

# Drainage and Water Resources

- India's is blessed with hundreds of large and small rivers. On the basis of origin of rivers, the Indian drainage system can broadly be divided into –
  - (i) The Himalayan river system including Indus, Brahmaputra, Ganga and their tributaries.
  - (ii) The Peninsular river system which include Mahanadi, Godavari, Krishna, Kavery, Narmada, Tapi and their tributaries.
- A river and its tributaries drain in area, which is called a 'river basin'. A river system usually develops a pattern which is related to the general structure of the basin.
  - (i) A **dendritic** pattern develops in a region made of rocks which after the same resistance to erosion and which has uniform structure.
  - (ii) A trellis drainage pattern develops in a region made up of alternate belts of hard and soft rocks which all dip in the same direction which lie right angle to the general slope, down which the river flows.
  - (iii) A radial pattern develops on a dome or volcanic cone. The river flows outwards, forming a pattern like the spokes of wheel.

## The Himalayan River System

### The Indus River system

- Originates from Tibet, near lake Mansarovar and flows towards west direction and ends at Arabian Sea.
- Tributaries are the Zaskar, the Nubra, the Shyok, the Hunza.
- The Sutlej, the Beas, the Ravi, the Chenab and the Jhelum join together to enter the Indus river near Mithankot in Pakistan.
- Total length is 2900 km. Near about 709 km in India and the drainage basin is estimated to have an area of 117,884 sq. km in India.

### The Ganga River System

- Originates from Gangotri Glacier and joined by Alakananda at Dev Prayag.
- The upper course of Ganga is popularly known as Bhagirathi.
- The tributaries are the Yamuna, the Ghaghara, the Gandak, the Kosi.
 

The Yamuna meets the Ganga at Allahabad. The Ghaghara, the Gandak, the Kosi originate from Nepal Himalayas, which cause flood of northern plain every year.
- The tributaries of Ganga at Peninsular uplands, the Chambal, the Betwa and the Son.
- The river Ganga bifurcates, at Farakka in West Bengal Bhagirathi, Hoogly and main stream of Ganga.
- The main stream of Ganga flows southwards into Bangladesh and joins Brahmaputra and forms the **Sunderban delta**.
- Total length is 2500 km and slope is hardly 300 metres.

### The Brahmaputra River system

- The Brahmaputra rises on Tibet east of Mansarovar Lake.
- On reaching of Namcha Barwa, it takes 'U' turn and enters India in Arunachal Pradesh through gorge.
- It is called Tsangpo in Tibet and Dihang in Assam Himalaya.
- It is joined from north by Subansiri, Kameng, Jai Bhorelli, Manas, Dhansiri and Tisa.
- The Dhansiri, Buhi Dihing, Disang and Kopoli join the Brahmaputra from south.
- It is met from the east by the Dibang, which drains the Himalaya east of Dihang and the Lohit, flowing between Assam and Burma.
- Total length of river 2580 km.

### Peninsular Rivers

- Rivers like the Mahanadi, the Godavari, the Krishna and Kavery flow eastward and drain into the Bay of Bengal.
- Narmada and Tapi flow westward and meet Arabian Sea.

### The Narmada Basin

- Rises from Amarkantak hills of Madhya Pradesh.
- Most part of the Narmada basin covers Madhya Pradesh and Gujarat.
- Very short streams are the tributaries.
- Dhuadhar waterfall is one of the picturesque location in Narmada river.
- It covers total area of about 1310 km.

### The Tapi Basin

- Rises from the Satpura ranges, in Betul district of Madhya Pradesh.
- The river basin covers part of Madhya Pradesh, Gujarat and Maharashtra.
- The main west flowing rivers such as the Sabarmati, the Mahi, Periyar are the tributaries of Tapi.
- It covers near about 720 km.

### The Godavari Basin

- The river Godavari originates from the slopes of the Western Ghats in Nasik district of Maharashtra.
- It covers Maharashtra, Madhya Pradesh and Andhra Pradesh.
- The tributaries are the Purna, the Wardha, the Pranhita, the Manjra, the Wain-Ganga.
- Its total length is 1500 km.

### The Mahanadi Basin

- Rises from Shihawa of Raipur district of Madhya Pradesh.
- It flows towards Eastern Ghat and forms many tributaries at Cuttack before entering the sea.

