GOVERNMENT OF NATIONAL CAPITAL TERRITORY OF DELHI
DIRECTORATE OF EDUCATION, SCIENCE & TV BRANCH
OLD GARGI COLLEGE BULDING, LAJPAT NAGAR-IV, NEW DELHI
(Ph. No.-011-26280410-12, email : sciencebranch@gmail.com)

F.No.DE.40(6)/57/SCB/SRD/MISC-III/2018/ 1441-1445 Dated: 15.10.2018

CIRCULAR

Subject: To celebrate Rashtriya Aavishkar Saptah, 2018 from 29th October to 02nd November, 2018.

All DDEs (District) please find enclosed herewith copy of guidelines and list of schools where Rashtriya Aavishkar Saptah, 2018 will be held from 29th October to 02nd November, 2018. In this connection, you are requested to direct concerned DDE Zone to implement the following instruction through HoS of the school mentioned in the list after going through the guidelines:-

1. To involve students of class IX to XII.
2. To take academic support from faculty members of SCERT and DIET.
3. School should involve all the BRC/CRC, Science Teachers and Lab Assistants etc.
4. The programme must be conducted successfully to generate enthusiasm and to encourage experimentation/exploration among school students.
5. Involvement of students in understanding and sensitization of some common issues and local problems like **water.**
6. All schools will upload the findings of experiment by filling up the Google Form on NCERT website.
7. If there is any query please contact DDE (Sc. & TV) through mail: sciencebranch@gmail.com and Phone: 011-26280410.

(USHA CHATURVEDI)
DY. DIRECTOR OF EDN. (SC. & TV BR.)

F.No.DE.40(6)/57/SCB/SRD/MISC-III/2018/ 1441-1445 Dated: 15.10.2018

Copy to:-

1. PS to Director of Education.
2. All the DDEs of District/Zone.
3. All the HoS of Directorate of Education.
4. OS (IT) with request to upload the circular on the website of DOE.
5. Guard file.

(USHA CHATURVEDI) 15/10/18
DY. DIRECTOR OF EDN. (SC. & TV BR.)

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LIST OF SCHOOLS SELECTED FOR "RASHTRIYA AAVISHKAR SAPTAH"-2018

29th October, 2018 to 02nd November, 2018

S.No.	Name of School	Zone	School ID
1.	RPVV Surajmal Vihar	01	1001104
2.	RPVV, I.P. Extension Near Mayo College	02	1002399
3.	RPVV, Gandhi Nagar	03	1003261
4.	RPVV, Yamuna Vihar, B-Block	04	1104149
5.	RPVV, Gautampuri	05	1105248
6.	RPVV, D-Block, Nand Nagri	06	1106252
7.	RPVV, Raj Niwas Marg	07	1207108
8.	RPVV, Kishan Ganj	08	1208092
9.	RPVV, BT Block, Shalimar Bagh	09	1309124
10.	RPVV, A-10, Pocket-5, Narela	10	1310409
11.	SKV, H-Block, Ashok Vihar	11	1411026
12.	RPVV, Sec-21, Ph-II, Rohini	12	1412291
13.	RPVV, Sec-11, Rohini	13	1413076
14.	RPVV, BE-Block, Hari Nagar	14	1514023
15.	SKV, Rajouri Garden Main	15	1515022
16.	SKV, Ramesh Nagar	16	1516027
17.	RPVV, A-6, Paschim Vihar	17	1617009
18.	SKV No.1, C-Block Janakpuri	18	1618017
19.	SV, Sec-12, R.K. Puram	19	1719001
20.	RPVV, D-Block, Vasant Kunj	20	1720181
21.	RPVV, Sec-5, Dwarka	21	1821286
22.	GGSSS No.1, Najafgarh	22	1822044
23.	SKV, Green Park Extension (Gargi)	23	1925032
24.	RPVV, B-1, Vasant Kunj	24	1720031
25.	RPVV, Lajpat Nagar	25	1925334
26.	SV, President Estate (Dr. Rajendra Prasad)	26	2026001
27.	SBV, Rouse Avenue	27	2127001
28.	RPVV, Link Road, Karol Bagh	28	2128031
29.	SKV, Noor Nagar	29	1925035

15/10/18

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Rashtriya Avishkar Saptah

2018

Guidelines

विद्यया ऽ मृतमश्नुते
एनसीईआरटी
NCERT

Department of Education in Science and Mathematics
National Council of Educational Research and Training
Sri Aurobindo Marg, New Delhi – 110016, India

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GUIDELINES FOR RASHTRIYA AVISHKAR SAPTAH 2018

INTRODUCTION

Science, Technology and Innovation have emerged as the major drivers of national development globally. To make learning of Science and Mathematics a joyful and meaningful activity; to nurture a spirit of inquiry and creativity; to bring focus on innovation and use of technology,Ministry of Human Resource Development (MHRD), Government of India have set up Rashtriya Avishkar Abhiyan (RAA).

At Secondary and Higher Secondary Stages of school education, systemic experimentation as a tool and working on locally significant projects involving science and technology are important parts of curriculum. In order to encourage school students for exploration and innovation, it is extremely important to engage them in experimentation.

Under PAB programme of MHRD, Government of India, it is proposed by Department of Education in Science and Mathematics (DESM), National Council of Educational Research and Training (NCERT), New Delhi that the last week of October, that is, October 29 to November 02, 2018 (October being the month of Dr APJ Abdul Kalam's birth anniversary) may be declared as 'Rashtriya Aavishkar Saptah - 2018'. During this week, all students at Secondary and Higher Secondary Stages, of one school of every block across the country, will uniformly carry out a study involving experimentation as per the Guidelines developed by NCERT. These experiments may be conducted within the periods allocated for laboratory work with in the school time table.

The objective of this programme is to generate enthusiasm and to encourage experimentation/exploration among school students at Secondary and Higher Secondary Stages so that they become motivated and engaged in Science and Mathematics. Involvement of students in understanding and sensitization of some common issues and local problems may be one of the ways to achieve this.

Water is essential to sustain life. Adequate, safe and accessible supply of water must be available to all. Every effort should be made to achieve safe drinking-water. Therefore, it is important from the educational point of view to make students aware of some testing procedures so that they become vigilant about the quality of water in their locality. Keeping this in view, "Testing of Water" has been proposed as a theme to observe "Rashtriya Aavishkar Saptah 2018". This may help in spreading a wave of awareness about the quality of water in our country. The procedures for testing the samples of water on three parameters, namely - Foaming Capacity, Hydrogen Ion Concentration (pH) and Total Alkalinity of Water, have been given in 'Guidelines for Rashtriya Aavishkar Saptah 2018', developed by DESM, NCERT.

Results of the study conducted by schools will be collected online through Google forms. The results of the study will be compiled, analysed and shared by DESM.

DATES FOR CONDUCT OF RASHTRIYA AVISHKAR SAPTAH 2018

Rashtriya Avishkar Saptah 2018 is scheduled to be conducted during October 29 to November 02, 2018 in one school from each block of the country. However, in exceptional circumstances, such as, exams, holidays, during that period, schools may decide to opt for another suitable week (preferably succeeding week) for the conduct of Rashtriya Avishkar Saptah 2018.

