii)

1 point - Subsidize the firm

(iii)

1 point - $3 per unit

0	1	2	3	4 ✓

Student receives 4/4 point(s)

(i)

1 point - Identifying Q_1

1 point - At Q_1, marginal private cost equals marginal revenue (MPC=MR or MC=MR)

(ii)

1 point - Subsidize the firm

(iii)

1 point - $3 per unit

Part D

The equilibrium quantity for the perfectly competitive industry is Q_3 because MPC =D(MSB) at this output level. To produce the socially optimal quantity, the government should levy a per-unit tax of $5.00 on firms in this industry

(i)

1 - Identifying Q_3

m

1 - Marginal social benefit equals marginal private cost D=MPC or MSB=MPC

(ii)

1 - Tax the industry

(iii)

1 - $5 per unit

0	1	2	3	4 ✓

Student receives 4/4 point(s)

(i)

1 - Identifying Q_3

1 - Marginal social benefit equals marginal private cost D=MPC or MSB=MPC

(ii)

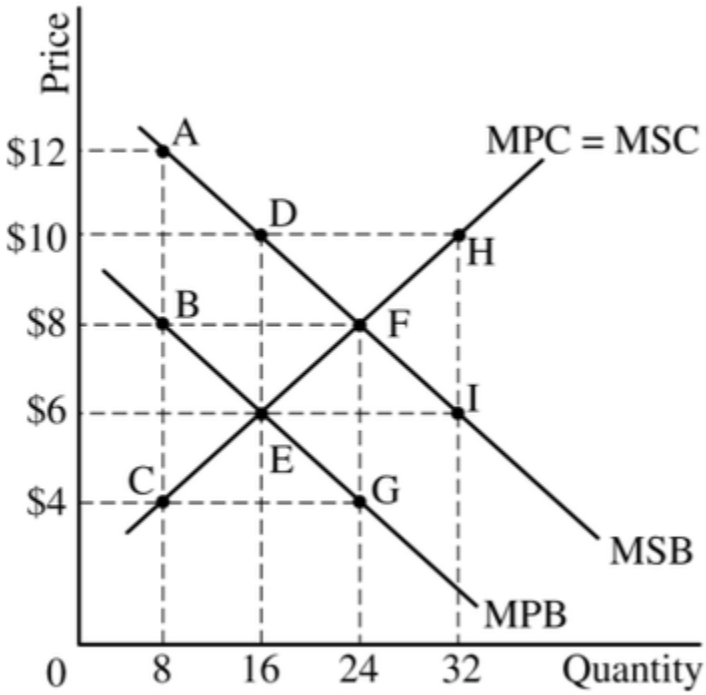
1 - Tax the industry

(iii)

1 - $5 per unit

m

Modern-day word processing software gives consumers the ability to create and save documents in different file formats that can then be accessed by multiple computer operating systems. The graph below depicts a perfectly competitive market for word processing software. In the graph, MSB is the marginal social benefit, MPB is the marginal private benefit, MPC is the marginal private cost, and MSC is the marginal social cost.



a. Identify the type of market failure illustrated by the graph. Explain.

b. Using the numbers on the graph, identify the market equilibrium price and quantity.

c. Using the labeling on the graph, identify the area representing the deadweight loss at the quantity identified in part (b).

d. Suppose the government is considering granting a subsidy to correct the market failure. What is the dollar value of the per-unit subsidy that would achieve the socially optimal quantity?

e. Suppose the government does not grant the subsidy and instead imposes a price floor at $8.

   i. How many units will consumers and producers exchange at the price floor?

   ii. Does the price floor correct the market failure? Explain.

3. Respond to all parts of the question.

Part A

m

1 point(s) maximum

1 point(s) earned for: stating positive externality, and for explaining that either marginal social benefit is greater than marginal private benefit (MSB>MPB) or the equilibrium quantity is less than the socially optimal quantity.

0	1 ✓

The student response earns one of the following points:

1 point(s) maximum

1 point(s) earned for: stating positive externality, and for explaining that either marginal social benefit is greater than marginal private benefit (MSB>MPB) or the equilibrium quantity is less than the socially optimal quantity.

Part B

1 point(s) maximum

1 point(s) earned for: identifying the market equilibrium price as $6 and the market equilibrium quantity as 16 units.

0	1 ✓

The student response earns one of the following points:

1 point(s) maximum

1 point(s) earned for: identifying the market equilibrium price as $6 and the market equilibrium quantity as 16 units.

Part C

1 point(s) maximum

1 point(s) earned for: identifying the area of the deadweight loss as DEF.

0	1 ✓

The student response earns one of the following points:

1 point(s) maximum

1 point(s) earned for: identifying the area of the deadweight loss as DEF.v

m

Part D

1 point(s) maximum

1 point(s) earned for: identifying $4 as the dollar value of the per-unit subsidy.

0	1 ✓

The student response earns one of the following points:

1 point(s) maximum

1 point(s) earned for: identifying $4 as the dollar value of the per-unit subsidy.

Part E

2 point(s) maximum

1 point(s) earned for: identifying 8 units.

1 point(s) earned for: stating no and explaining with one of the following reasons:

- The quantity exchanged in the market will be less than the socially optimal quantity.
- MSB>MSC at a quantity of 8 units.
- Deadweight loss increased after the price floor.

0	1	2 ✓

The student response earns two of the following points:

2 point(s) maximum

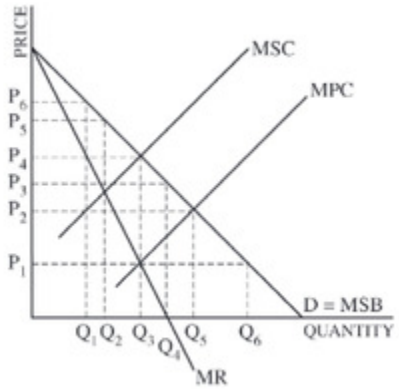
1 point(s) earned for: identifying 8 units.

1 point(s) earned for: stating no and explaining with one of the following reasons:

- The quantity exchanged in the market will be less than the socially optimal quantity.
- MSB>MSC at a quantity of 8 units.
- Deadweight loss increased after the price floor.

m

The graph below shows the marginal social cost (MSC), marginal private cost (MPC), marginal social benefit (MSB), demand (D), and marginal revenue (MR) curves for a monopoly.



a. Identify the monopolist's

   i. profit-maximizing quantity

   ii. profit-maximizing price

b. What information in the graph indicates that there is a negative externality?

c. Identify the socially optimal quantity.

d. In the case in which the government imposes a per-unit tax equal to the marginal external cost, identify each of the following.

   i. The dollar value of the tax, using the price labels from the graph

   ii. The profit-maximizing quantity associated with the tax

e. Given the monopoly facing the negative externality, would the deadweight loss increase, decrease, or stay the same as a result of imposing the per-unit tax? Explain.

4. Respond to all parts of the question.

Part A

1 point is earned for: correctly identifying the monopolist's profit-maximizing quantity, Q_3.

