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Tides:

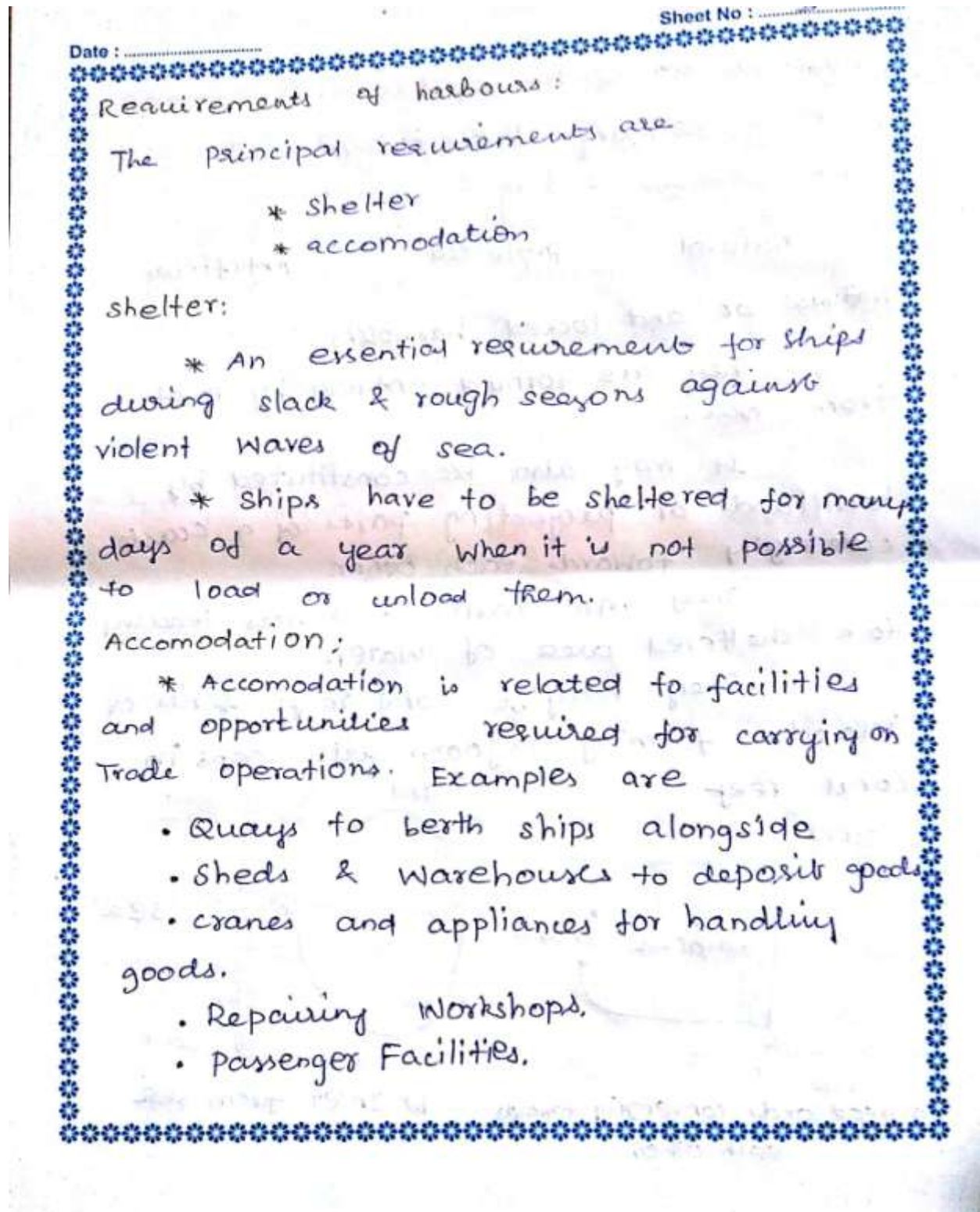
The level of sea undergoes a constant oscillation, rising and falling generally twice within about 25 hours. This is due to difference in combined gravitational attraction of sun and moon upon various parts of the earth's surface.

Waves:

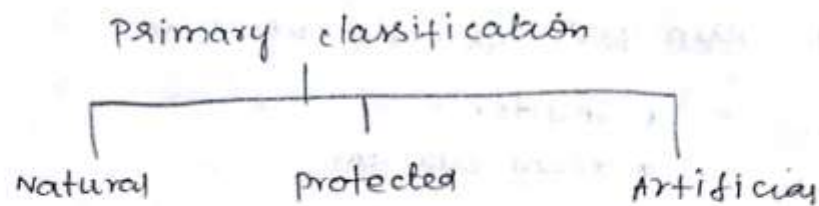
They are undulations caused on surface of sea water due to wind.

It is the raised waveline caused on surface water. They are of 2 types.
i) waves of oscillation ii) waves of translation
satellite port:

It depends on resources and facilities of another. It is a small port which is subordinate to a major port and depends upon the latter for higher order facilities.



† Classification of harbours:



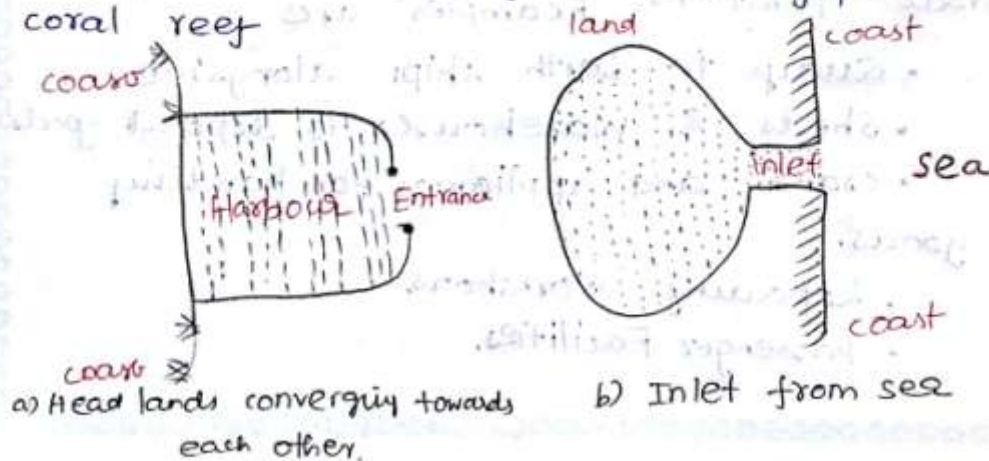
Natural or land locked harbours:

They are formed entirely by inlets from sea.

It may also be constituted by headlands or projecting parts of a coast converging towards each other.

They have narrow entrances leading to a sheltered area of water.

They may be coral reefs, series of islands forming lagoons with gaps in coral reef

