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UNIVERSITI SAINS MALAYSIA

Second Semester Examination  
Academic Session 2007/2008

April 2008

**KAT 341 – Pollution And Environmental Chemistry**  
**[Kimia Pencemaran Dan Alam Sekitar]**

Duration : 3 hour  
*[Masa : 3 jam]*

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Please check that this examination paper consists of **TWENTY ONE** printed pages before you begin the examination.

**Instruction:-**

Answer **FIVE** (5) questions only. Answer **THREE** questions from section A and **TWO** questions from section B.

Answer each question on a new page.

You may answer either in Bahasa Malaysia or in English.

If a candidate answers more than five questions, only the answers to the first five questions in the answer sheet will be graded.

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Section A

1. Fate and transport of chemicals within the aquatic environment will depend on their physical and chemical properties and characteristics of the receiving water. Some of the chemical and physical properties associated with the fate and transport of these chemicals are given in the table below

Properties	Water solubility	Octanol-water partition coefficient	Hydrolysis half-life	Soil sorption
Symbols	WS	$K_{OW}$	$Ht_{1/2}$	$K_{OC}$

- (a) What is likely and unlikely to happen to a chemical in the aquatic environment if that chemical has (i) a high WS (ii) low  $K_{OW}$  and (iii) high  $K_{OC}$ ?

( 9 marks)

- (b) Trichloroethylene has the following physical and chemical properties. Provide its possible fate and transport within the aquatic environment that is most likely to occur.

Trikloroetilena CAS No : 79-01-6 EC No: 201-167-4	WS ( 25 °C)	1,100 mg L <sup>-1</sup>
	$K_{OW}$	~ 260
	$K_{OC}$	~ 160
	D liquid	> 1.464
	P $t_{1/2}$	~ 1 month
	S $t_{1/2}$	Month to years
	VP (25 °C )	9.2 x 10 <sup>3</sup> Pascals

( 5 marks )

- (c) One of the possible fate of a persistent pollutant is bioaccumulation and biomagnification. Define these two terms.

( 6 marks )

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2. (a) Differentiate between water quality criteria and water quality standards. Explain why often it could be inappropriate to adopt water quality criteria directly in a pollution control program.

( 6 marks )

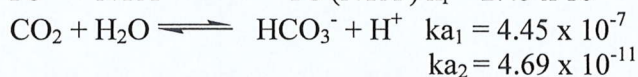
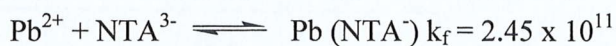
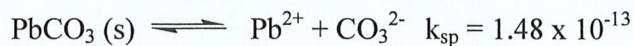
- (b) The following water quality parameters were measured for the nutrient concentrations in a lake.

Orthophosphate, $\text{PO}_4^{3-}$	$10 \mu\text{g L}^{-1}$
Total Phosphorous (Dissolved )	$15 \mu\text{g L}^{-1}$
$\text{NO}_3^-$ -N	$15 \mu\text{g L}^{-1}$
$\text{NH}_4^+$ -N	$10 \mu\text{g L}^{-1}$

- i) What is the likely limiting nutrient for algal growth in this lake based on the ratio of the two nutrients?
- ii) Discuss the implications of having total P content of the lake increased to greater than  $0.5 \text{ mg L}^{-1}$  due to sudden pollution of the lake.

( 14 marks )

3. (a) One of the impacts of chelating agents or ligands in the aquatic environment is to increase the solubility and mobility of heavy metals. This problem is due to the increased dissolution of  $\text{PbCO}_3(\text{s})$ . If a solution containing  $25 \text{ mgL}^{-1}$   $\text{Na}_3\text{NTA}$  ( $\text{MW} = 257 \text{ g mole}^{-1}$ ) is equilibrated with  $\text{PbCO}_3(\text{s})$ , and is then measured to have a pH of 8.5 and  $[\text{HCO}_3^-]$  of  $1.76 \times 10^{-3} \text{ M}$ , what is the equilibrium ratio of  $[\text{Pb}(\text{NTA})^-]/[\text{HNTA}^{2-}]$ ? Useful equations are given below.



( 6 marks )

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