1 point is earned for: correctly identifying the monopolist's profit-maximizing price, P_4.

m

0	1	2 ✓

The student response earns all of the following points:

1 point is earned for: correctly identifying the monopolist's profit-maximizing quantity, Q_3.

1 point is earned for: correctly identifying the monopolist's profit-maximizing price, P_4.

Part B

1 point is earned for: stating that MSC > MPC **or** that the MSC curve exceeds, is above, or is greater than the MPC curve.

0	1 ✓

The student response earns all of the following points:

1 point is earned for: stating that MSC > MPC **or** that the MSC curve exceeds, is above, or is greater than the MPC curve.

Part C

1 point is earned for: correctly identifying the socially optimal quantity, Q_3.

0	1 ✓

The student response earns all of the following points:

1 point is earned for: correctly identifying the socially optimal quantity, Q_3.

Part D

1 point is earned for: correctly identifying the dollar value of the tax, P_4–P_1.

1 point is earned for: correctly identifying the profit-maximizing quantity associated with the tax, Q_2.

0	1	2 ✓

m

The student response earns all of the following points:

1 point is earned for: correctly identifying the dollar value of the tax, P_4–P_1.

1 point is earned for: correctly identifying the profit-maximizing quantity associated with the tax, Q_2.

Part E

1 point is earned for: correctly stating that the deadweight loss increases because the monopolist's profit-maximizing quantity is equal to the socially optimal quantity before the tax and is less than the socially optimal quantity after the tax.

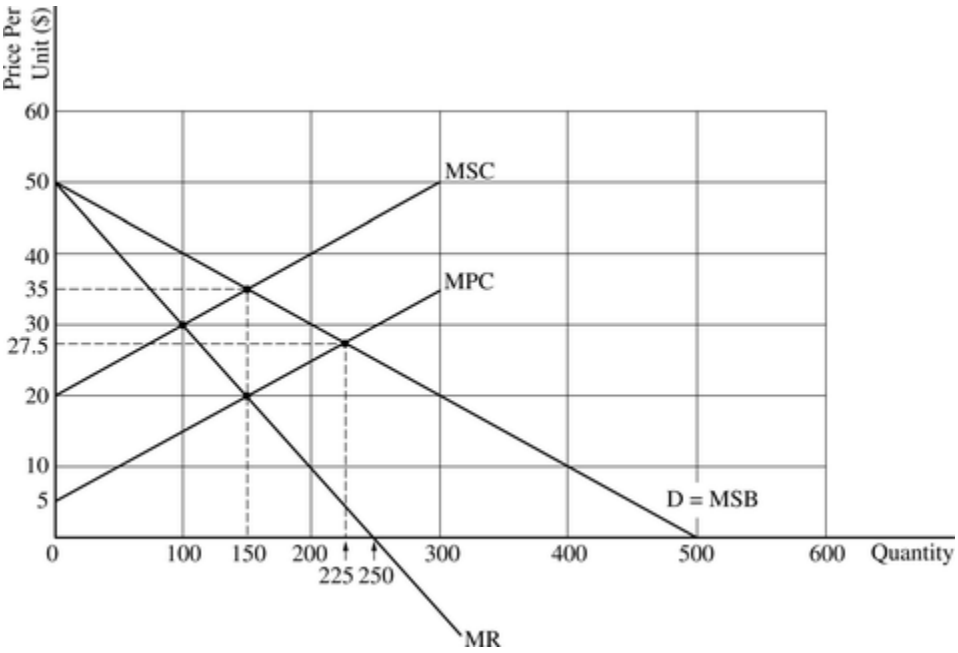
0	1 ✓

The student response earns all of the following points:

1 point is earned for: correctly stating that the deadweight loss increases because the monopolist's profit-maximizing quantity is equal to the socially optimal quantity before the tax and is less than the socially optimal quantity after the tax.

m

1. The graph below depicts the market conditions Zhao, Inc., faces in the zizzles market, where D = demand, MSB = marginal social benefit, MR = marginal revenue, MSC = marginal social cost, and MPC = marginal private cost.



a. What two potential sources of market failure exist in the market for Zhao's zizzles? Explain each potential source of market failure using the information in the graph.

b. Using numerical values from the graph, identify Zhao's profit-maximizing quantity and price.

c. Assume a $15 per-unit tax is imposed on the zizzles market. Using numerical values from the graph, identify Zhao's profit-maximizing quantity and price.

d. Zhao opposes the $15 per-unit tax analyzed above in part (c) and instead proposes a policy of no government intervention. If economic advisers are only interested in maximizing social welfare, would they support the policy of no government intervention? Explain.

5. Respond to all parts of the question.

Part A

2 points:

- One point is earned for stating one source of market failure is related to negative externality and for explaining that MSC>MPC.

m

- One point is earned for stating one source of market failure is related to monopoly and for explaining that P>MR.

0	1	2 ✓

Student receives 2/2 Point(s)

2 points:

- One point is earned for stating one source of market failure is related to negative externality and for explaining that MSC>MPC.
- One point is earned for stating one source of market failure is related to monopoly and for explaining that P>MR.

Part B

1 point:

- One point is earned for correctly identifying the profit-maximizing quantity is 150 units and the profit-maximizing price is $35.

0	1 ✓

Student receives 1/1 Point(s)

1 point:

- One point is earned for correctly identifying the profit-maximizing quantity is 150 units and the profit-maximizing price is $35.

Part C

1 point:

- One point is earned for correctly identifying that with the tax the profit-maximizing quantity is 100 units and the profit-maximizing price is $40.

0	1 ✓

Student receives 1/1 Point(s)

1 point:

m

- One point is earned for correctly identifying that with the tax the profit-maximizing quantity is 100 units and the profit-maximizing price is $40.

Part D

1 point:

- One point is earned for stating that economic advisors would support no government intervention and for explaining using one of the following:
    - without intervention the firm would produce the socially efficient (optimal) quantity of 150 units.
    - without intervention the firm would produce a quantity of 150 units where the DWL is zero.
    - without intervention the firm would produce a quantity of 150 units where MSB=MSC.
    - with the tax intervention the firm would produce a quantity of 100 units where MSB>MSC.

0	1 ✓

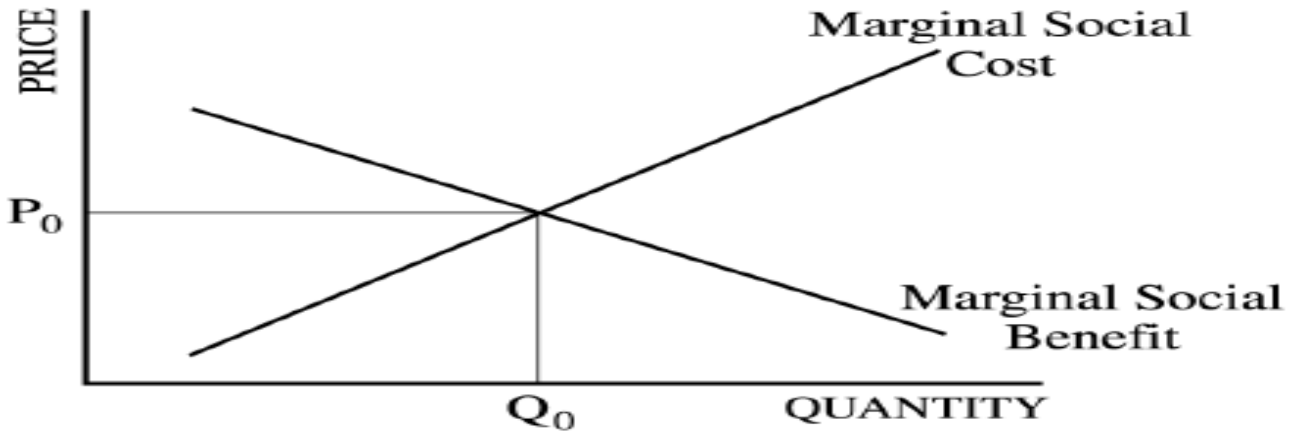
Student receives 1/1 Point(s)

