# OPEN TEXT - BASED ASSESSMENT

# ANNUAL EXAMINATION

# 2014-15

## SCIENCE (086/090)

## Class-IX




**CENTRAL BOARD OF SECONDARY EDUCATION**

Shiksha Kendra, 2, Community Centre,
Preet Vihar, Delhi-110 092 India

# OPEN TEXT MATERIAL

## 1. Theme – *Understanding the environment of Mars*

### Abstract

*Recent success of 'Mangalyan' (Mars Orbitor Mission) has made all of us proud of our scientists and engineers. The study of Mars' environment will help us in understanding more about our own environment. This text gives inputs on environment of Mars which can be correlated to the concepts learned by the students in class IX Science. The students are not supposed to memorize the facts and figures mentioned in the text, rather study the facts and figures with the above objectives in mind.*

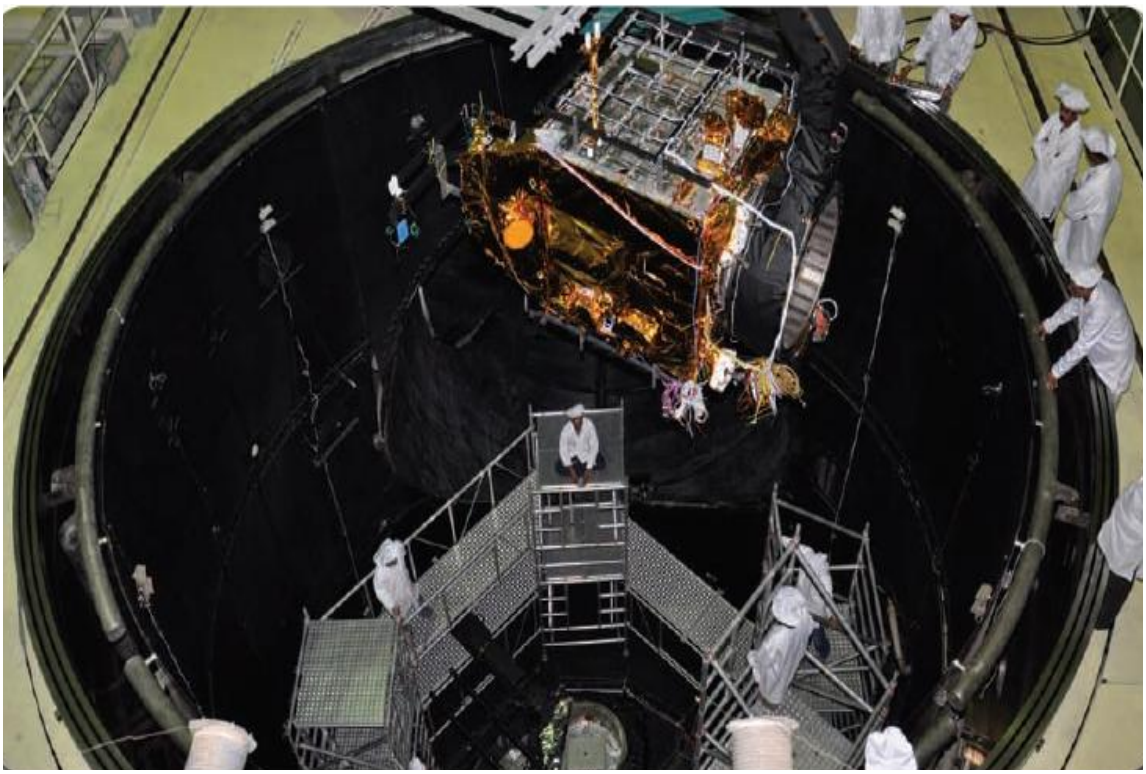

*Fig. 1: Mars Orbiter Mission Spacecraft getting in to Large Space Simulation Chamber for Testing*

