The problems below draw from the material in Chapters 9 and 10 and accompanying lectures.

1. The world price of cotton is below the no-trade price in Great Britain and above the no-trade price in Peru. Using supply and demand diagrams and welfare tables such as those in Chapter 9, show the gains from trade in each country. Compare your results for the two countries.

![Cotton in Great Britain](Q) ![Cotton in Peru](P)

**GREAT BRITAIN**

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<th>Before Trade</th>
<th>After Trade</th>
<th>Change</th>
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<tbody>
<tr>
<td>Consumer Surplus</td>
<td>A</td>
<td>A+B+C</td>
<td>+(B+C)</td>
</tr>
<tr>
<td>Producer Surplus</td>
<td>B+D</td>
<td>D</td>
<td>-B</td>
</tr>
<tr>
<td>Total Surplus</td>
<td>A+B+D</td>
<td>A+B+C+D</td>
<td>+C</td>
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**PERU**

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<tbody>
<tr>
<td>Consumer Surplus</td>
<td>E+F</td>
<td>E</td>
<td>-F</td>
</tr>
<tr>
<td>Producer Surplus</td>
<td>B</td>
<td>F+G+H</td>
<td>F+G</td>
</tr>
<tr>
<td>Total Surplus</td>
<td>E+F+H</td>
<td>E+F+G+H</td>
<td>+G</td>
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Both countries have a net gain from trade.
2. Suppose that Congress imposes a tariff on Japanese motorcycles to protect the U.S.
motorcycle industry from foreign competition. Assuming that U.S. and Japanese
motorcycles are homogeneous (perfect substitutes), use a diagram of the market for
motorcycles sold in the U.S. to show the effect of this tariff on the following: the
quantity of Japanese imports, the quantity of domestically produced motorcycles, the
price of motorcycles in the U.S., government revenue, and the deadweight loss. What
does the deadweight loss represent?

Price in US rises by the amount of the tariff. World price does not (why?).

Before tariff: Japanese imports = Qd^1 – Qs^1
Domestic output = Qs^1

After tariff: Japanese imports = Qd^2 – Qs^2 (smaller than before)
Domestic output = Qs^2 (bigger than before)

Tax revenue is area E.

Deadweight loss from tariff is D+F. This is a loss of gains from trade (in this case,
all CS) that would have occurred in absence of the tariff, but doesn’t occur because
of the tariff. In terms of resource allocation, too many resources in the US are
devoted to motorcycle production; without the tariff, these resources would be
employed in the production of a higher-valued output.

3. Alcohol consumption is directly related to motor vehicle accidents; thus, greater
consumption of alcohol imposes costs on people who do not drink and drive.
a. Illustrate the market for alcohol, labeling the demand curve, the social-value curve (marginal social benefit curve), the supply curve, the social-cost curve, the market equilibrium level of output, and the efficient level of output.

![Graph of Alcoholic Beverages]

- Demand curve: $D$ (Private Value)
- Social Value curve
- Social Cost curve: $S$
- Market Equilibrium: $Q_{mkt}$
- Efficient Level: $Q_{opt}$
- Deadweight Loss (DWL) from overconsumption of alcohol

b. On your graph, shade the area corresponding to the deadweight loss of the market equilibrium. (Hint: The deadweight loss occurs because some units of alcohol are consumed for which the social cost exceeds the social value.) Explain.

4. Consider the market for fire extinguishers.

a. Why might fire extinguishers exhibit positive externalities in consumption? **Use of a fire extinguisher in one building (or apartment) may prevent the fire from spreading to a neighboring building.**

b. Draw a graph of the market for fire extinguishers, labeling the demand curve, the social-value curve (marginal social benefits curve), the supply curve, and the social-cost curve.
c. Indicate the market equilibrium level of output and the efficient level of output. Explain why these quantities differ. 
   External benefits are not included in the private value (market demand) for fire extinguishers, because buyers do not take these benefits into consideration when purchasing a fire extinguisher.

d. Label the deadweight loss associated with the market equilibrium. What does this area represent? 
   Under-consumption of fire extinguishers. The number of units consumed should be greater because marginal benefit is greater than the cost of production.

e. If the external benefit is $10 per extinguisher, describe a governmental policy that would result in the efficient outcome. 
   Provide a subsidy (by tax credit or voucher) of $10 per fire extinguisher to buyers of fire extinguishers. (Do you see that there would be an equivalent effect of subsidizing the seller?)

