3 WATER RESOURCES

CONCEPT

- The main source of water on earth is the **hydrological cycle.**
- India receives nearly 4% of the global precipitation to rank 133rd in the world in terms of water availability per person per annum.
- If water is not conserved, by 2025 a large part of India will face water scarcity.
- **Water scarcity** is caused by over-exploitation, excessive use of and unequal access to water among different social groups.
- In India, most of the energy required to run industries comes from hydroelectric power.
- The water around us needs to be conserved and managed to safeguard ourselves from health hazards, to ensure food security, continuation of our livelihoods and productive activities, and also to prevent degradation of our natural ecosystem.
- The **multipurpose projects** are meant to tackle various problems associated with river valleys in an integrated manner.
- They help to control flood, check soil erosion, provide water for irrigation and drinking purposes, generate electricity for industries, villages, cities, provide inland navigation, help in preservation of wildlife and development of fisheries.
- Damodar Valley Corporation — built on river Damodar — beneficiary states are Jharkhand and West Bengal.
- Bhakra Nangal — built on river Satlej — beneficiary states are Punjab, Haryana and Rajasthan, Himachal Pradesh
- Hirakud — built on river Mahanadi — beneficiary state is Orissa.
- Kosi — built on river Kosi — beneficiary state is Bihar and our neighbouring country Nepal.
- Chambal Valley — built on river Chambal — beneficiary states are Madhya Pradesh and Rajasthan.
- The greatest example of integrated water management is the building of multipurpose river projects.
- These include the dam which is built not just for irrigation and flood control but also for generation of hydroelectricity for industrial uses, recreation, inland navigation and fish breeding.
- Many such projects have caused environmental damages by inducing earthquakes, destroying natural habitats, causing water-borne diseases and water pollution.
- **Rainwater harvesting** is a technique of increasing the recharge of groundwater by capturing and storing rainwater by constructing wells, percolating pits and check dams.

  The main objectives of the rainwater harvesting are :
  - to meet the increasing demand of water.
  - to reduce runoff.
  - to avoid the flooding of roads.

- to augment the groundwater storage and raise the water table.
- to reduce groundwater pollution.
- to improve the quality of groundwater.
- to supplement domestic water requirement during summer and long dry spells.

- Many thought that given the disadvantages and rising resistance against the multipurpose projects, water harvesting system was a viable alternative, both socio-economically and environmentally.
- People had in-depth knowledge of rainfall regimes and soil types and developed wide ranging techniques to harvest rainwater, groundwater, river water and floodwater in keeping with the local ecological conditions and their water needs.
- Rooftop rainwater harvesting has been done in Rajasthan, Meghalaya, Karnataka and Tamil Nadu on a regular and vast basis.

1. SUMMATIVE ASSESSMENT

A. NCERT TEXTBOOK QUESTIONS

Questions in the Exercise

Q.1. Choose the right answer from the four alternatives given below :

(i) Water becomes a renewable and rechargeable resource due to which of the following reasons?

(a) Water table (b) Hydrological cycle

(c) Oceans and seas (d) Surface runoff

Ans. (b) Hydrological cycle

(ii) Which of the following statements is not an argument in favour of multipurpose river projects?

(a) Multipurpose projects bring water to those areas which suffer from water scarcity.

(b) Multipurpose projects help to control floods by regulating water flow.

(c) Multipurpose projects lead to large scale displacements and loss of livelihood.

(d) Multipurpose projects generate electricity for our industries and our homes.

Ans. (c) Multipurpose projects lead to large scale displacements and loss of livelihood.

Q.2. Based on the information given below, classify each of the situations as 'suffering from water scarcity' or not suffering from water scarcity.

(a) Region with high annual rainfall.

— Not suffering from water scarcity – because it receives good natural freshwater supply which is renewed annually during the rainy periods.

(b) Region having high annual rainfall and large population.

— Suffering from water scarcity, because large population means more requirement of water for foodgrain production, industrialisation and urbanisation as well for domestic consumption which exhaust available water resources due to over-exploitation.

(c) Regions having high annual rainfall but water is highly polluted.

— Suffering from water scarcity – because the available fresh water sources, inspite of being renewed, are rendered useless due to pollution. Pollution turns the water sources toxic and they become hazardous and unusable for human consumption.

(d) Regions having low rainfall and low population.

— Not suffering from water scarcity – because the low demand for water by lower population compensates for the low water availability.

Q.3. Here are some false statements. Identify the mistakes and rewrite them correctly.

(a) Multiplying urban centres with large and dense population and urban lifestyle have **helped in proper utilisation of water resources.**

Correct : Multiplying urban centres with large and dense population and urban lifestyles have not only added to water and energy requirements but have further aggravated the problem.

(b) Regulating and damming of rivers **do not affect the river's natural flow and its sediment flow.**

Correct : Regulating and damming of rivers affect the river's natural flow causing poor sediment flow.

(c) In Gujarat, the Sabarmati basin farmers **were not agitated** when higher priority was given to water supply in urban areas, particularly during droughts.

Correct : In Gujarat, the Sabarmati basin farmers were agitated and almost caused a riot when higher priority was given to water supply in urban areas, particularly during droughts.

(d) Today in Rajasthan, the practice of rooftop rainwater water harvesting **has gained popularity despite** high water availability due to Rajasthan Canal.

Correct : Today in Rajasthan, the practice of rooftop rainwater harvesting is on the decline on account of high water availability due to Rajasthan Canal.

Q.4. Compare the advantages and disadvantages of multipurpose river projects.

Ans. Multipurpose river projects provide us with multiple benefits like (i) irrigation (ii) hydroelectricity for out industries and homes (iii) water for domestic and industrial use regulating flow of water and helping (iv) flood control (v) recreational facilities (vi) inland navigation and (vii) pisciculture and (viii) soil conservation through afforestation. The many purposes for which the impounded water of the these present day dams termed as multipurpose projects, are used, integrates progress of agriculture with rapid industrialisation. They bring water to those areas which suffer from water scarcity.

But the multipurpose river projects have come under great scrutiny in recent times because of (i) their failure to fulfil their basic objectives like flood control and the disadvantages resulting out of building of such projects. (ii) Regulating and damming of rivers affect the natural flow of the rivers, cause exessive sedimentation and adversely affect aquatic life. (iii) The reservoirs that are created in the floodplains overflow and submerge the existing vegetation and soil, consequently leading to their decomposition. (iv) Multipupose projects lead to large scale displacement of local communities and to loss of their livelihood (v) Excessive use of water, and over-irrigation on account of the projects lead to land degradation and cause waterborne disease, pests and pollution.

Q.5. Three-fourths of the world is covered with water and water is a renewable resource. Yet many countries and regions around the globe suffer from water scarcity. Explain.

OR

What is water scarcity and what are its main causes?

Ans. Shortage in the availability of usable water resource is known as water scarcity.

Three-fourth of the world is covered with water. But out of that 96.5 percent of water is estimated to exist as oceans and seas which are saline in nature and unfit for general use. Only 2.5 percent of the total volume of the world's water exists as freshwater. Though water is continuously renewed and recharged by the hydrological cycle, it is also being continuously used by the ever increasing population. Overuse and often misuse is leading to scarcity of this valuable resource. Hence, many countries and regions around the globe suffer from water scarcity.

Regions of low and erratic and uncertain rainfall face water scarcity. But water scarcity may be faced also in regions of high rainfall if the population is large. A large population means more requirement of water for producing more food, more consumption of water for domestic purposes and for expanding industries. These exhaust the available water resource and create water scarcity.

In some areas unequal access to water among different social groups creates water scarcity.

Pollution of existing water bodies due to discharge of industrial effluents and wastes, spoil the available water and create water scarcity.

Q.6. Describe how modern adaptations of traditional rain water harvesting methods are being carried out to conserve and store water.

