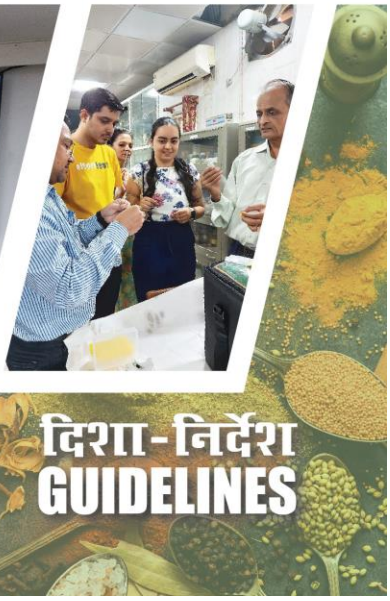
राष्ट्रीय आविष्कार सप्ताह 2023-24

RASHTRIYA AVISHKAR SAPTAH 2023-24



दिशा-निर्देश
GUIDELINES

Rashtriya Avishkar Saptah
2023-24

Guidelines

विद्ययाऽमृतमश्नुते

एन सी ई आर टी
NCERT

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

DR. APJ ABDUL KALAM

Avul Pakir Jainulabdeen 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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ACKNOWLEDGEMENTS

The Guidelines on Rashtriya Avishkar Saptah 2023-24 for school students is to bring focus on innovation and use of technology and to make learning of science experiments a joyful activity. As per the guidelines, all students at Middle (Classes VI–VIII) and Secondary (Classes IX-XII) stages will carry out the experiments on the Theme **"Identification of Adulterants in Food"**. The guidelines will be followed by PM Shri schools besides the other categories of schools of all States and Union territories.

Development of these guidelines would not have been possible without the appreciated inputs of various individuals associated with this programme. Foremost, the Council would like to thank *Prof. Dinesh Prasad Saklani, Director, NCERT* and *Prof. Sridhar Srivastava, Joint Director, NCERT*, for their directions and support at every step of the guideline's development.

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NCERT thanks *Dr. Divya Verma, JPF* and *Mr. Amar Kumar, JPF* who are associated with the programme and given their contribution at each stage of development of guidelines.

The council also thanks to our Technical Staff *Mr. Tarun Kumar Nogia, Graphic Designer, Mr. Kishore Singhal, Typist* and *Mr. Shivam Gaur, System Analyst f*or helping in the final layout and formatting of the Guidelines.

NCERT thanks all the people who has supported directly and indirectly in each and every phase of development of guidelines for Rashtriya Avishkar Saptah 2023-24.

Guidelines for Rashtriya Avishkar Saptah 2023-24

Introduction

Science, Technology and Innovation have emerged as the major drivers of national development globally. Ministry of Education (MoE), Government of India launched Rashtriya Avishkar Abhiyan (RAA) with the following objectives:

- To make learning of Science and Mathematics a joyful and meaningful activity
- To nurture a spirit of inquiry and creativity; and
- To bring focus on innovation and use of technology

National Education Policy (NEP) 2020 emphases on 'Experiential learning' that is 'learning by doing' to build conceptual understanding and skills through guided practice, reflection, observation, evaluation to accelerate learning, to improve retention resulting in amalgamation of cognitive, psycho-motor and affective domains of learning through an integrated and multidisciplinary approach of learning to ensure more meaningful, holistic and cohesive learning experience for the students.

For this, at Middle and Secondary stages of education, systematic experimentation and working on locally significant projects involving science and technology are important parts of curriculum. In order to encourage students for exploration and innovation, it is extremely important to engage them in experimentation-based learning.

Considering this, Programme Approval Board (PAB), MoE, Government of India has approved the proposal of Department of Education in Science and Mathematics (DESM), NCERT, New Delhi that any week during November 2023 to January 2024 may be declared as 'Rashtriya Avishkar Saptah 2023-24'. During this week, all the students at Middle and Secondary stages, at least from 3-5 schools of each block across the country, will carry out a few experiments as per the Guidelines developed by NCERT.

The objective of this programme is to generate enthusiasm and to encourage experimentation or exploration among students at Middle and Secondary stages in Science and Mathematics.

Engaging students in understanding and creating awareness of some common issues and local problems may be one of the ways to achieve this or could be a means to accomplish this goal.

Scheduled Dates for the conduct of Rashtriya Avishkar Saptah 2023-24

Rashtriya Avishkar Saptah 2023-24 is scheduled to be conducted in any week during November 2023 to January 2024 in at least 3 to 5 schools from each block of the country.

Note: *The schools which remain closed due to winter vacation from December to January can conduct the activities in February 2024.*

Selection of School

All States/ UTs/ KVS/ NVS will essentially involve all the PM Shri schools besides the other categories of schools.

The State/UT government has to select at least 3-5 schools preferably from each block which has classes for Middle and Secondary levels, for conducting the activities of 'Rashtriya Avishkar Saptah 2023-24'.

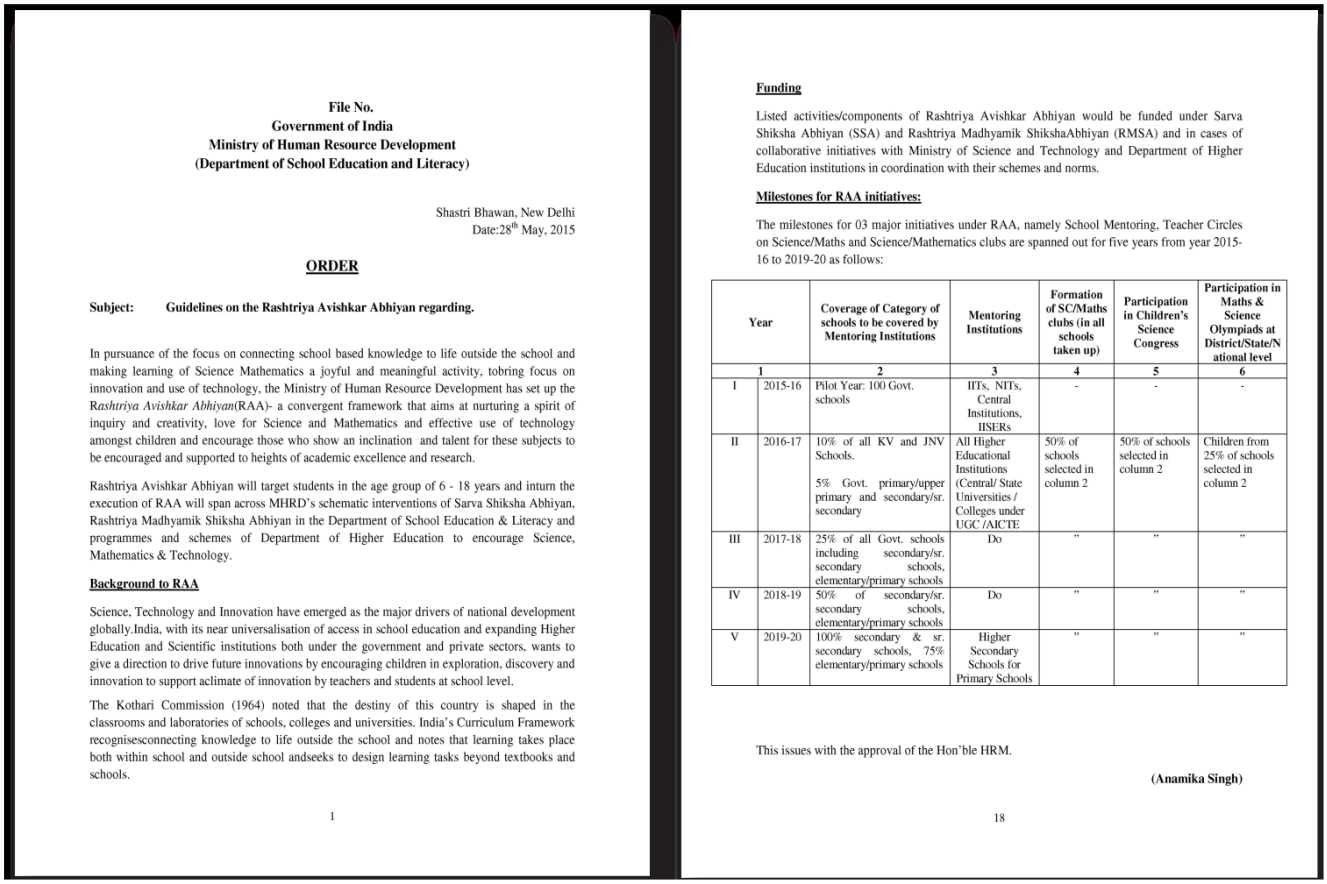
Note: However all the schools of the above-mentioned category may also be considered, if feasible. Composite schools may be selected. Some parameters have to be considered while selecting the school. It is desirable to select a co-educational school. If not possible, then care should be taken that within a State/UT, almost equal numbers of girl's and boy's schools must be selected. While choosing schools, an equal representation of rural and urban schools may also be ensured.

In some States/UTs, Middle and Secondary schools operate independently. In such cases, one Middle and one Secondary school may be selected from each block. If possible, twinning of these two schools may be done for Rashtriya Avishkar Saptah 2023-24. For special cases, such as in some UTs, where there are no blocks, 3-5 schools may be selected from each cluster/ zone.

Funding

It is suggested that the State/UT may allocate a budget of Rs. 3000-4000/- per school to support the implementation of the activities/ experiments related to the "Identification of Adulterants in Food" that are to be conducted during Rashtriya Avishkar Saptah 2023-24. In States/UTs, where Middle, and Secondary School each has been selected from a block, a budget of Rs. 3000-4000/- may be allocated to each school. For this purpose, the States/UTs may utilize the

funds allocated by Ministry of Education (MoE), through Programme Approval Board (PAB) of Rashtriya Avishkar Abhiyan (RAA) under Samagra Shiksha. For details please refer to page no. 18 of RAA Guidelines by Ministry of Education (MoE) initially known as Ministry of Human Resource Development (MHRD) **[Letter attached or link attached].**



File No.
Government of India
Ministry of Human Resource Development
(Department of School Education and Literacy)

Shastri Bhawan, New Delhi
Date:28th May, 2015

ORDER

Subject: Guidelines on the Rashtriya Avishkar Abhiyan regarding.