### Mars Orbiter Mission (M.O.M)

Mars tugs at the human imagination like no other planet. The conditions in Mars are believed to be hospitable since the planet is similar to earth in many ways. Mars and Earth have almost equal period of revolution around the axis. Mars takes 24 hours and 37 minutes to complete equal period of revolution around the axis. While Earth takes approximately 365 days to orbit round the Sun, Mars takes 687 days for an orbit around the Sun. The gravity of Mars is roughly one-third to Earth's gravity and it has a thin atmosphere with a pressure of 1% that of Earth. The atmosphere, water, ice and geology interact with each other to produce dynamic Martian environment as in Earth. Mars has surface features reminiscent of both the impact craters of the Moon, volcanoes, deserts and

polar ice of Earth. It inspires visions of an approachable world. For ages, humans have been speculating about life on Mars. But the question that is to be still answered is whether Mars has a biosphere or ever had an environment in which life could have evolved and sustained.

Mars Orbiter Mission is ISRO's first interplanetary mission to planet Mars with an orbiter craft designed to orbit Mars in an elliptical orbit. The mission is primarily a technological mission considering the critical mission operations and stringent requirements on propulsion and other bus systems of spacecraft. It has been configured to **carry out observation of physical features of mars and carry out limited study of Martian atmosphere** with following five payloads:

- Mars Colour Camera (MCC)
- Thermal Infrared Imaging Spectrometer (TIS)
- Methane Sensor for Mars (MSM)
- Mars Exospheric Neutral Composition Analyser (MENCA)
- Lyman Alpha Photometer (LAP)

The 'Mangalyan' or Mars Orbiter Spacecraft started its journey on 1st December 2013 and Indian Space Research Organization (ISRO) has been able to successfully do Mars Orbit Insertion operation on 24th September 2014. The trajectory (path) of travel of MOM is shown below.

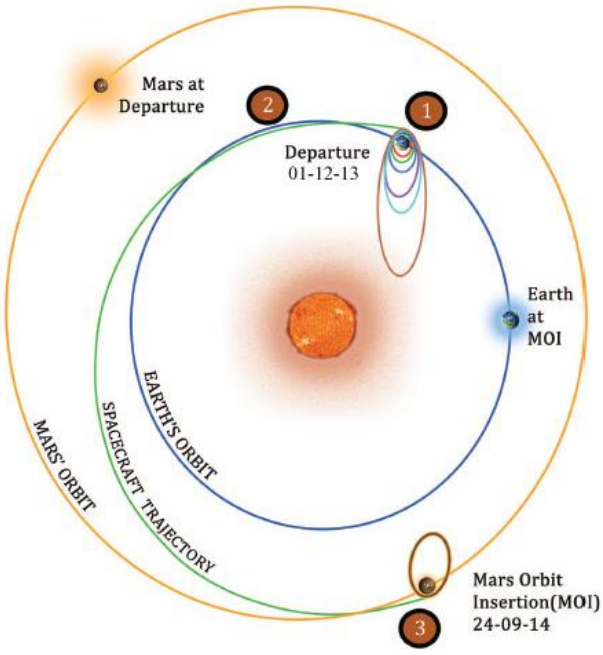


*Fig. 2: The Trajectory of Travel of MOM*

## Time to celebrate

It is a great moment to all of us. The Following Press Release from ISRO gives us the gist of our accomplishment.

September 24, 2014

## Mars Orbiter Spacecraft Successfully Inserted into Mars Orbit

*Fig. 3: Prime Minister Mr. Narendra Modi addressing from ISTRAC as ISRO Chairman Dr. K. Radhakrishnan looks on*

India's Mars Orbiter Spacecraft successfully entered into an orbit around planet Mars today morning (September 24, 2014) by firing its 440 Newton Liquid Apogee Motor (LAM) along with eight smaller liquid engines. This Liquid Engines firing operation which began at 07:17:32 Hrs IST lasted for 1388.67 seconds which changed the velocity of the spacecraft by 1099 metre/sec. With this operation, the spacecraft entered into an elliptical orbit around Mars. Prime Minister of India, Mr. Narendra Modi, was present at ISRO's Telemetry, Tracking and Command Network (ISTRAC) in Bangalore to witness this important event.

