Water Resources

Fastrack Revision

- Water is a precious resource necessary for life. Almost 3/4th of earth's surface is covered with water but only a small percentage of it accounts for fresh water.
- All water moves within the hydrological cycle ensuring that water is a renewable resource.

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It is anticipated that India would become a water scarce nation by 2025.

- Water scarcity is a situation which is the result of shortage of water. It is basically an outcome of large and growing population and consequent water demands and unequal access.

  Water scarcity can be of two types: Quantitative scarcity and Qualitative scarcity.
  - **Quantitative scarcity** refers to depletion in the amount of available water resources due to increase in population, irrigation of fields by farmers, intensive industrialisation and urbanisation, over-exploitation of water resources in cities.
  - **Qualitative scarcity** occurs due to bad quality of available water caused by pollution from domestic and industrial wastes, chemicals, pesticides and fertilisers used in agriculture.
  - The government of India has accorded highest priority to improve the quality of life and enhance case of living of people especially those living in rural areas by announcing the Jal Jeevan Mission (JJM). Its goal is to enable every rural household get assured supply of potable piped water at a service level of 55 litres per capita per day regularly on long-term basis.
- Sophisticated hydraulic structures like dams built of stone rubble, reservoir or lakes, embankments and canals for irrigation have been constructed from the ancient times as shown by archaeological and historical records.

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First Prime Minister, Mr. Jawaharlal Nehru proclaimed multi-purpose river project as 'The Temples of Modern India'

- First century BCE marks Sringaverapura near Allahabad for having water harvesting system channeling the flood water of river Ganga.
- One of the largest artificial lake, the **Bhopal lake** was built in the 11th century and in the 14th century, the tank in Hauz Khas, Delhi was constructed by Iltutmish for supplying water to Siri Fort area.
- Dams were traditionally built to impound rivers and rainwater that could be used to irrigate agricultural fields but now, they are used for various purposes. So, they are referred to as multi-purpose projects where the many uses of the impounded water are integrated with one another.
- A **dam** is a barrier across flowing water that obstructs, directs or retards the flow often creating a reservoir, lake or impoundment.
- Dams are classified according to structure, intended purpose or height. Based on structure and the materials used, there are timber dams, embankment dams or masonry dams. According to the height, there are large dams and major dams or alternatively as low dams, medium height dams and high dams.
- Multi-purpose river valley projects serves various advantages such as generation of electric power, water supply for domestic and industrial uses, flood control, recreation, inland navigation and fish breeding.
- The disadvantages of multi-purpose river valley projects are many change in cropping pattern, salinisation of soil, submerging of existing vegetation and villages, poor sediment flow leading to poorer habitats for aquatic life, etc.
- Multi-purpose river projects have been the cause of many social movements like Narmada Bachao Andolan, Tehri Dam Andolan, etc.

- Major River Projects in the India are as under:

River Projects	Rivers	River Projects	Rivers
Salal Project	Chenab	Koyna	Krishna
Bhakra Nangal	Satluj	Nagarjuna Sagar	Krishna
Tehri	Bhagirathi (Ganga)	Tungabhadra	Tunga bhadra (Krishna)
Naraura	Ganga	Mettur	Kaveri
Rana Pratap Sagar	Chambal	Krishna Raja Sagara	Kaveri
Gandhi Sagar	Chambal	Periyar	Periyar

Kota Barrage	Chambal	Hirakud	Mahanadi
Sardar Sarovar	Narmada	Tilaiya, Konar, Maithon and Panchet	Damodar (DVC)
Pravara	Pravara (Godavari)		

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Dams even cause conflicts between states on water use e.g., in Gujarat, the Sabarmati basin farmers were agitated and almost caused a riot.

- Rainwater harvesting system provides an ideal method of water conservation. In ancient India, there existed an extraordinary tradition of water harvesting system.
  - In hills and mountains regions, people built diversion channels like the 'guls' or 'kuls' of the Western Himalayas for agriculture.
  - In the flood plains of Bengal, people developed inundation channels to irrigate their fields.
  - In arid and semi-arid regions, agriculture fields were converted into rain fed storage structures that allowed the water to stand and moisten the soil like the '**Khadins**' in Jaisalmer and the '**Johads**' in the other parts of Rajasthan.
  - In the semi-arid and arid regions of Rajasthan (particularly in Bikaner, Phalodi and Barmer) almost all houses had tanks or tankas for storing water. The tanks could be as large as a big room, e.g., in Phalodi, a house had a tank 6.1 m deep, 4.27 m long and 2.44 m wide.
  - In Rajasthan, rooftop rainwater harvesting was commonly practised to store drinking water. Rainwater or 'Palar Pani' is considered by them as the purest form of water.
  - In Gendathur, a remote backward village in Mysuru, Karnataka, rooftop rainwater harvesting is practised. From every 20 houses, the net amount of rainwater harvesting annually is 1,00,000 litres.
  - In Meghalaya, Bamboo Drip irrigation is practised. Tamil Nadu is the first and only state of India to make rooftop rainwater harvesting system compulsory to all houses.

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Bamboo drip irrigation system is a 200 year old system of tapping stream and spring water by using bamboo pipes in which about 18-20 litres of water enters, get transported over hundreds of metres and reduces to 20-80 drops per minute at the site of the plant.

Practice Exercise

Multiple Choice Questions

Q 1. Name the river on which the Bhakra Nangal dam is located.

a. Satluj b. Beas c. Godavari d. Krishna

Q 2. How much percentage of the total electricity produced is contributed by hydro-electric power in India today?

a. 21 per cent b. 22 per cent
c. 23 per cent d. 24 per cent

Q 3. From ancient times, evidence of sophisticated irrigation works have also been found in Nagarjunakonda. It is located in .....

a. Andhra Pradesh b. Odisha
c. Karnataka d. Tamil Nadu

Q 4. In the 14th Century, the tank in ..... was constructed by Iltutmish for supplying water to the Siri Fort area.

a. Jaipur, Rajasthan
b. Hauz Khas, Delhi
c. Bhopal, Madhya Pradesh
d. Surat, Gujarat

Q 5. For which of the following purposes were dams traditionally built?

a. For generating electricity
b. For supplying water to industries
c. For flood control
d. To impound river and rain water for irrigation.