In pursuance of the focus on connecting school based knowledge to life outside the school and making learning of Science Mathematics a joyful and meaningful activity, tobring focus on innovation and use of technology, the Ministry of Human Resource Development has set up the R*ashtriya Avishkar Abhiyan*(RAA)- a convergent framework that aims at nurturing a spirit of inquiry and creativity, love for Science and Mathematics and effective use of technology amongst children and encourage those who show an inclination and talent for these subjects to be encouraged and supported to heights of academic excellence and research.

Rashtriya Avishkar Abhiyan will target students in the age group of 6 - 18 years and inturn the execution of RAA will span across MHRD's schematic interventions of Sarva Shiksha Abhiyan, Rashtriya Madhyamik Shiksha Abhiyan in the Department of School Education & Literacy and programmes and schemes of Department of Higher Education to encourage Science, Mathematics & Technology.

Background to RAA

Science, Technology and Innovation have emerged as the major drivers of national development globally.India, with its near universalisation of access in school education and expanding Higher Education and Scientific institutions both under the government and private sectors, wants to give a direction to drive future innovations by encouraging children in exploration, discovery and innovation to support aclimate of innovation by teachers and students at school level.

The Kothari Commission (1964) noted that the destiny of this country is shaped in the classrooms and laboratories of schools, colleges and universities. India's Curriculum Framework recognisesconnecting knowledge to life outside the school and notes that learning takes place both within school and outside school andseeks to design learning tasks beyond textbooks and schools.

1

Funding

Listed activities/components of Rashtriya Avishkar Abhiyan would be funded under Sarva Shiksha Abhiyan (SSA) and Rashtriya Madhyamik ShikshaAbhiyan (RMSA) and in cases of collaborative initiatives with Ministry of Science and Technology and Department of Higher Education institutions in coordination with their schemes and norms.

Milestones for RAA initiatives:

The milestones for 03 major initiatives under RAA, namely School Mentoring, Teacher Circles on Science/Maths and Science/Mathematics clubs are spanned out for five years from year 2015-16 to 2019-20 as follows:

Year		Coverage of Category of schools to be covered by Mentoring Institutions	Mentoring Institutions	Formation of SC/Maths clubs (in all schools taken up)	Participation in Children's Science Congress	Participation in Maths & Science Olympiads at District/State/National level
1		2	3	4	5	6
I	2015-16	Pilot Year: 100 Govt. schools	IITs, NITs, Central Institutions, IISERs	-	-	-
II	2016-17	10% of all KV and JNV Schools. 5% Govt. primary/upper primary and secondary/sr. secondary	All Higher Educational Institutions (Central/ State Universities / Colleges under UGC /AICTE	50% of schools selected in column 2	50% of schools selected in column 2	Children from 25% of schools selected in column 2
III	2017-18	25% of all Govt. schools including secondary/sr. secondary schools, elementary/primary schools	Do	"	"	"
IV	2018-19	50% of secondary/sr. secondary schools, elementary/primary schools	Do	"	"	"
V	2019-20	100% secondary & sr. secondary schools, 75% elementary/primary schools	Higher Secondary Schools for Primary Schools	"	"	"

This issues with the approval of the Hon'ble HRM.

(Anamika Singh)

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Note: Schools designated under PM Shri category may use fund provided under the scheme.

Academic Support

The faculty members of SCERTs and DIETs may be involved for providing academic support to the selected schools. If possible, the science faculty member(s) of Higher Education Institutes (HEIs) located close to the schools may also be involved. Block level administrator may coordinate through online mode during Rashtriya Avishkar Saptah 2023-24 to facilitate the conduct of experiments/ activities.

Stage appropriate involvement of the students in performing experiments

All students of classes VI to XII of the selected school will carry out the experiments/ activities within the stipulated time periods assigned to them in their time-table for performing practicals in science/chemistry classes or assignments given at their home as per requirements. Students who are performing activities/experiments at home are expected to perform these activities/ experiments individually at their home only under the supervision of guardians/parents/elder siblings.

Procedure for performing experiments

Understanding the procedure for performing the experiments/activities and importance of the chosen experiments/ activities 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/activities on identification of food adulteration.

Role of teachers while performing experiments

Teacher may provide instructions/hand holding to the students prior to performing the experiments on the selected theme in a scientific manner. Teacher may provide the procedure to the students for performing activities/experiments. She/he may make the students aware about the scientific method involved for the study, objectives of the study, preparations before the activities/ experiments, method of collecting the data scientifically and precautions to be taken while performing the activities/ experiments. It is expected that, all the material required for the activities/ experiments should be made available and easily accessible prior to the activities/ experiments to the students.

To facilitate the execution of the suggested activities by Students with special needs following points may be considered

- They may be allowed and encouraged to seek assistance from parents, caregivers or siblings.
- They may be given some time prior to commencement of the activity to familiarize themselves with the items used in the activity.
- They may be given more time for doing activities/ experiments considering the learning difficulty of the student(s).
- They should be acquainted with the units used like gram, millilitre etc.

Working Environment

Experiments should be performed at a suitable place as a normal routine of the laboratory practice. To create a positive, calm, and pleasant work atmosphere, teachers and parents may encourage students to appreciate that they may come across diverse data during their experiences. This approach aims to alleviate any fear, anxiety or tension among students and promotes inculcation of values.

Awareness about the event

To create awareness about the event among the students, the school should put up a poster within the school premises and may click a clear photo of the poster. The poster may be hand painted on paper/ cloth having details as shown in the Figure 1. Schools may think of a catchy title in their local language. In place of the title **"Identification of Adulterants in Food"; "Stop Food Adulteration"** may be given. School Development Management Committee (SMDC) members and local community people may not only be made aware about the event but should be involved them in such activities.

Figure 1: Sample of poster on Rashtriya Avishkar Saptah 2023-24

IDENTIFICATION OF ADULTERANTS IN FOOD

Food is essential for sustenance of life. We all eat food and gain energy for different metabolic activities. Every living organism requires nourishment to support its growth, perform work, facilitate repairs, and sustain essential life processes. Food plays an important role in prevention of diseases and fighting against infections. Pure, fresh and healthy diet is essential for good health and proper functioning of the body. The secret of a good life is to have the right food at the right time.

Adulteration: Food adulteration is an act of intentional/ unintentional addition of inferior substances to the food items leading to contamination of food. These inferior substances are called adulterants. The deliberate inclusion of adulterants in food products is driven by economic motives, resulting in a reduction of their nutritional quality.

Food is considered adulterated if it meets any of the following criteria:

- An addition of a substance that diminishes or harms its quality.
- Replacement with cheaper or inferior ingredients, whether in whole or in part.
- Removal of any valuable or essential components, whether in whole or in part.
- Addition of an imitation of the genuine product.
- Alteration through dyes or colourants to enhance its appearance.
- Deterioration in quality below established standards, regardless of the cause.

Why Food Adulteration?

Food adulteration is done often by dishonest people for quick financial gain. Adulterated food may be hazardous to life and pose significant risk to public health and safety. Adulteration could deprive nutrients essential for proper growth and development. However, food shortage and escalating costs, consumer demands, lack of awareness, negligence, and insufficient enforcement of food laws and food safety measures lead to food adulteration. Some of the main reasons that are responsible for adulterating food products are:

- to increase the quantity of food product.
- to meet the food demand for a rapidly growing population.
- to make maximum profit from food items by fewer investments.

- non-availability of skilled personnel for correct food processing, transportation, and storage.
- lack of knowledge of proper food handling.

Individuals may have limited understanding regarding how to consume food in a way that is safe, nutritious, and healthy. Incorrect food handling practices like wrapping food items in newspaper can transfer harmful dyes into food, keeping hot food in low grade plastics, long storage of perishable food items at room temperature etc., can lead to foodborne illnesses.

Classification of Adulterants

Food adulterants can be categorized on the basis of

A) Intention

B) Safety and Quality

A) Intention: Food adulterants can be categorized into two types based on the intent:

1. **Intentional Adulterants –** It involves deliberate and purposeful contamination or alteration of food products with the intent to gain economic benefits. It is often done to cut production costs or increase profits. This is a dangerous and unethical practice as significant amounts of nutrients are deducted from food items, and extraneous substances are added for profit-driven purposes. This type of adulterants not only compromises the nutritional value of the food but also raises serious health concerns for consumers.

   For Example: Sand, Marble, Dust, Mineral oil, Harmful colours, Chalk powder, Water, and Sawdust

2. **Unintentional or Incidental Adulterants –** Incidental adulteration occurs when food becomes contaminated or altered unintentionally due to factors such as environmental pollutants, processing errors, improper facilities like transportation and storage, negligence or ignorance. These incidental adulterants include chemical adulterants (e.g., pesticides), biological adulterants (e.g., rodent's droppings, larvae), metallic contaminants (e.g., lead from water, chemical industries/factories effluents) and other unintentional non-food ingredient contaminants (e.g., stones, dirt, etc.)

B) Safety and Quality: Food adulterants can also be categorized into two main types: safe and unsafe, based on their effects on the product's safety and quality:

- **Safe Adulterants –** Safe adulterants are substances added to products solely to boost profitability without causing immediate harm to consumers' health. These are substandard adulterants that do not meet the quality standards and compromise the quality and integrity of the product. These are generally added to increase the quantity and at the same time result in reduced quality of product. **For Example:** Addition of papaya seeds in black pepper, sugar syrup in honey, water to milk, etc.
- **Unsafe Adulterants –** Unsafe adulterants are substances added to a product that can pose significant risks to human health or safety. These adulterants can include toxic chemicals, contaminants, or harmful substances. **For Example:** Adding dyes (Lead Chromate, Metanil Yellow, etc.) to spices, coating green vegetables with artificial colours like Malachite Green.

Impact of Adulteration on Health

Food adulteration, whether unintentional or motivated by economic fraud or malicious food tampering, can have serious effects on health and safety. In India, normally the contamination/adulteration in food is done either for financial gain or due to carelessness and lack in proper hygienic condition of processing, storing, transportation and marketing. Also, food adulteration peaks during the festival season due to high demand and less supply. To get maximum profit at that time, shopkeepers start mixing adulterants to food on large scale. Milk, Ghee, Paneer, Khoya, Chenna, Sweets are commonly being adulterated during festival time.

