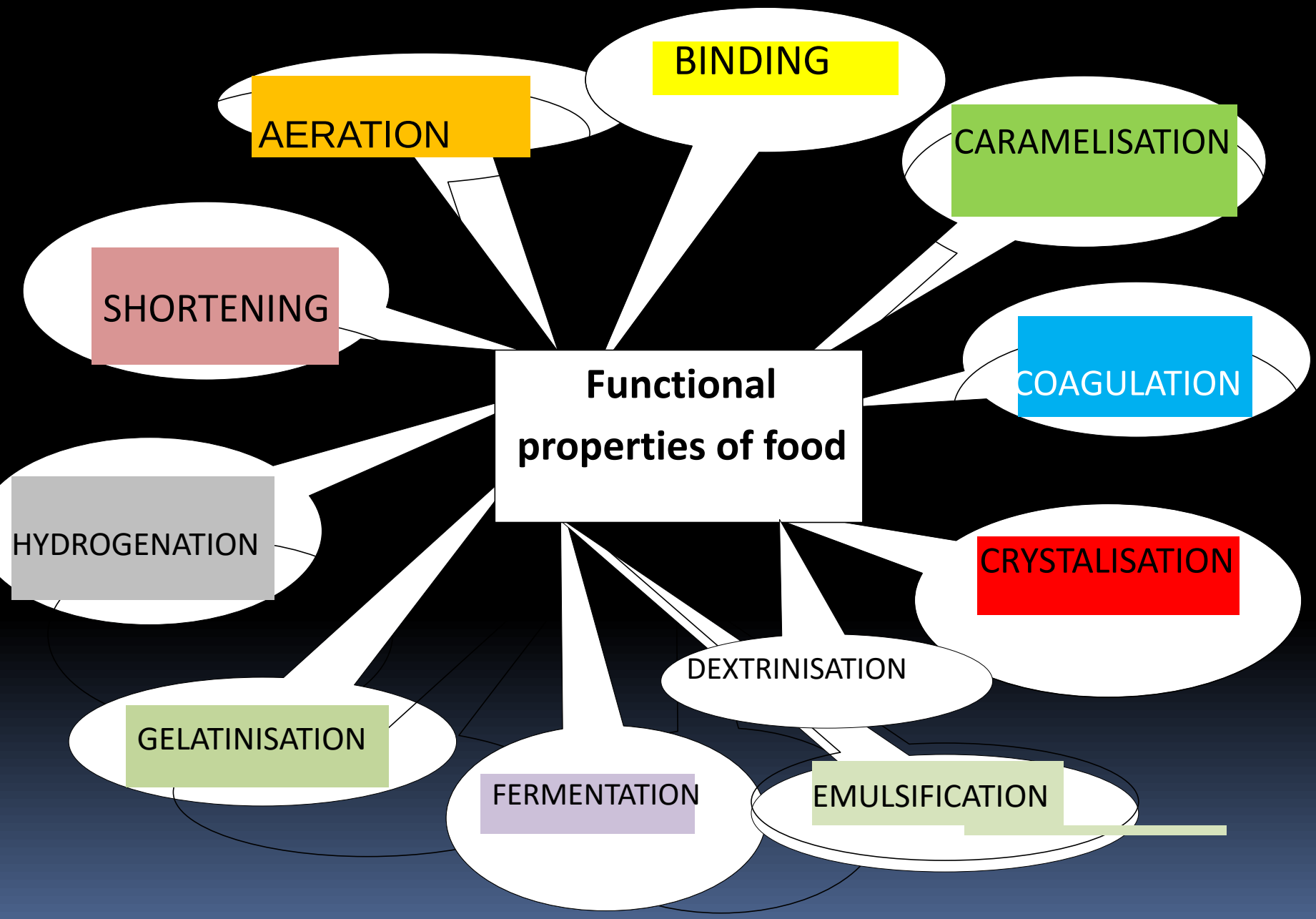

Functional properties of food
BINDING
AERATION
CARAMELISATION
SHORTENING
COAGULATION
HYDROGENATION
CRYSTALISATION
DEXTRINISATION
GELATINISATION
FERMENTATION
EMULSIFICATION

To make successful products, food technologists use these properties and they are described as **FUNCTIONAL PROPERTIES**