1 point:

- One point is earned for stating that economic advisors would support no government intervention and for explaining using one of the following:
    - without intervention the firm would produce the socially efficient (optimal) quantity of 150 units.
    - without intervention the firm would produce a quantity of 150 units where the DWL is zero.
    - without intervention the firm would produce a quantity of 150 units where MSB=MSC.
    - with the tax intervention the firm would produce a quantity of 100 units where MSB>MSC.

m

The graph below shows the price (P_0) and quantity (Q_0) at which there is an efficient allocation of resources.



However, in some cases the market fails to allocate resources efficiently.

a. Assume the chemical industry is polluting the air.

   i. Using marginal benefit and marginal cost analysis, explain how the chemical industry is misallocating resources.

   ii. Identify one policy or action the government could take to correct this market failure.

b. Assume it is difficult to exclude nonpayers from enjoying the benefits of national defense.

   i. Using marginal benefit and marginal cost analysis, explain how the private market will fail to produce the efficient level of national defense.

   ii. Identify one policy or action the government could take to correct this market failure.

6. Respond to all parts of the question.

Part A

Part a: Within the chemical industry (or market) at the unregulated level of output the marginal social cost of production exceeds the marginal social benefit. In other words, with this negative externality, there is an over allocation of resources to the chemical industry; the level of output is greater than the efficient level. The government should introduce a per unit tax on output, raising the marginal private cost of production and reducing output. Alternatively, the government could introduce some measure to reduce directly the level of output.

Part a(i)

Acceptable answers include: (1 point)

- Too much output

m

- Over allocation of resources to the market
- Showing higher than efficient output on graph

Acceptable answers include: (1 point)

- MSC > MSB at the unregulated output
- MSC > MPC
- MC > MB with term “negative externality”

Part a(ii)

Acceptable answers include: (1 point)

- Tax on output
- Quantity restriction
- Permits
- Liability and lawsuit

0	1	2	3 ✓

Student receives 3/3 point(s)

Part a: Within the chemical industry (or market) at the unregulated level of output the marginal social cost of production exceeds the marginal social benefit. In other words, with this negative externality, there is an over allocation of resources to the chemical industry; the level of output is greater than the efficient level. The government should introduce a per unit tax on output, raising the marginal private cost of production and reducing output. Alternatively, the government could introduce some measure to reduce directly the level of output.

Part a(i)

Acceptable answers include: (1 point)

- Too much output
- Over allocation of resources to the market
- Showing higher than efficient output on graph

Acceptable answers include: (1 point)

- MSC > MSB at the unregulated output
- MSC > MPC

m

- MC > MB with term “negative externality”

Part a(ii)

Acceptable answers include: (1 point)

- Tax on output
- Quantity restriction
- Permits
- Liability and lawsuit

Part B

Part b: National defense is a public good. Individuals have an incentive to withhold their true demand or willingness to pay for the good, i.e., the free-rider problem. Thus, at the level of output produced the marginal benefit of national defense exceeds the marginal cost of national defense; there is an under allocation of resources to national defense. The government could assume production of national defense and tax all members of the society to pay for the national defense. Or, a per-unit subsidy to private producers would lead to an increase in the output of national defense.

Part b(i)

Acceptable answers include: (1 point)

- Too little produced
- Under allocation of resources
- Showing lower than efficient output on graph

Acceptable answers include: (1 point)

- MSB > MSC at the unregulated output
- MSB > MPB
- Free-rider problem

Part b(ii)

Acceptable answers include: (1 point)

- Public production of national defense
- Tax to finance public production of national defense
- Subsidy, if there are private producers of national defense

m

0	1	2	3 ✓

Student receives 3/3 point(s)

Part b: National defense is a public good. Individuals have an incentive to withhold their true demand or willingness to pay for the good, i.e., the free-rider problem. Thus, at the level of output produced the marginal benefit of national defense exceeds the marginal cost of national defense; there is an under allocation of resources to national defense. The government could assume production of national defense and tax all members of the society to pay for the national defense. Or, a per-unit subsidy to private producers would lead to an increase in the output of national defense.

Part b(i)

Acceptable answers include: (1 point)

- Too little produced
- Under allocation of resources
- Showing lower than efficient output on graph

Acceptable answers include: (1 point)

- MSB > MSC at the unregulated output
- MSB > MPB
- Free-rider problem

Part b(ii)

Acceptable answers include: (1 point)

- Public production of national defense
- Tax to finance public production of national defense
- Subsidy, if there are private producers of national defense

m

Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to "Calculate," you must show how you arrived at your final answer.

Suppose a good is produced in a perfectly competitive market. In this market the marginal social benefit (MSB) exceeds the marginal private benefit (MPB) at every quantity. The marginal social cost (MSC) equals the marginal private cost (MPC) at every quantity.

(a) Draw a correctly labeled graph of the MSB, MPB, MSC, and MPC curves and show each of the following.

(i) The market equilibrium quantity, labeled $\mathrm{Q_M}$
(ii) The socially optimal quantity, labeled $\mathrm{Q_S}$
(iii) The deadweight loss at the market equilibrium, shaded completely

(b) Suppose the government is considering two proposals to make consumers internalize the consumption externality.

- Proposal I: Imposing a binding price ceiling
- Proposal II: Granting a per-unit subsidy to consumers

(i) Compared to the market equilibrium in part (a), would the deadweight loss increase, decrease, or remain the same under Proposal I? Explain.
(ii) Compared to the market equilibrium in part (a), would the quantity produced increase, decrease, or remain the same under Proposal II? Explain.

