ZOUCLG1 GEC-III Food, Nutrition and Health

1. Detecting adulteration in
a) Ghee b) Sugars c) Tea leaves and d) Turmeric.

Sr. No	Food Article	Adulterant	Method for Detection
1	Sugar	Chalk powder	Dissolve 10 gm of sample in a glass of water, allow settling, Chalk will settle down at the bottom.
		Urea	Dissolve 10 gm of sample in a glass of water, allow settling, Chalk will settle down at the bottom.
		Chalk powder	Dissolve 10 gm of sample in a glass of water, allow to settle, chalk will settle down at the bottom.
		Yellow colour (non-permitted)	Take 5 ml in a tests tube from the above solution and add a few drops of conc. HCl. A pink colour in lower acid layers shows the presence of non-permitted colour.
2	Ghee	Vanaspathy or Margarine	Take about one tea spoon full of melted sample of Ghee with equal quantity of concentrated Hydrochloric acid in a stoppered test tube and add to it a pinch of sugar. Shake for one minute and let it for five minutes. Appearance of crimson colour in lower (acid) of Vanaspati or Margarine.
		Mashed Potatoes, Sweet Potatoes, and other starches.	The presence of mashed potatoes and sweet potatoes in a sample of ghee can easily be detected by adding a few drops of Iodine, which is brownish in colour turns to blue if mashed potatoes/sweet potatoes/other starches are present.
3	Turmeric powder	Coloured saw dust	Take a tea spoon full of turmeric powder in a test tube. Add a few drops of concentrated Hydrochloric acid. Instant appearance of pink colour which disappears on dilution with water shows the presence of turmeric If the colour persists, metanil yellow (an artificial colour) a not permitted coal tar colour is present.
4	Tea leaves	Exhausted tea	Take a filter paper and spread a few tea leaves. Sprinkle with water to wet the filter paper. If coal tar colour is present it would immediately stain the filter paper. Wash the filter paper under tap water and observe the stains against light Spread a little slaked lime on white porcelain tile or glass plate; sprinkle a little tea dust on the lime.

			Red, orange, or other shades of colour spreading on the lime will show the presence of coal tar colour. In case of genuine tea, there will be only a slight greenish yellow colour due to chlorophyll, which appear after some time.

2. Estimation of Lactose in milk.

Solution Needs: -

Sodium carbonate, Benedict's reagent, Sodium tungstate 10%, 0.5NH2SO4

Glassware needs: -

Beaker (50 ml, 100 ml, 250 ml), Burette

Sample: Milk

How to Preparation a Solution for the Analysis?

1-Sodium tungstate 10%

Weigh 10 g of sodium tungstate, and pour it into a graduated cylinder or volumetric flask containing about 80 ml of water. Once the sodium tungstate has dissolved completely; add water to make the final volume to 100 ml.

2-Benedict's reagent

One litre of Benedict's reagent can be prepared by mixing 17.3 grams of copper sulphate pentahydrate (CuSO4.5H2O),100 grams of sodium carbonate (Na2CO3) and 173 grams of sodium citrate in distilled water (required quantity)

3-0.5 NH2SO4

Add slowly, With stirring, 30ml of H2SO4 to about 800 ml of distilled water. After Makeup up 1000 ml of distilled water When the temperature in the solution cooling to 25c after being used.

4-Sodium carbonate

Directly use powder

Procedure

1-Take 5 ml of milk sample into a volumetric flask (50 ml) After adding 2.5 ml of 10% sodium tungstate drop by drop with continuous mixing.

2-Add 5 ml of 0.5N H2SO4 with continuous mixing.

3-Finally make the volume to 50 ml with distilled water.

4-Leave the mixture in the flask for 10-15 minutes and then filter.

5-Transfer the filtered to a burette.

6-Add 25 ml of benedict's reagent + 30 ml of distilled water + 2 gm of anhydrous sodium carbonate in (Beaker or Conical flask or porcelain dish)

7-Mix well the mixture and heat till the solution becomes clear - while the solution is boiled, proceed with titration, firstly rapidly.

8-Then proceed with titration drop by drop till complete reduction of blue color.