Ans. Rooftop rainwater harvesting in Gendathur village of Mysore, Karnataka is an example of modern adaptation of traditional rainwater harvesting methods being carried out to conserve and store water. Gendathur is a remote, backward village in Mysore, Karnataka, which has earned the rare distinction of being rich in rainwater because of successful rainwater harvesting by the villagers.

Gendathur receives an annual precipitation of 1000 mm. The villagers have utilised this rainwater to meet their water need by collecting it throught rooftop rainwater harvesting system in their individual houses. Nearly 200 households in the village have installed the system. As such, with 80 percent of collection efficiency of the annual precipitation and about 10 fillings of rain, every house in Gendathur can collect and use about 50,000 litres of water annually. The net amount of rainwater estimated to be harvested annually from all the households amount to 10,00,000 litres.

Tamil Nadu is the first and the only state of India which has made modern rooftop rainwater harvesting structure compulsory to all houses acrosss the state.

Recharging of groundwater by means of dug wells, pits, handpumps etc., is a new concept of rainwater harvesting being adopted in many areas to conserve and store water.

Q.7. Discuss how rainwater harvesting in semi-arid regions of Rajasthan is carried out.

Ans. In some of the semi-arid regions of Rajasthan, agricultural fields were converted into rain-fed storage structures that allowed water to stand and moisten the soil. These structures are locally known as 'johads'. In the arid areas of Jaisalmer such structures are known as 'Khadins'.

In the semi-arid and arid regions of Rajasthan, particularly in Bikaner, Phalodi and Barmer, almost all the houses, traditionally, had big underground tanks called 'tankas' for storing drinking water.

The tankas were part of the well-developed rooftop rainwater harvesting system. The tanks could be as large as a big room, one household in Phalodi had a tank that was 6.1 metres deep,

4.27 metres long and 2.44 metres wide. Rainwater, commonly known as 'palar pani' in local language, is considered as the purest form of natural water in this region and was stored for drinking purpose.

The water was collected by channelising rainwater through pipes from the sloping rooftop to the underground tanks built inside the house or courtyard.

The first spell of rain was usually not collected as it would clean the roofs and pipes. As a result it would be dirty, and unfit for drinking purpose.

The rainwater from the subsequent showers was then collected and stored in the tankas till the next rainfall, making it an extremely reliable source of drinking water when all others sources dried up, particularly during summers.

Many houses constructed underground rooms adjoining the tankas to combat the summer heat as it would keep the rooms cool naturally.

The practice of rainwater harvesting, is however, declining in Western Rajasthan at present because the perennial Indira Gandhi Canal or Rajasthan Canal provides plenty of water to the region, throughout the year.

OTHER IMPORTANT QUESTIONS (AS PER CCE PATTERN)

B. MULTIPLE CHOICE QUESTIONS (1 MARK)

Q.1. Which of the following data shows the percentage of global precipitation that is received by India?

(a) 96.5 per cent (b) 30 per cent (c) 4 per cent (d) 2.5 per cent

Ans. (c)

Q.2. Which of the following areas would you immediately associate with water scarcity?

(a) Deserts of Rajasthan (b) The Ganga Plains
(c) Hills of North-Eastern India (d) Coastal areas of Orissa

Ans. (a)

Q.3. Which of the following is a reason for water scarcity in a region with sufficient water to meet the requirements of the people?

(a) Huge population (b) Less rainfall (c) Power requirement (d) Pollution

Ans. (d)

Q.4. Which of the following contributes approximately 22 per cent of the total electricity produced in India today?

(a) Solar power (b) Hydroelectric power
(c) Industries (d) Geothermal energy

Ans. (b)

Q.5. Which of the following problems arises due to water pollution?

(a) Sedimentation of water bodies (b) Water-borne diseases
(c) Discharge of industrial waste (d) Spawning of aquatic life

Ans. (b)

Q.6. Which of the following hydraulic structures is not a feature of ancient times?

(a) Multipurpose river valley projects (b) Dams built of stone rubble

(c) Reservoirs or lakes (d) Embankments and canals

Ans. (a)

Q.7. Which of the following is one of the largest artificial lakes of ancient India built in the 11th century?

(a) Govindsagar Lake (b) Hauz Khas (c) Bhopal Lake (d) Dal Lake

Ans. (c)

Q.8. Which of the following hydraulic structures was constructed by Iltutmish in the 14th century for supplying water to Siri Fort area?

(a) Water harvesting at Sringaverapura near Allahabad

(b) Bhopal Lake

(c) Tank in Hauz Khas, Delhi

(d) Irrigation work at Nagarjunakonda

Ans. (c)

Q.9. Which of the following hydraulic structures is built in river basins?

(a) Lakes (b) Dams (c) Tanks (d) Water harvesting

Ans. (b)

Q.10. In which of the following areas can you find one of the oldest water-harvesting systems of India?

(a) Sringaverapura near Allahabad (b) Kalinga, Orissa

(c) Bennur, Karnataka (d) Nagarjunakonda, Andhra Pradesh

Ans. (a)

Q.11. 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

Ans. (d)

Q.12. 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

Ans. (c)

Q.13. On which of the following rivers is the Hirakud dam constructed?

(a) Satluj (b) Beas (c) Mahanadi (d) Narmada

Ans. (c)

Q.14. 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

Ans. (b)

Q.15. 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

Ans. (c)

Q.16. 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

Ans. (a)

Q.17. On which of the following rivers are the Tilaiya, Panchet, Maithon, Konar and Bokaro dams located?

(a) R. Satluj (b) R. Damodar (c) R. Mahanadi (d) R. Krishna

Ans. (b)

Q.18. Which of the following river projects or groups of river projects provide hydroelectricity to the industries of Maharasthra?

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

Ans. (a)

Q.19. 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

Ans. (c)

Q.20. Which of the following environmental damages are not induced due to multipurpose projects?

(a) Water-borne diseases and pests
(b) Pollution resulting from excessive use of water
(c) Earthquakes (d) Volcanic activity

Ans. (d)

Q.21. In which of the following areas are 'guls' and 'kuls' used to channel water for agriculture?

(a) Deccan Plateau (b) Deserts of Rajasthan
(c) Western Himalayas (d) Ganga Plains

Ans. (c)

Q.22. Due to which of the following reasons are rooftop rainwater harvesting commonly practised, particularly in Rajasthan?

(a) To store water for irrigation (b) To keep the house cool
(c) To store drinking water (d) To clean the rooftops

Ans. (c)

Q.23. Which of the following structures are known as 'tankas'?

(a) Underground tanks for storing rainwater harvested from roof tops for drinking purpose
(b) Tanks constructed on rooftops for storing rainwater
(c) Tanks constructed in agricultural fields to store rainwater
(d) Tanks constructed to store floodwater

Ans. (a)

Q.24. In which of the following states is the bamboo-drip irrigation system prevalent?
(a) Rajasthan (b) Himachal Pradesh (c) West Bengal (d) Meghalaya

Ans. (d)

PREVIOUS YEARS' QUESTIONS

Q.1. Bamboo drip irrigation is prevalent in which of the following states? [2010, 2011 (T-1)]
(a) Rajasthan (b) Meghalaya (c) Karnataka (d) Madhya Pradesh

Ans. (b)

Q.2. Who among the following proclaimed dams as the temple of modern India? [2010 (T-1)]
(a) Rajendra Prasad (b) Jawaharlal Nehru (c) Sardar Patel (d) Mahtama Gandhi

Ans. (b)

Q.3. Roof tap rainwater harvesting system in Rajasthan is known as : [2010 (T-1)]
(a) Guls (b) Kuls (c) Tankas (d) Baobs

Ans. (c)

Q.4. Which one of the following is not an adverse effect of dams? [2010 (T-1)]
(a) Interstate water disputes (b) Excessive sedimentation of Reservoir
(c) Displacement of population (d) Flood control

Ans. (d)

Q.5. Which of the following is not a method of water haresting used in Rajasthan? [2010 (T-1)]
(a) Johads (b) Khadins (c) Guls (d) Tankas

Ans. (c)