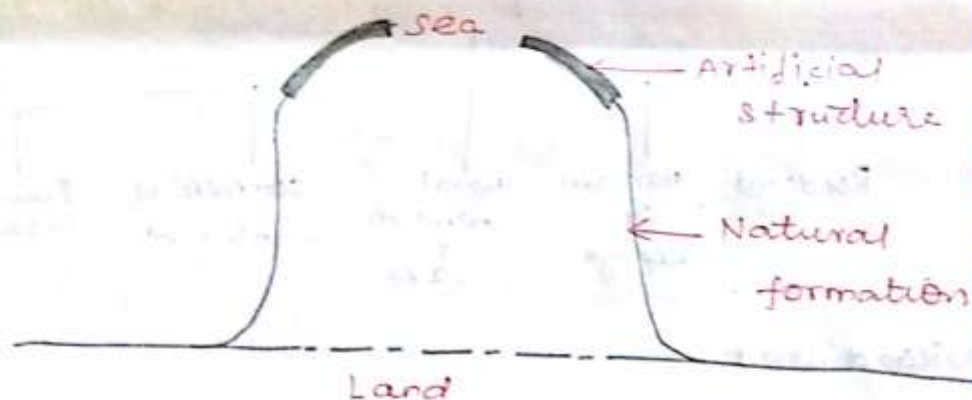


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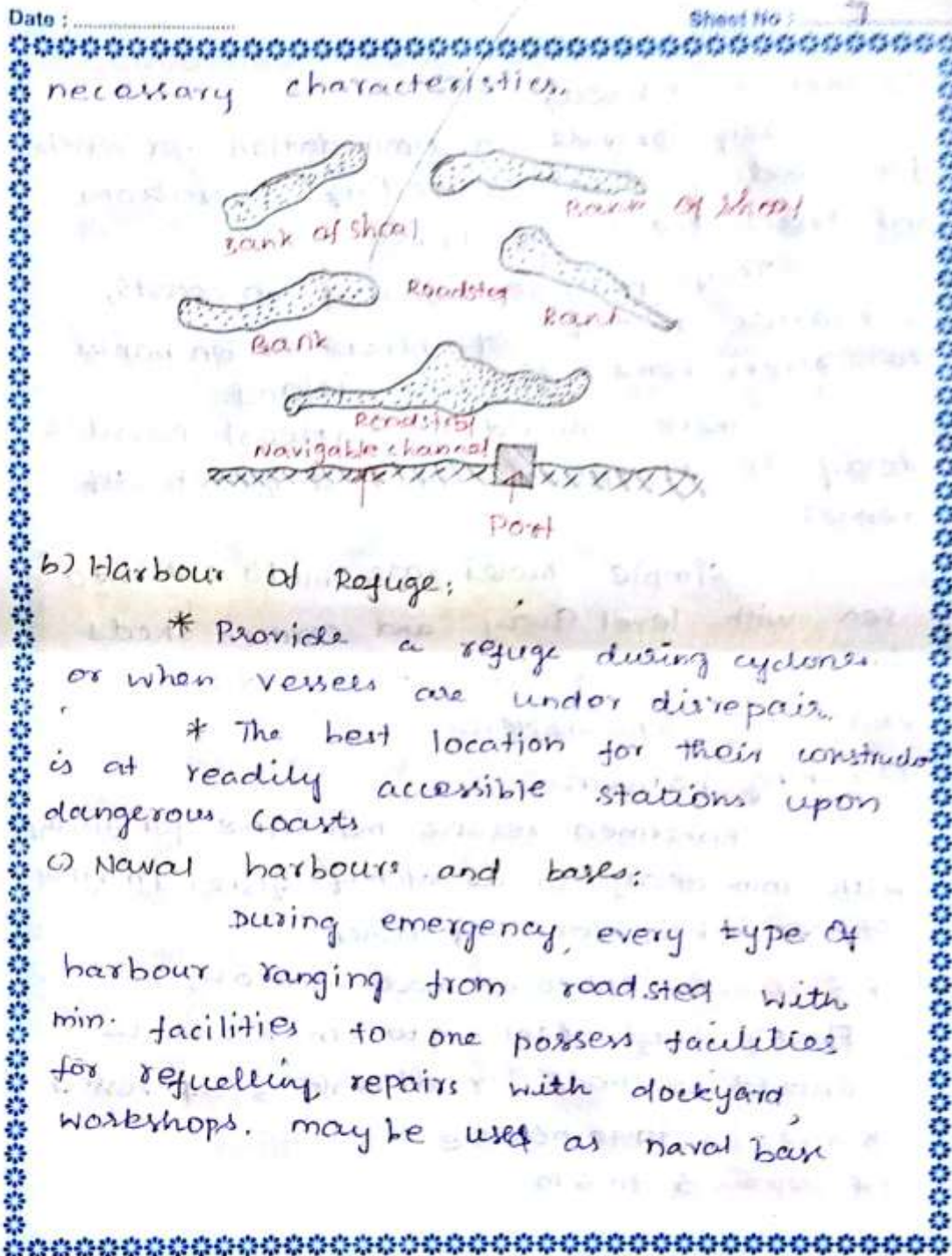
Protected Harbours,

- * Partly natural and partly artificial.
- * Formed in bays or positions in coastline.
- * Artificial construction of breakwaters or entrance moles may supplement existing natural features
- * They give protection from wave action to vessels, using or entering harbours.



Artificial harbours:

- They have to be created where there are no natural features.
- Breakwater on an almost open coastline.



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d) Commercial harbour;

They provide accommodation for vessels for loading and unloading operations and transactions of Trade.

They may be located on coasts, estuaries, mouth of rivers or on banks at divers some distance island.

There should be atleast possible delay in reception and despatch of vessels.

Simple moles are built out into sea with level quay and covered sheds for reception of vessels in addition to breakwaters for shelters.

e) Fishing harbours.

Fishermen require max. time for fishing with min. delay in despatching fishes in view of perishable nature of fishes.

* Entrance - not to be made narrow;

Fishing craft beam - 6 to 8 m. Allowance

should be made for atleast 3 to 4 vessels

* Size - 4 to 40 hectare.

* Depth - 3 to 5 m

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Location of harbours:

Identification of a suitable location is the decisive factor in the process of planning a harbour.

Harbour Engineers can have accurate knowledge on wave characteristics, their action in terms of erosion and deposition to help decide pattern, location, size and shape of coastal structures.

SITE INVESTIGATION FACTORS FOR LOCATION:

1) Speed of water:

* speed of water that enters and leaves a harbour should neither be excessive nor slow.

* If the speed is too slow it silts an area.

* If it is too fast, it may erode the harbour & channel areas.

* \therefore speed of water should be studied during different seasons over years

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ii) Amount of dredging;

A site must be located that the amount of initial dredging & amount of maintenance dredging should be lesser.

It is important when position lies in an estuary of river or upon a coast, subject to coastal changes and littoral drift.

iii) Tidal range;

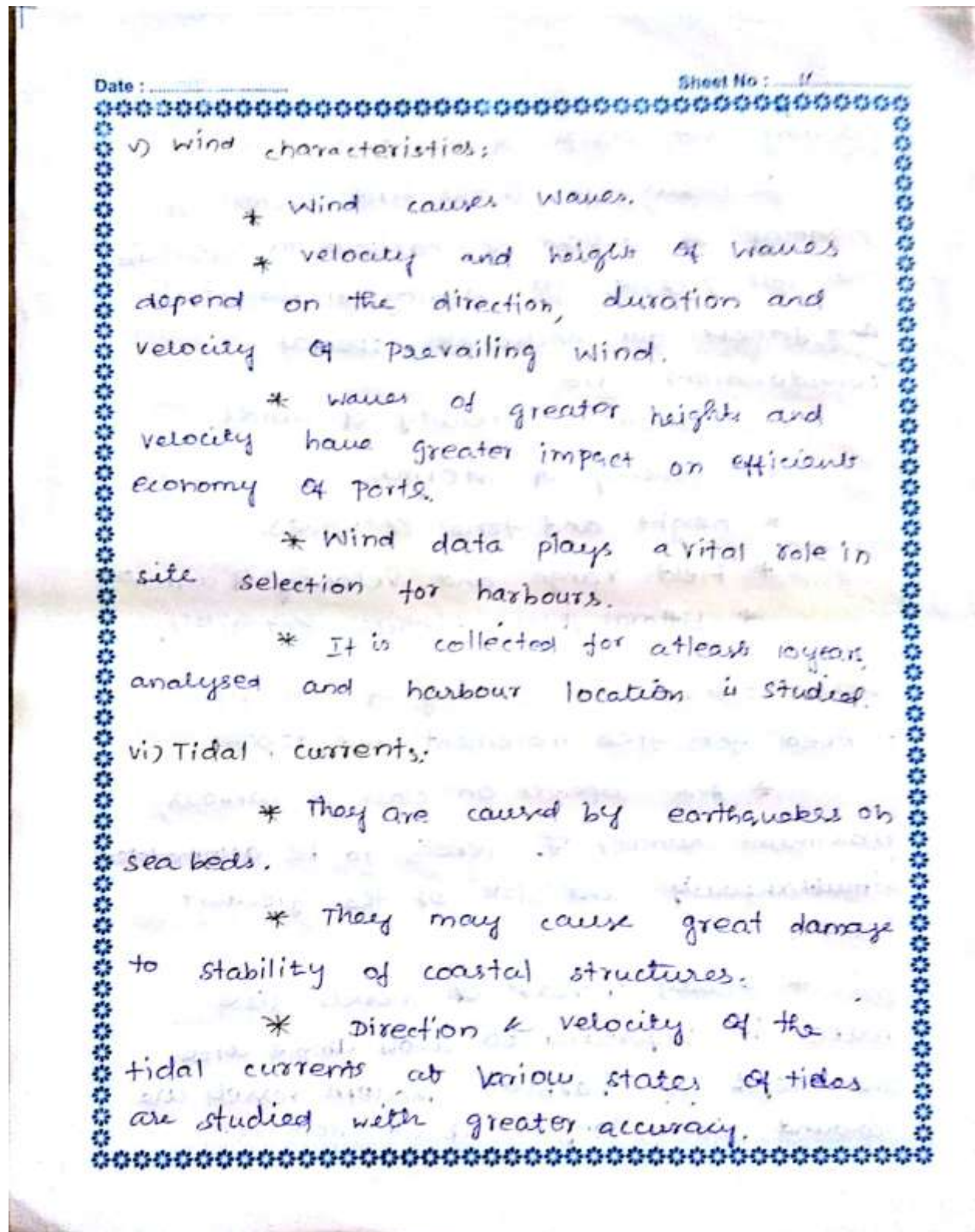
vessels can be loaded and unloaded at quayside, berths or wharves if tide doesn't exceed 5.5m.

It is important to select a site with a minimum tide range.

iv) Waves & their characteristics;

The incidence and magnitude of storms & direction and velocity of maximum and prevailing winds have to be decided.

Waves & their effects forms & design of breakwaters, pattern of sites, shoaling, shallowness, beach building



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Planning and Design of harbours:

surveying is the first factor in planning a design of harbour. to ascertain the soil profile, its geological characteristics and fitness for anchorage. special considerations are

- * direction & intensity of winds
- * Frequency of storms.
- * Height and force of waves.
- * Field range and velocity of currents
- * Littoral drift, erosion and silting.

Design Elements in Planning of Harbours:

i) Area for free movement and depth:

* Area depends on class of harbour, maximum number of vessels to be accommodated simultaneously and size of the greatest vessel.

* steady increase of vessel size makes it important to allow ample area and depth for harbours. modern vessels are around 300m long & about 30m wide

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* Area must be adequate for free movement for large no. of ships. It takes up their positions at berth.

* Area should not be adequate for reception but also for manoeuvring them into and out of the berth.

* There should be sufficient space for manoeuvring.

Harbour Entrance:

* It should be wide enough for access to shipping.

* It should be so sited as to exclude waves and its impacts.

* It is a trade off b/w the efficiency of port operations by precluding violent sea from entering into harbour.