9-Disappearance of blue colour and appearance of reddish-brown color (of cuprous thiocyanate)

Record the volume (ml) of filtrate exhausted in the titration (V)

Dilution Factor= 10

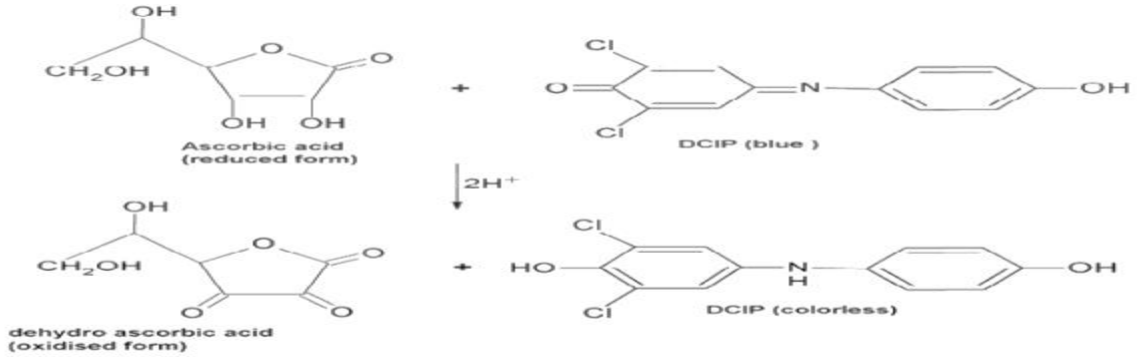
Every 25 ml of Benedict's solution is reduced by 0.0678 gm of lactose.

%Lactose = 0.0678 V ×Dilution Factor×100

Normal Content of Lactose in Milk is 3.8–5.3%

3. Titrimetric method for Ascorbic acid estimation.

Principle: In this reaction reduced form of vitamin C, donates its protons (H+ ions) to get oxidized and reduces the dye. In brief vitamin C, present in the given test sample reduces 2,6-dichlorophenol indophenol (DCIP), a blue coloured dye to pale pink or colourless leuco form in acidic medium. The appearance of pink colour indicates the end point of titration. In this reaction vitamins C acts as a reducing agent and get converted to dehydroascorbic acid (oxidised).



Reaction showing formation of colourless DCIP.

Materials Required: Glassware: 100 mL Volumetric conical flask, Pipette, Burette, Burette stand and 100 mL standard flask.

Preparation of Reagents:

DCIP Dye solution: Separately weigh 26 mg of the dye and 21 mg of sodium bicarbonate powder. Transfer both into a 100 mL volumetric flask, dissolve slowly and make up the volume to 100 mL with distilled water. Filter the reagent and use (store in dark coloured glass bottle)

Oxalic acid solution 4% (w/v): Weigh 4g of oxalic acid crystals and dissolve in 100 mL of distilled water.

Vitamin C stock solution (1 mg/mL): Take 100 mg of vitamin C (Tablet), and dissolve it with 4% oxalic acid in 100 mL volumetric flask. Later, up the final volume to 100 mL with oxalic acid solution.

Vitamin C working standard solution (0.1mg/mL): Take 10 mL of vitamin C stock solution and makeup to 100 mL, with 4% oxalic acid in a 100 mL volumetric flask.

Preparation of Test sample: Take 10g of citrus fruit, juice into a 100 mL beaker. Transfer juice into 100 mL volumetric flask and bring the final volume to 100 mL with 4% oxalic acid solution. Dilute the citrus solution ten times with oxalic acid solution before titration. 5 mL of diluted juice is used for titration and the titration is repeated thrice and average value is obtained (V2).

PROCEDURE FOR QUANTITATIVE ESTIMATION OF VITAMIN-C

Preparation of Test sample: Take 10g of citrus fruit, juice into a 100 mL beaker. Transfer juice into 100 mL volumetric flask and bring the final volume to 100 mL with 4% oxalic acid solution. Dilute the citrus solution ten times with oxalic acid solution before titration. 5 mL of diluted juice is used for titration and the titration is repeated thrice and average value is obtained (V2). Transfer 5 mL of the vitamin C working standard solution into a 100 mL conical flask. Later, add 10 mL of oxalic acid solution and mix well. Now titrate the contents against the DCIP solution, taken in a burette. Add dye solution drop by drop into the conical flask (Fig. 9.2) and mix the contents thoroughly. The appearance of a pale pink colour from blue, indicates the endpoint (appears for few minutes). Repeat the procedure thrice to obtain an average value of dye consumed, as shown in the Table

Quantitative Estimation of Vitamin C

Sl. No.	Sample for Titration	Volume of working standard (mL)	Volume of oxalic acid solution (mL)	Volume DCIP dye consumed (burette, mL)		
				Initial	Final	(Initial- final)
1.	Blank (5 mL Distilled water)	———	10			
2.	Vit. C Standard Titration 1	5	10			
	Titration 2	5	10			
	Titration 3	5	10			
3.	Test sample Titration 1	5 mLof diluted juice	10			
	Titration 2	5 mL of diluted juice	10			
	Titration 3	5 mLof diluted juice	10			