Q.6. How much of the earth surface is covered with water? [2010, 2011 (T-1)]
(a) About 1/4 (b) About 1/2 (c) About 3/4 (d) About 2/3

Ans. (c)

Q.7. On which one of the following rivers the Tehri Dam is being constructed? [2010 (T-1)]
(a) Bhagirathi (b) Yamuna (c) Koshi (d) Sutlej

Ans. (d)

Q.8. Which of the following rivers is not having any multipurpose river project? [2010 (T-1)]
(a) Satluj-Beas (b) Mahanadi (c) Narmada (d) Yamuna

Ans. (d)

Q.9. On which one of the following rivers Mettur dam is constructed? [2010, 2011 (T-1)]
(a) River Kaveri (b) River Krishna (c) River Godavari (d) River Mahanadi

Ans. (a)

Q.10. What is the contribution of hydroelectricity in the total generation of electricity? **[2010 (T-1)]**

(a) 52% (b) 42% (c) 32% (d) 22%

Ans. (d)

Q.11. How much percent of the total volume of world's water is estimated to exist as fresh water? **[2010, 2011 (T-1)]**

(a) 2.5 (b) 3.5 (c) 4.5 (d) 5.5

Ans. (a)

Q.12. Which of the following is a source of Fresh water ? **[2010 (T-1)]**

(a) Precipitation (b) Surface runoff (c) Groundwater (d) All the above

Ans. (c)

Q.13. In which of the following regions, people built 'Guls' and 'Kuls' for irrigation? **[2010 (T-1)]**

(a) Northern Plains (b) Western Himalayas (c) Coastal areas (d) None of these

Ans. (b)

Q.14. Hirakud dam is built on which river? **[2010, 2011 (T-1)]**

(a) Chenab (b) Mahanadi (c) Krishna (d) Satluj

Ans. (b)

Q.15. In which one of the following states was rooftop rainwater harvesting practised? **[2010 (T-1)]**

(a) West Bengal (b) Haryana (c) Rajasthan (d) Punjab

Ans. (c)

Q.16. Salal Dam is built on which river? **[2010 (T-1)]**

(a) Chenab (b) Mahanadi (c) Krishna (d) Satluj

Ans. (a)

Q.17. Against the construction of which one of the following multipurpose projects was the Narmada Bachao Andolan launched? **[2010, 2011 (T-1)]**

(a) Sardar Sarovar (b) Bhakra Nangal (c) Rihand (d) Tehri

Ans. (a)

Q.18. Tanka, a rainwater harvesting technique, is associated with which of the following states? **[2010 (T-1)]**

(a) Tamil Nadu (b) West Himalayas (c) Gujarat (d) Rajasthan

Ans. (d)

Q.19. Which of the following is not one of the reasons for criticism of multipurpose river valley projects? **[2010 (T-1)]**

(a) They create a rockier stream bed

(b) They create poorer habitats for the river's acquatic life

(c) The reservoirs created in the floodplain submerge vegetation

(d) They help in generation of hydroelectricity

Ans. (d)

Q.20. Large scale irrigation has led to : **[2010, 2011 (T-1)]**

(i) Changed cropping pattern in many regions

(ii) Increased salinisation of soil
(iii) Average reduction in crop production
(iv) Increasing gap between the rich and the poor farmers

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

Ans. (c)

Q.21. What percentage of the total volume of world's water is estimated to exist as oceans? [2010 (T-1)]

(a) 94.5% (b) 95.5% (c) 96.5% (d) 97.5%

Ans. (c)

Q.22. Nagarjuna Sagar Dam is built on which river? [2010, 2011 (T-1)]

(a) Clenab (b) Mahanadi (c) Krishna (d) Satluj

Ans. (c)

Q.23. Sardar Sarovar Dam is constructed on : [2010, 2011 (T-1)]

(a) River Krishna (b) River Mahanadi (c) River Cauvery (d) River Narmada

Ans. (d)

Q.24. In which one of the following states palar pani is considered the purest form of natural water? [2011 (T-1)]

(a) Gujarat (b) Rajasthan (c) Madhya Pradesh (d) Chhattisgarh

Ans. (b)

Q.25. Which of the following is not the cause of water scarcity? [2011 (T-1)]

(a) Rapid growth of population (b) Uneven distribution of water resources
(c) Construction of dams and reservoirs (d) Increase in demand

Ans. (c)

Q.26. Which state has made rooftop rainwater harvesting structure compulsory to all the houses across the state? [2011 (T-1)]

(a) Kerala (b) Karnataka (c) Tamil Nadu (d) Andhra Pradesh

Ans. (c)

Q.27. On which of the following rivers is Koyena dam built? [2011 (T-1)]

(a) Krishna (b) Kaveri (c) Ganga (d) Mahanadi

Ans. (a)

Q.28. Which of these is the major source of fresh water in India? [2011 (T-1)]

(a) Ground water (b) Ocean water (c) Tanks (d) Waterfalls

Ans. (a)

C. SHORT ANSWER TYPE QUESTIONS (3 MARKS)

Q.1. Why has the water shortage problem aggravated in post-independence India?

Ans. Intensive industrialisation and urbanisation witnessed in post-independence India have significantly contributed to the exploitation of available freshwater resources. Industries require huge supply of water for production, cooling of machineries and for power supply in form of hydroelectricity. Ever increasing urban centres with large and dense population

and urban lifestyles have increased the domestic water requirement and power requirement. Individual groundwater pumping devices in housing complexes of big cities have aggravated the problem of depletion of water resources. Agricultural progress in the post-independence era has also led to water scarcity. Irrigation in different forms to increase agricultural production exploits the available surface and groundwater sources excessively. As a result of the above mentioned reasons the water shortage problem has aggravated in post-independence India.

Q.2. Why should we conserve and manage our water resources? How can we control over-exploitation and mismanagement of water resources? State any two points that should be kept in mind for efficient management of water.

Ans. We should conserve and manage our water resouces to safeguard ourselves from health hazards, to ensure food security as well as for continuation of our livelihood and productive activities. Taking into consideration the problem of water scarcity and decreasing freshwater resources, the need of the hour is to conserve and manage our water resources.

Over-exploitation and mismanagement of water resources can be controlled through conservation and management of water resources. Conservation can also prevent degradation of our natural ecosystem as well as control the ecological crisis that may arise due its scarcity.

Two points that should be kept in mind for efficient management of water are :

(i) Prevention of water pollution, so that available water sources are not rendered unusable.

(ii) Integrated Water Resource Management should develop water saving technology and recycling and reuse of water.

Rainwater harvesting should be promoted.

Q.3. Mention a negative effect of irrigation? How can irrigation transform the social landscape?

Ans. Irrigation has changed the cropping pattern of many regions with farmers shifting to cultivation of water intensive and commercial crops. This has great ecological consequences. It leads to water logging and consequent salinisation of the soil. This is a negative effect of irrigation.

As rich farmers have better access to irrigation they have earned more money due to the production of commercial crops. On the other hand, the landless poor who couldn't avail of its benefit, became poorer. Thus, irrigation has transformed the social landscape by increasing the social gap between rich landowners and the landless poor farmers.

Q.4. Give examples of traditional water harvesting system prevalent in various parts of India.

Ans. Traditional water harvesting system prevalent in various parts of the India include the following methods :

(i) Diversion channels like 'guls' and 'kuls' of Western Himalayas are built in hilly and mountain areas for irrigating agricultural fields.

(ii) In hilly areas of Meghalya, bamboo-drip irrigation system taps stream and spring water.

(iii) Inundation channels are constructed to irrigate agricultural fields in the floodplains of Bengal.

(iv) In the arid regions of Rajasthan agricultural fields were converted into rainfed storage structures locally known as 'Khadins' in Jaisalmer and 'Johads' in other parts of Rajasthan. These structures allowed the water to stand and moisten the soil.