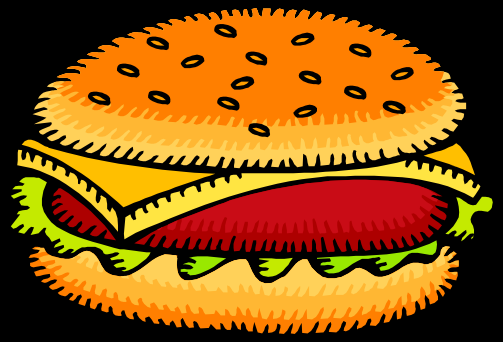
AERATION

- **SIEVING** – air becomes trapped between particles of flour when it is sieved
- **CREAMING** – air is trapped when fat and sugar are beaten together to form **an air in fat foam**
- **RUBBING IN** – Fat is rubbed into flour and coats the flour particles and form **a waterproof barrier that also traps air** as the mixture is lifted and rubbed in with the fingertips.
- **WHISKING** - protein in egg **(albumen) stretches and traps air bubbles in the foam**

BINDING

- When whole eggs are used for binding, the property of coagulation is used – eggs coagulate at 63-70·C
- The egg proteins coagulate when heated and they bind/ hold ingredients together resulting in an unbroken product eg. Fishcakes, hamburgers

- Binding, e.g. egg is used to bind ingredients for rissoles or burgers. The egg coagulates on heating and holds the ingredients together.



COAGULATION

- Coagulation is a change from liquid to a solid

Proteins coagulate by

- **HEAT** – eg meat becomes firm when cooked, milk forms a skin on the surface
- **ACID** – when milk becomes sour, lactic acid is formed and may cause coagulation of the milk protein
- **ENZYMES**– rennet is used to coagulate milk to produce curds in cheese making.
- **SALT**– increases the firmness of the curd in cheese making.
- **MECHANICAL ACTION**– partial coagulation of protein occurs when egg white is whisked.

However, it is the first method, heat, that is particularly important in food-product development and accounts for the difference between raw and cooked foods.

EGGS are commonly used in cookery due to their property of coagulation.

Coagulation of eggs is affected by:

- The temperature used
- The cooking time
- The other ingredients used.

The temperature and time used:

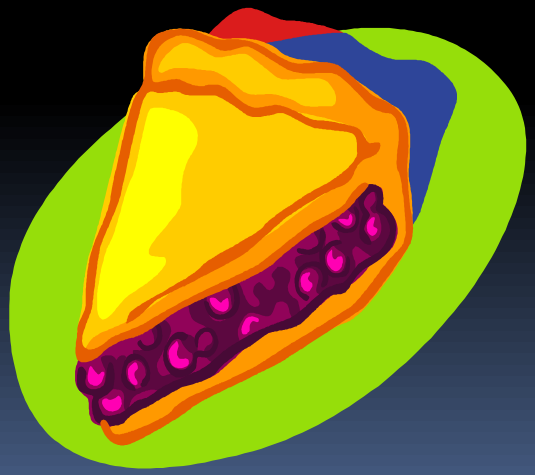
- When eggs are heated they change from a fluid state to a more solid state.

- Egg white thickens or sets between 60 and 65ºC.