The events related to Mars Orbit Insertion progressed satisfactorily and the spacecraft performance was normal. The Spacecraft is now circling Mars in an orbit whose nearest point to Mars (periapsis) is at 421.7 km and farthest point (apoapsis) at 76,993.6 km. The inclination of orbit with respect to the equatorial plane of Mars is 150 degree, as intended. In this orbit, the spacecraft takes 72 hours 51 minutes 51 seconds to go round the Mars once.

Mars Orbiter Spacecraft was launched on-board India's workhorse launch vehicle PSLV on November 05, 2013 into a parking orbit around the Earth. On December 01, 2013, following Trans Mars Injection (TMI) manoeuvre, the spacecraft escaped from orbiting the earth and followed a path that would allow it to encounter Mars on September 24, 2014.

With today's successful Mars Orbit Insertion operation, ISRO has become the fourth space agency to successfully send a spacecraft to Mars orbit. In the coming weeks, the spacecraft will be thoroughly tested in the Mars orbit and the systematic observation of that planet using its five scientific instruments would begin.

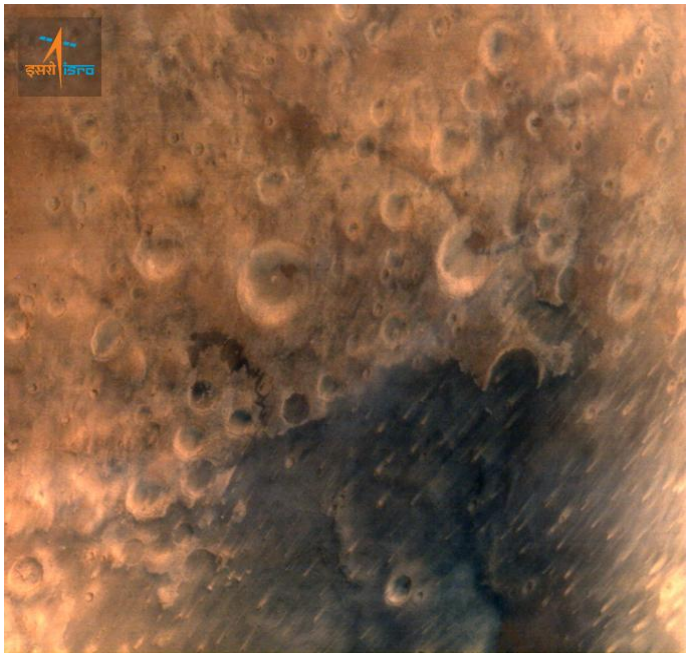

*Fig. 4: Mars Orbiter Spacecraft captures its first image of Mars, taken from a height of 7300 km*