Q 6. Which of the following multipurpose projects is found in the Satluj-Beas river basin?

a. Hirakud Project
b. Damodar Valley Corporation
c. Bhakra Nangal Project
d. Rihand Project

Q 7. On which of the following rivers is the Hirakud dam constructed?

a. Satluj b. Beas
c. Mahanadi d. Narmada

Q 8. Which of the following State Governments have raised the Krishna-Godavari dispute?

a. Karnataka and Andhra Pradesh
b. Gujarat and Rajasthan
c. Maharashtra and Madhya Pradesh
d. Karnataka and Maharashtra

Q 9. On which of the following rivers are the Tilaiya, Panchet, Maithon, Konar and Bokaro dams located?

a. Satluj b. Damodar c. Mahanadi d. Krishna

Q 10. Which of the following river projects or groups of river project provide hydroelectricity to the industries of Maharashtra?

a. Pravara Project and Koyna Project.
b. Hirakud Project.
c. Nagarjuna Sagar Project and Tungabhadra Project.
d. Ghatprabha Project and Mettur Project.

Q 11. Which of the following dams are part of Chambal Project?

a. Maithon, Panchet, Tilaiya, Konar, Bokaro
b. Pravara, Ramagundam
c. Rana Pratap Sagar, Gandhi Sagar
d. Sardar Sarovar dam

Q 12. ..... is the first state in India which has made rooftop rainwater harvesting structures compulsory to all the houses across the state.

a. Karnataka
b. Tamil Nadu
c. Maharashtra
d. Andhra Pradesh

Q 13. ..... in the Mahanadi basin integrates conservation of water with flood control.

a. Krishnarajasagar Project
b. Teri Project
c. Hirakud Project
d. Bhakra Nangal Project

Q 14. ..... proudly proclaimed the dams as the 'temples of modern India' as it would integrate the development of agriculture and the village economy with rapid industrialisation and growth of the urban economy.

a. Sardar Patel
b. Jawaharlal Nehru
c. Mahatma Gandhi
d. Dr B.R. Ambedkar

Q 15. Bhadu song in a particular region narrates the troubles faced by people owing to the flooding of ..... known as the river of sorrow.

a. Damodar river
b. Kaveri river
c. Narmada river
d. Yamuna river

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Bhadu is the social festival of South Bengal that starts from the first day of Bhadro, the fifth month in Bengali calendar and continues till the end of the month.

Q 16. Narmada Bachao Andolan is a Non-Governmental Organisation (NGO) that mobilised tribal people, farmers, environmentalists and human rights activists against the ..... being built across the river Narmada.

a. Sardar Sarovar Dam
b. Tehri Dam
c. Nagarjuna Sagar Dam
d. Bhakra Nangal Dam

Q 17. Koyna Dam is one of the largest dams located in .....

a. Uttar Pradesh
b. Himachal Pradesh
c. Rajasthan
d. Maharashtra

Q 18. Rihand Dam is located on river Rihand, a tributary of .....

a. Satluj river
b. Son river
c. Godavari river
d. Brahmaputra river

Q 19. The Krishna-Godavari dispute is due to the objections raised by the Karnataka and Andhra Pradesh Governments regarding the diversion of more water at Koyna by the ..... Government for a multi-purpose project.

a. Tamil Nadu
b. Madhya Pradesh
c. Maharashtra
d. Kerala

Q 20. Which one of the following statements is not an argument in favour of multi-purpose river projects?

a. Multi-purpose projects bring water to those areas which suffer from water scarcity.
b. Multi-purpose projects help to control floods by regulating water flow.
c. Multi-purpose projects lead to large-scale displacements and loss of livelihood.
d. Multi-purpose projects generate electricity for our industries and homes.

Q 21. Water of Bhakra Nangal Project is being used mainly for:

a. hydel power and irrigation
b. fish breeding and navigation
c. industrial use
d. flood control

Q 22. Identify the dam with the help of following features:

(i) It has been built over the Narmada river in Gujarat.
(ii) It is one of the largest water resources projects of India covering four states— Maharashtra, Madhya Pradesh, Gujarat and Rajasthan.
(iii) This project could meet the requirement of water in drought-prone and desert areas of Gujarat and Rajasthan.

a. Bhakra Nangal
b. Sardar Sarovar
c. Gandhi Sagar
d. Tehri

Q 23. Analyse the information given below, considering one of the following correct options:

(i) It is a barrier across flowing water that obstructs, directs or retards the flow, often creating a reservoir, lake or impoundment.
(ii) They are classified according to structure, intended purpose or height.
(iii) They are built not just for irrigation but also for electricity generation, water supply for domestic and industrial uses, flood control, recreation, inland navigation and fish breeding.

a. Multi-purpose projects
b. Dams
c. Khadins
d. Tankas

Q 24. Which of the following is the reason for which dams have come under great scrutiny in recent years?

a. Damming of rivers helps in increasing the natural flow of the water
b. Affects aquatic life adversely
c. Aquatic fauna migrate smoothly
d. Soil and vegetation remain undisturbed

Q 25. On which of the following issues did the Narmada Bachao Andolan first focus?

a. Benefits of irrigation to landless farmers.
b. Environmental issues related to submergence of trees under the dam water.
c. Rehabilitation of the people displaced due to construction of the dam.
d. Economic issues of wastage of money for the construction of the dam.

