

ECN 275/375 – Natural resource and environmental economics  
12:15-15:15 March 6, 2026

All help aids are allowed except assistance from others.

This test consists of three questions, for a total score of 100 points.

All questions are to be answered. You may answer in English or Norwegian.

**In case you find a question that is unclear or you are uncertain about what it means, state the clarifications you need to enable you to answer the question.**

This test has been designed to limit the benefits of using artificial intelligence (AI). If AI use is detected beyond reasonable doubt, unreported use leads to a zero-score on that sub-question. Students may use AI if they self-report such use on specific sub-questions at a cost: A question with self-reported AI use reduces the given score by 40%.

**When I submit my answers on this test, I confirm that I have worked alone on my answers and not cooperated with others. I am aware that cooperation with others is considered an attempt or a contribution to cheating.**

**I am aware of the consequences of cheating (cfr. Academic regulations for NMBU).**

**Your name:** NN (+ ECN 275 or ECN 375)

### Question 1 (30 points – 10 points for each part a-c)

Truthful revelation, commonly known as *truth-telling*, is an important feature of modern environmental economics.

- (a) (i) Explain what is meant by the term *truth-telling* in environmental economics. Provide an example related to environmental management contract auctions.
- (ii) Connect *truth-telling* to the relevant resource allocation mechanism criteria. Explain briefly for each criterion you choose to include. Illustrate your points linking your answers to the auction example you already provided above.

**Answer:** (i) write here

**Answer:** (ii) write here

- (b) The EU recently passed a law that suppliers of environmental goods or services are not allowed to earn rents.
- (i) Explain briefly what is meant by the term *information rents* for supplying environmental goods and services, and why it is difficult to avoid *information rents*.
- (ii) Provide an example where you explain how *information rents* play a role to give incentives for truthful revelation.

**Answer:** (i) write here

**Answer:** (ii) write here

- (c) Explain how an emission tax motivates *truth-telling* for an agent, *i*, under certain conditions. Name these conditions and explain their relevance.

**Answer:** write here

## Question 2 (30 points – 10 points for each part a-c)

A major source of SO<sub>2</sub> and NO<sub>x</sub> in the atmosphere is burning of fossil fuels to generate electricity. Two thirds of SO<sub>2</sub> and one fourth of NO<sub>x</sub> in the atmosphere come from fossil fueled electric power generators. Particles of SO<sub>2</sub> and NO<sub>x</sub> bind to water in the atmosphere lowering atmospheric pH (make atmospheric water more acid). The resulting rainfall is therefore more acid, which is the origin of the term *acid rains*.

Winds can carry SO<sub>2</sub>- and NO<sub>x</sub>-particles for long distances, and in some cases even across country borders, i.e. to different jurisdictions. The latter implies that acid rains may also cause problems not covered by national laws which could prevent affected citizens suing to receive compensation for damages. Moreover, citizens in other countries may not be compensated in kind for damages, for example through lower electricity prices.

Suppose we have three countries, *Origin* (where emissions originate but damages are perceived acceptable due to high smokestacks allowing most SO<sub>2</sub> and NO<sub>x</sub> to drift downwind) to *Close* (the closest downwind country to *Origin*), and *Next* (the next downwind country after *Close*). Marginal damages from acid rains gradually decline with the distance from *Origin*, implying that marginal damages are higher in *Close* than *Next*.

- (a) Side-payments is one possible way to break the deadlock agreeing on how to pay for reducing *Origin* emissions.
- (i) Why are side-payments difficult to implement in general?
  - (ii) Why is it particularly challenging to agree on side-payments in this case?

**Answer:** (i) write here

**Answer:** (ii) write here

**Information for sub-question (b) below:** An alternative to building higher smokestacks in *Origin* is to switch to lighter fuels containing less sulfur (S). A tradable permit regime requiring reductions in S-emissions would create incentives for such a fuel switch or replacing fossil fueled power generations with other energy sources like wind or solar. Allowing foreigners to buy permits could enlarge the funding base for such a transition of *Origin's* electric energy supply infrastructure.

- (b) Explain why such a tradable permit regime for emissions in *Origin* is a viable and more efficient solution in this case than side-payments.

**Answer:** write here

- (c) Suppose that an agreement on any mechanism (policy) that entails payment from *Close* and *Next* to *Origin* were to be made to reduce environmental damages.
- (i) Why would some environmental groups still oppose this agreement?
  - (ii) What are the welfare implications of not implementing a side-payment agreement to induce *Origin* to reduce its emissions compared to doing nothing?

**Answer:** (i) write here

**Answer:** (ii) write here

### Question 3 (40 points – 10 points for each part a-d)

Since the turn of the century, there has been increased concerns on micro particles from plastics (MPPs). These concerns have so far been particularly large for MPP emissions to water: MPPs negatively affect aquatic organisms by accumulating in their digestive systems and serving as attractors for various toxic substances that further increase negative impacts on aquatic life. Increased awareness on these issues has contributed to increase collection of plastic waste in many countries.

Styrofoam (polystyrene) is a plastics derivative. It is frequently used for insulation, packaging protection of high value products like consumer electronics, and to keep certain foods like burgers, warm. Styrofoam is high in volume and often contaminated, which makes recycling particularly costly. In many countries, including Norway, large shares of styrofoam therefore end up as residual waste or are not even collected. Recent protest against establishing fast food sale outlets is one example of styrofoam waste not collected.

Consider a small, open and affluent economy (not unlike that of Norway). Evaluate the following policies to reduce emissions of MPPs from styrofoam:

- (1) Forbidding the domestic (inland) use of styrofoam.
- (2) A tax on the use of styrofoam to reduce the relative profitability of styrofoam use.
- (3) A subsidy on the use of styrofoam substitutes to reduce the relative profitability of styrofoam use.

When answering, keep in mind that small and open economies import many consumer products.

- (a) Discuss the advantages and disadvantages of a ban on domestic use of styrofoam (1).

**Answer:**

Advantages: write here

Disadvantages: write here

- (b) What are the main advantages of price instruments like (2) and (3) in the above list compared to forbidding domestic use of styrofoam (1 in the above list).

**Answer:**

Advantages: write here

Disadvantages: write here

- (c) What are the main advantage of taxes (2) compared to subsidies (3) to reduce the domestic use of styrofoam.

**Answer:** write here

**Supporting information to sub-question (d) below:** Some countries have suggested to internationally reduce the use of styrofoam and other plastics based materials. The experiences with international agreements are mixed. One example of a highly successful international agreement is phasing out the use of freon and other hydrofluorcarbons (HFCs) to reduce damages to the ozone layer (the Montreal Protocol, 1987). Since its inception the ozone layer has gradually recovered. Important reasons for the success of the Montreal Protocol are that substitute products for HFCs were available, and that the protocol's general

negative impacts on profits were small. For some uses of HFCs the elasticity of substitution is high, which partly explains the low costs of the protocol's policies.

- (d) Based upon the above information, would you advocate an international ban on styrofoam or the use of economic instruments, primarily taxes or tradable permits on using styrofoam? Please provide the reasoning behind your answer.

**Answer:** write here

Jon Olaf Olaussen (external control of exam questions and expected answers)

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