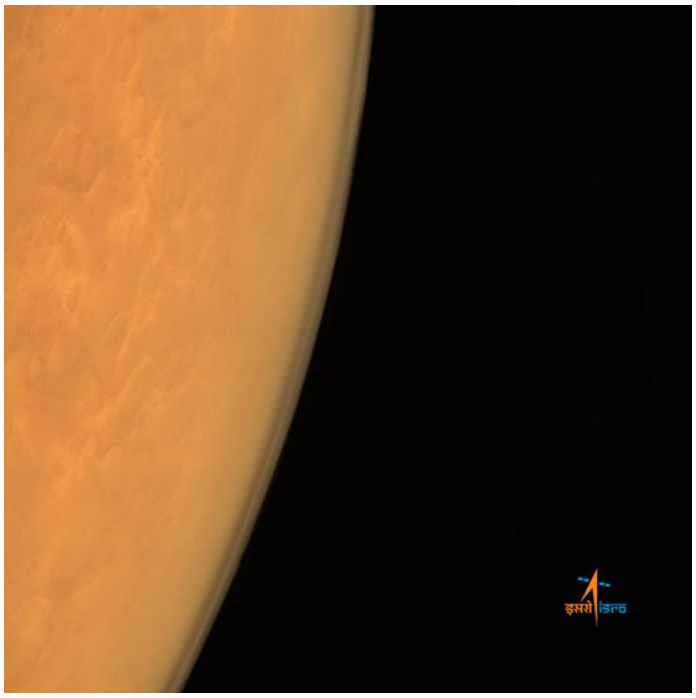

*Fig. 5: Image taken using the Mars Colour Camera from an altitude of 8449 Km*

Following are some facts on Mars available on the NASA website. The MoM may possibly verify the facts and get more information on Mars.

## Mars Facts

*Fig. 6: Picture of Mars*

## Mars Climate

Scientists think that the climate on Mars 3.5 billion years ago was similar to that of early Earth: warm and wet. But because of chemical reactions between Mars' carbon dioxide atmosphere and water, most of its carbon dioxide was used up forming carbonate rocks. Earth is big enough and active enough that it has plate tectonics which recycles this carbonate back to carbon dioxide. Mars is too small (10 times less massive than the earth) and does not have any recycling of its carbonate. So now the Mars atmosphere is very thin, the temperature is very cold, and what water remains is either frozen in the Martian poles as permafrost or hidden in deep underground springs. Mars' current climate changes drastically during the year. It has seasons similar to the Earth's due the tilt of its axis. But because its orbit around the Sun is elliptical; the distance from the Sun varies about by 20% depending on where it is in its annual orbit. The seasons in one hemisphere (South) are more extreme while in the other (north) they are less extreme.

## Temperature

The temperature on Mars may reach a high of about 70 degrees Fahrenheit (20 degrees Celsius) at noon, at the equator in the summer, or a low of about -225 degrees Fahrenheit (-153 degrees Celsius) at the poles. Obviously this is very inhospitable for humans, but it is also of some concern

for the electronics and mechanical parts of a Mars airplane and its instrumentation. In the mid-latitudes, the average temperature would be about -50 degrees Celsius with a nighttime minimum of -60 degrees Celsius and a summer midday maximum of about 0 degrees Celsius.

## Humidity

Humidity is the amount of water vapor in the air. This varies from day to day and depends on the temperature: warm air can hold more water vapor than cold air. Humidity is measured as a percentage of the maximum amount of water that the air can hold at a given temperature. The greater the difference between the two temperatures, the greater the evaporation. When there is a lot of evaporation, the air is drier and the humidity is low. The instrument used to measure humidity is called a psychrometer.

On Mars, the air is saturated (100% humidity) at night, but under saturated during the day. This is because of the huge temperature difference between day and night.

To demonstrate this:

- Take a clean, dry jar and place the lid on it.
- Allow to stand 10 minutes in a shaded area and observe.
- Put it in a freezer for at least an hour.

Remove and observe. (At room temperature, the air inside the jar was not saturated, but in the cold freezer the air could not hold much water-it became saturated-and the water condensed and formed frost.)

## Wind

Occasionally, winds on Mars are strong enough to create dust storms that cover much of the planet. After such storms, it can be months before all of the dust settles. The maximum wind speeds recorded by the Viking Landers in the 1970's were about 30 meters per second (60 miles an hour) with an average of 10 m/s (20 mph). Just as on Earth, at certain latitudes, the winds tend to blow in certain directions.

In Mars' northern mid-latitudes, wind blows from west to east just as it does in the United States. (Local variations of this can be caused by nearby mountains, large bodies of water, the season, etc.) Recent satellite images of Mars show that the dust storms have lessened, indicating that Mars winds have lessened, due to unknown causes. Scientists say that the planet is also getting colder.

## Air Pressure

A barometer is used to measure air pressure. The average air pressure on Earth is 29.92 inches of mercury (or 1,013 millibars). This is more than 100 times Mars' average of 0.224 inches of mercury (7.5 millibars).