7. Respond to all parts of the question:

Part A

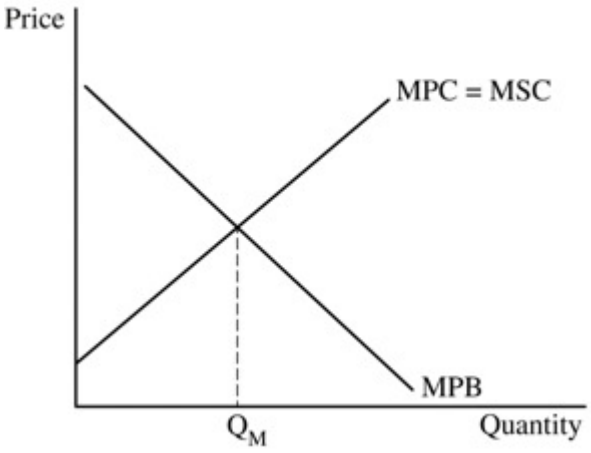
Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1	2	3 ✓

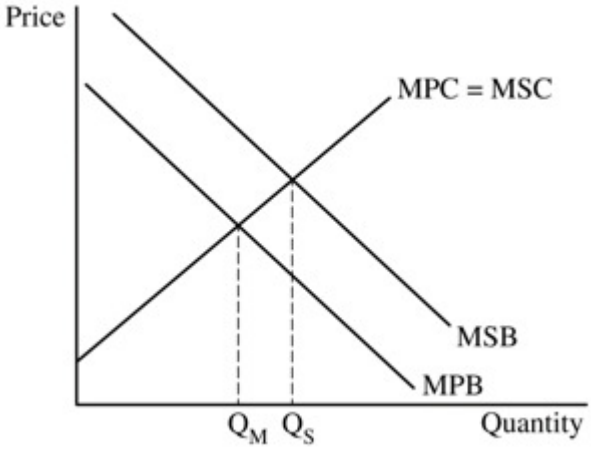
The response accurately includes all three criteria below.

- ☐ Draws a correctly labeled graph with an upward-sloping supply curve labeled $\mathrm{MPC} = \mathrm{MSC}$, a downward-sloping demand curve labeled MPB, and the market equilibrium quantity labeled $\mathrm{Q_M}$.

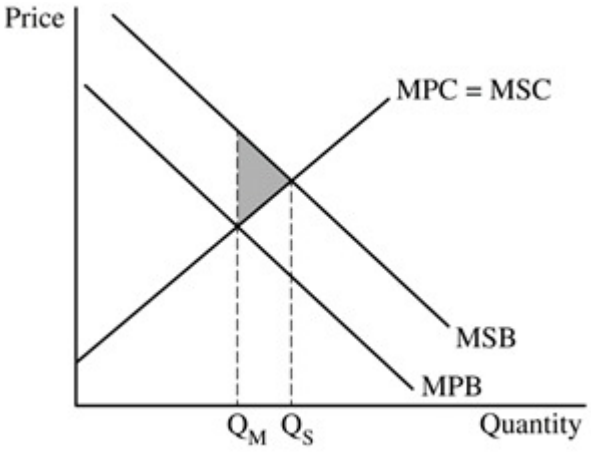
m



☐ Shows a downward sloping MSB curve that lies above the MPB curve at every quantity and the socially optimal quantity, labeled Q_S.



☐ Shows the area of deadweight loss, fully shaded.



Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

m

0	1	2 ✓

The response accurately includes both of the criteria below.

- ☐ States that the deadweight loss will increase and explains that the price ceiling will cause the quantity to decrease, moving farther away from Q_S.
- ☐ States that the quantity produced will increase and explains that the per-unit subsidy increases the MPB, or shifts the demand curve to the right, resulting in a higher equilibrium quantity produced.

Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to "Calculate," you must show how you arrived at your final answer.

A medical vaccine is produced and sold in a perfectly competitive market. Assume that the medical vaccine generates a positive externality in consumption within the society.

(a) Draw a properly labeled graph for a competitive market providing this medical vaccine and show each of the following.

(i) The market equilibrium quantity, labeled Q_C

(ii) The socially optimal quantity, labeled Q_S

(iii) The area of the deadweight loss, shaded completely

(b) Identify one policy action that would lead to the production of the socially optimal quantity of the vaccine.

(c) Would a binding price ceiling result in the production of the socially optimal quantity of the vaccine? Explain.

8. Respond to all parts of the question.

Part (a)

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1	2	3 ✓

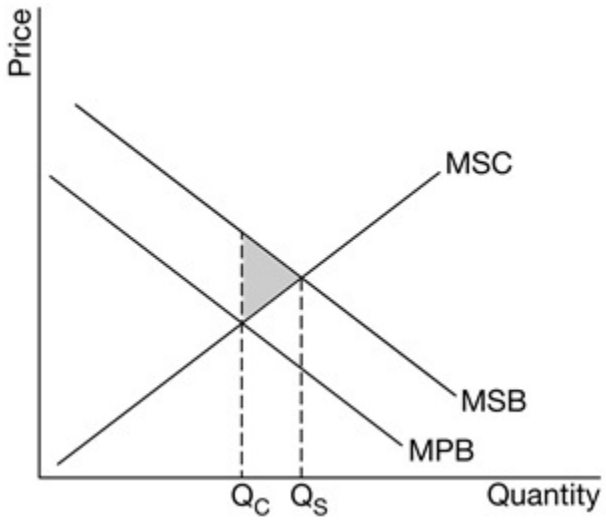
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m

The response accurately includes all three of the criteria below.

- Includes a correctly labeled graph of the market for medical vaccines with a downward-sloping demand and an upward-sloping supply curve, labeled as MPB and MPC, respectively, and the equilibrium quantity, labeled $\mathrm{Q_C}$
- Includes the marginal social benefit curve, labeled MSB, above the MPB curve, and shows the socially optimal quantity, labeled $\mathrm{Q_S}$
- Shows the area of the deadweight loss, shaded completely.

Solution



Part (b)

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1 ✓

The response states that a per-unit subsidy equal to the marginal external benefit will lead to the production of the socially optimal quantity.

Part (c)

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

The response must both state that the price ceiling will not lead to the production of the socially optimal quantity and explain why in order to receive the point.

m

0	1 ✓

The response states that the price ceiling will not result in the socially optimal quantity and explains that the price ceiling will lower the quantity supplied and increase the quantity demanded, thereby moving the quantity exchanged farther away from the optimal quantity and increasing the deadweight loss.

Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to "Calculate," you must show how you arrived at your final answer.

Copper is produced in a perfectly competitive market with an upward-sloping supply curve and a downward-sloping demand curve. Assume the production of copper results in liquid waste, which seeps into local rivers. The contaminated river water causes human illnesses and crop failures downstream. The marginal external cost from producing copper is constant across all quantities of copper produced.

(a) Draw a correctly labeled graph of the copper market with the marginal social benefit (MSB), marginal private benefit (MPB), marginal social cost (MSC), and marginal private cost (MPC) curves, and show each of the following.

(i) The market equilibrium quantity, labeled $\mathrm{Q_M}$
(ii) The socially efficient quantity, labeled $\mathrm{Q_S}$

(b) Suppose the demand for copper decreases. On your graph in part (a), show the deadweight loss at the new market equilibrium, shaded completely.

(c) Suppose the government is considering levying a tax on copper.

(i) What per-unit tax level would achieve the socially optimal quantity?
(ii) Explain why a lump-sum tax on producers will not achieve the socially optimal quantity in the short run.

