

一、以下為選擇題，每題五分，請作答於試卷內之「選擇題作答區」

1. Which are not major components of a sanitary landfill? (2 correct answers)
(A) sedimentation tank
(B) bottom barrier layer
(C) leachate collection and treatment
(D) methane collection and use
(E) chlorination tank
2. What is the cause of the odor in the river
(A) high organic concentrations
(B) high emerging contaminants concentrations
(C) too much ozone
(D) too much oxygen
(E) high hormone concentration
3. Lethal dose LD_{50} is used for measuring toxicity of a compound.
If compound A has $LD_{50} = 25 \text{ pg/L}$ and compound B has $LD_{50} = 20 \text{ ng/L}$, which compound (A or B) is more toxic?
4. (continue from Question 3) What are the problems of this toxicity measuring method? (2 correct answers)
(A) It neglects the long term (chronic) effect
(B) It neglects the synergistic effect with other toxins
(C) It is not as accurate as effective concentration EC_{50}
(D) It can only be tested on the fish or mice.
(E) It is not as accurate as lethal concentration LC_{50}
5. Which of the following is an organic pollutant
(A) Lead
(B) Radium-226
(C) Nitrate
(D) *Cryptosporidium*
(E) Perfluorooctanoic acid (PFOA)
6. Which of the following is the pH of the unpolluted rainwater.
(A) $\text{pH} > 9$
(B) pH between 8-9
(C) $\text{pH} = 7$
(D) pH between 5-6
(E) $\text{pH} < 5$