### The Krishna Basin

- Originates from Mahabaleshwar of Western Ghats.
- Total length is 1400 km.

- The tributaries are Tungabhadra, Verla, Malaprabha, Ghatprabha, Bhim etc.
- It flows through southern Maharashtra and Andhra Pradesh.

#### **The Kavery**

- Originates from Coorg district and drains the Mysore plateau before flowing into plain.
- Main tributaries are Bhavani, Amaravati, Hemavati, Shimsa.

#### **Water Scarcity and Conservation**

In different areas conservation methods of water are different. In Rajasthan, earthen pots are used for collecting and storing water.

#### **Lakes**

A lake is a body of water which lies on the earth's surface and is entirely surrounded by land.

- It is connected with sea except by rivers.
- In arid and semi-arid areas lakes may have no outlet to the sea and form the focus of an area of inland drainage.

Example – Pulicate, Chilka, Wular lake etc.

#### **Pollution of Rivers**

Most of the rivers are polluted by different causes. In India the most polluted river is Ganga. So, in 1986 Ganga Action Plan was started to protect the river Ganga.

#### **Water : Some Facts & Figures**

- In total volume of world's water, 96.5% is saline and 2.5% is freshwater.
- 70% of freshwater is as glacier in Antarctica.
- India receives nearly 4% of global precipitation and ranks 133 in the world in terms of water availability per person per annum. The availability of water depends on rainfall.
- In Rajasthan the rainfall is low so, the people are collecting and storing water by travelling long distance.
- In most areas people depend on ground water.

#### **Dams**

A dam is a barrier across flowing water that obstructs and retards the flow, often creating a reservoir or lake.

- Most dams have a section called a spillway or weir over which or through which it is intended that water will flow either intermittently or continuously.
- Dams are classified as timber dam, embankment dam, masonry dam.
- According to the height dams can be categorised as large dam and major dams or as low dams, medium height dam and high dam.

#### **Narmada Bachao Andolan**

- It is a movement that mobilised tribal people, farmers, environmentalists and human rights activist against the Sardar Sarovar Dam being built across the Narmada river in Gujarat.
- It was originally focused on the environmental issues related to trees that would be submerged under the dam water.
- Later it has the aim to enable poor citizens, to get full rehabilitation facilities from government.

#### **Rain Water Harvesting**

Rain water harvesting is an ancient technique to conserve water. In hills and mountainous regions, people built diversion channels like the 'guls' or 'kul' of Western Himalaya for agriculture.

- In Rajasthan rooftop rain water harvesting was commonly practised.
- In flood plains, people developed inundation channels to irrigate their fields.
- In arid and semi-arid regions agricultural fields are converted into rain fed storage structure.

## **Exercise**

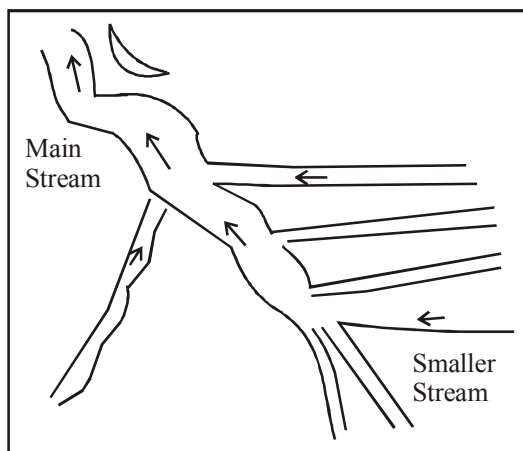
# **1**

**DIRECTIONS :** This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.

- Which one of the following describes the drainage pattern resembling the branches of a tree ?  
(1) Radial (2) Dendric  
(3) Centrifugal (4) Trellis
- In which of the following state is the Wular lake located ?  
(1) Rajasthan (2) Punjab  
(3) Uttar Pradesh (4) Jammu & Kashmir
- The river Narmada has its sources at  
(1) Satpura (2) Amarkantak  
(3) Brahmgiri (4) Slopes of Western Ghat
- Which of the following is the longest river of peninsular India ?  
(1) Narmada (2) Godavari  
(3) Krishna (4) Mahanadi
- Which of the following is a salt water lake ?  
(1) Sambhar (2) Dal  
(3) Wular (4) Govind Sagar
- Which one amongst the following rivers flows through a rift valley ?  
(1) Damodar (2) Tungabhadra  
(3) Krishna (4) Tapi
- The area drained by a single river system is called :  
(1) Water divide (2) Drainage basin  
(3) River system (4) Perennial river
- In which course the intensive erosional activity is performed by the river ?  
(1) Lower (2) Middle  
(3) Upper (4) Coast
- Which of the following rivers does not originate from Tibet ?  
(1) Sutlej (2) Brahmaputra  
(3) Beas (4) Indus