Air pressure is not the same everywhere on Earth. One reason is because temperature varies from place to place. When air heats up, air molecules move faster, pushing each other away and causing air to expand. With fewer molecules in the same amount of space, the air in that space weighs less: it exerts less pressure on the Earth. Cold air molecules are packed closer and exert more pressure on the Earth.

At any given location on Earth, the air pressure can vary about 10% whereas on Mars it can vary by as much as 50%. Mars' atmosphere is mostly carbon dioxide and therefore behaves differently than Earth's mostly nitrogen and oxygen atmosphere.

Changing air pressure is experienced as ears pop going up and down mountains or when flying in airplanes. Meteorologists, who try to predict the weather, know that a higher than average pressure reading usually brings fair weather while low pressure usually brings stormy weather.

We live on the bottom of an ocean of air. Air has weight and exerts pressure on us as a result of its weight. On each square inch of our bodies, there are 14.7 pounds of pressure. On the entire human body surface, the total air pressure varies from 10 to 20 tons! Just as ocean animals are not crushed by the weight of water above them, we are not crushed by the weight of the air because the inner pressure of our bodies pushing out equalizes the air pressure pushing down on us.

## Linking to what you have learnt

Let's see the beautiful picture of our earth, the 'Mangalyan' captured on its Mars Mission. You may try to connect the information given above to what you have learnt in the Unit IV: Our Environment.