* facilitates easy entry & exit of vessels into and out of harbour.

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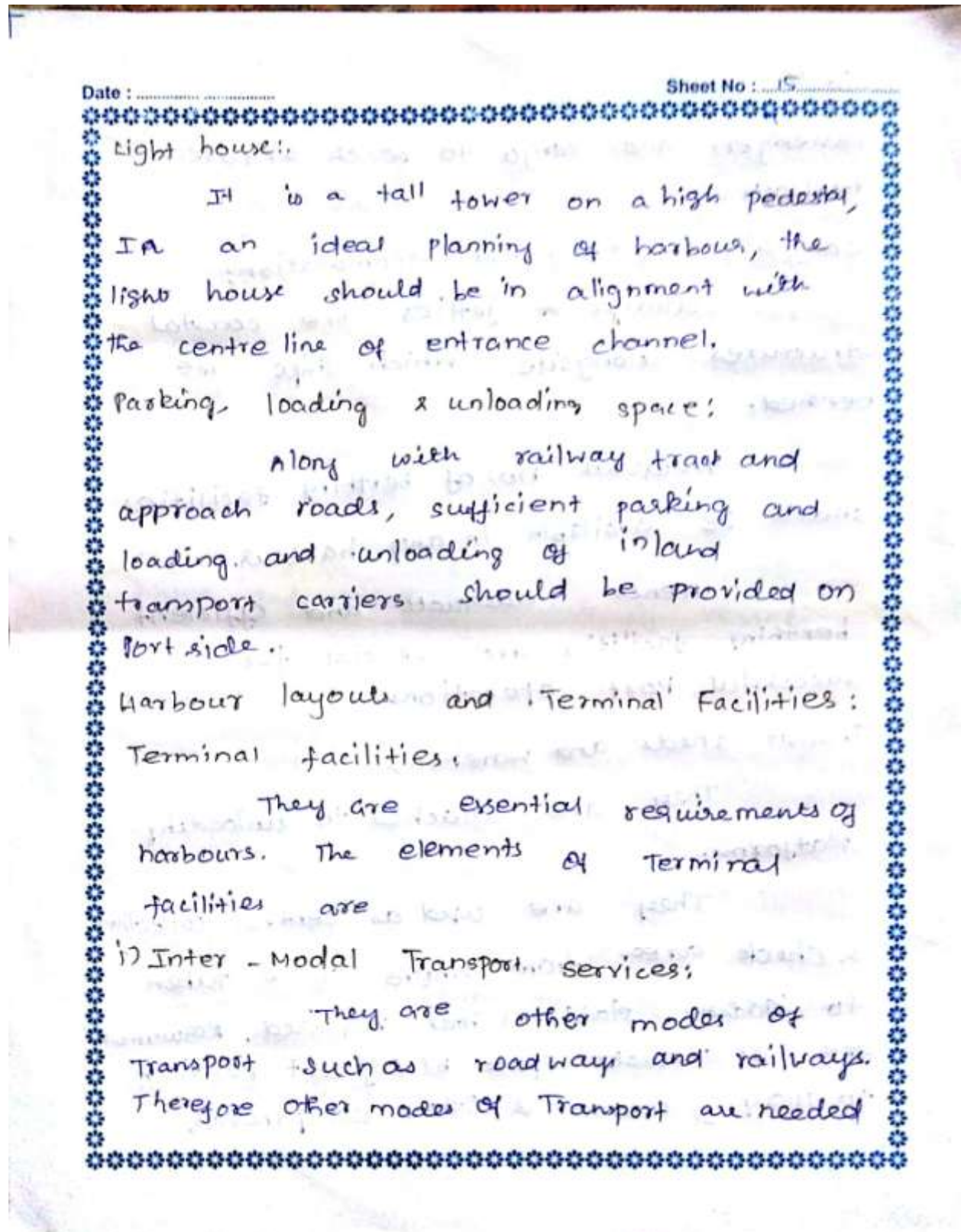
Entrance channel:

* The basic principle should be that the depth should be adequate to permit largest commercial vessels that frequently use harbours without undue delay or hazard.

* The entrance channel is long & tidal, a ship's arrival and departure are usually timed so that it enters and leaves on tide & not against it.

* In a channel, there must be sufficient draft, the depth of water below the bed to permit safe and efficient navigation of a ship underway by its own power.

* Where reduced speeds are imposed, minimum draft should be at least one meter.



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Passengers and cargo to reach or to leave harbours.

coastal structures for accommodation;

Quays & jetties are coastal structures alongside which ships are berthed.

Adequate no. of berthing facilities should be available in any harbour.

Hence, adequate and efficient berthing facilities are crucial for successful port operations.

Transit sheds and warehouses:

They are attached to unloading platform.

They are used as central collection & check area from where it is taken to loading platform when required. Requirements are: a) adequate space b) Adjacent position to quay c) cranes & other equipments.

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Mooring accessories;

In addition to berths @ regular wharves or quays, the port should also provide facility of mooring for vessels on open waters. In any harbour, considerable amount of unloading often proceeds at moorings.

Navigational Aids;

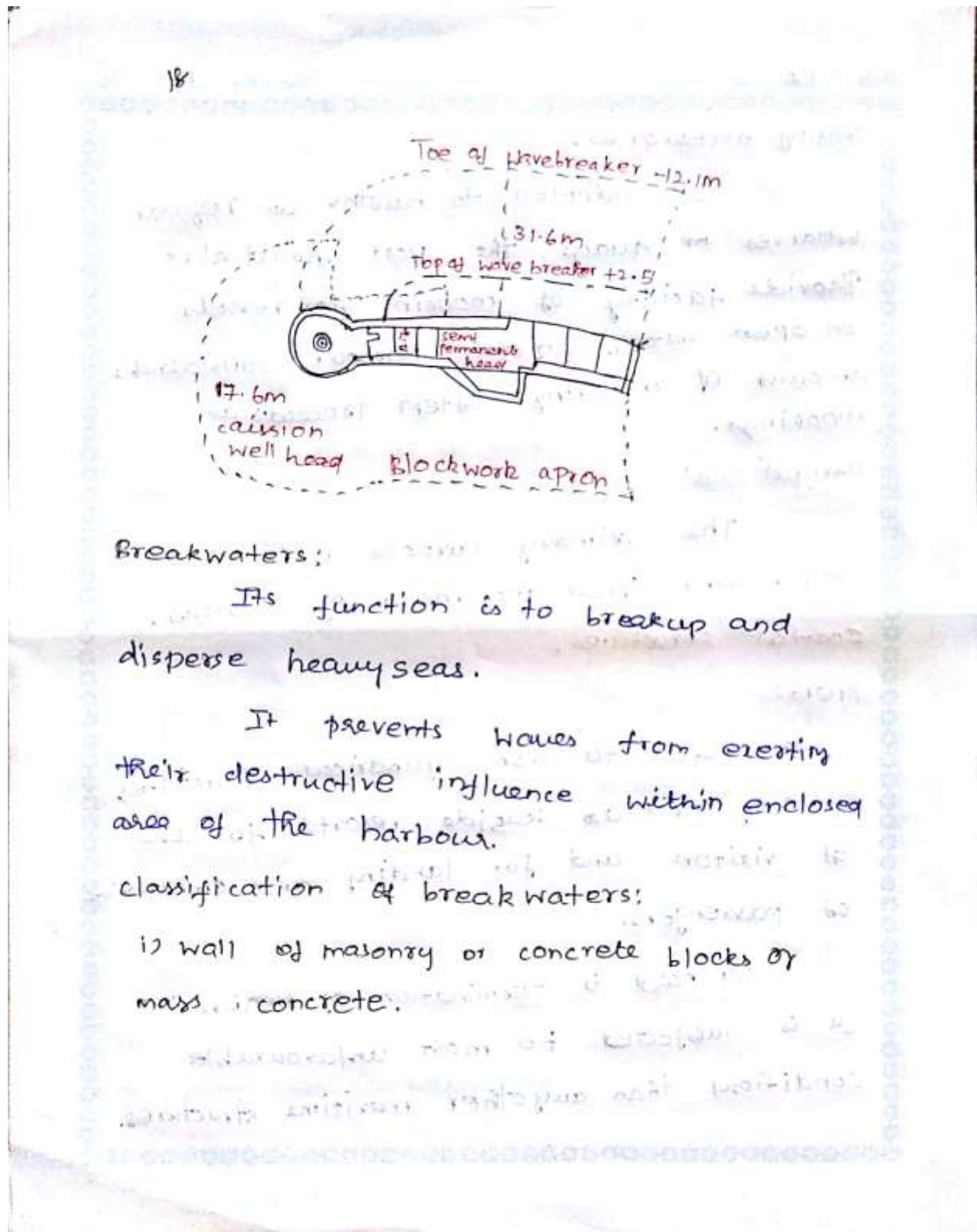
The primary purpose is to ensure safer and speed movements of vessels.