9. Respond to all parts of the question:

Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

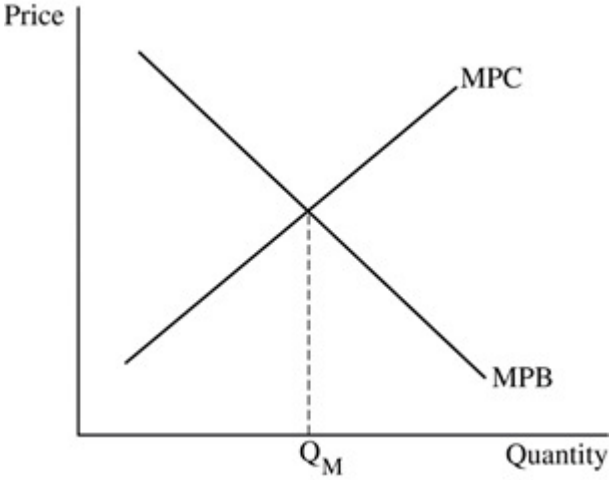
0	1	2 ✓

The response accurately includes the two criteria below.

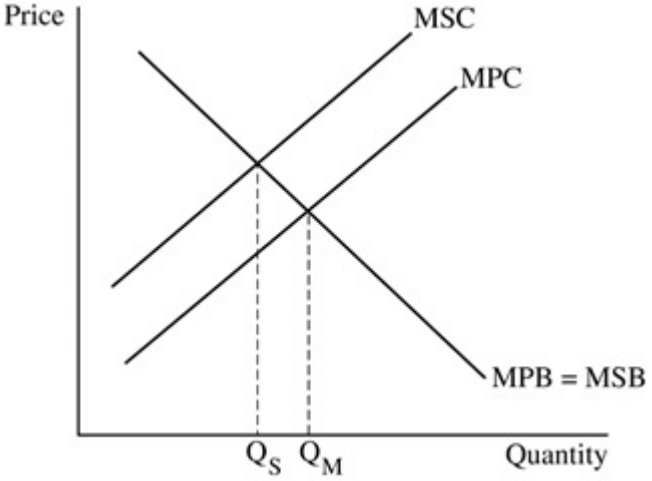
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m

- [ ] Draws a correctly labeled graph with an upward-sloping supply curve labeled MPC, a downward-sloping demand curve labeled MPB, and the market equilibrium quantity labeled $\mathrm{Q_M}$.



- [ ] Shows the MSC curve above the MPC curve at all output levels and shows the socially efficient quantity labeled $\mathrm{Q_S}$.



Part B

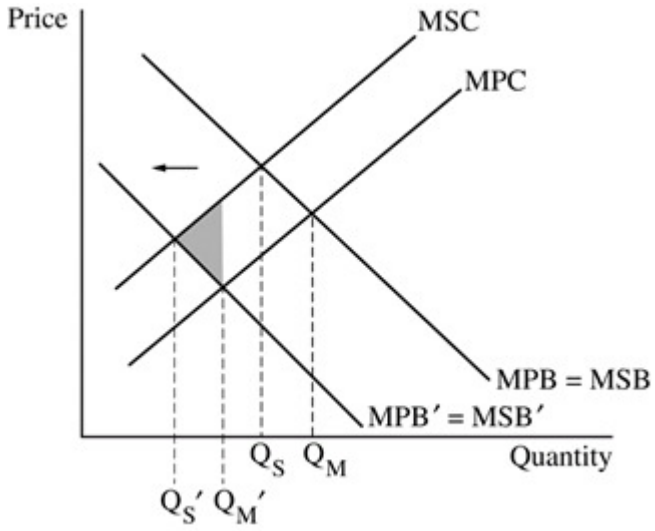
Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1 ✓

The response accurately includes the criterion below.

- [ ] On the graph from part (a), shows a leftward shift of the demand curve and shades completely the area of deadweight loss at the new market equilibrium.

m



Part C

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1	2 ✓

The response accurately includes the two criteria below.

- ☐ States that the per-unit tax would be equal to the marginal external cost $(\text{MSC} - \text{MPC})$.
- ☐ Explains that the lump-sum tax will not change the quantity produced because it does not affect the marginal cost.

The government has decided to take action to reduce the pollution caused by the chemical industry. This industry is composed of profit-maximizing, perfectly competitive firms.

a. Identify one policy that the government could implement to reduce pollution.

b. Explain the effect the policy you identified in part (a) would have on each of the following for the firms in the chemical industry.

   i. Marginal cost

   ii. Output

   iii. Price

c. Explain the effect of the policy you identified in part (a) on the efficiency of the allocation of society's resources.

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m

10. Respond to all parts of the question.

Part A

1 point: government can impose a per-unit tax on pollution, sell pollution permits, restrict quantity, or require emissions reduction equipment

0	1 ✓

Student receives 1/1 point(s)

1 point: government can impose a per-unit tax on pollution, sell pollution permits, restrict quantity, or require emissions reduction equipment

Part B

1 point: MC increases, since the tax increases the cost per unit of output

1 point: output will decrease

1 point: explanation that MC has shifted up and the firm will select new output level where the new MC equals P

1 point: price will increase

1 point: explanation that the supply curve will shift up by the amount of the tax, causing the price to rise

0	1	2	3	4	5 ✓

Student receives 5/5 point(s)

1 point: MC increases, since the tax increases the cost per unit of output

1 point: output will decrease

1 point: explanation that MC has shifted up and the firm will select new output level where the new MC equals P

1 point: price will increase

1 point: explanation that the supply curve will shift up by the amount of the tax, causing the price to rise

Part C

1 point: efficiency will increase

m

1 point: explanation that the tax shifts the supply curve up to account for the social cost of pollution, and at the new equilibrium the MSC equals the MSB

0	1	2 ✓

Student receives 2/2 point(s)

1 point: efficiency will increase

1 point: explanation that the tax shifts the supply curve up to account for the social cost of pollution, and at the new equilibrium the MSC equals the MSB

Assume that product X is produced in a perfectly competitive industry and that product X yields costs to individuals who are neither consumers nor producers of product X.

a. Using one correctly labeled graph, show the industry output and price under each of the following conditions.

   i. The industry ignores the externality.

   ii. The industry produces the socially optimum level of output.

   Assume that the market is producing the level of output you identified in (i).

b. Identify one policy the government might use to achieve the level of output you identified in (ii).