Q 26. In which of the following areas were farmers agitated when higher priority was given to water supply in urban areas, particularly during drought?

a. Krishna-Godavari basin
b. Koyna basin, Maharashtra
c. Sabarmati basin, Gujarat
d. Rihand basin, Uttar Pradesh

Q 27. In the semi-arid and arid regions of Rajasthan, all the houses store drinking water in:

a. Matkas b. Kuls c. Tankas d. Guls

Q 28. Water harvesting system has been sophisticated by channeling the flood water of the Ganga by:

a. Sringaverapura b. Chandragupta Maurya
c. Ashoka d. Tipu Sultan

Q 29. In Western Rajasthan today plenty of water is available due to:

a. rooftop water harvesting
b. perennial Rajasthan Canal
c. construction of Tankas
d. None of the above

Q 30. The only State which has made rooftop rainwater harvesting structure compulsory to all the houses is:

a. Andhra Pradesh b. Karnataka
c. Tamil Nadu d. West Bengal

Q 31. The remote village that has earned the rare distinction of being rich in rainwater is:

a. Gari b. Kaza
c. Gendathur d. None of these

Q 32. Which one of the following is not an adverse effect of irrigation?

a. Irrigation changes cropping pattern
b. Water intensive crops are grown in dry areas
c. Salinisation of soil
d. Increases crop yield

Q 33. In Phalodi and Barmer, almost all the houses traditionally had underground tanks or tankas for storing drinking water. Barmer and Phalodi are located in .....

a. Gujarat b. Himachal Pradesh
c. Uttarakhand d. Rajasthan

Q 34. The diversion channels seen in the Western Himalayas are called:

a. Guls or Kuls b. Khadins
c. Johads d. Recharge pits

Q 35. Agricultural fields which are used as rain fed storage structures are called:

a. Kuls b. Khadins/Johads
c. Recharge pits d. None of these

Q 36. Underground tanks seen in Rajasthan to store rainwater for drinking is called:

a. Tankas b. Khadin
c. Ponds d. Kuls

Q 37. Identify the type of rainwater harvesting with the help of the following features:

(i) Rainwater is collected using a PVC pipe.
(ii) Underground pipe takes water to sump for immediate usage.
(iii) Water from the well recharges the underground water.

a. Rooftop rainwater harvesting
b. Surface runoff harvesting
c. Direct pumped harvesting
d. Indirect pumped harvesting

Q 38. Bamboo drip irrigation system is prevalent in:

a. Manipur b. Meghalaya
c. Mizoram d. Madhya Pradesh

Knowledge BOOSTER

Bamboo drip irrigation system prevents leakage, increasing crop yield with less water and makes use of natural, local and inexpensive materials.

Q 39. A 200 year old system of tapping stream and spring water by using bamboo pipes is prevalent in the state of .....

a. Meghalaya b. Tripura
c. Assam d. Arunachal Pradesh

Q 40. Arrange the following events in the correct sequence:

(i) About 18-29 litres of water enters the bamboo pipe system.
(ii) It springs water by using bamboo pipes.
(iii) It is a 200-year-old system of tapping streams.
(iv) It is prevalent in Meghalaya.

a. (i), (iii), (ii), (iv) b. (iii), (i), (ii), (iv)
c. (i), (ii), (iii), (iv) d. (iv), (iii), (ii), (i)

Q 41. Which place in India has an artificial lake to conserve water that dates to 11th century?

(CBSE SQP 2023-24)

a. Delhi b. Bhopal
c. Mumbai d. Kolhapur

Q 42. Read the statements carefully and choose the correct option:

Statement (I): In Gujarat, the Sabarmati-basin farmers were agitated and almost caused a riot over the higher priority given to water supply in urban areas, particularly during droughts.
Statement (II): Inter-state water disputes are also becoming less common with regard to sharing the costs and benefits of the multi-purpose project.

a. Statement (I) is correct and (II) is incorrect.
b. Statement (I) is incorrect and (II) is correct.
c. Both statements are incorrect.
d. Both statements are correct.

Q 43. Read the statements carefully and choose the correct option:

Statement (I): Most of the objections to the projects arose due to their success to achieve the purposes for which they are built.
Statement (II): Ironically, the dams that were constructed to control floods have triggered floods due to sedimentation in the reservoir.

a. Statement (I) is correct and (II) is incorrect.
b. Statement (I) is incorrect and (II) is correct.
c. Both statements are incorrect.
d. Both statements are correct.

Assertion & Reason Type Questions

Directions (Q.Nos. 44-48): *In the following questions given below, there are two statements marked as Assertion (A) and Reason (R). Read the statements and choose the correct option:*

a. Both Assertion (A) and Reason (R) are correct and Reason (R) is the correct explanation of Assertion (A).

b. Both Assertion (A) and Reason (R) are correct, but Reason (R) is not the correct explanation of Assertion (A).

c. Assertion (A) is true, but Reason (R) is false.

d. Assertion (A) is false, but Reason (R) is true.

Q 44. Assertion (A): Groundwater is a highly overused resource.

Reason (R): Groundwater is used for domestic and drinking purposes.

TiP

Ground water is a highly overused resource as it is used for domestic and drinking purposes. Huge population mainly depends upon the groundwater for basic requirements.

Q 45. Assertion (A): The availability of water resources varies over space and time.

Reason (R): Availability of water resources helps in storing water.

TiP

Water resources vary over space and time due to the variation in seasonal and annual precipitation. However, water scarcity in most cases is caused by over exploitation and excessive use.

Q 46. Assertion (A): Dams are referred to as multi-purpose projects.

Reasons (R): Dams are built for irrigation, electricity generation, water supply for domestic and industrial use, flood control, recreation and fish breeding.

Q 47. Assertion (A): Local people oppose the big hydroelectric projects in India.

Reason (R): Big hydroelectric projects displace huge number of local people and their agricultural land and homes get submerged in water bringing loss to their livelihood and culture.

Q 48. Assertion (A): Rainwater harvesting is to collect and store rainwater.

Reason (R): Rainwater can be directed to recharge the underground water source.

Answers

1.	(a)	**2.**	(b)	**3.**	(a)	**4.**	(b)	**5.**	(d)
6.	(c)	**7.**	(c)	**8.**	(a)	**9.**	(b)	**10.**	(a)
11.	(c)	**12.**	(b)	**13.**	(c)	**14.**	(b)	**15.**	(a)
16.	(a)	**17.**	(d)	**18.**	(b)	**19.**	(c)	**20.**	(c)
21.	(a)	**22.**	(b)	**23.**	(b)	**24.**	(b)	**25.**	(b)
26.	(c)	**27.**	(c)	**28.**	(a)	**29.**	(b)	**30.**	(c)
31.	(c)	**32.**	(d)	**33.**	(d)	**34.**	(a)	**35.**	(b)
36.	(a)	**37.**	(a)	**38.**	(b)	**39.**	(a)	**40.**	(d)
41.	(b)	**42.**	(a)	**43.**	(b)	**44.**	(a)	**45.**	(c)
46.	(a)	**47.**	(a)	**48.**	(a)				

Source Based Questions

Source 1

Read the source given below and answer the questions that follow by choosing the most appropriate option:

Given the abundance and renewability of water, it is difficult to imagine that we may suffer from water scarcity. The moment we speak of water shortages, we immediately associate it with regions having low rainfall or those that are drought prone. We instantaneously visualise the deserts of Rajasthan and women balancing many 'matkas' (earthen pots) used for collecting and storing water and travelling long distances to get water. True, the availability of water resources varies over space and time, mainly due to the variations in seasonal and annual precipitation, but water scarcity in most cases is caused by over-exploitation, excessive use and unequal access to water among different social groups.

