Raising and Aerating

<table>
<thead>
<tr>
<th>Physical Methods</th>
<th>Mechanical Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Physical raising methods such as air, water vapour</td>
<td>• Food preparation methods such as sieving, whisking</td>
</tr>
<tr>
<td>or steam help products to have a light, open texture.</td>
<td>or beating can be used to trap air.</td>
</tr>
<tr>
<td>• Recipes that need to be light have ingredients that</td>
<td>• Combinations of physical and mechanical methods work</td>
</tr>
<tr>
<td>function as raising agents such as water, milk or egg</td>
<td>well in food preparation to make mixtures light, e.g.</td>
</tr>
<tr>
<td>whites.</td>
<td>batters for Yorkshire puddings.</td>
</tr>
</tbody>
</table>

Air, Steam and Foam as Raising Agents

1. Air is a very effective raising agent because it expands when it is heated. Air pockets swell and volume increases.
2. Food preparation techniques help prevent loss of air, e.g. folding in flour when making a whisked sponge cake.
3. Steam is produced from water in a mixture; this is a physical change. Steam produces light, open and uneven textures and adds volume during cooking, e.g. profiteroles.
4. Moist mixtures produce steam during cooking.
5. Foams - whisking helps trap air, creating foam.
6. Ingredients containing protein form foams, e.g. milk froth, egg whites.
7. Egg whites stretch and unravel to trap air to form a gas-in-liquid foam.
8. Sugar stabilises foam, e.g. cold-set soufflé.
10. Cooking stabilises foam, e.g. roulade, meringue.

Chemical Raising Agents

1. Chemical raising agents produce carbon dioxide when heated with a liquid.
2. They cause effervescent fizzing and bubbles of gas.
3. Chemical raising agents must be carefully measured.

Raising Agents

Bicarbonate of Soda

• Bicarbonate of soda is an alkaline powder.
• It can leave a soapy aftertaste but strong flavours, e.g. gingerbread, will mask the aftertaste.
• It works more effectively with an acid ingredient such as buttermilk or cream of tartar, e.g. soda bread.
• The acid neutralises the alkali and prevents soapy aftertaste.
• Cream of tartar is an acid raising agent, which is frequently used alongside bicarbonate of soda, e.g. in scones.

Baking Powder

• Baking powder is a ready-to-use mixture of cream of tartar plus bicarbonate of soda and rice flour.

Self Raising Flour

• Self-raising flour is plain flour and baking powder added together to create rise. Plain flour alone does not contain a raising agent.
• Self-raising flour can be brown or white.
• Self-raising flour contains a pre-sieved precisely measured amount of baking powder for ease and speed of use.

Biological Raising Agents

• Yeast is a biological raising agent. It ferments to give off carbon dioxide gas.
• Fermentation in yeast is a biological (also known as biotechnological) raising agent.
• The conditions for yeast fermentation are warm temperature 25°C-35°C; moisture; food; time.
• Temperatures above 60°C during baking will inactivate and finally destroy yeast cells.
• Boiling liquids will inactivate yeast, preventing fermentation from taking place.
• Yeast is the raising agent in bread, bread rolls, buns and rich pastries (Danish pastries).
• Leavened bread contains raising agent in the form of yeast or bicarbonate of soda.
• Unleavened bread contains no raising agent and is flat in structure.

Quick Test

1. What is the raising agent in a whisked sponge cake?
2. What happens when air is heated?
3. How does egg white trap air?
4. How can water help make a mixture light during cooking?
Raising Agents

1. Why is water an effective raising agent? Tick (✓) one answer.
   a) It turns to steam. [ ]
   b) It does not add calories. [ ]
   c) It makes mixtures runny. [ ]
   d) It makes mixtures moist. [ ]

2. Fill in the table by naming two chemical raising agents and giving an example of their use in food preparation.

<table>
<thead>
<tr>
<th>Names of Chemical Raising Agent</th>
<th>Example of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Name the gas produced by chemical raising agents. [1]

4. This question is about the function of ingredients in choux pastry.
   a) When making choux paste, state two ingredients that help the pastry rise and puff. [2]

   b) Explain how these ingredients work during baking.

   c) Why is it important to fully cook small choux buns, e.g., profiteroles? [3]

5. Tick (✓) the correct answer. Raising agents can be classified as:
   a) biological, microbial and physical. [ ]
   b) chemical, enzymic and biological. [ ]
   c) physical, globular and pathogenic. [ ]
   d) chemical, physical and biological. [✓]

Describe three functions of raising agents in food preparation.