Calculation: Vitamin C content (mg/100g sample) is calculated by the following equation:

$$\text{Vitamin C (mg/100g)} = \frac{0.5\,\text{mg}}{V_2\,\text{mL}} \times \frac{V_1\,\text{mL}}{5\,\text{mL}} \times \frac{100\,\text{mL} \times 10}{\text{Weight of the sample (g)}} \times 100$$

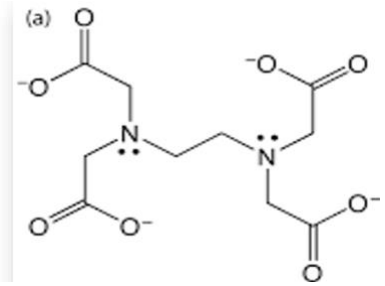
Where, V1 = Volume of the dye consumed for standard vitamin C (mL).
V2 = Average Volume of dye consumed for the sample (mL).
X 10 = Dilution factor.

Results: The amount of vitamin C present in 100 grams of fruit is _____ mg

Precautions
Use clean and dry glassware, no need to add any indicator as DCIP dye acts as self-indicator.

4. Estimation of Calcium in foods by titrimetric

Principle:
The determination of calcium in milk is based on a complexometric titration of calcium with an aqueous solution of the disodium salt of EDTA at high pH value. Complexometric titration is a type of titration based on complex formation between the analyte and titrant. Such compounds can form chelate complexes with many cations in which the cation is bound in a ring structure. The ring results from the formation of a salt-like bond between the cation and the carboxyl groups together with a coordinate bond through the lone pair of electrons of the nitrogen atom. The common form of the agent is disodium salt Na2H2EDTA. It is colorless and can be weighed and dissolve in water to form a stable solution. At high pH (> 10) the remaining protons leave EDTA forming $EDTA^{4-}$ anion:



The Solochrome dark blue indicator is a suitable indicator in this case. The dye itself has a blue color. This blue dye also forms a complex with the calcium ions changing colour from blue to pink/red in the process, but the dye–metal ion complex is **less stable** than the EDTA–metal ion complex. As a result, when the calcium ion–dye complex is titrated with EDTA the Ca2+ions react to form a stronger complex with the EDTA changing the dye color to blue.

How to determine calcium in the presence of Mg?
This method for determining Ca2+concentration in the presence of Mg2+relies on the fact that the pH of the solution **is sufficiently high** ((The pH will be approximately 12.5 due to the addition of concentrated NaOH solution)) to ensure that all magnesium ions precipitate as

magnesium hydroxide before the indicator is added. In this condition, magnesium ions are precipitated as hydroxide and **do not interfere** with the determination of calcium.

Method:

- Combine 10mL of sample, 40mL distilled water, and 4mL of 8M sodium hydroxide solution into an Erlenmeyer flask and allow solution to stand for about 5 minutes with occasional swirling.
- A small of magnesium hydroxide may precipitate during this time. Do not add the indicator until you have given this precipitate a chance to form.
- Then add 6 drops of the Solochrome dark blue solution.
- After that start to titrate with EDTA solution.
- Repeat titration for three trials.

Calculations:

1. Calculate the moles of EDTA required to complex the Ca2+ ions in the sample:

 Number of moles (for EDTA) = Molarity of EDTA x volume of EDTA in L

Note: Ratio Ca2+: EDTA = 1: 1 (i.e moles of EDTA = moles of Ca2+)

2. Calculate weight of Ca2+:

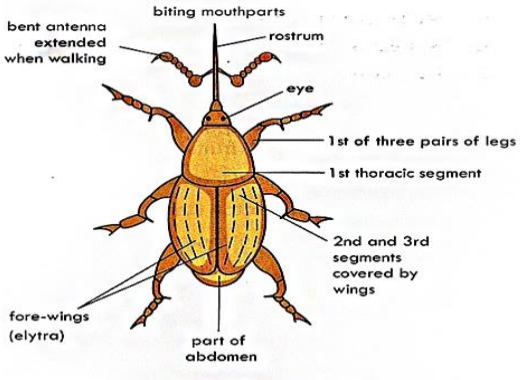
 Weight of Ca2+ = Number of moles x molecular weight (40.78)

- **% of Ca2+ = (weight of Ca2+ / weight of sample) x 100**

- **Amount of calcium=** $\dfrac{(Molarity\ of\ EDTA \times vol.\ of\ EDTA\ (in\ liter) \times 40.78)}{(wieght\ of\ sample)} \times 100$

5. Study of the stored grain pests from slides/ photograph (*Sitophilus oryzae, Trogoderma granarium, Callosobruchus chinensis* and *Tribolium castaneum*): their identification, habitat and food sources, damage caused and control.