10. River Ganga emerges on the plain at :  
 (1) Dev Prayag (2) Haridwar  
 (3) Ambala (4) Mithankot
11. Which of the following river is known as Dakshina Ganga ?  
 (1) Mahanadi (2) Godavari  
 (3) Narmada (4) Kaveri
12. The lake formed due to tectonic activities is :  
 (1) Lohtak (2) Dal lake  
 (3) Wular lake (4) Bhimtal
13. River Godavari emerges from which district of Maharashtra?  
 (1) Nagpur (2) Satara  
 (3) Nasik (4) Wardha
14. Zaskar, Nubra and Shyok are tributaries of :  
 (1) Satlej (2) Brahmaputra  
 (3) Indus (4) Chenab
15. Which of the following rivers does not drain into the Arabian sea ?  
 (1) Narmada (2) Indus  
 (3) Kaveri (4) None of these
16. A delta is formed at  
 (1) meander (2) upper course of the river  
 (3) mouth of the river (4) lower course of the river
17. Which of the following is a name of Brahmaputra ?  
 (1) Megha (2) Dibaang  
 (3) Tsangpo (4) Jamtina
18. Royal Bengal Tiger is found in which area of India ?  
 (1) The Sunderban Delta  
 (2) West Bengal  
 (3) The Ganga – Brahmaputra region  
 (4) None of these
19. What is the total length of the river Ganga's drainage basin?  
 (1) 1500 km (2) 2500 km  
 (3) 2550 km (4) 1800 km
20. Choose the correct option where both the lakes in the pair are salt water lakes in eastern coast of India ?  
 (1) Chilka and Pulicat (2) Pulicat and Wular  
 (3) Chilka and Wular (4) Wular and Sambhar
21. Through which of the two states does the river Kaveri pass through ?  
 (1) Tamil Nadu & Karnataka  
 (2) Andhra Pradesh & Tamil Nadu  
 (3) Karnataka & Andhra Pradesh  
 (4) None of these
22. When did the activities of the Ganga Action Plan phase-I initiated.  
 (1) 1951 (2) 1947  
 (3) 1963 (4) 1986
23. The Dibang and the Lohit are the tributaries of which river?  
 (1) The Indus (2) The Tista  
 (3) The Brahmaputra (4) The Narmada
24. From which place does the river Indus rise ?  
 (1) From Gangotri glacier (2) Amarkantak hills  
 (3) From Tibet (4) None of these
25. Which of the following rivers has the largest drainage basin in the world ?  
 (1) The Nile (2) The Brahmaputra  
 (3) The Amazon (4) The Thames
26. At which place do Sutlej, Beas, Ravi, Chenab and Jhelum rivers join together to enter the river Indus ?  
 (1) Mithankot (2) Pathankot  
 (3) Amritsar (4) Dev Prayag
27. Which place is located on the water divide between the Indus and the Ganga river system ?  
 (1) Allahabad (2) Ambala  
 (3) Haridwar (4) Kanpur
28. What is Narmada Bachao Andolan ?  
 (1) Social movement  
 (2) Movement against the Construction of Dam.  
 (3) Water Movement  
 (4) Industrial Worker Movement
29. Which dam is built on River Krishna ?  
 (1) Nagarjun Sagar (2) Periyar  
 (3) Mettur (4) Hirakud
30. Which of the following is also called as the temples of modern India ?  
 (1) Khadins (2) Tanks  
 (3) Dams (4) None of these
31. Which one of the following statement is true for a multipurpose river valley project ?  
 (1) It can store the entire rain water received in a region.  
 (2) It fragments rivers, which makes it difficult for aquatic fauna to migrate.  
 (3) It will not affect the natural flow of river.  
 (4) It will not affect the cropping pattern of a region.
32. Against the construction of which of the following multipurpose projects was the Narmada Bachao Andolan launched ?  
 (1) Sardar Sarovar (2) Bhakra Nangal  
 (3) Rihand (4) Tehri
33. Which one of the following multipurpose river valley project is constructed on river Mahanadi ?  
 (1) Tehri (2) Hirakund  
 (3) Rana Pratap Sagar (4) Nagarjun Sagar
34. Which river valley project has been constructed on river Sutlej ?  
 (1) Tehri (2) Rana Pratap Sagar  
 (3) Salal (4) Bhakra Nangal
35. Which one of the following state has made roof rain water harvesting compulsory for all the houses across the state ?  
 (1) Tamil Nadu (2) Haryana  
 (3) Rajasthan (4) Kerala
36. Which of the following river has joined to main streams of the Ganga at Dev Prayag ?  
 (1) Gandak (2) Alakananda  
 (3) Yamuna (4) None of these
37. On which of the following rivers is the Salal Project located ?  
 (1) Jhelum (2) Chenab  
 (3) Sutlej (4) Luni
38. In which state is the Tehri Dam located ?  
 (1) Himachal Pradesh (2) Punjab  
 (3) Uttar Pradesh (4) Uttarakhand
39. Which of the following is not a tributary of the Ganga ?  
 (1) Yamuna (2) Son  
 (3) Gomati (4) Sutlej
40. By what name is the Ganga known in Bangladesh ?  
 (1) Padma (2) Bhagirathi  
 (3) Rup Narayan (4) Nubra
41. Teesta forms a part of which major river system ?  
 (1) Ganga (2) Krishna  
 (3) Kavery (4) Brahmaputra