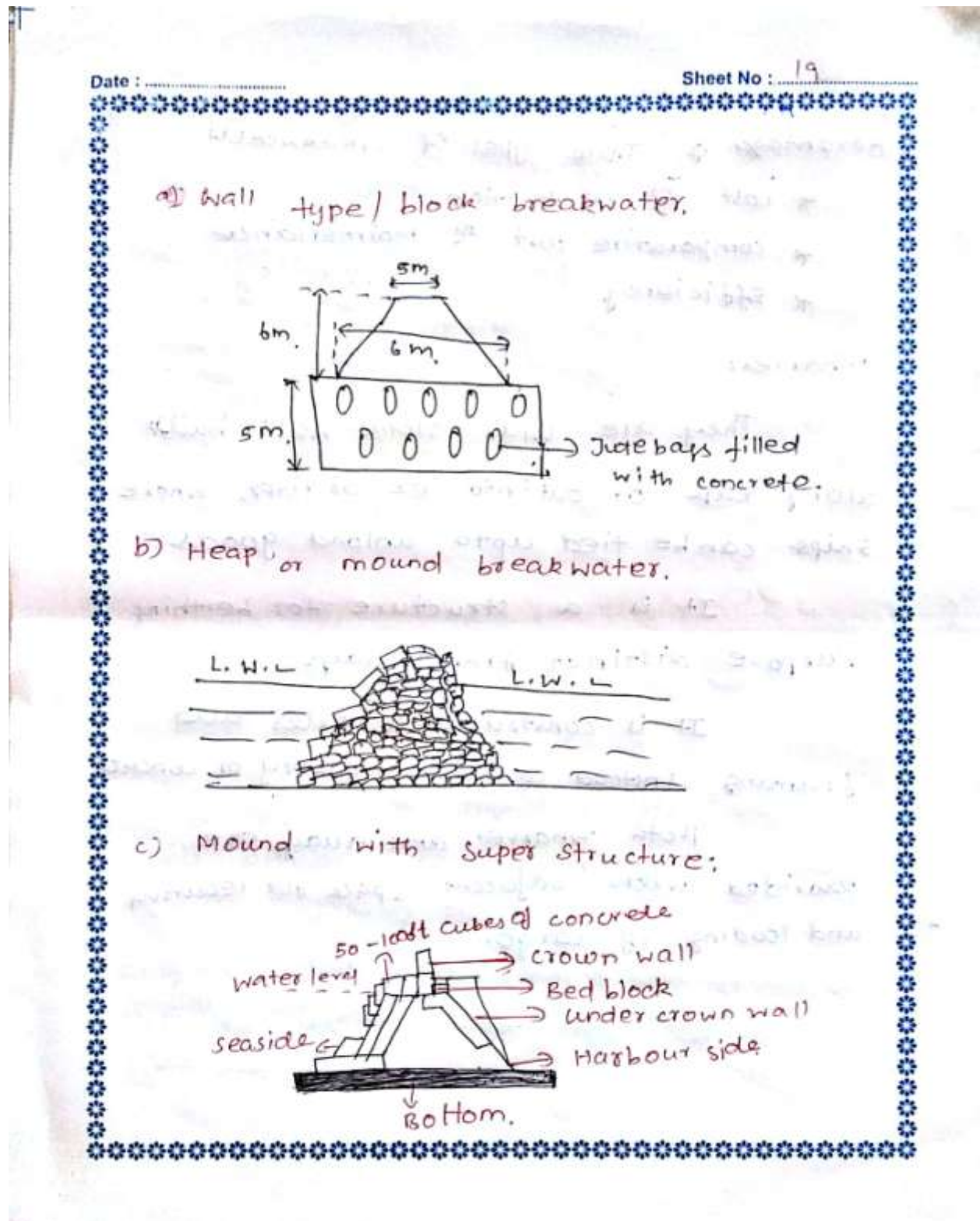
Coastal structures;

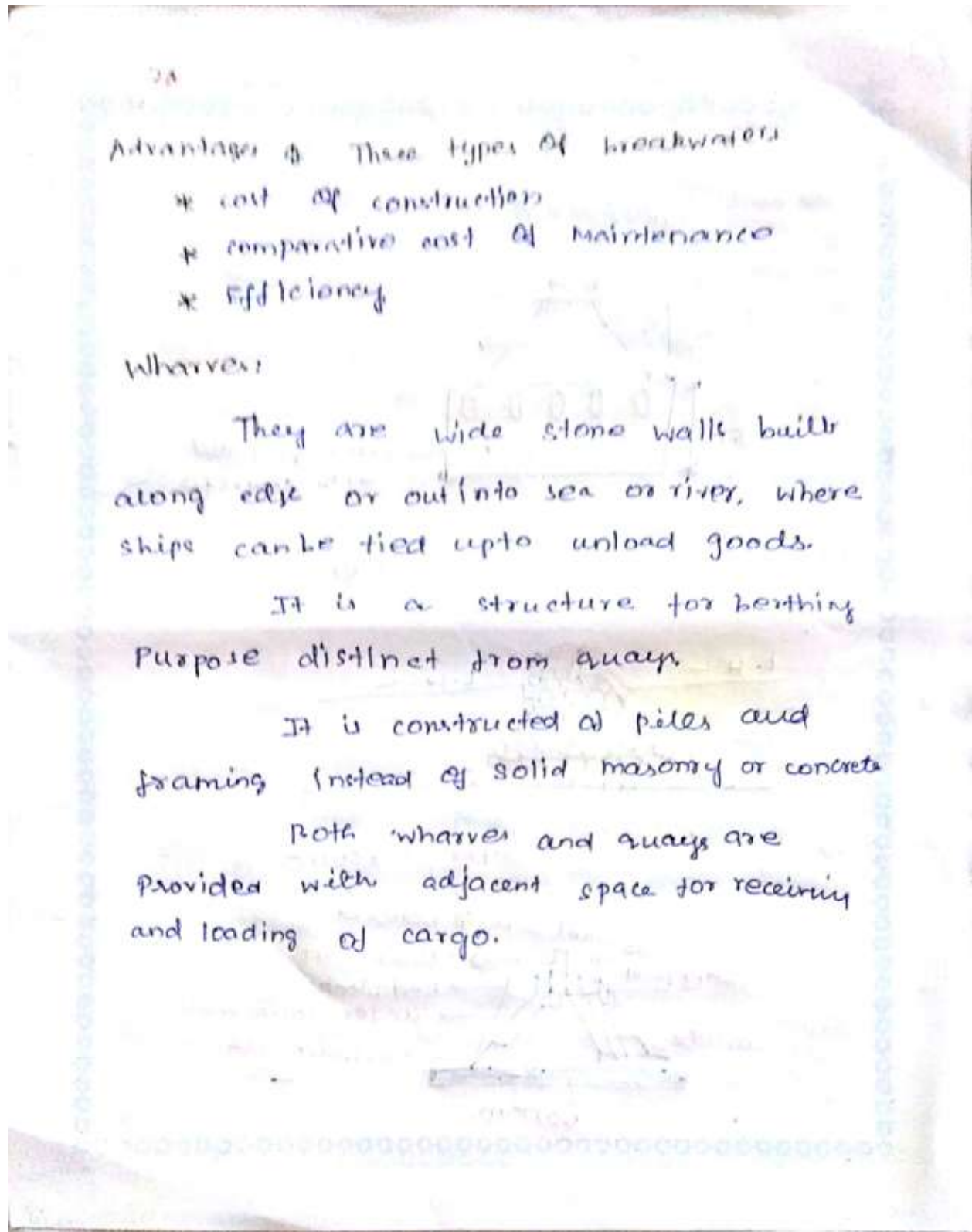
Piers:

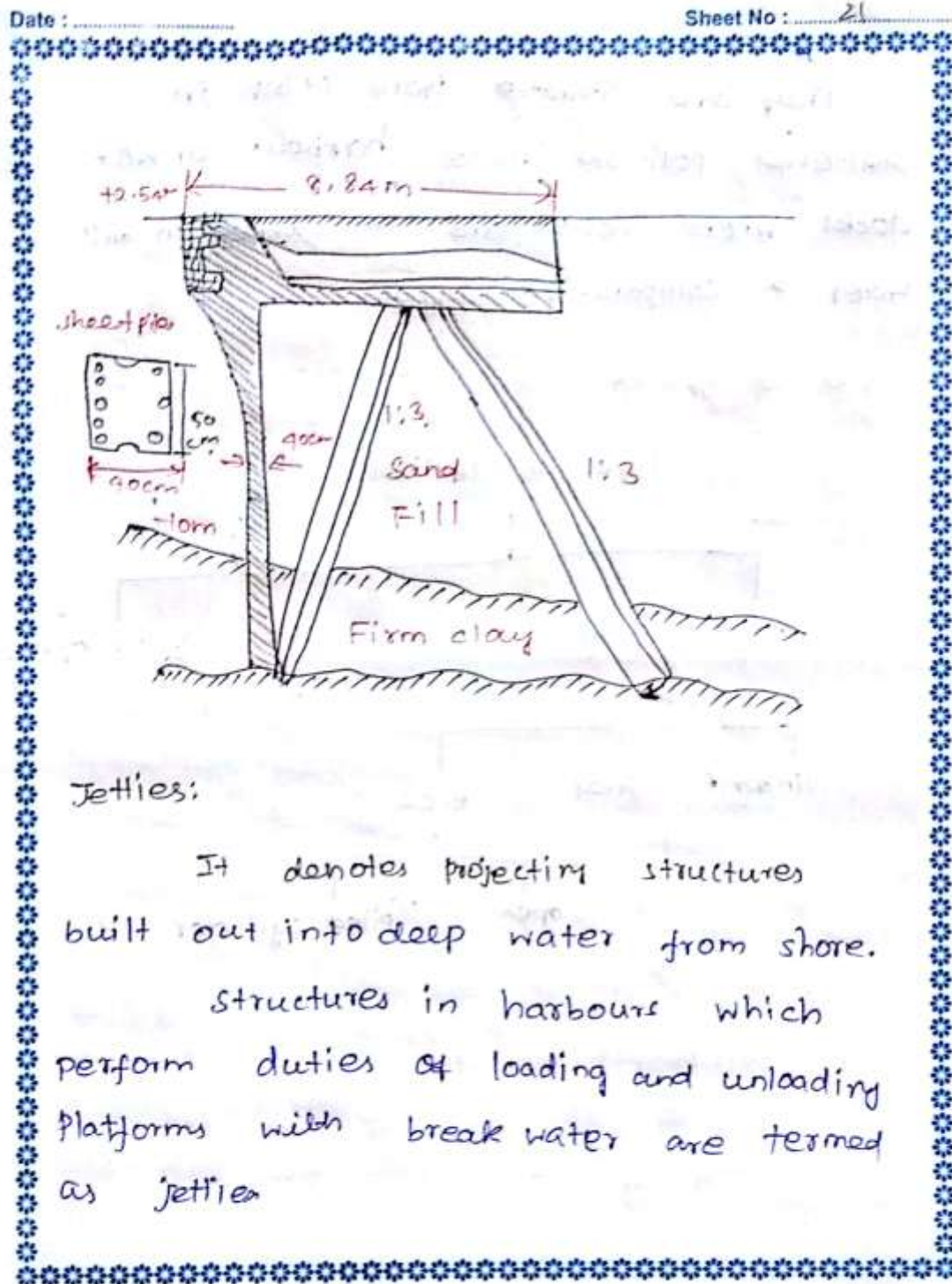
It refers to iron cylindrical structures. They exist at seaside resorts for use of visitors and for landing and embarkation of passengers.

