

OLLSCOIL NA hÉIREANN

NATIONAL UNIVERSITY OF IRELAND, GALWAY

SEMESTER I EXAMINATIONS, 2002

Second Year (Denominated B.Sc. Degree in Marine Science)*MR 201 Fundamental Oceanography and Meteorology*Prof. M.J. Dring
and the internal examinersTime allowed: *Three hours.*Students answer 4 questions, at least **one** from each sectionUse a **SEPARATE** answer book for each section**SECTION A**

1. a. Explain the use of Temperature-Salinity (T-S) diagrams in describing the mixing of water masses.

AND

- b. Write notes on the formation of North Atlantic Deep Water.

2. a. What is meant by 'wave refraction'?

AND

- b. How do offshore variations of depth (e.g. underwater canyons) affect the wave pattern at a beach?

3. a. What causes tides?

AND

- b. How do the tides vary during a month and why?

P.T.O.

SECTION B

4. Describe and account for the general distribution of sediment types in the world ocean.

5. **ANSWER ALL PARTS OF THE QUESTION.**

- a. Calculate the oceanic residence time for a dissolved element ($AW = 50$) given:

Average concentration in river water	$= 10 \text{ nmol kg}^{-1}$
River water flux to oceans	$= 30 \times 10^{15} \text{ kg yr}^{-1}$
Atmospheric deposition on ocean surface	$= 2.5 \times 10^6 \text{ kg yr}^{-1}$
Average oceanic concentration	$= 5 \text{ nmol kg}^{-1}$
Total mass of oceanic water	$= 1.5 \times 10^{18} \text{ tonnes}$

- b. How is the oceanic behaviour of dissolved elements related to their residence times?
- c. Account for the typical “nutrient-type” profile in open ocean water

6. **EITHER**

- a. How do the oceanic distributions of N_2 , O_2 and CO_2 reflect their differing chemistries and roles in biological processes?

OR

- b. Why do we distinguish between contamination and pollution and what are the major classes of marine contaminant?

P.T.O.

SECTION C

7. Explain what is meant by the following terms:

Hectopascal, millibar, scale height, lapse rate, tropopause

Show that the density of air is inversely proportional to temperature.

Calculate the density of air at 20 degrees Celsius and at standard atmospheric pressure.

$$\text{Standard Atmospheric Pressure} = 1.013 \times 10^5 \text{ N m}^{-2}$$

$$\text{Molecular mass of dry air} = 28.96 \text{ kg kmol}^{-1}$$

$$\text{Universal gas constant} = 8.314 \times 10^3 \text{ J kmol}^{-1} \text{ K}^{-1}$$

8. Explain what is meant by the following terms: planetary short wave albedo, radiative forcing, atmospheric window.

Give an account of (a) solar radiation (b) terrestrial radiation to include the intensity of radiation as a function of wavelength and maximum emission of radiation.

Determine the equilibrium temperature at which balance occurs between incoming solar radiation and outgoing terrestrial radiation, assuming the absence of absorbing gases. Assume that the solar irradiance is 1367 W m^{-2} at the top of the atmosphere and the planetary shortwave albedo is 0.31. Also assume the emissivity of the earth's surface is 1.0.

$$\text{Stefan-Boltzmann constant} = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$$

9. ***EITHER***

Describe in detail, with the aid of diagrams, the processes that influence the continental shelf, and the resultant features that may be encountered.

OR

Oceanward of the continental slope is a geologically inactive region of the Earth's surface. Discuss this statement using relevant examples and clearly labelled diagrams.