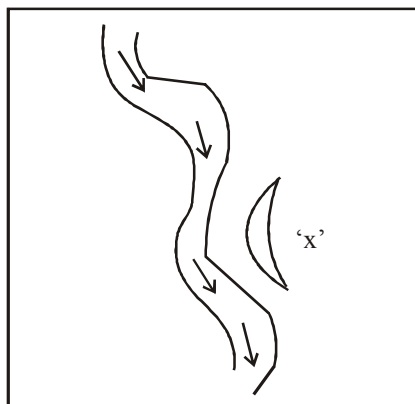
42. Observe the figure given below :



Which type of drainage is shown in the above figure ?

- (1) Rectangular (2) Radial  
(3) Dendric (4) Trellis

43. Observe the figure and identify the area 'x'.



- (1) Sea (2) Oxbow lake  
(3) Atolt (4) Delta area

44. Which of the following statement is not an argument in favour of multipurpose river project ?

- (1) Multi-purpose projects bring water to those areas which suffer from water scarcity.  
(2) Regulated water flow helps to control flood.  
(3) Lead to large scale displacement and loss of livelihood.  
(4) Generate electricity for industries and houses.

45. Which of the following is false ?

- (1) Krishna serves Maharashtra and Andhra Pradesh.  
(2) Godavari serves Madhya Pradesh.  
(3) Mahanadi serves Bihar & Orissa.  
(4) Narmada serves Maharashtra.

46. Most of the rivers flowing westward from the Western Ghats do not form deltas because

- (1) Of the high gradient  
(2) They are too slow  
(3) They are not perennial (4) There is no vegetation

47. Which of the following rivers is known as 'Vridha Ganga' ?

- (1) Godavari (2) Krishna  
(3) Mahanadi (4) Kauery

## Exercise

## 2

### Matching Based MCQ

**DIRECTIONS(Qs.1 and 2) :** Match Column-I with Column-II and select the correct answer using the codes given below the columns.

1.	Column-I Rivers	Column-II Origin
	(A) Indus	(p) Uttarakhand
	(B) Ganga	(q) Tibet
	(C) Godavari	(r) Madhya Pradesh
	(D) Narmada	(s) Maharashtra
		(t) Karnataka
(1)	A → (q); B → (p); C → (s); D → (r)	
(2)	A → (s); B → (r); C → (q); D → (p)	
(3)	A → (p); B → (q); C → (r); D → (s)	
(4)	A → (r); B → (s); C → (p); D → (q)	

2.	Column-I	Column-II
(A)	Flows between the Satpuras and the Vindhyas	(p) Mahanadi
(B)	Forms a delta in Orissa	(q) Narmada
(C)	Hemavati, Herani and Amaravati	(r) Brahmaputra
(D)	River also known as Tsangpo	(s) Krishna
		(t) Kavery
(1)	A → (q); B → (p); C → (t); D → (r)	
(2)	A → (p); B → (s); C → (q); D → (r)	
(3)	A → (t); B → (r); C → (q); D → (p)	
(4)	A → (s); B → (p); C → (r); D → (q)	