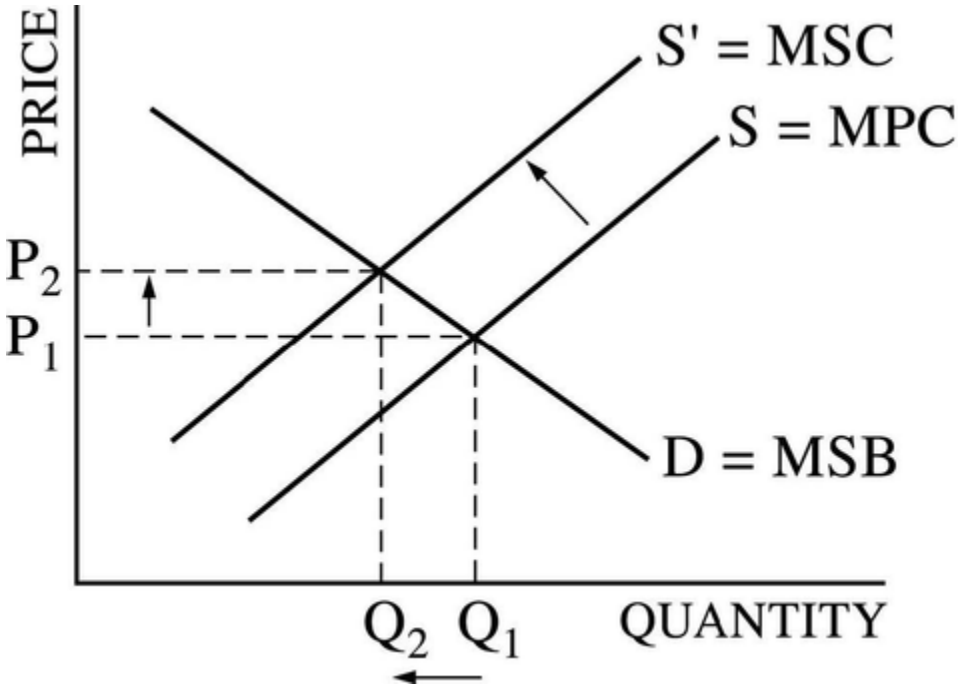
11. Respond to all parts of the question.

Part A

The student should show a market supply curve that includes only private costs of production. For a given market demand curve, there will be an equilibrium price and quantity of output. There should be a second supply curve that incorporates all costs of production, including the external costs. The socially optimum level of output is found at the intersection of the market demand and the supply curve that incorporates all costs, both private and external. With the same market demand curve, at the social optimum, the equilibrium price should be higher and the equilibrium quantity lower. In essence, the unregulated private market will produce too much output at too low a unit price.

To achieve the socially optimum level of output the government could introduce a unit tax on output. If properly chosen, this tax could raise the supply curve with only private costs to intersect at the socially optimum output level. Alternatively, quantity controls or pollution permits could be used to correct the overproduction.

m



1 point: A simple supply and demand diagram, correctly labeled, is sufficient for full credit.

1 point: Recognizing that the negative externality results in a difference between the private supply curve and the socially optimum supply curve.

The second supply curve must be labeled “socially optimal” or MSC or something to that effect.

They need not explicitly identify the externality.

Simply labeling curves S1 and S2 w/o an explanation is insufficient.

A firm graph is incorrect.

The difference in two supply curves *must be due* to the existence of external costs:

MSC > MPC

Cost not accounted for in the private market

S with external costs > S private

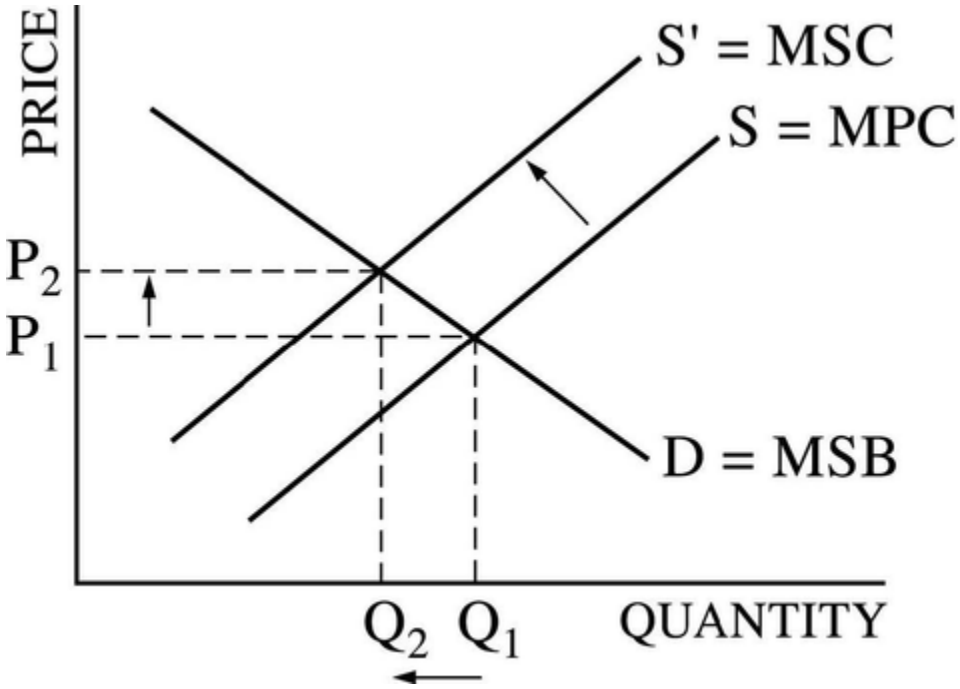
They can **not** get credit for shifting supply due to a tax — it confuses causality.

1 point: Showing a higher price and lower quantity in the socially optimum equilibrium.

0	1	2	3 ✓

Student earns 3/3 point(s)

m



1 point: A simple supply and demand diagram, correctly labeled, is sufficient for full credit.

1 point: Recognizing that the negative externality results in a difference between the private supply curve and the socially optimum supply curve.

The second supply curve must be labeled “socially optimal” or MSC or something to that effect.

They need not explicitly identify the externality.

Simply labeling curves S1 and S2 w/o an explanation is insufficient. A firm graph is incorrect.

The difference in two supply curves *must be due* to the existence of external costs:

MSC > MPC

Cost not accounted for in the private market

S with external costs > S private

They can **not** get credit for shifting supply due to a tax — it confuses causality.

1 point: Showing a higher price and lower quantity in the socially optimum equilibrium.

Part B

1 point: Various answers will suffice:

A unit tax

Quantity restriction

Effective price ceiling (*not* a price floor) that leads to production of Q1

m

Pollution permits

0	1 ✓

Student earns 1/1 point(s)

1 point: Various answers will suffice:

A unit tax

Quantity restriction

Effective price ceiling (*not* a price floor) that leads to production of Q1

Pollution permits

Assume soybeans are produced by a perfectly competitive, constant-cost industry. Fresh Farm is a typical firm producing soybeans and is currently operating with an economic loss.

a. *Using a correctly labeled graph for Fresh Farm, show each of the following in the short run.*

   i. *The marginal cost curve and average total cost, labeled MC and ATC, respectively*

   ii. Fresh Farm's price and loss-minimizing quantity, labeled P_F and Q_F, respectively

   iii. The average variable cost curve, labeled AVC

b. Suppose that newspapers have recently reported that excessive soybean consumption can cause health problems. As a result, will the new loss-minimizing quantity for Fresh Farm be greater than, less than, or equal to Q_F in the short run? Explain.

c. Is the long-run market supply for soybeans perfectly inelastic, relatively inelastic, unit elastic, relatively elastic, or perfectly elastic?

d. Assume now that the soybean market is in a long-run equilibrium and that fertilizers used in soybean production cause water pollution. Using a correctly labeled graph for the soybean market, show each of the following.