(v) Rooftop rainwater harvesting was commonly practised to store drinking water particularly in Rajasthan. In the semi-arid and arid regions of Rajasthan, particularly in Bikaner,

Phalodi and Barmer, almost all the houses traditionally had underground 'tankas' or 'tanks' for storing drinking water.

Q.5. What is rainwater harvesting? State the objectives of rainwater harvesting.

Ans. Rainwater harvesting is an efficient method of water conservation and management. The techniques of collecting and storing rainwater directly or recharging it into the ground through artificial means to improve groundwater storage is called rainwater harvesting. It includes traditional methods like (i) conversion of agricultural fields into rainfed storage structures locally known as 'Khadins' and 'Johads' in Rajasthan, (ii) rooftop rainwater harvesting to store drinking water in tanks or sumps for direct usage and to recharge and use groundwater for household purposes through abandoned wells or check dams, or through handpumps during dry season.

Rainwater harvesting is very simple, practical and cost effective and can be easily conducted by individuals to solve their water problem.

The objectives of rainwater harvesting are :

(i) To prevent wastage and pollution of the monsoon rains.

(ii) To reduce runoff and control the flooding of roads.

(iii) To recharge and improve the quality of groundwater storage and raise water table.

(iv) The meet the demands of domestic water requirement during dry season.

(v) To solve problem of drinking water shortage especially in regions receiving less rainfall.

PREVIOUS YEARS' QUESTIONS

Q.1. What is rainwater harvesting? Explain any two different methods of rainwater harvesting in different regions of India. [2010, 2011 (T-1)]

Ans. Rainwater harvesting is a system in which rain water is collected through various techniques and then collected water is used in many ways.

(i) **Hill region -** In hilly region people built diversion channels like the "guls" or "kuls" in the western Himalayas for agriculture. With these channel rainwater is used in meaningful ways.

(ii) **Arid region -** In Rajasthan almost all houses had underground tanks. These tanks were part of well developed rooftop rainwater harvesting system. They were connected to the sloping roof of the houses through a pipe. Rain falling on the rooftops would travel down the pipe and get stored in these underground 'tankas'.

Q.2. What is a multipurpose river valley project? Give any four objectives of the multipurpose river valley project. [2010, 2011 (T-1)]

Ans. The multipurpose river valley project is a river project in which a dam is constructed on the river and stored water is then used in a number of for like irrigation, power generetion etc. Four objectives of multipurpose projects are :—

(i) To check floods by regulating flow of water.

(ii) To generate hydropower for our industries and homes.

(iii) To provide irrigation facilities. This helps in increasing agricultured productivity and bringing more area under cultivation.

(iv) To check soil Erosion.

Q.3. Discuss how rainwater harvesting in semi-arid regions of Rajasthan is carried out. **[2010 (T-1)]**

Ans. Rain water harvesting in semi-arid region of Rajasthan is carried out in the following ways :- In Bikaner, Phalodi and Barmer, almost all the houses traditionally had underground tanks or ''tankas'' for storing drinking water. The tanks could be as large as a big room; one household in Phalodi had a tank that was 6.1 metres deep, 4.27 metres long and 2.44 metres wide. The tankas were part of the well developed rooftop rainwater harvesting system and were built inside the main house or the courtyard. They were connected to the sloping roofs of the houses through a pipe. Rain falling on the rooftops would travel down the pipe and was stored in these underground 'tankas'.

Q.4. Describe three traditional methods of rainwater harvesting practised in India. **[2010, 2011 (T-1)]**

Ans. In India traditionally rainwater harvesting is done in the following ways :—

(i) In hilly regions people built diversion channels like the guls or kuls for agriculture.
(ii) In Rajasthan rooftop rainwater harvesting is practised.
(iii) In Bengal people built inundation channels to irrigate their fields.
(iv) In arid and semi-arid regions people convert their agricultural fields into rainfed storage structures.

Q.5. Give three reasons for water scarcity in post-independence India **[2010, 2011 (T-1)]**

Ans. Three reasons for water scarcity in India are :–

(i) Post-independance India has witnessed intensive industrialisation and urbanisation which increased water demand.
(ii) Large urban centres with large and dense population and urban lifestyles have only added to water requirement.
(iii) Population explosion after independence led to overexploitation of underground water for irrigation.

Q.6. 'Three-fourths of the earth's surface is covered with water but there is still scarcity of water across the globe' Explain giving three reasons. **[2010, 2011 (T-1)]**

Ans. Water scarcity is due to the following causes :—

(i) Water availability varies over space and time mainly due to the variation in seasonal and annual precipitation.
(ii) Rapid urbanisation is another factor for water scarcity.
(iii) Rapid increase in population that demand more and more water.
(iv) Industrialisation is another cause, large industrial houses are using more and more water, they also require more water to generate electricity.
(v) Rising income levels also create more demand for water.
(vi) 96.5 per cent of the total volume of world's water is estimated to exist as oceans and only 2.5 per cent as fresh water. Nearly 70 per cent of this freshwater occurs as ice sheets and glaciers, while a litlle less than 30 per cent is stored as groundwater in the world's aquifers.

Q.7. How have industrialisation and urbanisation aggravated water scarcity in India? **[2010, 2011 (T-1)]**

Ans. Industrialisation and urbanisation have aggravated water scarcity in India in the following ways :

(i) Large industrial houses are exerting pressure on existing freshwater resources. Industries apart from being heavy user of water also require water power to run them.

(ii) Multiplying urban centre with large and dense population and urban lifestyles have not only added to water and energy requirement but further aggravated the problems. Water resources are being over-exploited.

Q.8. Why is the conservation and management of water resources important? Give any three reasons. [2010 (T-1)]

OR

Why is there an urgent need to conserve and manage our water resources? Give three reasons. [2011 (T-1)]

Ans. The conservation and proper management of water is necessary because of following reasons:

(i) **Growing population :-** As population is growing its need for water is also growing, so it is necessary to properly manage the availability of water.

(ii) **Increasing Urbanisation :-** More and more people are moving to cities where need of water is growing. On the other hand, cities are overexploiting and polluting water resources, so there is need to conserve water.

(iii) **Due to industrialisation** also water is being overexploited. So, without proper conservation it would be difficult to survive.

Q.9. Explain any three disadvantages of multipurpose projects. [2010, 2011 (T-1)]

Ans. Three disadvantages of multipurpose projects are :-

(i) A large area is submerged with water causing destruction of wildlife and forests.

(ii) A large number of people living in the affected areas are displaced, so their rehabilitation remains a problem.

(iii) Aquatic life and natural course of rivers get affected. Multipurpose projects had to destruction of flora and fauna.

Q.10. Why are different water harvesting systems considered a viable alternative both socio - economically and environmentally in a country like India? [2010, 2011 (T-1)]

Ans. No single method can be applicable everywhere. It is true in rain case of water harvesting system too, as geographically there are different regions. Different regions have different methods.

(i) **In Hilly region :-** Through kuls or guls it is very easy to divert water for irrigation. It is a low cost method.

(ii) **In Arid region :-** Like in Rajasthan rainwater is collected on roofs, then piped into ground storage system. That method is also economical, needing no extra effort.

(iii) In villages agricultural fields are converted into ponds where rainwater is collected. All these methods are very easy and viable

Q.11. How far have the multipurpose projects been able to achieve their purpose for which they were made? Explain. [2010 (T-1)]

Ans. To some extent multipurpose river valley projects have been able to achieve their purpose. Irrigation has increased, power generation is a classic example of their success. But there are some concerns too.

(i) They have obstructed the natural flow of rivers causing destruction of habitat aquatic life.

(ii) People have also been affected as their habitat too have been submerged. It leads to socio-economic proplems of big magnitude as lakhs of people are displaced.

(iii) This has led to huge destruction of flora and fauna, forests and biodiversity.

Q.12. Why is the need for water increasing day by day? Explain three reasons. [2011 (T-1)]

Ans. (i) Rapid industrialisation and urbanization have led to greater demand for water. Industries need water for various purposes.

(ii) Large population means more water is needed for domestic use and for agriculture to produce more food.