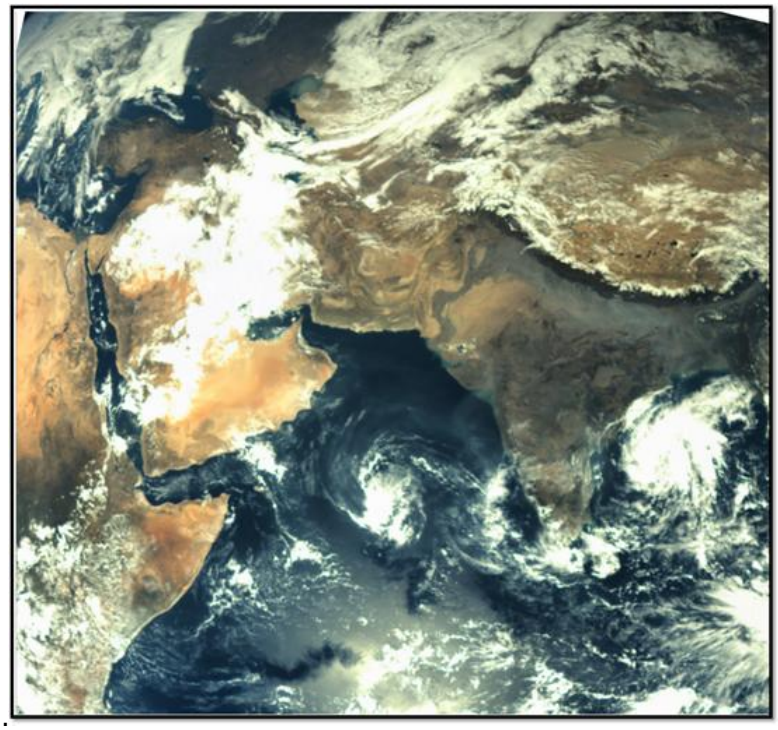

*Fig. 7: Picture of Earth captured by Mangalyan on its Mission*

**Table 1:**

| | Mars | Earth |
|---|---|---|
| Atmosphere (composition) | Carbon dioxide (95.32%) Nitrogen (2.7%) Argon (1.6%) Oxygen (0.13%) Water vapour (0.03%) Nitric oxide (0.01%) | Nitrogen (77%) Oxygen (21%) Argon (1%) Carbon dioxide (0.038%) Water vapour (1%) |
| Atmosphere (pressure) | 7.5 millibars (average) | 1.013 millibars (at sea level) |
| Deepest Canyan | Valles Marineris 7 km deep 4,000 km wide | Grand Canyon 1.8 km deep 400 km long 149,597,891 kilometers |
| Distance from Sun (average) | 227,936,637 kilometers | 149,597,891 kilometers |
| Equatorial Radius | 3,397 kilometers | 6,378 kilometers |
| Gravity | 0.375 that of Earth | 2.66 times that of Mars |
| Largest Volcano | Olympus Mons 26 km high 602 km in diameter | Mauna Loa (Hawaii) 10.1 km high 121 km in diameter |
| Length of Day | 24 hours, 37 minutes | Just slightly under 24 hours |
| Length of Year | 687 Earth days | 365 days |
| Polar Caps | Covered with a mixture of carbon dioxide ice and water ice | Permanently covered with water ice |
| Surface Temperature (average) | - 63 degrees C | 14 degrees C |
| Tilt of Axis | 25 degrees | 23.45 degrees |
| Number of Satellites | 2 (Phobos and Deimos) | 1 (Moon) |

## Sample Questions

1. Suggest an experiment to check the presence of atmosphere on Mars. Explain the role of atmosphere in the climate of a planet. (5)
2. From the information given above, differentiate between the environment of Earth and Mars. (3)
3. How will the concerns of our environment be addressed from the inputs of Mars Orbiter Mission? (2)

## Marking Scheme:

1. Any one experiment to prove the presence of atmosphere e.g. use of syringe. (5)

   Role of atmosphere in temperature, rain, humidity, air pressure, wind etc.

2. Comparison of environment between mars and earth which may include, composition of air, temperature, humidity, wind etc. (3)

3. Objective of MoM, possible achievements correlating information with concerns of environment. (2)

***Note:*** *To be assessed as a whole as per total weightage of marks.*

## Reference


1. http://www.isro.gov.in/satellites/mars-orbiter-spacecraft.aspx retrieved on 28/9/14
2. http://www.isro.gov.in/pressrelease/scripts/pressreleasein.aspx? Sep24_2014 retrieved on 28/9/14
3. http://quest.nasa.gov/aero/planetary/mars.html retrieved on 28/9/2014

# OPEN TEXT MATERIAL

## 2. Theme – *Clean India - We mean it!*


### Abstract

Recent launch of 'Swachh Bharat Abhiyan' has inspired many of us to take up the task related to sanitation in and around us. There are many case studies available which show the involvement of committed individuals and organizations who have done exceptionally good work in the area of sanitation. The content given here focuses on some selected case studies which help the learner to assimilate the importance of sanitation. It is also expected that the learner find solutions to day to day environmental issues based on the inputs given in the text.


### Sanitation – Need of the hour:

Let's start with the pledge we had taken on 2nd October 2014.

**Pledge**

*Mahatma Gandhi dreamt of an India which was not only free but also clean and developed.*

*Mahatma Gandhi secured freedom for Mother India.*

*Now it is our duty to serve Mother India by keeping the country neat and clean.*

*I take this pledge that I will remain committed towards cleanliness and devote time for this.*

*I will devote 100 hours per year that is two hours per week to voluntary work for cleanliness.*

*I will neither litter nor let others litter.*

*I will initiate the quest for cleanliness with myself, my family, my locality, my village and my work place.*

*I believe that the countries of the world that appear clean are so because their citizens don't indulge in littering nor do they allow it to happen.*

*With this firm belief, I will propagate the message of Swachh Bharat Mission in villages and towns.*

*I will encourage 100 other persons to take this pledge which I am taking today.*

*I will endeavour to make them devote their 100 hours for cleanliness.*

*I am confident that every step I take towards cleanliness will help in making my country clean.*

There are individuals in our country who have been doing a lot of work in the area of sanitation. Read the three case studies and correlate that to what you have learnt in the unit : Our Environment

## *Case Study-1: Waste to Wealth: An experiment in Schools*

*Fig. 1: Glimpses of Waste Management Activities*

Tirur Block in Malappuram district of Kerala has adopted an innovative approach to convert waste in the schools into wealth – through establishing a bio-gas plant in the school. Waste management is a major problem in the schools: given that 85 per cent of the things dumped as waste are actually resources in the wrong place, the necessity of correct practices for waste management is imperative.