### Statement Based MCQ

3. With reference to origin of rivers;  
Consider the following statements :  
(a) River Brahmaputra originates from Tibet near Mansarovar.  
(b) River Mahanadi rises from Western Ghats.  
Which of the statement(s) given above is/are correct ?  
(1) (a) only (2) (b) only  
(3) Neither (a) nor (b) (4) Both (a) and (b)
4. With references to the tributaries of the river Ganga;  
Consider the following statements :  
(a) The Yamuna and the Son are right bank rivers.  
(b) The Gandak and the Kosi are its major left bank tributaries.  
Which of the statement(s) given above is/are correct ?  
(1) (a) only (2) (b) only  
(3) Neither (a) and (b) (4) Both (a) and (b)
5. With reference to rain water harvesting;  
Consider the following statements :  
(a) In hilly areas people conserve rain water through diversion channels.  
(b) In Bengal Khadin and Johads are found for rain water harvesting.  
Which of the statement(s) above is/are correct ?  
(1) (a) only (2) (b) only  
(3) Neither (a) nor (b) (4) Both (a) and (b)

### Passage Based MCQ

**DIRECTIONS (Qs. 6 to 12) :** Read the passage(s) given below and answer the questions that follow.

#### PASSAGE - 1

Chilka is the largest brackish water lake in Asia. A mixture of estuarine, marine and fresh water of ecosystem is observed here. Due to serious degradation brought mainly by siltation and Choking of sewage inlet channel, the decrease in fish productivity and overall loss of biodiversity. Chilka lake was added to the list of Ramsar Site in danger the Montreux Record in 1993. To address the ecological problems of the lagoon Chilka Development Authority (CDA) was created in 1992.

It implemented a bold programme of action to restore the ecosystem and to improve the socio-economic conditions of communities living around the lagoon and on its island.

6. Which is the chief cause of Chilka pollution ?  
(1) Siltation (2) Industrial sewage  
(3) Thermal plant sewage (4) None of these
7. Which type of lake is Chilka ?  
(1) Fresh water (2) Saline water  
(3) Brackish water (4) None of these
8. To avoid ecological problems in Chilka, which organization has been set up ?  
(1) MPEDA (Marine Processing Export Development Authority)  
(2) Zoological Survey of India  
(3) Chilka Development Authority  
(4) None of these

#### PASSAGE - 2

Worldwide, over 45,000 large dams have been built and nearly half the world's rivers are obstructed by a large dam. The belief

that large dams, by increasing irrigation and hydroelectricity production, can cause development and reduce poverty has led developing countries and international agencies such as the World Bank to undertake major investments in dam construction.

9. Which of the following are not the advantage of the dam ?  
(1) Displacement of people  
(2) Hydroelectric production  
(3) Irrigation of water  
(4) None of these
10. Which organisation has mostly invested in dam construction ?  
(1) Asian Development Bank  
(2) World Bank  
(3) IMF  
(4) None of these

#### PASSAGE - 3

**Jhalaras** were human made lakes found in Rajasthan and Gujarat, for conservation of rainwater and essentially meant for community use and for religious rites. Often rectangular in design, **Jhalaras** have steps on three or four sides.

Jhalaras are ground water bodies which are built to ensure easy and regular supply of water to surrounding areas.

Jhalaras collect subterranean seepage of a talab or a lake located upstream. Water from these Jhalaras was not used for drinking but for only for community bathing and religious rites.

11. What is the shape of a Jhalara ?  
(1) Spherical (2) Rectangular  
(3) Triangular (4) None of these
12. Which of the following is not a use of water of Jhalaras ?  
(1) Drinking (2) Bathing  
(3) Cleaning of animals (4) None of these

### Assertion Reason Based MCQ

**DIRECTIONS (Qs. 13 to 15) :** Following questions consist of two statements, one labelled as the '**Assertion**' and the other as '**Reason**'. You are to examine these two statements carefully and select the answer to these items using the code given below.

**Code :**

- (1) Both A and R are individually true and R is the correct explanation of A:  
(2) Both A and R are individually true but R is not the correct explanation of A.  
(3) A is true but R is false.  
(4) If both A and R are false.

