

Please refer to the following description about PFAS for question 1-4

PFAS, or per- and polyfluoroalkyl substances, are a group of human-made chemicals that have been widely used in various industrial and consumer products since the 1940s. These substances are known for their unique ability to resist heat, water, and oil, making them valuable in the manufacturing of a wide range of products, including waterproof fabrics, non-stick cookware, food packaging, firefighting foam, and more.

The concern surrounding PFAS arises from their persistence in the environment and their potential adverse effects on human health. Some key points about PFAS and their impact on human health include:

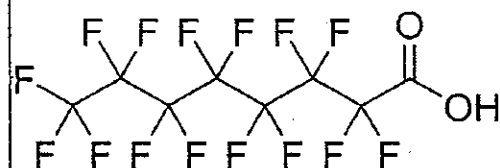
1. **Persistence and Bioaccumulation:** PFAS are highly persistent in the environment, meaning they do not break down easily over time. Additionally, these chemicals have the ability to bioaccumulate, meaning they can accumulate in the tissues of living organisms, including humans, as they move up the food chain.
2. **Exposure Sources:** Human exposure to PFAS can occur through various sources, such as contaminated drinking water, food, and consumer products. For example, PFAS can migrate from food packaging into food.
3. **Health Concerns:** Research has linked exposure to certain PFAS to a range of health issues. Some of the potential health effects associated with PFAS exposure include developmental effects in fetuses and infants, effects on the immune system, liver damage, thyroid disease, and an increased risk of certain cancers.
4. **Regulatory Actions:** On March 14, 2023, US Environmental Protection Agency announced the proposed National Primary Drinking Water Regulation for six PFAS including perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS); their maximum contaminant levels (MCLs) were proposed to be 4.0 ppt.

1.(10%) Which statement about "4.0 ppt" in drinking water is incorrect?

- a. Can also be expressed as 4.0 parts per trillion
- b. Can also be expressed as 4.0 ng/L
- c. Can also be expressed as  $4.0 \times 10^{-6}$   $\mu\text{g/mL}$
- d. Can also be expressed as 4.0 ng/kg
- e. All of the above are correct

2. (10%) What are environmental hormones or endocrine disrupting compounds (環境荷爾蒙)? Can PFAS be considered as one type of environmental hormones? Please explain your answer

3. (20%) Here is the molecular structure of PFOA. PFOA is considered as surfactant due to its chemical structure. It consists of long fluorinated carbon chain, and a carboxylic acid group (-COOH) at one end of the molecule. Please try to explain why PFOA can be used as surfactant, non-stick coating or water-repellent spray in terms of its **polarity** and **hydrophobicity**.



見背面

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國立臺灣大學 113 學年度碩士班招生考試試題

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4. (10%) PFOA is

- a. Micropollutant
- b. Inorganic compound
- c. Nutrient
- d. Radioactive substances
- e. Disinfection byproducts

5. (10%) Please draw a figure to explain the spectrum of electromagnetic radiation based on its wavelength. Please indicate and explain the range of solar radiation.

6. (10%) Please draw a figure and explain "the rock cycle".

7. (15%) Please draw a figure and explain "the global carbon cycle".

8. (15%) Please draw four generalized population age-structure diagrams to explain countries with "expanding rapidly", "expanding slowly", "stable", "declining" populations.

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