Certain food adulterants do not result in illness; instead, they solely impact the nutritional aspect, leading to health deterioration and diminishing the overall quality of the food. While there are numerous adulterants readily available in the market, some of them carry both short-term and long-term health repercussions. Consuming the food adulterated with such substances could be hazardous and may lead to multiple health issues including allergic reactions, diarrhoea, kidney disorders, failure of an individual’s organ systems, and even cancer.

The Prevention of Food Adulteration Act, 1954 (Amended in 1964, 1976, 1986)

The Act provides the protection from adulteration / contamination of food because adulterated food may lead to the health risk of consumers. The Act deals with the frauds also that can be perpetrated by the dealers by supplying cheaper or adulterated foods. The Act regulates the use

of chemicals, pesticides, flavouring agents and other additives in food preparation. Through this Act there is a control over dumping of sub-standards foods.

The common food items in which adulterants are commonly found includes Milk, Spices (Turmeric powder or Whole turmeric, Chilli powder, Black pepper, Coriander powder, Salt, Cumin seeds), Pulses, Honey, Tea Leaves, Wheat flour (Atta), All purpose flour (Maida), Gram flour (Besan), Green vegetables and Fruits.

These food products and their adulterants are listed below in the Table:

S. No.	Food Item	Adulterant
1.	Milk	Water Starch Urea Alkalizers Soap
2.	Fat (Ghee)	Starch
3.	Khoya	Starch
4.	Indian cottage cheese (Paneer)	Starch
5.	Coriander powder	Dye/ Coloured sawdust
6.	Turmeric powder	Dye/ Artificial colour
7.	Chilli powder	Dye/ Red Artificial colour Brick powder
8.	Black pepper (whole)	Papaya seeds
9.	Cumin seeds	Coloured grass seeds Foreign material
10.	Pulses (Arhar/ Chana/ Moong dal)	Artificial dyes Khesari dal
11.	Honey	Sugar syrup
12.	Tea Leaves	Dyed exhausted tea leaves
13.	Wheat flour (Atta)/ All purpose flour (Maida)	Borate
14.	Gram flour (Besan)	Metanil yellow dye
15.	Green vegetables/ Fruits	Dye (Malachite green or Rhodamine B)

❖ List of Activities:

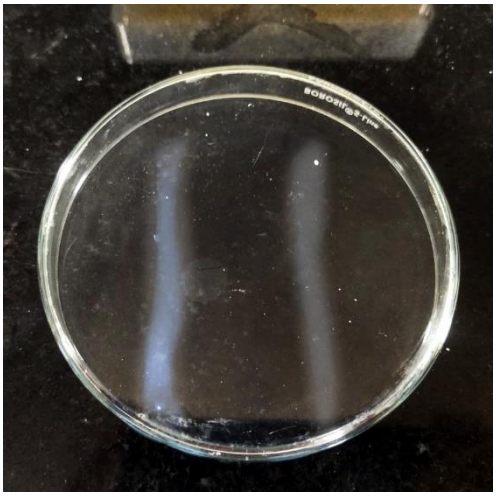
Activity I: To test the adulteration in milk and its products

a.) To Test the Purity of Milk

- **Materials required:** Milk sample, Dropper/pipette, glass tile or any other plain surface

(i) By flow test on slant surface (glass tile)

S. No.	Procedure	Observation	Inference
1.	Put a drop of milk on a slant plain surface.	a) The drop of milk moves slowly, leaving a white trail behind it. b) The drop of milk flows rapidly, without leaving a mark.	The sample of milk is pure Water is added to the milk sample.



Note: Put drop of milk carefully on slant surface so that the white trail can be observed clearly.

(ii) To test the purity of milk using standard lactometer

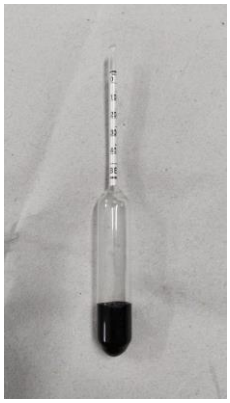
- **Materials Required**:

Measuring cylinder (50 mL/100 mL), Pure milk, Distilled water, Test tubes, Beaker, Standard lactometer

- **Procedure:**

1. Pour the homogenized fresh milk sample into a clean and dry measuring cylinder and fill it up to the brim at room temperature.
2. Clean the lactometer with water and wipe dry.
3. Lower the lactometer and release it gently into the milk holding it by the stem.

4. Record the reading on the scale corresponding to the top of the meniscus of the milk.
5. Observe the lactometer scale reading.



- **Observations:**

Lactometer reading	Specific gravity	Type of Milk	Inference
Less than 20		-	Water has been added to milk
28-30	1.028 to 1.030	Cow milk	
30-32	1.030 to 1.032	Buffalo milk	
35-37	1.035 to 1.037	Skim milk	

Note: Lactometer is standardized for measurement at room temperature. Hence, milk should be at room temperature, while taking the lactometer reading.

(iii) By density method using self-made lactometer

- **Materials required:**

Plastic drinking straw, Sand, Sealing wax, Measuring cylinder (50 mL/100 mL), Pure milk sample, Distilled water, Test tubes, Beaker

- **Principle:**

Lactometer works upon the Archimedes' Principle. It states that the upward buoyant force that is exerted on a body immersed in a fluid, whether fully or partially, is equal to the weight of the fluid that the body displaces.

- **Fabrication and calibration of self-made lactometer**

➢ **Fabrication:**

1. Take a straw and seal its one end with sealing wax.

2. Put some sand (around one cm height above sealing wax) at the bottom to add weight to the straw so that it does not float at the liquid surface and partially submerge in the liquid.
3. Now close the other end with the sealing wax.
4. The lactometer is now ready for calibration.

- **Calibration:**

1. Dip the lactometer in water. It will sink up to a certain level, mark this level as 'W'.
2. Now put the lactometer in pure milk and mark the sinked in level as 'M'.
3. Mix 50 % water in pure milk and put lactometer in the mixture. It would sink in between 'W' and 'M'. Mark this level as 'H'.

S.No	Procedure	Observation	Inference
1.	Put the lactometer in the test sample of milk.	a) The lactometer sinks in between 'W' and 'H' b) The lactometer sinks in between 'H' and 'M'	a) The milk sample contains more than 50% water b) The milk sample contains less than 50% water

Note:

1. The diameter of test tube/measuring cylinder should be more than lactometer.
2. The test tube/ measuring cylinder should be filled to the top every time.
3. The apparatus of same capacity should be used for making all observations.
4. The reading on the lactometer should be noted when it becomes stationary.

- **Results:**

Milk Samples (in mL)	Level Marked at
Sample A	
Sample B	
Sample C	

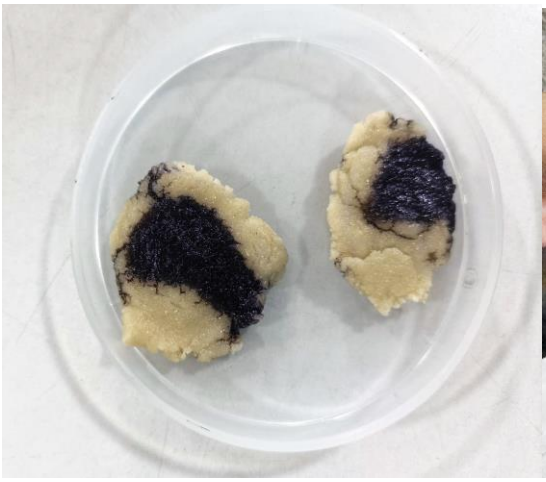
b) To Test the Presence of Starch in Milk, Paneer, Khoya and Ghee

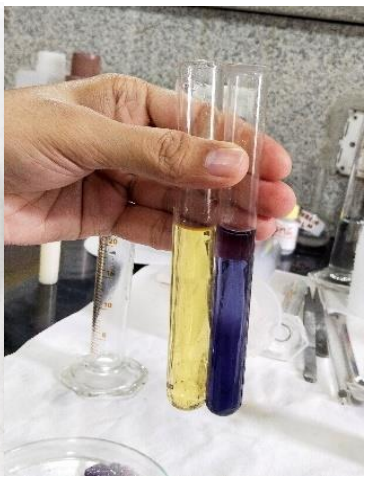
- **Materials required:**

1% Iodine solution, Test tubes, Test tube stand, Sample of Milk, Paneer, Khoya and Ghee

S. No.	Procedure	Observation	Inference
1.	Add few drops of 1% Tincture of Iodine/ Iodine solution in milk, Paneer, Khoya and Ghee samples taken in different test tubes.	Formation of blue colour	Starch is present in these samples

Note: Preparation of 1% Iodine Solution- Dissolve 1.0 g of Iodine crystals in Potassium iodide solution (prepared by dissolving 2 g of Potassium iodide in minimum amount of water).