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Selection of School

The state/UT goverment has to select a school, which has classes for both Secondary and Higher Secondary levels, from each block for conducting the 'Rashtriya Avishkar Saptah 2018'. If possible, composite schools may be selected. Some parameters have to be kept in mind while selecting the school. The selected school should have a functional Science/Chemistry laboratory. It would be desirable to select a co-educational school. If not possible, then care should be taken that within a state/UT almost equal number of girls schools and boys schools are being selected. While making selection for the schools, an equal representation of rural and urban schools may be ensured.

In some States/UTs, Secondary and Higher Secondary Schools are separate. In such cases, one secondary school and one higher secondary school may be selected from each block. If possible, twinning of these two schools may be done for Rashtriya Avishkar Saptah.

For special cases, such as some UTs, where there are no blocks, one school may be selected from each cluster/zone.

Funding

The items required for the suggested procedures for testing the water are available in a fully functional science/ chemistry laboratory of any higher secondary school. However, it is suggested that the state/UT may allocate Rs.2000/- per school to buy some items needed for the study 'Testing of Water' to be conducted during Rashtriya Avishkar Saptah 2018. In States/UTs, where one Secondary School and one Higher Secondary School has been selected from a block, Rs. 2000/- may be allocated to each school. For this purpose, the States/UTs may utilize the funds allocated to them under PAB.

Academic Support

The faculty members of SCERTs, and DIETs may be involved for providing academic support to the selected schools. The science faculty member(s) of Higher Education Institutes (HEI) located close to the schools may also be involved.Block level administrator may visit the school during Rashtriya Avishkar Saptah 2018 to facilitate the conduct of experiment.

School management

School management is very important for organising an event in the school.

Team work: Efficient conduct of study during Rashtriya Aavishkar Saptah requires the involvement of each and everybody in the school including BRCs, CRCs, school head, teachers, laboratory assistants, laboratory attendents, etc. In team work collaborative efforts are provided by all members of the team for a common goal. A team work is possible when all involved people know their own responsibilities to make the event successful. Thus, responsibility for each and every team member may be distributed well in advance. It may be assured that all persons involved know their own responsibility.

Stage appropriate involvement of the students in performing experiments: All students of classes IX to XII of the selected school will carry out the experiments within the stipulated time periods assigned to them in their timetable for performing practicals in science/chemistry in the laboratory. Student may perform experiments in the group of three or more as per convenience of space and infrastructure for performing experiments.

Procedure for performing experiments for study: Understanding the procedure for performing the experiments and importance of the chosen experiments is one of the major factors for the efficient conduct of the event. For this,the guidelines containing procedure may be distributed to teachers, school heads,

education administrators, etc, in advance. Students may be provided the procedure for conducting the experiments on testing of water.

Role of teachers while performing experiments: Teacher may provide instructions/hand holding prior to the students perform the experiments on the selected theme in a scientific manner. Teacher may provide the procedure for performing experiments. She/he may make the students aware about the scientific method for performing study, objectives of the study, how to gather the data scientifically and what precautions they may take while doing the experiments or preparations before the experiments.

Physical Environment and setting of Science and Chemistry Laboratory: Laboratory assistant may setup laboratory, under guidance of concerned teacher, prior to the science practical period in such a way that all the material required for the experiments are available and easily accessible in a simple and not cluttered manner for the easy conduct of the experiments. The working table or chairs may be arranged in such a way that facilitate flexible actions of the students in groups without wasting of the time.

Atmosphere: Experiments should be performed as normal routine of the laboratory practice. For a positive, calm, pleasant work atmosphere, teachers may let the students know that they may get various data and errors may also be expected so that there will not be any fear, anxiety or tension among the performing students and inculcation of values among the students will be encouraged.

Awareness about the event: To create awareness about the event among the students, the school should fix a poster within the school premises. The poster may be hand painted on paper/cloth having following details:

Rashtriya Avishkar Saptah 2018
29.10.2018 to 02.11.2018
Testing of Water

Name of the School
Block
District
State/UT

Schools may think of a catchy tittle in their local language, in place of the tittle "Testing of Water".

SMDC members and local community people may also be made aware about the event and may be invited on the last day for sharing the findings of the study.

Sharing of findings at school level: Schools may widely share findings on all platforms, such as, with students of classes other than IX-XII, parents, community, etc. Sharing of information about the water-testing experiment performed in each school is an important aspect of the study. This will make students, teachers, and schools feel that the study they embark on is an important one. Such information may be shared through the following:

1. Students can share about their experiences to other students (class I to VIII during one of their Science periods) in their school. The information shared should focus on the following:
   (i) demonstration of the experiments (if possible)
   (ii) about their experiences
   (iii) what they learned
   (iv) difficulties they faced
   (v) what they found about the water quality
2. Students can prepare a write-up about the findings of the whole school and get it publised in some

local newspapers. It will be a huge encouragement for students to see their work being published in a print media and also bring a sense of satisfaction for their parents.

3. The results may also be shared with the municipality or other bodies responsible for maintaining sanitation, hygiene or public health, etc.
4. Teachers may also be asked to share their experiences to the state functionaries and/or NCERT about the study. They may also be asked to provide suggestion for improvement.

The District Education Officer may also make such arrangements so that students and teachers can share their experiences with the students and teaches, respectively, of other schools within the block.

Sharing of findings with NCERT: The schools will share the findings with NCERT by filling up the Google form online. This form can be assessed on the web link provided by NCERT. Schools are requested to upload a few photographs of the event along with Google form (The photographs may be taken using the smart mobile phone available). Photographs of clippings of news papers (if any) reporting the conduct of Rashtriya Avishkar Saptah 2018 by the school may also be uploaded with the Google form.

Procedures for Testing of Water

A major part of all living organisms is made up of water. It is a crucial compound for the survival of all life forms. The procedures for testing the samples of water on three parameters namely; foaming capacity,pH and the total alkalinity of water are given below. Using these procedure the school may test water from 2- 4 water samples.

1. Collection of Water Sample

Take a clean and dry glass bottle with a cork/ stopper. Rinse it with sample water 2- 3 times. Now fill it with sample water and cork it.

- If water is collected from tap, first run the tap for about 2 minutes before collecting the sample water.
- If water has to be collected from a water body like pond/well etc., the collection must be done under supervision of an elderly person.

2. Foaming Capacity of Water

Introduction

Water is a colourless, odourless and tasteless liquid. It is a solvent of great importance. One important use of water in our daily life is for washing. Soft water is suitable for washing purpose. It forms lather/foam with soap without formation of any insoluble scum. It is free from soluble salts of calcium and magnesium. The presence of calcium and magnesium salts in the form of hydrogen carbonate, chloride and sulphate makes water hard. Hard water gives very little or no amount of lather/foam with soap. It is very difficult to wash clothes with hard water as it requires more soap and leaves a messy scum that cannot be washed out easily. Hard water when boiled at home or in industries leaves deposition of salts in the form of scale in kettles, hot-water pipes, boilers and radiators. It also makes the skin dry.

