ENGR 202/1 section AA

- Summer 2013

Sustainable Development and Environmental Stewardship

Instructor : Dr. John Hadjinicolaou

FINAL EXAM

June 18, 2013

CLOSED BOOK

Total : 60 Marks

Problem # 1 (5 marks)

Define or explain the following terminology :

--- CAA clean air act

--- PCB Polychlorinated bi-phenyls.

--- NOAEL No observable adverse effect level.

--- T_e = ~~Threshhold~~ ., Earth's temperature.

--- USDOE U.S Department of Energy

Problem # 2 (5 marks) a) i) = Enviromental effect

ii) - Effect on economy

iii) Effect on tourism, industry.

a. Name some major effects of oil pollution ? (3 marks)

b. Give two benefits of designing a product to fit into a life cycle ? (2 marks)

-> It minimizes the impact of wastes.

-> It reduses the use of natural resourses to make new product.

Problem #3 (6 marks)

a. What is a pathogen (3 marks)

b. Give the quantities for as many standards as you can (International, US or Canadian) for drinking water (3 marks) i) Total coliform bacteria
ii) Fecal coliform and E.coli

Problem # 4 (2 marks)

Among the many toxic metals the quantitative analysis on mercury is one of the most widely studied. Give me some reasons why mercury has received attention in scientific studies?
(2 marks) - Affects central nervous system
- Expose to the metal can be fatal.
- It can bio-accumulate in blood + body of fish that we eat.

Problem #5 (6 marks)

a) What is the difference between Potency Factor and Chronic Daily Intake for a carcinogenic chemical ? (3 marks)

b) Explain some of the "uncertainties" in assessing risk for non-carcinogens ? (3 marks)
3) Unknown variability in mass or concentration
4) Complexity of chemical composition of contaminants

1) Lack of information on source location
2) Poorly known history of Contaminant releases

Problem # 6 (5 marks)

a) What are the 3 major factors affecting increase in CO_2 emissions ? (3 marks) 1) Population growth
2) G.D.P. growth/capita
3) Energy intensity

b) What is bioaccumulation and give an example (2 marks)
It refers to the accumulation of substance or other organic chemicals or even toxic metals in an organism. It occurs when the organisms absorbs the toxic substance at a rate greater than that at which a substance is lost, Example is lead.

Problem # 7 (7 marks)

a) What is Hazard Quotient ? (3 marks)

b) Name the four steps of risk assessment (4 marks)

1) Hazard Assessment.
2) Dose-Response Assessment
3) Expose Assessment.
4) Risk characterization.

A 3.3 Km deep ice core was drilled from Vostok, Antarctica which allowed trends in the ice over the past 420000 years to be examined. Scientist measured the concentration of atmospheric CO_2 and Methane trapped air bubbles inside the ice, as well as the corresponding variation.

Problem # 8 (6 marks)

a) Describe what are the scientific results of the research done on the ice core section at the Vostok, Antarctica test station ? (3 marks)

b) Describe some of the stabilization scenarios developed by the Intergovernmental panel of climate change (IPCC) (3 marks) The stabilization scenarios are mitigation scenerioes that aim at pre-specified greenhouse (GHG) reduction targets. The different scenarioes try to either stabilize the radiative forcing of the atmosphere (by controlling the concentration of CO_2 of combination of GHG), or to stabilize the total mean temperature increase

Problem # 9 (6 marks)

A well has 2.0 mg/L of zinc, 2.5 mg/L formaldehyde and 70 µg/L of chloroform. Would there be any concern about carcinogenic health effects of using this water for drinking purpose ?

$Zinc = \frac{2(2)}{70} = \frac{0.057}{3\times10^{-1}} = 0.19$ given on table

$Formaldehyde = \frac{(2.5)(2)}{70} = 0.071$ given on table $= 0.2$

$\frac{(70\times10^{-4})(2)}{70} = \frac{2\times10^{-3}}{(1+10^{-2})} = 0.2$ given

$HI = \Sigma HQs$

$= 0.745$ as $0.745 < 1$ so its good

Problem # 10 (6 marks)

At the back

A contaminated site has 100 mg/kg of chloroform. Is the cancer risk low enough for the site to be used as a playground for children according to the EPA guideline of 1×10^{-6} ? Assume that a child would use it 4 hours/day, 350 days /year for 12 years

Problem # 11 (6 marks)

1) Housing and Industrial development.
2) Agriculture.
3) Emission of chemical substance to land, air & water

a) What are the 3 key factors that influence the environmental change ? (3 marks)

b) The population of a city is currently 1 million people. Using a constant annual growth rate, what is the percent increase in population after 10 years with the annual growth rate at 5 percent ? (3 marks)

$P = P_0(1+r)^t \Rightarrow P = 1,500,000$
$r = 0.05$
$t = 10$ year
$P = 1,000,000(1+0.05)^{10}$
$= 1628.894.63$

BONUS (6 marks)

a) What is " bad ozone" and its source ? (3 marks)

b) What is eutrophication and what is its cause ? (3 marks)

Air Pollutant ozone found at ground level, Sources, Automobile Power Plant, Factories

→ eutrophication is over enrichment of water by neutrients such as nitrogen and Phosphorus in lakes, river, Steams

chronic daily intake.

$$CDI = \frac{100\,mg \times (2\times10^{-4}\,kg)}{15\,kg} \times \frac{4\,hrs \times 350\,days \times 12\,years}{24\,hr \times 365\,day \times 70\,years}$$

Just because we specified the time

$$mg/kg\text{-}day = \frac{ADD\,(mg/Day)}{Body\,weight\,(kg)}$$

$$= 3.65\times10^{-5}\,\frac{mg}{kg\text{-}dy} = CDI$$

$$IR = CDI \cdot PF \quad (PF \Rightarrow \text{chloroform})$$

$$= \frac{3.65\times10^{-5}\,mg}{kg\text{-}day} \times \frac{6.1\cdot10^{-3}\,kg\text{-}day}{1\,mg}$$

$$= 2.228\times10^{-7}$$

$$Ratio = \frac{IR}{EPA} = \frac{2.228\times10^{-7}}{10^{-6}} = 0.222 < 1$$

Safe.

Con Ploy