(iii) Multiplying urban centres with large and dense population and urban life-styles have led to greater need for water.

Q.13. Give an acount of any three hydraulic structures of ancient India. [2011 (T-1)]

Ans. (i) During the period of Chandragupta Maurya dams, lakes and irrigation systems were extensively built.

(ii) In the 11th century, Bhopal lake, one of the largest artificial lakes of its time was built.

(iii) In the first century B.C. Sringaverpur near Allahabad had large and complex water harvesting system chenneling the water of the Ganga.

Q.14. 'Large multi-purpose projects also lead to land degradation.' Explain. [2011 (T-1)]

Ans. Regulating and damaging of rivers affect their natural flow causing poor sediment flow and excessive sedimentation at the bottom of reservoir. Large reservoirs submerge large tracts of forests, flora and fauna. They also submerge soil leading to its decomposition over a period of time.

D. LONG ANSWER TYPE QUESTIONS (4 MARKS)

Q.1. Multipurpose river projects are referred as the 'temples of modern India.' Elucidate.

OR

Why did Jawaharlal Nehru proudly proclaim the dams as teh temples of modern India? (2010)

Ans. Multipurpose River Projects were launched after Independence with the approach of integrated water resource management. The objective was to provide multifarious benefits that would lead to the development and progress of the nation, overcoming the handicap of its colonial past. Jawaharlal Nehru had proudly proclaimed the present-day dams or multipurpose projects as 'temples of modern India'. The reason behind this was that these projects integrate the

development of agriculture with rapid industrialisation and lead to the progress of both the village and urban economy.

The benefits provided by Multipurpose Projects include :

(i) Providing water to those areas which suffer from water scarcity.

(ii) Irrigation of agricultural fields during dry season as well as in regions of scanty or inadequate rainfall.

This helps in increasing agricultural productivity and bringing more area under cultivation.

(iii) Flood control by regulating flow of water.

(iv) Water supply for domestic and industrial purposes.

(v) Generation of hydroelectricity for our industries and homes.

(vi) Inland navigation for the purpose of transport and trade.

(vii) Fish breeding.

(viii) Recreational facilities.

(ix) Soil conservation through afforestation.

As a result of these benefits that lead to all round development of the nation, the multipurpose projects are termed as 'temples of modern India.'

Q.2. In recent years, multipurpose projects and large dams have come under great scrutiny and opposition. Explain why. (2010)

Or

What objections have been raised against multipurpose river valley projects? Explain any three.

Ans. In recent years, multipurpose projects and large dams have come under great scrutiny and opposition for a variety of reasons.

(i) Regulating and damming of rivers affect their natural flow and lead to sedimentation and rockier stream beds which become poorer habitates for aquatic life.

(ii) Fragmentation of the river, its diverson and barricading due to building of dams affect migration and spawning of aquatic life.

(iii) The reservoirs that are created on the floodplain overflow and submerge the existing vegetation and soil and consequently lead to their decomposition and land degradation.

(iv) Ironically, the dams that were constructed with the objective of flood control have triggered floods due to sedimentation in the reservoir and release of excess water during heavy rains.

(v) The primary cause of resistance to some multipurpose projects like the 'Narmada Bachao Andolan' and the 'Tehri Dam Andolan' by activists of social and ecological movements is large scale displacement of local communities who lose their livelihood when ousted from their land for the projects.

(vi) Landowners and large farmers, industrialists and a few urban centres are benefitted while the more numerous local people who give up their land for the projects hardly receive any

benefit. This widens the social gap between the rich and the poor and leads to social tensions.

(vii) Interstate water disputes with regard to sharing the costs and benefits of multi-purpose projects are leading to tension between states, e.g. Kaveri-Godavari dispute, Sabarmati water dispute.

(viii) It has also been observed that multipurpose projects induced earthquakes, caused water borne-diseases and pests, and led to pollution resulting from excessive use of water.

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

Ans. Tension created between two or more states regarding sharing of river water mainly due to construction of multipurpose projects is termed as interstate water dispute. Interstate water disputes arise between states regarding sharing of the costs and benefits of the multipurpose projects. When a river flows through two or more states, damming at one state may affect the flow and volume in another state. If the flow is not regulated, one state may derive multiple benefits from the river, and another state may suffer leading to interstate disputes.

Interstate water disputes :

(i) The Krishna-Godavari dispute is due to the objections raised by Karnataka and Andhra Pradesh regarding the diversion of more water at Koyna, a tributary of river Krishna, by Maharashtra government for the Koyna hydroelectric project. The construction of the multipurpose project would reduce downstream flow in their states with adverse consequences for their agriculture and industry.

(ii) The Kaveri water dispute between Karnataka and Tamil Nadu regarding sharing of the water of Kaveri river.

(iii) Narmada River water dispute involving Rajasthan, Madhya Pradesh, Gujarat, Maharashtra and (iv) Ravi-Beas water dispute between Punjab and Haryana and (v) Mandovi-Mahadayi-Vansadhara and dispute between Goa, Karnataka and Andhra Pradesh and Orissa.

Q.4. Write about the rooftop rainwater harvesting system prevalent in Meghalaya. How is the bamboo drip irrigation system employed for water harvesting in Meghalaya.

Ans. Rooftop rainwater harvesting is the most common practice in Shillong, Meghalaya. Shillong, the capital of Meghalaya, is situated only at a distance of 55 km from Mawsynram, the place receiving highest rainfall in the world. Yet, it faces acute water shortage as it is located in the rainshadow area on the leeward side of Khasi hills. So, nearly every household has rainwater harvesting structure to tap whatever amount of rainfall is received by the area for use during dry periods. Nearly 15 to 25 percent of the total water requirement of the households comes from rooftop rainwater harvesting.

The Bamboo-drip irrigation system prevalent in Meghalaya is 200-years old system of tapping stream and spring water by using bamboo pipes. Bamboo grows naturally in plenty in the region. Hence, bamboos are used instead of pipes for collection of water free of cost. Bamboo pipes are used to divert water from perennial springs on the hilltops to the lower reaches by gravity. The channel sections, made of bamboo, divert water to the plant site where it is

distributed into branches, again made and laid out with different forms of bamboo pipes. The flow of water into the pipes is controlled by manipulating the pipe positions. The last channel section enables water to be dropped near the roots of the plant.

About 18-20 litres of water enters the bomboo pipe system, gets transported over hundreds of metres, and finally reduces to 20-80 drops per minute at the site of the plant.

Q.5. An area or region may have ample water resources but still face water scarcity. Explain why such circumstances arise.

Ans. (i) Water scarcity in most of the cities are an outcome of dense and growing population. The multiplying urban centres and urban lifestyles of the huge population have not only added to water and power requirements but have also aggravated the problem by over-exploiting available groundwater resources.

(ii) A large and growing population results in greater demands of water and consequently unequal access to it, especially in rural areas.

(iii) More water is required for domestic use by the multiplying population. Over and above, available water resources are over- exploited for expanding irrigation and dry season farming to facilitate higher foodgrain production. Over irrigation may lead to falling groundwater levels, adversely affecting water availability and food security of the people.

(iv) Ever-increasing number of industries with their heavy consumption of water and hydroelectricity have placed undue pressure on the existing freshwater resources.

(v) Another situation of water scarcity arises when the available water resources are rendered unusable due to pollution by discharge of effluents from industries, use of pesticides and chemical fertilisers in agriculture and due to dumping of domestic wastes.

Q.6. Identify the reasons (any three) for water scarcity specially, in metropolitan towns. Suggest one measure that in your opinion can lead to a more equitable distribution of available water supply.

Ans. Metropolitan towns are characterised by large and dense population and intensive urbanisation as well as industrialisation. The fast development demands excess use of water leading to water scarcity. The main reasons for water scarcity in metropolitan towns are as follows :

(i) The dense population with urban lifestyles not only consumes more water and energy for daily domestic requirements but has further aggravated the problem by over-exploiting the available groundwater resource.