(CBSE SQP 2020)

Q 1. What is the being discussed about in the given source?

a. Watershed management
b. Rainwater harvesting
c. Water scarcity
d. Integrated water resource management

Q 2. What is the term 'water shortage' associates with?

a. Regions having low rainfall
b. Drought prone areas
c. Deserts of Rajasthan
d. All of the above

Q 3. What is the reason for the variation in the availability of water resources over space and time?

a. Large and growing population
b. Variation in seasonal and annual precipitation
c. Over- exploitation
d. Falling ground water level

Q 4. Which among the following is the reason for water scarcity?

a. Industrialisation
b. Urbanisation
c. Modernisation
d. All of these

Q 5. Which of the following statements shows maximum intensity of water scarcity in India?

a. Groundwater is under serious threat.
b. About 300 districts have reported a water level decline.
c. Nearly one third of the country is overusing their groundwater reserves.
d. Groundwater overuse is particularly found in the agriculturally prosperous regions.

Q 6. Two statements are marked as Assertion (A) and Reason (R). Read the statements and choose the correct option:

Assertion (A): Water resources are being over-exploited to expand irrigated area.
Reason (R): This helps to increase production of food grains.

a. Both Assertion (A) and Reason (R) are correct and Reason (R) is the correct explanation of Assertion (A).
b. Both Assertion (A) and Reason (R) are correct. but Reason (R) is not the correct explanation of Assertion (A).
c. Assertion (A) is true. but Reason (R) is false.
d. Assertion (A) is false. but Reason (R) is true.

Answers

1. (c) **2.** (d) **3.** (b) **4.** (d) **5.** (b) **6.** (a)

Source 2

Read the source given below and answer the questions that follow:

Irrigation has also changed the cropping pattern of many regions with farmers shifting to water intensive and commercial crops. This has great ecological consequences like salinisation of the soil. At the same time, it has transformed the social landscape *i.e.*, increasing the social gap between the richer landowners and the landless poor. As we can see, the dams did create conflicts between people wanting different uses and benefits from the same water resources. In Gujarat, the Sabarmati-basin farmers were agitated and almost caused a riot over the higher priority given to water supply in urban areas, particularly during droughts. Inter-state water disputes are also becoming common with regard to sharing the costs and benefits of the multi-purpose project.

Q 1. How did irrigation change the cropping pattern in India?

Ans. Through irrigation facilities, farmers in many parts of India have shifted their cropping pattern to water intensive and commercial crops as can be seen in the states of Punjab and Haryana.

Q 2. What was the cause of riot among the Sabarmati basin farmers in Gujarat?

Ans. In Gujarat, the Sabarmati basin farmers caused a riot over the higher priority given to water supply in urban areas particularly drought conditions.

Q 3. What are inter-state water disputes? Why are such issues raised?

Ans. Inter-state water disputes are disagreements on the sharing of water and other resources of rivers and other water bodies among State Governments.
Such disputes are raised due to unresolved problems regarding sharing of the costs and benefits of multi-purpose projects on these rivers.

Source 3

Read the source given below and answer the questions that follow:

RAINWATER HARVESTING

Many thought that given the disadvantages and rising resistance against the multi-purpose projects, water harvesting system was a viable alternative, both socio-economically and environmentally. In ancient India, along with the sophisticated hydraulic structures, there existed an extraordinary tradition of water harvesting system. People had in-depth knowledge of rainfall regimes and soil types and developed wide ranging techniques to harvest rainwater, groundwater, river water and flood water in keeping with the local ecological conditions and their water needs. In hill and mountainous regions, people built diversion channels like the 'guls' or 'kuls' of the Western Himalayas for agriculture. 'Rooftop rainwater harvesting' was commonly practised to store drinking water, particularly in Rajasthan. In the flood plains of Bengal, people developed inundation channels to irrigate their fields. In arid and semi-arid regions, agricultural fields were converted into rain fed storage structures that allowed the water to stand and moisten the soil like the 'Khadins' in Jaisalmer and 'Johads' in other parts of Rajasthan. *(CBSE 2023)*

Q 1. Why is water harvesting system a viable alternative?

Ans. Rainwater harvesting is comparatively more economical, environmentally viable, and socially acceptable alternative, as compared to the construction of dams.

Q 2. Describe the process of 'rooftop rainwater harvesting'?

Ans. Rooftop rainwater harvesting, is the technique through which rainwater is captured from the roof catchments and stored in reservoirs. Harvested rainwater can be stored in subsurface groundwater reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks.

Q 3. Mention any two methods adopted by ancient India for water conservation.

Ans. Methods adopted by ancient India for water conservation are:

(i) Stepwells: Stepwells are examples of the many types of storages and irrigation tanks that were developed in India, mainly to cope with fluctuations in water availability.

(ii) Tanks: Rainwater tanks collect stormwater runoff from impervious surfaces such as roofs, reducing the amount that enters our water ways.

Source 4

Read the source given below and answer the questions that follow:

In ancient India, along with the sophisticated hydraulic structures, there existed an extraordinary tradition of water-harvesting system. People had an in-depth knowledge of rainfall regimes and soil types and developed wide ranging techniques to harvest groundwater, rainwater, river water and flood water in keeping with the local ecological conditions and their water needs. In hilly and mountainous regions, people built diversion channels like the 'kuls' and 'guls' of Western Himalayas for agriculture. Rooftop rainwater harvesting was very commonly practised to store drinking water, particularly in Rajasthan.

(CBSE 2023)

Q 1. Mention any two methods of traditional water-harvesting used in India.