Pier head is termination of breakwater. It is subjected to most unfavourable conditions than any other maritime structures.



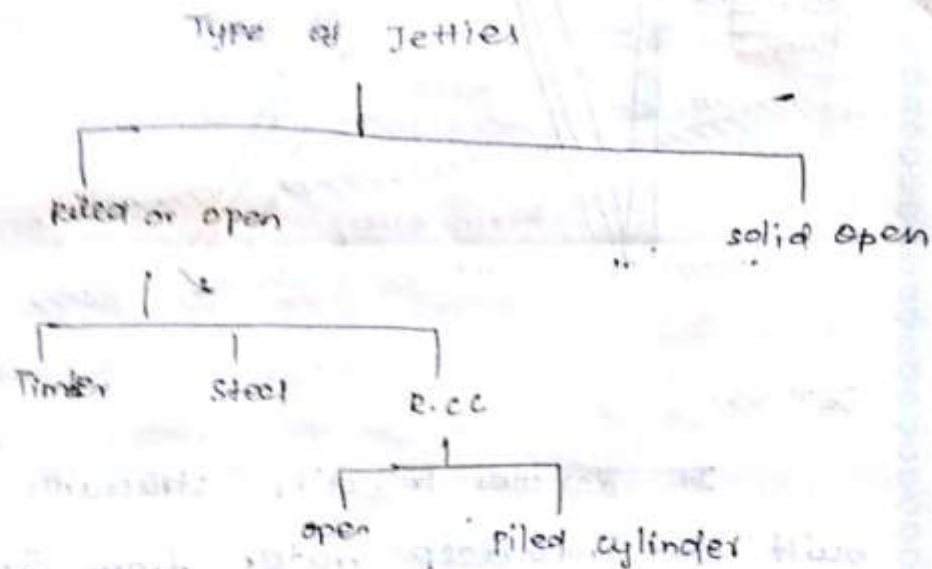


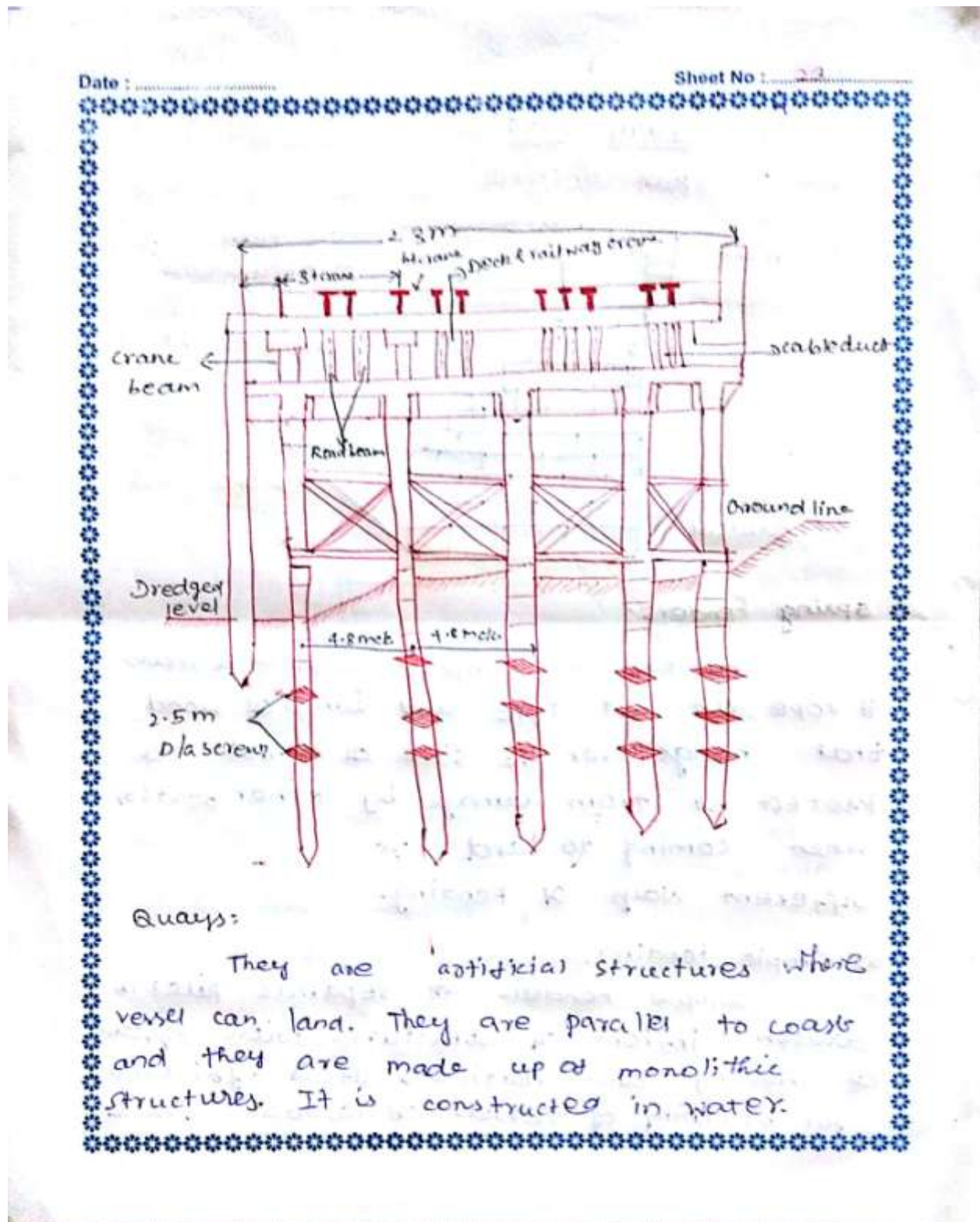




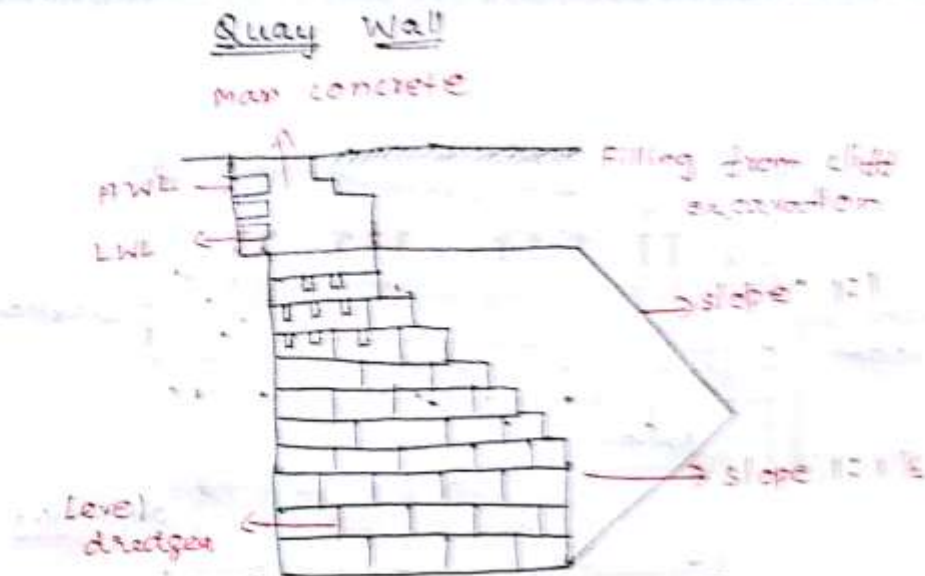
They are situated more or less in sheltered position inside harbour or wet dock where vessels are manoeuvred in still water & comparative safety.

Types of jetties.