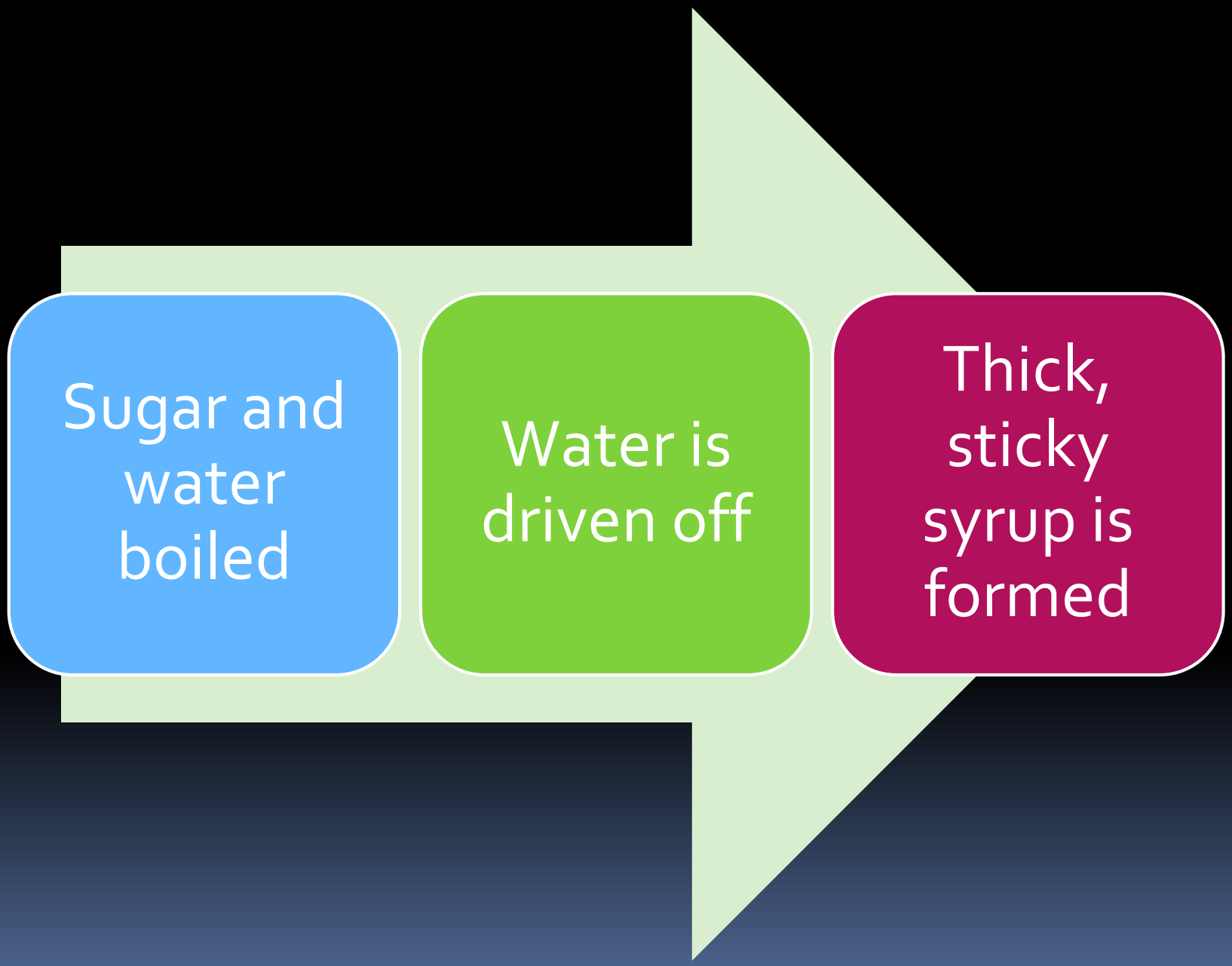
When eggs are mixed into a liquid, e.g. milk, and then heated, coagulation makes the mixture thicken. This is what happens when an egg custard, bread-and-butter pudding or the filling for a flan are
baked.

Coating, e.g. on potato croquettes. The coating of egg coagulates
and prevents the food from falling apart.

- Glazing, e.g. whole egg or egg yolk is used to glaze pastry.



CRYSTALLISATION


Sugar and water boiled
Water is driven off
Thick, sticky syrup is formed

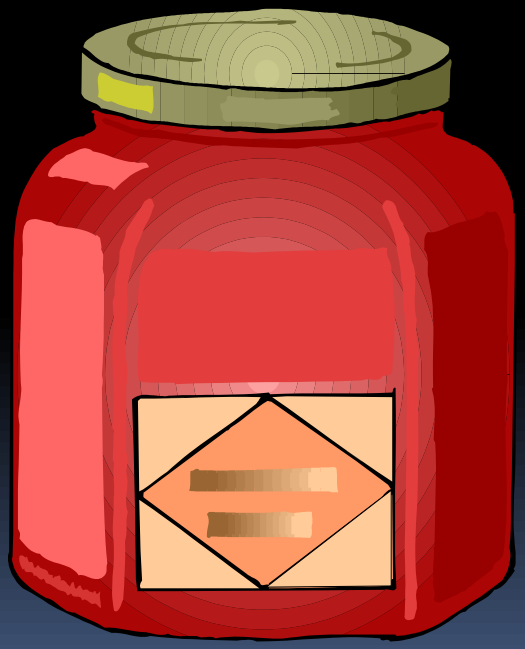
Sucrose changes to invert sugars called glucose and fructose

Sets and solidifies on cooling

Crystallisation happens when crystals form after a saturated sugar cools after boiling

Uses of crystallisation

- Jam making



- Sweet making

CARAMELISATION

This is the process whereby sugar is heated to give a brown colour eg. In baked products like cakes and biscuits, toffee

DEXTRINISATION

This is the effect of dry heat on starch which gives a brown colour eg. When flour is cooked as part of a cake or a biscuit a golden brown colour is achieved because of the flour (starch) used.

