BASIC ENVIRONMENTAL ENGINEERING & ECOLOGY
(CHEM 2001)

Time Allotted : 3 hrs　　　　　　　　　　**Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following:　　　**10 × 1 = 10**

   (i)　Ozone acts as a pollutant when resides in
   　(a) troposphere　　　　　　(b) stratosphere
   　(c) mesosphere　　　　　　(d) ionosphere.

   (ii)　In parasitic food chain the nature of pyramid is
   　(a) upright　　　　　　　　(b) inverted
   　(c) can be upright and inverted　　(d) none of these.

   (iii)　What is Kyoto Protocol?
   　(a) It is an agreement among countries to take steps for reducing global warming.
   　(b) It is an agreement among countries to take steps for reducing acid rain.
   　(c) It is an agreement among countries to take steps for planting trees to control pollution.
   　(d) It is an agreement among countries to start using nuclear energy.

   (iv)　Solid waste management involves
   　(a) collection of solid waste　　(b) storage of solid waste
   　(c) disposal of solid waste　　(d) all of the above.

   (v)　India celebrates Van Mahotsav every year in the month of ……………… in which lakhs of trees are planted across the country. Which one of the followings is suitable for blank?
   　(a) June　　　(b) July　　　(c) August　　　(d) September.

   (vi)　The primary pollutant responsible for the photochemical smog formation are
   　(a) SO_2 and NO_2　　　　(b) HC and NO_2
   　(c) PAN and HC　　　　　　(d) aldehyde and PAN.

   (vii)　Which of the following can be used for disinfection of water?
   　(a) Bleaching powder　　　　(b) Hydrogen peroxide
   　(c) Blue vitriol　　　　　　(d) potassium permanganate.

   (viii)　Temporary hardness of water is due to the presence of
   　(a) Cl^-　　(b) SO_4^{2-}　　(c) PO_4^{3-}　　(d) HCO_3^- .

   (ix)　Aquatic eco system contains
   　(a) Plankton　　　　　　　(b) Nekton
   　(c) Benthos　　　　　　　(d) Plankton and Nekton.

   (x)　Unit of intensity of sound is
   　(a) W/m^2　　(b) N/m^2　　(c) Decibel　　　(d) Hz.

Group – B

2. (a) Define food chain. Discuss saprophytic food chain with example.

   (b) Write phosphorous cycle in the environment with diagram.

   (c) Briefly account for the sustainable development.

   (d) What do you mean by environmental resistance?
   　　　　　　　　　　　(2 + 2) + 4 + 2 + 2 = 12

3. (a) Give a brief account of carbon cycle with a schematic diagram mentioning four major chemical reactions.

   (b) What is exponential growth of population? Derive the expression.

   (c) The human population follows a logistic growth rate until it stabilizes at 10 billion. In the year 1970, the world population was 2 billion with growth rate of 2.0 %. When will the population reach 6 billion?
   　　　　　　　　　(3 + 2) + (1 + 2) + 4 = 12

Group – C

4. (a) Define lapse rate. Classify lapse rate. Prove that, in case of adiabatic lapse, rate of change of temperature decreases with altitude and is equal to -9.76 °C/km.

   (b) Write short notes on thermosphere and carbon storage.
   　　　　　　　　　(2 + 2 + 4) + (2 + 2) = 12

5. (a) What is acid rain? Write down the causes and effect of acid rain.

   (b) Write down the reactions of ozone layer depletion. Deduce the chemical formula of CFC-115.

   (c) What are the main constituents of photochemical smog?

$$(2 + 4) + (2 + 2) + 2 = 12$$

Group – D

6. (a) State the Darcy's Law of ground water flow.

   (b) Why the knowledge of hydraulic gradient is necessary? What is activated sludge?

   (c) What is thermal pollution? How do you control thermal pollution?

   (d) What are the physiological impacts of noise pollution? Calculate the intensity of 100 dB sounds. (Reference intensity = 1×10^{-12} w/m^2)

$$2 + (1 + 2) + (1 + 2) + (2 + 2) = 12$$

7. (a) The BOD rate constant is 0.30/days. Calculate the expected BOD$_5$ if the two day BOD is 150 mg/l. (Suppose temperature is constant).

   (b) Draw a flow diagram for a waste water treatment plant showing the primary and secondary treatment.

   (c) Why hard water cannot be used in boilers?

   (d) What is the definition of noise pollution? How can noise be controlled at source?

$$3 + 4 + 2 + (1 + 2) = 12$$

Group – E

8. (a) Write short note on Biological waste treatment.

   (b) Name two chemical methods by which toxicity of hazardous waste shall be reduced. Mention by chemical reaction.

   (c) What is green chemistry? Name two green solvents and green catalyst.

   (d) Write the full name of MIC and state its effects in living organisms?

$$3 + (2 + 2) + (1 + 2) + 2 = 12$$

9. (a) Write a short note on Chernobyl Disaster.

   (b) Give a brief idea of Environment Impact Assessment (EIA)?

   (c) What are the biomedical wastes? What is the best way to dispose biomedical wastes?

   (d) Depict the working principle of modern sanitary landfill process for the safe disposal of solid waste.

$$3 + 3 + (1 + 1) + 4 = 12$$