Housing societies and colonies in the metropolitan cities have their own groundwater pumping devices to meet their water needs. As such, the groundwater level in the cities has been adversely affected due to over-exploitation.

(ii) Industries and multinational corporations in the metropolitan cities have made the water situation worse. They have exerted pressure on existing freshwater resources due to heavy consumption of water and hydroelectricity.

(iii) Water pollution due to discharge of domestic and industrial wastes into water bodies leads to water scarcity.

A more equitable distribution of available water supply throughout the country can be achieved through linking of the river systems of India. This can distribute the water in the various river basins from areas of surplus to areas with deficient water resources.

Q.7. Water is available in abundance in India but even then scarcity of water is experienced

in major parts of the country. Explain with four examples.

Ans. India receives nearly 4 per cent of the global precipitation. The total renewable water resources of India are estimated at 1,897 sq km per annum. Inspite of this fact that water is available in abundance in India, scarcity of water is experienced in major parts of the country. At present India ranks 133rd in the world in terms of water availability per person per annum. It is predicted that by 2025, large parts of India will join countries or regions having absolute water scarcity.

Geographically, some parts of India like the desert region of Rajasthan receive low rainfall and are drought-prone. Thus, water shortage is a common and regular problem of such regions.

The metropolitan cities of India like Mumbai and Kolkata face acute water shortage on account of large and dense populations and their urban lifestyles requiring more water and power consumption. The multistoreyed buildings and housing complexes or colonies have their own groundwater pumping devices which lead to over-exploitation and depletion leading to water scarcity.

In the industrial areas of Uttar Pradesh, National Capital Region, Bihar etc. water pollution due to discharge of effluents and industrial wastes and chemicals has turned big rivers like Ganga and Yamuna into toxic streams. Though freshwater resources are present in sufficient quantities, it is unfit and hazardous for human use.

In agriculturally advanced regions of India like Punjab, Haryana and Western Uttar Pradesh, to facilitate higher foodgrain production for our growing population, water resources are being over-exploited to expand irrigated areas and dry-season agricultrure. Over-irrigation in these areas have adversely affected water-availability.

Q.8. How have intensive industrialisation and urbanisation passed a great pressure on existing freshwater resources in India? Explain with two examples for each.

Ans. Intensive industrialisation and urbanisation in the post-independence period have exerted great pressure on existing freshwater resources of India. The following examples further explain their effects on the fragile water resources of India.

Effects of industralisation. Industries like cotton textile mills of Maharashtra, jute textile mills of Hooghly basin in West Bengal and all the iron and steel plants in the Damodar Valley region and other parts of the country are heavy users of water and require large supply of hydroelectricity. The existing freshwater sources of these regions are over-exploited as a result. Discharge of industrial effluents and dumping of industrial wastes and chemicals have turned big rivers like Ganga and Yamuna into toxic streams unfit and hazardous for human use. Pollution of the freshwater resources have lead to water scarcity.

Effects of urbanisation. The metropolitan cities of India like Mumbai and Kolkata face acute water shortage on account of large and dense population and their urban lifestyles requiring more water and power consumption.

Housing societies and colonies and multistoreyed buildings in the cities have their own groundwater pumping devices which lead to over-exploitation and depletion of the fragile water resources.

E. MAP WORK (4 MARKS)

Q.1. On an outline map of India, mark and label the following :

(a) The river on which the Sardar Sarovar Dam is being built

(b) The river on which the Hirakud Dam is built

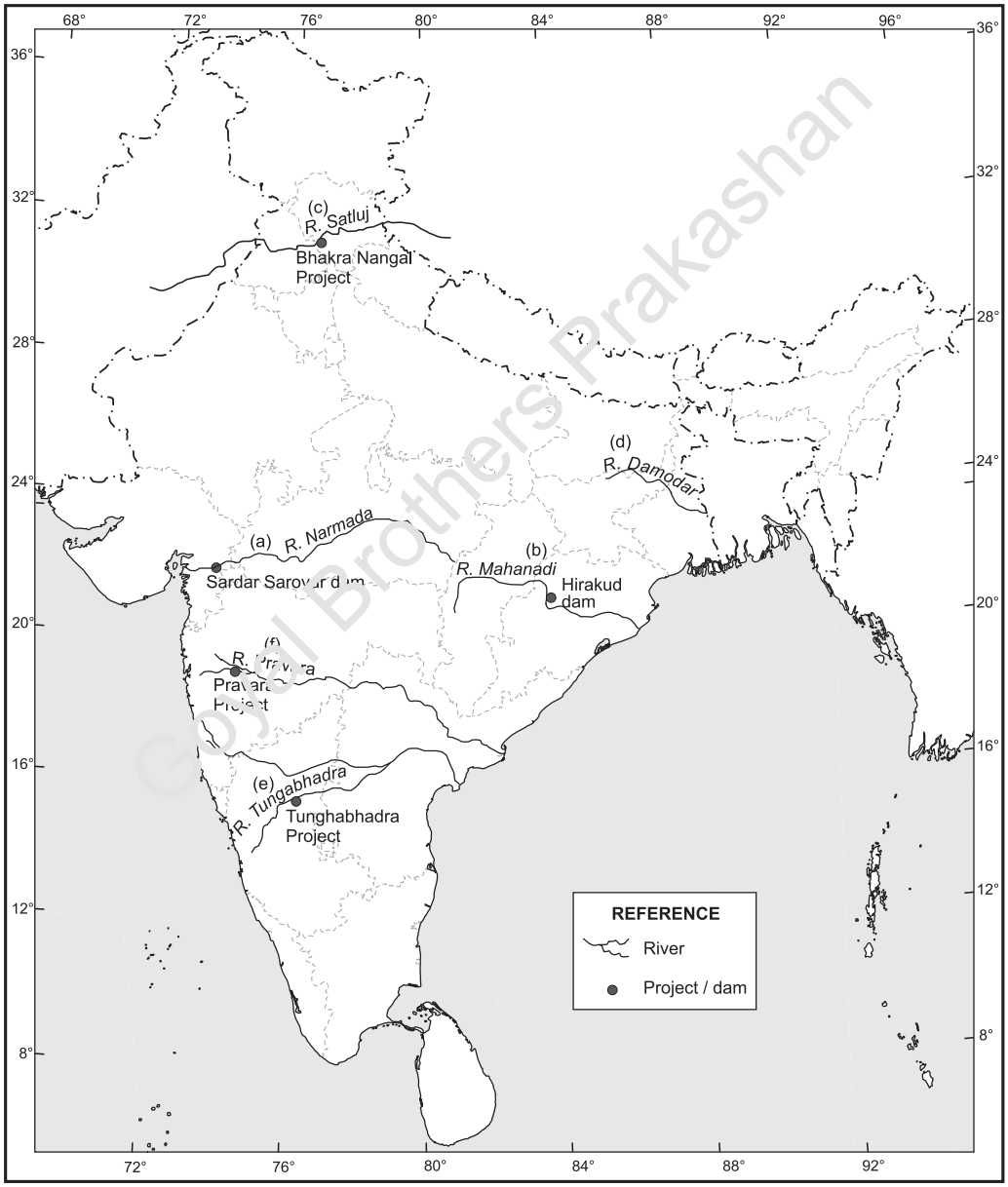
(c) The river on which the Bhakra Nangal Project is built