13. **Assertion :** Most dams have a section called a spillway or weir.

**Reason :** Through the spillway water will flow intermittently or continuously for migration of different fishes and other organisms and flood control.

14. **Assertion :** 'Narmada Bachao Andolan' and 'Tehri' Dam Andolan' are social movements for protection of environment.

**Reason :** It would integrate development of agriculture and the village economy with rapid industrialisation.

15. **Assertion :** Bamboo pipes are used for drip irrigation.

**Reason :** About 28-30 litres of water enters the bamboo pipe system.

**Correct Definition Based MCQ**

16. Which is the correct definition of a 'lake' ?  
 (1) A water body, completely surrounded by land is known as a lake.  
 (2) The part of river which has been bypassed by the main flow of a stream, through still joined to it.  
 (3) A wide curving indentation made by the sea.  
 (4) None of these
17. What is a river ?  
 (1) A stream with small island of sand and silt in between its course.  
 (2) A large stream of fresh water flowing down hill within a channel to enter another river or sea.  
 (3) The horizontal movement of water of the sea caused by the tide.  
 (4) None of these
18. What is the correct definition of the term 'Doab' ?  
 (1) The place where the delta of river begins.  
 (2) The place where two or more rivers meet.  
 (3) The land between two separate river system.  
 (4) The land between two tributaries of a river.

**Feature Based MCQ**

19. On the basis of following features identify correct option.  
 (I) It is the area of junction of land and the sea.  
 (II) Located on an eroded platform of solid rock, the wave cut platform.  
 (1) Bay (2) Lagoon  
 (3) Beach (4) None of these
20. On the basis of following features identify correct option.  
 (I) The small crescent -shaped lake in a flood plain that originally formed part of a river meander.  
 (II) Formed by erosion of a meandering river.  
 (1) River (2) Tributaries  
 (3) Oxbow lake (4) None of these
21. On the basis of following features identify correct option.  
 (I) Sedimentary material deposited by a river.  
 (II) Found in delta regions and flood plains.  
 (III) These deposits are agriculturally fertile.  
 (1) Black soil (2) Red soil  
 (3) Alluvial soil (4) None of these

# Hints & SOLUTIONS

**Exercise 1**

1. (2)  
 2. (4) Wular lake is in Jammu and Kashmir.  
 3. (2) Narmada rises from Amarkantak Plateau of Madhya Pradesh.  
 4. (2) Godavari is the longest river in Peninsular India.  
 5. (1) 6. (4)  
 7. (2) 8. (3)  
 9. (3) Beas originates from Kullu hills near Rohtang.  
 10. (2)  
 11. (2) The Godavari is called 'Dakshina Ganga'.  
 12. (3)  
 13. (3) River Godavari originates from Nasik of Maharashtra.  
 14. (3) 15. (3) 16. (4)  
 17. (3) 18. (1) 19. (2)  
 20. (1) 21. (1)  
 22. (4) Prime minister Rajeev Gandhi started in 1986.  
 23. (3) The Dibang and the Lohit are the tributaries of Brahmaputra in Arunachal Pradesh.  
 24. (3)  
 25. (3) The Amazon has the largest drainage basin in the world.  
 26. (1) 27. (2) 28. (2)  
 29. (1) 30. (3) 31. (2)

32. (1) 33. (2) 34. (4)  
 35. (3)  
 36. (2) The head stream of the Ganga is fed by the Gangotri Glacier and joined by the Alakananda at Dev Prayag in Uttaranchal  
 37. (2) Salal hydroelectric power station is located on river Chenab in Jammu & Kashmir.  
 38. (4) 39. (4) 40. (1)  
 41. (4) 42. (3) 43. (2)  
 44. (3) 45. (4) 46. (1)  
 47. (1)

**Exercise 2**

1. (1) 2. (1)  
 3. (1) River Mahanadi rises from Eastern Ghats.  
 4. (4)  
 5. (1) Johads and Khadins are found in Rajasthan.  
 6. (1) 7. (3) 8. (3)  
 9. (1) 10. (2) 11. (2)  
 12. (1) 13. (1) 14. (2)  
 15. (3) 16. (1) 17. (2)  
 18. (3)  
 19. (3) Accumulation of materials lying between the lowest level of spring tides and the highest level reached by storm waves.  
 20. (3) 21. (3)