Emulsifying

- Egg yolk contains a substance called lecithin which acts as an emulsifier.
- When egg yolk is added to the mixture of oil and another liquid, it is the lecithin in the yolk which enables the oil and liquid to be mixed to an emulsion without separating eg. mayonnaise

LECITHIN

In cake making, lecithin in the egg yolk stabilises the mixture by forming an emulsion with the fat and oil in the margarine and the liquid in the egg. This prevents the fat from separating from the liquid (the sugar and eggs), which would cause the mixture to curdle.

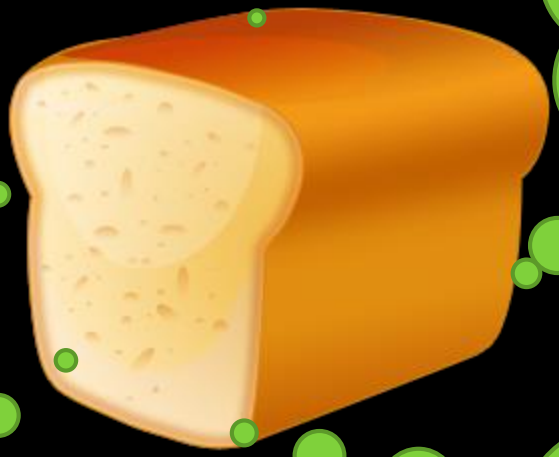
FERMENTATION

Successful results depend on

- the correct amount of yeast
- a source of food (sugar or flour)
- moisture
- the correct temperature – fermentation works best at 25–29°C and the process stops at 55°C, when the yeast is killed.

1. Made with strong flour with high gluten content

2. Elasticity of the gluten allows the dough to stretch and hold CO_2



3. During fermentation, sugars present naturally in flour are converted to glucose

4. Glucose is fermented by the yeast to CO_2 and alcohol

5. This raises the dough

FERMENTATION

- Over fermentation
- The gluten becomes overstretched, dough is not able to hold CO_2 and large, uneven holes in the bread appear.
- The bread is heavy, poor volume an d 'off flavours'

Insufficient fermentation

- Not enough CO_2 gas therefore bread is heavy, close texture and volume is poor.

GELATINISATION

Starch added to cold water and held in suspension

Mixture is heated starch cells swell and burst

By this process the starch absorbs water and thickens the liquid eg sauce

Process is called gelatinisation

As a cooked starch mixture cools there is an increase in the stiffness as gelling takes place

How thick a mixture becomes is called its

VISCOSITY

Degree of gelatinisation is affected by

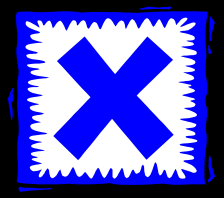
- The proportion and type of starch
- The temp of the liquid – most start to thicken between 75 and 87 degrees C and is complete at nearly boiling point
- The effect of other ingredients

– acid like lemon juice reduces the thickening quality

_ if too much sugar is added gelling will not take place – it is recommended sugar is added after the starch has gelatinised

HYDROGENATION

- Liquid oils are converted to solid fat
- Used in the production of margarine



- Causes some polyunsaturated fatty acids to change to trans fatty acids
- These trans fatty acids may raise blood cholesterol levels

SHORTENING

- To make shortbread and short crust pastry soft and crumbly, fat is added as a shortening
- The best shortening fats are lard and pure vegetable fats
- The proportion of fat to flour is critical as there needs to be enough to coat the flour particles and reduce gluten development. Too much will make it unpalatable and difficult to handle

Identify and explain **three functional properties of eggs**

Explain how **each of the following affects gelatinisation in food products.**

(i) Starch

(ii) Acid

Explain how **each of the following functional properties may be used in** food manufacture.

(i) Crystallisation

(ii) Coagulation

- Evaluate how each of the following ingredients used to make a pizza base affects the finished product

-strong wholemeal flour

- sugar

-yeast

Evaluate how each of the following ingredients used to make a cake affects the finished product

-Soft margarine

-Caster sugar

-SR flour

Describe the result on a Sponge Cake of increasing the proportion of

(a) sugar

(b) margarine

(c) Raising agent

Identify and discuss two effects that the proportion of fat may have on a product

State the effect of the following

- scones which have too much liquid added

-pastry which has too little water added

-a fruit cake which has too much liquid added.

Choose one of the following products

- Quiche Lorraine
- Swiss Roll

a) Select 3 ingredients used
b) Describe at least one functional property of each ingredient
c) Explain how the functional property will affect the finished product

Eggs can be used in a variety of ways

Design a poster which would highlight their versatility in food production

Produce a flow diagram to show the process of gelatinisation of starch granules.