

Mahindra University Hyderabad
École Centrale School of Engineering
Mid Term Examination
(2022 – Batch)

Program: B. Tech.

Branch: All

Year: I

Semester: I

Subject: Earth & Environmental Sciences (CE1101)

Date: 09-11-2022

Time Duration: 1.5 Hours

Start Time: 02:00 pm

Max. Marks: 30

Instructions:

- 1) This paper is divided into three sections: A, B and C. All the sections are compulsory.
- 2) Read questions carefully and answer to the point.

SECTION – A

[5 x 2 = 10 M]

Answer **any five** questions. Each question carries **two** marks

1. Draw a diagram to illustrate the interactions between the geosphere, atmosphere, cryosphere, and hydrosphere.
2. Describe magma formation in a spreading center and a subduction zone.
3. Summarize the main processes of rock cycle in a neat diagram.
4. What factors cause ocean water to be vertically stratified? What might cause the thermohaline circulation system to stop or shut down?
5. Define snowline. How will the latitude and increasing inland distance affect snowline elevation?
6. How are nitrogen and oxygen gases formed and become more abundant in the atmosphere?

SECTION – B

[5 x 2 = 10 M]

Answer **all** questions. Each question carries **two** marks

The Red Sea contains some of the hottest and saltiest seawater in the world and is located in the Northern Hemisphere between Africa and Asia. Neighboring nations Egypt, Sudan, Eritrea and Saudi Arabia intend to exploit all sources of water for irrigation. The Current runoff to the Red Sea (rivers + groundwater) is $2.5 \times 10^{11} \text{ m}^3/\text{year}$ carrying dissolved salts of $10 \text{ mg}/\text{m}^3$. The direct precipitation to the surface is $1.25 \times 10^{11} \text{ m}^3/\text{year}$ and evaporation from surface is $1 \times 10^{12} \text{ m}^3/\text{year}$. The sediment adsorbs 30% of the salt from runoff.

The coastal currents of the Red sea are affected by local winds. In summer, the prevailing winds over the Red Sea are along its axis, from north to south (given in Figure 1). Winds over the southern Red Sea are in a northward (south to north) direction during the winter monsoon. The CO_2 concentration in the atmosphere is 400 ppm. In general, the sea absorbs 25% of the CO_2 from the atmosphere and about 5% is released back to atmosphere through the respiration of marine life. The box model of atmosphere-sea interaction is shown in Figure 2.

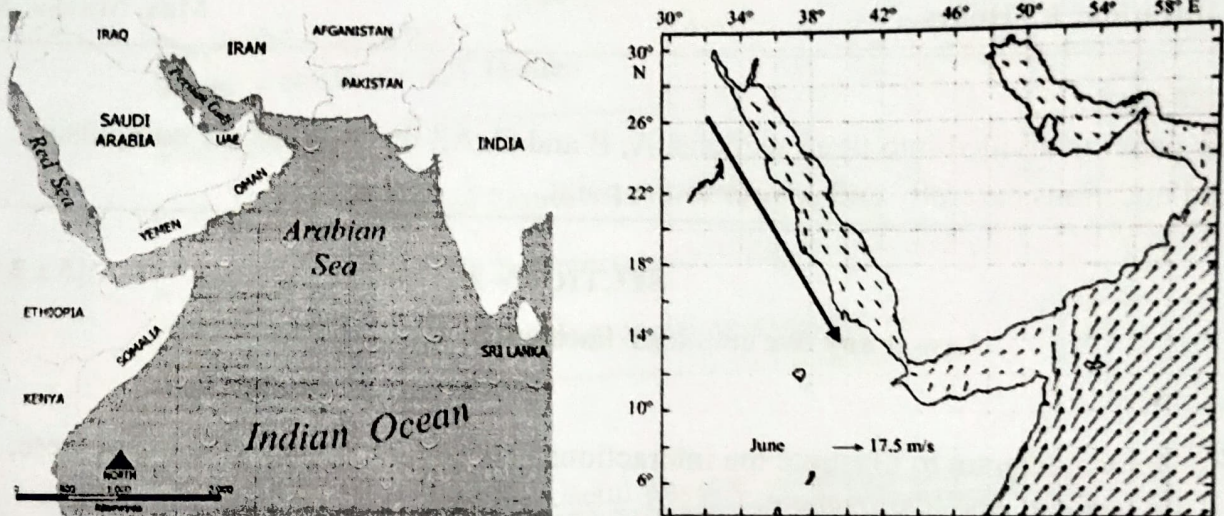


Figure 1: Schematic of the Red sea area, the black arrows highlight the wind direction in Summer

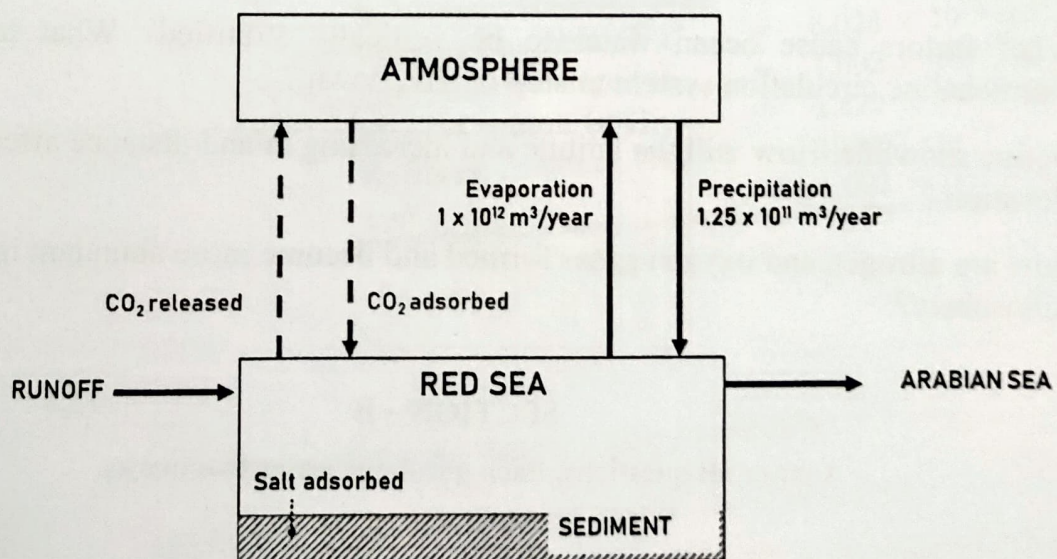


Figure 2: Box-model of Atmosphere-Red sea interaction

Answer the following questions based on the information given above.

1. Assume Red sea is at steady state and write the mass balance equation for water. Calculate the water flow in the Arabian sea.
2. Calculate the concentration of dissolved CO_2 at steady state in the sea.

3. What happens to the pH of the sea water and life when the levels of atmospheric CO₂ increase due to human activity?
4. Due to the Coriolis and Ekman transport effect, what type of process occurs in the coastal regions of the Red Sea in summer and winter?
5. Estimate the concentration of salt in the Red Sea. What factors are affecting the salinity of the Red Sea?

SECTION – C

[1 x 10 = 10 M]

Answer **any one** question. Each question carries **ten** marks

1. Describe some important differences in topography and geologic events at plate boundary interactions between oceanic crust and continental crust.
2. What is dissolution? What role does it play in the formation of caves and sinkholes in karst topography?