What we have to do?

Find the nature of water qualitatively as hard or soft by comparing the foaming capacity of soap in the samples of water collected and in distilled water.

Science behind it!

Foam is produced when soap is shaken with water. Foaming of a soap is due to the

presence of hydrophilic and hydrophobic portions in its molecule i.e., $RCOO^-Na^+$.The foaming capacity of soap gets reduced in hard water. When soap is added to hard water, it reacts with the calcium and magnesium salts present in it and gets precipitated in the form of scum, which is insoluble in water. The scum reduces the cleansing power and foaming capacity of soap. As a result more soap is required. Chemical reactions that take place are as follows:

$$\underset{\text{Calcium Hydrogencarbonate}}{Ca(HCO_3)_2(aq)} + 2Na^+ - \underset{\text{Sodium stearate (Soap)}}{\text{stearate (aq)}} \longrightarrow \underset{\text{Calcium stearate (Scum)}}{Ca(\text{stearte})_2(S)} + \underset{\text{Sodium hydrogencarbonate}}{2NaHCO_3(aq)}$$

$$CaSO_4(aq) + 2Na^+ - \text{stearate(aq)} \longrightarrow \underset{\text{(Scum)}}{Ca(\text{stearate})_2\ (s)} + 2Na_2SO_4(aq)$$

Here the foaming capacity of sample water will be compared with respect to distilled water in which calcium and magnesium salts are not present. If the foaming capacity of sample water is nil or very little, it is hard water. In such cases, formation of scum may be observed. However, if the foaming capacity of sample water is significant but less than that of distilled water, it is not as soft as distilled water. In such cases scum formation may not be seen. As the hardness of water increases, scum formation increases and the foaming capacity decreases. It is important to note that the detergents give foam even with hard water.

What do we need?

- Distilled water
- Sample water
- Bathing soap
- Beakers(50 mL) ---------- One
- Test tubes(15 mL) ---------- Four
- Test tube stand ---------- One
- Glass rod ---------- One
- Measuring cylinder (50mL)----- One
- Measuring scale ---------- One
- Physical balance and weight box

How do we proceed?

1. Crush the soap in small pieces.
2. Weigh 1g of crushed soap and put it in a 50 mL beaker.

Note: All the students must use only 1g crushed sample of same soap. Do not take detergent.

3. Add 20 mL of distilled water in the beaker containing the soap pieces. Dissolve the soap pieces completely in water by stirring the solution with a glass rod. Our soap solution is ready.
4. Take a test tube stand and place four test tubes in it and label them as A, B , C and D.

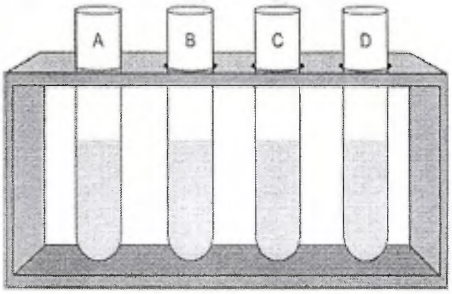

Fig. 1: *Test tubes containing soap solutions in distilled water and sample water.*

5. Add 5 mL of distilled water each in test tubes 'A' and 'B' and 5 mL of sample water each in test tube 'C' and 'D'. Ensure that the level of water is same in all the test tubes. If not change the test tube.
6. Pour 1 mL of the soap solution prepared above ,in each of the test tubes(Fig.1).
7. Take the test tube 'A' and shake it ten times by placing thumb on its mouth (Fig.2).

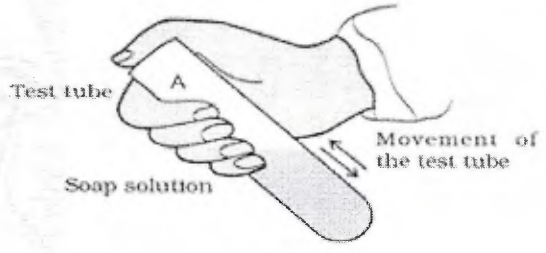

Fig. 2: *Shaking of the test tube*

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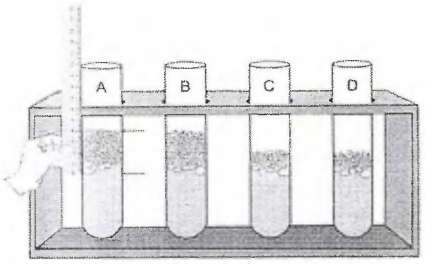


Fig. 3: Comparison of the foaming capacity of soap in distilled water and sample water.

8. Measure the height of the foam produced immediately with the help of a measuring scale (Fig. 3) and note it down in the Table given above.
9. Repeat steps 7 and 8 with the test tubes 'B', 'C' and 'D'.

avoid spilling of soap solution.

- Ensure that soap dissolves completely in distilled water.
- The quantity of soap solution added to all the samples of water must be same.
- The mass of the soap samples must be determined very carefully using a physical balance. In case of any need, take help from your facilitator/ teacher.
- Take care that separate test tubes are used for testing different samples of water
- Shake every tube for equal number of times and in a similar manner.
- Measure the height of the foam produced immediately after its production.

Observation Table

Mixture (Water+ Soap)	Test Tubes	Height of the Foam Produced cm	Average height of Foam cm
Distilled water	A		
	B		
Sample water	C		
	D		

Findings

Infer from the observations whether in distilled water the soap produces more foam (lather) in comparison to sample water. If the height of the foam produced in the sample water is less than the distilled water, this means sample of water is not as soft as distilled water. If scum is produced, then it is a sample of hard water.

What precautions to follow?

- Use same sample of soap solution for distilled water and sample water. Do not use detergent solution in place of soap solution.
- Use distilled water for preparing the soap solution
- Stir the mixture carefully while dissolving soap in water so as to
- Perform experiment in the presence of a teacher/facilitator.

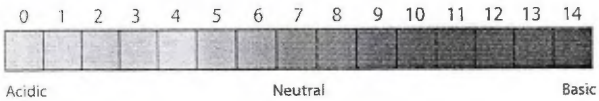
3. Testing the pH of Water

Introduction

pH is a measure of acidity or alkanity of a solution. pH value indicates the concentration of hydrogen ions (H^+) contained in the solution. At 298 K, pH of pure water or any neutral aqueous solution is 7. Generally universal indicator or pH paper is used for finding the pH. Universal indicator shows different colours at different pH.

The lower the pH of solution, the more acidic it is. The higher the pH of a solution, the more alkaline or basic it is. At 298 K, a

neutral solution has pH equal to 7. Surface water has pH range between 6.5 to 8.5.



pH- Scale

What we have to do?

Find the pH of the samples of water from different sources using pH paper.

Science behind it!

Universal indicator exhibits different characteristic colours at different pH between pH range 0-14. It is used for determining the approximate value of pH. At low pH, universal indicator appears red and at high pH it appears blue. At neutral pH, it appears green.

What do we need?

