ECO 411: ECONOMICS OF NATURAL RESOURCES AND THE ENVIRONMENT TUTORIAL QUESTIONS, 2018

Question 1
A chemical factory has leaked a toxic substance into the ground because fixing the leak was more expensive than the small amount of toxic substance was worth to them. Once it was discovered that the substance was contaminating local water supplies, though, the factory agreed to fix the leak.
(a) Draw supply and demand curves for the chemicals produced by the factory before the contamination was discovered.

(b) Which, if either, of these curves will be affected by the decision to fix the leak? Adjust your diagram to reflect this change. What, if anything, has happened to the equilibrium price and quantity?

(c) How have the buyers of chemicals from the factory (who live far away from the contamination) been affected by the decision to fix the leak? Why do they feel that effect? Do you think that this effect is appropriate? Why or why not?

Question 2
Mining is proposed for Wonderful Wilderness. This area provides two benefits: recreation (it is known for its remarkable backpacking opportunities) and biodiversity (it is a unique habitat for endangered wildlife and plants). The mining is expected to reduce backpacking visits from its current level of 10,000 recreation visitor-days (RVDs, a measure of recreational use) per year to 4000 RVDs/year for the next 10 years; after that time, recreational use would partially rebound to 7000 RVDs/year into perpetuity. If the mine is not opened, recreational use is expected to continue at current levels into perpetuity. Mining is expected to bring profits of GHS1 million/year for the 10 years of the mining operation.

A. What is the present value of mining in the area (excluding effects on recreation) if the interest rate is 6 percent? If it is 3 percent?

B. If one RVD of backpacking is worth GHSP, what is the present value of recreation in the area if it is mined? If it is not mined? (Hint: Your answer will be GHSP times some number.) Again, do the calculation using both a 6 percent and a 3 percent discount rate.

C. One option for the area is to delay mining for 10 years. If an RVD of backpacking is worth GHS80, what is the present value of this alternative? How does it compare to the present value of mining the area in the present?

Question 3
Consider a group of students who share a bathroom, and there are no janitorial services provided. Some of the students prefer a clean bathroom; others have a high tolerance for messiness.

a. Explain why, using concepts in market failure, there is a good chance that the bathroom will end up a mess.

b. Are there circumstances in which the mess is Pareto optimal? Are there circumstances where the mess is a market failure?

Question 4
a. Do you expect all pollutants for one country to have the same shape of environmental Kuznets curve? If so, what shape do you expect? If not, does the EKC always imply that a country can grow its way out of polluting?
b. “In environmental liability cases, courts have some discretion regarding the magnitude of compensation polluters should be forced to pay for the environmental incidents they cause. In general, however, the larger the required payments the better.” Discuss.

**Question 5**
An activity to improve the well-being of some impoverished people will provide benefits of GHS1 million right now, but it will obliterate the earth in 200 years. The world’s value in 200 years is projected at GHS$10^{12}$. There are no costs or benefits between these two dates.

(a) Is it worth avoiding the world’s destruction in 200 years at a 10 percent discount rate?
(b) Is it worth avoiding the world’s destruction in 200 years at a 6 percent discount rate?
(c) If 10 percent is the interest rate in the private sector, what are some of the arguments for using a 10 percent discount rate?
(d) What are some of the arguments for a lower discount rate?
(e) Do you think discounting and benefit-cost analysis are appropriate ways to handle this problem? Why or why not?

**Question 6**
Suppose you are part of a research team evaluating a proposal to clean up a hazardous waste site. You are in charge of assessing the incremental benefits. Which method would you choose to derive the estimation? Explain.

**Question 7**
A. While some economists argue for the creation of private property rights to protect the environment, many of those concerned for the environment find this approach abhorrent. What are the essential issues in this dispute?

B. Suppose you were asked to comment on a proposed policy to control oil spills. Since the average cost of an oil spill has been computed as GHC\$X, the proposed policy would require any firm responsible for a spill immediately to pay the government GHC\$X. Is this likely to result in the efficient amount of precaution against oil spills? Why or why not?

**Question 8**
Assume that there are two firms, each emitting 20 units of pollutants into the environment, for a total of 40 units in their region. The government sets an aggregate abatement standard ($A_{ST}$) of 20 units. The polluters' cost functions are as follows, where the cedi values are in thousands:

- Polluter 1: $TAC_1 = 10 + 0.75(A_1)^2$
- Polluter 2: $TAC_2 = 5 + 0.5(A_2)^2$

(a) What information does the government need to support an assertion that the 20-unit abatement standard is allocatively efficient?

(b) Suppose that the government allocates the abatement responsibility uniformly, requiring each polluter to abate 10 units of pollution. Quantitatively assess the cost implications.

(c) Now, assume that the government institutes an emission fee of GHS16 thousand per unit of pollution. How many units of pollution would each polluter abate? Is the GHS16 thousand fee a cost-effective strategy for meeting the standard? Explain.
(d) If instead the government used a pollution permit system, what permit price would achieve a cost-effective allocation of abatement? Compare the costs of this allocation to the costs of using the uniform standard described in part (b).

**Question 9**

A. What is an environmental Kuznets curve? Would you expect that it would be more likely to hold for a local or an international air pollutant? Why?

B. The notion of sustainability is not the same in the natural sciences as in economics. In the natural sciences, sustainability frequently means maintaining a constant physical flow of each and every resource (e.g., fish from the sea or wood from the forest), while in economics it means maintaining the value of those service flows. When might these two choices lead to different choices? Why?

C. All environmental problems may be said to result from poorly defined property rights. True or False? Explain.

**Question 10**

Suppose that a wood pulp mill is situated on a bank of the River Tay. The private marginal cost (MC) of producing wood pulp (in £ per ton) is given by the function MC = 10 + 0.5Y where Y is tons of wood pulp produced. In addition to this private marginal cost, an external cost is incurred. Each ton of wood pulp produces pollutant flows into the river which cause damage valued at £10. This is an external cost, as it is borne by the wider community but not by the polluting firm itself. The marginal benefit (MB) to society of each ton of produced pulp, in £, is given by

\[ MB = 30 - 0.5Y \]

a. Draw a diagram illustrating the marginal cost (MC), marginal benefit (MB), external marginal cost (EMC) and social marginal cost (SMC) functions.

b. Find the profit-maximising output of wood pulp, assuming the seller can obtain marginal revenue equal to the marginal benefit to society derived from wood pulp.

c. Find the pulp output that maximises social net benefits.

d. Explain why the socially efficient output of wood pulp is lower than the private profit-maximising output level.

e. How large would marginal external cost have to be in order for it to be socially desirable that no wood pulp is produced?