6. 1 [ ] 2 [ ] 3 [ ]

A baker wants her shop assistants to understand raising agents. She uses examples from her shop.

7. Example 1 is a whipped sponge flan.
   a) What is the raising agent in the flan sponge? [1]
   b) Describe how the raising agent is incorporated into the sponge. [1]

   Example 2 is a cheese scone.
   c) Which raising agent is used in scones? [1]
   d) What gas would the raising agent produce? [1]
   e) Explain how the raising agent works during baking. [2]

Raising Agents

1) What are the differences between bicarbonate of soda, baking powder and self-raising flour? [1]
2) Name one biological raising agent and explain how it can be used to raise bread dough. [1]
3) Explain how choux pastry profiteroles are risen by steam. [1]
4) Describe six ways you could mechanically incorporate air into a cake mixture. [1]

Learn this stuff — it's the yeast you can do...

Unlike chemical agents which add gas during baking, yeast adds gas to dough before baking. Yeast isn't used in cakes very often because cake mixtures struggle to hold air for the time it takes for fermentation to occur.

Q1 Give two examples of mechanical raising agents. [2 marks]
Q2 Explain why you would not use bicarbonate of soda to raise a plain sponge cake. [2 marks]

Total Marks: 41
Carbohydrate

You must be able to:
- Know and understand the functions, structures and main sources of carbohydrate
- Understand an individual's need for carbohydrate
- Demonstrate a knowledge and understanding of the consequences of consumption of excess carbohydrate and of deficiencies in carbohydrate.

Excess and Deficiencies of Carbohydrate

- Excess carbohydrate is converted to fat and is stored under the skin; this is the main cause of obesity.
- Excess sugar in the diet is linked to dental decay.
- There is evidence to suggest that the rise in Type 2 diabetes is linked to diets high in sugar.
- If insufficient carbohydrate is eaten, the body will firstly start to use protein and fat as an energy source.

Dietary Fibre

- The scientific name for fibre is Non-Starch Polysaccharide (NSP).
- Soluble NSP absorbs water, forming a gel-like substance. It can inhibit the absorption of cholesterol.
- Insoluble NSP is not absorbed by the body. It passes through the body as waste, which helps prevent bowel diseases.

Function and Sources of Dietary Fibre

- Dietary fibre makes food matter passing through the intestines soft and bulky.
- Dietary fibre can be found in wholemeal bread, wholegrain breakfast cereals (e.g. bran flakes, shredded wheat, porridge oats), wholemeal pasta and wholemeal flour; fruit and vegetables; potato skins; dried fruit; nuts and seeds; beans, peas and lentils.
- Adults should consume at least 18 g of fibre per day.
- Young children must gradually add high fibre foods to their diets.
- Fibre deficiency can lead to:
  - Constipation – this is when faeces become difficult to expel from the body because they are hard and small.
  - Diverticular disease – pouches form in the intestines, which become infected with bacteria.
- A low-fibre diet can be linked to cancer, particularly bowel cancer.

Function and Sources of Carbohydrate

- Sugars are digested quickly in the body, providing instant energy.
- Starches have to be digested into sugars before absorption – this is slow energy release.
- Eating starchy foods rather than sugary foods is the healthier way to provide the body with energy. Starch (a polysaccharide) is found in bread, pasta, rice, breakfast cereals and potatoes.
- Sugars are found in a variety of sources including table sugar (sucrose), honey and jam, fruit juice, sweets and chocolate, fruit and vegetables.

Key Points

- Carbohydrate provides the body with energy. Most of our energy should come from starchy foods.

Function and Sources of Carbohydrate

- Monosaccharides
  - Monosaccharides are the simplest form of carbohydrate structure. They include:
    - Glucose – all other carbohydrate is converted into this in the body.
    - Galactose – found in the milk of mammals.
    - Fructose – found in fruit.
  - Disaccharides are more complex sugars that are formed when two monosaccharides join together. They include:
    - Sucrose – 1 unit of glucose + 1 unit of fructose.
    - Maltose – 2 units of glucose linked.
    - Lactose – 1 unit of glucose + 1 unit of galactose.
  - Polysaccharides are made up of many monosaccharides units joined together. They include:
    - Starch – many glucose units formed together.
    - Glycogen – formed after digestion.
    - Dietary fibre.
    - Dextrin – toasted crust on bread; sugars caramelise on the surface.
    - Cellulose – formed by plants from glucose.
    - Pectin – found in fruit, forms a gel on cooking.