- Beakers (100 mL) as per requirement
- Glass/plastic droppers as per requirement
- pH colour chart ------one
- pH paper strips as per requirement
- Water sample(s)

How do we proceed?

1. Put one drop of the sample of water on the pH paper strip by using a dropper.

   Note:

   (i) Dropper used for the sample must first be washed with distilled water then rinsed with the sample water of which pH is to be found.

   (ii) pH paper should be kept on a white tile/ paper

2. Observe and record pH by comparing the color appearing on the pH paper with the colour on the pH chart.
3. Repeat the steps 1 to 2 for other samples you have.

What do we observe?

Observation Table

S. No.	Water Sample			Colour of pH Paper soaked in Sample Water	pH
	Source	Colour	Odour		
1.					
2.					
3.					
4.					

4. Testing Total Alkalinity of Water

This experiment is specifically for students of classes XI and XII. However, students of classes IX and X can also perform this experiment, if interested.

Introduction

Alkalinity is a measurement of ability of water to neutralize acids. Acidity in natural water generally come from rain or snow, through soil sources and from industrial discharges. Alkalinity of natural waters is primarily due to the presence of basic salts; although strong bases (i.e. OH^-) may also contribute in extreme environments. Hydrogen carbonates represent the major form of alkalinity in natural waters; its source being the dissolution of CO_2 from the atmosphere and the weathering of carbonate minerals in rocks and soil. Other salts of weak acids and bases, such as borates, silicates, ammonium salts, phosphates etc. may be present in small amounts.

Highly acidic and alkaline waters are considered unpalatable.

Knowledge of alkalinity of water may be important because:

1. It provides information about how sensitive a water body will be to acid inputs such as acid rain.
2. Hard waters are frequently softened by precipitation methods. In order

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to calculate the lime ($Ca(OH)_2$) and soda ash (Na_2CO_3) requirements for precipitation, the alkalinity of the water must be known.

3. Knowledge of alkalinity is important to control corrosion in piping systems made from iron.
4. Systems of living organisms, especially aquatic life, function best in a pH range 6.0 to 9.0. Alkalinity is important because it provides buffer actions against rapid pH changes.

Alkalinity, by convention, is reported as mg/L of $CaCO_3$ since most alkalinity is derived from the weathering of carbonate minerals.

What we have to do?

Find out the alkalinity of water that we use

Science behind it!

Natural water may become alkaline due to the presence of one or more of soluble salts of sodium, potassium, calcium or magnesium in the form of carbonates, bicarbonates or hydroxides. For estimation of alkalinity of water, a known volume of the water sample is titrated against standard acid (like 0.1M HCl) solution using methyl orange indicator. At the end point colour of the indicator changes from yellow to pink.

Chemicals Reaction Involved:

(a) For carbonates:

$$K_2CO_3 + 2HCl \rightarrow 2KCl + H_2O + CO_2$$

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$

(b) For bicarbonates:

$$Mg(HCO_3)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O + 2CO_2$$

$$Ca(HCO_3)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O + 2CO_2$$

$$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$$

(c) For hydroxide:

$$NaOH + HCl \rightarrow NaCl + H_2O$$

$$KOH + HCl \rightarrow KCl + H_2O$$

What do we need?

(a) Apparatus:

Burette ---------- (One)
Pipette (25 mL)---------- (One)
Volumetric flask (100 mL) -------- (One)
Watch glass ----------(One)
Funnel ----------(One)
Wash bottle ----------(One)
Conical flask (250 mL) ---------- (One)
Burette stand.---------- (One)

(b) Chemicals:

Sodium carbonate,
Hydrochloric acid,
Distilled water,
Solution of methyl orange indicator
Water sample.

How do we proceed?

(a) Preparation of 0.1 M standard solution of sodium carbonate

To prepare 0.1 M Na_2CO_3solution, 10.6 g of Na_2CO_3 (molar mass106 g/mol) should be dissolved in one liter of the solution. Therefore, to prepare 100 mL of 0.1 M Na_2CO_3 solution 1.0600 g of sodium carbonate is first taken in volumetric flask and dissolved in minimum quantity of water .Then the solution is diluted to exactly 100 mL by adding distilled water through wash bottle.

(b) Standardization of hydrochloric acid solution by titrating it against standard sodium carbonate

(i) Concentration of laboratory reagent grade conc. HCl is about 36% (11.56 M). To make it about 0.1 M, dilute about 8.6 mL of it to 1.0 L with the help of distilled water. Now fill up the burette with this HCl solution with the help of funnel and mount it on the burette stand. Record the initial burette reading in the observation Table-1 given below.

(ii) Carefully pipette out 10 mL of standard sodium carbonate solution

and transfer to a clean conical flask. Add two to three drops of methyl orange indicator. The solution will turn yellow in colour.

(iii) Titrate the solution with constant swirling till colour of the solution changes from yellow to light pink. Record the final burette reading in the observation Table- 1 given below.

Observation Table – 1

S. No.	Volume of Sodium Carbonate (V_2)/mL	Burette Readings		Volume of Acid solution used (V_1)/mL
		Initial	Final	
	Concordant reading			

(iv) Repeat the titration to get at least three concordant readings.

Chemical reaction involved in the standardization of HCl:

$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

1 mole 2 mole

(a_2=2) (a_1= 1)

Acid Base

$a_1 M_1 V_1 = a_2 M_2 V_2$

$a_1 = 1$; $a_2 = 2$

where a_1 = basicity of HCl = 1

and a_2 = acidity of Na_2CO_3 = 2

$$M_1 = \frac{2 M_2 V_2}{V_1}$$

(c) Determination of total alkalinity

(i) Take 50 mL of water sample into conical flask with the help of pipette. Add 2-3 drops of methyl orange indicator. The solution will turn yellow in colour. Titrate with the standard HCl solution till the colour of solution changes from yellow to light pink. Record the initial and final burette readings in Table- 2 given below

(ii) Repeat the titration to get at least three concordant readings.

Observation Table – 2

S. No.	Volume of Water Sample (V_3)/ mL	Burette Readings		Volume of HCl Solution Consumed (V_4)/mL
		Initial	Final	
	50			
	Concordant reading			

Water sample Standard Acid

$a_4M_3V_3 = a_3M_1V_4$

where a_3 = basicity of HCl = 1
and a_4 = acidity of $CaCO_3$ = 2

Here $a_3 = 1$; $a_4 = 2$

$1 \times M_3 \times 50 = 2 \times M_1 \times V_4$

$$M_3 = \frac{2 \times M_1 \times V_4}{50}$$

We know

(i) Molar mass of $CaCO_3$ = 100 g/ mol;

(ii) 1 g = 1000 mg;

(iii) Strength = Molarity of sample water × Molar mass of $CaCO_3$

$= M_3 \times 100$ g/L

(iv) Units of strength = g/L

(v) parts per million (ppm) or mg/L

The total alkalinity of water sample

$= M_3 \times 100 \times 1000$ mg/ L of $CaCo_3$

$= M_3 \times 100000$ ppm

What do we conclude?

The total alkalinity of water sample is _____mg/ L (or ppm).