   I. Market equilibrium quantity and price, labeled Q_M and P_M

   II. Marginal social cost curve, labeled MSC

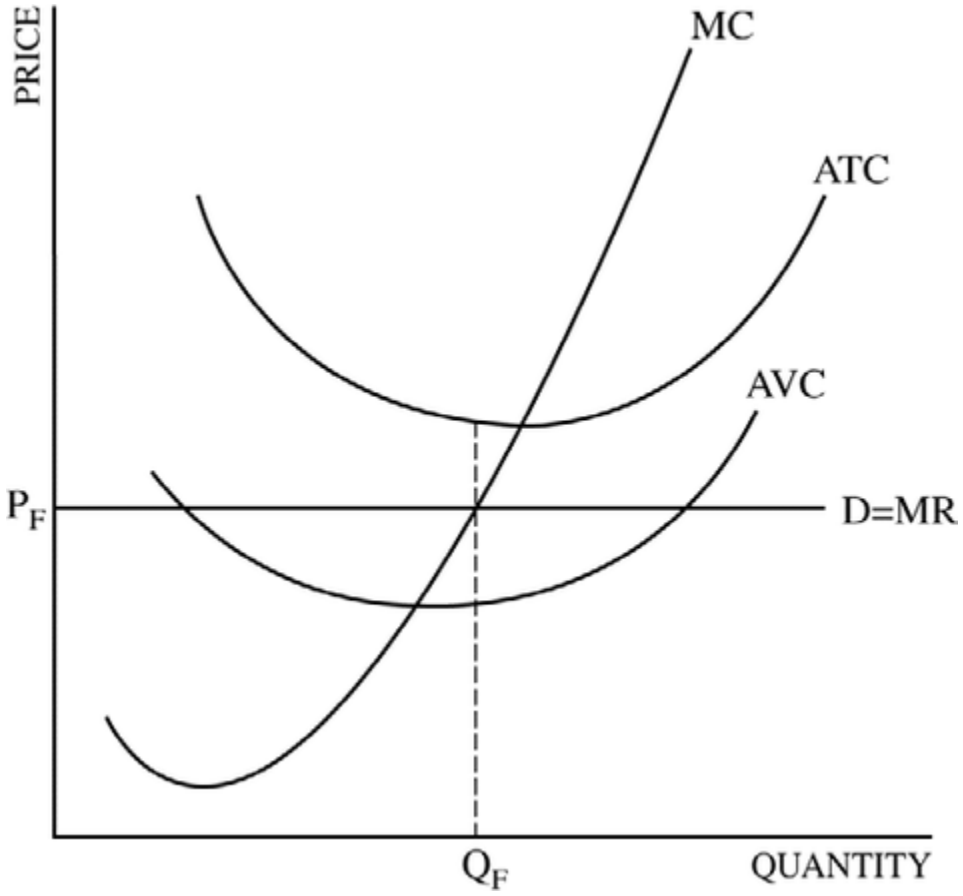
   III. Socially optimal quantity, labeled Q_S

   IV. The area representing deadweight loss, shaded completely

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12. Respond to all parts of the question.

Part A



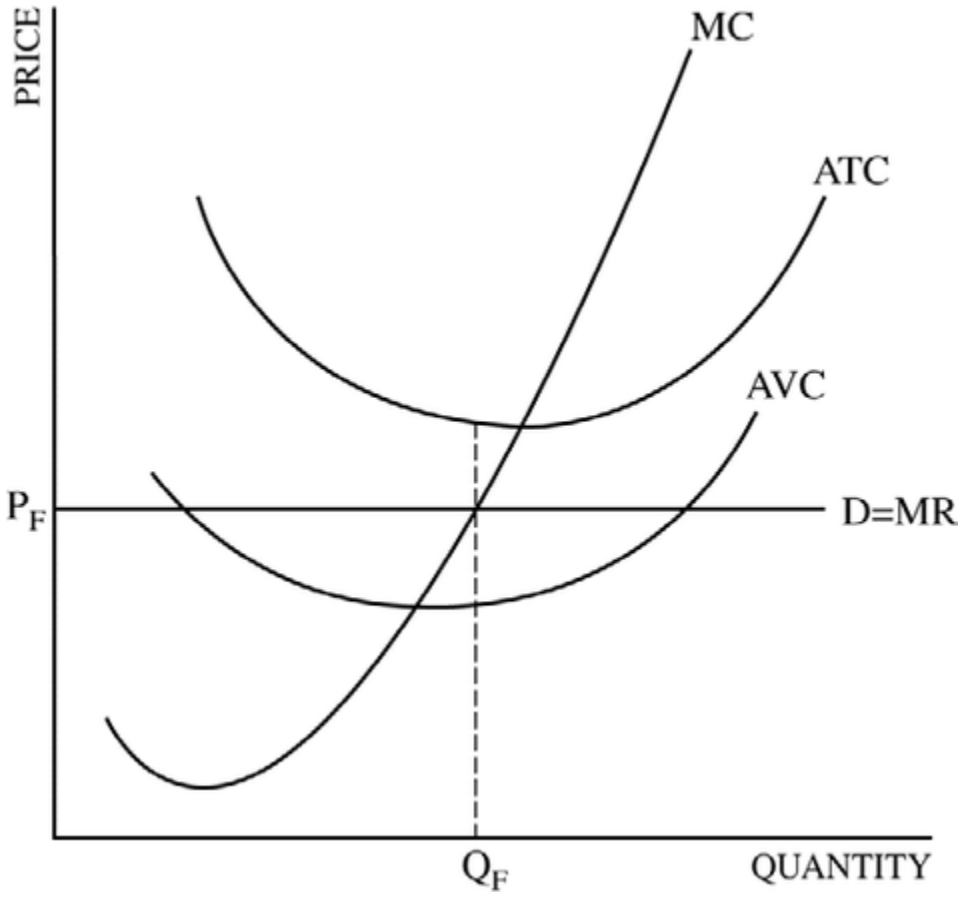
4 points:

- One point is earned for showing an upward sloping MC curve going through the minimum point of the ATC curve.
- One point is earned for a correctly labeled graph of the typical firm, Fresh Farm, with a horizontal demand curve below ATC, showing P_F.
- One point is earned for showing the profit-maximizing quantity, QF at MC=MR or MC=P if P is horizontal.
- One point is earned for showing the AVC curve below the price line at Q_F.

0	1	2	3	4 ✓

Student receives 4/4 point(s)

m



4 points:

- One point is earned for showing an upward sloping MC curve going through the minimum point of the ATC curve.
- One point is earned for a correctly labeled graph of the typical firm, Fresh Farm, with a horizontal demand curve below ATC, showing P_F.
- One point is earned for showing the profit-maximizing quantity, QF at MC=MR or MC=P if P is horizontal.
- One point is earned for showing the AVC curve below the price line at Q_F.

Part B

1 point:

- One point is earned for stating that the new quantity will be less than Q_F, since demand decreases or price decreases.

0	1 ✓

Student receives 1/1 point(s)

m

1 point:

- One point is earned for stating that the new quantity will be less than Q_F, since demand decreases or price decreases.

Part C

1 point:

- One point is earned for stating that the long-run market supply for soybeans is perfectly elastic.

