INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF SCIENCE AND TECHNOLOGY

END OF SEMESTER EXAMINATIONS - DECEMBER 2025

PROGRAMME: BSEM
YEAR/SEM: YEAR 1/SEMESTER 1
COURSE CODE: BSE1104
NAME: ENVIRONMENTAL CHEMISTRY

DATE:
TIME:

INSTRUCTIONS TO CANDIDATES:

SECTION A

Answer all questions in this section by selecting the correct option (40 marks)

Question 1:

1. Carbon monoxide (CO) gas in the atmosphere is primarily produced through incomplete combustion of fossil fuels. A. True B. False

2. Which gas is primarily responsible for absorbing ultraviolet radiation in the stratosphere?
A. CO_2
B. CH_4
C. O_3
D. NO_2

3. What role does UV-B radiation play in environmental damage due to ozone depletion?
A. It causes water pollution
B. It warms the oceans
C. It damages DNA in living organisms
D. It blocks photosynthesis

4. The reaction (photodissociation of oxygen) $O_2 + hv \rightarrow 2O$ occurs mainly in which region of the atmosphere?
A. Troposphere
B. Mesosphere
C. Stratosphere
D. Thermosphere

5. The troposphere is the layer where most weather phenomena occur.
A. True B. False

6. Which of the following is the most abundant greenhouse gas in Earth's atmosphere?
A. Carbon dioxide (CO_2)
B. Methane (CH_4)
C. Nitrous oxide (N_2O)
D. Water vapor (H_2O)

7. Which of these gases is a byproduct of livestock digestion and contributes significantly to global warming?
A. Nitrous oxide (N_2O)
B. Carbon dioxide (CO_2)
C. Methane (CH_4)
D. Water vapor (H_2O

8. Which pollutant is produced mainly by vehicle exhaust and industrial activities and is harmful because it replaces oxygen in the bloodstream?
A. Carbon monoxide (CO)
B. Ozone (O_3)
C. Nitrogen dioxide (NO_2)
D. Particulate matter (PM)

9. What is the primary focus of environmental chemistry?
A. Studying the chemistry of living organisms
B. Investigating chemical reactions in industrial processes
C. Understanding the chemicals & chemical processes in the environment

D. Analyzing chemical compounds in outer space
10. Which of the following best describes the greenhouse effect?
A. The release of harmful chemicals into the atmosphere
B. The trapping of heat by certain atmospheric gases
C. The destruction of the ozone layer
D. The process of photosynthesis in plants
11. Acid rain is primarily caused by the release of which atmospheric pollutant?
A. Carbon dioxide (CO_2)
B. Methane (CH_4)
C. Sulfur dioxide (SO_2)
D. Oxygen (O_2)
12. Which chemical compound is responsible for the depletion of the ozone layer in the stratosphere?
A. Carbon dioxide
B. Chlorofluorocarbons
C. Nitrogen oxides
D. Hydrochloric acid
13. Which wavelength range is most responsible for photodissociating atmospheric NO_2?
A. Infrared (700–1000 nm)
B. Visible (500–600 nm)
C. UV radiation (100–400 nm)
D. X-rays (<1 nm)
14. Identify the odd man out among the following freshwater environments
A. Lakes
B. Reservoirs
C. Ponds
D. Rivers
15. What is the term for the process by which contaminants are removed from groundwater as it passes through layers of soil and rock?
A. Filtration
B. Desalination
C. Eutrophication
D. Leaching
16. What is the term for the process by which plants absorb water from the soil and release it into the atmosphere?
A. Photosynthesis
B. Respiration
C. Evapotranspiration
D. Eutrophication
17. What environmental problem is associated with the excessive use of synthetic fertilizers and runoff into water bodies?
A. Acid rain
B. Desertification
C. Eutrophication
D. Ozone depletion
18. What environmental issue is associated with the thinning of the ozone layer?
A. Acid rain
B. Deforestation
C. Skin cancer

D. Ocean acidification

19. In the formation of photochemical smog, the key photochemical step is:

A. Oxidation of VOCs

B. Photodissociation of NO_2 to NO + O

C. Reaction of CO with OH radicals

D. Condensation of aerosols

20.What is the primary greenhouse gas responsible for trapping heat in the Earth's atmosphere?

A. Oxygen

B. Carbon dioxide

C. Nitrogen

D. Methane

Question 2:

1. In the formation of photochemical smog, the key photochemical step is:

A. Oxidation of VOCs

B. Photodissociation of NO_2 to NO + O

C. Reaction of CO with OH radicals

D. Condensation of aerosols

2.Which of the following best describes the greenhouse effect?

A. The release of harmful chemicals into the atmosphere

B. The trapping of heat by certain atmospheric gases

C. The destruction of the ozone layer

D. The process of photosynthesis in plants

3.Albedo refers to the fraction of solar energy reflected by a surface.