What precautions to follow?

1. Rinse the burette and pipette and conical flask with the solutions which are to be taken in them
2. Hydrochloric acid and sodium carbonate are highly corrosive, so these should be handled carefully.
3. For dilution of acid, acid should be added slowly in small lots to water with shaking .Water should never be added to the acid for preparing solution.
4. Lower meniscus should be observed while noting the reading of solution.
5. Preparation of solutions and dilution of acid should be carried out in the presence of a teacher/facilitator.
6. If pipette is not available, burette may be used.

What do we conclude from the above activities?

On the basis of the results of the above activities, for which of the following purpose are the samples of water collected by you are suitable. (Mark √ or ×) in Table - 3.

Table - 3

S. No.	Purpose	Sample 1	Sample 2	Sample 3	Sample 4
1.	Drinking				
2.	Cooking				
3.	Washing of clothes				
4.	Washing of utensils				
5.	Mopping				
6.	Gardening				
7.	Any other (please specify)				

Extended Learning

During Rashtriya Avishkar Saptah 2018, schools may organise discussion, interaction and/or lecture by expert(s) in the area of water quality testing for wider awareness of all students, teachers and even local community.

In addition to the suggested experiments the schools may explore and include some more parameters of water testing with the help of faculty members of nearby Higher Education Institutions (HEIs). Even, a few group of students may undertake investigatory projects on quality of water of different sources available in their locality.

121C

Reporting the Results of Study

All students of classes IX to XII of the selected school have to carry out the study 'testing of water' using different sources of water. The results obtained by all the students of the school, for three parameters of testing, for each source of water, should be collated. The average of the values obtained by all the students of the school should be calculated for each parameter of testing for each source of water.

The average of the results of the study 'testing of water' conducted during Rashtriya Avishkar Saptah 2018,are to be reported by each school by filling up the details in the Google form on the following link:

http://bit.ly/2BXhIPk

A gmail id is required for filling up the details on the Google Form. For this a new Gmail id may be created for the school or an existing Gmail of the school or any teacher may be used.

The duly filled Google form has to be submitted within fifteen days after the conduct of Rashtriya Avishkar Saptah 2018. The results submitted by all schools will be collated, analysed and shared by DESM, NCERT.

111C

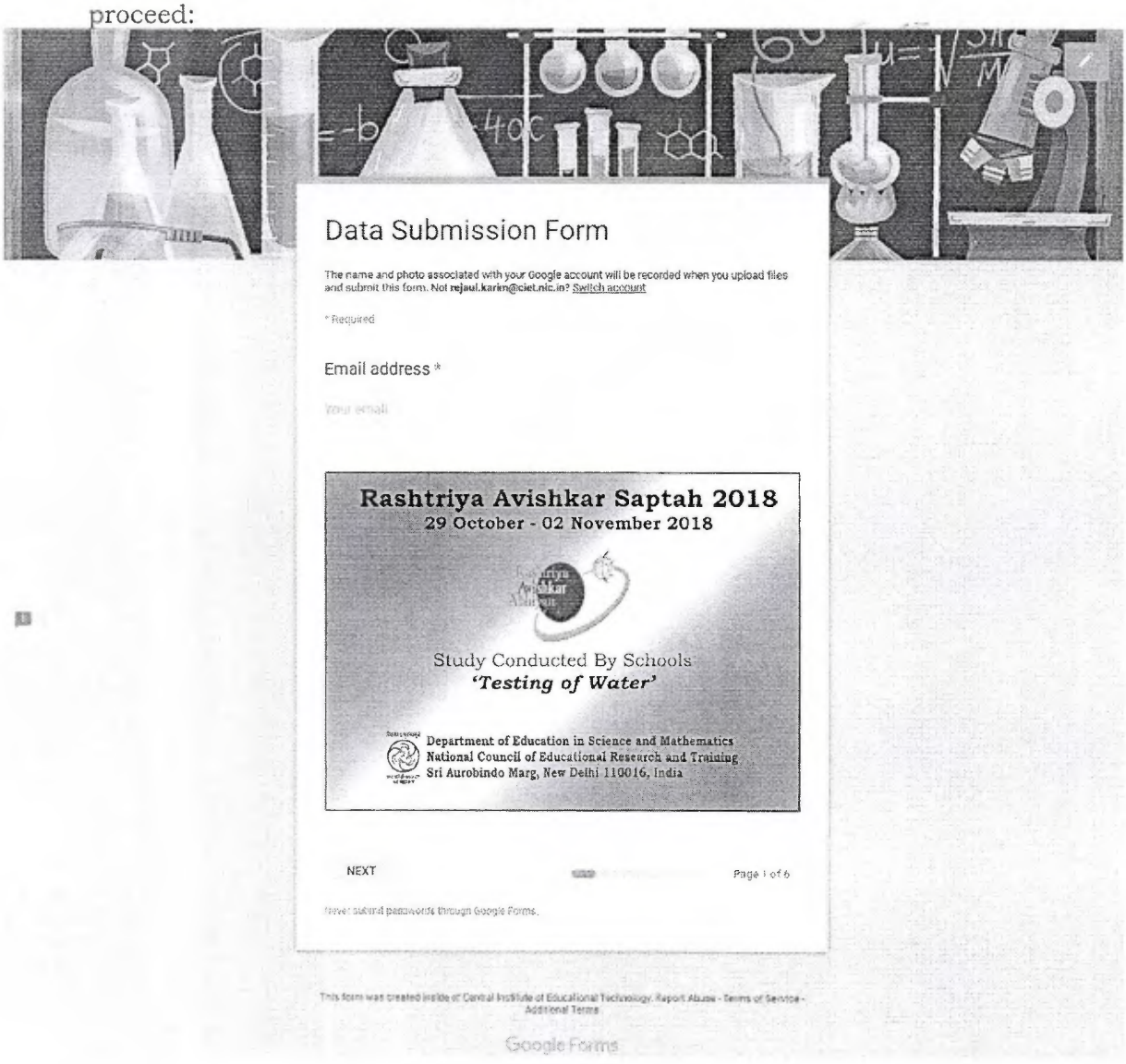
PROCEDURE FOR FILLING GOOGLE FORM

Filling up Google Form is very easy. You need to have a Gmail account for filling this Google form.

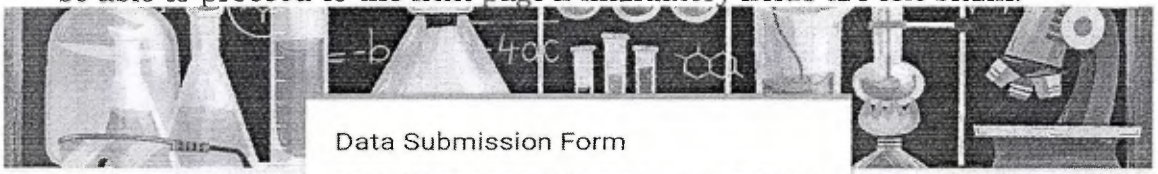
1. Once you have a working Google id (Gmail), you can open any browser and copy/ type the following URL into browser:

   http://bit.ly/2BXhIPk

2. It will take you to the following page where you need to enter the Gmail id to proceed:



3. Once you click on 'NEXT', following page opens up. On this page, you will fill up the details of your school. Fields marked with * are mandatory and you wouldn't be able to proceed to the next page if mandatory fields are left blank.



