

國立臺北科技大學九十七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

填准考證號碼

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注意事項：

1. 本試題共 23 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。
4. 1-22 題為單選題，答錯每題倒扣 1 分，未作答不倒扣。

Question 1 (4%). The term dosage refers to the

- A. concentration of the pollutant in the environment.
- B. length of time the pollutant persists in the environment.
- C. amount of the pollutant required to cause harm in an organism.
- D. amount of the pollutant absorbed by an organism per unit of body mass.

Question 2 (4%). Insecticides are best applied to fields of crops on days with low wind speeds and low temperatures. This is to account specifically for the insecticide's

- A. airborne transport mechanism and solubility in water.
- B. airborne transport mechanism and high rate of evaporation.
- C. bioaccumulative potential and solubility in water.
- D. bioaccumulative potential and high rate of evaporation.

Question 3 (4%). *Belladonna* is a toxic weed commonly found in gardens. Although human deaths linked to *Belladonna* are generally very few, increased toxicity may occur if leaves from this plant are ingested along with some medications. This is an example of

- A. synergistic action.
- B. bioaccumulation.
- C. chronic toxicity.
- D. acute toxicity.

Question 4 (4%). PCBs (polychlorinated biphenyls) are a health risk to humans due to bioaccumulation. Which one of the following properties contributes most to bioaccumulation?

- A. high volatility
- B. solubility in water

- C. solubility in fatty tissues
- D. artificial manufacture by industry

Question 5 (4%). Acute toxicity from a pollutant refers to

- A. harmful effects due to the pollutant's long-term persistence in the environment.
- B. harmful effects of a single dose of the pollutant.
- C. the health effects of breathing the pollutant over a long period.
- D. the length of time during which a person is exposed to the pollutant.

Question 6 (4%). Chronic toxicity from a pollutant refers to

- A. breathing in a large amount of the pollutant.
- B. the harmful effects of repeated doses of the pollutant.
- C. the immediate symptoms of breathing the pollutant.
- D. the length of time a person is exposed to the pollutant.

The following information relates to Questions 7-9.

Obsolete electronic devices, such as outdated computers and mobile phones, are known as 'e-waste'. Disposing of e-waste is hazardous to environmental and human health, because it contains a variety of toxic substances such as cadmium, arsenic and lead. Cadmium is a heavy metal with similar properties to mercury.

Question 7 (4%). Cadmium is toxic to humans as it

- A. dissolves readily in water.
- B. is very dense.
- C. bioaccumulates in body tissue.
- D. has low persistence in the environment.

One environmental scientist has proposed three possible solutions to address the issue of e-waste.

- . establishing more long-term enclosed landfills
- . increasing the charges for disposing of waste in existing long-term enclosed landfills
- . developing more high-technology recovery and recycling centers

Question 8 (4%). The high-technology recovery and recycling center is likely to be a successful solution as it will reduce the

- A. cost of mobile phone calls.
- B. number of mobile phones being disposed of.
- C. number of mobile phones being manufactured.
- D. amount of e-waste being released into the environment.

Question 9 (4%). Increasing the charges for the disposal of toxic waste is likely to increase ecological sustainability by

- A. increasing income for local authorities.
- B. leading to the opening of more landfill sites.

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- C. leading to illegal dumping in remote areas.
- D. encouraging development of recycling methods which are currently uneconomic.

The following information relates to Questions 10 and 11.

Exposure to sulfur dioxide in the air can cause both acute and chronic effects. Exposure to very high levels can be life threatening. Acute exposure may lead to dryness of the nose and throat, sneezing, coughing and eye problems. Chronic exposure may lead to permanent breathing damage. A study of air quality in a large city examined the link between daily death rates and atmospheric concentrations of sulfur dioxide and airborne particles. The results from 12 days of the study are presented in Figure 1.