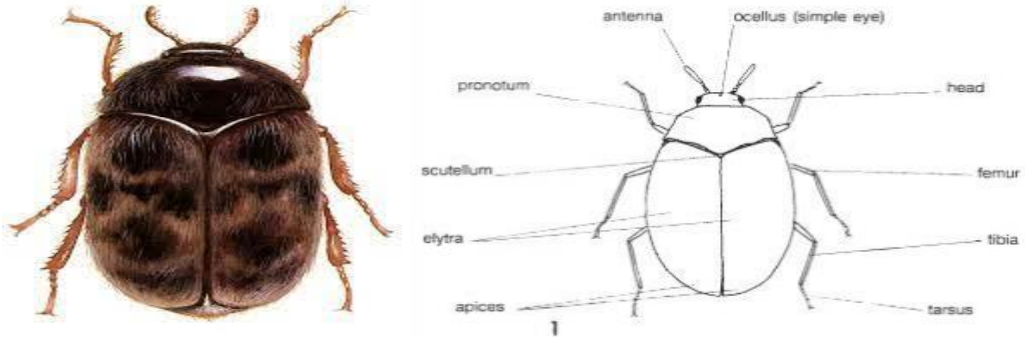
a) *Sitophilus oryzae*



Grain weevil *Sitophilus oryzae*

Rice Weevil:
Sitophilus oryzae Linn.; Curculionidae: Coleoptera
Economic Importance:
It is cosmopolitan and polyphagous species and found to cause considerable damage to rice. Besides rice, it also causes damage to several other cereals and their products.
Identification: Adult: Tiny weevil, 3 mm in length with a head produced into a snout like structure. Body reddish brown to dark brown or almost black in colour. Fore wings with four light reddish or yellowish spots. The insect can fly. Grubs: whitish, often found inside kernels, small and legless.
Nature of Damage: Both adults and larvae feed on the sound grains of wheat, rice, maize, jowar, barely, bajri, etc. as a result, they are rendered unfit for human consumption. The adult damage a small portion of grain and feeds on inner content. Though the grains are mostly damaged in storage, the infestation is carried from the field also.
Life History: Eggs: The adult female makes holes in the soft portion of the grain with the help of its mount parts and lays eggs singly. Each female can lay 350-400 eggs during her life time. The incubation period is about 4 days. Larva: The grub stage lasts for 19 to 34 days. Pupa: The pupation inside the grain and the pupal period 3 to 6 days. Life cycle completed within 26-28 days.

b) *Trogoderma granarium*



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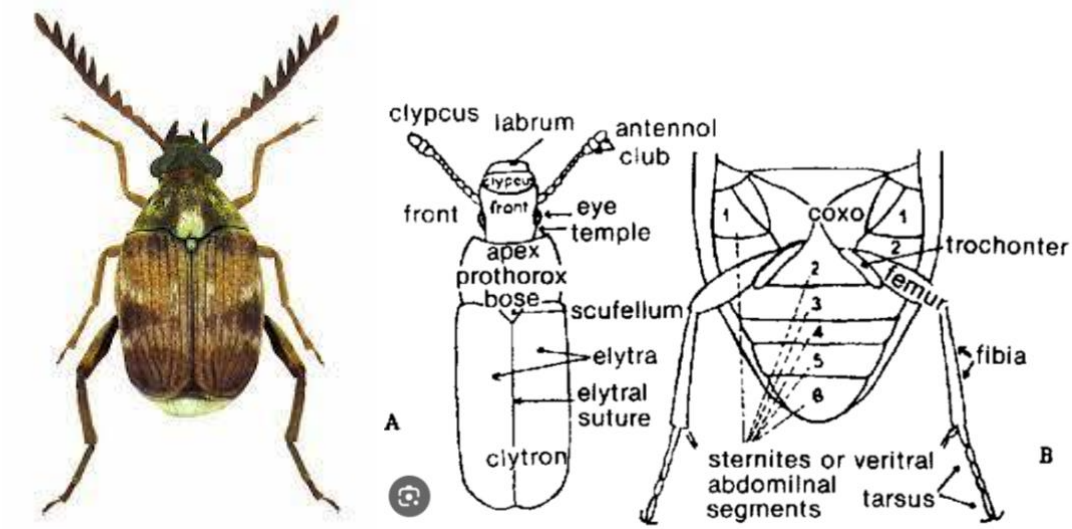
Khapra Beetle: Trogoderma granarium E.; Dermestidae: Coleoptera
Economic Importance: It is a cosmopolitan species and observed to thrive well under climatic conditions where temperature ranges between 92° F to 110° F. In the Indian Union it has been reported as one of the most destructive pests from all the States. Though it is a serious pest of wheat, it is found to attack other cereals like rice, oat, maize, jowar etc.
Identification: Adult: About 2-3 mm long, convex, oval with grey and light brown markings and emarginated eyes. Grubs – brownish white in colour, 4 mm long and body covered with long reddish-brown hairs, which are usually directed backward and form a sort of thick tail at the anal end.
Nature of Damage: The infestation generally occurs at superficial layers of grains as they are not able to penetrate beyond certain depth. However, in case of heavy infestation, it may destroy the entire lot. Only larvae are harmful, usually feed voraciously on embryo of grains thus adversely affecting their germination but can destroy the entire grains. Adults are harmless.
Life History: Eggs: A female lays about 125 eggs, loosely among the grains in her life time. They hatch in 6 to 26 days. Larva: Larvae become full grown in about 50 days. Pupation: on