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spring Fenders:

Fenders are objects such as a mass of rope, an old tyre and a lump of wood that hangs over the side of a boat to protect it from damage by other boats when coming to land.

Different ways of Fending:

a) Simple Fending:

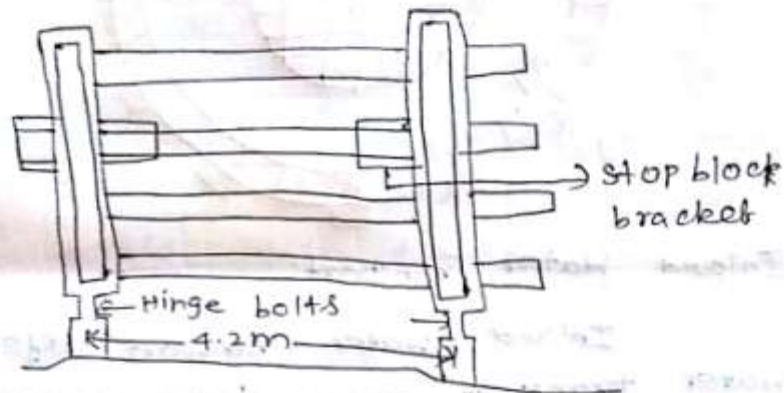
Simple Fenders are separate piles driven in front of structures with system of walling and verticals. It is efficient for berthing of vessel of 10,000 tons.

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Spring Fenders.

They are more appropriate in open or tidal waters. It provides for absorption of K.E and for limiting travel of vessels after impact.

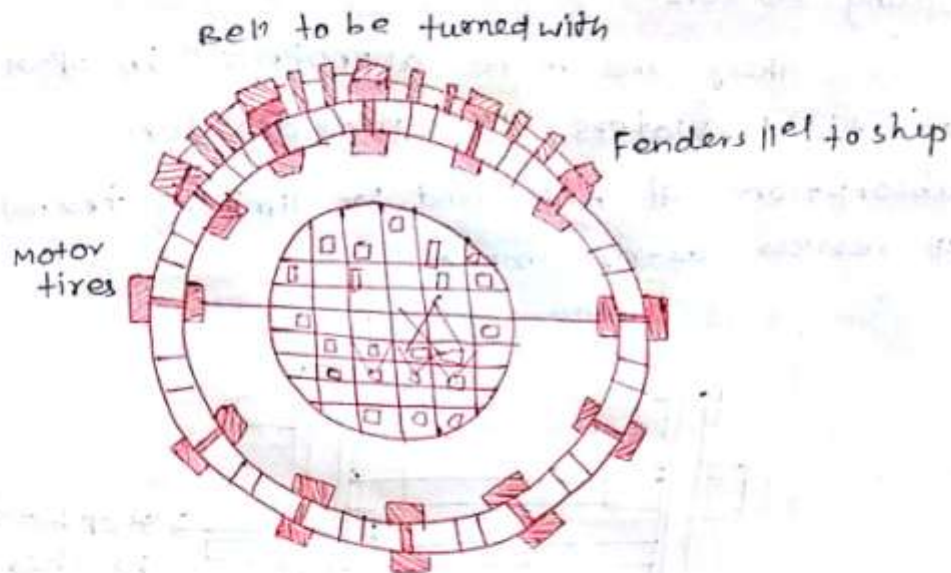


Dolphins:

It refers to a buoy, pile or cluster of piles for mooring a vessel. It is shock absorbing.

It shows the Baker bell dolphin. The weight of the bell when ballasted with concrete block is 170t. It is @ a speed of 38cm/sec.

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Inland water Transport:

Inland water Transport refers to water transport away from coast. Inland waterways are integral part of Transport system. Rivers were principal means of transportation of goods.

Landing stage & Floating landing stage (FLS)

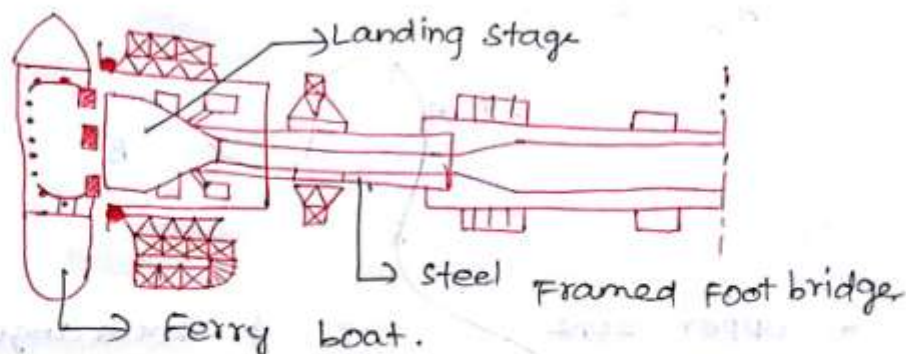
It is a raised platform along which vessels could be berthed for loading and unloading of cargo and embarkation & disembarkation of passengers.

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The FLS in its simplest form is a single pontoon or a large low boat with a flat bottom. The pontoon is fixed b/w timber dolphins or group of piles.

It is to overcome the problem due to tides. The FLS overcome this problem by maintaining the same level b/w landing stage and the vessel irrespective of sea water level because the pontoon rises and falls with tides.



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Waves and their action on coastal structures

Types of waves

Types of waves

Waves of oscillation

Ordinary unbroken waves

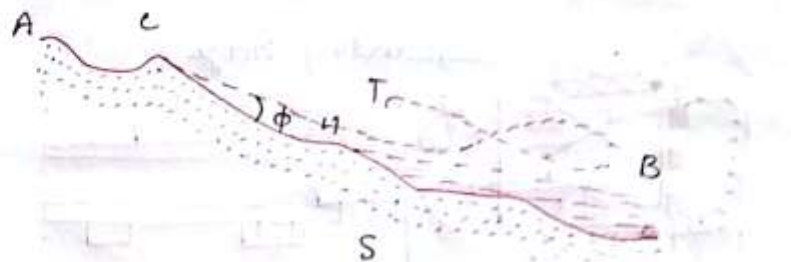
Waves of Translation

When they enter shallow water

Tidal waves

Frequently occurs as a result of E.M. in seabed.

Beach zones;



A - upper zone

B - Lower beach

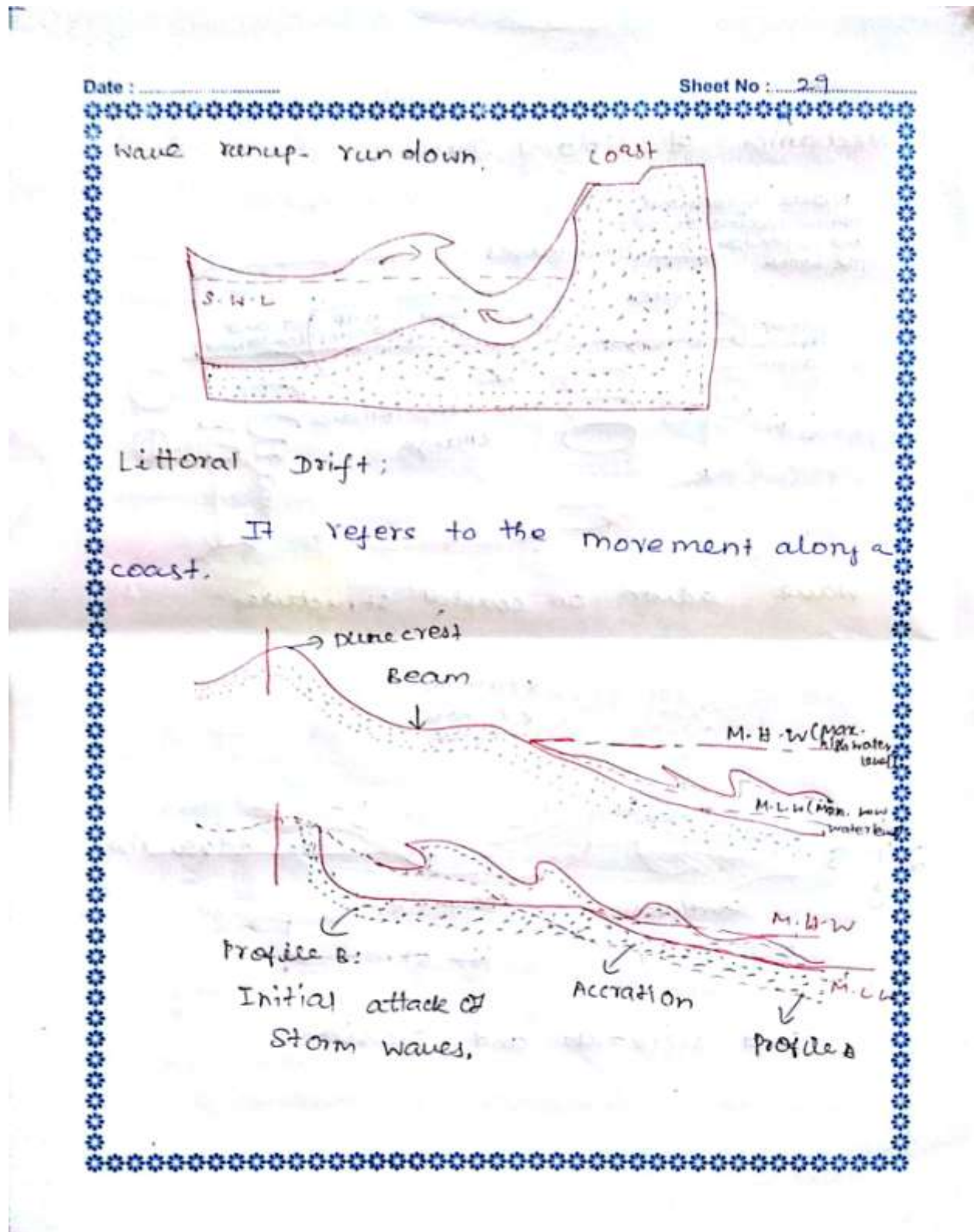
S - separation of two beaches

C - crest, the highest pt.