To sensitise the younger generation of this fact, the Tirur block panchayat (BP) constructed a bio-gas plant (8 $m^3$ digester able to digest 75 kg bio-waste) in Government VHSS, BP Angadi, in Talakkad gram panchayat (GP). With around 2300 students on the rolls, the remains of the mid-day meal and the lunch brought by children is turned into bio-gas. A nearby hotel run by 'Kudumbashree' can also use this for its waste disposal. This in turn meets part of the fuel needs for cooking the mid-day meal. Slurry is used as manure for the school garden.

The waste from the school kitchen and food remains thrown away by the children used to make the surroundings dirty and a perfect breeding ground for diseases. The Tirur BP, formulated a plan for setting up a bio-gas plant for transforming this waste into a resource, that is, fuel for the mid-day meal and slurry/manure for the school garden. This unit is meant to be a display unit to show children how waste can be managed scientifically and turned into a useful resource.

Discussions were held with representatives of the school Parent Teacher Association (PTA), and their support ensured. Sustainability, a major factor in the case of such plants, operation and maintenance, was properly planned. Under the supervision of the PTA, health club/green club members formed maintenance committees which maintain and operate the plant without complaint. The plant has been operating successfully till date, with the help of the school authorities, especially with the help of some dedicated teachers. In case of schools situated in market places, vegetable, fish or chicken merchants use this facility to get rid of their waste and the schools get more fuel for their needs.

## *Case Study-2 : Dhedhuki- Water Resource Management*

Dhedhuki Regional Water Supply Scheme (RWSS) provides water to 22 villages of Sayla taluka in Surendranagar, Gujrat. Dhedhuki area is composed of sand stone, which is medium to coarse

grained and has good porosity and transmissibility. However, the area around Dhedhuki has poor ground water quality and the average rainfall in the area is also on the lower side, about 500 mm. Under these circumstances, water resource management assumes significance for source sustainability

Dhedhuki has two ponds namely, Somani talao and the Bhimnath talao which is on the road to Dhandhalpur. Both these ponds were deepened by excavating 55,000 $m^3$ and 6,000 $m^3$ mud respectively and the mud was used to increase the height of both the talaos by 30 cms. As result of deepening, the capacities of the two ponds have been augmented by 1,38,000 $m^3$. In addition, a 3 km stretch of recharge channel has been deepened and diverted to the two ponds. Thus the water that overflows from the Bhimnath talao as well as the run-off from the village borders is diverted through the recharge channel. In each talao a recharge bore has also been developed so that water easily percolates into the aquifer. The Dhedhuki Regional Water Supply Scheme, sources the ground water in the area through 11 bore wells. Of these nine are functional and the water is pumped from a depth of about 112 meters. The artificial recharging carried out at the two ponds will help in improving both the quantity and quality of water in the bore wells of the RWSS. The Pani Samiti of Dhedhuki participated in the work with complete enthusiasm.

Based on the report from operator of RWSS and village people of Dhedhuki, the inflow of water started in the ponds from mid night of July 01, 2007 and outflow started just after 8 hours from the time of inflow i.e. at about 0800 hrs on July 01, 2007 because it was indeed very heavy rains in the beginning itself. It was noticed that the result has been very encouraging and a huge quantity of pond water penetrated into deep aquifers through the bore wells.

