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國立臺北科技大學 115 學年度碩士班招生考試

系所組別：3220 環境工程與管理研究所乙組

第一節 環境科學 試題

第 1 頁 共 1 頁

注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Under the global net-zero transition, greenhouse gas mitigation policies increasingly affect industrial competitiveness and international trade. The European Union has implemented the Carbon Border Adjustment Mechanism (CBAM), while Taiwan has enacted the *Climate Change Response Act* and is introducing carbon pricing. Please answer the following questions:

- a. **Define** Global Warming Potential (GWP) and **explain** why fluorinated gases (e.g., SF₆) generally have much higher GWP values than CO₂? (6%)
- b. Compare the economic mechanisms of a **carbon tax** and a **cap-and-trade (emissions trading system, ETS)**. (5%)
- c. Taiwan is a highly export-oriented economy. **Analyze** the potential impacts of carbon pricing on Taiwanese industries under CBAM and domestic carbon pricing schemes. (5%)
- d. **Explain** how firms can use **internal carbon pricing** to manage risks associated with future carbon taxes, emissions trading, and carbon border adjustment mechanisms. (4%)

2. **Per- and polyfluoroalkyl substances (PFAS)**, often called “**forever chemicals**”, and plastic pollution are major environmental concerns due to their persistence, long-range transport, and ecological and health risks in aquatic ecosystems. Please answer the following questions:

- a. From a chemical structure perspective, **explain** why PFAS exhibit high environmental persistence and bioaccumulation. (5%)
- b. **Describe** the major environmental transport pathways of PFAS and **discuss** promising remediation or removal technologies for PFAS-contaminated water. (5%)
- c. What is microplastic? Please **define** microplastics and **identify three** major sources. (5%)
- d. Plastic pollution poses significant threats to aquatic ecosystems. **Discuss** the major sources of plastic pollution, its effects on aquatic organisms, and potential mitigation or management strategies. (5%)

3. In recent years, many cities have successfully reduced PM_{2.5} concentrations but have simultaneously observed an increase in surface ozone (O₃) levels. This unintended consequence is often referred to as the “*blue sky effect*”, highlighting the complex interactions among air pollutants. Based on atmospheric chemistry and photochemical smog formation mechanisms, please answer the following questions:

- a. **Describe** the formation mechanisms of photochemical smog and **explain** the major pathways of surface ozone formation in urban atmospheres. (6%)
- b. **Explain** the roles of volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in ozone formation and their interactions. (5%)
- c. **Define** the VOC-limited regime and the NO_x-limited regime, and **explain** how ozone control strategies differ between these two regimes. (5%)
- d. Integrating the above, **explain** why PM_{2.5} reduction policies may lead to increased surface ozone concentrations and **discuss** the implications for air pollution control strategies. (4%)

4. Under climate change, the frequency and intensity of extreme weather events such as heavy rainfall and flooding are increasing, posing significant risks to both human and natural systems. International climate governance has expanded beyond mitigation to include **climate adaptation** and **loss and damage**. Please answer the following questions.

- a. Compare the **definitions**, **objectives**, and **examples** of **climate mitigation** and **climate adaptation**. (6%)
- b. **Define** loss and damage and **explain** its relationship with climate adaptation. (4%)
- c. **Explain** the climate risk framework and **interpret** the equation $Risk = Hazard \times Exposure \times Vulnerability$ in the context of **extreme rainfall**. (5%)
- d. Using urban flooding caused by extreme rainfall as an example, **propose strategies** to reduce flood risk from the perspectives of **hazard**, **exposure**, and **vulnerability**. (5%)

5. Plastic pollution is a major global environmental challenge. Its impacts occur across the entire life cycle, from raw material extraction and product design to production, use, and disposal. Therefore, a **full lifecycle approach** is increasingly emphasized in environmental policy and sustainability management. Please answer the following questions.

- a. **What is Life Cycle Assessment (LCA)? Explain** its basic concept and purpose. (6%)
- b. **Explain** why addressing plastic pollution requires a *full lifecycle approach* rather than focusing solely on waste management. (6%)
- c. **Analyze** the major environmental impacts of plastics across three life cycle stages: **raw material extraction**, **production and product design**, and **waste management**, and **discuss** potential improvement or management strategies. (8%)