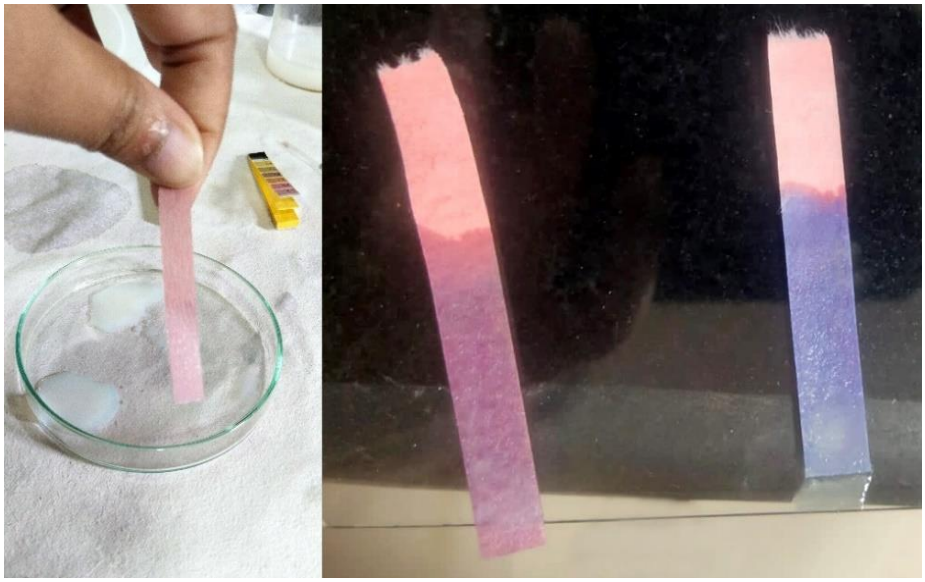
- **Results:**

Sample (Milk/Paneer/Khoya/Ghee)	Starch Present/Absent
Sample A	
Sample B	
Sample C	

c) To Test the Presence of Urea in Milk

- **Materials required:** Measuring Cylinder (50 or 100 mL), Milk sample, Dropper/pipette, Test tubes, Test tube stand, Soybean/ Arhar dal powder, Red litmus paper

S. No	Procedure	Observation	Inference
1. 2. 3.	Fill half test tube with milk and add one teaspoon soybean/ Arhar powder. Shake the contents of test tube. Dip a red litmus paper in it after 5-7 minutes. Remove the paper after a minute and observe.	The colour of litmus paper changes from red to blue	Urea is present in the milk sample



- **Results:**

Milk samples (in mL)	Red litmus paper colour change
Sample A	
Sample B	
Sample C	

d) To Test the Presence of Alkalizers ($NaOH$/ Na_2CO_3/ $NaHCO_3$) and Soap in Milk

Materials Required: Measuring Cylinder (50 or 100 mL), Milk sample, Dropper/pipette, Test tubes, Test tube stand, and Phenolphthalein indicator

S.No	Procedure	Observations	Inference
1.	Take one test tube of milk and add equal amount of hot water (bearable to hand). Add 2-3 drops of Phenolphthalein indicator.	The colour changes from white to red/pink	Milk is adulterated with alkalizers ($NaOH$/ Na_2CO_3/ $NaHCO_3$)
2.	Add equal amount of water in 15-20 mL milk sample in a beaker and shake it vigorously.	Lather is produced in huge amount	Milk is adulterated with soap

Activity II: To Test the Adulteration in Spices

a.) To Test the Foreign Material (sawdust) or Dye in Coriander Powder

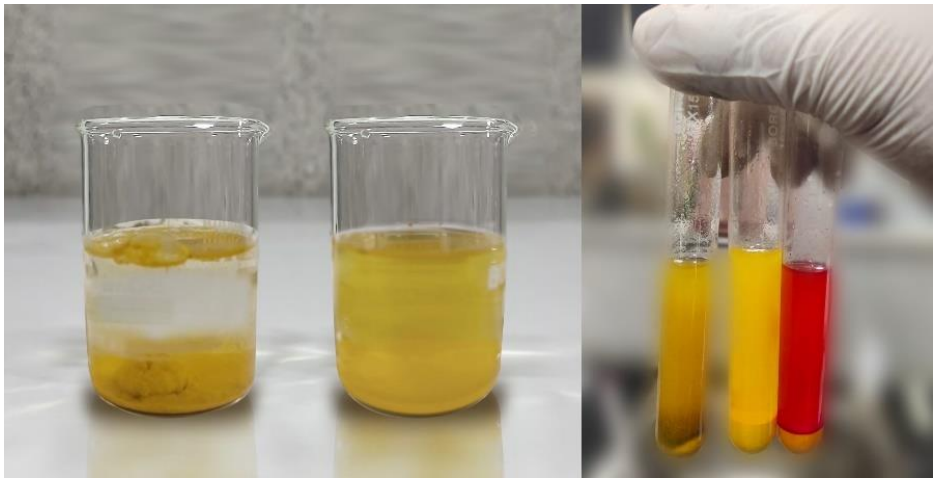
Materials required: Test tubes, Test tube stand, Glass tumbler/ Beaker, Coriander powder, Conc. Hydrochloric acid, Dropper/ pipette

S. No.	Procedure	Observations	Inference
1.	Add a teaspoon of coriander powder in a glass tumbler/ beaker filled with around 50 mL of water.	Some powder floats on the surface of water. The total amount of the powder sinks at the bottom of glass tumbler/ beaker.	The coriander powder is adulterated with sawdust The coriander powder is pure
2.	Take a teaspoon of coriander powder in a test tube. Add few drops of conc. HCl	Formation of instant reddish pink colour	The coriander powder is adulterated with artificial colour/dye.

b.) To Test the Presence of Dyes/ Artificial Colour in Turmeric Powder

Materials Required: Test tubes, Test tube stand, Beaker, Turmeric powder, Conc. Hydrochloric acid, Dropper/ pipette,

Method	Procedure	Observations	Inference
1.	Take a beaker filled with around 50 mL water. Add 1-2 teaspoon of turmeric powder in it.	The turmeric powder instantly leaves bright colour streaks.	Turmeric powder is adulterated with lead chromate or any other colour
2.	Take a teaspoon of Turmeric powder in a test tube. Add few drops of conc. HCl.	Formation of instant reddish pink colour	Turmeric powder is adulterated with artificial colour/ dye (lead chromate/ metanil yellow dye)



c.) To Test the Presence of Dye/ Red Artificial Colour in Red Chilli Powder

- **Materials required:**

Beaker, Chilli powder, Conc. Hydrochloric acid, Dropper/ pipette, Distilled water, Glass rod, Test tubes, Test tube stand

S. No.	Procedure	Observations	Inference
1.	Take a beaker filled with around 50 mL of water. Add 1-2 teaspoon of Chilli powder in it.	The chilli powder instantly leaves red colour streaks. The chilli powder will sediment at the bottom of beaker.	Chilli powder is adulterated with colour/dye Chilli powder is pure
2.	Take a teaspoon of Chilli powder in a test tube. Add few drops of conc. HCl.	Formation of instant reddish pink colour.	Chilli powder is adulterated with artificial red colour/dye

3.	To a half teaspoon of Chilli powder, add few drops of conc. HCl and mix to make the semi solid paste; dip the rear end of the glass rod in the paste and hold over the flame.	Brick red flame produced	The presence of calcium salts in brick powder produces the red flame that indicates the adulteration.

- **Results:**

Spices	Sample Adulterated or Pure
Coriander powder	
Turmeric powder	
Chilli powder	

d.) To Check the Adulterant/ Foreign Materials in Cumin Seeds by Visual/ Physical Examination

- **Materials required:**

Beaker, Magnifying glass (if available), Distilled water, Filter paper, Cumin seeds

Method	Procedure	Observations	Inference
1.	Examine the seeds carefully (Magnifying glass can be used, if available). Cumin can be separated out from grass seeds on the basis of their colour, shape, and size.	Presence of seeds other than cumin seeds.	Cumin seeds are adulterated with grass/other seeds.
2.	Take a filter paper and evenly spread a teaspoon of cumin seeds on it. Sprinkle	Seeds leaves black colour on filter paper	Cumin seeds are adulterated with colour/dye.

	with water to wet the filter paper.		

e.) To Test the Presence of Papaya Seeds in Whole Black Pepper

- **Materials required:**

  Beaker, Distilled water, Filter paper, Black pepper, Test tubes, Test tube stand

Method	Procedure	Observations	Inference
1.	Physical Examination- Examine the seeds carefully. Papaya seeds can be separated out from pepper on the basis of their colour and shape.	Some seeds are black, rough and round while others are shrunken, oval in shape and deep brown in colour.	Black pepper seeds are adulterated with deep brown coloured, shrunken, and oval shaped papaya seeds.
2.	Gently press the seeds with the help of finger/ pen.	Some seeds break easily while others do not on pressing with finger or pen.	Papaya seeds are easily broken and are present as adulterant.
3.	Put the sample of black pepper in a beaker filled with water and leave it for some time.	Some seeds float on water surface while others settle down at the bottom.	Papaya seeds float on the water surface and are present as adulterant.

Activity III: To Check the Adulteration in Pulses/Legumes

- **Materials Required:**

  Pulses (Arhar/ Moong), Test tubes, Magnifying glass, Beaker, Conc. Hydrochloric acid, Distilled water

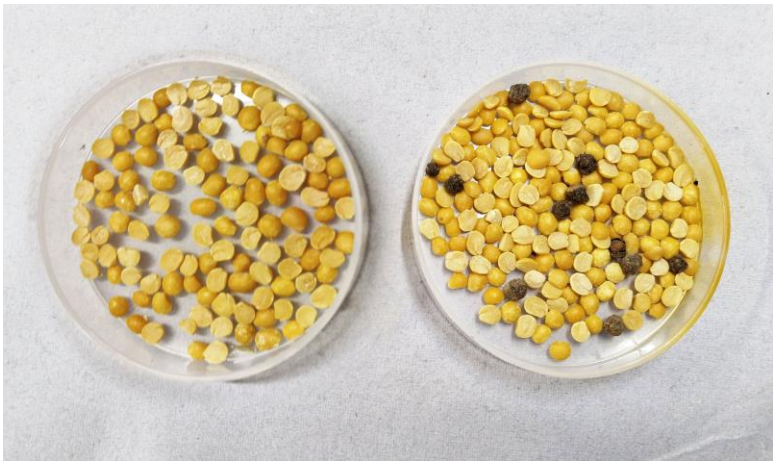
a.) Presence of Lead Chromate/ Metanil Yellow Dyes in Pulses by Acid Method

Method	Procedure	Observations	Inference
1.	Take a clean dry test tube and half fill it with water. Now, add a teaspoon of pulse and mix. Add a few drops of HCl carefully; shake the test tube and observe.	Formation of instant pink colour	Lead Chromate/ Metanil Yellow dye is present in given sample.

b.) Presence of Other Dals/ Stones in Pulses by Visual Examination

Visual Detection:

Method	Procedure	Observations	Inference
1.	Physical Examination- Examine the Arhar dal sample carefully	The sample has dal that has edged type appearance and is slant on one side and square in appearance The sample has small stone pieces	Khesari dal/ stones are present as adulterants in Arhar dal



- **Results:**

Pulses/ Dal	Other grains/ stones etc.	Dyes
Sample A		
Sample B		
Sample C		

- **Precautions:**
  - Wear gloves when using acids and handle carefully.

