WHAT IS OCEANOGRAPHY?

Oceanography is the application of all science to the phenomena of the ocean. To truly understand the ocean and how it works, one must know something about almost all fields of science and their relationship to the marine environment. Thus, oceanography is not a single science but rather a combination of various sciences.

The objective of oceanography, at least to the scientist, is to increase human understanding of all aspects of the world's ocean and of the processes and mechanism that have made, and now make, the ocean what it is. This, of course, encompasses the subsidiary aim of describing as many marine features as possible.   of the many scientific disciplines that make up oceanography, one would be justified in calling the study of the oceans a very broad science, and however in another sense oceanography is restrictive. It is not a universal science like physics or chemistry; where-in the physical laws governing matter appear to have application throughout our universe.

Scope:

(1) Chemical

(2) Physical

(3) Biological

(4) Geological which includes marine geology and geophysics

(5) Ocean engineering

(6) Marine policy.

1. Chemical oceanography: chemical reactions that occur both in the ocean and on the sea floor.
2. Biological Oceanography: deals with the distribution and environmental aspect of life in the ocean.
3. Physical oceanography: physical reactions such as changes and motion of the ocaen.
4. Geological oceanography: studies the sediments and topography of the ocean floor.
5. Ocean engineering: concerns with the development of technology for oceanographic research and exploitation.
6. Marine policy: considers the application of social and political sciences such as economics, law, and policy towards the use and management of the ocean.

Why study oceanography?

Water covers 72% of the world

- Source of food for man for many centuries and still holds the promise of solving today's food problems.
- Source of commercially valuable chemical resource including iodine, bromine, potassium, manganese, e.t.c.
- Desalinization of ocean water is yielding increasingly important amounts of freshwater in the arid areas of the world.
- Sea-floor mineral accumulations, like phosphorite, Mn modules, heavy-metal rich muds, sand, gravel, are valuable commodities that are already being exploited.
- Accumulations of oil and gas below the sea floor are very important natural resources, supplying already almost 20% of the world's needs. This energy, when released, helps power the earth's atmospheric circulation.
- The ocean is necessary to commerce, communication, and natural defense.
- For recreation, sports of during, boating, water skinning, and scuba diving, as well as swimming attract ever greater numbers of pensions each year.

Origin of the ocean

a. Where did the water come from?
b. Second, how did it get its unique concentration of salt and other elements?
    i. From the primordial atmosphere of the earth.
    ii. From the decomposition of volcanic rocks
    iii. From incremental addition of water throughout geological time.

Condensation in the atmosphere at one time formed the ocean. The present atmosphere of the earth in fact can hold no more than about 13, 000km^3 of water; whereas the volume of water in the ocean is over 1 billion km^3.

Original water was chemically bound into volcanic rock and subsequently has been removed by decomposition of the rocks to form ocean.

- 5% water in volcanic rocks
- All volcanic rocks have less than 50% of water in the ocean.

This shows that the whole water in ocean did not come from the weathering of rocks – Na^+, Mg, Ca^+, etc come from these rocks.

The source of the water is from volcanic activity, hot springs, and the heating of igneous rocks – and also anions are released from volcanoes.

However, volcanic activity is the source of the water and the anions and that the cations come mainly from decomposition and weathering of igneous rocks.

THE WORLD OCEANS

The ocean basins of the world are large depressions on the earth's surface which are filled by a great mass of salt water. These oceans cover about 71% of the earth's surface which means that about 29% of the earth's surface is occupied by the land and rivers. The world oceans have an average depth of 3, 700m. There are four major oceans of the world. These are as follows:

i. The Pacific ocean
ii. The Atlantic ocean
iii. The Indian ocean
iv. The arctic ocean

The Atlantic, Pacific and Indian Ocean are the three oceanic extensions of the Antarctic Ocean which surrounds the Antarctic continent, but they are separated by the continental barrier into these three oceans. The other small oceans and seas are referred to as the Arctic Ocean. It is from here the Mediterranean Sea projects from. There are connections between the major ocean basin which allows for exchange sea waters and marine organisms.

PACIFIC OCEAN

This is the largest of the entire ocean basins in the world. The Pacific Ocean basin occupies 1/3 of the total earth's surface. In size, it measures about 180 million square kilometres. Infarct, the Pacific Ocean is far bigger in size than every other continent in the world. In depth, it has a maximum depth of 10,542 m.

THE ATLANTIC OCEAN

This ocean is one of the largest oceans in the world. It is located between Africa and Europe to the east and the Americas to the west. It is the busiest sea route in the world with a total area of about 82million km^2 and a depth of about 9,218 m. It is narrow in equatorial latitude and this has made it possible for the two basins, the North Atlantic and the South Atlantic basins.