Data Submission Form

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* Required

School Details

State/Union Territory

Choose

Name of the District *

Your answer

Block where School is located *

Your answer

Name of School *

Your answer

U-DISE Code of School *

Your answer

Address of School

Your answer

Pin code

Your answer

Locality of School (Urban/Semi-urban/Rural) *

- ○ Rural
- ○ Semi-urban
- ○ Urban

Name of School Principal/Head Master *

Your answer

Name and designation of Teacher(s) involved in guiding the experiments for the study

Your answer

Name and designation of Laboratory Assistant(s) involved in facilitating the experiments for the study

Your answer

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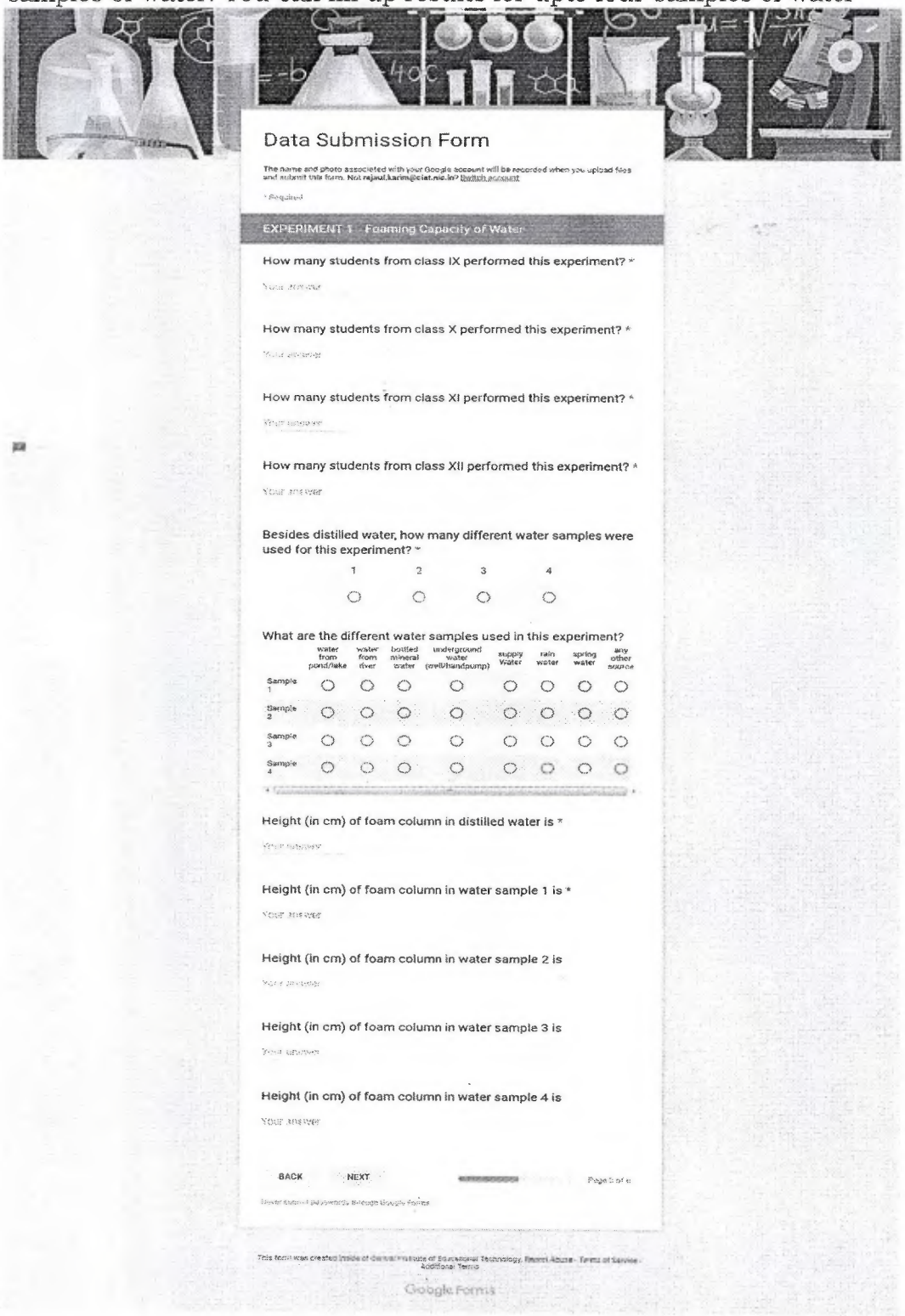
Google Forms

4. Anytime you can go back to change/correct data by clicking on 'BACK' button. Otherwise click on 'NEXT' to proceed. On next page fill up the average of results obtained by the students in the experiment 'Foaming Capacity of Water' for different samples of water. You can fill up results for upto four samples of water



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EXPERIMENT 1 - Foaming Capacity of Water

How many students from class IX performed this experiment? *

Your answer

How many students from class X performed this experiment? *

Your answer

How many students from class XI performed this experiment? *

Your answer

How many students from class XII performed this experiment? *

Your answer

Besides distilled water, how many different water samples were used for this experiment? *

1	2	3	4
○	○	○	○

What are the different water samples used in this experiment?

	water from pond/lake	water from river	bottled mineral water	underground water (well/handpump)	supply water	rain water	spring water	any other source
Sample 1	○	○	○	○	○	○	○	○
Sample 2	○	○	○	○	○	○	○	○
Sample 3	○	○	○	○	○	○	○	○
Sample 4	○	○	○	○	○	○	○	○

Height (in cm) of foam column in distilled water is *

Your answer

Height (in cm) of foam column in water sample 1 is *

Your answer

Height (in cm) of foam column in water sample 2 is

Your answer

Height (in cm) of foam column in water sample 3 is

Your answer

Height (in cm) of foam column in water sample 4 is

Your answer

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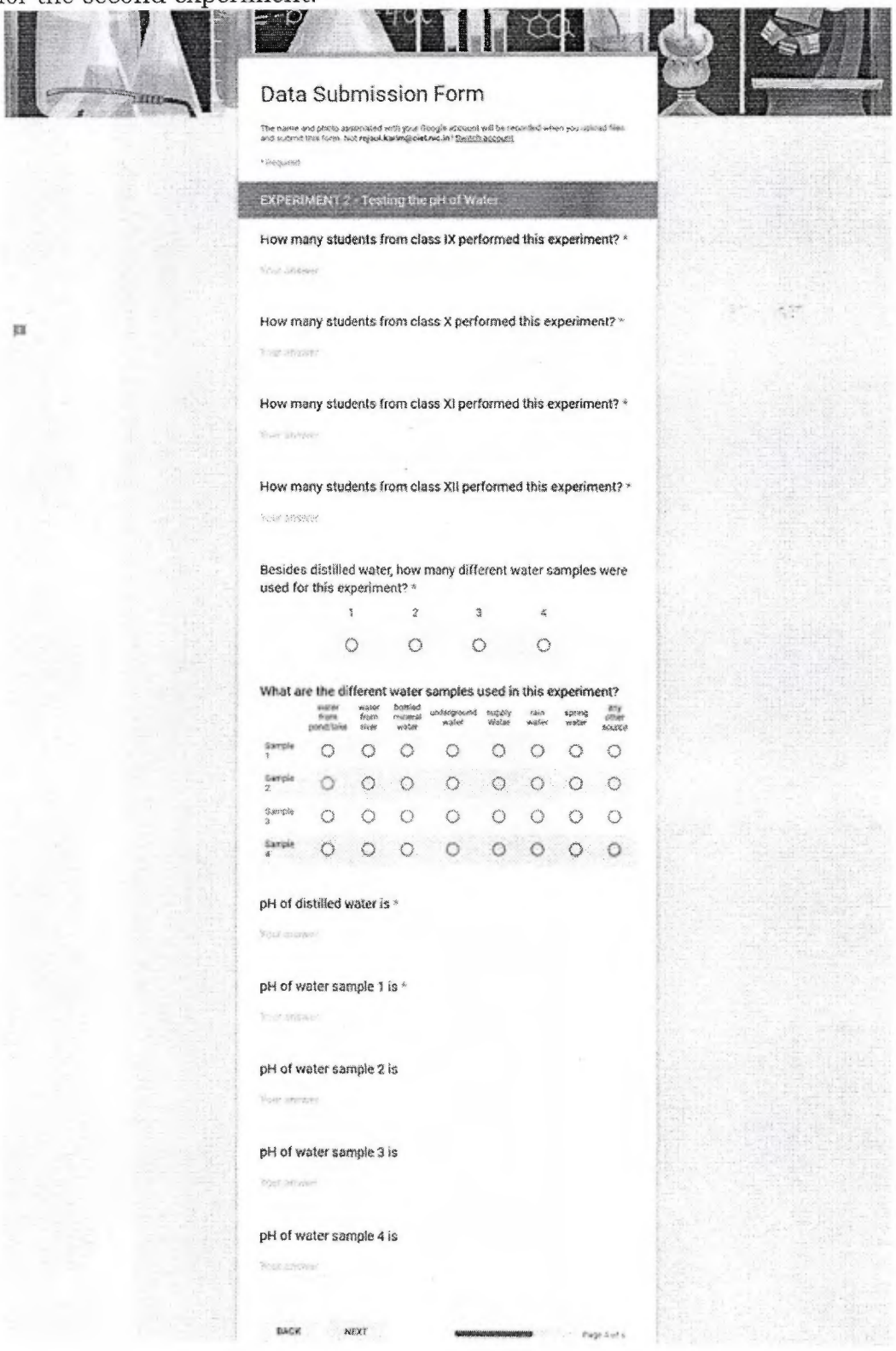
5. When you click on NEXT, following page opens up where you have to fill up results for the second experiment.



Data Submission Form

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* Required

EXPERIMENT 2 - Testing the pH of Water

How many students from class IX performed this experiment? *

Your answer

How many students from class X performed this experiment? *

Your answer

How many students from class XI performed this experiment? *

Your answer

How many students from class XII performed this experiment? *

Your answer

Besides distilled water, how many different water samples were used for this experiment? *

1	2	3	4
○	○	○	○

What are the different water samples used in this experiment?

	water from pond/lake	water from river	bottled mineral water	underground water	supply water	rain water	spring water	any other source
Sample 1	○	○	○	○	○	○	○	○
Sample 2	○	○	○	○	○	○	○	○
Sample 3	○	○	○	○	○	○	○	○
Sample 4	○	○	○	○	○	○	○	○