(d) A river known as 'River of Sorrow' in Jharkhand and West Bengal

(e) A tributary of R. Krishna on which there is a multipurpose project

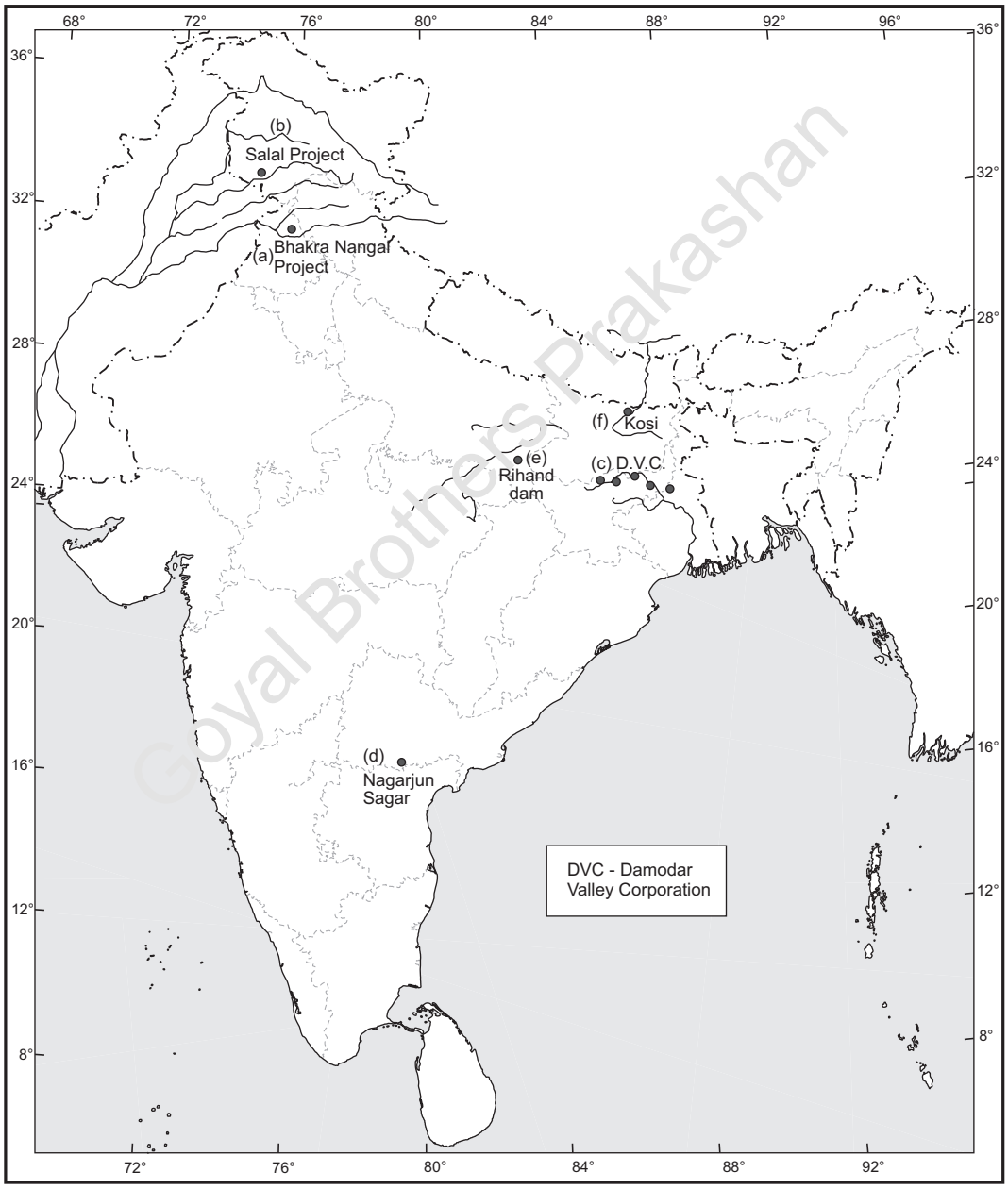
(f) A tributary of R. Godavari on which there is a multipurpose project.

Q.2. On an outline map of India, mark and label the following multipurpose projects :

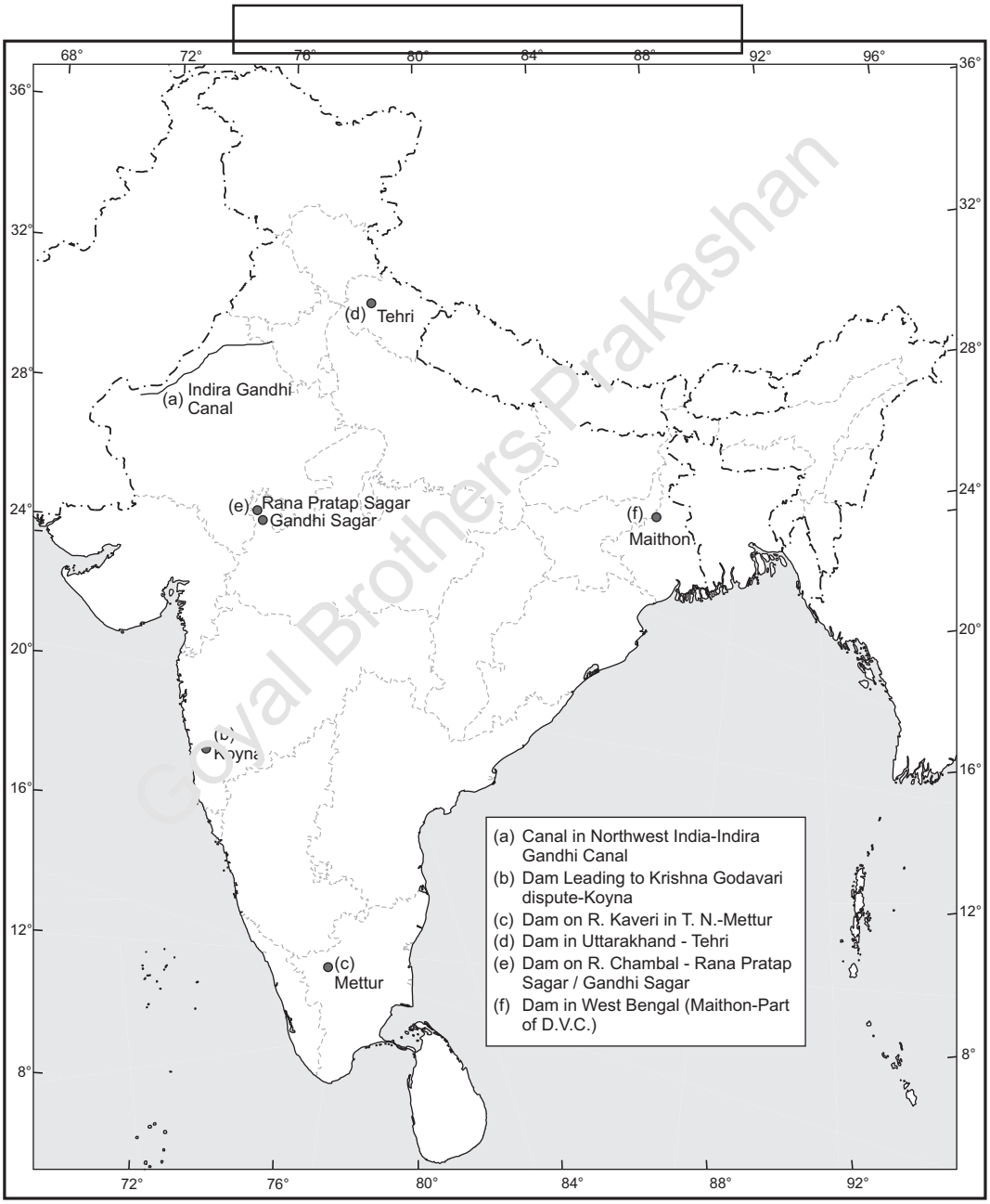


(a) Bhakra Nangal Project
(b) Salal Project
(c) Damodar Valley Corporation
(d) Nagarjuna Sagar Project
(e) Rihand Dam
(f) Kosi Project

Q.3. Identify the following and mark and label them on an outline map of India.