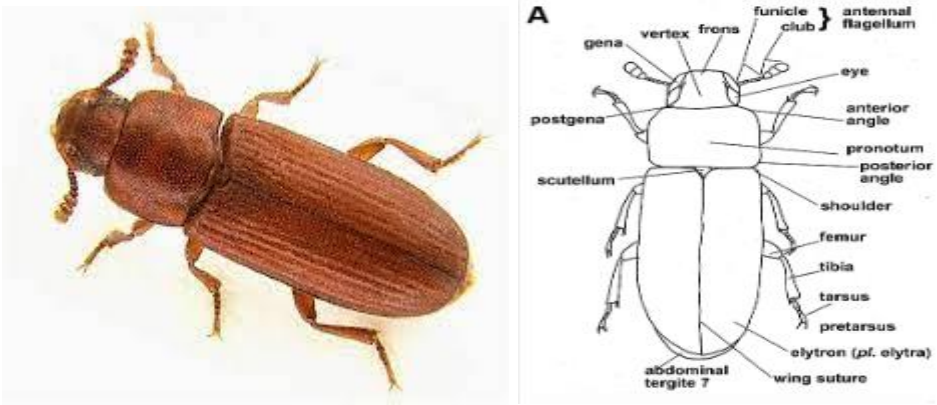
the surface of grain in bulk or edges of bags. The pupal stage lasts for 6 to 17 days. The adults are ready for egg laying in 2 to 3 days after emergence and live for 10 to 32 days. Under unfavourable conditions of climate and shortage of food the larval period may be prolonged upto 200 days or even upto 4 years.

c) *Callosobruchus chinensis*



Pulse Beetle: Callosobruchus chinensis Linn.; Bruchidae: Coleoptera.
Identification: Adult small 3-4 mm in length, oval, chocolate, or reddish brown, active with long serrate antennae, brownish grey, elevated ivory like spots near the middle of dorsal side, elyctra do not cover the abdomen completely. Larva is creamy white.
Nature of Damage: It is a major pest of pulses like mug, gram, tur, bean, masor and udid and causes heavy damage during monsoon season. Though the pest attack is commonly noticed in storage, the infestation sometimes is carried from the field where the eggs are laid on green pods. The young grub burrows into the pod or grain, feed on inner contents and pupate inside the grain and later emerges as an adult through the exit hole prepared by the full-grown grub before pupation.
Life History: Eggs: Incubation period - 5 days. Larva: Larval period 30-50 days. Pupa: Pupal period 5-8 days. Life cycle completed in 45 days.

d) *Tribolium castaneum*



Rust Red Flour Beetle: Tribolium castaneum H.; Tenebrionid: Coleoptera

Identification: Beetle small, 3-4 mm, oblong, flat, brown in colour.

Nature of Damage: Both the larva and adult feeds on grains which are already broken or damaged. The pest is more damaging to milled cereals, like atta, maida, suji which become mouldy and emit a pungent smell. It is secondary pest of all grains and primary pest of flour and other milled products. In grains, embryo or germs portion is preferred.

Life History: The female lays eggs in the flour or grassy material among the grains and other food stuff. The incubation period lasts 4-10 days. Larval period 22-25 days. Pupation takes place in the flour. Pupal stage lasts 5-9 days. Life cycle completed in 26-30 days.