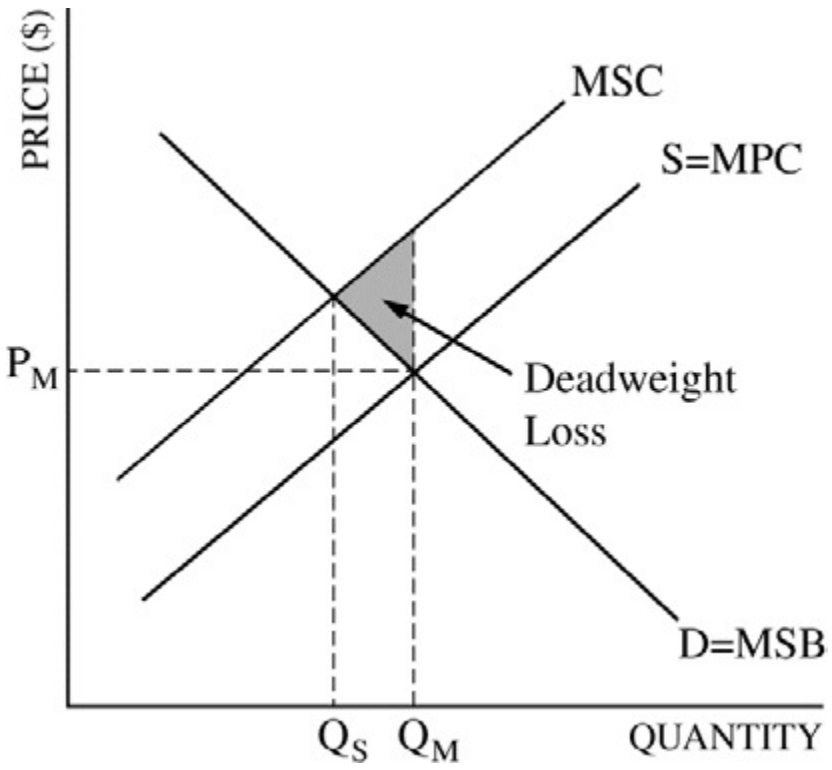
0	1 ✓

Student receives 1/1 point(s)

1 point:

- One point is earned for stating that the long-run market supply for soybeans is perfectly elastic.

Part D



4 points:

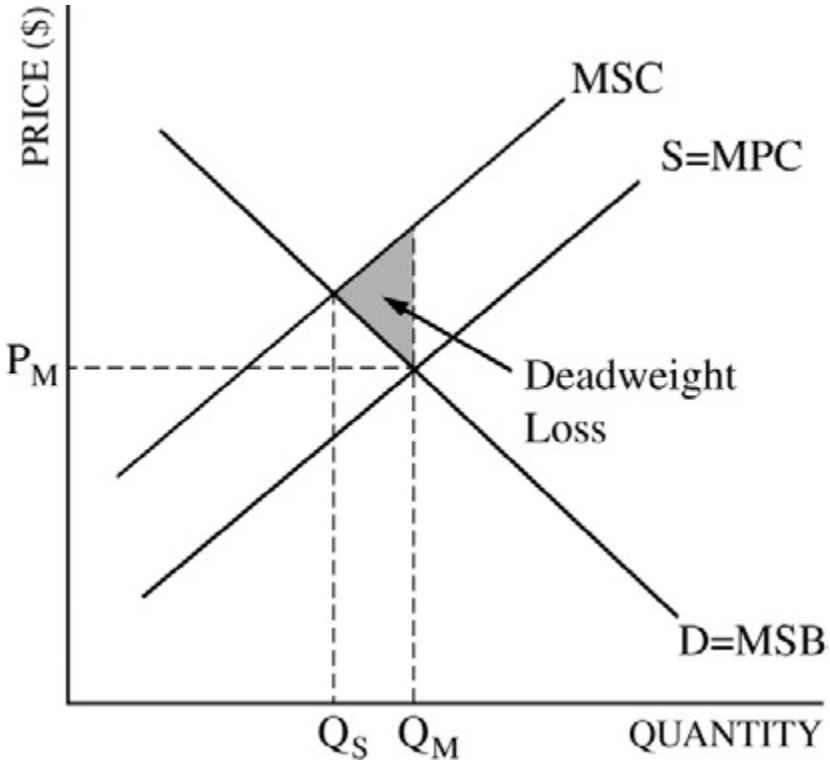
- One point is earned for drawing a correctly labeled graph for the soybean market showing a downward sloping demand curve (or MSB), supply curve (or MPC), equilibrium quantity, Q_M, and price, P_M.

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- One point is earned for drawing the marginal social cost curve above the supply curve.
- One point is earned for showing the socially optimal quantity, QS, at MSB=MSC or D=MSC.
- One point is earned for showing the area representing the deadweight loss, shaded completely.

0	1	2	3	4 ✓

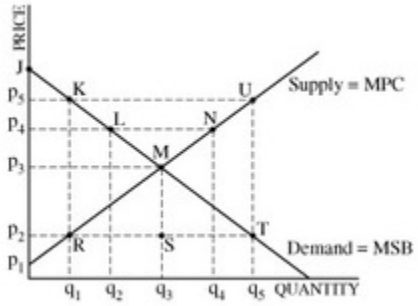
Student receives 4/4 point(s)



4 points:

- One point is earned for drawing a correctly labeled graph for the soybean market showing a downward sloping demand curve (or MSB), supply curve (or MPC), equilibrium quantity, Q_M, and price, P_M.
- One point is earned for drawing the marginal social cost curve above the supply curve.
- One point is earned for showing the socially optimal quantity, QS, at MSB=MSC or D=MSC.
- One point is earned for showing the area representing the deadweight loss, shaded completely.

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The graph above shows the perfectly competitive market for hard candies in Country Alpha. In the graph the letters correspond to points, not areas. MPC denotes marginal private cost and MSB denotes marginal social benefit.

(a) Using the labeling on the graph, identify the area representing each of the following at the market equilibrium.

(i) The consumer surplus

(ii) The producer surplus

(b) Assume that the production of each unit of candy creates a negative externality equal to (p_5-p_2).

Using the labeling on the graph, identify the socially optimal quantity.

(c) Assume that the government imposes a per-unit tax of (p_5-p_2) to correct for the negative externality. Using the labeling on the graph, identify the area representing each of the following.

(i) The consumer surplus

(ii) The deadweight loss

13. Respond to all parts of the question.

Part A

2 Points

- One point is earned for identifying the consumer surplus as P_3JM.
- One point is earned for identifying the producer surplus as P_1P3M.

0	1	2 ✓

The student earns all of the following points:

m

- One point is earned for identifying the consumer surplus as P_3JM.
- One point is earned for identifying the producer surplus as P_1P3M.

Part B

One point is earned for identifying the socially optimal quantity as q_1.

0	1 ✓

The student earns all of the following points:

One point is earned for identifying the socially optimal quantity as q_1.

Part C

2 Points

- One point is earned for identifying the consumer surplus as P_5JK.
- One point is earned for indicating that there is no deadweight loss.

0	1	2 ✓

The student earns all of the following points:

- One point is earned for identifying the consumer surplus as P_5JK.
- One point is earned for indicating that there is no deadweight loss.