Key Words

dietary fibre
photosynthesis
monosaccharides
disaccharides
polysaccharides
Non-Starch Polysaccharide (NSP)
constipation
diverticular disease
What are the three carbohydrate groups?

Give an example of a monosaccharide.

Fill in the missing words.
Sugars are digested very quickly in the body, providing instant energy.

Most people in the UK do not eat enough dietary fibre. Suggest a similar food that is higher in dietary fibre to replace each of those listed below.

a) White bread
b) Cornflakes
c) Mashed potato

Sugar, sweets and sugary drinks are associated with which type of decay in the body?

What would be the results of not eating enough carbohydrate?

Fill in the missing words.
Starches have to be digested into simple sugars before release.

What is the name of the common medical condition frequently caused by a lack of dietary fibre (NSP) in the diet?

Total Marks / 18
**Changing Properties — Proteins**

I hope you like eggs, because they’re a great way to look at the functional and chemical properties of proteins. **Functional** = how they change food, **chemical** = the science behind these changes. Let’s get cracking...

### Proteins Denature during Preparation and Cooking

1. **Proteins** (p.1) have a **complex structure**. When food is cooked, proteins **denature** — this means the chemical bonds holding their structure together **break down**.
2. The proteins **unwind** and their shape changes — in most cases this is **irreversible**.
3. Proteins can be denatured in different ways, including:
   - Physical agitation (e.g., whisking, beating and kneading)
   - Changes in **temperature** (e.g., heat)
   - **Acids** (e.g., lemon juice and marinades)

### Denatured Protein Molecules Coagulate

1. Once they have been **denatured**, protein molecules collide with other protein molecules and **coagulate** (join together).
2. During this process, water becomes **trapped** between the protein molecules.
3. Coagulation also changes the **appearance and texture** of the food. E.g., egg white turns from a see-through liquid into a white solid, while steak becomes brown, firmer and **easier to eat** as you cook it.
4. However, if food is **overcooked** and coagulation happens too much, the protein tightens. This forces water out of the molecules, making it **dry** and **chewy**.

### Foams are Formed when Air is Trapped

1. Foams, e.g., chocolate mousse, whipped cream or cappuccino foam, form when gas becomes trapped (separated) inside liquid.
2. When liquids containing proteins are agitated (e.g., egg whites are whisked), the proteins inside the liquid **denature** — this causes them to stretch and air becomes **trapped** in the liquid.
3. When the proteins **coagulate**, this air becomes trapped, creating a foam.
4. However, over-whisking causes these new protein bonds to break — air escapes and the foam **collapses**.
5. Some foams form a **solid structure** when they are cooked, e.g., egg white foams become **meringues**.

### Gluten allows Doughs to Stretch and Rise

1. **Gluten** is a protein found in wheat flours (e.g., those made from wheat, barley and rye).
2. It’s formed when water is mixed with the flour to make dough and can be found in foods like bread, pasta, cakes and pastries.
3. Molecules of gluten are **coiled** — this means they are able to stretch and bend — this gives all doughs **elasticity** (stretchiness).
4. Doughs need to be **kneaded** to ‘work’ the gluten — this causes gluten strands to get longer, stronger and stretchier.
5. When it reaches a high temperature, gluten **coagulates** (see above) and the dough **stages** stretched. This gives foods like well-risen bread a light, airy texture.

---

**Indiana Foams and the Temple of the Whipped Egg White...**

It might be fun helpful to draw a mind map of the ways proteins change during cooking — include changes to their chemical properties (e.g., molecules coagulate) and how this affects their functional ones (e.g., food becomes firmer).

---

**Changing Properties — Carbohydrates**

For the exam you’ll need to know about **three ways** in which carbohydrates change in food during cooking. If you need a quick refresher on carbohydrates before we get going, have a quick flick back to pages 5-6.