ϕ - beach angle

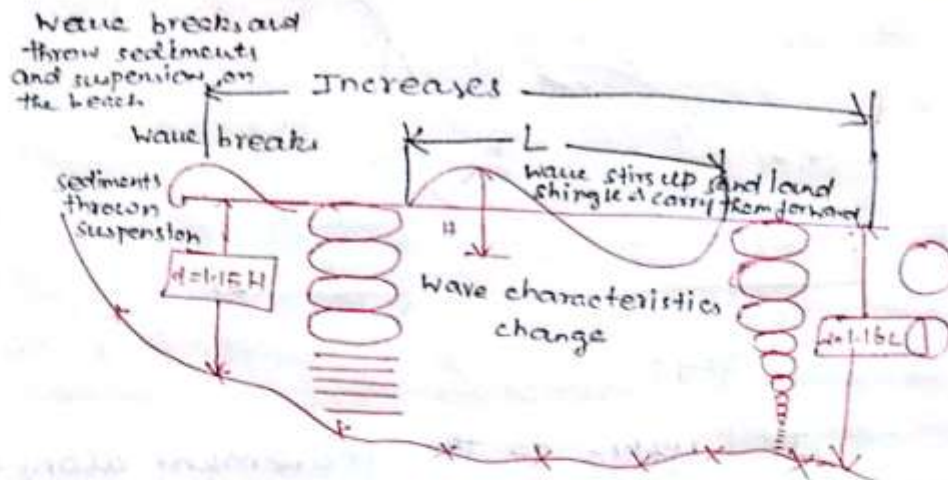
H - wave

amplitude.

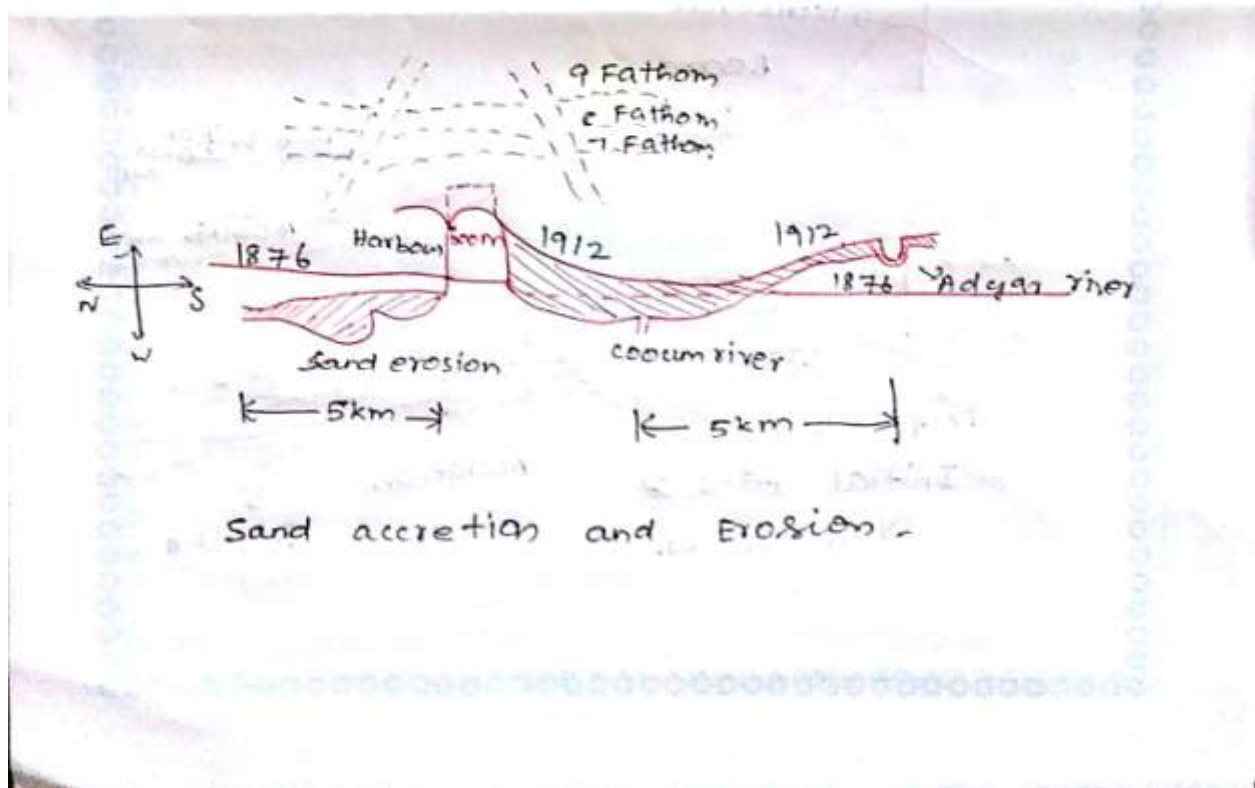


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Mechanics of littoral Drift:



Wave action on coastal structures



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Environmental concern in Port Operation

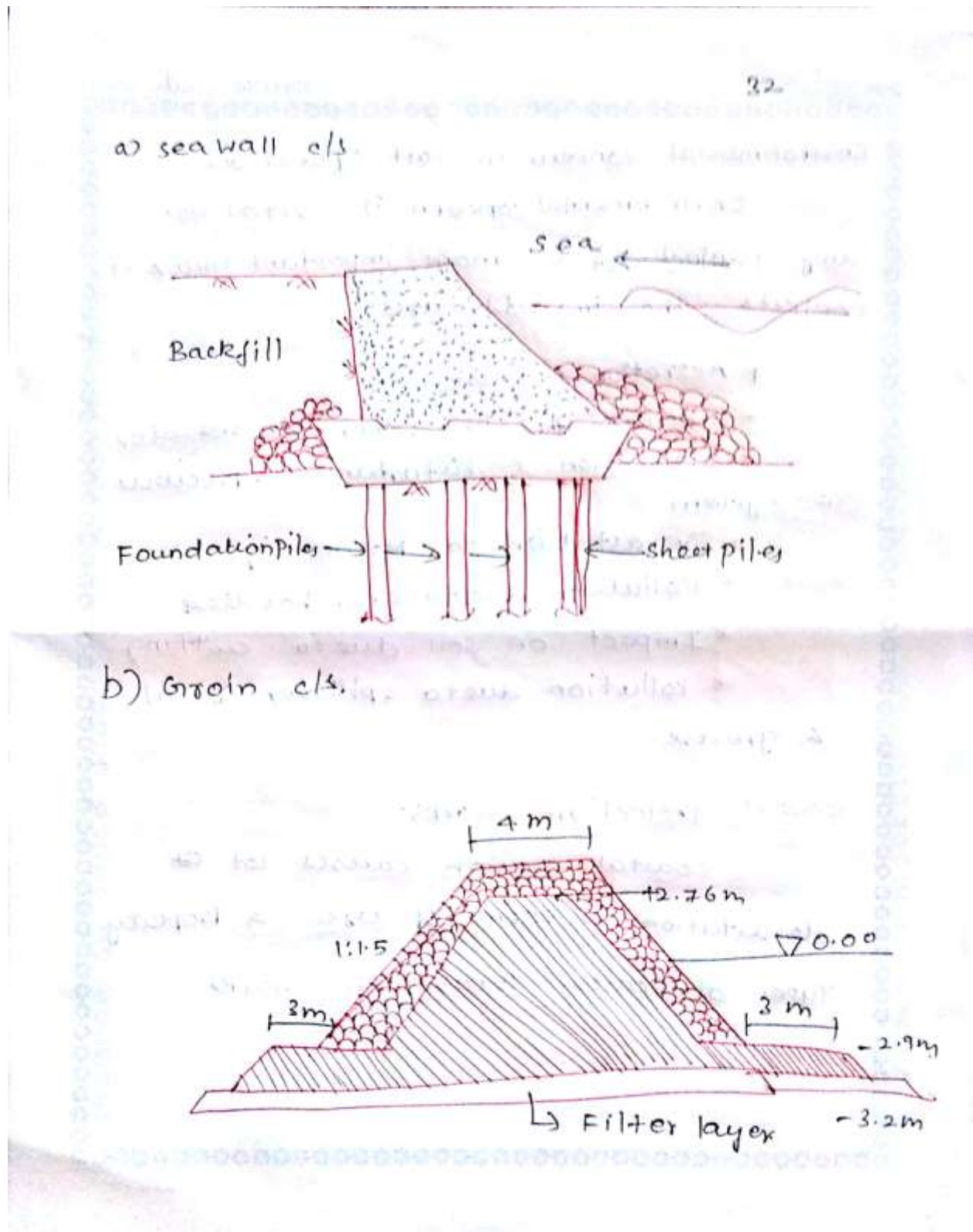
Environmental concern is vital for any project. It is more important in case of projects. The impacts are

- * Accretion & Erosion
- * Intrusion of saline water into seawater
- * Dislocation & disturbance to precious eco-system
- * Devastation to Marine life
- * Pollution due to cargo handling
- * Impact on soil due to cutting
- * Pollution due to spillover of oil & grease.

coastal Protection works:

coastal erosion causes lot of devastation in terms of life & Property.