二、以下為簡答題，每題十分，請作答於試卷內之「非選擇題作答區」

1. What is the chemical significance of pK_a for the fate of pollutants in environmental waters?
Please explain.

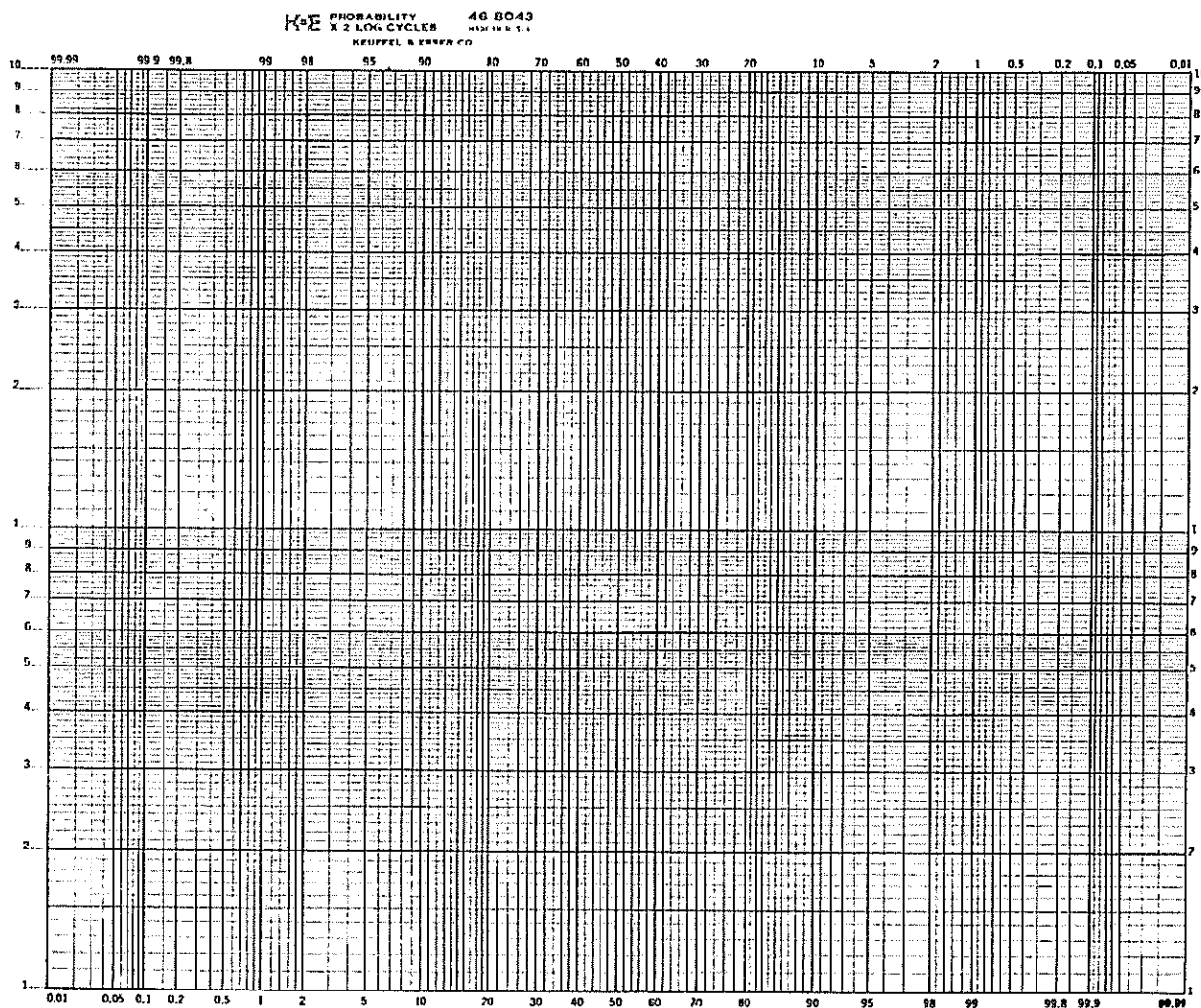
見背面

2. Plasticizer such as bis(2-ethylhexyl)phthalate, commonly abbreviated DEHP is an example of environmental hormone (or environmental endocrine disrupting compound). Please explain the term 'environmental hormone.' What is it and what are the possible effects on human health and ecosystem.

三、(20%) 下表為某一金屬冶煉工廠所排放之廢氣中，粒狀物對應其粒徑之濃度分布情形。請計算(1)對應粒徑之 percent in size range (%)以及 percent greater than stated size (GTSS, %); (2)利用所得的計算結果，配合下方提供之 log-probability graph，估算 geometric mean diameter 以及 geometric standard deviations；(3)你得到的結果，是否能證明本粒狀物之濃度分布為 log-normal distribution？如果是，請根據粒狀物顆粒形成原理，解釋此 distribution 可能由何種機制產生。

Particle Size Range (μm)	Distribution ($\mu\text{g}/\text{m}^3$)	Percent in size range (%)	GTSS range (%)
<0.62	25.5		
0.62-1.0	33.15		
1.0-1.2	17.85		
1.2-3.0	102		
3.0-8.0	63.75		
8.0-10.0	5.1		
>10.0	7.65		
total	255		

此二欄為必須計算之部分，請自行於答案卷內重新繪製本表格並完成作答



四、(20%) 某一受油品污染的場址需要進行土壤整治，經評估後決定以現地開挖污染土壤後使用一個低溫熱處理反應器進行處理。該反應器為CFSTR類型，經初期實驗顯示其熱處理反應符合一階反應動力行為，且反應速率常數為0.5/min，公式如下所示（ τ 為土壤停留時間，公式內其他符號之定義請根據專業判斷）：

$$\frac{C_{out}}{C_{in}} = \frac{1}{1+k\tau}$$

經土壤採樣分析結果顯示，該土壤之total petroleum hydrocarbon (TPH)濃度為3500 mg/kg，計畫目標為整治到土壤管制標準1000 mg/kg以下，請計算(1)土壤於反應器中之最少停留時間；(2)處理期間，如果土壤量必須保持在反應器體積的40%，同時期望之土壤處理量為500 kg/hr，請問反應器體積大小應該為何？假設土壤密度為1.5 g/cm³；(3) 低溫熱處理反應器主要是在200到1000°F之間操作，將土壤所含之TPH有效脫附，請說明TPH脫附速率快慢與效能可能與哪些因子有關？(4)請提出脫附出來的TPH之適當處理方式。

五、(10%) 請詳述粒狀物去除機制，並根據這些機制，說明為何靜電集塵器在粒狀物粒徑介於某範圍時其集塵效率會有最小值。請問該範圍大概介於多少粒徑？

試題隨卷繳回