

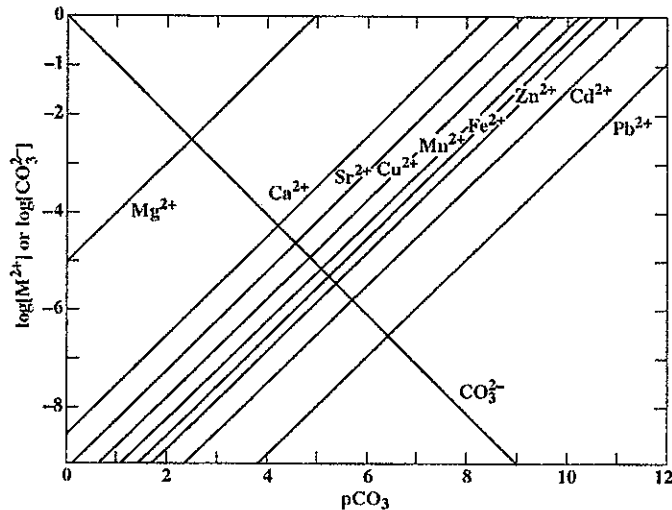
※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Selected Values of $\log x$. You may need this information for the following calculation.

x	$\log x$
1	0
2	0.301
3	0.477
4	0.602
5	0.699
6	0.778
7	0.845
8	0.903
9	0.954

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1. (a) Give the structural formula for the following compounds. (7 points)
- (b) Please rank the following compounds from most (most likely to partition into the atmosphere) to least volatile. Please also give your reason. (8 points)
- 1) Benzene
 - 2) Phenol
 - 3) Chloroform
 - 4) Bromoform
 - 5) Trichloroethene
 - 6) 1,1,1-Trichloroethane
 - 7) Tetrachloroethene (also called perchloroethene)
2. A buffer is made by combining monosodium oxalate ($\text{NaC}_2\text{O}_4\text{H}$) and disodium oxalate ($\text{Na}_2\text{C}_2\text{O}_4$) to give concentration of 0.01 M for monosodium oxalate and 0.02 M for disodium oxalate. The pK_{a1} and pK_{a2} for oxalate are 1.25 and 4.28 respectively.
- (a) What is the initial pH of this buffer? (7 points)
- (b) What is the pH of this buffer after the addition of 0.005M NaOH? (8 points)

3. The following is the logarithmic concentration diagram showing the solubility of various metallic carbonates at 25 °C. "M²⁺" represents divalent cations.



- (a) Please determine the solubility product of calcium carbonate and magnesium carbonate. (5 points)
- (b) Please determine the solubility of Ca²⁺ in water sample containing 10⁻³ molar carbonate at 25°C. (5 points)
4. Which parameter, H (Henry's law constant), S_w (water solubility), or K_{ow} (octanol water partition coefficient), would you expect to be better predictors for whether a compound will sorb strongly to particulate material in soils and sediments, why? (10 points)
5. Please define the terminology terms and the possible relationships.
- (a) *Nitrosomonas* and *Nitrobacter* (6 pts)
- (b) Carboxysome and Ribulose-1,5,-bisphosphate Carboxylase (Rubisco) (6 pts)
- (c) Polymerase Chain Reaction and Agarose Gel Electrophoresis (6 pts)
- (d) Acetogenesis and Methanogenesis (6 pts)
- (e) Natural Attenuation Method and Bioaugmentation Method (6 pts)
6. (a) Please describe how to use the streak plate technique and the serial dilution method to obtain a pure bacterial culture for degrading benzene pollutant from soil (10 pts), and (b) how do you justify the "purity" of the culture (10 pts).