Homework Exercises 9: Public Goods and Externality

Question 1

Every morning at 6 a.m., a large, noisy truck takes a shortcut off the main highway and drives past a single house, waking up the resident. The shortcut saves the truck driver time worth $12, but it causes the resident to lose sleep, which costs the resident $7.

a. Is it economically efficient for the truck driver to use the shortcut or stay on the highway? Explain briefly using the costs and benefits given.
b. Suppose the truck driver has the legal right to use the shortcut. Would the resident want to side pay the truck driver to stay on the highway instead? If so, how much might the resident offer? Equally, would the truck driver accept? Why or why not?
c. Suppose the resident has the legal right to block the shortcut. Would the truck driver offer the resident payment to let him use the shortcut? If so, how much might he offer? Would the resident accept? Briefly explain your reasoning.

Question 2

You and your roommate have a pile of dirty dishes in the sink. Either of you would clean the dishes if you were the only one responsible. However, when you're together, both of you avoid cleaning up, hoping the other person will do it instead. Use economic concepts to explain this situation.

Question 3

Four roommates — Judd, Joel, Gus, and Tim — want to rent and watch old movies together over the weekend. Here is each roommate's willingness to pay for each movie:

Movie	Judd	Joel	Gus	Tim
1st	$7	$5	$3	$2
2nd	6	4	2	1
3rd	5	3	1	0
4th	4	2	0	0
5th	3	1	0	0

a. Is watching a movie together in the dorm a public good? Explain your reasoning.
b. If it costs $10 to rent each movie, how many movies should they rent to maximize total surplus? Show your working.
c. For the optimal number of movies from part (b), if they split the total movie rental bill equally, how much surplus does each roommate get from the movie night?
d. Could they split the cost in a different way so that all roommates come out ahead? What practical issues might come up with your suggested solution?
e. If the roommates agree in advance to rent the efficient number of movies and split costs equally, does Judd have any incentive to overstate or understate his willingness to pay? Explain.
f. What does this example teach you about the problems of providing public goods.

Question 4 (This question helps you to understand how tradable emission permits work.)

Three factories in Happy Valley each produce pollution. Here are their details:

Factory	Current Pollution	Cost to Reduce Pollution by 1 unit
A	70 units	$20
B	80 units	$25
C	50 units	$10

The government wants to lower total pollution to **120 units**. Instead of direct limits, it gives each factory **40 pollution permits** (each permit allows one unit of pollution). Permits can be traded with each other.

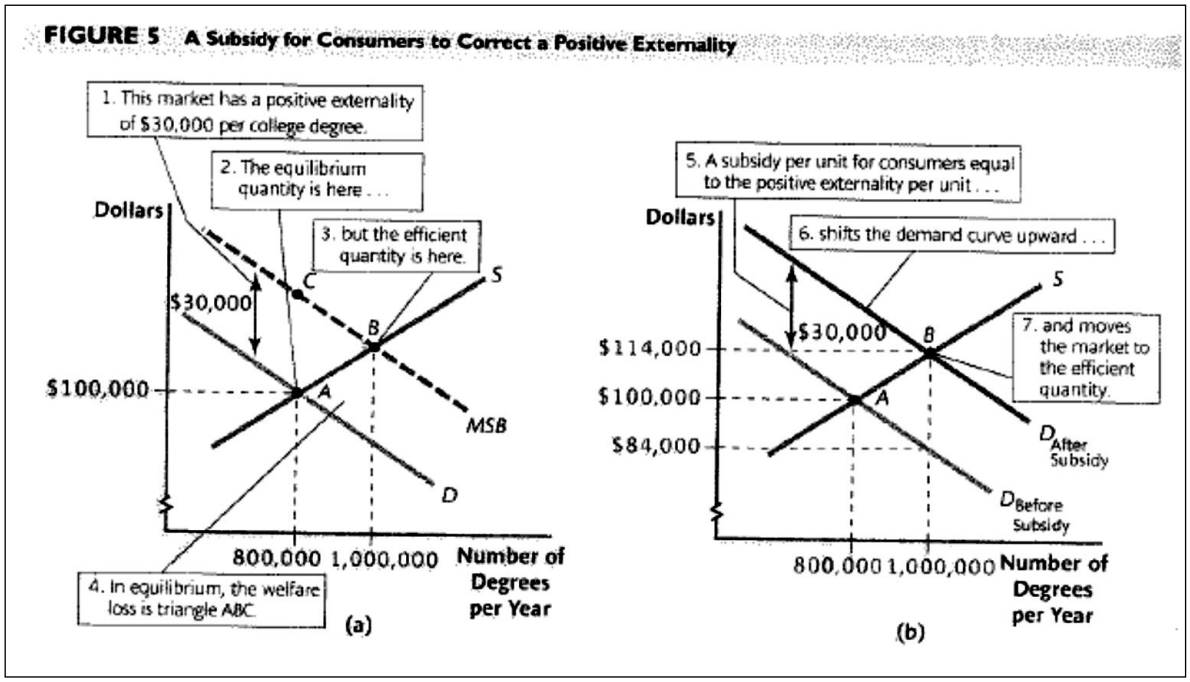
a. Who will **sell** and who will **buy** permits, and how many? Explain your answer using costs and benefits.
b. What is the *total cost* of pollution reduction when permits can be traded?
c. In contrast, if **no trading is allowed** and each factory must use only its own 40 permits, how much higher would the **total pollution reduction costs** be in total?

Question 5

In recent years, coal seemed to be on the way out in much of the world. America and Europe were gradually cutting back. In 2021, at the COP26 climate summit, countries agreed to "phase-down" their use of the world's dirtiest or the most polluting fuel. However, last year the world generated more electricity from coal than ever before. Greenhouse-gas emissions from the fuel reached a record 15.3 billion tonnes. It is set to be even higher this year[1].

With an aid of a diagram, discuss why using coal in electricity production might result in market failure and how it would impact allocation efficiency and welfare.

Question 6



In Figure 5(b), students received a $30,000 per-person subsidy to encourage them to get a college degree. Draw a diagram showing that if instead the $30,000 subsidy were given directly to colleges, the outcome for the price paid by consumers, the price received by colleges, and the equilibrium quantity of degrees would have been exactly the same as when the $30,000 subsidy was given to students.

[1] Source: Why the war in Ukraine is driving up Europe's use of coal – and its price, *The Economist*, May 9th, 2022.