### *Case Study-3 : Community Sanitary Complexes under Total Sanitation Campaign*

*Fig. 4: A Community Sanitary Complex*

A hilly state, Mizoram is situated in the Northeast corner of India. As per the 2001 Census, Mizoram has a population of 8,91,058 with a literacy percentage of 88.94 per cent. In Mizoram, the Total Sanitation Campaign (TSC) was introduced in 2002. Emphasis has been laid on information,

education and communication components to change the behaviour of the targetted population, by creating awareness about health education. The programme is being implemented with focus on community-led and people-centred initiatives. The Village Water and Sanitation Committee (VWSC) plays an effective role in absorbing new ideas and concepts. Through the TSC, the consciousness of the community is being transformed towards health and hygiene practices. People choose from a menu of options for household toilets for satisfying their felt needs. The generation of demand for sanitation facilities motivated the targetted audiences and they are willing to pay their share in the project. Thus, the physical implementation of this programme has made remarkable achievements in converting dry toilets into pour flush toilets, and construction of septic tanks. The programme has made a highly positive impact, especially in the rural areas.

A community sanitary complex (CSC) is an important component of the TSC. It is meant for public places, markets, etc, where large-scale congregation of people takes place. Mizoram has implemented innovative ideas for the operation and maintenance of such complexes, which is essential as gram panchayats (GPs) have to ultimately own the responsibility for them, as CSCs are to be used by the community. The location of a CSC is decided after taking into consideration where people congregate every day, that is, near shopping areas and taxi stands, etc. The public land is donated by the village council free of cost in the interest of cleanliness in the village.

An innovative design has been evolved for the CSC: one side of the complex is extended on one side, and this is converted into a shop, which could sell items of daily need, books, stationery or eatables. The shop is given to a person in return for a commitment to operate and maintain the CSC. The shop is rented generally for one year through local advertisements as per terms and conditions set for the purpose. The shopkeeper also takes care of the electricity and water bills of the CSC. In certain cases, where collection through users' fee has been large or the shop has been running successfully, the shop-owner also contributes up to Rs. 200 per month to the village council – for further maintenance of the complex or a one-time expenditure for the evacuation of the septic tank, as and when required. This has, therefore, resulted in the sustainability of the community sanitary complexes, constructed with central assistance under the Total Sanitation Campaign. Community members, too, are satisfied as they get clean sanitary facilities. This concept can certainly be replicated in the north-eastern reason for ensuring clean surroundings in public places and market areas.

## Sample Questions:

1. Suggest sanitation practices which may lead to reduction of Air and Soil pollution from the inputs from the above case studies. (5)
2. Explain how sanitation can be linked to water resource management. (3)
3. Suggest measures to maintain the quality of water collected through rain harvesting. (2)
4. Write a letter to the school principals suggesting ways in which sanitation practices can be improved in the neighborhood slum cluster or a nearby village. (3)

5. As a part of the expression series, CBSE had given many topics to students for creative expression. Write an essay on any of the following topics related to sanitation: (5)

   a) It is difficult to imagine a clean village until each citizen contributes. Develop a Citizen Charter for the clean village of your dreams.

   b) Deliberate upon the changes in the common cultural and social norms that you feel necessary to create clean spaces in the long run and fulfil Gandhiji's dream of 'Swachh Bharat'.

## Marking Scheme

1) Based on the case studies: (5)
   - Two sanitation practices which will help reduction in Air Pollution
   - Two sanitation practices which will help in reduction of Soil Pollution

2) Explanation of water resource management (3)

   Linkage of water resource management and sanitation

   Some of the practices given in the text

3) Rain water harvesting (2)

   Importance of quality of water

   Some measures to maintain the quality of water collected through rain water harvesting

4) Detailed suggestions on sanitation practices involving students, teachers and parents, giving examples from the text given above. (3)

5) a) Citizen's charter: Do's and Don'ts, Duties and responsibilities (5)

   b) Importance of clean spaces (5)

   Cultural and social norms hindering the clean spaces

   Changes in the norms

***Note:*** *To be assessed as a whole as per total weightage of marks.*

## Reference:


1. http://www.mdws.gov.in/
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