In the northern hemisphere, a larger part of the continental shelf occurs, for instance in the North-western Europe and round New Foundland as well as the maritime, parts of Canada. There is a broad shelf off Patagonia in the Southern hemisphere. However, apart from the places mentioned above, continental shelf is narrow elsewhere. e.g. in the blocks of Africa and Brazil.

INDIAN OCEAN

The Indian Ocean has an area of about 74million km^2. Comparatively, it is smaller in size than the Atlantic and totally different from other two main oceans because it is wholly enclosed to the north and lies mainly in the southern hemisphere.

The ocean is bounded in the West by Africa, in the East by Australia, Asia in the north and to the south by Antarctica. It has a total depth of about 7,450 metres.

THE ARCTIC OCEAN

The Arctic Ocean occupies the areas around the North Pole. It is a shallow basin with a mean depth of 5,449metres and it occupies an area of about 14million square kilometres.

PROPERTIES OF SEA WATER

SALINITY

Salinity is defined as the total amount of solid material, in grams, contained in one kilogramme of sea water when all carbonate has been converted to oxide, the bromide and iodine replaced by chlorine, and all organic matter completely oxidized. In the sea, salinity ranges from 32-38‰. In the ocean and seas of the world, it ranges from nearly 0‰ where large rivers empty into sea to over 40%o where the river influx from the land is negligible and where surface evaporation is great. At the depth of the ocean, salinity ranges from 35-36%o. And higher salinity values occur near the arid equatorial areas whereas lower values occur near the polar regions.

Surface water salinity is usually influenced by two major factors:

i. Evaporation
ii. Precipitation

An excess of evaporations over precipitation removes water from the sea surface thus, concentrating the salts and increases the salinity. This is usually facilitated when the water is warmer than air. It is greats when cold air flows over warm water. But when the sea is colder than air, turbulence as well as evaporation is reduced. Excess precipitation decreases salinity by diluting the sea salts. Run-offs from rivers, thawing of ice both have the same effect in diluting the sea salts.

The difference between evaporation and precipitation shows a linear correlation with surface salinity. Precipitation is universe to evaporation. e.g. the effect of evaporation on the salinity of sea water is found in the Mediterranean sea. The relatively fresh Atlantic water flowing into the Mediterranean Sea is completely altered by processes including evaporation and flow-out of the sea as saline water. This change is due to great increase in evaporation and the relatively low rainfall and run-offs into the Mediterranean Sea area. In the Black sea, the reverse situation occurs, precipitation and run-offs exceed evaporation thus water becomes less saline.

When sea water freezes, only the molecules are incorporated into the ice-crystal, the dissolved salts are left-out thus increasing the salinity of the remaining sea waters. The process is reversed when ice thaws or melts. Freezing and thawing of sea water are usually seasonal phenomena resulting in little long term salinity differences.

A vertical distribution of salinity is very similar to temperature and this distribution can be expressed into three or four major zones:

i. A well mixed surface zone of generally uniform salinity. This zone is usually between 50-100m.
ii. A zone with a relatively large salinity change below surface water – the Halocline zone.
iii. A thick zone of relatively uniform salinity extending to the ocean bottom

iv. Occasionally, there is a zone of about 600-1000m in some areas where there is a minimum salinity.

The normal chemical content of sea water with a total salinity of 35%o is as follows:

MAJOR CONSTITUENTS OF SEA WATER

10N	**CHM SYMBOL**	**G/KG OF WATER OF SALINITY 35%**
Chloride	Ct	19.353
Sodium	Na^+	10.762
Slulfilate	SO_4^2	2.709
Magnesium	Mg^+	1.293
Calcium	Ca^{2+}	0.411
Potassium	Kt	0.399
Bicarbonate	$HC0_3$	0.142
Bronite	Br^-	0.0673
Strontuim	Sr^{2+}	0.0079
Boron	Br^+	0.00445
Fluoride	F^-	0.00128

The proportion of these various elements remains very constraint in sea water from place to place even when the total salinity differs. A good measure of any of these constituents gives a good index of salinity.

In addition to the major constituents, there is in the sea virtually every natural element, but most are in very small concentration. The elements and compounds associated with living organisms such as carbon, oxygen, nitrate and phosphate are found in small but highly variable amounts. The trace elements that are important for biology, e.g. Copper, Cobalt, etc. have even smaller concentrations. As an example of the relative concentrations of major constituents, nutrient elements, and trace elements, the typical concentration ratio of Na: N (in $N0_2$, $N0_3$, NH_4): CO are roughly 10^7: 10^3: 1.