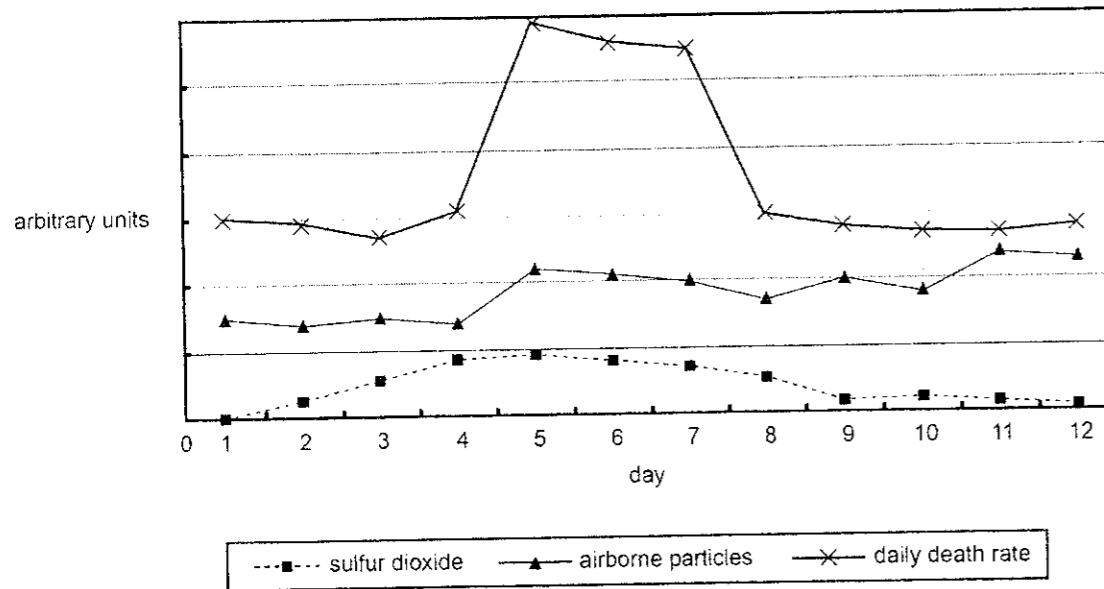


Figure 1. Air pollution and death rates

Question 10 (4%). Which one of the following best describes the results from the air quality study as presented in Figure 1?

- A. High concentrations of sulfur dioxide lead to the highest death rates.
- B. High concentrations of airborne particles lead to the highest death rates.
- C. The highest death rates happen when both concentrations of sulfur dioxide and airborne particles are high.
- D. There is no link between pollutant concentrations and daily death rate.

Question 11 (4%). The effect of sulfur dioxide and airborne particles on death rates found during the air quality study is best described as

- A. not significant.
- B. bioaccumulation.
- C. synergistic action.
- D. pollutant specificity.

The following information relates to Questions 12-17.

An old water storage dam is to have its dam wall repaired. To access the dam wall for repairs, a large amount of water stored in the dam needs to be released into a river.

Question 12 (4%). In releasing the water into the river, which one of the following environmental consequences will most likely need to be avoided?

- A. erosion
- B. evaporation
- C. dryland salinity
- D. increased salinity in the river

Question 13 (4%). In developing an Environmental Risk Assessment for the project, which of the following groups would not usually need to be consulted?

- A. ecotourists
- B. local residents
- C. local irrigators
- D. local government

Question 14 (4%). The main purpose of the Environmental Risk Assessment is to

- A. ensure maximum local employment on the project.
- B. eliminate any disruption to the environment during repair.
- C. minimize the number of people likely to object to the project.
- D. balance any environmental damage against the benefit of the repair.

Question 15 (4%). Which one of the following factors best indicates that the dam repair is ecologically sustainable?

- A. disruption to local wildlife is temporary
- B. employment is created during the repair project
- C. habitat of endemic threatened populations has been disturbed
- D. previously submerged heritage buildings can be investigated

Question 16 (4%). After the dam is repaired, it is found that soil sediments in the flood plain of the river contain significant levels of phosphorus which were not present before the water release. A scientist suggests that this can be corrected by planting a particular type of vegetation that absorbs and bioaccumulates phosphorus from the soil. This is an example of

- A. recycling.
- B. soil bioremediation.
- C. water conservation.
- D. waste minimization.

Question 17 (4%). After completion of the work, a scientist conducts an evaluation of the effectiveness of the Environmental Management Plan for the project. Which one of the following would be evidence for the success of the Environmental Management Plan?

- A. The dam no longer leaked.
- B. The work came in under budget.
- C. No native animals were disturbed during the work.
- D. Two years later, the ecology of the area downstream of the dam is similar to the ecology before the work was done.

The following information relates to Questions 18-20.

A mining operation, which also includes some preliminary processing, is conducted on a small island 50 km south of a coastline. This is shown below in Figure 2. A strong west to east current flows along the coast. The predominant wind is from the south.