pH of distilled water is *

Your answer

pH of water sample 1 is *

Your answer

pH of water sample 2 is

Your answer

pH of water sample 3 is

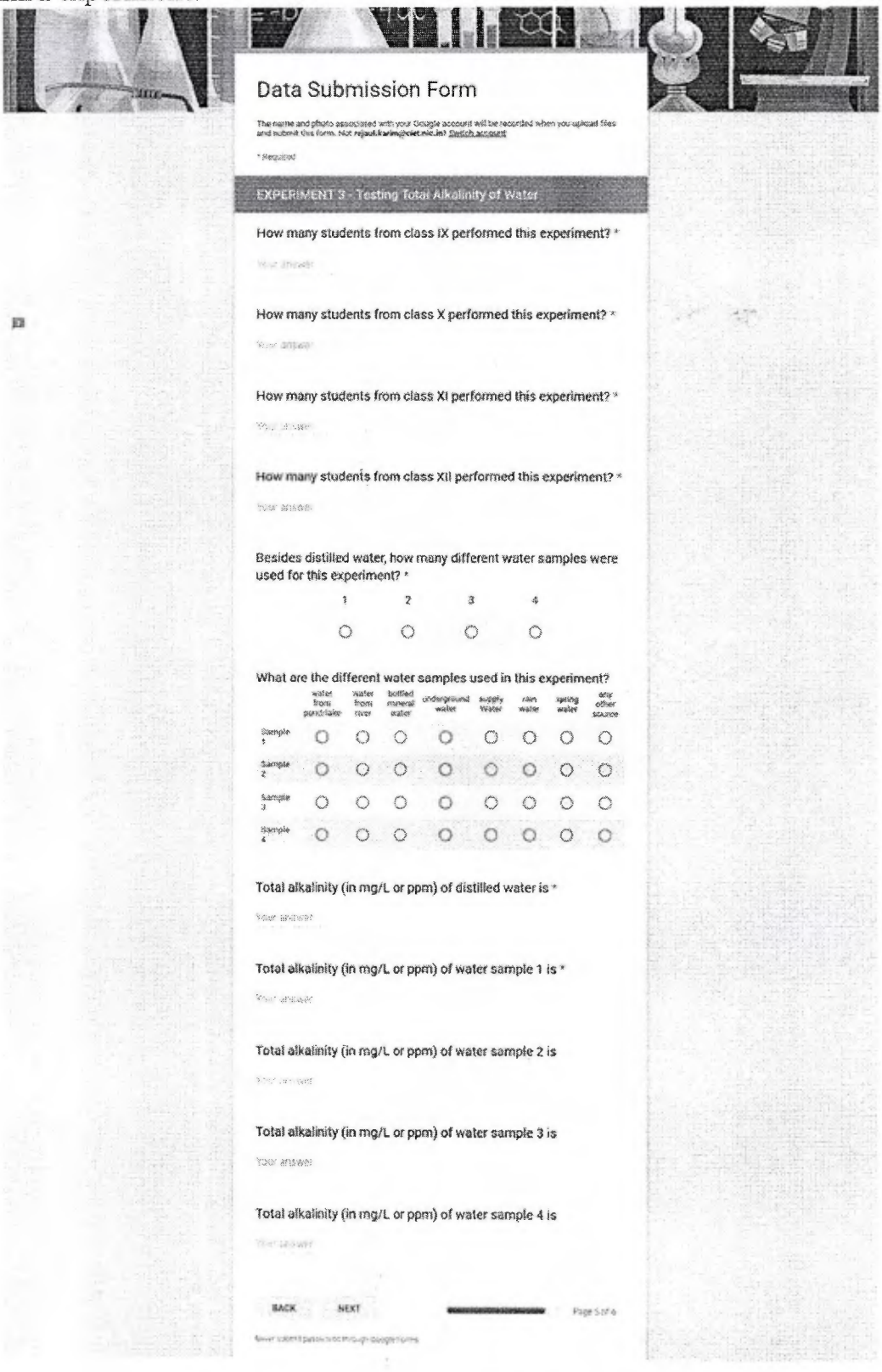
Your answer

pH of water sample 4 is

Your answer

BACK NEXT

6. On clicking NEXT, following page opens up where you have to fill up results for the third experiment.



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* Required

EXPERIMENT 3 - Testing Total Alkalinity of Water

How many students from class IX performed this experiment? *

Your answer

How many students from class X performed this experiment? *

Your answer

How many students from class XI performed this experiment? *

Your answer

How many students from class XII performed this experiment? *

Your answer

Besides distilled water, how many different water samples were used for this experiment? *

1	2	3	4
○	○	○	○

What are the different water samples used in this experiment?

	water from pond/lake	water from river	bottled mineral water	underground water	supply water	rain water	spring water	any other source
Sample 1	○	○	○	○	○	○	○	○
Sample 2	○	○	○	○	○	○	○	○
Sample 3	○	○	○	○	○	○	○	○
Sample 4	○	○	○	○	○	○	○	○

Total alkalinity (in mg/L or ppm) of distilled water is *

Your answer

Total alkalinity (in mg/L or ppm) of water sample 1 is *

Your answer

Total alkalinity (in mg/L or ppm) of water sample 2 is

Your answer

Total alkalinity (in mg/L or ppm) of water sample 3 is

Your answer

Total alkalinity (in mg/L or ppm) of water sample 4 is

Your answer

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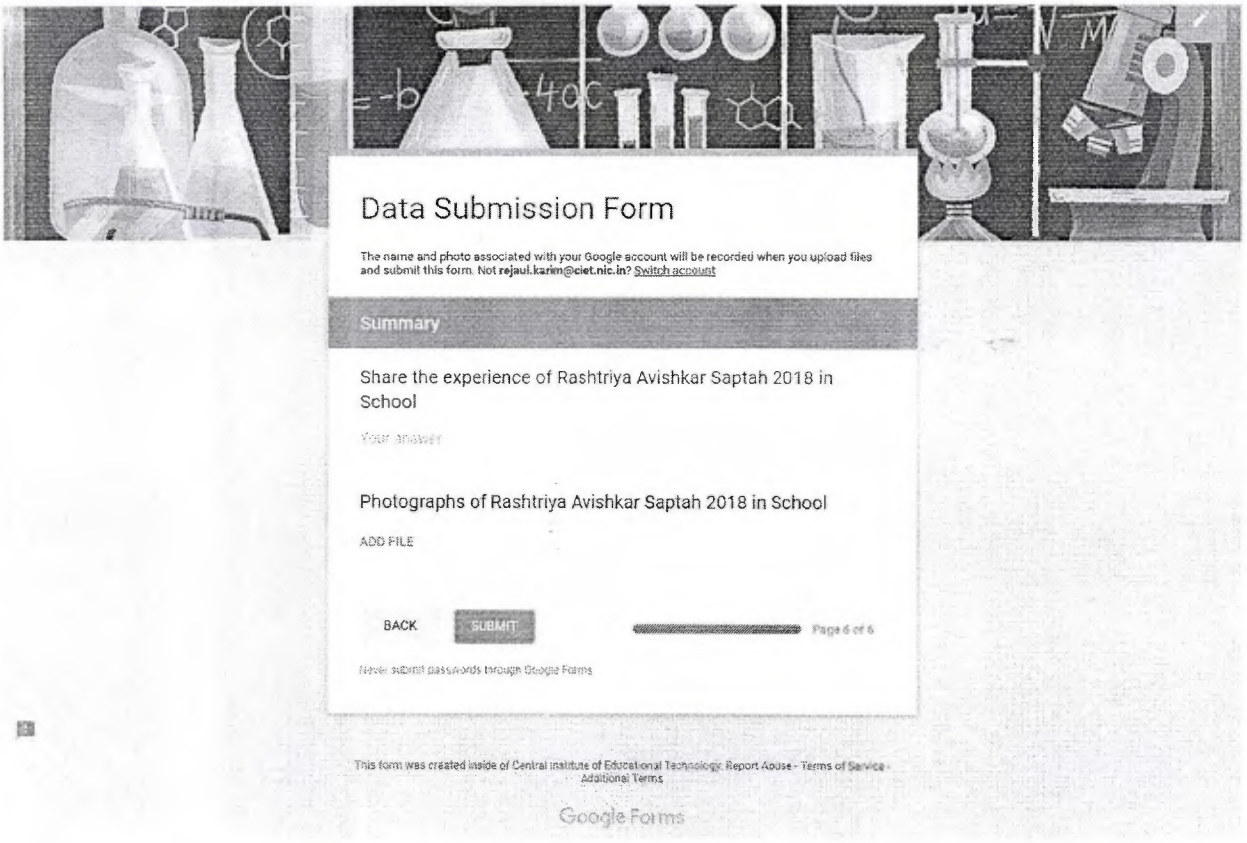
7. On this page, share your experience of conducting Rashtriya Avishkar Saptah 2018. Also upload photographs of Rashtriya Avishkar Saptah 2018 in your school.



8. After clicking on Submit, you will get the following confirmation message that you have successfully submitted the form.

DR. APJ ABDUL KALAM

AvulPakirJainulabdeen Abdul Kalam, born on 15th October, 1931 in a small village in Rameswaram in Tamil Nadu, rose to become the President of India. Dr. Kalam was elected as 11th President of India in July, 2002. One of the iconic Presidents of India, the late Dr. A P J Abdul Kalam, who was not only the country's Missile Man, but the most popular "People's President". Coming from a very humble background, he used to distribute newspapers as a child to supplement family income, relentlessly pursued education in the most difficult circumstances and became one of the leading space and missile scientists of India. A newspaper boy becoming President of India is the greatness of this country.

As President, he shared his vision for India, addressing youth and old with the same passion which formed his entire life. Dr. Kalam was passionate for transforming society through technology especially in inspiring the youth of India to harness Science and Technology for human welfare. Dr. Kalam, inspite of his achievements, always wanted to be remembered as a teacher. And it was as a teacher addressing a gathering at IIM Shillong that he breathed his last on the evening of 27th July, 2015.

Source: http://pibmumbai.gov.in/English/PDF/E2015_FR44.PDF

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(2)C

Rashtriya Avishkar Abhiyan

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एन सी ई आर टी
NCERT

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