### Starch Gelatinisation Thickens Liquids

1. **Gelatinisation** helps to **thicken** foods that contain starch, e.g., sauces, custards and gravies.
2. When starch granules are first mixed with liquid, they become **swollen** up in it — if you don’t stir the liquid these granules will sink to the bottom.
3. When the granules are heated with water, the bonds between starch molecules start to break, allowing water molecules to enter. As water is absorbed, the starch granules swell in size and **soften**.
4. Between 62°C and 68°C, the starch granules **burst open** and release their starch into the liquid.
5. This release of starch causes the liquid to **thicken**. How thick the liquid becomes depends on the ratio of starch to liquid in the mixture — the **higher** the concentration of starch, the **thicker** the liquid.
6. When it cools, the liquid thickens and a **solid gel** is formed — this is useful for making ‘set’ desserts like **custard** and **lemon pie filling**.

### Dextrinisation occurs when Starch is Exposed to Dry Heat

1. When starchy foods such as **bread** or **biscuits** are cooked with **dry heat**, e.g. toasting or baking, the starch molecules in the food **break down** into smaller molecules called **dextrins**.
2. This breakdown is called **dextrinisation** and it gives food a **brownish colour** and crispier texture as well as a different **taste** (imagine the difference in taste between bread and toast).
3. The longer the food is cooked, the more starch is converted into **dextrins** and the darker and crispier the food becomes.

### Sugar Caramelises When it’s Heated

1. Sugar molecules **break down** when they reach a high temperature — this causes sugar to turn **brown** and change **flavour**. This process is called **caramelisation**.
2. The sugar goes through various stages:
   - At first the liquid is runny and has a **very sweet** taste.
   - As time passes, it becomes more like a smooth **caramel**.
   - Eventually, it turns hard and as it cools it becomes more like a **crystal**.
3. Caramelised sugar can **burn** very quickly, turning black, brittle and bitter to taste.
4. To avoid this, **water** is often added during the early stages of heating.
5. **Caramelisation** gives **sugars** such as a **crema tibolada** and **apple sofa** extra sweetness.
6. **Even savoury foods** that contain sugary **e.g., onions** can **caramelise**. The sugars in the food are broken down and released, turning the food brown and adding sweetness.

---

**Tony Starch — saving the world one sauce at a time...**

Blimey, there are some long words on this page! While it might be tempting to read over them quickly, it’s important you can spell them correctly — especially **gelatinisation**, **dextrinisation** and **caramelisation** — lovely...

Q1 Explain why onions can develop a sweet taste when they are fried in oil or fat. [2 marks]

Q2 Describe what happens to starch granules when they are heated with water. [3 marks]
Changing Properties — Proteins

1. When liquids that contain proteins are agitated, air can become trapped and form a foam.
   a) Which one of the following is an example of a foam?
      Circle the correct answer.
      A  Béchamel sauce  C  Whipped cream
      B  Custard  D  Mayonnaise

   [1 mark]

   b) Explain why whisking a foam too much can cause it to collapse.

   [2 marks]

2. Gluten is a protein that’s formed when water is added to flour.
   Explain one role of gluten in bread making.

   [2 marks]

3. Jen is making a quiche. A step of the recipe she writes down some notes.
   Explain the changes Jen has noticed for each of the following steps.

   **| Recipe | Jen's Notes | Why have these changes occurred? |
   ---|---------|-------------|----------------------------------|
   **| Step 5: Place the quiche in the centre of a pre-heated oven and bake for half an hour at Gas Mark 5 (190 °C). | "After half an hour, the quiche mixture started to set around the edges. I will keep it in the oven a little longer to firm up." | |
   **| Step 6: Remove the quiche from the oven when it has developed a golden colour. | "The quiche has developed a rubbery texture." | |

   [4 marks]

Changing Properties — Carbohydrates

1. Bread turns brown and crispy when it is toasted.
   What is the name of the process that causes these changes?

   [1 mark]

2. Caramelisation is a process where sugars change during cooking.
   a) Describe the changes that take place during caramelisation.

   [2 marks]

   b) What can happen if caramelised sugar is heated for too long?

   [1 mark]

   c) i) Give one sweet food that shows caramelisation.

   [1 mark]

   ii) Give one savoury food that shows caramelisation.

   [1 mark]

3. A roux-based sauce is made using butter, plain flour and milk.
   Explain how gelatinisation occurs in a roux-based sauce.

   [4 marks]