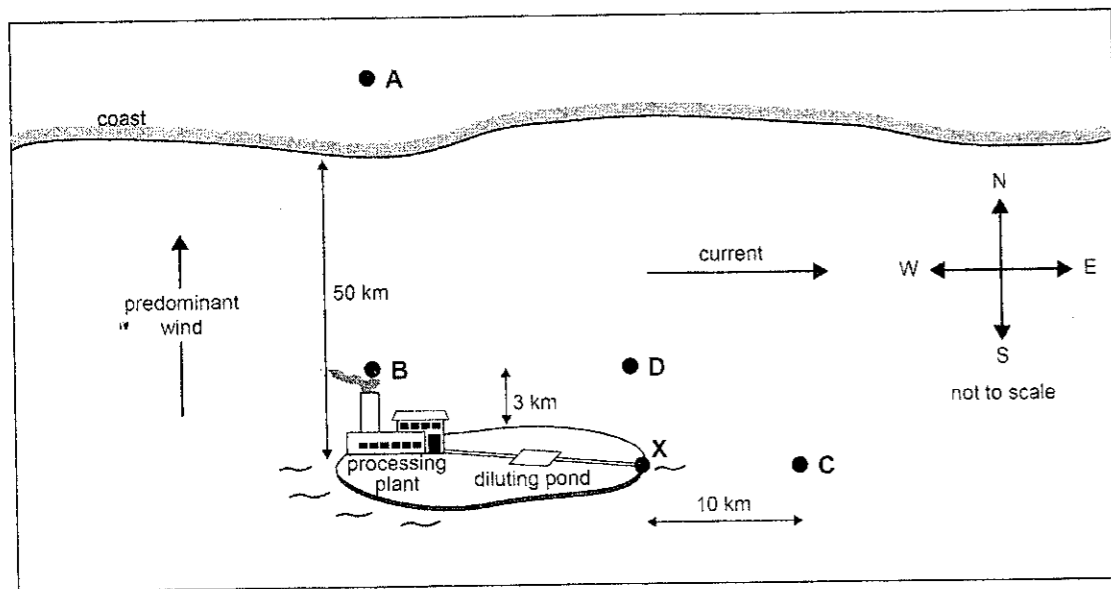


Figure 2

Two pollutants are released into the environment from the island.

- . sulfur dioxide from the high chimney at the processing plant into the air
- . a highly soluble liquid waste, diluted in the pond and then released once per day into the sea at point X

Question 18 (4%). At which one of the following locations in Figure 2 would you expect to observe the largest concentration of sulfur dioxide?

- A. on the coast - location A
- B. 3 km north of the island - location B
- C. 10 km east of the island - location C
- D. 4 km north of the point X - location D

Question 19 (4%). At which one of the following locations in Figure 2 would you expect to observe the largest concentration of the liquid waste?

- A. on the coast - location A
- B. 3 km north of the island - location B
- C. 10 km east of the island - location C
- D. 4 km north of the point X - location D

Question 20 (4%). 45 kg of the liquid waste is produced each day. Before release, the daily liquid waste is diluted by mixing with water in a 12,000 L (liter) pond, and then the mixture released once per day into the sea at point X. The concentration, g/L (grams per liter), in the pond immediately before release is best given by

- A. 0.267 g/L
- B. 3.75 g/L
- C. 267 g/L
- D. 3,750 g/L

Question 21 (4%). Which of the following groups contains only non-fossil energy resources?

- A. biomass, coal, solar, tidal
- B. oil, solar, biomass, uranium
- C. wind, water, natural gas, hydrogen gas
- D. geothermal, hydrogen gas, uranium, biomass

Question 22 (4%). Energy released from uranium is not popular with the community because it

- A. is a major cause of the greenhouse effect.
- B. is an inefficient way to produce electricity.
- C. has by-products which are perceived as being dangerous and long lasting.
- D. produces large amounts of waste heat compared to a coal-fired power station.

Question 23. A power station burns brown coal to produce electricity. Brown coal is burned in air to produce steam to drive a turbine to generate electricity. When 1.0 kg of brown coal is burned it releases 6750 kJ of energy. For each kilogram burned, 2500 kJ of electrical energy is produced.

- a. Calculate the efficiency of electrical energy generation in the power station. (4%)
- b. Describe two of the energy transformations happening in the power station that account for the missing energy. (4%)

The main chemical reactions in this process involve conversion of carbon, hydrogen and sulfur in the coal into the following exhaust gases: carbon dioxide, water (steam) and sulfur dioxide. These exhaust gases are released into the atmosphere. The masses of some of the reactants and their products are given in tonnes (t).

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carbon (coal) + oxygen → carbon dioxide

12 t 32 t 44 t

sulfur + oxygen → sulfur dioxide

16 t 32 t 48 t

One hundred tonnes (t) of brown coal contain 26 t carbon and 0.16 t sulfur.

- c. If a power station consumes 500 t of brown coal in one hour, calculate the mass of each of the two exhaust gases emitted to the atmosphere. (4%)