Ans. The methods of traditional water-harvesting used in India are:

(i) Surface Runoff Harvesting.

(ii) Rooftop Rainwater Harvesting.

Q 2. How do people of Rajasthan utilise rainwater?

Ans. Rajasthan people constructed underground tanks inside the house or in the courtyard. There was a pipe which is connected from the roofs and this helps in storing water to the tanks from the roofs.

Q 3. Explain any two benefits of rainwater harvesting.

Ans. The two benefits of rainwater harvesting are:

(i) Promotes both water and energy conservation.

(ii) Improves the quality and quantity of ground water.

Source 5

Read the source given below and answer the questions that follow:

Maharashtra is a state located in Western India, with a population of over 110 million people. The state is home to several large cities, including Mumbai, and has a significant agricultural sector. However, the state is facing a severe water crisis, with its water resources coming under increasing pressure due to climate change, industrialisation and urbanisation. The main challenges faced by water resource management in Maharashtra are:

(i) Overexploitation of Groundwater: Maharashtra is one of the most groundwater-stressed states in India, with the demand for water exceeding the supply. Overexploitation of groundwater for agriculture and urban use has led to a decline in water levels, which has severe implications for the sustainability of water resources.

(ii) Pollution of Surface Water: Industrialisation and urbanisation have led to the pollution of surface water bodies such as rivers and lakes. The pollution has led to water quality degradation, which poses risks to human health and the environment.

(iii) Inefficient Irrigation Practices: The agricultural sector is the largest user of water in Maharashtra, accounting for around 80% of total water use. However, traditional irrigation practices such as flood irrigation are inefficient and lead to the wastage of water.

(CBSE SQP 2023-24)

Q 1. Mention any two reasons for the water crisis faced by the state of Maharashtra.

Ans. Reasons for the water crisis faced by the state of Maharashtra are:

(a) Overexploitation of groundwater.

(b) Pollution of surface water bodies due to industrialisation and urbanisation.

Q 2. Despite being the second highest rainfall-receiving state of the country, Maharashtra still faces water crisis. Substantiate this statement in 40 words.

Ans. Despite receiving the second-highest rainfall in the country, traditional irrigation practises like flood irrigation leading to water shortages in Maharashtra. This is because flood irrigation involves excessive water use, and the water gets lost due to runoff, leading to less water available for other uses.

Q 3. Propose any one solution to mitigate the water crisis faced by Maharashtra state.

Ans. Implementing rainwater harvesting systems in Maharashtra could be an effective solution to mitigate the water crisis by increasing the availability of water and reducing the pressure on existing water sources.

Very Short Answer Type Questions

Q 1. What is water scarcity?

Ans. Water scarcity is the lack of sufficient available water resources to meet the demand.

Q 2. What is hydrological cycle?

Ans. The process of evaporation from the water bodies and condensation on the earth's surface followed by precipitation in the form of rain, is known as the hydrological cycle.

Q 3. What is the most important benefit of 'hydrological cycle'?

Ans. 'Hydrological cycle' renews and recharges the fresh water which is quite essential for the sustenance of life.

Q 4. How water is being over-exploited for agriculture?

Ans. Water is being over-exploited to increase production of food-grains, by expanding the irrigated area and by practising dry season agriculture.

Q 5. Why is the quality of water resources inferior?

Ans. Quality of water resources is inferior due to the discharge of dumping of the following materials into the water:

(I) Industrial effluents
(II) Chemicals
(iii) Pesticides and insecticides
(iv) Chemical fertilisers

Q 6. How does agriculture sector contribute to depletion of freshwater in India?

Ans. Agriculture sector contributes to depletion of fresh water in the following ways:

(i) Agriculture practices use valuable groundwater from wells and tubewells which result in depletion of freshwater.
(II) Pesticide, fertiliser etc used in agriculture often contaminate freshwater and make it unfit for use.

Q 7. What was Nehru's assumption about multi-purpose projects?

Ans. Nehruji assumed that multi-purpose projects will lead to integrated development of rural economy, and industrialisation and growth of urban economy.

Q 8. Define the term 'Dam'.

Ans. A dam is a barrier constructed across a waterway to control the flow or raise the level of water. It is also understood as a body of water or a reservoir controlled by such a barrier.

Q 9. Give an example where ancient large hydraulic structure was built.

Ans. In the 1st century BC, Sringaverapura near Allahabad in North India had sophisticated water harvesting system to control flood water of Ganga.

Q 10. What is the most importance of Hirakud Project?

Ans. Hirakud project is the largest mud walled hydraulic structure built on river Mahanadi in Odisha that integrates conservation of water with flood control.

Q 11. Name some hydroelectric projects on Damodar river basin.

Ans. Tilaiya, Konar, Maithon and Panchet are major hydroelectric projects on Damodar river basin.

Q 12. How did irrigation change the cropping pattern in India?

Ans. In many parts of India farmers have shifted their cropping pattern of water intensive and commercial crops through irrigation facilities *e.g.*, in Punjab and Haryana.

Q 13. Why local people oppose the big hydroelectric projects in India?

Ans. Big hydroelectric projects displace huge number of local people and their agricultural land and homes get submerged in water. This consequently bring loss to their livelihood as well as culture. So, these local communities oppose the big projects.

Q 14. Besides flood and sedimentation, what are the other negative consequences of multi-purpose projects?

Ans. The other negative consequences of multi-purpose projects are that they have induced other problems like earthquake due to increased water pressure on the rock floor, water borne diseases and pests, etc.

Q 15. Inter-state river water disputes increased significantly. Why so?

Ans. Damming and over-exploitation of river water on upstream reduces the quantity of water down stream that creates disputes among states for sharing of water resource.

Q 16. What are the benefits of constructing tankas in Rajasthan?

Ans. Tankas are underground store houses for rainwater harvesting on the rooftop in arid and semi-arid regions of Rajasthan. These satisfy the drinking water needs of the people throughout the year. Rooms are constructed near the tankas as the place remains cool in summer.

Q 17. Name the village in Karnataka which has earned a rare distinction of being rich in rainwater. Explain its example.