A. True B. False

4. What role does UV-B radiation play in environmental damage due to ozone depletion?

A. It causes water pollution

B. It warms the oceans

C. It damages DNA in living organisms

D. It blocks photosynthesis

5. Which wavelength range is most responsible for photodissociating atmospheric NO_2?

A. Infrared (700–1000 nm)

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6. The reaction (photodissociation of Oxygen) $O_2 + hv \rightarrow 2O$ occurs mainly in which region of the atmosphere?

A. Troposphere

B. Mesosphere

C. Stratosphere

D. Thermosphere

7. Which gas is primarily responsible for absorbing ultraviolet radiation in the stratosphere?

A. CO_2

B. CH_4

C. O_3

D. NO_2

8. In terms of volume, the greatest proportion of liquid freshwater is found in:

A. Lakes

B. Rivers
C. Groundwater
D. Soil moisture
9.Which of the following layers contains the coldest temperatures in the atmosphere?
A.Troposphere
B. Stratosphere
C. Mesosphere
D. Thermosphere
10.Environmental chemistry is the discipline which deals with;
A. The movement of chemicals through the various environmental segments and their impacts
B. The reduction of contamination
C. Management of the environment
D. None of the above
11.That part of the Earth upon which humans live and from which they extract most of their food, minerals, and fuels is known as;
A. Environment
B. Geosphere
C. Atmosphere
D. Biosphere
12..... is the introduction of harmful substances into the environment.
A. Contamination
B. Pollution
C. Eutrophication
D. Evaporation
13. Identify the chemical reaction below
$CO_{2\ g} + H_2O_{\ l} + \text{energy} \rightarrow C_6H_{12}O_6 + O_{2\ g}$
A. Respiration
C. Combustion
B. Photosynthesis
D. Oxidation
14. What is the primary source of carbon dioxide (CO_2) emissions?
A. Volcanic activity
B. Deforestation
C. Industrial processes
D. Fossil fuel combustion
15.Ice and snow help cool the Earth by reflecting sunlight back into space.
A. True B. False
16. The troposphere is the layer where most weather phenomena occur.
A. True B. False
17.Atmospheric gases are evenly mixed in all layers of the atmosphere.
A. True B. False
18.How do chloroflorocarbons destroy stratospheric ozone molecules?
A. By absorbing UV light
B. By combining with oxygen
C. By releasing chlorine atoms into the stratosphere
D. By increasing global temperatures
19. What is the term for the process by which contaminants are removed from groundwater as

it passes through layers of soil and rock?
A. Filtration
B. Desalination
C. Eutrophication
D. Leaching
20. Carbon monoxide (CO) gas in the atmosphere is primarily produced through incomplete combustion of fossil fuels. A. True B. False

SECTION B

Attempt any 3 questions from this section (60 marks)

Question 1:

Describe the carbon cycle and briefly explain why it is important for life on Earth. (20 marks)

Question 2:

a. What are environmental compartments? (2 marks)
b. Describe the various environmental segments that do exist on planet Earth. How do they relate with each other? (18 marks)

Question 3:

With examples, define the following terminologies as applied in Environmental chemistry. (4 marks each)
a. Fossilization
b. Nitrogen fixation
c. Sublimation
d. Photochemical reactions
e. Denitrification

Question 4:

Using relevant diagrams, briefly describe the following biogeochemical cycles. (10 marks each)
i. Nitrogen cycle
ii. Hydrological cycle

Question 5:

a. Draw and name the different layers that make up the atmosphere (10 marks)
b. The atmosphere serves several critical roles that are essential for life on Earth and the planet's overall stability. Discuss (10 marks)

Question 6:

Discuss the interrelationship among the four major segments of the environment (atmosphere,
lithosphere, hydrosphere, and biosphere). How does human activity affect these segments? (20 marks)

Question 7:

With examples, differentiate between the following terms used in Environmental chemistry. (5 marks each)
i. Contaminant and pollutant
ii. Long term and short term carbon cycles
iii. PM10 and PM2.5
iv. Indoor and outdoor air pollution

Question 8:

Discuss the following concepts, highlighting their causes and effects. (10 marks each)
i. Global warming
ii. Ozone layer depletion

Question 9:

Describe the vertical structure of the atmosphere and identify the key characteristics (e.g., temperature changes, composition, and density) of each atmospheric layer. (20 marks)

Question 10:

a. Describe the key processes involved in the hydrological cycle. (10 marks)
b. How has man interfered with the hydrological cycle? (10 marks)

Question 11:

a. Distinguish between biological and industrial nitrogen fixation. What are the environmental implications of increased use of industrial nitrogen fertilizers? (13 marks) b. Discuss the role of leguminous plants in the nitrogen cycle. How do they contribute to soil fertility and sustainable agriculture? (7 marks)

Question 12:

a. Define the following terminologies in the context of environmental chemistry (2 marks each) i. Eutrophication ii. Water pollution iii. Biogeochemical cycles b. Compare the troposphere and stratosphere in terms of their composition, temperature patterns, and relevance to weather and aviation. (14 marks)