Types of coastal protection work



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c) offshore breakwater.

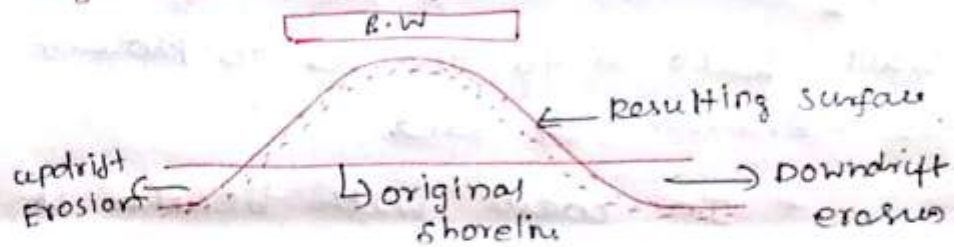
There are two types.

a) Exposed type

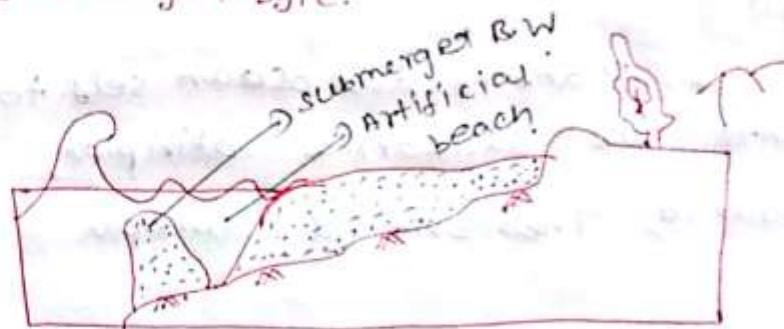
b) submerged type.

a) Exposed type.

single detached B.W



b) submerged type.



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Protection against natural calamities

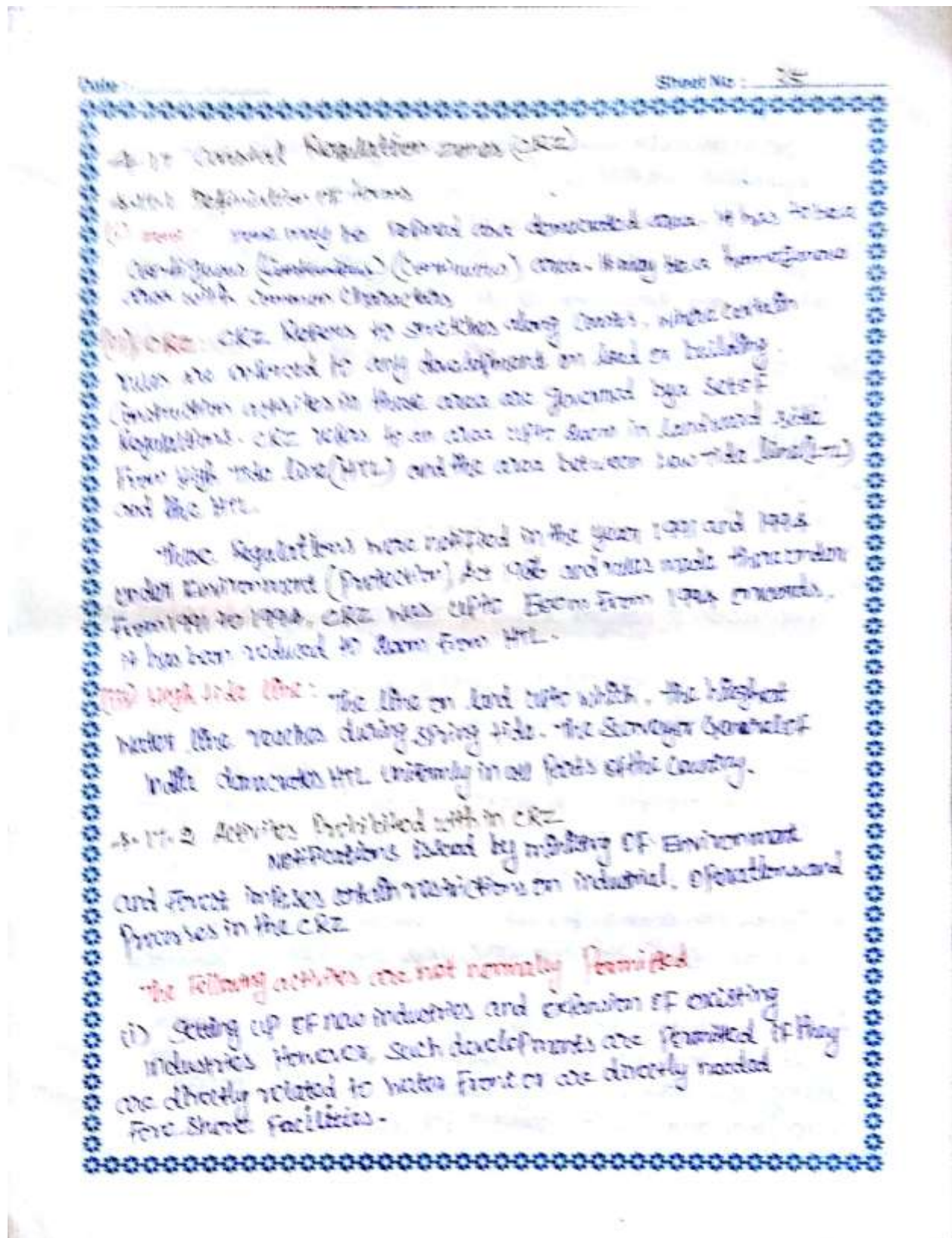
- * construction of coastal retaining wall along coast.

- * Afforestation along the coastal area.

- * construction of groins or low walls built in to the sea to protect the erosion of sand.

- * In coasts with beaches it is not necessary to construct a wall.

- * Planting and ocean self tolerant plants like salicornia, atropis, casuarina, Thespesia & bamboo.



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- (ii) Manufacture or handling or storage or disposal of hazardous substances.
- (iii) setting up and expansion of fish processing units including warehousing. However, hatchery and natural fish drying in permitted areas may not be prohibited.
- (iv) Setting up and expansion of units/mechanism for disposal of waste and effluent excepting where it is permitted under water Act 1974
- (v) Dumping of solid waste for purpose of land filling or otherwise or ash or any other waste from thermal power station
- (vi) Land reclamation, bunding or any other action to cause distribution to natural course of sea water, there is no bar for these activities if they are required for control of coastal erosion, maintenance of cleaning of cleaning of water ways and for prevention of sand bars.
- (vii) Harvesting or drawl of ground water and construction of mechanism therefor such activities shall be permitted if done -
- Manually, through ordinary well for purpose of drinking, horticulture, agriculture and fisheries.
- (ix) Construction activities for residential buildings, office building, hospital complexes and workshops shall not be permitted.
- (x) Any construction activity except facilities to carry treated effluents and waste water discharge into sea. facilities for carrying sea water for cooling purpose oil, gas and similar pipe lines and facilities essential for permissible activities

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(xi) Dressing or altering of sand dunes, hills, natural features including landscape, changes for beautification, recreation and other such purpose

4.17.3 Regulation of Permissible activities

(i) any Activity which requires water from Foreshore Facilities

(ii) Activities Permitted with clearance from the ministry of Environment and Forest

(a) Construction activities related to defence facilities requirements for which Foreshore Facilities such as jetties and jetties are essential.

(b) Coastal structures such as jetties, quays, breakwaters and light house

(c) Thermal Power Plants

4.17.4 Coastal zone management Plan (CZMP)

As per notification for CRZ all coastal states and union Territory Administration in India shall prepare CZMP. The Plan shall be submitted within a period of one year from the date of notification. (17th Feb 1991) Ministry of Environment and Forest (MEOF) shall approve the CZMP for coastal states and union Territory and local Governments, within the frame work of the CZMP.

4.17.5 Norms and guidelines For development of beach resorts/ Hotel in CRZ III

(i) NO Construction

(ii) (a) Plot size - not less than 4 ha

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- (c) FSI - Shall not exceed 0.83
- (iii) (a) ~~over~~ ~~all~~ overall height - shall not exceed 9.0m
- (b) No. of Floors - not to exceed two
- (iv) Ground water shall not be tapped
- (v) Extraction of sand, ~~swelling~~ or digging of sandy stretches for structural foundation of building and swimming pool shall not be discharged into the sea.
- (vi) At least a gap of 10m width shall be provided between any two hotels/ beach resorts to allow public access to beach
- (viii) Construction of beach resorts and hotels shall not be permitted in ecologically sensitive areas.

4.17.6 Classification of CRZ

For regulation of developmental activities coastal stretches within Ecom are classified into four zones

- (i) Coastal Regulation zone - (CRZ I)
- (ii) Coastal Regulation zone - (CRZ II)
- (iii) Coastal Regulation zone - (CRZ III)
- (iv) Coastal Regulation zone - IV (CRZ IV)

Table depicts details of regulations enforceable in each zone.