

M.Sc. ENVIRONMENTAL SCIENCE
FIRST SEMESTER
ENVIRONMENTAL CHEMISTRY
MEV-102

(Use separate answer scripts for Objective & Descriptive)

Duration : 3 hrs.

Full Marks : 70

(PART-A : Objective)

Time : 20 min.

Marks : 20

Choose the correct answer from the following:

1X20=20

- Ozone production in the stratosphere peaks at:
a. 185nm b. 220 nm c. 320 nm d. None of above
- After sodium chloride, which of the following compounds has the maximum concentration in sea water?
a. Magnesium sulphate b. Calcium sulphate
c. Magnesium chloride d. Potassium sulphate
- What are the most abundant multivalent metallic ions in natural waters?
a. Fe, Al b. Ca, Mg
c. As, F d. Fe, Mn
- Trace metals are determined by:
a. HPLC b. Flame photometry
c. AAS d. None of above
- The conjugate acid of HF is:
a. H_2F^+ b. HF^{2-} c. F^- d. F^+
- In a constant volume process, internal energy change is equal to:
a. Heat transferred b. Work done
c. Zero d. None of the mentioned
- Which one of the following conditions will favour maximum formation of the product in the reaction?
 $A_2(g) + B_2(g) \rightleftharpoons X_2(g) \Delta_r H = -X kJ?$
a. Low temperature and high pressure b. Low temperature and low pressure
c. High temperature and high pressure d. High temperature and low pressure
- Enthalpy of $CH_4 + \frac{1}{2}O_2 \rightarrow CH_3OH$ is negative. If enthalpy of combustion of CH_4 and CH_3OH are x and y respectively. Then which of the following relations is correct?
a. $x > y$ b. $x < y$
c. $x = y$ d. $x \geq y$
- Considering entropy (S) as a thermodynamic parameter, the criterion for the spontaneity of any process is:
a. $\Delta S_{system} + \Delta S_{surroundings} > 0$ b. $\Delta S_{system} - \Delta S_{surroundings} > 0$
c. $\Delta S_{system} > 0$ only d. $\Delta S_{surroundings} > 0$ only

10. The correct thermodynamic conditions for the spontaneous reaction at all temperatures is:

- a. $\Delta H > 0$ and $\Delta S < 0$
 b. $\Delta H < 0$ and $\Delta S > 0$
 c. $\Delta H < 0$ and $\Delta S < 0$
 d. $\Delta H < 0$ and $\Delta S = 0$

11. Loamy soil contains:

- a. 40% silt, 40% sand, 20% clay
 b. 50% silt and sand, 50% clay
 c. 50% sand, 25% silt, 25% clay
 d. None of above

12. The single most important reactive intermediate species in atmospheric chemical processes is:

- a. HO• radical
 b. Water
 c. Cl atom
 d. None of above

13. During thunderstorms, water dissolves:

- a. Dust particles
 b. HCl
 c. Nitric acid
 d. Clouds

14. Mottling or discoloration of teeth occurs due to consumption of drinking water contaminated with:

- a. Arsenic
 b. Fluoride
 c. Iron
 d. All of above

15. Entamoebahistolytica is a:

- a. Bacteria
 b. Virus
 c. Protozoa
 d. None of above

16. Choose the correct statement.

- a. Clean rain has a natural acidity of about 5.6.
 b. Ozone is a stronger oxidant than PAN.
 c. Arsenic is a major problem in surface water of Assam.
 d. All are correct.

17. If M EDTA is used, 1 mL of the titrant measures 1 mg of hardness of CaCO_3 .

- a. 1.0
 b. 0.1
 c. 0.01
 d. 0.001

18. During estimation of total alkalinity of water, acid is added to a sample to make final pH.....

- a. 3
 b. 4.5
 c. 6.5
 d. 7

19. Which one of the following best accounts for mercury's significant harm to the environment?

- a. Persistence
 b. Degradability
 c. Specificity
 d. Synergism

20. Which of the following plays a role in the formation of tropospheric ozone?

- a. Infrared radiation
 b. VOC
 c. CO_2
 d. N_2O

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(PART-B : Descriptive)

Time : 2 hrs. 40 min.

Marks : 50

[Answer question no.1 & any four (4) from the rest]

- Describe the principles of green chemistry. 10
- Discuss the reactions of atomic oxygen and atomic nitrogen in atmosphere. 5+5=10
- A solid analysis is to be conducted on a sample of waste water. The procedure is as follows: 2x5=10
 - A crucible and filter pad are dried to a constant mass of 25.439 g.
 - 200 ml of a well shaken sample of waste water is passed through the filter
 - The crucible, filter pad and removed solids are dried to a constant mass of 25.645 g
 - 100 ml of the filtrate is placed in an evaporation dish that had been pre-weighed at 275.419 g
 - The sample in (D) is evaporated to dryness and the dish and residue are weighed at 276.227 g.
 - Both the crucible from (C) and the evaporation dish from (E) are placed in a muffle furnace at 600°C for an hour. After cooling, the mass of the crucible is 25.501 g and the mass of the dish is 275.944 g.

Determine the following:

 - The filterable solids.
 - The non-filterable solids.
 - The total solids.
 - The organic fraction of filterable solids.
 - The organic fraction of non-filterable solids.
- Discuss the principles of Atomic Absorption Spectrophotometry (AAS) and Flame photometry. 5+5=10
- What do you mean by texture, bulk density, porosity, permeability and CEC of soil? 2x5=10
- Discuss the situations and reactions of Ozone formation and destruction in the stratosphere. 5+5=10
- What are soaps and detergents? Describe how soaps are formed. Write about structure and cleaning mechanism of a soap. 3+3+4=10
- Write short notes on: 5x2=10
 - Photochemical smog.
 - Atmospheric aerosols.

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