Activity IV: To Test the Purity of Honey

- **Materials Required:**

  Water, Beaker, Honey samples, Cotton wick, Burner/ Spirit lamp

Method	Procedure	Observations	Inference
1.	Take a transparent glass tumbler/ beaker of water. Add some honey to the glass tumbler and left it undisturbed for few minutes.	The Sample does not disperse in water. The sample disperses in water.	The given honey sample is pure. The honey sample is adulterated with sugar syrup.
2.	**Wick Test:** Burn a cotton wick dipped in honey over the flame.	Cotton wick burns completely. Cotton wick burns with a crackling sound.	The given honey sample is pure. The honey sample is adulterated with sugar syrup.

- **Results:**

Honey Samples	Purity Test Using
	Water
Sample A	
Sample B	
Sample C	

- **Precautions:**

1. Handle the flame cautiously.
2. Hold the cotton wick with forceps or tongs while burning it.

Activity V: To Test the Artificial Dyes/ Coal Tar Dyes in Exhausted Tea Leaves

- **Materials Required:**

Different samples of tea leaves, water, filter paper, blotting sheet, porcelain glass/tile, bar magnet, slaked lime

Method	Procedure	Observations	Inference
1.	Take a filter paper and spread a few tea leaves. Sprinkle with water to wet the filter paper. Observe the filter paper stains against light.	Instant black brown stain appears on the filter paper. Light greenish yellow colour appears after some time due to the presence of chlorophyll.	Given sample is adulterated with Coal tar/ artificial dyes. The given sample is pure.
2.	Spread some slaked lime solution on white porcelain tile/glass plate;	Red, orange or other shades of colour spreading on the slaked lime.	Coal tar dye/ artificial colour is present in the given sample.

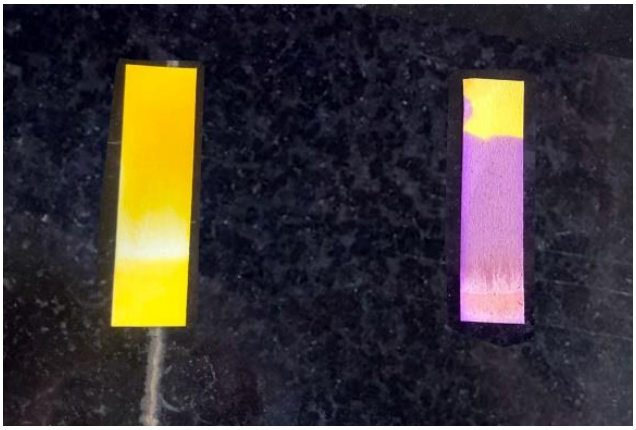
	sprinkle some tea dust over it.		
3.	Move a bar magnet through the tea leaves sample.	Some iron fillings/dust cling with the magnet.	Tea leaves adulterated with iron fillings/dust.

Activity VI: To Test the Presence of Borate in Maida/Atta and Artificial Dye (Metanil Yellow) in Besan

- **Materials Required:**

  Maida/Atta samples, Besan sample, Test tubes, Water, Conc. HCl, Turmeric Paper strips, Alcohol, Dropper

Method	Procedure	Observations	Inference
1.	Take a teaspoon of atta/ maida sample in a test tube. Add water in it and shake. Add few drops of Conc. HCl with the help of a dropper. Dip a turmeric paper strip. Observe the change in colour.	Turmeric paper strip changes from yellow to red colour	The given sample is adulterated with Borate.
2.	Take half teaspoon of Besan in a test tube. Add 5-6 mL of alcohol and shake the contents. Then, add few drops of HCl. Observe the change.	Formation of pink colour	The given sample is adulterated with metanil yellow dye.



- **Precautions:**

  1. Use gloves while handling acids.
  2. Shake the contents of test tubes attentively.

Activity VII: To Check the Malachite Green or Rhodamine B Dyes in Vegetables and Fruits

- **Materials Required:**

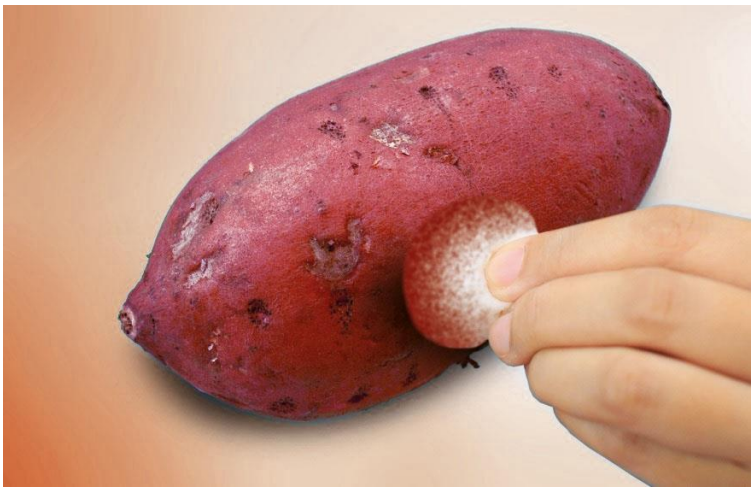
  Beaker, Water, Cotton, Liquid paraffin or oil, Green vegetables (Lady finger, Green chilli, Green peas), Sweet potato/Beet root

a.) To test the presence of Malachite Green dye/colour in green vegetables

Method	Procedure	Observations	Inference
1.	Take a cotton piece soaked in liquid paraffin/oil/water and rub the outer green surface of a small part of green vegetable.	Cotton turns green in colour.	The green vegetables are adulterated/ coated with malachite green dye.
2.	Take a little amount of green peas in a beaker. Add water to it and mix well. Let it stand for half an hour and observe.	Green peas will release colour in water.	Green peas are adulterated with Malachite Green dye.

(b.)To test the presence of Rhodamine B/ red colour in sweet potato or beet root

Method	Procedure	Observations	Inference
1.	Take a cotton piece soaked in liquid paraffin/oil/water, and rub the outer surface of the sweet potato.	The cotton absorbs red colour	Rhodamine B/ red colour is coated on the outer surface of sweet potato/ beet root.



Activity VIII: To Test the Presence of Iodine in Salt and Differentiate between Iodized and Common salt.

- **Materials Required:**

  Beaker, Petri-dish or Watch glass, Spatula, Glass rod, Dropper, Potassium iodide, Starch (potato/ rice), Hydrochloric acid, Distilled water, Salt samples

- **Procedure:**

- Preparation of Solution A (KI-Starch Solution): Take 0.25 g of starch (crushed boiled potato or cooked rice water) and dissolve it in 20 mL distilled water. Then, take 1.25 g Potassium iodide and add in the above solution. Now, make the volume upto 50 mL by adding more distilled water.
- Preparation of Solution B: Add 2.5 mL Dilute Hydrochloric acid in 47.5 mL of distilled water.

Method	Procedure	Observations	Inference
1.	Take a teaspoon of salt samples A and B separately in a petridish. Add few drops of Potassium iodide- starch solution (Solution A). Now, Add Solution B to both the samples.	Blue colour is developed in Sample A. No blue colour developed in Sample B.	Salt is iodized. Salt is not iodized.

To Find Out the Amount/ Concentration of Iodine in Salt by Performing Iodometric Titration

- **Aim:** Determination of iodine content in iodized salt by redox titration (iodometrically) using Sodium thiosulphate as an intermediate solution
- **Apparatus required:** Burette (50 mL), Burette stand, Clamp, Volumetric flasks, Pipettes, Conical flasks, Beakers, Droppers, Measuring cylinder, Test tubes, Cork, Spatula, Wash bottle, and Weighing balance
- **Chemicals required:** Dilute Sulphuric acid (2N), Potassium iodide solution, Standard Sodium thiosulphate solution, Starch solution, and Iodized salt sample
- **Principle/ Theory:** Iodometric titration is a method of volumetric chemical analysis, a redox titration where the appearance or disappearance of elementary iodine indicates the end point.

In this method, we determine the amount of iodate **(IO_3^-)** in Iodized salt by first reacting the iodate with added iodide **(I^-)**, under acid conditions, to produce iodine:

$$IO_3^- + 5I^- + 6H^+ \rightarrow 3I_2 + 3H_2O$$

Then the resulting iodine is titrated with thiosulphate as follows:-

$$I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$$

The free iodine (I_2) which remains in the solution as **KI_3** complex is than titrated with sodium thiosulphate solution using starch as an indicator. At the end point of the titration, the blue colour (due to formation of starch-iodine complex) of solution will disappear.

In the titration of iodine starch should not be added before the end point is reached, if starch solution is added when the iodine concentration is high some iodine may remain adsorbed in starch resulting in incorrect readings.

- **Procedure**

Preparation of different reagents

1. **Dilute Sulphuric Acid** - Approximately 2 N (Add 8 mL of Dil. H_2SO_4 (2.5 N) into 2 mL of Distilled Water.

2. **Potassium Iodide Solution -** Approximately 10 % (m/v).
3. **Standard Sodium Thiosulphate Solution-** Prepare 0.005N solution by dissolving 1.25g of sodium thiosulphate AR grade in 1000 mL of distilled water.
4. **Starch Solution-** 1%, freshly prepared (m/v).

- **Iodometric titration**

  Step I: Preparation of Salt Solution

  Accurately weigh about 20 g dry salt sample and transfer to conical flask. Dissolve Dissolve it in about 100 mL water and acidify with 10 mL of dilute 2 N sulphuric acid.

  Step II: Method

  Add 10 mL of 10% potassium iodide solution. The contents of conical flask will turn deep blue-brown because of liberation of iodine. Titrate the liberated iodine against standard 0.005 N sodium thiosulphate solution until the solution becomes pale yellow. Introduce 2mL of starch solution and titrate with constant stirring. Record the end point when the blue colour just disappears.

  Step III: Repeat Step I and II two more times.

  Observations and Calculations

  - **Colour changes –** Solution containing iodine changes its colour from pale yellow to straw yellow (intermediate colour).
  - **End point –** Dark blue colour of starch disappears, showing completion of reaction.