5. a. Education is produced and sold by private schools. What is the economic argument for public provision of education? 
   There are external benefits to education, both in consumption of education and in production of education.

b. Assuming there are external benefits in the production of college education, show the optimal quantity of higher education on a graph.
c. List some of the benefits of college education that spill over to society at large. Civic participation and better (that is, more attentive) parenting. By definition, an external benefit is one that the market prices do not reflect. Another possibility: a brilliant student learns skills in college that later yield an important technological advancement that is used in many production processes. More years of schooling lead to higher productivity and higher earnings, but that is a private benefit of education, since it is captured by the market in the form of higher earnings.

6. a. A copper smelter emits a smoke externality that contains sulfur dioxide. Suppose the external cost is $5 per pound of copper produced. Explain exactly why this smoke is a cost.

   The sulfur dioxide emitted into air reduces other uses of air. For example, if you were to run or jog through the smoke, you would experience the taste of sulfuric acid in your mouth and a burning sensation in your throat—water in your saliva combines with the sulfur dioxide to form sulfuric acid. If this condition makes you stop exercising, the production of copper imposes a cost on you.

   b. Use a graph to show the market quantity of copper and the socially optimal quantity.
c. Label the welfare loss associated with the market outcome. Explain what this welfare loss represents.

This geometric area is a welfare loss because these units of copper (between Optimal Q and Mkt Q) have a higher opportunity cost to produce than they are worth to buyers. This is shown geometrically by the Social Cost curve being above the Social Value curve for these units of copper.

7. Many observers believe that the levels of pollution in our economy are too high.

a. If society wants to reduce overall pollution by a certain amount, why is it efficient to have different amounts of reduction at different firms?

The cost to reduce pollution varies across firms. The least-cost reduction is preferred, which means different firms would reduce pollution by different amounts. It is a waste of resources to require high-cost pollution reducers to clean up much as polluters who could clean up at lower cost.

b. Command-and-control approaches often rely on uniform reductions in pollution among firms. Why are these approaches generally unable to target the firms that could easily (cheaply) undertake bigger reductions?

No firm has an incentive to reduce pollution any more than required. In addition, government cannot know the cost structure of given firms, so it is not possible for government to assign pollution reductions based on the costs to firms of pollution reduction.

c. Economists argue that appropriate Pigovian taxes or tradable pollution rights will
result in efficient pollution reduction. How do these approaches target firms that should undertake bigger reductions?

**Firms are rewarded by paying lower taxes or spending less on permits, so there is an incentive to improve pollution abatement technology.**

8. Ringo loves to play rock and roll music at high volume. Luciano loves opera and hates rock and roll. Unfortunately, they are next-door neighbors in an apartment building with paper-thin walls.

   a. What is the externality here? What resource is in dispute?
   
   The externality is noise pollution. Ringo’s consumption of rock and roll music affects Luciano, but Ringo does not take that into account in deciding how loud he plays his music.

   b. What command-and-control policy might the landlord impose? How might such policy be inefficient?
   
   The landlord could impose a rule that music could not be played above a certain decibel level. This could be inefficient because there would be no harm done by Ringo playing his music loud if Luciano is not home.

   c. Suppose the landlord allows tenants to do whatever they want? According to the Coase theorem, how might these neighbors reach an efficient outcome on their own? What might prevent Luciano and Ringo from reaching an efficient outcome?
   
   Ringo and Luciano could negotiate an agreement that might, for example, allow Ringo to play his music loud at certain times of the day. If Ringo values playing his music more than Luciano values peace and quiet, Ringo could pay Luciano enough to make both parties better off. Alternatively, if Luciano values peace and quiet more than Ringo values playing his music, Luciano could pay Ringo enough to make both parties better off. They might not be able to reach an agreement if the transactions costs are high or if bargaining fails because each holds out for a better deal.

9. Suppose there are three factories along a river. Each discharges 1000 units of effluent into the river. The government determines that 2000 units of effluent is the maximum allowable, and the government will sell two 1000-unit permits to the highest bidders. A device capable of eliminating the effluent can be installed by any firm. Cost for Factory A to install the abatement device is $10,000; for Factory B, it’s $15,000; and for Factory C, $20,000.

   a. Which firm will install the abatement device?
   
   A
b. Which firms will buy the permits and at what price?
   B and C; P = $10,000, if both permits are sold at same price.

c. If a fourth firm enters and the pollution abatement cost for them is $25,000, what will happen?
   New firm would buy permit from B at a price between $15,000 and $20,000. Firm B would buy and install abatement device.