Ans. Gendathur is that village in Karnataka which has earned a rare distinction of being rich in rainwater by installing rooftop rainwater harvesting system. Each of 20 household collects and uses total 100,000 litres of water annually.

Q 18. What is the need of rainwater harvesting?

Ans. Rainwater harvesting is carried out to conserve and store water. This method mainly reduces water scarcity.

Q 19. Name two techniques of rooftop rainwater harvesting.

Ans. The two techniques of rooftop rainwater harvesting are:

(I) Recharge through hand pump.
(II) Recharge through abandoned dug well.

Q 20. What is a *kul*?

Ans. In the hill and mountainous region of the Western Himalayas, the diversion channels are called *kuls* which are used for agriculture.

Short Answer Type Questions

Q 1. Water is a very important and critical resource in India? Support the statement by explaining any three points.

Ans. Water is a very important and critical resource in India. This fact can be validated with the help of the following points:

(i) It is used for producing power.
(ii) Water is a basic input for irrigation in agriculture.
(iii) It is vital for human survival.
(iv) In industries, water is used for various activities.
(v) Water is essential for maintaining ecological balance. (Any three)

Q 2. Explain any three causes for water scarcity in most parts of India. *(CBSE 2015)*

OR

Analyse three major causes of water scarcity in India.

Ans. The reasons for rise in scarcity of water in most parts of India are as follows :

(i) The fast growing population has increased the demand for water used for drinking and domestic purposes.
(ii) The rising demand of food and cash crops require large amount of water for agriculture.
(iii) Growing urban areas require more power for which water is required to produce hydroelectricity.
(iv) Industrialisation has been increased and industrial processes require large amounts of water.
(v) Multiplying urban centres with large and dense population and urban life styles have not only added to water and energy requirements but have aggravated the problems. (Any three)

COMMON ERROR

Students do not mention separate causes and repeat the same in different points.

Q 3. Why is there differences in the availability of water resources in India according to regions?

Ans. The differences in the availability of water resources in India are due to the following reasons:

(i) The availability of water resources varies over space and time mainly due to the variation in seasonal and annual precipitation in different parts of the country.
(ii) The variation is due to the diverse geographical and climatic conditions in our country.

Q 4. Identify any three hydraulic structures as part of water management programmes initiated in ancient India along with the period when they were built.

Ans. Examples of hydraulic structures in India developed in ancient times were:

(i) Dams, lakes and irrigation system were built during the time of Chandragupta Maurya.
(ii) In the 11th century, Bhopal lake, one of the largest artificial lakes of its times, was built.
(iii) For channeling the flood water of Ganga, water harvesting system was built at Sringaverapura near Allahabad in the first century BCE.
(iv) The tank in Hauz Khas, Delhi was constructed by Iltutmish for supplying water to Siri Fort area in the 14th century. (Any three)

Q 5. 'Overpopulation or large and growing population can lead to water scarcity'. Explain the statement.

Ans. 'Overpopulation or large and growing population can lead to water scarcity' in the following ways:

(i) A large population means more water not only for domestic use but also to produce more food.
(ii) More population means more demand for water.
(iii) Overutilisation of water results in lowering of the groundwater.
(iv) To facilitate higher foodgrain production, water resources are being over exploited to expand the irrigated areas and the dry season agriculture.

Q 6. Multi-purpose projects are 'Temples of Modern India'. Justify.

OR

Why are multi-purpose projects considered as the 'Temples of Modern India'? *[CBSE 2015]*

Ans. Jawaharlal Nehru wanted India to be a self-reliant country to overcome the handicap of its colonial past.

That is why he launched the multi-purpose projects that not only control flood but also are useful in irrigation, power generation, fish breeding, etc. These projects were considered to bring development in villages and make a modern India.

The dams were an important symbol of these projects and consequently of the modernisation of India. That is why Nehru considered muti-purpose projects as the 'Temples of Modern India'.

Q 7. Explain three ways in which irrigation schemes have changed the social landscape of the region.

OR

Explain any two consequences of changing crop pattern due to irrigation. *(CBSE 2016)*

Ans. The three ways in which irrigation schemes have changed the social landscape of the region are:

(i) Multi-purpose projects have widened the gap between rich and poor. The landlords, large farmers and industrialists are getting benefit at the cost of poor.
(ii) Multi-purpose projects and large dams have also been the cause of many new social movements like the Narmada Bachao Andolan and the Tehri Dam Andolan, etc.

(iii) Local people often had to give up their land, livelihood and their meagre access and control over resources for the greater good of the nation.

Q 8. Explain any three reasons due to which multi-purpose projects and large dams have come under great opposition in recent years. *(CBSE 2015)*

Ans. The reasons for multi-purpose projects and large dams coming under great opposition in recent years are:

(i) Local communities have been displaced from their original settlement areas, with consequent loss of livelihood and income.

(ii) These projects create social gap as rich landlords and big farmers take more benefits as compared to poor farmers.

(iii) Rising sedimentation in the reservoirs leads to land degradation while flooding the nearby areas around the dam.

Q 9. What is the reason behind Krishna-Godavari water dispute? Name the multi-purpose river valley project constructed on river Krishna.

Ans. Maharashtra Government built Koyna multi-purpose project on river Godavari and diverted much water to the state, so, the lower stream of Godavari remained water starved. It became a contentious issue between Karnataka and Andhra Pradesh for use of Godavari for agriculture and industrial purposes. Koyna multi-purpose project is the reason behind Krishna-Godavari water dispute.

The multi-purpose river valley project constructed on river Krishna is Nagarjuna Sagar Dam.

TiP

Explain the reason properly and do not skip the 2nd part of the questions.

Q 10. Name any two movements that have been started to oppose multipurpose projects. Who are benefitted from such projects?

Ans. Two movements that have been started to oppose multipurpose projects are:

(i) **Tehri Dam Andolan:** Resistance to these projects has primarily been due to the large-scale displacement of local communities.

(ii) **Narmada Bachao Andolan:** It was started against the Sardar Sarovar Dam being built across the Narmada River in Gujarat.

The landowners and large farmers, industrialists and a few urban centres are benefitted from such projects.

Q 11. Give two reasons why rainwater harvesting is important in India. Name two states which practise rain water harvesting in India.