Table: Titration of given Salt Solution against Standardized Sodium thiosulphate Solution ($Na_2S_2O_3$) solution

Burette: - $Na_2S_2O_3$ solution Indicator Used: - Starch (1%)

Conical Flask: - Given Salt solution End Point: - Dark blue colour disappears

Salt Solution in conical flask	**Burette Readings (in mL)**		**Volume of Thiosulphate solution used (in mL)**
	Initial	**Final**	
I			
II			
III			

- **Method when Iodate is used for Iodizing the Salt**

Iodine (I), ppm (on dry basis) =

Where,

V_1=volume in mL of 0.005N sodium thiosulphate solution required for titration;

F =;

which is a fixed value; for the given reaction, 1 mole of IO_3^- reacted with 6 moles of thiosulphate, F= X 126.9 (atomic mass of iodine) = 21.15

w = mass in g of the salt sample taken for analysis

- **Results**

In the given salt sample, the average iodine content is found to be 16.94 ppm (per kg).

Note: As per standards, Iodine content in salt at retail level should be 15-40 ppm (per kg).

- **Precautions**

1. In the titration of iodine, starch should not be added before the end point is reached. If the starch solution is added when the iodine concentration is high some iodine may get adsorbed even at end point.

2. Handle the glassware carefully.

3. Do place beaker below the burettes before opening the tap to prevent unnecessary spilling of liquids.

4. Wear safety goggles and gloves.

5. Carefully handle the corrosive reagents.

(Reference: IS 7224:2006, Bureau of Indian Standards)

Reporting the Results of Study

All students of classes VI to XII of the selected schools have to carry out the study uniformly on 'Identification of Adulterants in Food' in different area(s). The results obtained by all the students for the activities should be submitted as per format given in the guidelines for each activity. The results of the study on 'Identification of Adulterants in Food'

are to be reported by each school (assigned teacher(s) for RAS 2023-24) by filling up the details in the Google form on the following link:

https://forms.gle/obD8eNkuVd59eu3J8

References:

1. **IS 7224:2006, Bureau of Indian Standards**
2. **www.fssai.gov.in/upload/uploadfiles/files/pfa-acts-and-rules.pdf**
3. **https://eatrightindia.gov.in/dart/**

PROCEDURE FOR FILLING GOOGLE FORM

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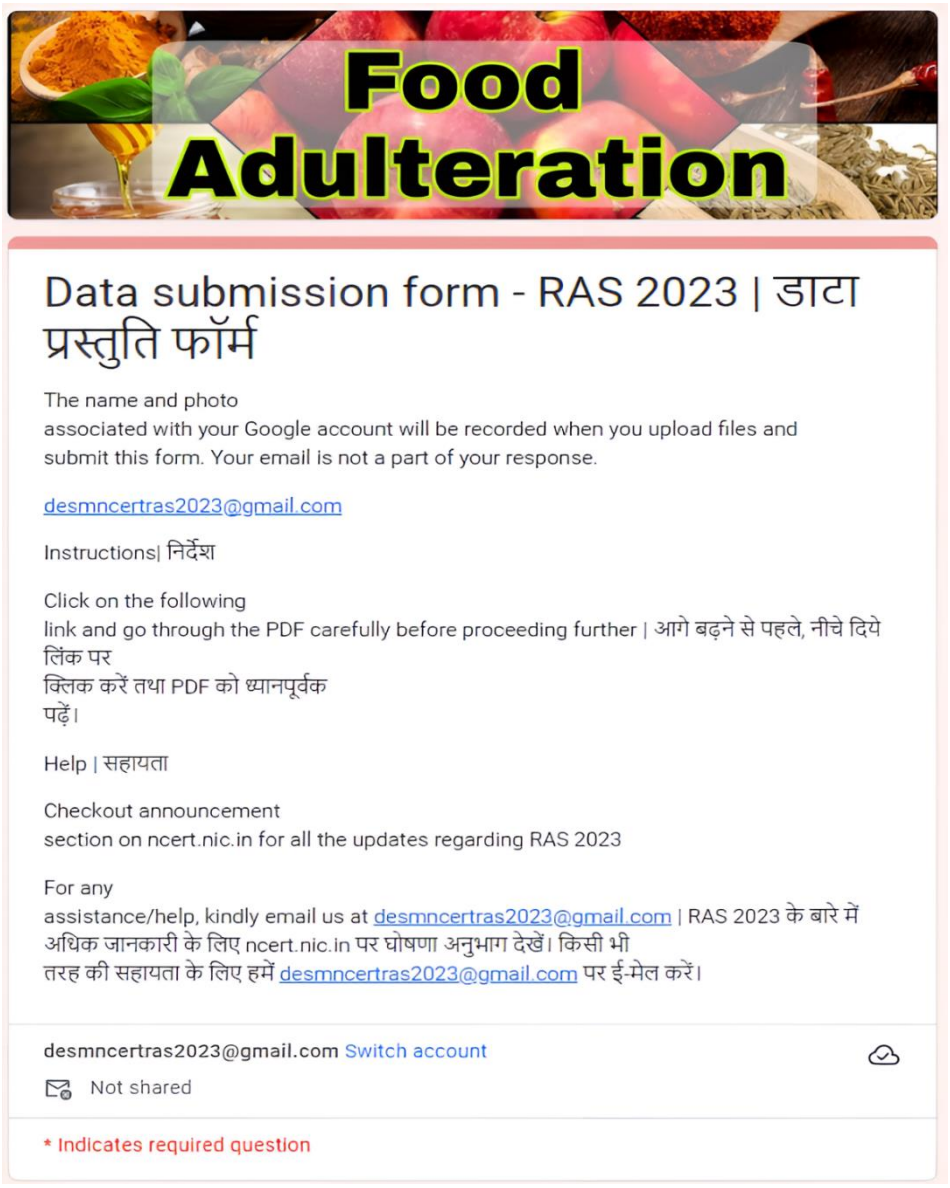
1. Once you have a working Google ID (Gmail), you can open any browser and copy/ type the following URL into browser:

   https://forms.gle/obD8eNkuVd59eu3J8

2. Click on fill out form on the front page.
3. It will take you to the Section 1 where you need to enter the Gmail ID to proceed.



Email *

Your answer

Name of the Student *

Your answer

Gender

- Male
- Female
- Other

Class of the Student *

Your answer

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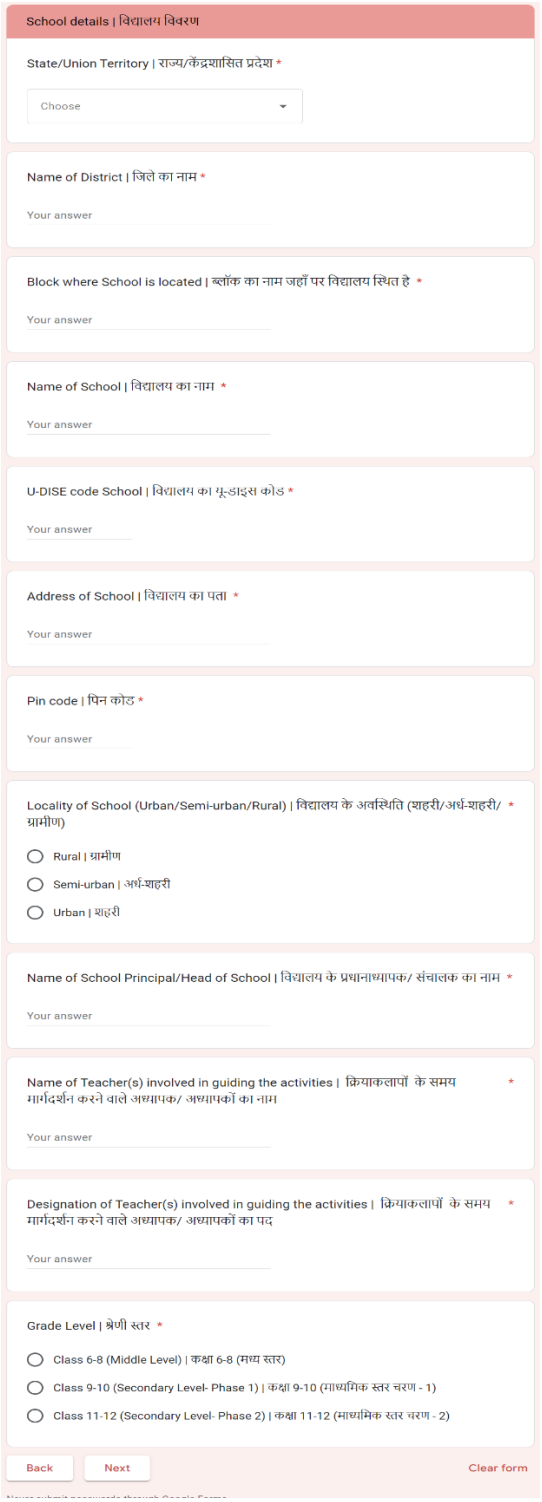
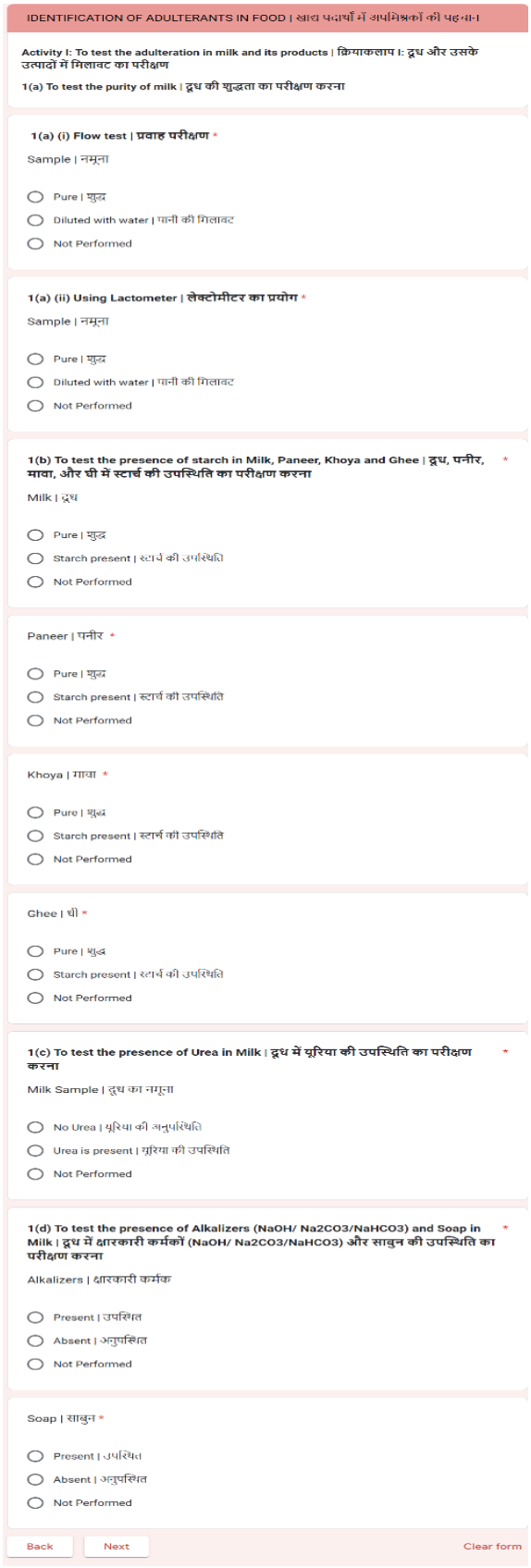
4. After clicking on Next button, you will be taken to Section 2 of the Form, where you have to fill your State, District and School details like School Name, Address etc.