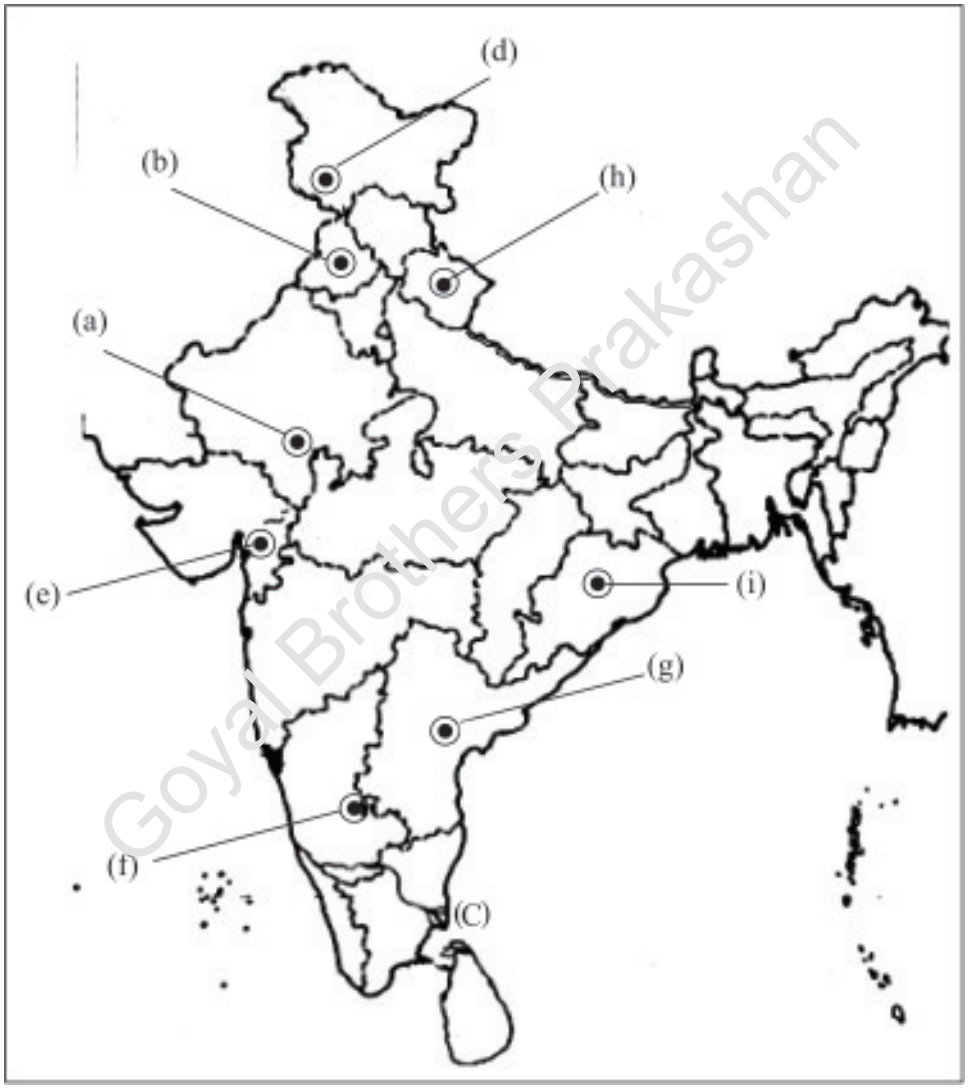
(a) A famous canal in northwest India
(b) A dam leading to Krishna-Godavari dispute
(c) A dam on river Kaveri in Tamil Nadu
(d) A dam in Uttarakhand that led to agitation and social movement
(e) A dam on the R. Chambal in Madhya Pradesh
(f) A dam located in West Bengal.



PREVIOUS YEARS' QUESTIONS

1. For locating and labelling. **[2010, 2011 (T-1)]**

(a) Rana Pratap Sagar dam
(b) Bhakra Nangal dam
(c) River Tungabhadra
(d) Salal dam
(e) Sardar Sarovar dam
(f) Tungabhadra dam
(g) Nagarjunasagar dam
(h) Tehri dam
(i) Hirakud dam



II. FORMATIVE ASSESSMENT

A. PROJECT WORK

Q.1. Select a water body with freshwater like a tank, pond or river. Study the various purposes for which the water is used. Make a chart on the utilisation of water in a project book. Find out how the water is over used or misused. Study the quality of water by collecting its sample in a beaker and compare it with clean water. Find out the causes of its pollution. Present your whole study in form of a report. Use pictures, photographs and paper cuttings to support your view.

Q.2. Survey your locality and find out what are the sources of drinking water. Take pictures of these sources. Find out about the availability of sufficient water and check whether the area faces problem of water scarcity. Identify the causes for the shortage of water and note them on a chart. Study about the seasonal variation in the availability of water and represents it in the form of bar graph. Suggest measures for proper water management. Note them on the chart as well as train the people about it.

B. ACTIVITIES

Q.1. Temples of modern India

Fill up the following chart with necessary information on Multipurpose Projects

	Multipurpose Project/Dam	River	State
1.		R. Chenab	Jammu and Kashmir
2.		R. Satluj	
3.	Tehri (caused Tehri dam Andolan)		Uttarakhand
4.		R. Narmada	Gujarat
5.	Rihand		
6.	Damodar Valley Corporation	R. Damodar	
7.		R. Koyna	Maharashtra
8.	Tungabhadra		
9.		R. Mahanadi	
10.	Ramagundam		
11.	Kota Barrage		Rajasthan
12.		Tributary of R.Kaveri	Karnataka

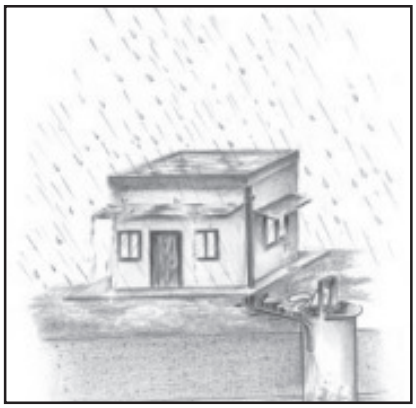
Q.2. Pollution Search

Fill up the table by giving information of how pollution is caused by the following sources. Give two instances for each.

INDUSTRIES	AGRICULTURE	INDIVIDUALS
1. 2.		

C. ASSIGNMENTS

Q.1. Observe the diagram and the picture carefully and answer the following questions.



(a) What does the diagram and picture depict?
(b) Why is it a better method of water management?
(c) In which areas do we usually find these systems?
(d) Label the following on the diagram given.
(i) Rooftop rainwater harvesting (ii) PVC pipe (iii) Filteration
(iv) Sump/Tanka (v) Tube well

Q.2. Observe the picture carefully and answer the following questions.

(a) What does the picture depict?
(b) Where do you find these system of tapping water?
(c) From where is the water tapped?
(d) What material is used to construct these pipes?

D. QUIZZES

Q.1. Word Jumble

(a) ACYRLHGODOIL YLCCE — Process by which water is continuously being renewed and recharged

(b) CANOES	96.5 percent of the total volume of world's water exist here
(c) QIRAUEFS	about 30 percent of freshwater is stored as groundwater in these
(d) AAMTK	Earthen pots for collecting water
(e) AAPLR NIPA	Rainwater is known by this name in Rajasthan

Ans. (a) HYDROLOGICAL CYCLE (b) OCEANS (c) AQUIFERS
(d) MATKA (e) PALAR PANI

Q.2. Missing Letters

(a) _U_S	Diversion channels for agriculture in Western Himalayas
(b) _H_D_N_	Rainfed storage structures in Jaisalmer
(c) _A_K_	Underground storage structures for drinking water in Bikaner, Phalodi and Barmer
(d) IN_N_A_I_ _ C_A_NE_S	Structures to irrigate fields in plains of Bengal
(e) _A_IL_AD_	First and only state in India which has made roof top rain water harvesting structure compulsory to all houses across the state

Ans. (a) KULS (b) KHADINS (c) TANKA
(d) INUNDATION CHANNELS (e) TAMILNADU

E. EXCURSION

Take the students on a trip to a multipurpose project/dam/hydroelectric Project in your state.