Ans. Rainwater harvesting is important in India due to the following reasons:

(i) India has seasonal, erratic and uneven rainfall. Also, in the dry season, some parts of India have scarcity of water, *e.g.* in Rajasthan.

(ii) With the help of rainwater harvesting techniques, water can be conserved and used during the dry season.

The two states which practise rain water harvesting in India are Rajasthan and Gujarat.

Q 12. Describe the procedure for rooftop rainwater harvesting. *(CBSE 2015)*

OR

Describe the rooftop rainwater harvesting technique. *(CBSE 2016)*

Ans. The procedure for rooftop rainwater harvesting is as follows:

(i) The rainwater falling on the roof is collected by a PVC pipe and filtered using sand and bricks.

(ii) Underground pipe takes water to a sump for immediate use.

(iii) Excess water from the sump is transferred to a well which recharges the groundwater. Any further requirement of water can be fulfilled from the well.

Long Answer Type Questions

Q 1. Why is groundwater a highly overused resource?

Ans. Nowadays, groundwater is a highly overused resource because of many reasons:

(i) Groundwater is a fresh water source and is used for drinking purpose and it is actually over-exploited in urban areas for domestic and drinking purposes.

(ii) Groundwater is also now over-exploited for irrigation purpose especially in Green Revolution areas of Punjab-Haryana and Western Uttar Pradesh region. Intensive agricultural practises intensify over-exploitation of groundwater.

(iii) After independence, many industries have been developed and many development projects have been initiated. All these exploit groundwater for various purposes and often contaminate it.

(iv) After the toxication and pollution of rivers and many lakes, groundwater has become practically the only source of fresh water which can be used directly without treatment.

(v) Due to large and growing population and consequent greater demands for water and unequal access to it, groundwater is highly exploited and has become a highly overused resources.

Q 2. Why are multi-purpose projects and large dams facing resistance? How have they been the cause of many new social movements like Narmada Bachao Andolan?

OR

How construction of large dams has become a controversial issue? *(CBSE 2015)*

Ans. In recent years, multi-purpose projects and large dams have become a controversial issues for variety of reasons:

(i) Regulating and damming of rivers affect their natural flow causing poor sediment flow and excessive sedimentation at the bottom of the reservoir resulting in rockier stream beds and poorer habitats for the rivers aquatic life.

(ii) Dams also fragment rivers making it difficult for aquatic life to migrate especially for spawning.

(iii) The reservoirs that are created on the flood plains submerge the existing vegetation and soil leading to its decomposition over a period of time.

(iv) Construction of dams have also caused many social movements such as Narmada Bachao Andolan and the Tehri Dam Andolan, etc. These are due to large scale displacement of local people. They lose their land and business and are not benefitted.

(v) They have led to many inter-state disputes with regard to sharing the costs and benefits of the projects such as Kaveri-Godavari dispute and Sabarmati water dispute, etc.

(vi) The large-size projects have induced earthquakes, caused water borne diseases and water pollution.

Q 3. What are inter-state water disputes? Why are such issues raised? Give some examples of such disputes.

Ans. Inter-state water disputes are disagreements on the sharing of water and other resources of rivers and other water bodies among State Governments. They arise due to unresolved problems regarding sharing of the costs and benefits of multi-purpose projects on these rivers.

Examples of such disputes are:

(i) The Kaveri river water dispute is among Tamil Nadu, Karnataka, Kerala and Puducherry.

(ii) The Krishna-Godavari water dispute is among Maharashtra, Andhra Pradesh and Karnataka.

(iii) The Ravi-Beas river water dispute is between Punjab and Haryana.

(iv) The Yamuna river water dispute is between Haryana and Delhi.

COMMON ERROR

Students do not discuss about the states of water disputes.

Q 4. How have intensive industrialisation and urbanisation posed a great pressure on existing freshwater resource in India? Explain.

OR

How do increasing number of industries exert pressure on existing freshwater resources?

Ans. India has witnessed intensive industrialisation and urbanisation after independence:

(i) Freshwater is almost limited, though renewable in India, but over-exploitation and mismanagement of this resource by industries are aggravating the water stress day-by-day.

(ii) Industries especially heavy industries use huge amount of freshwater for industrial purpose and they pollute and waste such water.

(iii) These industries for their energy consumption purpose depend on hydroelectric projects and this electricity is generated through damming the rivers upstream. So, the river almost dries up in the lower stream areas.

(iv) Again industries dump the chemical wastes in the river, lake, etc. which then consequently pollute the water that pose threat for human survival.

(v) The chemical wastes contaminate the ground water through seepage of industrial wastes.

So, the increasing number of industries exert pressure on existing fresh water resources.

Q 5. Discuss how rainwater harvesting in semi-arid regions of Rajasthan is carried out. *(NCERT)*

Ans. Rainwater harvesting in semi-arid regions of Rajasthan is carried out in the following manner:

(i) People living in Rajasthan use rooftops rainwater harvesting techniques to store drinking water.

(ii) In the semi-arid and arid regions of Rajasthan, particularly in Phalodi, Bikaner and Barmer, most of the houses, have underground tanks or 'tankas' for storing water in their courtyards. They are connected to the sloping roofs of the house through a pipe.

(iii) The rainwater travels through the pipes and gets stored in the underground tanks or tankas. The rainwater can be stored till the next rainfall.

(iv) Rainwater or *Palar Pani* as commonly called in these parts is considered as the purest form of natural water.

(v) The agricultural fields are also converted into rain-fed storage structures that allow the water to stand and moisten the soil like the *'Khodins'* in Jaisalmer and the *'Johads'* in other parts of Rajasthan.

Q 6. Describe the traditional methods of rainwater harvesting adopted in different parts of India.

Ans. The traditional methods of rainwater harvesting adopted in different parts of India are:

(i) Guls and Kuls: People built these in hilly and mountainous regions to divert water. These are simple channels mainly used in the Western Himalayas.

(ii) **Rooftop Rainwater Harvesting:** It is commonly practised to store drinking water in Rajasthan.

(iii) **Inundation Channels:** These channels were developed in the flood plains of Bengal to irrigate fields.

(iv) **Khadins and Johads:** In arid and semi-arid regions, some of the agricultural fields were converted into rain fed storage structures. Such structures are found in Rajasthan.

(v) **Tankas or Tanks:** In Bikaner, Phalodi and Barmer, almost all houses have tanks for storing drinking water. Tanks are part of the well-developed rooftop rainwater harvesting system.

Q 7. Describe how modern adaptation of traditional rainwater harvesting methods are being carried out to conserve and store water? *(NCERT)*

Ans. Modern adaptations of traditional methods of rainwater harvesting being carried out to conserve and store water are:

(i) Rooftop rainwater harvesting is one of the most common practises in Shillong, Meghalaya. Nearly every household in the city has a rooftop rainwater harvesting structure.

(ii) Tamil Nadu is the first and the only state in India which has made rooftops rainwater harvesting structure compulsory to all the houses across the state. There are legal provisions to punish the defaulters.

(iii) In many parts of rural and urban India, rooftop rainwater harvesting is being successfully adopted to store and conserve water.

(iv) In Gendathur, a remote backward village in Mysore, Karnataka, villagers have installed in their households, rooftop rainwater harvesting system to meet their water needs. Nearly 200 households have installed this system and the village has earned the rare distinction of being rich in rainwater.

TiP

Write all kinds of modern adaptations as discussed in the NCERT book in separate points.

Q 8. Explain any five reasons for water pollution in India. *(CBSE 2015)*

OR

Explain any five causes of water pollution.

(CBSE 2023)

Ans. The five reasons/causes for water pollution in India are as follows:

(i) **Industries:** Industries discharge various chemicals and hazardous wastes into water sources such as lakes, ponds and canals without treating them which cause harm to aquatic living organisms.

(ii) **Agriculture:** Modern agricultural practises use chemical in the form of fertilisers, pesticides and herbicides which flow into rivers or seep into groundwater.

(iii) **Households:** Man uses water for drinking, cooking, bathing, for cleaning the house, etc. Most of the used water is drained out through municipal drains and is then poured into a river or lake.

(iv) **Offshore Drilling and Oil Spills:** Exploring for oil and gas under the sea bed, involves some risks to the marine environment. The consequences of such oil spills is of great environmental concern posing a threat to human survival ultimately.

(v) **Nuclear Wastes:** Nuclear power plants, nuclear weapon testing, laboratories where isotopes are used, are sources of nuclear wastes which can pollute the entire water sources of a region.

Chapter Test

Multiple Choice Questions

Q 1. The dams constructed to control floods have triggered floods due to ..... in the reservoir.

a. decantation b. filtration
c. sublimation d. sedimentation

Q 2. In the semi-arid and arid regions of Rajasthan, all the houses store drinking water in:

a. Matkas b. Kuls
c. Tankas d. Guls

Q 3. Tank, in Hauz Khas Delhi was constructed by Iltutmish for supplying water to:

a. Red Fort b. Siri Fort
c. Chandni Chowk d. Trans Yamuna

Q 4. Identify the reason for which dams have come under great scrutiny in recent years.

a. Damming of rivers helps in increasing the natural water flow
b. Affects aquatic life adversely
c. Aquatic fauna migrate smoothly
d. Soil and vegetation remain undisturbed

Q 5. Match Column I with Column II and choose the correct options:

Column I	Column II
A. Sardar Sarovar Dam	1. Hydel Power production and irrigation.
B. Hirakud Project	2. River of Sorrow
C. Damodar river	3. Mahanadi Basin
D. Bhakra-Nangal Project	4. Narmada River

	A	B	C	D
a.	1	3	2	4
b.	2	3	4	1
c.	4	3	2	1
d.	3	2	1	4

Assertion and Reason Type Questions

Directions (Q.Nos. 6-7): *In the following questions given below, there are two statements marked as Assertion (A) and Reason (R). Read the statements and choose the correct option:*

a. Both Assertion (A) and Reason (R) are correct and Reason (R) is the correct explanation of Assertion (A).
b. Both Assertion (A) and Reason (R) are correct. but Reason (R) is not the correct explanation of Assertion (A).
c. Assertion (A) is true. but Reason (R) is false.
d. Assertion (A) is false. but Reason (R) is true.

Q 6. Assertion (A): An area or region having ample water resources may face water scarcity.

Reason (R): Water scarcity is caused due to pollution of the available water and inefficient management of water sources.

Q 7. Assertion (A): The rooftop rainwater harvesting is now declining in Rajasthan.

Reason (R): The multi-storeyed buildings and group housing societies tend to over-exploitation of water resources.

Source Based Question

Q 8. *Read the source given below and answer the questions that follow:*

Most of the objections to the projects arose due to their failure to achieve the purposes for which they were built. Ironically, the dams that were constructed to control floods have triggered floods due to sedimentation in the reservoir. Moreover, the big dams have mostly been unsuccessful in controlling floods at the time of excessive rainfall. You may have seen or read how the release of water from dams during heavy rains aggravated the flood situation in Maharashtra and Gujarat in 2006.

The floods have not only devastated life and property but also caused extensive soil erosion. Sedimentation also meant that the flood plains were deprived of silt, a natural fertiliser, further adding on to the problem of land degradation. It was also observed that the multi-purpose projects induced earthquakes, caused waterborne diseases and pests and pollution resulting from excessive use of water.

(i) Why do the dams constructed to control floods have triggered floods? Give an example.

(ii) List any two disadvantages of multi-purpose projects.

(iii) What are the problems caused due to sedimentation?

Very Short Answer Type Questions

Q 9. How is water scarcity caused?

Q 10. What are the ill-effects of irrigation in India?

Q 11. What is the need of rainwater harvesting?

Q 12. Why is the management and conservation of water resources essential?

Short Answer Type Questions

Q 13. Why are multi-purpose projects facing resistance? Explain three reasons.

Q 14. What is Bamboo Drip Irrigation? Mention its two features.

Q 15. The roof top rain water harvesting is now declining in Rajasthan. Discuss the issue.

Q 16. How has urbanisation posed a threat to existing fresh water resources in India?

Long Answer Type Questions

Q 17. Why are different water systems considered a viable alternative both socio-economically and environmentally in a country like India?

Q 18. What is the reason behind Krishna-Godavari water dispute? Name the multi-purpose river valley project constructed on river Krishna.