Note: Select the Middle or Secondary level option from Grade Level for filling the activities result data.

5. After clicking on Next button, you will proceed to Section 3 of the Form. In this section, you have to fill the data for Activity I- I(a), I(b), I(c), and I(d).



IDENTIFICATION OF ADULTERANTS IN FOOD | खाद्य पदार्थों में अपमिश्रकों की पहचान-I

Activity I: To test the adulteration in milk and its products | क्रियाकलाप I: दूध और उसके उत्पादों में मिलावट का परीक्षण

1(a) To test the purity of milk | दूध की शुद्धता का परीक्षण करना

1(a) (i) Flow test | प्रवाह परीक्षण *

Sample | नमूना

- Pure | शुद्ध
- Diluted with water | पानी की मिलावट
- Not Performed

1(a) (ii) Using Lactometer | लेक्टोमीटर का प्रयोग *

Sample | नमूना

- Pure | शुद्ध
- Diluted with water | पानी की मिलावट
- Not Performed

1(b) To test the presence of starch in Milk, Paneer, Khoya and Ghee | दूध, पनीर, मावा, और घी में स्टार्च की उपस्थिति का परीक्षण करना *

Milk | दूध

- Pure | शुद्ध
- Starch present | स्टार्च की उपस्थिति
- Not Performed

Paneer | पनीर *

- Pure | शुद्ध
- Starch present | स्टार्च की उपस्थिति
- Not Performed

Khoya | मावा *

- Pure | शुद्ध
- Starch present | स्टार्च की उपस्थिति
- Not Performed

Ghee | घी *

- Pure | शुद्ध
- Starch present | स्टार्च की उपस्थिति
- Not Performed

1(c) To test the presence of Urea in Milk | दूध में यूरिया की उपस्थिति का परीक्षण करना *

Milk Sample | दूध का नमूना

- No Urea | यूरिया की अनुपस्थिति
- Urea is present | यूरिया की उपस्थिति
- Not Performed

1(d) To test the presence of Alkalizers (NaOH/ Na2CO3/NaHCO3) and Soap in Milk | दूध में क्षारकारी कर्मकों (NaOH/ Na2CO3/NaHCO3) और साबुन की उपस्थिति का परीक्षण करना *

Alkalizers | क्षारकारी कर्मक

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

Soap | साबुन *

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

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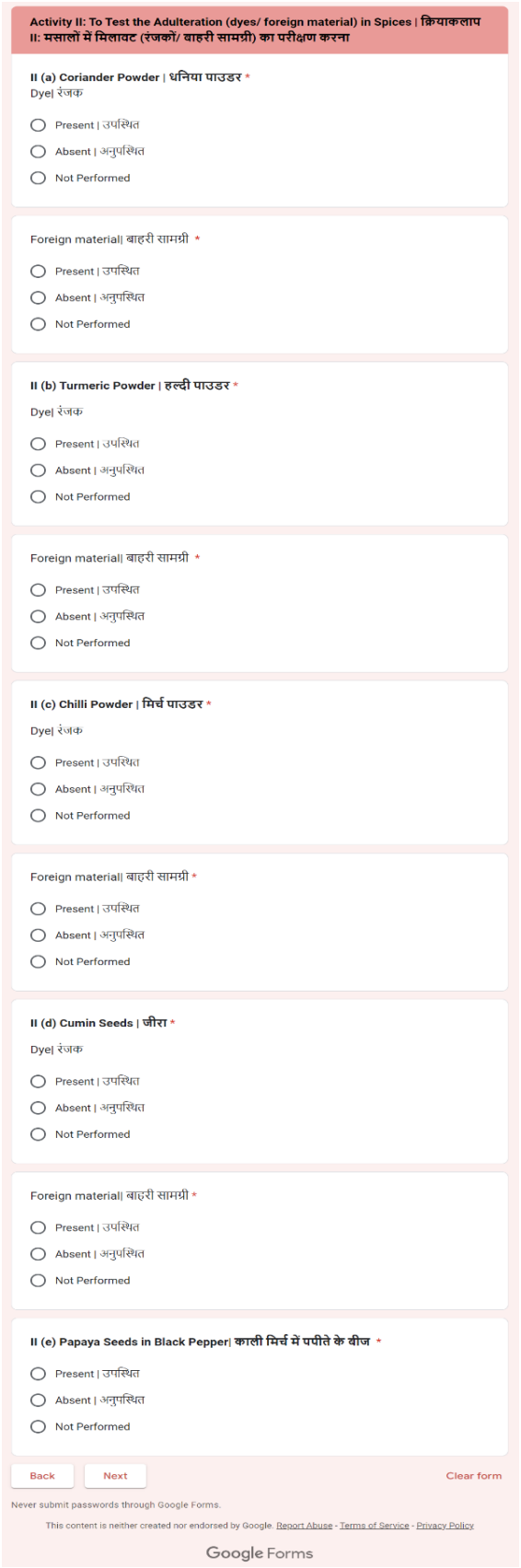
6. After clicking on Next, you will move to Section 4 of the Form. In this, you must fill out data for Activity II- II(a), II(b), II(c), II(d), and II(e).



Activity II: To Test the Adulteration (dyes/ foreign material) in Spices | क्रियाकलाप II: मसालों में मिलावट (रंजकों/ बाहरी सामग्री) का परीक्षण करना

II (a) Coriander Powder | धनिया पाउडर *
Dye| रंजक

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

Foreign material| बाहरी सामग्री *

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

II (b) Turmeric Powder | हल्दी पाउडर *
Dye| रंजक

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

Foreign material| बाहरी सामग्री *

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

II (c) Chilli Powder | मिर्च पाउडर *
Dye| रंजक

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

Foreign material| बाहरी सामग्री *

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

II (d) Cumin Seeds | जीरा *
Dye| रंजक

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

Foreign material| बाहरी सामग्री *

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

II (e) Papaya Seeds in Black Pepper| काली मिर्च में पपीते के बीज *

- Present | उपस्थित
- Absent | अनुपस्थित
- Not Performed

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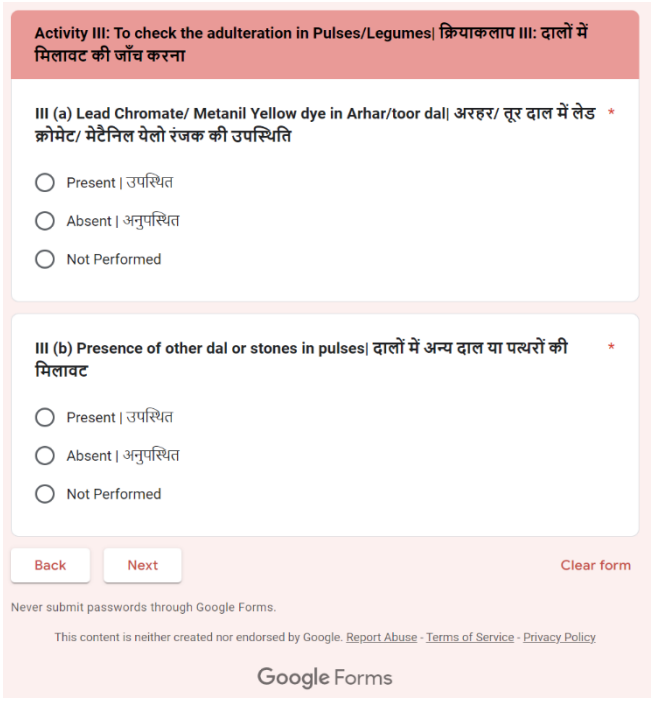
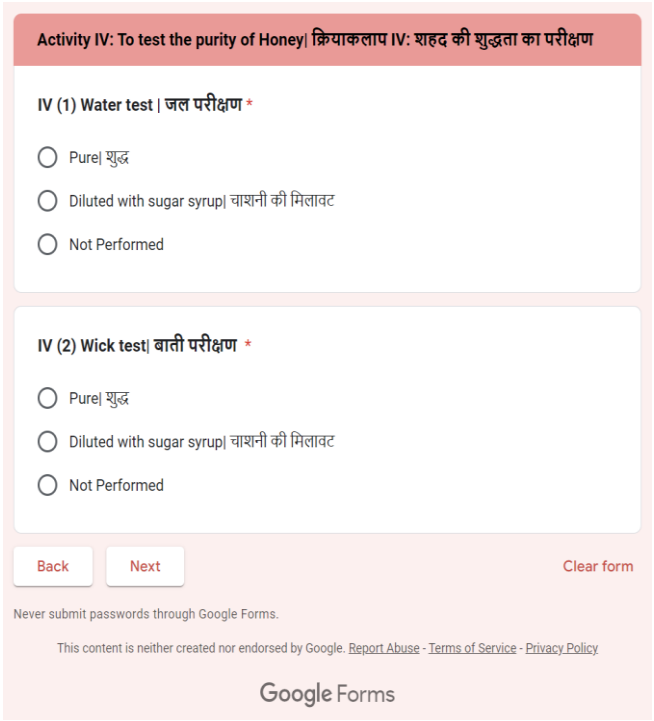
7. After clicking on Next, you will move to Section 5 of the Form. In this, you must fill out data for Activity III- III(a), and III(b).

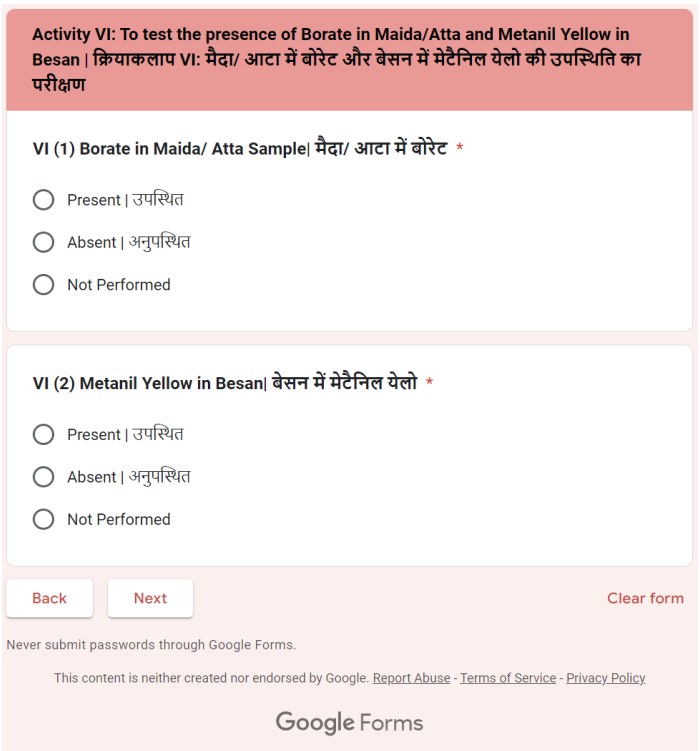


8. After clicking on Next, you will move to Section 6 of the Form. In this, you must fill out data for Activity IV- IV(1), and IV(2).

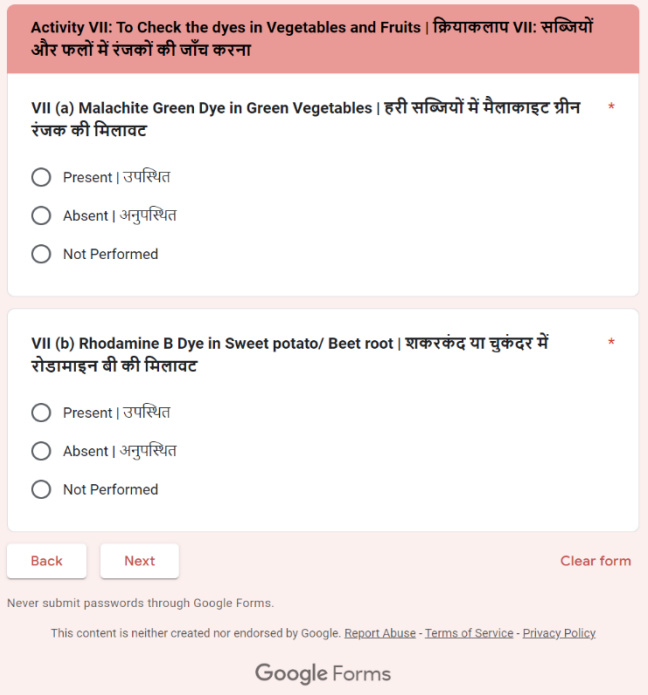


9. After clicking on Next, you will move to Section 7 of the Form. In this, you must fill out data for Activity V- V(a), and V(b).

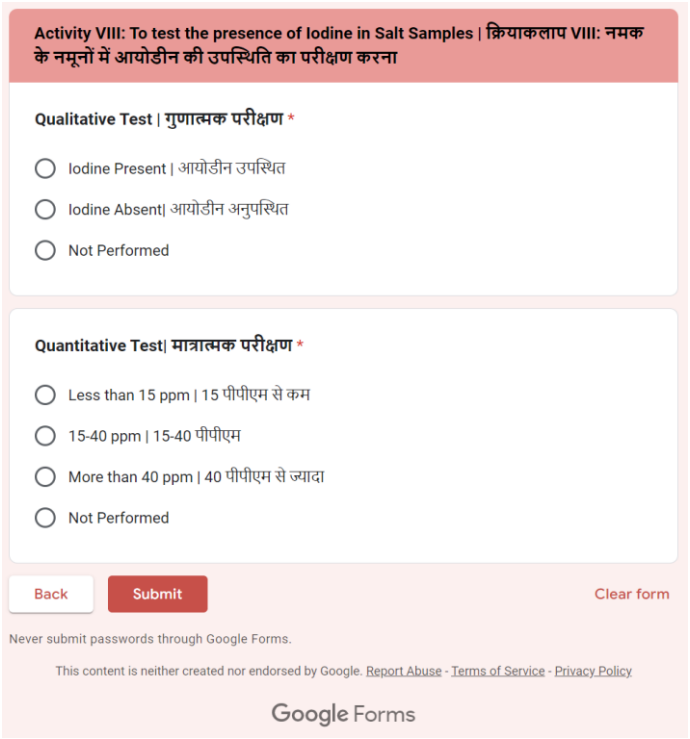
10. After clicking on Next, you will move to Section 8 of the Form. In this, you must fill out data for Activity VI- VI(1), and VI(2).



11. After clicking on Next, you will move to Section 9 of the Form. In this, you must fill out data for Activity VII- VII(a), and VII(b).

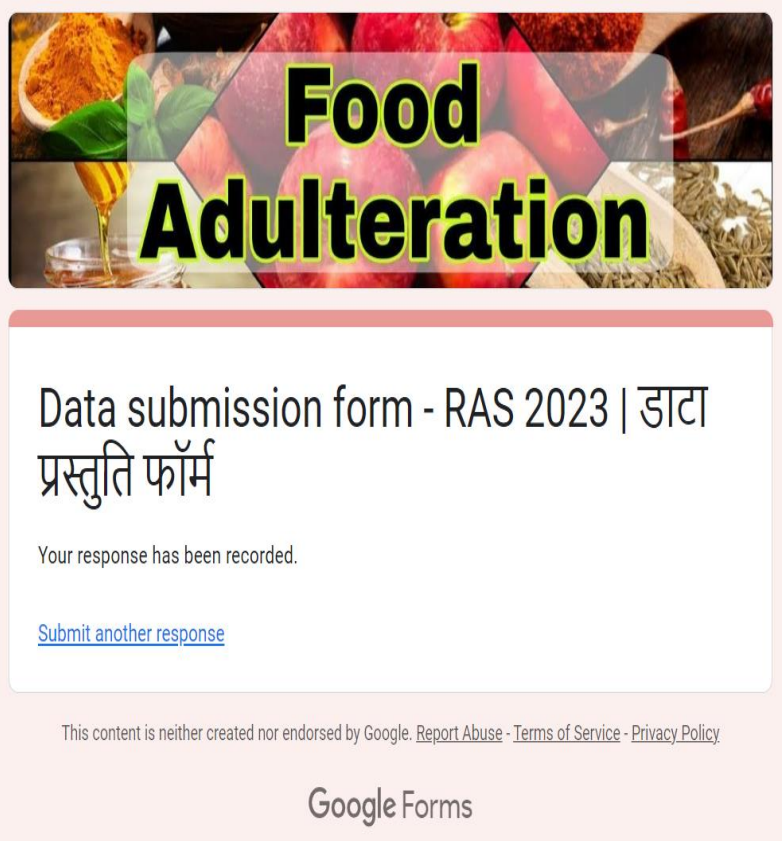


12. After clicking on Next, you will move to Section 10 of the Form. In this, you must fill out data for Activity VIII- Qualitative and Quantitative tests.



13. After this, you have to click on Submit button to finally submit your Form.

Note: You can check your responses again by clicking on the Back button before making Final submission. No changes can be made after Final submission of the Form.



14. After submission, a message will be received "Your response has been recorded".
15. After this, you may close the window/ tab of your web browser.

For any assistance/ support, kindly email us at:

desmncertras2023@gmail.com

ANNEXURE I

- **Reagents and Chemicals**

1. Conc. Hydrochloric acid
2. Dilute Hydrochloric acid
3. Iodine solution
4. Conc. Sulphuric acid
5. Ethyl alcohol
6. Distilled water
7. Liquid paraffin
8. Slaked lime
9. Sodium chloride
10. Sodium thiosulphate
11. Starch
12. Soybean/ Arhar dal powder
13. Red litmus paper
14. Turmeric paper strips
15. Potassium iodide

- **Apparatus/ Glasswares/ Other Materials**

1. Test tubes
2. Test tube Stand
3. Test tube holder
4. Beakers
5. Burner
6. Petridishes
7. Self made Lactometer
8. White porcelain tile
9. Measuring cylinders

10. Conical flasks
11. Volumetric flasks
12. Burette
13. Burette stand
14. Clamp
15. Wash bottles
16. Cork
17. Magnet
18. Filter paper
19. Magnifying glass
20. Dropper
21. Pipettes
22. Spatulas- different sizes
23. Weighing balance
24. Cotton
25. Plastic drinking straw
26. Sand
27. Sealing wax

ANNEXURE II

- **Food Items**

1. Milk
2. Indian cottage cheese (Paneer)
3. Khoya
4. Fat (Ghee)
5. Coriander powder (Dhaniya powder)
6. Chilli powder (Mirch powder)
7. Turmeric powder (Haldi powder)
8. Common Salt
9. Iodized Salt
10. Cumin Seeds (Jeera)
11. Black Pepper (Kali Mirch)
12. Pulses (Dal)
13. Gram flour (Besan)
14. Wheat flour (Atta)
15. All-purpose flour (Maida)
16. Tea leaves
17. Honey (pure and adulterated)
18. Green peas/ Lady finger
19. Green chilli
20. Sweet potato/ Beet root

विद्यया ऽमृतमश्नुते

एन सी ई आर टी
NCERT

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING