Zig Zag Education

Food and Nutrition GCSE (9–1) | Eduqas | C560

endorsed for eduqas

Course Companion

for Eduqas GCSE Food Preparation and Nutrition: The Science of Food: The Effect of Cooking on Food and Food Provenance

zigzageducation.co.uk POD 8252

Contents

Teacher's Introduction

This resource is designed to meet The Science of Food (Area 4) element of the Eduqas GCSE Food Preparation and Nutrition qualification.

What it covers
The resource comprises two chapters covering the following:

Chapter 1: The effect of cooking on food	Chapter 2: Food spoilage
• Why and how food is cooked • The positive use of microorganisms in food production • The working characteristics, and functional and chemical properties of cooking ingredients	• Food safety principles • Bacterial contamination and how to prevent it • Food wastage

How to use this resource
The resource covers all aspects of The Science of Food and is designed to increase knowledge of the topic and enable learners to test their understanding and skills through a variety of assessment methods.

Learning Outcomes enable the learner to clearly see what they are expected to know at the end of each chapter.

The **Overview** provides a brief summary of what will be covered in the chapter and the **Key Terms** box provides information on key terms within the resource (key terms are emboldened within the chapter text).

Did you know?	These boxes contain handy tips.
Things to think about	These boxes provide learners with a chance to develop cognitive skills, do some research (books, Internet, people) and take part in a discussion.
Apply	These boxes provide the learner with the opportunity to further their skills, either through cognitive or practical application.
Qs	Learners' knowledge and understanding is tested through quick Y/N questions.
Skills	Based on the suggested application of skills section of the Eduqas GCSE Food Preparation and Nutrition specification, these test learners' skills in food safety through practical application.
Study tip	Useful tips are given to help the learner concentrate on important aspects that may appear in the final assessment.
Check your understanding	Multiple-choice, short-answer and extended-answer questions appear at the end of each section to test knowledge and develop understanding.
Quiz-ine	There is a crossword-style quiz at the end of each chapter to test learners' understanding of key terms used within the resource. The shaded squares spell out a word associated with the chapter text.
Answers	Answers to questions are provided at the end of the resource.

M Golebiowska, March 2018

Chapter 1: The effect of cookin

Overview

In this chapter you will learn why we cook food, how heat is transferred to food and how the cooking method can affect the nutritional value and palatability of the dish. You will also discover why and how various ingredients are used in cooking. In this chapter you will also learn how food is made with the use of microorganisms.

Learning Outcomes

After studying this chapter you should be able to do the following:

- ❑ identify the main reasons behind cooking food
- ❑ identify foods that cannot be eaten raw and reasons for tha
- ❑ learn how cooking affects foods' features such as appearan
- ❑ learn how preparation affects foods' features and nutritiona
- ❑ define what conduction, convection and radiation are
- ❑ know how conduction, convecti[illegible]d radiation work and w
- ❑ indicate the main pr[illegible] take place while cooking d
- ❑ identify [illegible] are produced with the use of microorga
- ❑ unde[illegible] the functional and chemical properties of cookin
- ❑ explain why certain chemical reactions take place
- ❑ indicate how to prevent or trigger certain reactions
- ❑ identify the main reasons why particular results may not be remedy the situations in such cases

Key Terms

Aeration	The process of incorporating air between fat partic a food mass lighter
Conduction	The process of exchanging heat between two obje temperature, without the use of any means such a (thus, the objects must touch each other); this is th
Convection	A process of exchanging heat between two objects air; this is an indirect way of transferring heat
Dextrinisation	The process of breaking down long starch chains in
Radiation	A process in which a wave of heat is sent without t other; this is an indirect way of transferring heat
Emulsification	The process of combining water and oil together to
Enzymatic browning	The process of enzymatic breakdown due to plant leakage of enzymes
Foam formation	The process of trapping air bubbles between prote a mixture lighter and more susceptible to growth
Food safety	All conditions and actions taken to make food safe
Gelatinisation	The process of breaking [illegible]e chemical bonds presence of wat[illegible]r [illegible]nd [illegible]at
Gluten formation	The [illegible] creating a strong, elastic, netlike str [illegible]ater
Infrared	Type of invisible radiation emitted by all living orga
Microwa	Type of electromagnetic waves with frequencies o 300 GHz, used, for example, in microwave ovens
Oxidation	The process of substances (such as vitamins) decomp
Plasticity	Elasticity; ability to easily change shape or physica
Protein coagulation	The process of changing proteins from liquid to ge
Protein denaturation	The process of damaging proteins' chemical struct
Shortening	The process in which fat particles surround flour p formation impossible

Knowing how various cooking ingredients react to different preparation and coo
obtaining a healthy, tasty and appetising dish. The temperature and time of coo
selecting the correct cooking method.

The reasons why food is cooked

Food is cooked not just to taste nice, but to make it safe, change the textures, to
provide variety in our diets. Let's explore in a bit more depth some of these reas

To make food safe to eat

One of the greatest advantages of cooking is that it makes our food **safe to eat** b
harmful substances.

S. ...e. is a species of bacteria known to cause food po
...fection include stomach ache, nausea, vomiting, diarrhoe
commonly in eggs, poultry, meat and milk, and in products
creams. For this reason, it is not advisable to eat these pro
Also, it is better not to freeze the food again once it has be
defrosted, because it allows bacteria to grow.

Study tip

Cooking is a way to ensure **food safety**.

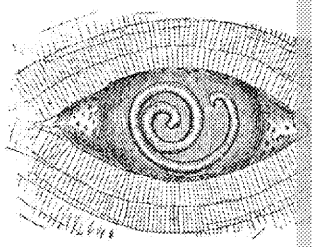
Other bacteria found in food include *Escheri*
(which usually live in our bowels but are poi
when in food), *Shigella* (which causes dysen
Yersinia enterocolitica (which causes sympto
to *Salmonella*).

One of the most dangerous bacteria found in food is *Clostridium botulinum*, whic
a toxin that paralyses the nerves and may lead to death (if it paralyses the interc
muscles responsible for breathing). Happily, there is a visible sign of its presence
the lid of a tuna or meat preserve can is bulging, you definitely should not eat its

Most bacteria are killed at temperatures over 65 °C. Cooking food at temperatu
appropriate time ensures that all the bacteria and spores are neutralised.

Other poisonous agents in food include toxins, pesticides, enzymes, mycotoxins a

- Solanine is a green-coloured toxin present in badly-stored potatoes (it is pro
when they are exposed to sunlight), green tomatoes and other foods. Eatin
them raw may cause stomach ache, diarrhoea or fever, so it is best to cook
thoroughly to avoid such troubles.
- Aflatoxin is a harmful substance produced by mo...s. It is often found in pe
grains and other products which ...e ...d in improper conditions. They a
very toxic and can lead to ...r
inflammation, g... ...ations and
cance...



Trichinella spiralis *is a parasite living*
cells which causes trichinosis if eaten
infection include very high fever, shive
pains. To prevent that, all meat is ca
before it can find its way to shops

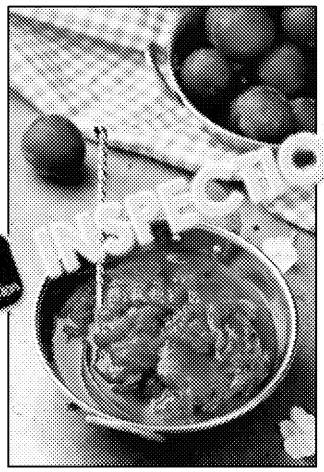
Did you know?

Wild boars are carriers of the *Trichinella spiralis* parasite and, therefore, their meat cannot be eaten raw!

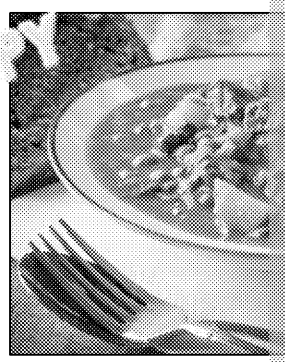
To develop taste and aroma

Cooking allows development of flavours in a number of ways:

- It evaporates water and therefore makes the flavour of its residue more pro
- It causes sugars to caramelise, which is especially advantageous in such pro and even certain vegetables, such as onion or carrot.
- During cooking, aromatic molecules evaporate and make the smell more int compounds present in foods are called essential oils (present in large amou mint).
- It allows combination of different ingredients, which leads to developing ne



This plum chutney uses both caramelisation and water evaporation to obtain its strong flavour.



Traditional Irish stew is c which allows the j characteristic texture

Cooking allows us to create the pronounced flavour of stews, jams, sauces or chu breaking down the structure of cells and freeing the aromatic chemical compoun ingredients is also helpful in developing the desired flavour and smells, e.g. by ad

To improve texture and aid digestion

You have probably noticed that cooked meat is not only easier to cut, but also to bite and chew. This is because cooking softens and loosens muscle fibres, which makes the meat softer. Also, during cooking, fat melts and penetrates the meat, making it juicy. This is not only important for your taste buds, but also makes it much easier to eat for those who cannot bite or chew, or who experience various digestive issues: babies, the elderly, and people suffering from Crohn's disease or irritable bowel syndrome (IBS), etc.

Cooking (especially frying, grilling and baking) also makes ain foods crunchy/crispy – which is more desirable by some s includes meat, bread and pastries, and chips and crisps.

During cooking, some fo s change their physical state – from liquid to solid (or the othe ar). You can obtain the desired texture by simply adjusting c ime, e.g. four minutes for a soft-boiled egg and 10 minutes for a hard-boiled one, or 10 minutes for a thin sauce and 30 minutes for a thicker one.

Things to think about

Identify some foods which are difficult to digest and discuss how mc could aid digestion.

To improve shelf life

Applying high temperatures is a great way of preserving food. This is because m harmful microorganism species die at temperatures above 65 °C. For that reaso cooking kills most of the bacteria or mould normally present in food and prevents **spoilage**. This way, if correctly stored, food can last longer and maintain all of its nutritional values.

Things to think about

for discussion and th

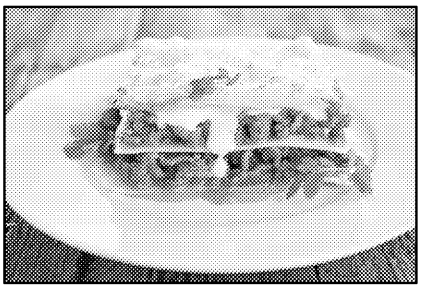
1. Discuss the 'use by' and/or 'best before' dates of various food items that are stored differently. For example, fresh fish, froze fish and tinned fish. Note down w[illegible] e food items are cooked or not and how thi[illegible] on the longevity of the f
2. Discuss wh[illegible] some cooked foods and raw foods have a 'use by' date [illegible] some have a 'best before' date.

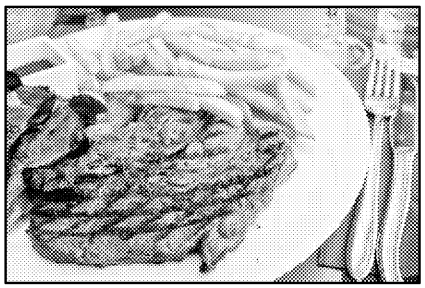
To give food variety

Cooking also allows us to have variety in our diets. This is because of two reason

- Different cooking techniques allow us to prepare the same product in a num fried.
- Different combinations of foods, seasoning, herbs and spices make it possib number of different dishes using the same main ingredient.

For example, beef can be used to prepare carpaccio, steaks, burgers, stews, soup as bolognese sauce), and so on.





Lasagne, steaks and burgers are examples of foods made with beef, but each has a unique f they are prepared and cooked, and through the combinations of other ingredie

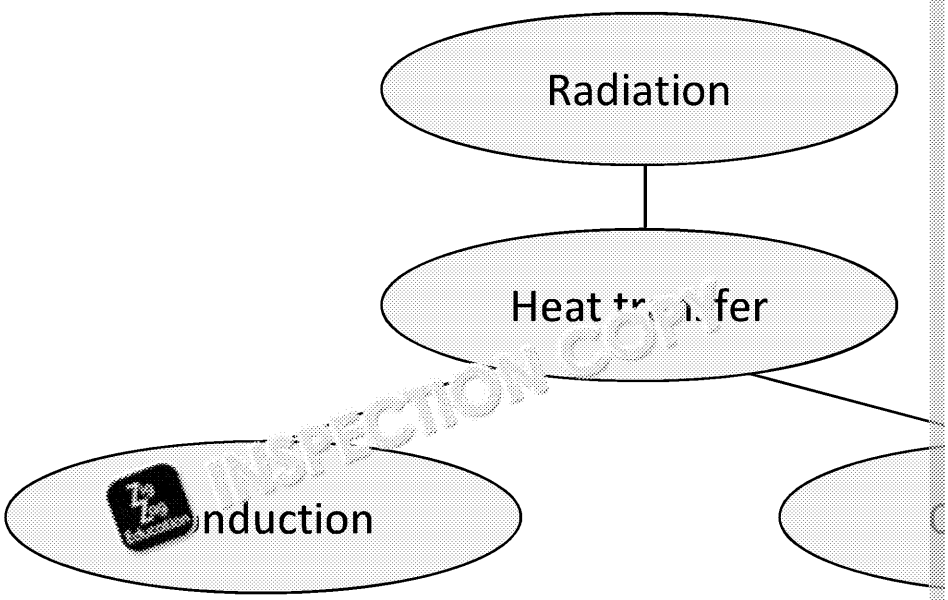
To improve the food's appearance

During cooking, various chemical reactions change th appearance of the food. For example, caram[illegible]sa[illegible]n and dextrinisation cause bread to form a [illegible]er crust, while fermentation causes it to ri[illegible]ea[illegible]on between proteins and sugars, call[illegible]d th[illegible]d reaction, is responsible for creating th[illegible]n colour of roasted meat, coffee or cocoa beans. The [illegible]on of bicarbonate of soda with water causes muffins to rise and obtain their sponge-like texture. Prolonged cooking can also affect the food's appearance in a negative way, e.g. red cabbage would become blue-green and mushy, while green beans would become dull grey.

During cooking, separate and e rise. At th caramelises the

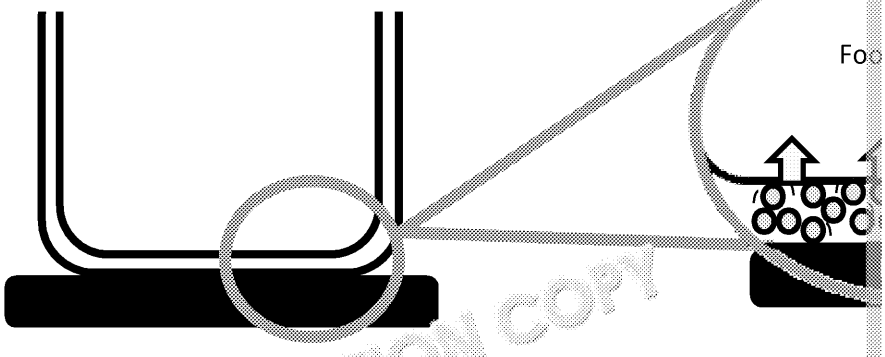
Different methods of heat transfer

There are three ways in which heat is transferred to food. These are conduction

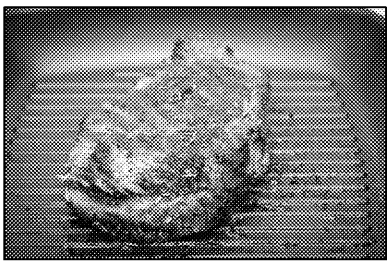


Conduction

The hotter the substance is, the faster its molecules move. That rule is applied in conduction cooking. Heat from the hob is transferred directly to the pan or pot you're cooking in. The molecules of the metal vibrate, and give their energy to surrounding molecules – in this case, molecules of food in the pan. The heat (energy) is transmitted directly, which means that the two objects (the pan and the food) have to touch each other.



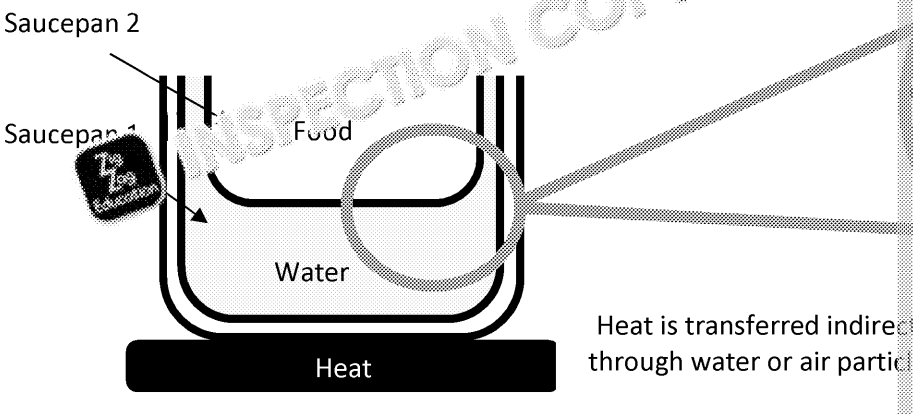
Heat causes metal particles in the saucepan and causes food molecules to kinetic energy and heats the food.



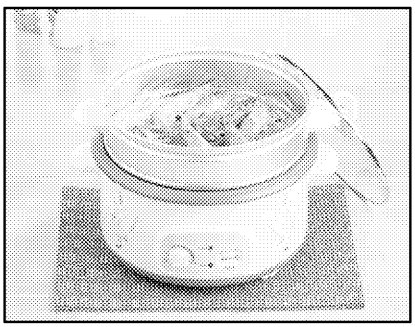
Simmering a stew, frying a steak or cooking a curry in a pan are using conduction

Convection

Convection is a way of transferring heat through migration of water or air particl
heated, water or air particles move up, and when chilled, they move down. Thes
convection currents, are used in cookers, during the baking, boiling, poaching an
transferred indirectly through the use of water or air.



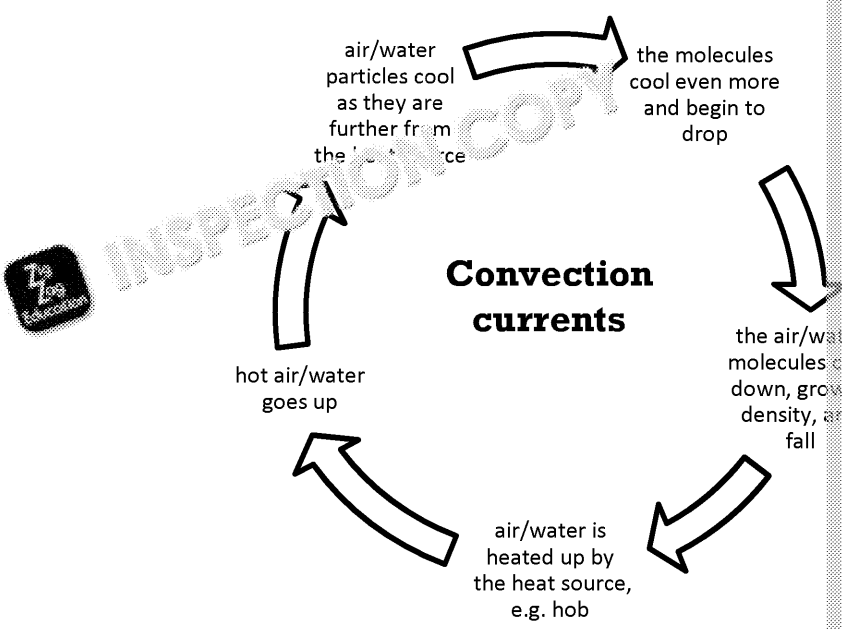
Heat is transferred indire
through water or air partic



Steaming is an example of convective heat transfer, through the use of vapour.

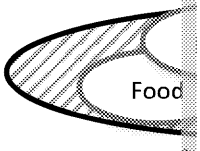
Apply

1) Prepare a chosen sauce
2) Explain how conductio
during the process.
3) Explain why it is necess
mixture.



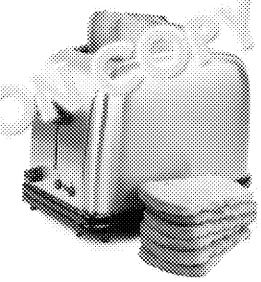
Radiation

Radiation is a technique that involves waves of heat being sent to the food – it m
the heater and the food do not need to touch each other.
Radiation involves two kinds of waves – infrared and microwaves.



Infrared is a kind of electromagnetic radiation, which involves the use of light waves which are invisible to the eye. In cooking, infrared radiation is used in stoves, ovens and grills, where heat goes from the source to the food.

Grilling/barbecuing is a classic way of using infrared for cooking as the matt black coal is effective in emitting infrared rays.



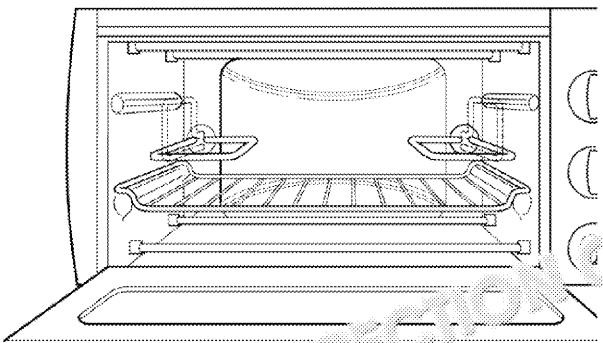
Infrared radiation is also used in toasters.

Apply

List co
use du
nutriti
radiati

Microwaves are also a kind of electromagnetic radiation, but they are longer tha
infrared waves. They are, most obviously, used in microwave ovens. The waves
are sent to the food and heat up particles of water, which (as you already know)
move faster and faster, transferring the heat to all other surrounding particles. A
the meal can be warmed up quite effectively, but the use of microwave ovens is l
which contain a high proportion of water.

It is also important to remember that microwaves can bounce back from shiny su
for example, aluminium foil or plates with metallic decoration into a microwave o



How a mi

1. Transformer chang
high-power electri
2. Magnetron create
3. Microwaves are se
an antenna.
4. Microwaves heat u
5. Water molecules v

Apply

1) Prepare a vegetable stew using the recipe at **zzed.uk/8252-vegetab**
2) Discuss what methods of heat transfer are used at each stage of prepa

Why are heat transfer methods combined?

Conduction, convection and radiation can often be combined when preparing a d
methods allows us to obtain the desired texture, flavour and appearance of the f
various methods of heat transfer when the dish we're preparing consists of many
pastry and filling, as each of them often needs to be cooked differently. The tabl

Cooking method	How it works
Baking, roasting	The heat from the heating element in the oven is transferred to the baking tin, which then transfers it to the food inside. The food warms up thanks to conduction and through convection as the hot air inside the o[illegible]irculates.
Boiling, simmering, stewing	The heat from the [illegible] is transferred from the pan to th[illegible], and as the water creates convection currents, it passes the heat through to the food.
Deep-fryin[illegible]allow-frying	The heat is transferred from the pan to the oil, which creates convection currents just as in water. That's why frying in oil uses both conduction and convection.
Grilling, barbequing	As the heat radiates from the heating element (e.g. coal), it heats up both the food and the grill/tin it is placed upon. As the grill/tin warms up, it begins to heat up the food through conduction – that's why grilled foods are 'striped'!

An example of how various methods of heat transfer are used when preparing a

Making spaghetti bolognese requires three steps:

1. Cooking pasta
   To cook the pasta, you need to boil the water first, and then add pasta. This process uses conduction (to transfer the heat from the saucepan to the water) and convection (to transfer the heat from the water to the pasta).

2. Making a sauce
   To make the sauce, you need to fry onion and meat first – this process uses c
   tomato sauce and simmer the sauce for a long time to reduce it – during tha
   as the sauce contains a high percentage of water.

3. Combining the sauce with pasta and addi[illegible]
   At the end you can decide to sp[illegible] dish with grated cheese. As you k
   when sprinkled on top of [illegible]ot d[illegible] – that's because it is heated by radiation
   the hot pasta a[illegible] mixture, not an oven or grill, though)!

Things to think about

Think of other dishes which use various methods of heat transfer. Exp
transfer happens.

Heat transfer summary:

Heat transfer method	Conditions
Conduction	The objects have to touch each other
Convection	The objects don't have to touch each other
Radiation	The objects do not touch each other but waves of heat are being sent

Apply

Identify the processes that take place when:

1) grilling tomato
2) baking pie
3) cooking a soup
4) roasting chicken
5) boiling potatoes
6) frying fish
7) preparing cottage pie
8) preparing a curry
9) cooking a béchamel sauce
10) poaching eggs

Got time? Give them a go at home or in your class.

Apply

Use a microwave and an oven to prepare frozen pizza. How long does it ta

How cooking affects food

Cooking affects food both externally (which makes it look different) and internally (which changes its features such as texture). Cooking also affects the nutritional value of foods. That's because certain micronutrients – such as group B vitamins, vitamin C and vitamin A – are very sensitive to temperature and break down during cooking.

Nutritional value

High temperature, pressure, time of cooking, fragmentation, contact with oxygen in the air – all these factors can affect nutritional value of foods. Most vitamins are damaged by high temperatures; for example, 50% of vitamin B6 and 70% of folate will be damaged during cooking. It is also important to remember that some vitamins are water-soluble. This means that they will dissolve in water during boiling and will be lost if the water is drained.

Appearanc

The look of i changes depending on the ingredients and cooking methods used. In meat, protein fibres will shrink and push out water (or jus), so the meat Denaturation and coagulation will cause eggs and pastry to set and become solid. Dough and cake will rise –due to either yeast or chemical leavening agents producing carbon dioxide. Rice, pasta and other starchy foods will absorb water and increase in size.

Colour

The colour of the food usually changes due to the Maillard reaction, caramelisation and dextrinisation, which cause the food to become golden or brown. Some vegetables, such as red cabbage or beetroot, will lose their purple colour and become blue or brown if cooked for too long – the colour may then be restored by adding an acid, such as vinegar. Green vegetables, such as spinach or broccoli, may lose their colour and become dull. To avoid this, they should be cooked for a short time only, and preferably in a lidded pan.

Texture

High temperatures cause food ingredients to change their chemical structure. A (meat, vegetables, fruit, rice or pasta), while others will become crispy and crunc Starch gelatinisation and water evaporation will cause sauces to thicken. Coagul proteins will cause eggs to set and change from liquid to solid. Dough and cakes due to carbon dioxide, air or steam action. Sugar will caram se and create a cru

Smell

The smell of hot foods is usually m n nced than that of cold foods. That compounds in foods are ev n and filling the air, which makes them easier especially wh k or simmering a stew.

Flavour

The flavour of food may change due to changes in chemical structure or due to t other flavourings. During cooking, starch will dextrinise, giving a slightly sweet ta leading to a deeper, buttery or nutty taste. A complex chemical reaction called t produce numerous chemical compounds which change the flavour of coffee or c

Palatability

Various chemical reactions which take place during cooking affect all food prope
food is pleasurable is called palatability. It could be described by such terms as '
'crispiness' and will usually make food appetising and desirable to the consumer.

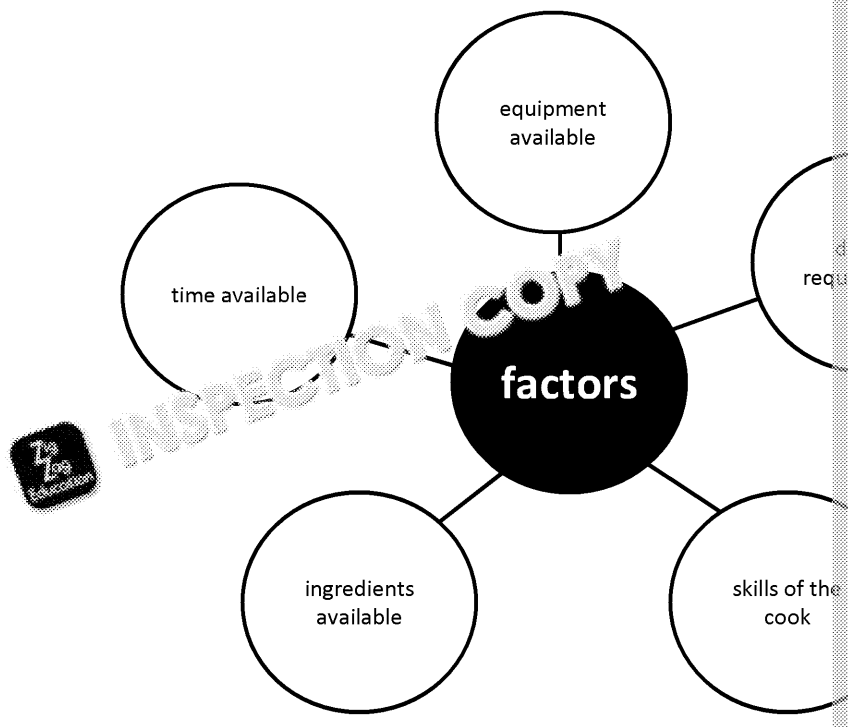
Raw oni... whi... ...opy.

During cooking, sugar in onion caramelises, which causes the onion to change colour and taste (fried onion is sweet). Some of the sulphur-based compounds present in the onion are br..., so the smell will be s...ee...er a...d more gentle. The ... also becomes softer – that's because some of the fibres in its cell walls are broken down. Cooked onion will have less vitamin C than raw onion.

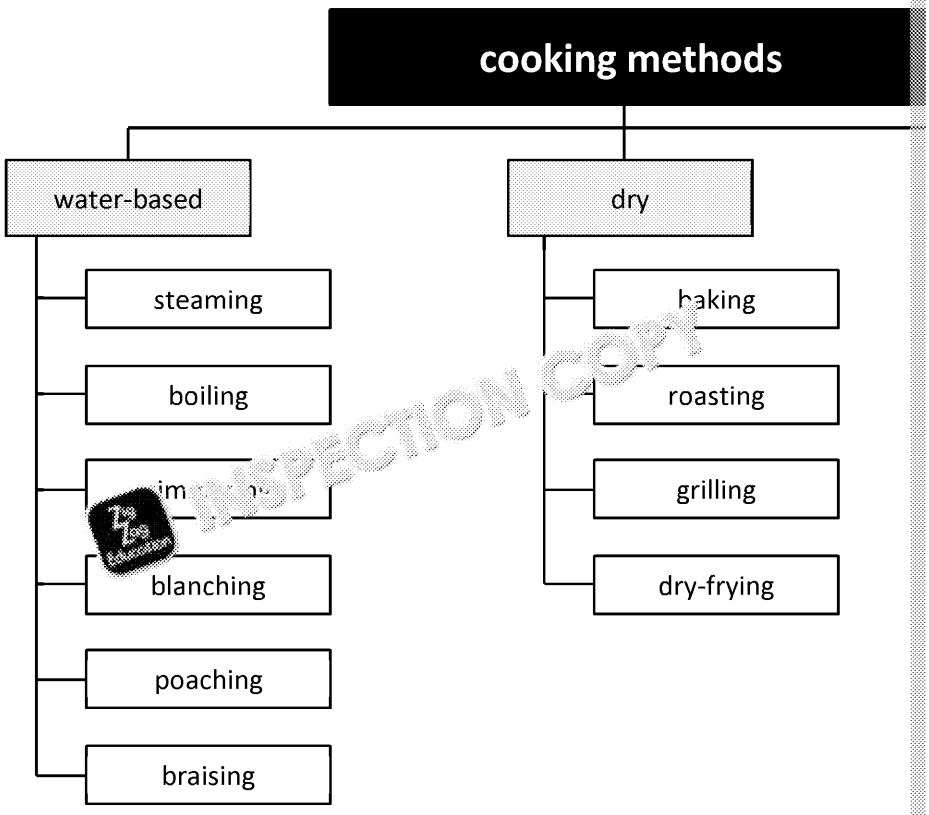
How cooking affect food

There is a wide selection of cooking methods, which involve water-based, fat-ba
choice depends on various factors, such as skills of the cook or requirements of t
person who doesn't own an oven will not be able to make a lasagne, and a perso
not be able to poach an egg. Likewise, it won't be possible to cook a three-cours
won't be possible to cook spaghetti without water (frying isn't a good example, a
is not recommended to offer triple-fried chips to someone suffering from cardio

Therefore, the choice of a cooking method depends on such factors as equipmen
the cook, time available for cooking, available ingredients and requirements of a
is for.



Different cooking methods are often combined to obtain the desired meal. Cool
based, dry and fat-based methods.



Water-based cooking methods

Water-based cooking methods use water and other liquids to transfer heat – eith
indirectly (as in steaming). Their use is beneficial for a number of reasons:

- The addition of fat is usually not required, making the dishes low in calories
- They help to soften proteins, which makes them more digestible.
- They are safe for fat-soluble vitamins as they will not dissolve in water or be
- They help to soften the starch and make it more digestible for people.
- The cooking time may be easily adjusted – it's enough to probe the cooked f
  it's done.

Steaming is a technique which requires the use of a steamer (or simply a strainer
steamer, a small amount of water is placed in the lower pan, and food is placed in
water evaporates and cooks the food above. This method is advantageous becau
vitamins do not dissolve in water because they have no contact with it). Foods co
nutritious and low-fat.

Boiling is one of the most popular cooking methods, in which food is cooked in a
heat. An example of this method is boiling potatoes, cabbage or eggs.
makes them easier to digest, although it also leads to loss of water-soluble vitam

Simmering is a technique in which food is cooked with a significant amount of liquid, but on a low heat and for a long time. An example of the use of this method is simmering a stew. The foods cooked this way will become soft and tender, but the long cooking time will decrease their nutritional value.

Poaching is a technique in which small amounts of water (or other liquid, such as wine or milk) and low heat are applied to food to prevent it breaking apart. It is used to cook delicate products such as eggs, poultry or fish, as it seals their surface and prevents them from falling apart. It is a good idea to save the liquid and use it to prepare a sauce to prevent vitamin loss

Braising is a cooking method which, technically, combines frying and simmering. the surface, and then simmered for a long time this way, the food remains juicy tender. The long time necessary and the high temperatures applied will, unfortu value of a food.

Apply

Boil, fry and roast potatoes. Measure the time they need to cook properly benefits of different cooking methods versus the time people may have to

Dry methods

Dry methods include those cooking techniques which do not require the use of w roasting, grilling and dry-frying. Since these methods produce high temperatures special probe to check the readiness of the cooked food (because the surface is u

Baking and roasting are techniques that require the use of an oven.

Baking is applied to foods that do not have a stable structure but will obtain it after processing. This includes such foods as muffins, sponge cake or fish pie. Before baking, it is advisable to line the baking tin with parchment paper or cover with fat/breadcrumbs, to prevent it from sticking to the pan or baking tray Baking helps to obtain soft foods with a crispy surface – such as the crust on top of bread. Sugar will caramelise at high temperatures and add flavour to the foods. Starch will break down and become more easily digestible, which may be important for people with digestive tract diseases.

Roasting is applied to foods that are already solid, such as turkey or parsnips. During roasting, it is advisable to sprinkle the surface of t[illegible]ast with fat or juice that's leaking out of it to create a crispy, shiny s[illegible]n. Roasting softens and te time required leads to the loss of heat-u[illegible] vitamins.

Grilling is a technique w[illegible] infrared waves to heat up the food. Grilling allo out, which [illegible] it [illegible] appropriate for some people, e.g. those on a low-fat di grill foods, [illegible] harmful, carcinogenic substances may be produced as a resu

Dry-frying is frying in a dry pan – without the use of fat. It usually requires the u (Teflon, stainless steel or ceramic). During dry-frying, fat will melt and leak out o more acceptable for people who cannot consume a lot of fat. The cooking time i the food is cooked the more vitamins will be lost due to the high temperatures a

All dry methods of cooking are recommended for health reasons to people who on fats.

Apply

Research (using books or the Internet) a recipe for a casserole or tagine a
of how to prepare. What cooking methods will you use?

Fat-based cooking methods

Fat-based cooking methods include shallow-frying, deep-frying and stir-frying. Frying usually produces high temperatures (around 200 °C and more) and, therefore, damages vitamins in foods. Depending on the quality and quantity of the fat used, fried foods are more or less appropriate for different people. For example, frying in general is inappropriate for an elderly person with hypertension but shouldn't be harmful for a healthy individual.

Fat-based cooking methods use different fats, such as vegetable oils, butter, lard margarines.

Shallow-frying requires only a small amount of fat. The fat in shallow-frying:

- seals the surface and closes juices inside the food (e.g. meat)
- creates a crispy skin/surface
- gives the food the desired taste
- prevents food sticking to the pan

Shallow-frying will damage some of vitamin C and vitamin B2 due to heat, but will add more fat-soluble vitamins to the food.

These de

Deep-frying uses large amounts of fat – this is often used to fry chips or breaded treats such as Scotch eggs. During deep-frying, the whole product is sunk in fat, allowing it to cook evenly. Unfortunately, during deep-frying a lot of fat is absorbed by the food, making it fatty and not suitable for many people. Also, the heat will lower the vitamin content in the food.

Study tip

Stir-frying, steaming, grilling, dry-frying and poaching are ways of conserving foods' nutritional value.

Stir-frying is a variation of shallow-frying, in w
constantly in the pan. The technique is speci
Chinese). The dish in which food is stir-fried i
method which takes a short time only, so the
nutritional value and colour.

Thing... think about

... the advantages and disadvantages of all of the cooking metho
methods and fat-based methods). Discuss how the use of each of the
health of an individual and how this can influence the food choices th
make.

Check your understandi
Why and how food is coo

1. Water is necessary for… *(1 mark)*

   a. baking ☐ b. boiling
   c. frying ☐ d. grilling

2. The flavour of food may be changed by… *(1 mark)*

   a. coagulation ☐ b. caramelisation
   c. dextrinisation ☐ d. both b and c

3. During cooking, pie fillings… *(1 mark)*

   a. increase in size and absorb water ☐ b. decrease its siz
   c. decrease its size and lose water ☐ d. decrease its siz

4. Sauces thicken during cooking because of… *(1 mark)*

   a. water evaporation and caramelisation ☐
   b. water absorption and caramelisation ☐
   c. water evaporation and starch gelatinisation ☐
   d. water absorption and starch gelatinisation ☐

5. State three reasons why food is cooked. (3 marks)

   1. .....
   2. .....
   3. .....

6. Explain the scientific changes that take place when baking a lasagne. (4

   .....
   .....
   .....
   .....
   .....
   .....
   .....
   .....

7. Identify two ways in which braising affects the nutritional value and/or

   1. .....
   2. .....

The positive use of microorganisms in fo

Bacteria, yeast and mould can all be used in the production of foods such as brea
bagels, pizza or calzone), soya products (tofu), cheese and yoghurt to name a few
that only selected species are used in food manufacturing – others may cause m
Microorganisms in food production are responsible for the distinctive flavour, ar
product, and help to improve its shelf life and nutritional value, as well as digesti

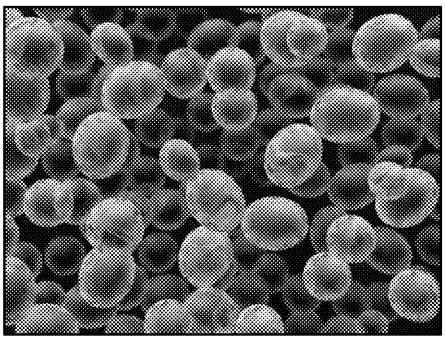
The role of yeast, mould and bacteria in food produ

Various microorganisms can be used in food production for different reasons. Fo
raising agent in baked goods and to ferment sugars int[illegible]ol in the productio
species of bacteria can be used in the manufactu[illegible]ng [illegible]airy products, but also i
pickles. Mould is used in the productio[illegible]n [illegible]y and meat products, and sauces
microorganisms are used in th[illegible]oduction of one product, as the combination a
effect.

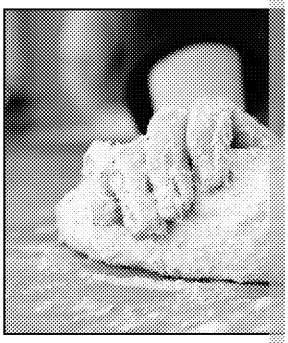
How is ye[illegible]ed in bread-making?

Yeast is a type of fungus used in bread-making to make bread dough rise. Yeast w
which, in turn, release carbon dioxide. It is the carbon dioxide that makes the do
in bread production is referred to as baker's yeast (or brewer's yeast in alcohol p
Saccharomyces cerevisiae. Yeast can be isolated from the skins of fruit. Yeast ca
for bread-making.

Baker's yeast breaks down sugars and releases carbon dioxide.



Carbon dioxide makes do bake



D

Blue m
on lem

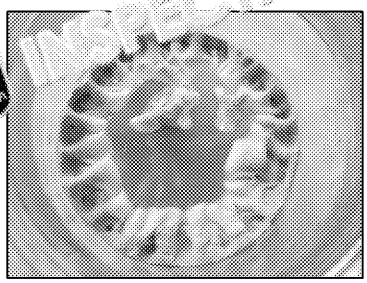
How is mould used in blue cheese?

A culture of the blue mould *Penicillium* is used to create the blue-veined appeara
Roquefort (from sheeps' milk), Gorgonzola and Stilton (from cows' milk). The mo
enhance flavour and produce a pungent taste and smell. It does this by breaking
proteins) within the cheese and releasing **enzymes**. This process also raises the p

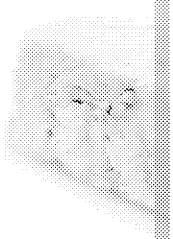
Mould requires oxygen for it to grow. Air holes within the cheese act as pockets
(sometimes bacterial cultures are added to create the holes).

The *Penicillium* mould culture is found naturally (blue mould grows on lemons) a
manufactured in laboratories. The *Penicillium* mould is non-toxic, unlike other m
can be safely used in food production without the risk of p ucing mycotoxins.
(from oxygen) once 'blueing' has occurred, the ch is rapped in foil and plac

The blue mould culture Peni
grown in a l

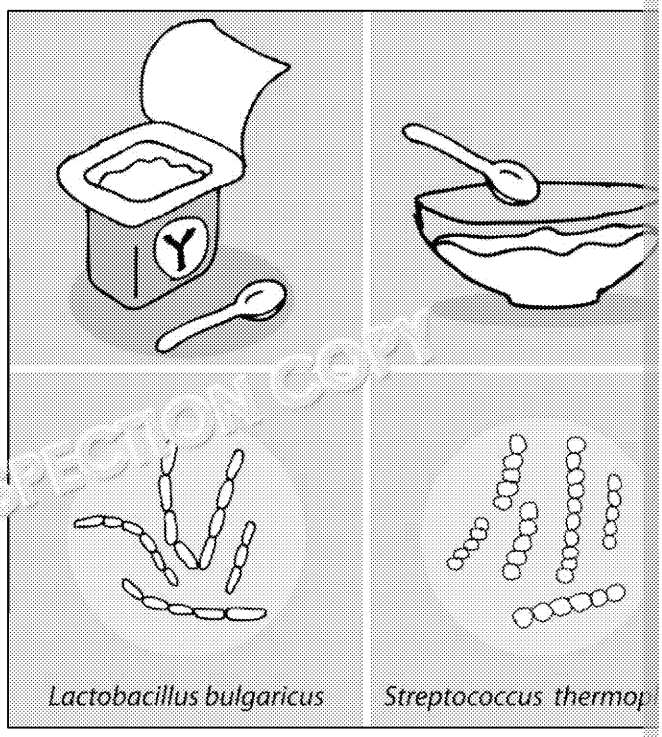


The mould is added t
it spreads vi



How is bacteria used in yogurt?

The bacteria used in yoghurt are *Streptococcus thermophilus* and *Lactobacillus b*
the sugars in the milk (called lactose) and create lactic acid. This lowers the **pH b**
acidic. This process makes milk curdle, thereby producing yogurt (a type of **ferm**
considered **'friendly' bacteria** as they aid digestion and help to improve gut flora
bacteria are referred to as 'probiotic'.



How microorganisms are used in production of meat products

Some fermented meat products such as Spanish chorizo, Italian salami or French s
of 'good' bacteria and mould. The bacteria are added to raw, minced meat, whe
chemical reactions. The different species and varieties of microorganism play dif
production:

- *Micrococcus* bacteria transform nitrate to nitrite – due to this, the meat ma
the sausage is safe to eat
- *Lactobacillus* bacteria lower the pH of the sausage, making its flavour slightl
(through denaturation of the protein in the meat) – the ready sausage is oft
- *Penicillium* moulds create a white coat on the surface, which is desirable in s

The 'good' bacteria and moulds also help to protect t[illegible]sa[illegible]e from the harmful varieties, increasing its shelf life.

The fermented meat is ther[illegible]d with salt and spices, put into natural or artificial casing[illegible]and [illegible]dry and mature. During the last step, some sausages c[illegible]be [illegible]noked (this is popular, e.g. for German and Hungarian fermented s[illegible]ges). The various preservation methods used during production of these meats means that they can be safely stored even outside the fridge.

Apply

Read the article at **zzed.uk/8252-sausages** and list all of the preservation me
of fermented sausages.

Explain why low temperatures have to be kept during production.

Champagne is made from fermented grapes. It is served in tall, thin glasses called 'flutes' so that the CO_2 bubbles don't escape too quickly!

Use of microorganisms in the drinks

When yeast ferments sugar, it produces not
very helpful in baking), but also ethanol. Th
7000 BC to produce wine from fruit, honey a
used in the production of alcoholic beverage
champagne. During production, the sugar-r
and pumped into large containers. There, s
added – they transform the sugar from fruit
and carbon dioxide. That's why most of the

Other foods made with the use of microorganisms

Fermentation has been used as a popular way of preserving foods around the wo
though people didn't understand the mechanisms behind it. Today we know tha
probiotic bacteria, mould and yeast. The products made with them usually have
and texture. These products include the following:

- Soy sauce, Worcestershire sauce, fish sauce, Tabasco
- Pickles (e.g. pickled gherkins)
- Sauerkraut and kimchi (Asian-style sauerkraut)
- Milk beverages, e.g. kefir, ayran, *Actimel®*, *Yakult® and* kombucha (beverage
bacteria, drunk instead of fizzy drinks)
- Tempeh and miso paste (made of fermented soybeans)
- Cocoa beans (yes – they also undergo fermentation before being turned into
- Pu-erh tea
- Olives
- Fish preserves, e.g. anchovies in the Mediterranean region, surströmming in

Yakult is made with the use of specially selected bacteria species.

*Soy sauce is made f
fermented with mo*

Skills

1. Demonstrate the effect of yeast in making bread rise.
2. Make a bread dough, and finish and shape it for use in pizza, breads, etc.

Things to think about

Think of other foods that go through a fermentation process.

Check your understanding: the po microorganisms in food proc

1. Which of the following mould cultures is used in blue cheesemaking? (
   a. Mycotoxins ☐ b. *Penicillium* ☐ c. Spores

2. What is the name for sugars in milk on which bacteria feed? *(1 mark)*
   a. Fructose ☐ b. Lactose ☐ c. Sucrose ☐

3. Lactic acid causes which type of pr... in order to create yoghurt? (
   a. Boiling ☐ b. ... ☐ c. Whipping ☐

4. St... w... ...ns of bacteria in cheesemaking. *(2 marks)*
   1. .....
   2. .....

5. Discuss how the processing of salami helps to make it microbiological...
   .....
   .....
   .....
   .....
   .....

The working characteristics, and function
properties of cooking ingredi

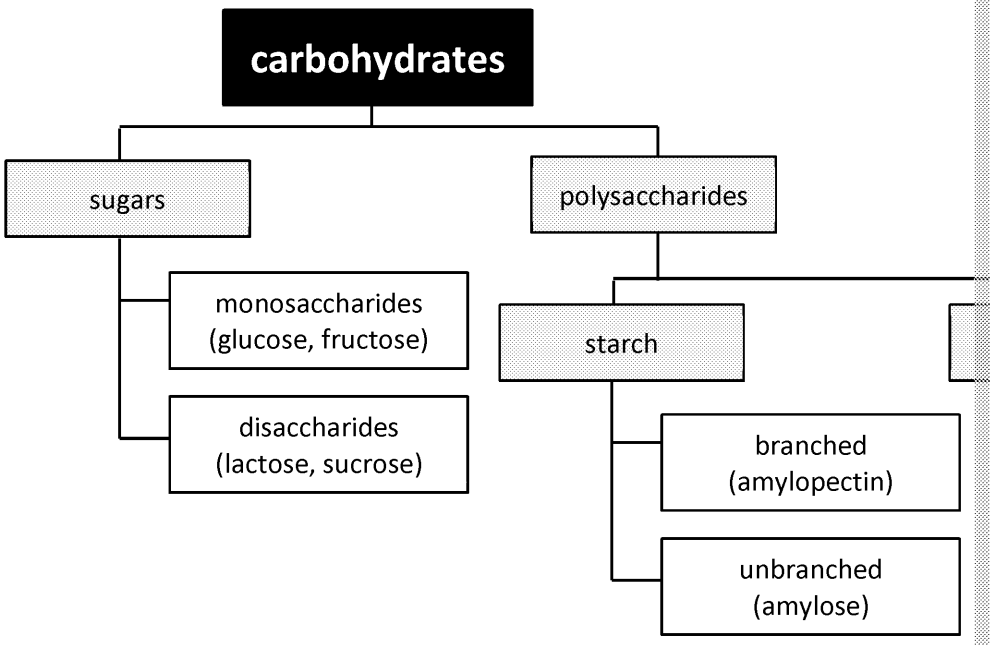
Cooking is mostly based on the sciences of chemistry and physics. Knowing the c
ingredients is very important, as it helps to understand why and how an ingredie
its functions are, and how to adjust the proportions, cooking methods and time, e
assessing why a particular effect has not been obtained – and how to prevent th

The working characteristics, and fu[illegible]onal and ch
carbohydrates

Carbohydrates include sugars, st[illegible] dietary fibre. They are present in ma
vegetables and fruit to p[illegible] carbohydrates are the main source of energy
necessary to [illegible]nds and conduct all live processes in every living cell.

The chem[illegible] structure of carbohydrates

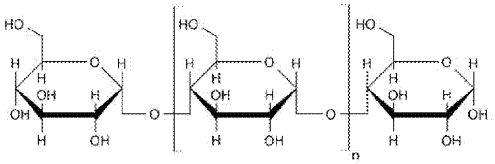
Carbohydrates are all structured differently and can be split into the following gr



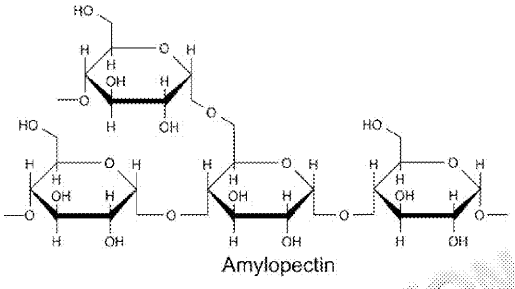
Sugars include monosaccharides (single molecules) and disaccharides (built of tw
They are found in table sugar, honey, syrups, etc. They di[illegible]e easily in water.

Starches and fibre are long chains of mo[illegible]ha[illegible]es bound together.

Starch is the main compo[illegible]. It is built from many
monosaccha[illegible] b[illegible]gether into long chains, which can be either
branched o[illegible]nched (this may be important when dissolving starch –
the branche[illegible]e should dissolve more easily). Starch doesn't dissolve in
cold water, but instead forms a suspension. A suspension is a mixture of
starch particles floating in water, and eventually, forming a residue at the
bottom of the vessel (dish, glass). During cooking, starch can either
gelatinise or **dextrinise**.



Amylose



Amylopectin

Amylose is an example of an unbranched starch, while amylopectin is branched. The starch is built from thousands of glucose molecules.

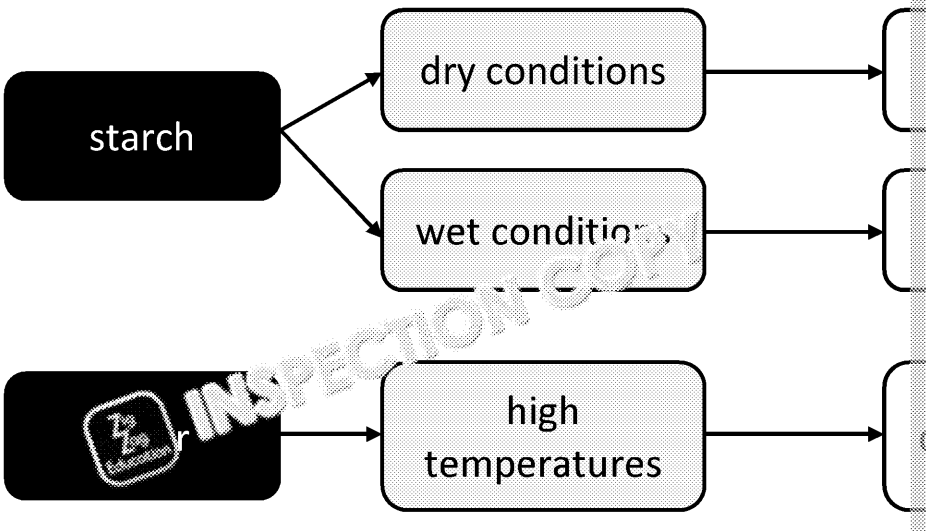
Dietary fibre is built of tho
bound together into long
walls, although it is availab
usually indigestible for hu
benefits. Soluble fibre abs
creates a jelly-like substan
a gel. Insoluble fibre will b
cooking, which causes pla

The table below shows wh
cooking. Can you think of

	Function in cooking	Example
Sugar	Sweetening	Cakes, creams, beverages
	Bulking agent	Cakes, e.g. sponge
	Aeration	Creams, e.g. buttercream
	Improving flavour	Sauces, e.g. tomato sauce
	Preserving food	Jams
	Improving texture	Cakes, e.g. sponge cake, meringue
	Enhancing fermentation	Baked goods which use yeast, e.g. brea
	Improving colour	Cakes, bread and meat (due to dextrini Maillard reaction)
Flour	Bulking agent	Baked goods, e.g. cakes, bread
	Improving texture	Goods that are high in gluten, e.g. brea
	Thickening agent	Sauces, e.g. custard, white sauce
	Improving nutritional value	Goods made with wholemeal flour, e.g

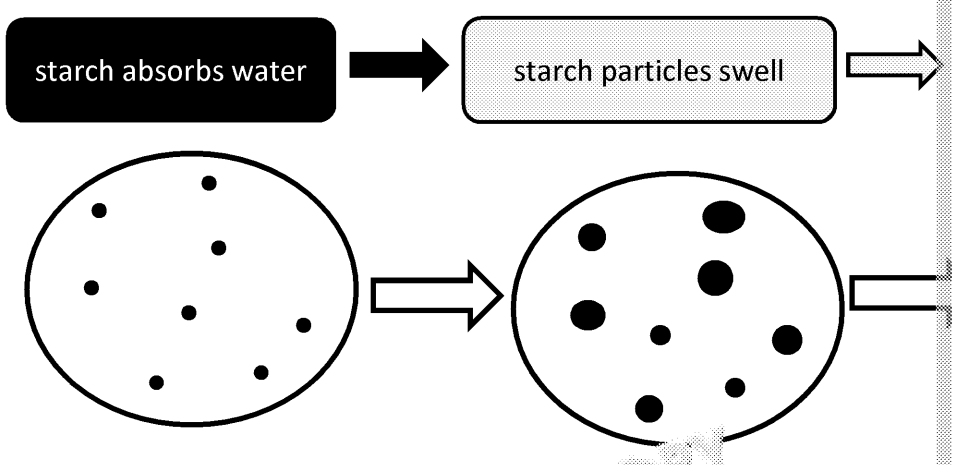
Preparing and cooking with carbohydrates

Food preparation and cooking involve many varied techniques which differently a
and the chemicals it's made of. Various cooking times, temperatures and the pre
will cause visibly different effects on carbohydrate-rich food products.



Gelatinisation of starch

Starch particles do not dissolve in water. Instead, they absorb it and swell, turni
process happens when the mixture of water and starch is heated and is called ge
cooking since it helps thicken sauces and other mixtures, such as puddings. The
constantly to prevent the formation of lumps. In cold water, starch granules will
then fall to the bottom of the vessel.



Starch granules in cold water

ch granules absorb water when heated.

Apply

1) Prepare three samples of béchamel sauce: use plain flour for sample 1
and again plain flour for sample 3 but do not stir the mixture. What d
2) Explain how convection and conduction are applied during sauce-mak

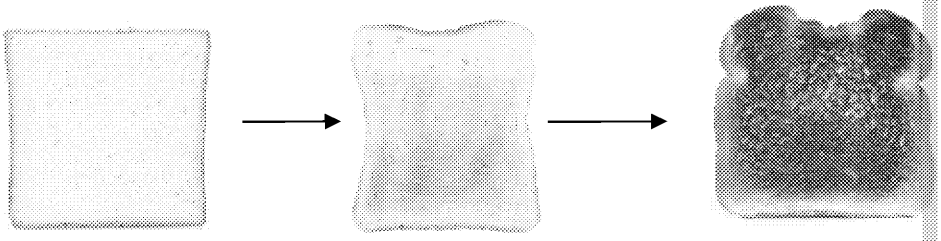
Dextrinisation of starch

Shorter chains of polysaccharides are also called dextrin. When polysaccharides, conditions, their long chains break down into shorter ones – this is called dextrin while baking bread (and other starchy foods) and is responsible for the sweet-ish crispiness of the crust.

Apply

Place a piece of br chew for 60 secon changes from savo long chains of poly down by the enzy sweet short chains molecules of suga when bread is bei enzymes, but heat

While makin ux for a sauce, flour dextrinises. Different stages of dextrinisatio lead to a final variation of colour and taste.



Fresh bread has long chains of polysaccharides.

Lightly toasted bread will have some of the polysaccharides broken down into dextrins, so its colour and flavour will change.

Too long a time and high a temperature toasting will cause t bread to burn. Th starch in it will be dextrinised, but evaporation of wat will cause it to tast bitter.

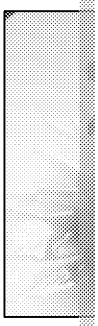
Apply

Toast bread on different settings in a toaster (1, 2, 3, 4 nd 5) or for differe (e.g. 2, 5, 10, 15 and 20 minutes). Compare th o r c the bread slices. N both the appearance and the taste of t br d

Additional reading: caramelisation of sugars

Sugars include molecules of monosaccharides and disaccharides. At high temperatures, sugar crystals break and melt into syrup, and change colour from light yellow through golden to brown. This is because oxygen and hydrogen are being evaporated and only black molecules of carbon are being left. Depending on the temperature and time of cooking, all foods containing sugars will caramelise.

Caramelisation is used in cooking to either change the flavour or affect the colour of the food to make it more appealing. This process is used when making fudge or burning the surface of *crème brûlée* to create the golden, crunchy top. Caramel is also used in manufacturing cola-like beverages and is responsible for their dark brown colour.



Caramel sweet to s

Apply

1) In groups, prepare roasted carrots and onions.
   - Group A: roast for 30 minutes at 200 °C
   - Group B: roast for 30 minutes at 160 °C
   - Group C: roast for 60 minutes at 160 °C
   - Group D: roast for 60 minutes at 100 °C

2) Make notes on how cooking time and temperature affect the colour and

Did you know?

The Maillard reaction takes place when proteins and carbohydrates are cooked by dry methods. Amino acids from proteins and sugar from carbohydrates react with each other, which results in the creation of so-called Amadori compounds. These agents change the smell, flavour and colour of the food (it becomes brown). The Maillard reaction is used to obtain the desired smell and flavour of bread and pastry, beer and coffee beans.

Check your understanding: carb

1. Tick the box next to each statement to show whether it is true or fal

a)	sugar helps to extend the shelf life of foods	
b)	the main function of carbohydrates is to sweeten food	
c)	flour can be used as a gelling agent	

2. Dextrinisation ta[illegible] when… (*1 mark*)

a. [illegible] a tomato sauce ☐ b. making a roux
c. [illegible]ling jelly ☐ d. boiling pasta

3. The process of absorbing water and thickening mixtures with the use

a. dextrinisation ☐ b. caramelisation
c. gelatinisation ☐ d. gelation

4. During cooking, pasta… *(1 mark)*

a. will push out water and dextrinise ☐ b. will swell and
c. will absorb water and dextrinise ☐ d. will absorb wa

5. Describe the function of starch when making sauces and explain how
product. (*4 marks*)

.....

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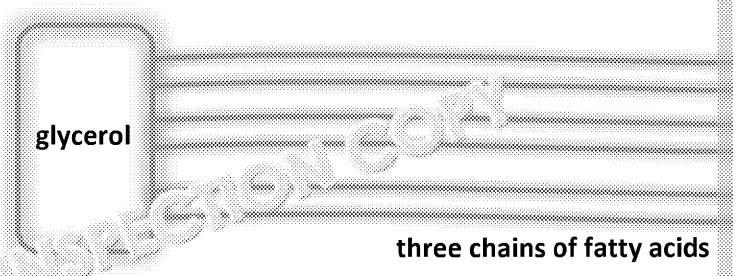
The working characteristics, and functional and ch
fats and oils

Fats and oils are built of a glycerol 'head' to which three chains of fatty acids are
in the fatty acids are bound together by either single or double bonds. This dete
liquid at room temperature – generally, saturated fats (which have only single bo
temperature and unsaturated fats (in which double bonds are present) are liquid
The chemical structure of a fat or an oil is important because it determines its co
and, therefore, usage in cooking.



The table be ows why we need fats and oils in cooking. Can you think of ar

	Function in cooking	
Fats and oils	Improve the texture	Butter in buttercrea
	Serve as shortening	Biscuits, pie crust, p
	Extend the shelf life	Baked goods, e.g. b
	Improve the flavour	Cream in soup, butt
	Help to obtain a crispy surface	In fried foods, e.g. b
	Add flaky texture	Flaky pastry
	Emulsify mixtures	Sauces, e.g. mayon
	Add colour	e.g. butter in shortb
	Improve nutritional value	e.g. olive oil in salad
	Carry and improve absorption of fat-soluble vitamins	e.g. dressing in sala

Preparing food and cooking with fats and oils

The structure of fats has an important role when choosing cooking ingredients. S
preparing shortcrust pastry, while oils will be better for frying or preparing a dre
fat will help to obtain the desired effect.

Plasticity

The plasticity of fats means their ability to b sl d and to melt at different temperatures (they have differen nts). A good example is butter and lard. They are solid while i idge, become soft and greasy at room temperature m il during cooking.

There are ce ypes of margarine which are spreadable at low temperatures you can say that they have good plasticity.

Shortening

When mixed with starch (such as flour), fats create a layer around starch particles therefore, prevent gluten from forming long chains. This is called **shortening** and obtain crunchy, crumbly textures, as in biscuits. It is noticeable that only solid fa shorten the mixture – oils will rather turn it into a lump. For this reason, it is best cold butter/lard and cold water, and then let the pastry rest in a fridge to obtain melt-in-the-mouth pastry.

Apply

Prepare two shortbread doughs, one using butter and the other using half bu
and half oil. Bake the biscuits and describe the difference in texture and taste

Aeration

Similar to foam formation, aeration is the trapping of air bubbles in the fat mixtu
leads to the creation of creams, which can be observed when whisking butter wi
or when whipping cream. Aeration is also used to obtain the cloud-like texture o
creams.

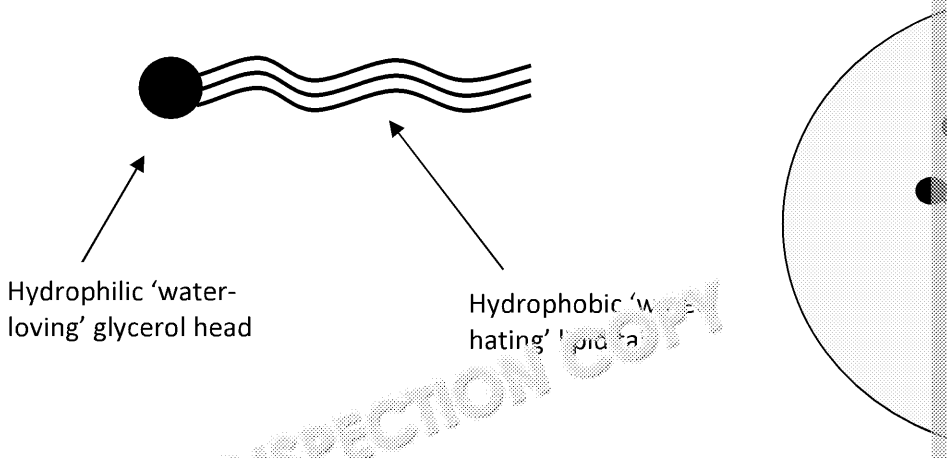
Apply

1) Pour three different kinds of crea i to h ee separate bowls: single cr
double cream.
2) In groups, whisk e ea n to measure the time needed and observe t
3) Compare h h at each of the creams contains and how this affec
t e volume.

Emulsification

An emulsion is a mixture of oil and water. Depending on the proportions of ingr
we can distinguish water-in-oil emulsions and oil-in-water emulsions. An examp
in-water emulsion is milk: usually, fat molecules are spread evenly in the liquid, b
boiled, they will form a layer on top. An example of a water-in-oil emulsion is bu
how it 'sweats' when taken out of the fridge).

Since fat is hydrophobic, the particles of fat and water will repel each other, lead
separation of the emulsion into layers. To prevent this and to make the mixture
emulsifiers are used. One of the most popular emulsifiers is lecithin, present in e
Emulsions are used not only in cooking, but also in the cosmetic industry.



When put i , fat particles will turn their hydrophilic heads towards it, crea

Emulsifiers will attach to oil droplets, keeping them dispersed and making the mi

Did you know?

Mayonnaise is also an emulsion, made of vegetable oil, egg yolk, vinegar and fl

- liquid phase – vinegar (sometimes milk is also used)
- oil phase – vegetable oil, such as sunflower oil; various types of mayonna other kinds of oil, such as olive oil, to improve their nutritional value
- emulsifier – egg yolk; it is a natural source of lecithin, which will suspend the mixture and prevent layering

Large factories may also use homogenisers – special machines which pump th and make oil droplets smaller, making it easier to sus n the mixture.

Research

Read t l c ayonnaise jar/bottle and try to define whether it's an oi water-i ulsion. Justify your answer.

Research

Check what substances are used as emulsifiers in foods on **https://www.faia.org.uk/emulsifiers-in-food/**

Check your understanding: fat

1. Shortening means that… *(1 mark)*

   a. fatty acids become shorter ☐ b. gluten fibres b
   c. sugar chains become shorter ☐ d. carbohydrate c

2. Plasticity means that… *(1 mark)*

   a. fat is solid at room temperature
   b. fat is liquid at room temperature
   c. fat is easily spreadable at room temperatu
   d. different fats melt at the same tem er tu

3. Which statements abo RUE? *(1 mark)*
   a. fats dissol
   b. s r create emulsions
   c. with acid create emulsions
   d. fats have the same melting temperature

4. Identify two changes to the fat during the production of a sponge cake

   1. .....

   2 . .....

5. Describe how the chemical structure of fats affects their physical state examples in your answer. (*2 marks*)

   .....

   .....

6. Explain why emulsifiers must be used during the production of mayon

   .....

   .....

7. Explain the chemical changes that help to obtain a shortcrust pastry. (

   .....

   .....

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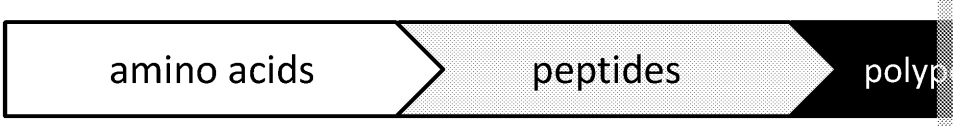
The working characteristics, and functional and ch
proteins

There is a wide variety of food products that are rich in protein. And although th
protein in the diet, they also play a crucial role in creating the desired texture, fla
dish. One of the most versatile protein-rich ingredients is egg. Due to its chemic
various dishes, and for different reasons. Other protein-rich staples include milk
functions of each of these products in cooking are described in the table below.

	Function	
Eggs	Binding agent / improve the texture	Cakes, muffins,
	Coating (adds shine and lengthens shelf life)	Bread rolls
	Leavening agent	Cakes, soufflés
	Thickening agent	Sauces, e.g. cus
	Stabiliser and emulsifier	Sauces, e.g. ma
	Improve the moisture	Cakes, muffins
	Improve the nutritional value (by adding protein, vitamins, minerals, and omega-3 fatty acids)	Sweet and savo
	Improve the appearance (used as a garnish)	Garnish in sala
Milk	Binding agent	Muffins, panca
	Improves the texture	Yorkshire pudd
Cheese	Improves the flavour	Sauces, e.g. ca
	Adds colour	Sauces, fillings,
	Adds texture	e.g. on pizza or
Yoghurt and buttermilk	Improve the texture (used as a marinade)	Meat, fish
	Improve the nutritional value (lowers fat content)	Salads, soups, s
	Thickening agent (add creamy texture)	In soups and sa
Cream	Thickening agent	In soups and sa
	Improves the appearance (often used instead of garnish)	In salads and so
	Improves the texture	In creams, and

The chemical structure of proteins

Proteins are large biomolecules built of hundreds of amino acids. Amino acids bo
of peptides, and peptides bond together to form longer chains of polypeptides (p



Proteins can adopt different spatial structures, usually to save room and fit more into a cell. Amino acids may react with each other, creating new chemical bonds.

1. **Primary structure** – when the protein has the form of a simple chain of amino acids bound together.

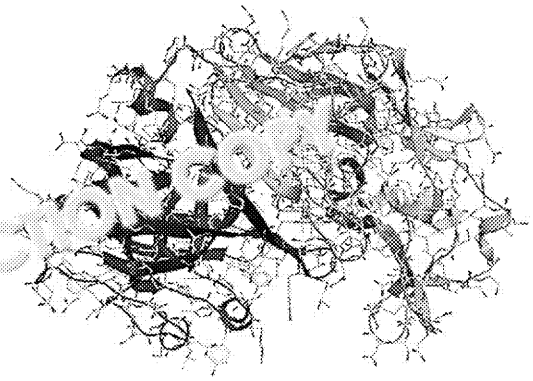
2. **Secondary structure** – when the chain starts to form a spiral (helix) or harmonica (sheet); here, the amino acids come closer together, creating hydrogen bonds between them, which gives them one of these two shapes (shown right).

3. **Tertiary structure** – when the spiral/harmonica clumps more tightly to form a ball or other 3D shape (usually to save room). In the tertiary structure the protein is still built from one chain of amino acids, which now form three different types of chemical bond (peptide bonds, hydrogen bonds and disulphide bridges).

4. **Quaternary structure** – when different chains of proteins form a 'lump' made of different tertiary-structured proteins, to form a fully functioning biological unit such as an enzyme or hormone.

Now you have a better understanding of how proteins are structured, we can begin to look at how different methods of preparation and cooking can change the structure and chemical properties of a protein.

In the quaternary structure, different chains of proteins join together to form a functioning unit, such as an enzyme.



Preparing food and cooking with proteins

Protein denaturation

Denaturation is a process in which chemical bonds in the proteins are broken, da
happens in certain conditions:

1. when heat is applied to a protein, e.g. when baking a soufflé or boiling an eg
2. when acid is applied to a protein, e.g. when lemon juice is added to meringu
3. due to mechanical actions, such as whisking egg white (see foam formation)

Different proteins denature at different temperatures. For most of the proteins i
denaturation is around 65 °C and more. This is why eggs set, meats and fish beco
spongy when cooked.

Acid is also capable of damaging bonds in protein. This is used when adding lem
foam from collapsing (e.g. whipped egg white or meringue) or when marinating

Foam formation

Mechanical actions, such as whisking, also lead to the damage of protein structu
be partially denatured – you can notice how whipped egg white will turn into liqui
During whisking, protein molecules stretch and tiny air bubbles are forced into th
forming a foam. Foams are used to lighten the texture of food, to make it more p
during cooking. Foam formation is used to prepare sponge cakes, soufflés, ice cr
other foods.

Notice that if beaten for too long, the proteins will shrink and push out water – th

Apply

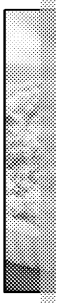
1) Prepare an egg white. Beat it to obtain a white foam.
2) Divide the foam into three bowls.
3) Add a teaspoon of lemon juice to the second bowl. Continue beating
4) Write down your observations.

Apply

1) Marinate a piece of pork and a piece of fish. Compare the structure of
marinated pieces.
2) Roast all of the products. Compare the structure. What do you notice
3) Learn at **zzed.uk/8252-marinades** how to ma various marinades

Coagulation

Coagulation is a process in which large particles of proteins agregate and form lumps. This is because they are being deprived of their electric charge. You can observe it by adding salt to an egg white. This process is usually reversible. Coagulation is used, for example, in salted fish – to undo it, you need to soak the fish in water in order to wash out the salt. Coagulation often takes place simultaneously with dentauration, so it might be difficult to differentiate them; for example, when frying eggs, the proteins both denature and coagulate, leading to the final change of texture. Coagulation may also be caused by enzymes, such as rennin used in cheese production, and heat; for example, when boiling eggs.



In c… in r…

Apply

1) Prepare five eggs and boil the… …fferent time: 3, 5, 7, 10 and 20 mi… with a pen to know … to remove which egg from the water.
2) Peel the eggs … them in half, and note down the differences you …

Gluten gives the dough plasticity and traps air bubbles, allowing it to rise.

Gluten formation

Gluten is the protein found in certain grains (such as wheat, rye, barley and oats). Gluten is formed from two kinds of protein: glutenin and gliadin. When mixed with water, they join together and form a net-like structure. Gluten fibres are elastic and can be easily stretched, which gives the dough a sponge-like structure. This feature is called **plasticity**. This is why wheat bread is soft and elastic, and gluten-free bread is rather fragile and crumbly.

During bread-making, yeast produces carbon dioxide (CO_2). The gluten net is useful because it traps the carbon dioxide bubbles and allows the dough to rise.

Di…

Oats are … Unfortun… process u… the same … process w… oats very … with glute… found on … product i… which me… make sur… certified … eaten by … amounts … will occur… gluten.

Apply

1) In groups, prepare three kinds of … st… d… ugh using different flours, su… flour, plain flour and co… …ch … you can use the recipe at **zzed.uk/8…**
2) Write down yo… …ervations.

Check your understanding: p

1. Which process occurs when kneading a bread dough? (*1 mark*)

   a. foam formation ☐ b. denaturation
   c. coagulation ☐ d. gluten formati

2. Denaturation CANNOT be caused by… *(1 mark)*

   a. adding lemon juice ☐ b. adding kitchen
   c. adding balsamic vinegar ☐ d. adding spirit v

3. A marinade tenderises meat because… *(1 mark)*

   a. it contains salt ☐ b. it contains oil
   c. it contains acid ☐ d. it contains pep

4. Gelatinisation takes place when… *(1 mark)*

   a. baking a shortbread pastry ☐ b. baking a quiche
   c. toasting bread ☐ d. cooking pasta

5. Explain three functions of eggs in cooking. (*6 marks*)

   1. .....

   .....

   2. .....

   .....

   3. .....

   .....

6. Explain how the use of high-gluten flour helps to produce a quality bre

   .....

   .....

   .....

   .....

7. Identify two changes to pr… making a quiche. *(2 marks)*

   1. .....

   2. .....

Fruit and vegetables

Various cooking and preparation methods affect the nutritional value of fruit and
important source of fibre, vitamins and minerals. Special care should be taken to
damaging influence of external factors, such as oxygen or light. To prevent the lo
fruit and vegetables, and to maintain their appearance, texture and taste as muc
taken when preparing and cooking, such as:

- not exposing them to air or light unnecessarily to prevent such processes as
  oxidation from happening
- consuming the liquid in which they were cooked
- microwaving, steaming, roasting or grilling vegetables rather than boiling the
- shortening the time of cooking whenever possible
- scrubbing instead of peeling

Enzymatic browning

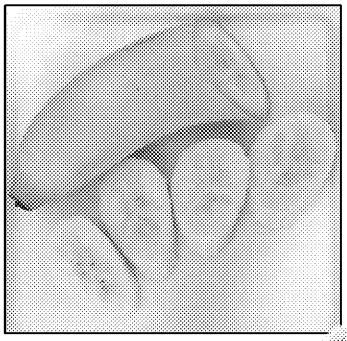
When you're peeling or cutting vegetables, you destroy the structure of plant cel
contents to air. An enzyme in the cells' juices, called polyphenol oxidase, re
damages substances in plant tissues, causing them to brown. This is damaging to
on the other hand, helps to obtain the desired flavour of tea, coffee or chocolate.
in a number of fruit and vegetables , such as:

- avocados, bananas, peaches, pears, apples, mangos, apricots, plums, grapes
- aubergines, mushrooms, potatoes, lettuce

Enzymatic browning can be slowed down or stopped by either:

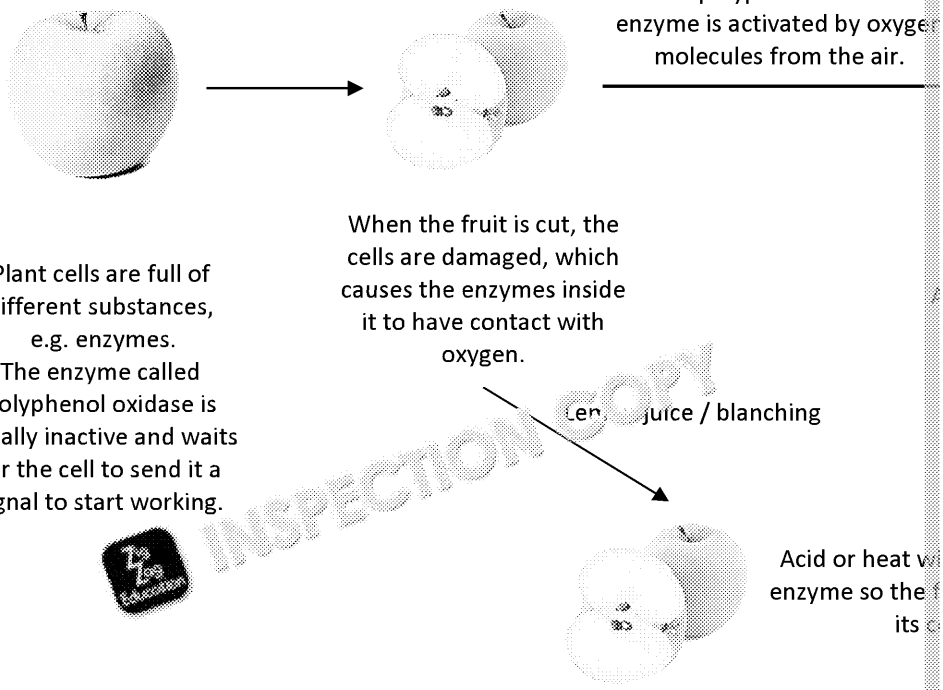
- lowering the temperature, e.g. putting the cut vegetables into the fridge
- inactivating enzymes by blanching
- adding acid, such as lemon juice or vinegar, to foods
- removing oxygen – this is applied in salad factories, where salads are packed

Enzymatic browning will accelerate in the presence of iron or copper – for this re
plastic containers to store the food.



Freshly cut banana

The same banana
minutes



Research

Explore in more detail why enzymatic browning takes place at **zzed.uk/8252-ap**

Oxidation

Oxygen is necessary to live – it is produced by plants from carbon dioxide and used by animals for breathing. However, oxygen has a destructive effect on most foods, causing substances in them to oxidise. During oxidation, food particles lose electrons, which are caught (or, more often, stolen) by oxygen molecules. This leads to food spoilage and loss of nutritional value, leading to the development of an unpleasant flavour and smell.

Natural antioxidants are present in foods (such as vitamins A, C and E), but it is best not to expose the food to air if possible. Oxidation may be stopped or slowed down by:

- protecting food from oxygen, e.g. by covering it or packing in oxygen-free conditions
- using antioxidants, either natural of artificial, such as lemon juice, lime juice
- using barrier substances such as salad dressing wh ers the surface of f

Apply

- Take three apples o ffer kinds (e.g. Golden Delicious, Gala and J
- Cut or grat a leave for 30 minutes.
- ne, you should observe different stages of oxidation – this
  different amounts of vitamins protecting them from the proce
- Repeat the experiment, but add lemon juice to each sample. What do

Research

Explore the variety of English apples and pears on **zzed.uk/8252-apple-varie** antioxidants in them and assess which apple varieties are less prone to enzyma

Check your understanding: fruit a

1. Oxidation is undesirable because… *(1 mark)*

   a. it increases the amount of vitamins to dangerous levels
   b. it leads to vitamin loss
   c. it prevents food spoilage

2. Antioxidants include… *(1 mark)*

   a. vitamins A, C and K ☐ b. vitamins A, C a
   c. vitamins C, E and K ☐ d. vitamins A, E a

3. Enzymatic browning affects m… *(1 mark)*

   a. dairy product… ☐ b. nuts
   c. meat ☐ d. fruit and veget…

4. C…n leads to… *(1 mark)*
   a. development of a bad smell and flavour
   b. loss of nutritional value
   c. unappetising appearance of the food
   d. all of the above

5. Enzymatic browning will happen more quickly in… *(1 mark)*
   a. fruit which is high in vitamin C
   b. grated potatoes kept in a metal bowl at room temperature
   c. vegetables which are cooked whole
   d. fruit kept in a covered bowl in a fridge

6. Explain the difference between enzymatic browning and oxidation in f…

   .....

   .....

   .....

   .....

7. Explain three ways of preventing enzymatic browning in food. *(6 mark…*

   1. .....

      .....

   2. .....

      .....

   3. .....

      .....

The most common faults in cooking and

There are many factors which can affect the final effect which is your dish. Knowing why common co
preventing failure in the future. The most common causes of error include:

- lack of skills in the cook – but don't worry, you will learn everything you need during this course!
- lack of care when measuring ingredients
- improper time and temperature of cooking
- improper preparation technique, including overdoing and underdoing
- improper choice of ingredients

Cake catastrophes

The most common ingredients used for cake-making include flour, eggs, sugar and fat, sometimes wit
below describes the most common problems encountered during cake-making, and explains how to p

What happened	Why it happened	How to r
The cake is tough and dry	Too much flour (or other powder, e.g. cocoa) was used	• Measure the flour carefully ne for the same amount of cocoa • Cut the cake in half horizontall a layered dessert, such as tira
The cake has sunk in the middle	The cake is under-baked	• Adjust the cooking time accord • Check the readiness of the cak the oven! • If the t already browned b baking
	You used too much sugar and/or baking p and the gluten softened too m so it wasn't able to support the cake!	• Measure the ingredients prop • Cut the cake into pieces and us
	You opened the door during cooking	• We know it is tempting, but co baked it for the proper amoun • Try not to open the oven need oven door

them

ıt or other ingredients. The table
ow to remedy the situation!

in the future
late cake, substitute the amount of flour ol or squash – it will make a great base for
l the size of baking tin you are using king to it, the cake needs more time in e surface with aluminium foil and
ar to bread and butter pudding
oven, so the cake may fail even if you on the cake by peeking through the glass

What happened	Why it happened	How to
The top of the cake has cracked	You poured too much dough into the tin	g[illegible]d practice to only fill the [illegible] ûlée, which need to be fully fil[illegible]
	The temperature was to[illegible] [illegible]d th[illegible] [illegible]rface cooked before t[illegible]ke has [illegible]s[illegible] properly	• Put the cake on the middle shelf [illegible] • To save the cake, cut off the top [illegible] or another dessert
The cake has not risen at all	You didn't use the proper raising method, e.g. you folded whipped egg whites in too quickly or did not cream the sponge for long enough	• Next time, spend more time ens[illegible] creaming the butter, sifting the f[illegible]
	You didn't add enough raising agent	• Measure bicarbonate of soda care[illegible]
	You folded the flour in too vigorously	• Next time, fold in the flour gentl[illegible] mixture
The cake has a hard crust	Too much sugar was used	• Next time, carefully measure out [illegible] into grams and weigh with kitche[illegible]
	You used granulated sugar instead of caster sugar	• It is [illegible]l[illegible]ays best to use a type of s[illegible] [illegible]n[illegible]ng sugar – so that the cry[illegible]
	You didn't cream the dough properly	• The mixture of sugar and butter [illegible]

What happened	Why it happened	How to
The fruit has sunk	The fruit was not dried properly	• te… yashing the fruit, strain it • …ou can also coat it with a sma…
	The cake r… was …o …et	• If you think the mixture may be … the dough is too runny
The cream has curdled	You placed it too close to a heat source, e.g. hot hob or heater	• Always use cream/cheese strai… possible • Try to whisk in a spoonful of wa…
	The mixture was too acidic	• Although this can be desirable … separate like that • You can try to save the cream b…
	You used wrong type of cream/cheese	• Low-fat cream/cheese usually s… • Try to whisk in a teaspoon of co…

Other baked goods, such as bread and other yeast-based products, may also fa… rise properly due to

- **lack of sugar** in the dough – the yeast needs sugar to multiply and … …e c…bon dioxide
- **lack of water** in the dough – the yeast needs water to m…ltip…
- **improper temperature** – it is best to let these fo… … a warm place and protect them from th… a temperature will cause the dough to …; too hot a temperature can kill the yeast, ar… not rise at all
- **too much salt** – salt lo… …y …he yeast, so it cannot grow as fast as it could in proper cond…
- **too little** … …e y… …eds time to work, and it is best to let it rise until the dough doubles its…
- **overdone** … …f you over-kneaded the dough, the chances are that you knocked out the carb… best to kne… …e dough lightly and let it prove for a proper amount of time in the baking tin.

Pathetic pastries

Although shortcrust pastry may seem easy, sometimes it may not turn out as expected. It is crucial to p
the temperature of the ingredients, the pastry and your own hands, as they all play a role in creating a
pastry.

What happened		How to
The shortcrust pastry is sticky and difficult to handle	You used soft fat	• Next time use cold, hard fat
	It is too hot in the kitchen	• Try to open the window to let so
	You overdid the pastry	• Try to knead the pastry for as sh
The shortcrust pastry shrank during baking, and the filling spilled out	You didn't let the pastry relax	• Next time, after rolling put the ra
The shortcrust pastry looks raw and wet after cooking	The pastry is under-baked	• ou noticed this immediately a the temperature slightly
The shortcru too dark	Y ke the pastry	• Next time, adjust the cooking tim recipe, as each oven works differ
	The temperature was too high	• Next time, adjust the temperatu the recipe may be too high or to
	The pastry was too high up in the oven	• Always try to put the pastry on t

What happened	Why it happened	How to
The choux pastry has collapsed after baking	You didn't bake the choux pastry for enough	• …uns rise thanks to steam …ll cause them to collapse after • Next time, make sure the choux … the time. • Alternatively, right after removin… remaining steam out.
The choux pastry didn't rise	You didn't cut up the butter	• It is important to cut up the butt… water and milk, the more liquid … baking. • Next time cut up the butter. Alte… lightly with water to produce ext… • Next time ensure the cooking tim…
	Water has evaporated from the dough during the cooking of the choux buns.	
	You cooked the pastry for too long	
The choux pastry has risen unevenly	You added flour little at a time	• It is important to tip all the flour … granules will soak up more liquid

Serious sauce problems

There are many various techniques of sauce-making. Some sauces are based on starch, some require a reduction of liquid and concentration of flavour, and others require the use of emulsifiers. Sauce is oft worth knowing how to make it well.

What happened	t happened	How to
The white sc… gone lumpy	The sauce was not stirred properly	• Next time stir the flour into the b… whisking continuously • Continue whisking all the time u… • Strain the sauce into a clean sauc…
The sauce is burning at the bottom	You are using too high a heat	• Usually, it is best to use a low hea… is worth it
The sauce is too pale	You didn't cook the roux long enough	• By increasing the time of cooking … ('blonde') to dark brown (as in gr… time t… ime until the roux has th… …ck on the hob to cook.
Mayonnaise is separating	There is not enough … to t… droplets are … sperse… correctly	• Whisk in a spoonful of water
	…ients were at different …emperatures	• Next time, make sure all ingredie… • Put a fresh egg yolk into a clean … the mixture is smooth again

Other common mistakes

Both new and experienced cooks can make mistakes – due to lack of either skill, k
haste is not your friend when in the kitchen, so it is best to always spend your tir
recipes thoroughly, so that you know what to do step by step, how to schedule yo
ingredients and utensils to make the cooking easier – and succeed at it! The tabl
cooking mistakes which many of us make.

Mistake	Effect
Overcrowding the pan	Instead of frying, your meat and fish be obtain that lovely, crunchy crust
Adding garlic too early	A dish which is s[illegible]y burnt and bitter
Flipping the food too often	Fish is li[illegible]ely to overcook and fall apart, a cr[illegible]y crust
Adding wet greens to a pan f[illegible]f hot oil	The oil splatters around may possible b boil instead of frying, and you end up w
Breading t[illegible]d improperly	The breading falls off. Next time, dip th and then in breadcrumbs – this way, it w

Check your understanding: the r
faults in cooking and how to pre

1. Why should garlic be added to a dish at the end of cooking? (*1 mark*)

   a. to make the aroma less intense ☐ b. to improve the t
   c. to improve the appearance of the dish ☐ d. to make sure it

2. Which method can prevent fruit from sinking to the bottom of a cake?

   a. coating it with breadcrumbs ☐ b. washing it thoro
   c. coating it with flour ☐ d. cutting it very fin

3. What can cause a sauc[illegible] lumpy? (*1 mark*)

   a. overcookin[illegible] ☐ b. lack of agitation
   c. addi[illegible]ch salt ☐ d. adding too much

4. T[illegible] box next to each statement to show whether it is true or fal

The longer the roux is cooked, the darker the sauce will be.
Using a high-gluten flour causes cakes to sink in the middle.
Low-fat cream is less likely to curdle than full-fat cream.

5. State three issues which may occur when making a cake, and which ar
of ingredients. (*3 marks*)

   1. .....

   2. .....

   3. .....

6. Explain three cooking mistakes which can cause bread to fail. (*6 marks*)

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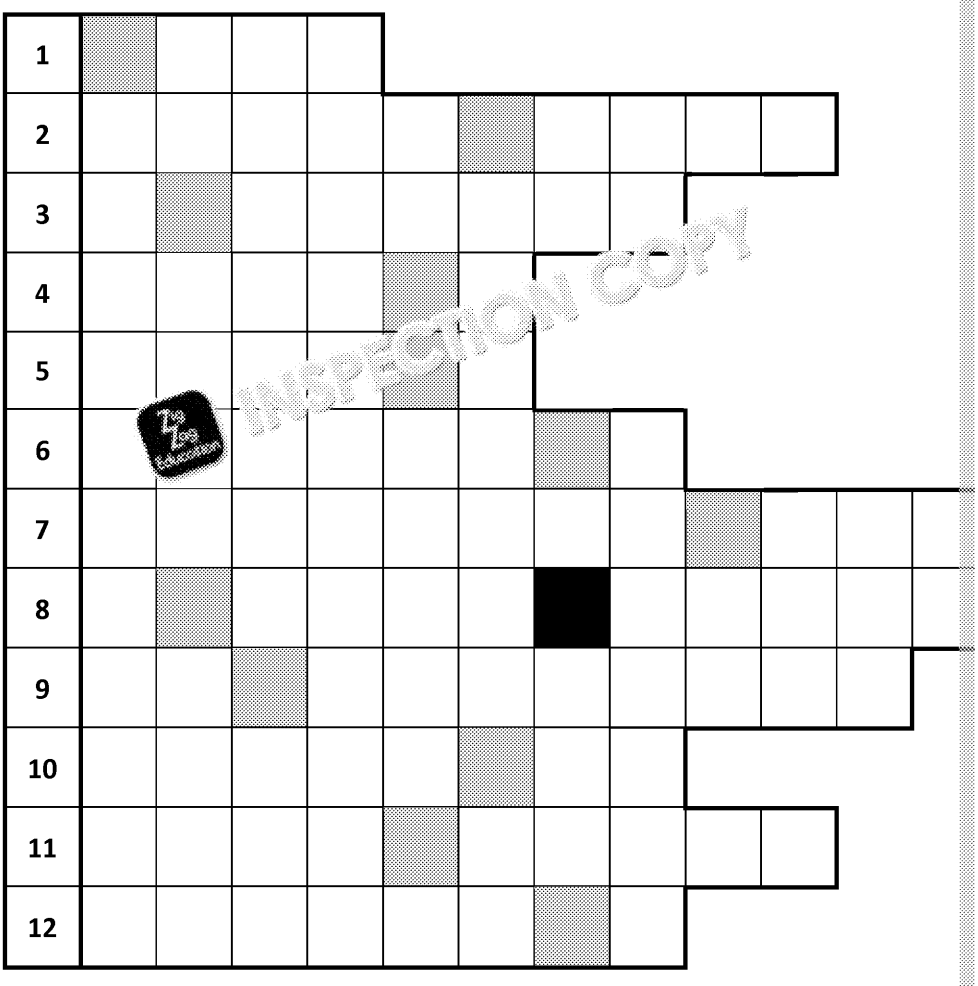
Fill in the answers to the questions below to reveal a phrase relevant to food scie
black square is a space).



1. A mixture in which gas bubbles are suspended in a liquid phase (4)
2. Type of fat used for making pastry (10)
3. Discolouration of fruit and vegetables caused by enzymes (8)
4. Traditional Italian sausage made with the use of bacteria and mould (6)
5. Complex protein formed when flour is mixed with water (6)
6. Green-coloured toxin which accumulates in badly-stored potatoes (8)
7. Term used to describe the damage to the chemical structure of protein caus
8. Lack of this gas can cause bread to fail (6, 7)
9. Vitamin or agent which prevents the negativ ef s of oxygen on food (11)
10. Action which prevents lumps in a
11. Type of radiation used fo kin (10)
12. Cooking method w h is convection currents and water vapour (8)

The shaded s reveal this word:

Chapter 2: Food spoila

Overview

In this chapter we will look at the effects of microorganisms and enzymes and their role in food spoilage. We will also explore different sources of bacterial contamination and food poisoning, and learn how to recognise and prevent them. Issues with high-risk foods and the danger zone temperatures of cooling foods will be addressed, along with using temperature probes to check that food is cooked thoroughly.

Learning outcomes

After studying this chapter you should be able to do the foll

- ❑ understand and describe the conditions that cause fo
- ❑ list the conditions needed for microorganisms to grow
- ❑ identify high-risk food items and understand what ma
- ❑ describe the measures for control of enzymatic actio
- ❑ recognise the signs of food spoilage such as mould g
- ❑ identify the different sources of bacterial contaminat
- ❑ list the main causes of bacterial food poisoning
- ❑ recognise the main symptoms of food poisoning
- ❑ explain different ways of preventing cross-contamina

Key T

Aerobic bacteria	Bacteria that require oxygen to live and multiply
Allergen	A substance – e.g. an ingredient in food, such as nuts, dairy or su cause an allergic reaction in susceptible individuals
Anaerobic bacteria	Bacteria that do not require oxygen to live and multiply
Blanching	The process of quickly dropping food (usually vegetables and fru and refreshing them in cold water immediately after in order to
Blast chiller	An appliance that reduces temperature of food quicker than a re bacteria to reproduce
Cold store	A room or large cupboard area where stored food can be kept co
Colour-coded	Using different coloured utensils and equipment for different foodst
Danger zone	The temperature range in which most food poisoning bacteria are able
Date marks	'Best before' dates refer to the date at which the quality of food used for perishable foods and refer to the safety of food.
Dry food area	A dry, dark, ventilated room in which food can be kept stored
Enzyme	A biological catalyst usually made from protein which makes fru
Fermentation	The breakdown of sugar to form alcohol and carbon dioxide per
Friendly bacteria	Used in probiotic products designed to improve gut flora
High-risk food	Food which has ideal conditions for bacterial growth. It can be r eat food that will easily support the growth of pathogenic bacte heat treatment or cooking.
Microbial spoilage	See spoilage bacteria
Microorganism	An organism (e.g. bacterium) that is small to see with the na under a microscope
Pathogenic bacteria	Bad bacteria that cause illness. A **pathogen** is a microorgani
Perishable	Food with a limited 'use by' date that will not 'keep'
Personal hygiene	Ensuring personal cleanliness to prevent bacterial contaminatio
pH / pH l	Measures acidity/alkalinity: 7 = neutral, <7 = acidic, >7 = alkaline
Spoilage b	Bacteria that make food 'go off'
Spore	A reproductive cell capable of developing into another reproduc by which mould (and other fungi) reproduce
Stock rotation	Items where items are prioritised subject to a principle of 'first in, already in stock are used before freshly delivered items
Temperature gauge	A gauge positioned on the outside of appliances that enables the
Temperature probe	A handheld device that is used to check that the temperature in sources to check its internal temperature
Thawing temperature	The recommended temperature at which food is thawed: 0 °C –
Work surface	A surface such as a table or counter top on which food is pre

The knowledge and ability to apply food safety principles when buying, storing, c
to ensure that the food is nutritious and safe to eat. Correctly handling food pro
and cross-contamination. Let's have a look at what causes food spoilage and ho

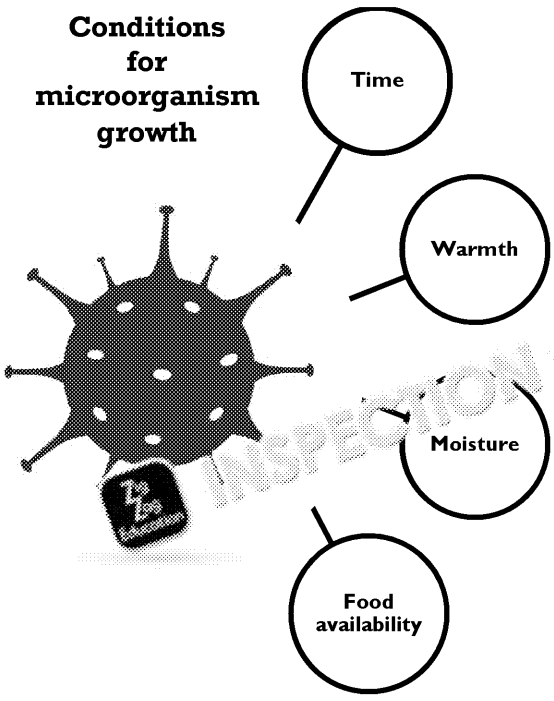
Microorganisms in food (bacteria, mould and yeast)

An organism is an individual animal, plant, fungus, bacterium or single-celled life
A **microorganism** is an organism that is too small to see with the naked eye and needs to be viewed under a microscope. Microorganisms can be carried on food or in water and can cause food poisoni
roorganisms can also be used in food production; for example, ba
a in bio-yoghurt, yeast in bread and moulds in blue che
s.

**The role of micr
sms in food production**

| Microo
n	Good	
Bacteria	**'Friendly' bacteria** are used in probiotic products designed to improve gut flora.	Microbial ba
(**spoilage ba
disease (**pat** |
| Yeast | This is used in bread-making. Yeast produces carbon dioxide to make dough rise. Yeast is also used to make fruit ferment and to create alcohol. | A single-cell
family which
in some pec
spoilage thr |
| Mould | Mould is used in cheesemaking to improve flavour (blue cheese). | Mould can g
making ther |

Microorganisms need certain conditions in order to grow and multiply. These co



Where are micr

Microorganisms are
- rubbish / foo
- clothing
- soil
- food packagi
- water
- air
- dust
- saliva
- animal and h
- dandruff
- tears
- phlegm
- pus
- blood
- urine and ex
- skin cells

These will be discussed in greater detail later on in this chapter.

Bacteria

There are 'good' and 'bad' bacteria – good bacteria are also referred to as **'friendly' bacteria**, and they help to maintain good gut flora (complex microorganisms that live in the digestive system). **Good bacteria** are needed to help digest food and also to make yoghurt and probiotic products. The positive use of microorganisms in food production was discussed in Chapter 1.

Spoilage bacteria make food 'go off', rot or spoil. This is referred to as **microbial** sometimes smell spoilage bacteria. Microbial spoilage is caused by bacteria, yeas

Bad bacteria which can cause illness (food poisoning) are referred to as **pathoge** lead to bacterial infections such as *E. coli*, *Staphylococcus aureus* and *Campylobac* bad bacteria which can cause illness and cannot be seen or smelled in food. Pathogenic bacteria can come from the following sources:

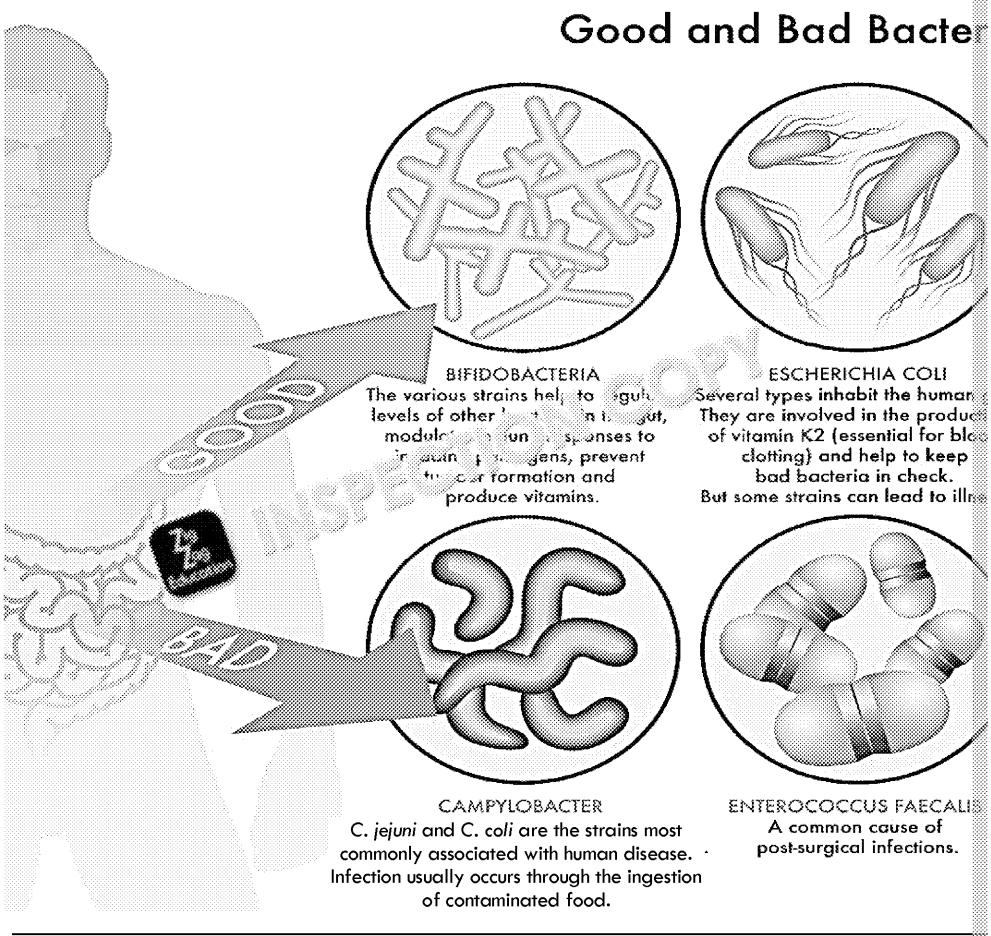
- raw foods
- pests and dust pets
- people (from their hands, hair, nose, throat, infected cuts)
- air and dust
- dirt and soil (unwashed vegetables and salads)
- food waste

Research

Research food poisoning symptoms and causes on the NHS website using the **zzed.uk/8252-food-poisoning**

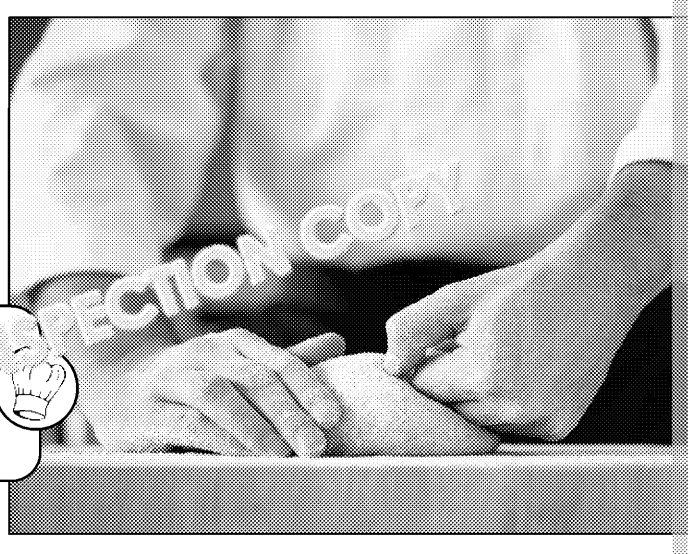
Things to think about

Think about who is most at risk from food poisoning, and why.



Yeast

Yeast is a microscopic fungus used in the **fermentation** of food products such as b
Fermentation is a process caused by combining yeast and sugar. Yeast turns sug
'rise' by producing carbon dioxide (CO_2) gas. Yeast can cause digestive problems
cause **food spoilage** through fermentation (as yeast uses up sugar and produces
becomes sour and slightly fizzy, which is not necessarily desired in most foods).



Apply

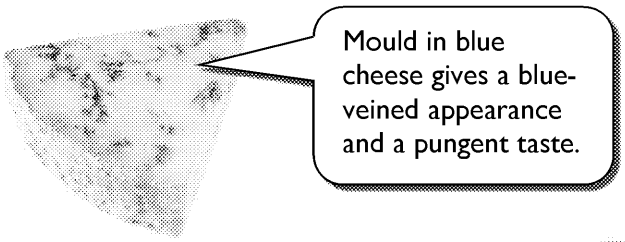
List thr
o od
ite t
contain yeast.

*Yeast has an important role in bread-making – it makes dough
strengthens the bread dough and its fermentation develops fla*

Mould

A mould is a fungus that reproduces via **spores,** which grow on organic matter, s
conditions are present, i.e. warmth and moisture. Mould is used in the productio
Stilton, Gorgonzola and Roquefort, and produces a blue-veined appearance. Blu
taste. Mould in food produces enzymes, which break down the food and cause f
eat. Mould can also cause allergic reactions and produce harmful toxins called m

Mould in Food Production



Mould in blue cheese gives a blue-veined appearance and a pungent taste.

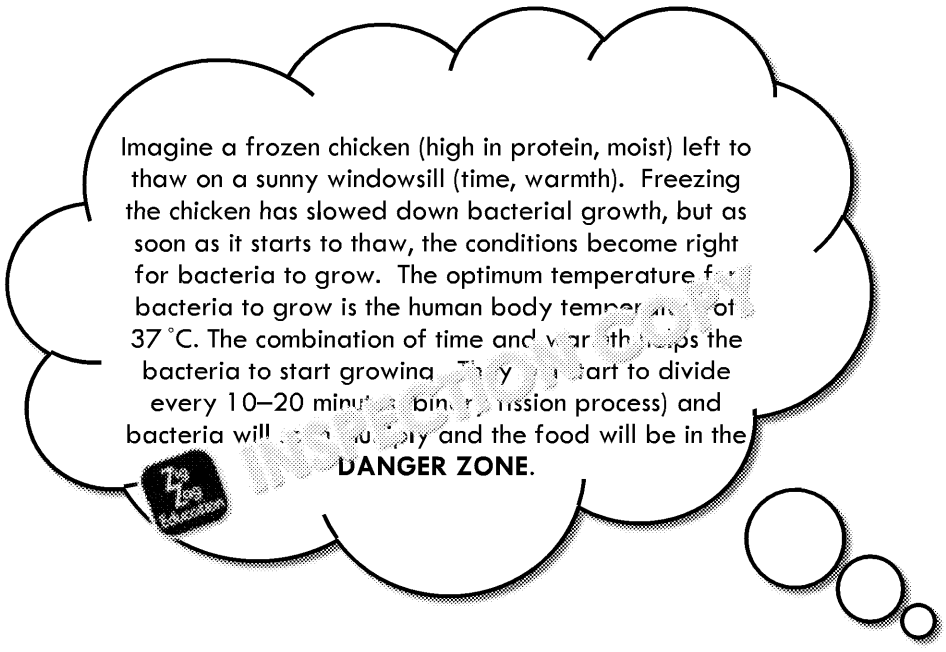
Mould in bread is usually white with initially a white or greenish co

Did you know?

The mould used in cheesemaking is Penicillium.

The role of temperature, moisture, pH and time

To survive and multiply, bacteria need certain conditions such as *time*, *food* (pref
warmth and *moisture*.



Control of microorganisms – temperature

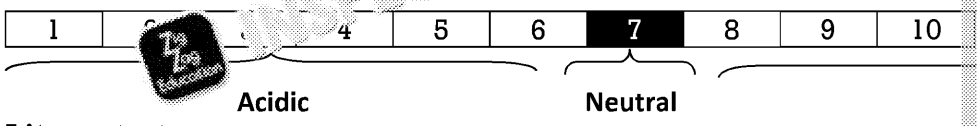
Bacteria can multiply at temperatures between five degrees centigrade (5 °C) and
degrees centigrade (63 °C), with the optimum temperature being 37 degrees
centigrade (human body temperature). Even if cooked at high temperatures, **hig**
food (i.e. any food that has been cooked and will not go through any other proce
kill bacteria, such as a chicken or an egg mayonnaise sandwich) passes through th
DANGER ZONE as it cools down. *Between the temperatures of 5 °C and 63 °C is w*
bacteria can grow and multiply. Bacteria can be killed off at temperatures of at le
If reheated, the centre must be at least 82 °C.

Although bacteria can be killed at temperatures of 75 °C or above, at temperatur
slow down ready to grow and multiply once conditions are right, i.e. the food pa
Freezing food at the recommended temperature of -18 °C does not guarantee tha
it will slow it down. Bacteria may still be present and given time, warmth, moistu
these elements, bacteria start to grow and multiply.

Control of microorganisms – pH

pH refers to neutrality, acidity and alkalinity with pH playing a part in controlling
been used for centuries (such as in pickling) to control micro
and pickled foods have a pH of 4.8 and below (acidic)
7 is acidic and over 7 is alkaline. Lemon juic
7 is neut

pH Scale



Litmus test

Litmus paper allows you to test the acidity of food yourself. A pH test kit contains
litmus paper and a colour chart. The litmus paper is dipped into the food and
then compared to the colour on the pH chart to determine its acidity or alkalinity.
Litmus paper changes colour depending on the pH. It is red when acidic and blue
when alkaline. If you dip blue litmus in an acid such as lemon juice it will turn red
you dip red litmus paper in an alkali such as baking soda dissolved in water, it will

Control of microorganisms – water availability

Bacteria, mould and yeast need moisture in order to survive, and the availability of water within a food item determines whether these microorganisms can exist or multiply. Dehydrating or desiccating foods helps to inhibit moulds, yeast and bacteria. This is why drying foods can be an effective preservation technique that helps prevent spoilage and increases
Preparation for drying may include washing and blanching fruit and vegetables b
begin to grow on partly dried foods. Some nutrients, such as vitamins C and A, c
The food preservative sulphur dioxide is sometimes added to dried foods to prev
apricots) and to prevent loss of vitamins. Sulphur dioxide is listed as an allergen
reaction in some people.

Preserving foods, such as fruit, through
used for centuries. Examples of d
raisins, sultanas, nuts, apricots and tom
include:

- Sun-drying
- Oven-drying or microwave-drying
- dehydrators or air-dryers

Research

Look up house rules on temperatures and bacterial contamination on the Go
Standards Agency website using the redirect URL **zzed.uk/8252-food.gov**

Things to think about

Why is the optimum temperature for human pathogens 37 °C?

Signs of food spoilage

Spoilage refers to decay and decomposition of food items. Food that has decayed or is in the process of decaying may lose some or all of its nutritional value and may not be fit to eat. Correct storage of food can help to prevent spoilage. Enzymatic action causes ripening (e.g. of fruit such as bananas) and browning of some fruits and vegetables. Yeast reacts with sugars to cause **fermentation**. This process can occur with fruit such as grapes which contain naturally occurrin Yeast and mould growth are signs of age and spoilage. Other fruits that can be a blueberries, strawberries, blackberries, tomatoes, raspberries and also citrus fru

Di

It is illeg if it is no or has lo

Spoilage can be slowed down by:

- preserving food
- handling food correctly
- storing food at co[illegible]eratures

A banana a

Although y[illegible] see **pathogenic bacteria** with the naked eye, **spoilage bac[illegible]** cause a process of decay that can be recognised from:

- by the colour of food – e.g. browning
- by the smell
- by the texture – e.g. wrinkling or shrivelling
- by the taste
- by mould growth

Bacterial growth can be prevented by using preservatives such as salt and sugar lemon juice. Preservatives may also be used in food, such as sulphur dioxide for browning) – sulphur compounds may appear in the ingredients list as sulphites (metabisulphite, potassium bisulphite, sodium metabisulphite or sodium sulphite may cause an allergic reaction in some people. To prevent spoilage food preserv as the following:

- Curing, salting and pickling
- Smoking
- Vacuum sealing
- Heat treatment (e.g. UHT) and pasteurisation
- Low temperatures
- Drying
- Irradiation

Research

Look up the general l[illegible] regulations regarding food law at the Government's Agency w[illegible] u[illegible] redirect URL **zzed.uk/8252-food-law**

Prepare fruit and vegetables to prevent yeast and mould growth

Some fruit and vegetables sustain yeast and mould more readily than others (e.g. and need to be prepared carefully in order to prevent their growth. Preparation skinning fruits and vegetables (yeast and mould growth is contained on the skin) deter the growth of **microorganisms**.

Skills

Skin a tomato

(take care with hot water and sharp implements)

Using a knife, slice an X on the base of the tomato. Place tomato in a bowl of boiling water to loosen the skin and leave until it starts to curl around the X. Pop the tomato into cold water to stop the cooking process (use a spoon) and then peel.

Skills

S
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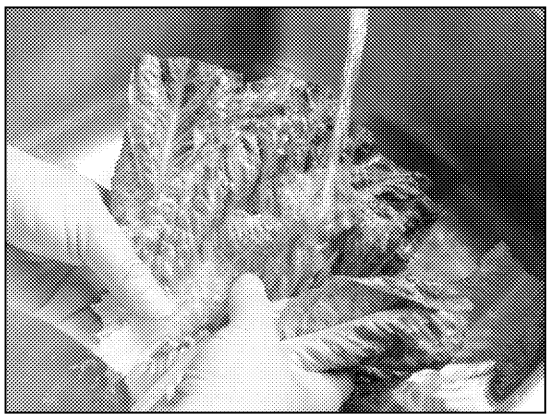


Soil contains **patho**
present on unwashe
grains, such as rice a
vegetables helps to

After washing fruit a
chilled to deter **mic**
some exceptions be

Did you know?

Some fruit has to be ripe before placing in a refrigerator as chilling stops the fruit from ripening (e.g. melons, oranges and tomatoes).

Ro
po
sto

Apply

List three food items that quickly show signs of de with age.

Skills

1. Dem w shing and chilling y ui /v ables.
2. Demonstrate different ways of pre control enzymatic browning.

Things to think about

Why do some foods show signs of spoilage before others?

Signs of food spoilage (enzymic action)

We have looked at how the growth of bacteria, yeast and mould can cause micro
at how **enzymes** can cause cell destruction (called **autolysis**) in some foods. Auto
or self-digestion of cells by their own enzymes.

An enzyme is a biological catalyst usually made from protein. Enzymes can do th

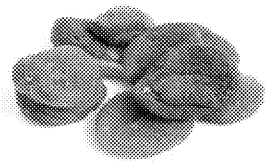
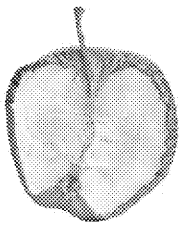
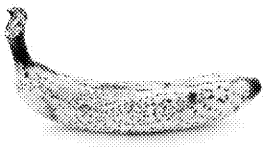
- Help fruit to ripen
- Cause discolouration of fruit and vegetables
- Cause **oxidation**. When chemicals in food are exposed to oxygen, this ca
  molecular structure (such as the way in which an apple browns as soon a
  oxygen). The **oxidation** process can cause the loss of nutrients, such as v
  vitamins B and C) from food. Antioxidant properties can help to prevent

Enzymatic action in food can also be beneficial. For example, developing flavour
retaining colour and flavour in fruit.

Destructive enzymes in food

Blanching fruit and vegetables helps to stop the enzymatic action within food which causes discolouration and other changes such as loss of flavour, colour, texture and nutrients. Blanching is recommended before freezing or drying fruit and vegetables. Although blanching can protect fat-soluble vitamins from breaking down, it can also cause the loss of water-soluble vitamins. However, this process is less destructive than overboiling. Certain acids, such as citric acid or ascorbic acid, can also be used to prevent browning in fruit and vegetables. For example, lemon juice can be used to lower the **pH** a

Fruits which exhibit enzymatic browning: apricots, apples, bananas, pears, grap

Vegetables which exhibit enzymatic browning: lettuce, mushrooms, potatoes


Things to think about

Think about why some foods exhibit oxidation and enzymatic brow

High-risk foods

Bacteria prefer moist foods that are high in protein and as they exist where there time. Given one or more of these conditions, they can start growing. Foods in th fish, shellfish, eggs, milk and dairy products. High-risk foods are foods that have down to be served cold later. High-risk foods will not go through any other proc should be kept hot and cold foods should be kept cold. Bacteria numbers can be thawed or reheated.

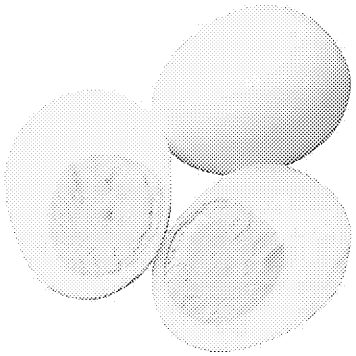
When dealing with high-risk foods, you should ensure that:

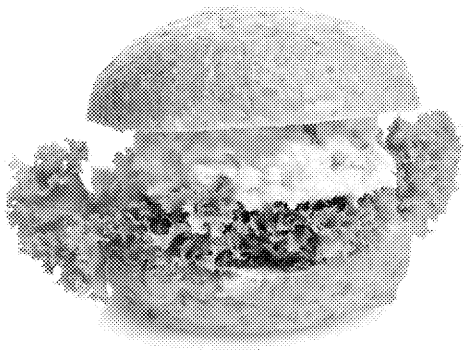
- your hands are clean throughout the day and handling is kept to a minim
- stored food is kept covered
- temperature is NOT within the danger zone between 5 °C and 63 °C for
- raw food and high-risk food are kept separate – *clean utensils after chopp bacteria transferring from raw food to the board, work surface or utensils contamination with ready-to-eat foods. Store raw meat on the bottom s drippings onto other foods.*

Be extra vigilant when dealing with the following high-risk foods:

- cooked meat and poultry – e.g. chicken drumsticks, burgers, sausage rolls
- milk and other dairy products – e.g. ice cream or products containing cooked
- shellfish and seafood – e.g. prawn cocktail, fish pâté, scampi
- cooked rice (never leave to cool and then reheat)

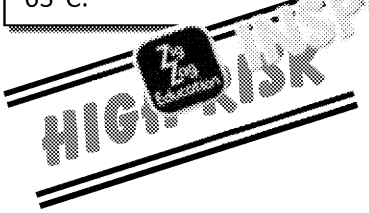
Chicken and poultry should never be washed before cooking as water droplets fr bacteria onto work surfaces, utensils or food.





Danger zone
Food is in the **danger zone** when it starts to cool and the temperature is between 5 °C and 63 °C.

Ready-to-eat foods
Ready-to-eat foods such as a chicken sandwich, b egg or sausage roll are refer to as **HIGH-RISK** f because they have passed through temperatures between 5 °C and 63 °C and will not be subject to a other process that will slow down or kill bacteria.



Check your understandi
microorganisms (food spoi

1. Which of the following statements about **autolysis** is INCORRECT? (1

   a. It causes ripening of fruit ☐ b. It causes discolouration o
   c. It causes oxidation ☐ d. It causes the pH to becom

2. Which of the following methods would NOT help to deter microorga
   (1 mark)
   a. Skinning and chilling ☐ b. Seeding and wa
   c. Storing at room temperature ☐ d. Washing and c

3. What temperature is re[illegible]as the DANGER ZONE? *(1 mark)*

   a. Betwe[illegible]an 63 °C ☐ b. Less than 5 °C
   c. re[illegible]an 63 °C ☐ d. Between 5 °C a

4. Which of the following statements about preserving food is FALSE? *(1*

   Bacterial growth can be prevented by using:

   a. vinegar ☐ b. salt ☐ c. pepper ☐

5. Describe three ways in which temperature control helps to prevent fo
   and/or enzymes. *(3 marks)*

   1. .....

   .....

   2. .....

   .....

   3. .....

   .....

6. Assess how microorganisms, such as pathogenic bacteria, can cause fo

   .....

   .....

   .....

   .....

   .....

   .....

   .....

   .....

   .....

   .....

Buying food

Buying food seems an easy job. You go to the shop, choose what you need, pay a
about it again. How many questions do you ask yourself before deciding whether
need to know what product you need, in what quantity, whether it is fresh and of
factors. In this chapter you will learn what to pay attention to when buying food
consumption.

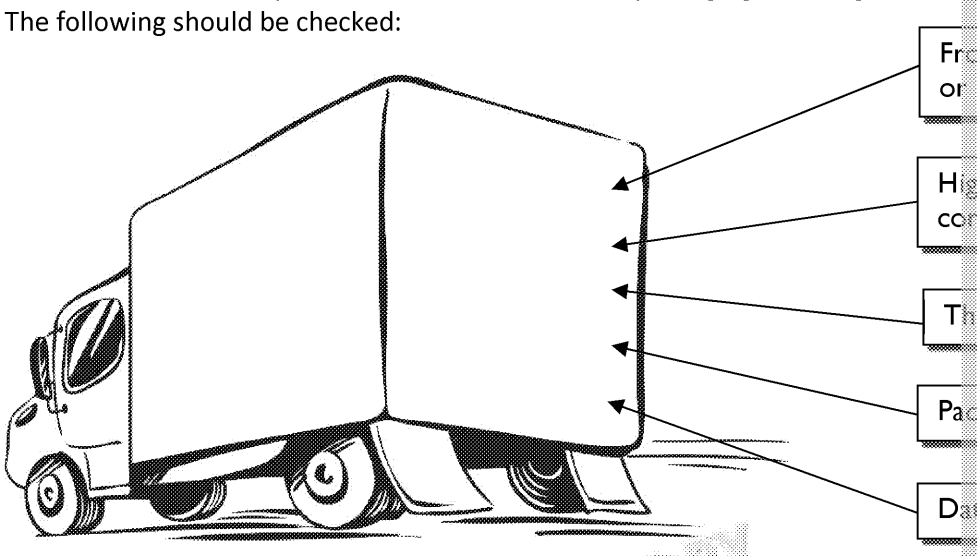
The food we eat comes from both plants (grown in fields, orchards and polytunne
and fish tanks or caught in the wild). The farmers, growers and hunters then sell
food factories, who process it to make food. The food is then transported to supe
whom we are able to buy food to cook the dinner. It is important to pay attentio
is processed, transported and stored, as they can affect its safety and quality.

Deliveries

When raw d**ishable** food is delivered, it should be at a safe temperature (i.e. less than 8˚C for refrigerated foods and less than -12˚C for frozen foods). When taking deliveries the following should be checked:

- **Date marks**
- Packaging
- Temperature

Deliveries should be rejected if food is out of date, if packaging is damaged or if t
The following should be checked:



When storing food after a delivery, the following should be performed:

- Handle food with care – do not drop food or damage packaging
- Store **perishable** food at correct temperatures
- Store food at correct temperatures
- Do not store food on the floor
- Keep food away from pests and be aware of the signs of pests
- Keep storage area clean

Date marks

When checking **date marks**, ensure that you know the difference between 'best b

Best before	
'Best before' dates refer to the date at which the quality of food will be affected. Food may still be safe to eat after this date. So 'best before' dates refer to **QUALITY**.	'Use by' dates are use fish or dairy products. should NOT be eaten. **SAFETY** of the food.
It is illegal to serve or sell food past its 'use by' da	

Storage rotation

When storing food, it is important to ... the correct **storage rotation** methods. Food with a short shelf life should be used before food with a longer shelf life and it should be stored accordingly, with items with a short shelf life st... fr... of items with a longer shelf life. Always check the date mark o... before using it.

Things to think about

Why is storage rotation important?

Additional reading: What to look for when buying food: visual chec

Visually checking the food is probably the simplest way of ensuring that it is fresh point is to make sure that the food looks as it should. The table below will help y going to buy is OK to use.

	What to look for
Packaging ***(see more on the next page)***	Clean, whole, undamaged; no unintended holes marks are clearly visible
Fruit and vegetables	Not wrinkled[1]; firm, no brown or black stains[2]; u bruised
Fish	Clear, bright eyes; eyes not sunken; bright red g the skin; the flesh is firm and shiny; tail is stiff
Meat	Bright colour (not dull) – the shade will depend fibres are tightly packed and firm; cuts are smo is white and firm (not yellow)
Milk and dairy	Lid is not bulging; the mi... not curdled or sepa with mould[4]

1 Passion fruit is an exception!

2 Occasional soil is OK, as ... vegetables keep longer when unwashed

3 It is OK in yo... hu... ...eams though (yoghurt separates because during **fer** and pus... the water; it is natural and the yoghurt is still safe for consum opening ... with a spoon; the cream separates into two layers – fat and w fat and water repel each other so the process is totally natural – simply shake

4 This doesn't apply to cheeses such as blue cheese, Camembert or Brie, where

Packaging

The packaging of food is important as it has many different functions. Food manufacturers have to ensure that the type of packaging used for a chosen product is safe (doesn't interact with the food inside), cheap, light and easy to transport. There are four main functions of packaging:

Crisp
air. Th

1. it protects the food from external factors, such as light, oxygen, dirt or microorganisms (protection)
2. it informs the consumer about the product (information)
3. it attracts consumers and tempts them to buy it (marketing)
4. it increases the shelf life of a given product

When buying and storing food, you have to pay extra attention to the following aspects of food packaging:

- whether the packaging is whole and intact – any holes, tears and other unintended openings may allow microorganisms penetrating through to the food, and contaminating it; they may also mean that the food is no longer protected from oxygen (and oxidation)
- whether the date marks are clear and easy to read (e.g. not covered by a price sticker) and whether the food is out of date
- whether the ingredients of the product are safe, e.g. if it is allergen-free for those with a particular food, or whether it is gluten-free for coeliacs
- whether it requires any special storage conditions – usually the producers state whether it should be refrigerated or frozen, stored in a dark place, etc. Typical information you may see on the label is '*refrigerate after opening*' or '*store in a cool, dry place*'.
- whether the food is stored correctly in the shop – e.g. yoghurt is in a fridge / chilled cabinet
- whether the lid or packaging is 'bulging' – this can mean that harmful bacteria, such as *Clostridium botulinum*, have developed in the food, and it is best to throw it away, even if it looks fine

This cart[illegible] eggs from bumping into each [illegible] breaking. On the package you can often find advice to store it in a fridge after purchase.

A food package may also have o[illegible] it can tell you whether the pro[illegible] vegans, how to s[illegible]

Food labelling

The information included on a food label and the way a product is displayed in a s people's food choices. Food labelling is subject to EU law, and all countries belon to apply these rules. This is to ensure that all European citizens have the possibili when buying food. Various marketing techniques are used to make products app

Paying attention to food labelling when shopping is important. It provides usefu nutritional value, fat, and sugar and/or salt content, and lists potential allergens avoided by some people. Some information is mandatory, such as ingredients, a serving suggestions are non-mandatory.

When buying food, people should closely inspect the la[illegible] to ensure the safety a example:

- people suffering from diabet[illegible] should pay attention to sugar content in the added sugar
- people wi[illegible] weight should pay attention to the amount of fat and [illegible] in the food, and choose foods rich in dietary fibre
- sportsm[illegible] should pay attention to the protein content of the food, etc.

One of the most important elements of a food label is the date mark. There are two types of date mark used on a food packaging: *use by date* and *best before date*. You learnt about them earlier on in this chapter.

Date marks help you to make food choices in the shop as they help you to assess can also support you in deciding whether you'll be able to consume the food bef prevent food waste) and whether you can store it in correct conditions (e.g. you fridge).

You will learn more about nutritional labelling requirements later on in this cours

Things to think about

Discuss what elements of a food label may be important for differe

Check your understanding: bu

1. Which of the following statements is correct about mandatory inform

   a. It is compulsory and required by EU food legislation
   b. It is at the manufacturer's discretion whether to display it or not
   c. It refers to marketing and advertising and is used to tempt consu
   d. It refers to serving suggestions displayed on food products

2. Which of the following statements serves as a rem nder about storage

   a. First out, First in
   b. First in, First o
   c. First in, First on
   d. First is best

3. Which of the foll ments is TRUE? *(1 mark)*

   a. dates refer to dates at which the quality of food is a
   b. st before' dates refer to the safety of food, rather than the qu
   c. se by' dates refer to the quality of food, rather than the safety
   d. Food is still safe to eat after the 'use by' date

4. Describe two ways in which appropriate packaging helps to ensure fo buying food. (*4 marks*)

   1 .....

   .....

   2 .....

   .....

5. State what kind of date mark would appear on the packaging of each o

   a. a chicken and mayonnaise salad .....

   b. breakfast cereals .....

   c. UHT milk.....

   d. unpasteurised orange juice .....

Storing food

Correct storage of food can help to prevent spoilage, bacterial contamination an
non-allergens and **allergens**. Spoilage refers to decay and decomposition of foo
or is in the process of decaying may lose some or all of its nutritional value and n

Did you know?

An allergen is a substance – e.g. an ingredient in food such as nuts, dairy or sulphites – which can cause an allergic reaction in susceptible individuals.

D
Am
food
temp

The points to remember for storage are:

- Keep storage areas clean
- Keep food covered
- Keep food stored at the correct temperatures (dry goods s
  stored between 10 °C and 25 °C)
- Keep food stored off the floor
- Keep storage areas dry and free from mould
- Ensure drainage channels run away from food
- Ensure the storage is lit sufficiently so that damage, and sign
  or spoilage can be seen on food

Food premises should have the following types of storage are :

- **Dry food areas**
- Refrigerator and **cold store**
- Freezers – check fridge and **er temperatures** regularly

When storing f d, e following:

- Air culate between items stored on shelves
- Corr containers are used
- Stock is rotated (**stock rotation**) properly (**First in, First out**)
- Raw food is kept on the bottom shelves
- Warm food is not put in the refrigerator or **cold store**
- Food is not stored in open tin cans
- Soily vegetables, such as potatoes, are stored away from other food in a dark, dry area of the store room

Temperature control

Temperature control is necessary for cooked foods such as ready-to-eat foods **(H**
through the **DANGER ZONE** temperatures of between 5 °C and 63 °C and will not
that will slow down or kill bacteria.

Cooked food should be eaten within:

- two hours – hot food
- four hours – cold food

After this time, the food should be disposed of and not eaten. Food can only b
zone.

Acidic conditions, i.e. a pH of below 4.5, help t in hibit the growth of **pathogenic**
UHT products, do not need temperat co or due to their acidic nature or to t

- However, some foo a higher pH are subject to temperature contro
accordingly.
- It is important to remember that some types of pathogenic bacteria can
produce spores which act as a protective barrier.
- Some pathogenic bacteria also produce toxins which cannot be destroye
cooking.

During the ripening process, cheese exhibits a low pH (acidic) and this helps to p
growing. However, once cheese has ripened, it should be kept in chilled storage
acidity drops, allowing the growth of bacteria. Bacteria cannot grow in temperat
or stop at temperatures below 5 °C. This is why it is important to check the temp
is served.

✓ Cooked meat should be at least 75 °C in the centre or the thickest part of

✓ Beef steaks and other cuts of whole beef and lamb (only whole cuts and no
rare and bloody IF the outside has been properly cooked or sealed to kill

✘ Sausages, burgers, pork and poultry should **NOT** be served or eaten rare
the way through the meat and not just on the outside.

Gravy, sauces and soups should be **simmering** to ensure they are cooked. Cooke
when it cools down below 63 °C and chilled food is in the **danger zone** when the

Combining hot and cold food, such as pouring a hot sauce over cold food, ca
food, either warming it up or cooling it down.

Remember that some of the foods are not ideal high-risk foods due to the risk of
also may contain potential **allergens** for some people. Remember – allergens can

Temperatures to remember:

Hot food	min 63 °C but preferably at least 75 °C in the middl
Cold food	should be kept at 5 °C or less (chilled food prefera
Reheating food	min 75 °C but preferably at least 82 °C
Cooling food	10 °C or lower within 90 minutes
Freezing	-18 °C
Thawing temperature	between 0 °C and 8 °C
Delivered chilled food	should be at a temperature of 8 °C or below, and f should be at -12 °C or below

Microorganisms multiply the fastest at temperatures between five degrees centi
centigrade (63 ˚C). This is important as ensuring correct temperatures during sto
shelf life of foods.

Danger zone	Human body temperature	Cooking	
5 ˚C – 63 ˚C	37 ˚C	at least 75 ˚C	at least 75 ˚ recommended

If reheating food at 82 ˚C will adversely affect the food, then cooking at temperat
two minutes should be sufficient to kill bacteria.

Temperature control is important for [illegible] high protein food, such as chicken. Most high-risk food [illegible] protein and high in moisture.

[illegible] you know?

Food can only be reheated once.

Did you know?

Cooked hot food prior to s
held at temperatures of at l

Ambient storage

Ambient storage refers to food stored in sealed containers at room temperature
ambient temperature is referred to as *shelf-stable food* and this usually has a lon
preservation processes and packaging used). To make food shelf-stable and able
temperatures, it must undergo various processes, such as dehydration or dessica
(or chemical preservatives), or be subjected to very high temperatures (pasteuris

Refrigeration and freezing

Some foods should be stored at very low temperatures in order to maintain thei
may be quickly cooled down with the use of blast chillers, and then stored either
time only) or in a freezer.

Refrigeration

It is important that the temperature of a fridge does not rise above 5 ˚C.
The refrigerator temperature should be checked regularly and, if it exceeds the required temperature, your supervisor must be informed, as the food may need to be disposed of and not eaten. T[illegible]intain the temperature of a refrigerator, ensure that:

- it is not overstocked
- the refrigerator door is [illegible] opened too frequently or for too long
- wa[illegible] is stored in the refrigerator

Alth
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According to legal regulations, chilled food must be stored below 5 ˚C.

Research

To find out more on food safety, temperatures and storage visit the Governm
Agency website using the redirect URL **zzed.uk/8252-food.gov**

Cooling food

To prevent the temperature from rising above 5 °C, hot or warm food should never be placed in a refrigerator but should instead be cooled as quickly as possible through placing it in a large shallow dish (or several smaller dishes) and stirring to distribute heat.

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tem

Because hot food goes through the **danger zone** when it cools down, ensure that cooked food takes no longer than 90 minutes to cool down.

To help the cooling process:

- transfer the food to a larger dish
- stir frequently
- use a **blast chiller**
- divide it into smaller pieces
- place the container with the food in cold water
- store it in a cold store or garden

Defrosting

Frozen food should be defrosted in a chilled area, refrigerator or **cold room** before cooking. As chicken defrosts and thaws, liquid/juices will be released. It is important that defrosting takes place on the BOTTOM shelf to avoid juices dripping onto other food items. Some food items may require a bowl or other container to contain the juices. Most microwaves have a defrost function but this should only be used to defrost food items that will be cooked immediately; otherwise, defrost slowly in a refrigerator. Meat should be eaten within 24 hours of thawing.

Although you should never refreeze raw meat, fish or poultry that has been defrosted, you can refreeze defrosted items if cooked first.

Freezing

Frozen food must be kept at -18 °C or lower and thawed using manufacturer's instructions. Once thawed, **HIGH-RISK** food should be cooked at the required temperatures. **Freezing** at these temperatures slows down the growth of **pathogenic bacteria** and helps to prevent spoilage bacteria from causing decay.

Frozen food goes through the **danger zone** when it thaws, so it is important that it does not remain frozen while the outside of the food thaws. Some large items of frozen food are thawed slowly at room temperature.

Appliance	Temperature
Refrigerators	5 °C or below; most caterers set their fridge to lower than 5 °C in case of leaving the fridge door open
Freezers	-18 °C or below
Note: The temperature of appliances should be checked regularly. If temperatures have risen above these figures, then your supervisor must be informed. Food may have to be disposed of and not used.	

Packaging and covering food

Storing food correctly is key to ensuring its safety. If raw or cooked food is not p
lidded box or cover it, e.g. with cling film. Covering food is important as it:

- protects the food in question and prevents foods from contacting each
contamination)
- prevents any leaking juice from dripping onto other foods –
this applies especially to raw meat
- protects the food from oxygen and prevents oxidation
- prevents the food from taking the smell of other products
stored in the same area – and vice versa.

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Did you know?

Freezing food at the re ed temperature of -18 °C does not guarantee th
although at b ria go/remain dormant. Bacteria may still be present and
moisture o or a combination of these elements, bacteria start to grow an

Check your understanding: st

1. Which of the following statements about ambient storage is TRUE? *(*
   a. It is at freezing temperature ☐ b. It is at boiling
   c. It is at room temperature ☐ d. It is at human

2. To which of the following temperatures should a freezer be set? *(1 m*
   a. -10 °C ☐ b. 5 °C ☐ c. -12 °C

3. HOT cooked food (if not refrigerated) should be eaten within: *(1 ma*
   a. 2 hours ☐ b. 1 hour ☐ c. 4 hours

4. Describe two ways in which appropriate packaging supports food safe

   1 .....

   .....

   2 .....

   .....

5. Explain why temperature control is important for food such as chicke

   .....

   .....

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   .....

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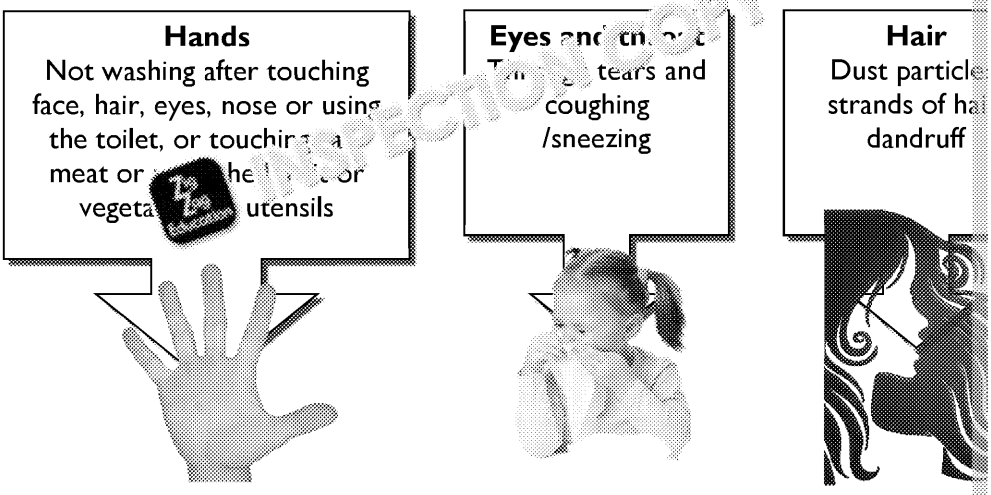
   .....

Pathogenic bacteria which find their way into foods can cause food spoilage (inc
poisoning (in direct and indirect ways). It is very important to distinguish the hig
microorganisms they can contain, and take appropriate steps when preparing, se
their negative effect on food and human health.

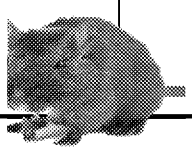
Bacterial contamination

Bacteria can be transferred from people to food in the following ways:



Other ways in which bacteria can be transferred are shown in the table below:

Animals	Dust	Water	So
Animals can carry bacteria in their saliva, their urine and in their hair/fur. This includes domestic pets as well as mice, rats, cockroaches and other pests. Animals can transfer bacteria to food in the following ways – mice leave traces of urine after running across food; flies vomit int nt alight on fo ter visiting bins, food waste and excrement.	Bacteria can exist within tiny particles of dust which fall off humans or animals as dead skin cells or from hair or clothes. Dust contains food, moisture and dirt which we may not be able to see when it settles on food.	Untreated water can also contain **pathogenic bacteria**, and some foods, such as shellfish, which feed by filtering water, can become contaminated by dirty water.	Soil also co **pathogenic bacteria** w be present unwashed vegetables grains, suc and pulses



Sources of contamination

Contamination may occur in the following ways:

- From unwashed fruit or vegetables – soil and dirt
- From raw food – cross-contamination occurs when raw food is stored wit high-risk food or when juices or fluids from raw foods drop onto high-risk Cross-contamination also occurs via hands or utensils if they touch raw fo

Bacteria can live on hands, work surfaces, containers, cutlery, utensils and equipment, and towels and cleaning cloths.

When food spoils, it is decaying or decomposing, and this can occur through natural ageing or through microbial contamination with bacteria, mould or yeast. Spoilage can be slowed down by refrigerating food, handling food properly and storing it at the correct temperatures. Any member of staff who handles food, and their work surfaces, equipment, etc. must practise good personal hygiene and keep their hands clean.

Types of bacterial food poisoning

Food poisoning is caused by contamination of food or water with various species different living conditions, and for that reason we can usually guess what type of if we know what a person has eaten. Types of food poisoning bacteria are listed

Type	Cause
Salmonella	Raw or undercooked poultry, eggs, dairy products, raw beansprouts
Staphylococcus aureus	Undercooked or badly stored meat, not chilling sufficiently, eating foods handled by someone infected with *Staphylococcus aureus*
Campylobacter	Raw or undercooked meat (particularly chicken), unpasteurised milk, untreated water
E. coli	Undercooked meat (beef), unpasteurised milk, raw beansprouts
*Listeria**	Ready-to-eat foods and also soft cheeses
*Clostridium perfringens**	Undercooked beef and poultry
*Bacillus cereus**	Rice and other leftover foods left to cool at room temperature

*these are not required by the specificati

Food poisoning is most likely to be caused by bacterial contamination from untre and the foll ra or insufficiently cooked foods:

- Me icularly *E. coli* – beef)
- Poultry (particularly *Campylobacter*)
- Eggs (particularly *Salmonella*)
- Seafood
- Vegetables
- Unpasteurised milk (particularly *E. coli* and *Campylobacter*)
- Ready-to-eat foods (particularly *Listeria*)
- Raw sprouted seeds (e.g. beansprouts)
- Cooked rice left to stand at room temperature

Bacterial contamination can occur through the following:

- not storing, cooking or chilling properly
- allowing cooked food to cool down gradually and go through the **danger**
- not reheating at correct temperatures to kill bacteria
- being touched or handled by someone who is unwell or does not practise
- allowing food to go past its 'use by' dates
- cross-contamination between cooked food and raw food (e.g. fluid from food)

Rice and reheating

Spores containing the bacterium *Bacillus cereus* exist on rice, which can cause food poisoning. When left to cool at room temperature, the **spores** multiply and produce toxins. Ideally, leftover cooked rice should not be allowed to cool or be reheated but, if necessary, it should be refrigerated and then reheated until piping hot.

Symptoms and treatment of food poisoning

Food poisoning can be caused when bacteria grow in large numbers in food, or by viruses transferred from people or animals, or by toxic moulds. Food poisoning can also be caused by poisonous plants and fish or from contamination from chemicals or metals. The symptoms of food poisoning are:

- vomiting
- diarrhoea
- stomach ache and stomach cramps
- high temperature and fever
- aching muscles, chills and weakness

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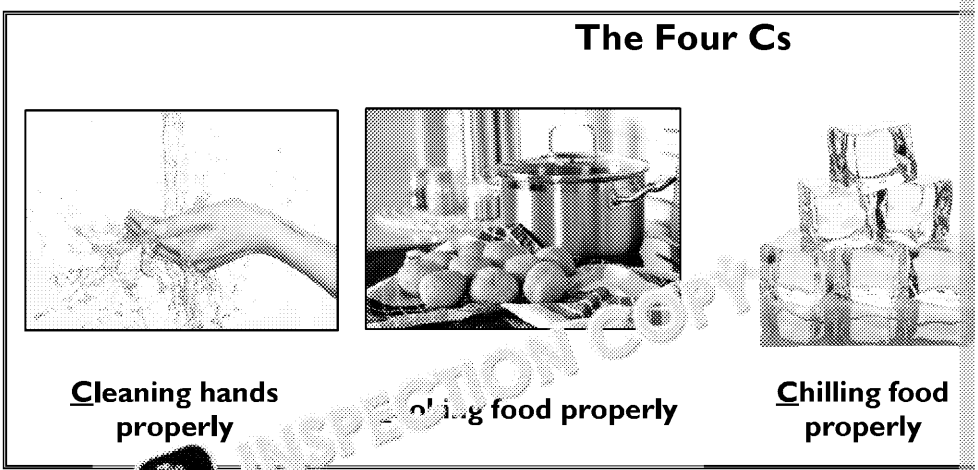
The four 'C's

The Food Standards Agency advise that food-borne illness / food poisoning can be four 'C's of food hygiene: **C**leaning, **C**ooking, **C**hilling and avoiding **C**ross-contamination these later on in this section.



Research

Look up food poisoning *on* the Government's Food Standards Agency website redirect URL **zzed.uk/8252-food-poisoning-2**

Things to think about

What is the cause of food poisoning (*E. coli* and *Salmonella*) fro can it be prevented?

Food safety

Food safety is about making sure that food is safe to eat. This means making sur
clean, that food handlers follow effective **personal hygiene** procedures, that foo
that it is eaten within its 'use by' date, that it is cooked or reheated using the **cor**
chilled, thawed or frozen correctly.

To make sure that food is safe to eat, we must make sure that we use the correc
understand the importance of **personal hygiene**.

Unsafe food handling can result in illness or death caused by the following:

- food poisoning
- chemical and physical contamination
- food spoilage
- allergic responses and/or [illegible] shock

The consequ[illegible]s o[illegible]ood hygiene could be:

- cor[illegible]tion claims from customers
- pest[illegible]ats, mice, insects, birds, etc.
- food poisoning / fatalities
- food contamination and wastage
- legal action and closure
- bad publicity on review sites and social media
- loss of profits, leading to redundancies

An emp
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Environmental Health Officers (EHOs) have the right of entry and the power t
prosecute if necessary. An EHO can sample and examine food, examine recor
and serve notices.

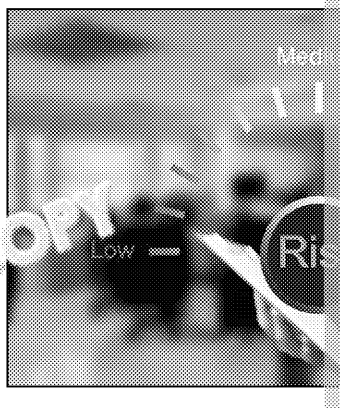
Reporting sickness

To prevent food poisoning or bacterial contamination of food, it is important tha
supervisor. It is a legal requirement to report certain illnesses to the health auth
and management need to be kept informed by their staff.

You must report the following to your supervisor:

- diarrhoea
- vomiting
- sickness and nausea
- ear, eye, nose discharge
- a septic cut, wound or other skin condition
- any other skin condition or infection

You must also tell your supe[illegible] if a[illegible]yone who
lives with you has a[illegible] above symptoms, as
you may be[illegible]er



*You have a responsibility t
maintain food safet*

Things to think about

Why are pregnant women at higher risk from food poisoning?

Personal hygiene

Bacteria can live on hands, **work surfaces**, containers, cutlery, utensils and equip
cloths.

Any member of staff who handles food, utensils, **work surfaces**, equipment, etc. m
hygiene and keep their hands clean. This means washing your hands:

- before you start work
- before you touch **high-risk** food
- between handling raw food and cooked food, e.g. peeling potatoes and t
- after handling raw food
- after going to the toilet
- after touching any part of your face, body and hair
- after coughing, sneezing, blowing your nose or wiping your eyes
- before and after eating and drinking
- after handling rubbish, e.g. bin smells
- after performing cleaning jobs or handling containers or chemicals
- after touching with food waste or rubbish

The hand-washing basin should be used exclusively for hand washing and not be u
There should be liquid soap, hot water and paper (disposable) towels available.

Outdoor clothes are a contamination risk as they can transfer dust, soil and dir
Remember: hair, dust and soil can carry bacteria.

Ideally, to prevent contamination from outdoor clothes, light-coloured protect
food handling area (light coloured so any spillages or marks can be seen). A ch
be available for changing from outdoor clothes into protective clothes. Hair sh
with a hat.

What you wear:
To ensure that you do not drop fibres, hair or other foreign objects into food, wear protective clothing or an apron and tie your hair back (if your hair is too short to be tied back, use an Alice band) or use a hairnet or cap to keep your hair in place. Remove jewellery – gemstones from earrings could fall out and land in food, and rings harbour bacteria. Do not wear nail varnish or false nails, and keep nails short and clean.

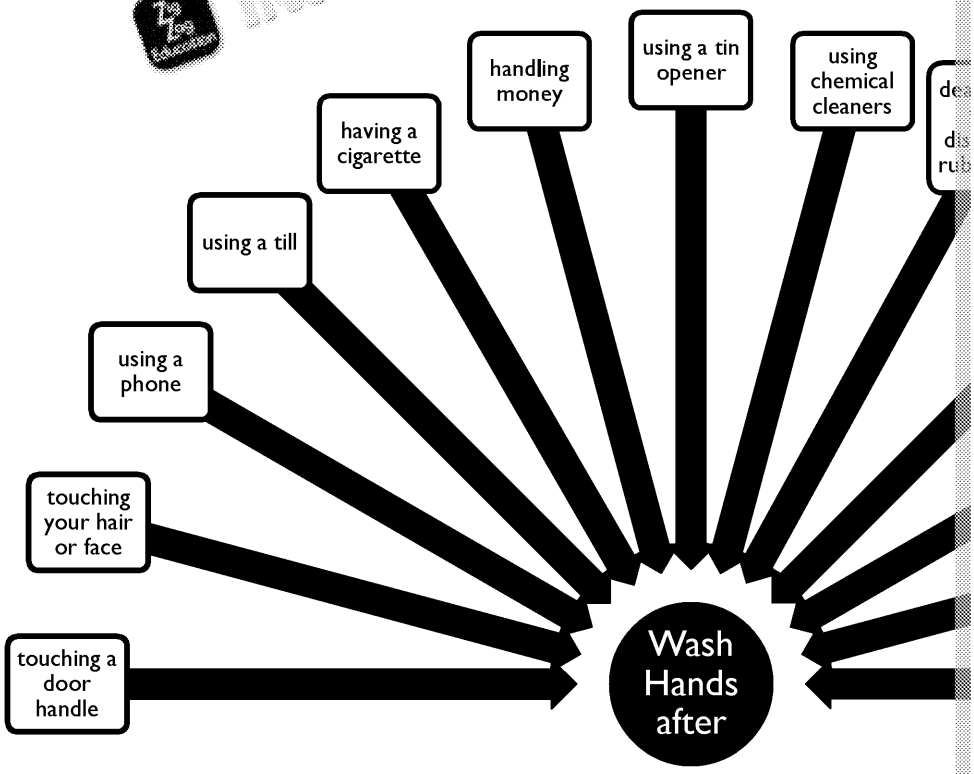
Cuts, boils and rashes:
If you cut yourself, pla a brightly coloured waterproof sticking plaster over the cu o not touch spots, rashes or boils.

Hand washing:
Wash your hands before and after handling food.
There should be washing facilities provided with hot and cold water, liquid soap and paper towels. This sink should be used exclusively for hand washing and not be used for washing dishes or vegetables.

Food handling area – dos and don'ts

Do	
✓ go outside the food handling area to blow your nose	✗ blow your nose the food handli
✓ wash your hands after blowing your nose	✗ touch any part your nose or mo head or touch yo
✓ take your breaks away from the food handling area	✗ use your finger clean spoons ar
✓ wash your hands before handling food	✗ use a tissue in a nose on your sle
✓ wash hands after touching hair or any part of body	✗ breathe on glas

You should wash your hands after:



Smokers should remove their protective clothing/apr[illegible] or smoking and also e[illegible] be transferred to food.

Hands should also be washed after doing the following:

- touching w[illegible]es which have not been cleaned properly
- eat[illegible]rinking
- hand[illegible]aw eggs in their shells

Remember: Wash your hands thoroughly when you start work and before to[illegible] food. You must wash your hands between touching high-risk food and raw foo[illegible]

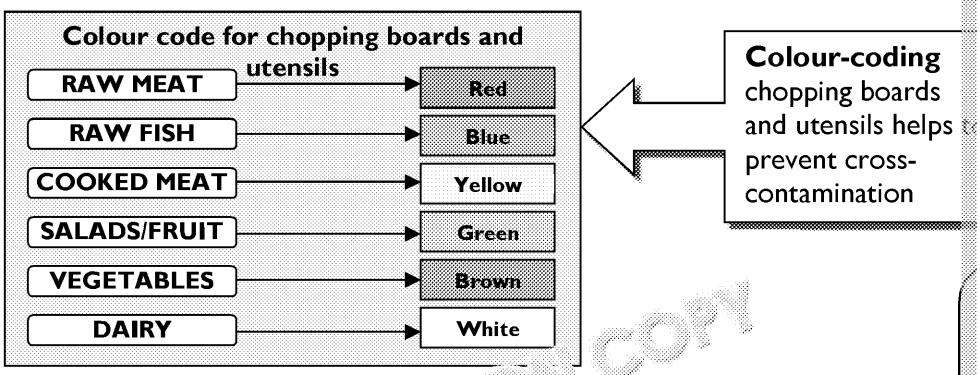
Correct hand-washing technique

Wet hands thoroughly and add a blob of liquid soap (more hygienic than a bar
rub over backs of hands, rub between fingers and thumb, rub across your nails
Rinse and dry with a disposable paper towel (ensure your hands are totally dry
environment on which to grow). Turn off the tap using the paper towel, and t

Cross-contamination

Using separate utensils

Equipment and utensils such as knives and chopping boards should be colour-co
contamination. For example, only use a chopping board and knives that are colo
green for salads and fruit. This helps to prevent bacteria being transferred from



Colour-coding chopping boards and utensils helps prevent cross-contamination

Ensuring that equipment and surfaces are kept clean and free from damage will help to prevent **cross-contamination**.

Clean utensils after chopping raw meat to prevent bacteria transferring from the meat to the chopping board or work surface and utensils. This helps to prevent **cross-contamination** of foods.

It is important that raw foods and high-risk foods are stored separately so that cross-contamination does not occur. For example, do not place raw meat on a shelf above other food, especially high-risk foods, as juices could drip onto the items stored on shelves below.

Keep stored food covered.

Chicken and poultry should never be washed before cooking as water droplets from the chicken can splash bacteria onto work surfaces, utensils or food.

Skills

1. Demonstrate knife skills to prevent cross-contamination.
2. Demonstrate washing and drying fruit and vegetables to prevent food
3. Prepare, combine and shape wet mixtures (e.g. falafel, fish cakes, meat
of cross-contamination and correct handling of high-risk foods.

Separating raw and cooked foods

To prevent **cross-contamination**, raw foods such as u ed meat (e.g. chicken) should not be prepared or stored with cooked fo ds e.g. **high-risk** foods such as rolls.

Other ways to prev mination:

- Ke covered
- Kee covered, and empty them when required
- Store food safely
- Check for damaged packaging on deliveries
- Keep doors and window screens closed to prevent **pests**
- Clean work surfaces regularly
- Clean up spillages and dispose of food waste promptly

Did y

It is easy t probe is w checking t boiling wa be 100 °C, should be

Checking temperatures

It is important that temperatures of freezers and fridges are checked daily. **Tem** should be positioned on the outside casing of appliances, such as ovens, refriger so that temperatures can be seen and recorded easily.

It is also important that **temperature probes** are used to record the temperature **centre (or thickest part)** of meat to at least 75 °C or 82 °C if reheated. Temperatu should be recorded. You can also check the temperatures of food on the oven g the food is being cooked.

Temperature probes should be calibrated on a regular basis and cleaned after e

Other ways to test food for readiness and/or to ensure it is safe to eat:

- With a knife/skewer
- Finger or poke test
- Taking a bite
- Visual checking

Thing k about

cu how cross-contamination can occur between different fo

Skills

1. Use a temperature probe (to ensure food is safe to eat).

Skills

1. Use a knife/skewer, bite, sou poke test to test the readine ensure food is safe to eat).

Using correct cooking times

We have looked at the correct temperatures at which to cook and reheat food, b
times is also vitally important to food safety, especially when cooking red meat a
reach at least 70˚C for a minimum of two minutes.

Although some foods are safe to be blanched briefly, most foods must be cooke
recommended cooking times to ensure safety.

Lower cooking temperatures can be used so long as the food is cooked for the re
temperature. The core temperature of food should be kept at the following leve

Temperature	Duration
[illegible]	At least 45 minutes
65 °C	At least 10 minutes
70 °C	At least 2 minutes

Leave food to stand for a minute after cooking as the temperature will either sta
thereby killing bacteria.

Cleaning

It is important that food handling areas are kept clean to ensure that **cross-conta**
surfaces should be cleaned frequently by removing food debris and then disinfec

Work surfaces and equipment include:

- chopping boards
- preparation areas
- tables
- machinery
- utensils
- containers

Skills

1. Use a bl
(ensurin
cleanline

Worktops should be smooth and non-porous, and wood should be avoided unless fully washable.

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Disinfection should be performed after cleaning (remove debris, dirt and grease first) and for the correct contact time (as stated on the manufacturers' instructions).

- Detergents dissolve grease and loosen debris – det[illegible]ts do NOT kill bacteria.
- Hot water at 82˚C or above, such [illegible] high temperatures in dishwashe may kill some bacteria [illegible]
- Steam can also [illegible] kill some bacteria.
- San[illegible]ar[illegible]mbination of disinfectant and detergent *but should on be [illegible] lightly soiled areas.*
- Chemical disinfectant (e.g. bleach) is required to KILL bacteria.

Did you know?

Cleaning cloths should be changed after wiping a surface that has been used fo
meat and also after wiping up spills (e.g. raw egg or soil from root vegetables).

Cleaning schedules

Food premises should have a cleaning schedule in place which will detail the follo

- What to clean
- How often it should be cleaned
- Type of cleaning required
- Who is responsible for cleaning

Clean, clean, clean…

- ✓ All areas in a food handling area should be cleaned regularly throughout th special care should be taken on surfaces where raw food or high risk food placed. Work surfaces must be cleaned between using for raw food and h
- ✓ Temperature probes should be cleaned after each
- ✓ Items that are regularly touched should be cleaned such as handles and sw cleaned after each use for different fo
- ✓ Mops and cloths need to be washed to prevent multiplication of bacter stored away from fo
- ✓ Bins should be emptied regularly and kept covered, away from food. Outs over should be kept covered with tightly fitting lids so as not to a

The correct way to clean

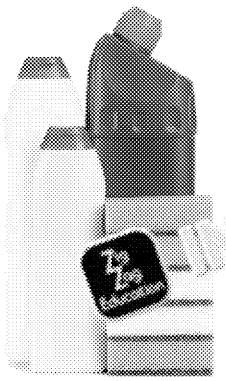
Some food premises use a two-sink method when washing dishes. This enables t debris and to clean dirt, and then rinse in a second sink with hot water at 82 °C. T procedure below:

- Remove food debris from soiled areas or from pots, pans and crockery
- Wipe the area or wash with hot water and detergent to remove dirt and
- Rinse the area or rinse items with hot water to remove traces of deterge
- Disinfect the area or items using a chemical cleaner for the prescribed co
- Use a final rinse of clean hot water
- Avoid using cloths to dry dishes as they may harbour bacteria. If hot wat rinse, then the moisture will evaporate if left to dry in the air.

Taking care

Take care when cleaning, and take the following precautions:

- Keep food covered or well away from areas that are being cleaned to pre
- Wear protective clothing, gloves, masks and goggles if necessary
- Do not mix cleaning agents together – this is **DANGEROUS**
- Store chemical cleaners, cloths and mops away from food
- Always wash your hands after cleaning and before you touch food



Breathing vapours from e detergents can ir

Chemical cleaners can be a source of skin irrita

Chemical cleaners or vapours can irritate the e

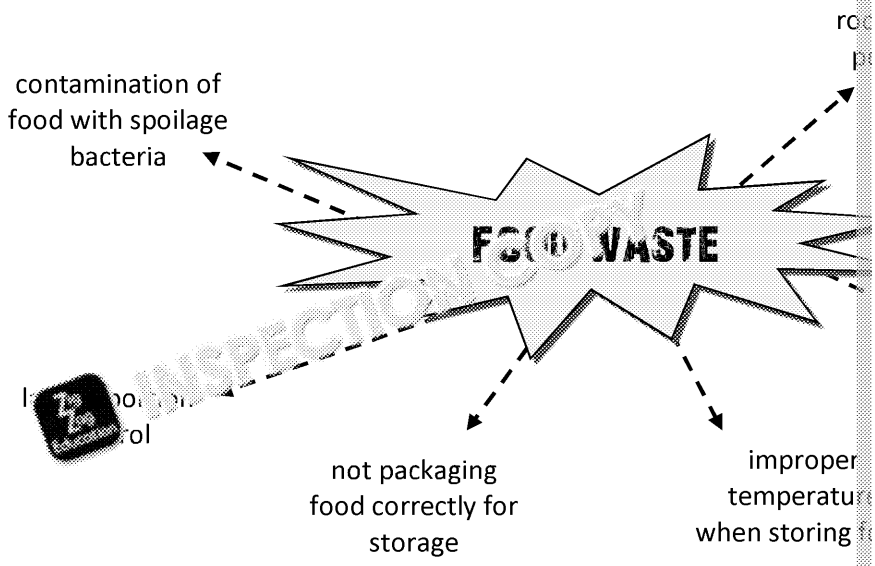
Chemical cleaners (such as bleach) can ruin clo

Research

To find out more about cleaning schedules go to *the* Government's Food Stand website using the redirect URL **zzed.uk/8252-food.gov**

Food waste

You already know that mishandling food may cause food poisoning or an allergic
handle food correctly may also lead to food waste. Some of the reasons for was
diagram below.



It is important for food outlets to prevent food waste, as it may cause serious fin
business, increase recycling costs and reduce clients' trust. Food waste also pose
environment. This will be covered in more depth in 'Where Food Comes From'.

Check your understandin
preparing, cooking and servi

1. Which of the following statements about bacterial transference is FALSE?

   a. Mice and rats can transfer bacteria to food ☐ b. Domestic pets
   c. Bacteria can exist in dust particles ☐ d. Bacteria can ex

2. Which of the following DON'T you need to tell your supervisor about?

   a. Vomiting ☐ b. Diarrhoea
   c. Sickness ☐ Toothache

3. Why should light-coloured cl[illegible]orn in the kitchen? *(1 mark)*

   a. They look ni[illegible] ☐ b. So that the public can te
   c. T[illegible]and marks ☐ d. So that the restaurant's l

4. Wh[illegible]OULDN'T you need to use separate utensils? *(1 mark)*

   a. Between preparing fruit and salad ☐ b. Between preparing ra
   c. Between handling raw fish and eggs ☐ d. Between handling dai

5. The four Cs represent which of the following? *(1 mark)*

   a. Cleaning, Cooking, Chilling, Cross-contamination
   b. Cleaning, Cooking, Containing, Cross-contamination
   c. Cleaning, Cooking, Cold-storing, Cross-contamination
   d. Cleaning, Cooking, Chilling, Cross-transferring

6. Explain why correct cooking times are important when preparing, cooki

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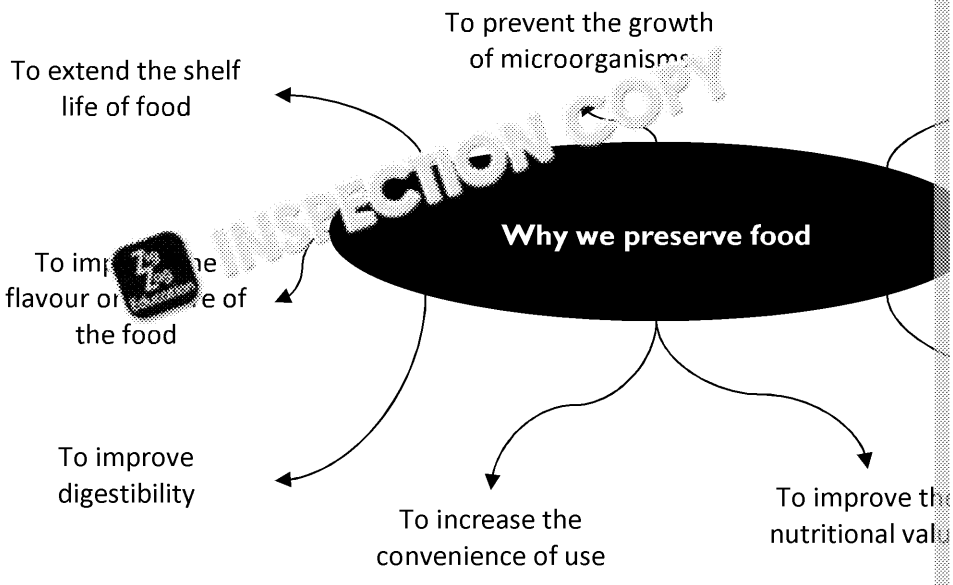
Preservation methods used to keep fo

Personal hygiene, correct cooking times and care when handling high-risk foods a ensuring food safety. As applying food hygiene rules prevents cross-contaminati edible for longer. For centuries, people have been using various preservation me know no fresh food will be available for the forthcoming months. Thanks to glob transportation, we can enjoy fresh foods all year long. However, many people st make them at home). The diagram below shows different reasons why people p



Freezing

Freezing means that a food is stored at temperatures below 0°C (home freezers usually are set to -18°C; industrial freezers can use lower temperatures or liquid nitrogen). At such low temperatures, the water turns solid, and so-called water activity decreases. This means that bacteria and other microorganisms lack the basic nutrient (water) and cannot multiply. This method has been used since ancient times (before the agricultural revolution) during cold winter months.

Drying

In the past, drying was performed during the summer months, as the hot rays of quickly and efficiently. The development of technology allows us today to dry fo nutritional value. Drying means that water is removed from the food, so it is not microorganisms – and that stops them from multiplyi y, dried foods such preserved with the use of preservatives to ext n th elf life even more. The include dried milk, beef jerky and rai

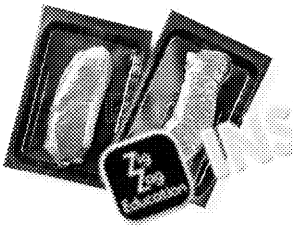
Pickling

Food can b d brine (solution of water and salt) or in vinegar. Pickling significantly s the texture, appearance and flavour of the food. The pickling solution often contains flavourings, such as garlic, horseradish, bay leaf, black peppercorn or cloves to improve the flavour of the final product. It is worth mentioning that foods pickled in brine undergo bacterial fermentation. As a resu lactic acid is produced. This has many health benefits, as it promotes the growth of probiotic bacteria in the large intestine and improves digestion.

Bottling

Bottling is used to preserve liquids, such as fruit juices, milk or beer. During bottling, glass or plastic bottles are washed, and then the liquid is poured into them on a bottling line. Often, the bottle is then closed with a seal (usually made of aluminium foil) and only after that is the lid put on the bottle. The seal and lid close the bottle tightly, so that no air can get inside. This is important as it prevents oxidation. You can often notice that bottles are darker in colour (e.g. vanilla extract, syrups, medicine) – this is to protect the liquid in them from the sunlight. Once the bottles are filled and closed, they are often additionally pasteurised to ensure harmful bacteria are killed and cannot spoil the food.

Vacuum packing



In vacuum packing, all air is removed from the container kept. Afterwards, the package is sealed. Vacuum packaging life of food by removing oxygen and limiting oxidation and organisms. Unfortunately, it does not prevent microorganisms. To additionally protect the food it is filled with nitrogen – consequently, they don't get crushed transportation.

Jam making

Jam is a thick mixture made of fruit and sugar. To prepare a jam, you need to wash and crush the fruit, and then simmer it with sugar. During cooking the fruit releases pectin, which is a natural gelling agent. Release of pectin can be improved by adding a little lemon juice. As some fruit is low in pectin, food factories may decide to use powdered pectin, agar-agar or other gelling agents to thicken the mixture. To make sure that the jam keeps for a long time, you need to ensure the following:

- high content of sugar – it is a natural preservative and keeps moulds and bacteria at bay; this is because sugar binds water, which then becomes unavailable (remember they cannot grow without it!)
- thorough cooking – high temperatures help to kill microorganisms which may spoil the food
- clean jars and lids – ideally, they should be sterilised before pouring the jam in

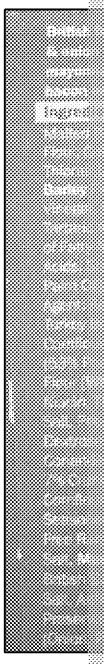
You can also choose to pasteurise the jam after it has been closed in the jars – to do so, in a large saucepan, pour some water in so that it reaches two-thirds the height of the jars, and simmer for around 30 minutes.

Preservatives

Preservatives are natural or artificial agents which are not an ingredient of a recipe, but are added to food to enhance its shelf life, e.g. by preventing bacterial growth or oxidation. Preservatives can be divided into antimicrobial preservatives (they prevent the growth of microorganisms, e.g. by lowering the pH of food) and antioxidants (which prevent oxidation). The most popular preservatives include sulphur dioxide, which is considered a major food allergen, and is found in dried fruit and wine; nitrates and nitrites are used in cured meats; and sodium benzoate is added to a wide range of foods (such as salad dressings and sauces). Antioxidants include ascorbic acid (vitamin C, added to fruit juices), and tocopherols (vitamin E, added to baked goods).

Apply

Inspect packages of various food products to see what kinds of preservatives are added to them.



Food labels

Check your understanding: preserva

1. Which statement is FALSE about vacuum packing? *(1 mark)*

   a. It removes all air from the package ☐ b. The package must
   c. It prevents growth of aerobic bacteria ☐ d. It prevents growth

2. Pickling food in brine increases the amount of which nutrient in food? *(1*

   a. Sodium ☐ b. Glucose
   c. Protein ☐ d. Fat

3. Which of the following foods CANNOT be preserved by drying? *(1 mar*

   a. Milk ☐ b. Grapes
   c. Eggs ☐ d. Vegetable oil

4. Which of the following is the preservative in jams? *(1 mark)*

   a. ☐ b. Pectin
   c. Water ☐ d. Apple juice

5. Describe how three preservation methods help to prevent bacterial co
   (*6 marks*)

   1 .....

   .....

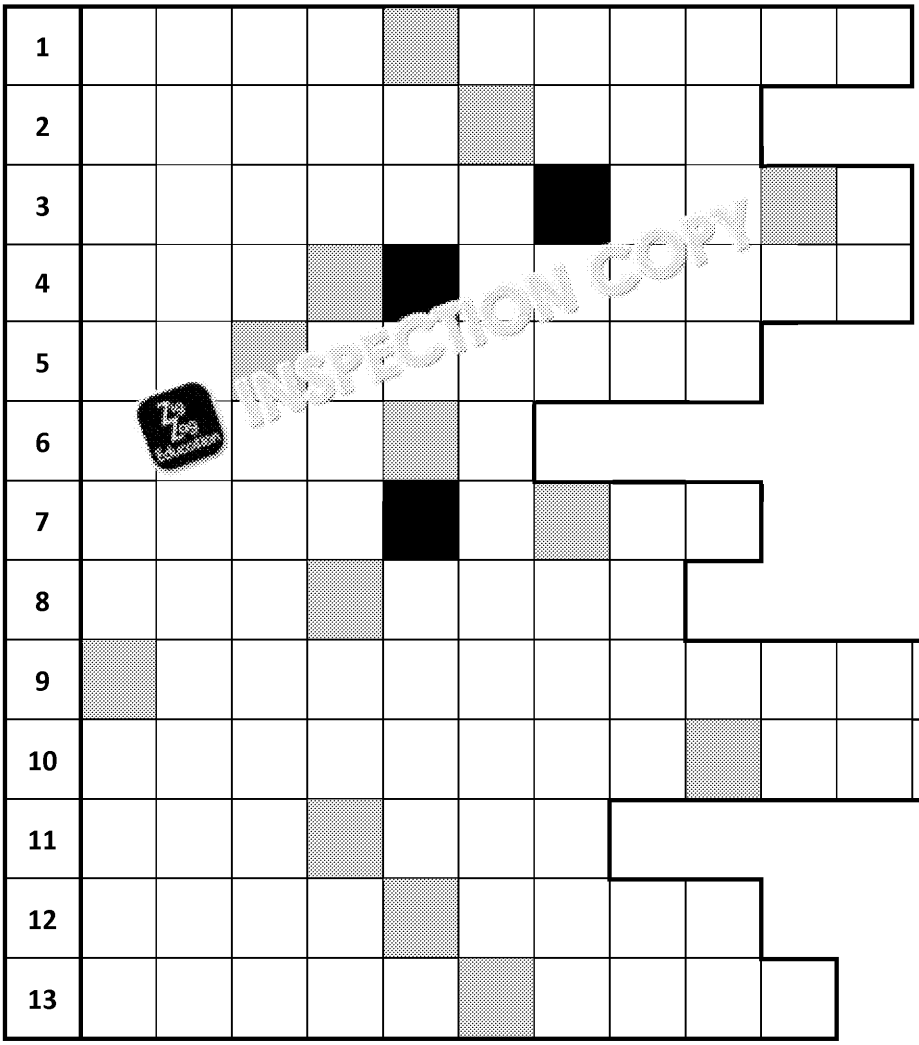
   2 .....

   .....

   3 .....

   .....

Fill in the answers to the questions below to reveal a phrase relevant to food scie
black squares are spaces).



1. Type of mould used in production of blue cheese (11)
2. Dangerous toxin produced by certain mould types (9)
3. A term used to describe the range of temperatures in which microorganisms
4. Date mark which applies to food quality (4, 6)
5. One of the digestive symptoms of food poisoning (9)
6. Protein-based catalyst which speeds up chemical reactions (6)
7. Ready-to-eat foods are referred to as _ _ _ _? (4, 4)
8. When a food takes on the smell and taste of another food product (8)
9. ____ wipes or sprays can inhibit or kill bacteria (13)
10. Something added to foods to extend the shelf life (12)
11. Room temperature is also referred to as this (7)
12. The 'bad' bacteria which cause food spoilage and poisoning (9)
13. The type of bacteria commonly associated with eggs (10)

The shaded squares reveal this word:

_ _ _ _ _ _ _ _ _ _ _ _ _

Answers – The effect of cookin

Why and how food is cooked

Things to think about (p. 4):

- Examples could include deep-fried foods, such as chips, which are high in fats. T bile has to be produced in the gall bladder, and that puts extra strain on the live boiling before frying so that the surface of the food is sealed and the food doesn't
- Also, raw vegetables might be difficult to digest for some people due to high ins be best to steam or boil them to break down some fibre and improve digestion.

Things to think about (p. 5):

1. Students should note that foods which are froz ua have longer date mark as raw fish and fish salad. Students sho e that highly processed, steri labelled with a 'best before' dat r than a 'use by' mark.
2. Students should draw a si that a 'use by' date mark is used on fresh, ea processed) food while a 'best before' date mark is used on foods whic in a wa rom them from external factors and significantly extends thei

Things to think about (p. 9)

Examples could include the following:

- Fish pie – preparation of this dish includes several steps, such as poaching fish (c potatoes (conduction, convection) and making cheese sauce (conduction, convec prior to assembling the dish helps to shorten the baking time (radiation, conduct obtain the desired texture of the dish (potatoes are soft, fish is not 'leaking' juices
- Braised pork – in braising, food is first lightly fried, which helps to 'seal' the surf the dish moister; then, the food is roasted or simmered for a long time at a low t the desired soft, melt-in-the-mouth texture.

Things to think about (p. 15):

Examples could include:

	Advantages	
Boiling	• Low-calorie • No added fat • Quick	• Vitamins d when drai • Loss of vit • Loss of col
Steaming	• Preserves the nutritional value of food • Low-fat • Food becomes tender • Hard to overcook	• Can't be us pork, as it
Simmering	• Develops the flavours • Helps to obtain a desirable texture • Helps to cook the food evenly throughout • Helps to obtain the desired texture by evaporating water the food be om thicker	• Time-cons • Can cause
Blanching	• Helps to preserve th nal value and colour of the ood • Qui	• The food d remains ha
Poaching	od for preparing delicate ingredients • Helps to preserve the texture of the food • Food remains juicy	• Can't be us meat, as th • Vitamins c then drain
Braising	• Seals the surface so the food remains juicy • Improves the texture of the food	• Time-cons • Causes vit temperatu
Baking	• Creates an attractive crust • Develops flavours through dextrinisation and caramelisation • Improves palatability of food	• Time-cons • Food may too high o • The long c temperatu

	Advantages	
Roasting	• Creates an appetising crust/surface • Helps to lower the calorific value of food as fat melts and leaks out of it	• Causes vita… temperatu… • Time-cons… • Can increa… extra fat is …
Grilling	• Usually quick • Usually low-fat • Helps to preserve the nutritional value of food	• May create … to the very …
Dry-frying	• Very quick • Helps to preserve the nutritional value of food • Helps to lower the calorific value of food	• Very high t… to burn ver…
Shallow-frying	• Creates a crunch… st… • Helps to … an appetising colour • Se… st…face so the food remains juicy	• Increases c… • High temp…
Stir-frying	• …y quick Helps to prevent the nutritional value of food • Low-fat • The food remains crunchy • The colour of food (e.g. broccoli) is usually preserved	• Can't be us… pork, as th…

Check your understanding

1) B **2)** D **3)** A **4)** C (1 mark for each correct, max. 4 mark…

5) 1 mark for each correct, max. 3 marks
Any three from (1 mark for each, max. 3 marks):
- To make food safe to eat
- To prevent bacterial contamination of food
- To improve/aid digestion of food
- To improve the texture of food
- To improve the taste of food
- To improve the appearance of food

Other suitable answers may be accepted.

6) 1 mark for each correct statement, max. 4 marks:
- During baking, heat is transferred to food through radiation (from the ove…
- Also, the heat is transferred through conduction directly from the baking t…
- When baking a lasagne, the water from sauce is absorbed by starch in the p…
- Thanks to contact with water, the starch in the pasta begins to gelatinise.
- The pasta changes its texture from hard and dry to soft and moist.
- The cheese on top melts.
- The cheese also changes its colour to golden/brow… …nks to the Maillard …
- The meat in the sauce tenderises and softe…
- The aroma of the lasagne becomes … i… te…se.
- Since tomato sauce usually c… …ns… …e sugar, the sugar may begin to car…
- Cooking allows the m… …ure … …n the sauce to be absorbed by the pasta, al… final texture (s… …t …, not runny).

Other s… …e a… …s may be accepted.

7) Any tw… (1 mark each, max. 2 marks):
- Frying helps to seal the surface of the meat, thanks to which it stays moist/…
- Frying helps to create an attractive, brown colour / improves the appearan…
- Stewing helps to soften and tenderise the meat, as the protein in it will den…
- The long time and high temperature of cooking will cause vitamin loss (gro… sensitive to heat)
- Addition of fat during the first step of braising means that the calorific valu… amount of fat in the dish will increase.

Other suitable answers may be accepted.

Things to think about (p. 20)
Examples could include:
- baked goods (bread, bread rolls, buns, croissants)
- alcoholic beverages (beer, cider, wine and champagne)
- yoghurts and cheeses

Check your understanding
1) B **2)** B **3)** B (1 mark for each correct, max. 3 marks)

4) 1 mark for each correct, max. 2 marks
Any two from:
- transforming lactose
- producing lactic acid
- lowering the pH
- coagulation of protein
- denaturation of protein
- separation of curd and whey
- altering the colour
- altering the aroma
- altering the texture

Other suitable answers may be accepted.

5) Production of salami includes a number of steps and procedures, each of them h
answer should include reference to at least three from: (1 mark for each correct
- Before mincing, the meat is partially frozen to kill potential parasites (*Trich*
- Before mincing, the mincing machine and all utensils used are sterilised to k
- Mincing takes place at a low temperature to slow down the growth of micro
- Starter cultures of bacteria and moulds are added.
- Bacteria produce lactic acid, which lowers the pH of the sausage and slows
- Mould creates a coat on the outside of the sausage and shields it from the a
- Drying reduces the amount of water in the sausage, so bacterial growth is s

The working characteristics, and functional and ch
cooking ingredients

Carbohydrates

Check your understanding

1) a = true b = false c = true (1 mark for each correct, max. 3 marks)

2) B **3)** C **4)** D (1 mark for each correct, max. 3 marks)

5) 1 mark for indicating the function of starch (max. 1 mark)
- Function of starch: thickening / improving the texture / setting agent

Up to 3 marks for the correct description/explanation (max. 3 marks)

Indicative content:
- Starch undergoes gelatinisation in the pre[illegible] of water and heat.
- Starch molecules absorb water and s[illegible]ll.
- Absorption of water leads t[illegible]re[illegible]g of a given mixture, e.g. a soup or sa
- The more starch th[illegible]n th[illegible]ixture, the thicker it will become.
- If the mixtu[illegible]oils, it will become thin again.
- D[illegible]ela[illegible]ation, the starch forms a net-like structure in which water i
- If [illegible]ture is overcooked, that structure is damaged and the water is rel
- The stages of gelatinisation include:
  - at 60°C the starch granules begin to swell (due to absorption of water)
  - at 80°C the starch granules begin to burst open and release starch int
  - at 100°C all starch is released into the mixture, and the sauce is cooke
  - cooking the sauce for longer may lead to its separation, as the starch g water they previously absorbed

Other suitable answers may be accepted.

Fats and oils

Check your understanding

1) B **2)** C **3)** B (1 mark for each correct, max. 3 marks)

4) 1 mark for each correct, max. 2 marks
Any two from:
- Creaming/aeration (during beating)
- Melting of fat (during baking)
- Beating (fat with sugar)

5) Up to 2 marks for a detailed description. Must supply examples with explanatio
- If a fat only contains single chemical bonds, it will be solid both at room te Examples include butter, lard and coconut oil.
- The presence of double chemical bonds in fatty acid chains changes the ph monounsaturated fats will be liquid at room temperature, but will solidify extra virgin olive oil); polyunsaturated fats are always liquid (example: su

6) 2 marks for a detailed explanation, 1 mark for a basic explanation (max. 2 mark
Indicative content:
- Mayonnaise is a mixture of oil and vinegar [illegible]er-based liquid).
- Fats are hydrophobic and repel wate[illegible]ole[illegible]es, leading to separation of th
- Emulsifiers bond to both t[illegible]m[illegible]ecule.
- Consequently, emul[illegible]pr[illegible]ent the mayonnaise from separating.
- Emulsifiers h[illegible]ure the proper texture of mayonnaise.

7) 1 mark[illegible]h correct statement (max. 4 marks):
- In [illegible]ening, fat molecules coat flour granules.
- Fat molecules create a hydrophobic layer around starch molecules.
- This prevents gluten in starch from accessing the water.
- Gluten cannot form long fibres without water.
- Only short fibres of gluten can be developed. This helps to keep the dough
- Therefore, the pastry is crumbly/crunchy, rather than spongy and elastic.

Proteins

Check your understanding

1) D **2)** B **3)** C **4)** B (1 mark for each correct, max. 4 mark

5) Any three from (1 mark for each function and 1 mark for a relevant explanation

- Glazing – egg wash helps to create a shiny finish to bread rolls and other ba
- Binding – egg acts as a glue in sweet and savoury dishes, such as muffins o
- Coating – egg helps the breadcrumbs stick to the food, meaning they do no
- Raising agent – whisked egg white traps a lot of air, which is used in many s for soufflé
- Improving the texture – whisked whole eggs create a foam, which can be u
- Emulsifier – eggs contain lecithin, which is a natural emulsifier; as a result, emulsion sauces, such as mayonnaise
- Thickener – eggs coagulate in the presence of h therefore, are used
- Colourant – egg yolks add a yellow shade nd other mixtures

Other suitable answers may be accept

6) 2 marks for a detailed desc ion, 1 mark for a basic description (max. 2 marks)
Indicative content:

- Gl fo hen flour is mixed with water.
- In sence of water, gliadin and glutenin proteins bind together, form glu
- The gluten net has the ability to stretch and trap air bubbles inside.
- During baking, the air expands and stretches out the gluten fibres.
- This makes it possible to obtain the open texture of bread.
- Gluten-free flours cannot trap air, and, therefore, their texture is close and

Other suitable answers may be accepted.

7) 1 mark for each correct (max. 2 marks)

- coagulation (of the egg)
- denaturation (of the egg and gluten)

Fruit and vegetables

Check your understanding

1) B **2)** B **3)** D **4)** D **5)** B (1 mark for each correct, m

6) 2 marks for a detailed description, 1 mark for a basic description (max. 2 marks)

- Enzymatic browning is primarily caused by an enzyme called polyphenol o oxygen. Enzymatic browning cannot take place if either the enzyme or oxy browning can be stopped or prevented by removing oxygen or stopping th blanching the food). Enzymatic browning affects some fruits and vegetable apples, bananas and lettuce.
- Oxidation is primarily caused by oxygen, which reacts with various chemic place if oxygen is lacking. Oxidation may be stopped by removing oxygen / oxygen or by the use of antioxidants (e.g. vitamin C). Oxidation may affect (causes it to go rancid).

7) 1 mark for each method of prevention, max. 3 marks
1 mark for each explanation, max. 3 marks
Indicative content:

- covering with cling film or putting i d box to shield from air/oxyg because it bonds with the p n oxidase enzyme
- packing in a modifi osphere to reduce the amount of oxygen – as abo
- using prope s which do not contain copper or iron – both of these m br g, so avoiding contact with them is a good idea
- us d such as lemon juice or vinegar – enzymes are built from protein of a
- lowering temperature by putting food in the fridge – enzymes are built fro low temperature
- blanching the food to deactivate enzymes – enzymes are built from protein temperature

Other suitable answers may be accepted.

Check your understanding

1) D **2)** C **3)** B (1 mark for each correct, max. 3 marks)

4) a = true b = false c = false (1 mark for each correct, max. 3 marks)

5) 1 mark for each correct statement, max. 3 marks
Any three from:
- Adding too much sugar can cause the cake to sink in the middle.
- Adding too much flour or cocoa can cause the cake to be tough and dry.
- Adding too much baking powder / bicarbonate of soda can cause the cake t
- Adding too little baking powder / bicarbonate of soda can cause the cake t
- Adding too much sugar can cause the cake to develop a hard, sugary crust.

Other suitable answers may be accepted.

6) Any three from (1 mark for identifying the mistake and 1 mark for explaining w
- **Mistake:** not adding sugar to the d
- **Explanation:** this means that the yeast has no food, so cannot multiply, an

- **Mistake:** using the wrong type of flour (e.g. low-gluten)
- **Explanation:** this means that the carbon dioxide produced by yeast will no and will make the bread tough

- **Mistake:** lack of water in the dough
- **Explanation:** this means that gluten will not develop, and the dough will b

- **Mistake:** using the wrong type of flour (e.g. gluten-free)
- **Explanation:** this means that gluten will not develop in the dough, and the develop the open, sponge-like texture)

- **Mistake:** using old yeast
- **Explanation:** can mean that it is not alive any more, so the dough will not r

- **Mistake:** using water that is too hot
- **Explanation:** it can kill the yeast in the dough, so it will not rise at all

- **Mistake:** using water that is too cold
- **Explanation:** it will lower the temperature of the dough, and that can slow dough will rise very slowly (or not at all)

- **Mistake:** adding too much salt to the dough
- **Explanation:** this means that it will compete with sugar for water, and tha much (as there will be no more sugar to caramelise)

- **Mistake:** adding too much salt
- **Explanation:** it can slow down yeast growth, but that can cause the dough

- **Mistake:** kneading the dough too vigorously
- **Explanation:** it can cause carbon dioxide to escape from the dough, and th

- **Mistake:** proving the dough for too short a time (or not proving at all)
- **Explanation:** it means that the yeast will have not enough time to multiply of carbon dioxide, and that will make the bread tough

- **Mistake:** baking the bread for too short a time
- **Explanation:** this can cause it to sink and become tough and moist

- **Mistake:** baking the bread too high up in the oven
- **Explanation:** it can cause it to burn on top and crack, while the middle can

Or any other suitable answer

Chaper 1: Quiz-ine

1. Foam
2. Shortening
3. Browning
4. Salami
5. Gluten
6. Solanine
7. Denaturation
8. Carbon dioxide
9. Antioxidant
10. Stirring
11. Microwaves
12. Steaming

The shaded fields reveal this word: **fermentation**

Microorganisms (food spoilage)

Things to think about: (p. 52)
Most at risk are the very young or elderly, people who are already ill or recovering, a
Any individual whose immune system is weaker is more susceptible to the effects of p
pass from a pregnant woman to an unborn foetus.

Things to think about: (p. 55)
This is human body temperature which creates ideal conditions for bacteria to grow a

Things to think about: (p. 57)
Some foods, such as grapes and tomatoes, show signs of spoilage before others as they ca
This is because they provide all the conditions necessary for the growth of microorganism
food (protein and sugar) and temperature (as they are often stored in room temperature

Things to think about: (p. 57)
Some fruits have yeasts on their skins which react with sugars, causing fermentati
action throughout the ripening process. Grapes, apples and bananas are examples of this

Check your understanding
1) D **2)** C **3)** A **4)** C (1 mark for each, max. 4 marks)

5) 1 mark for each correct statement, max. 3 marks
Any three from:
- Very low temperatures, such as in freezing, deactivate enzymes, so that enz
conducted.
- Very low temperatures, such as in freezing, make bacteria dormant and ca
they are inactive and do not multiply.
- Low temperatures, such as in a fridge, slow down the action caused by enz
be delayed.
- Low temperatures, such as in a fridge, slow down the growth of bacteria a
in temperatures above 5°C.
- High temperatures, such as in cooking (above 63°C) and blanching, deactiv
protein and denaturate due to high temperatures).
- High temperatures, such as in cooking (above 63°C), kill most bacteria.
- Very high temperatures, such as in sterilisation (above 100°C), kill all bacte
safe at least until it cools down and goes through danger zone again, or until
contaminated food.

6) Any 8 from (1 mark for each correct statement, max. 8 marks):
- Microorganisms such as *E. coli* and *Campylobacter jejuni* cause food poison
toxic mould present in food or water.
- Pathogenic bacteria can come from raw foods, pests, people, air, dust, dirt a
food, moisture, protein and warmth, bacteria can multiply using a process c
- Because pathogenic bacteria cannot be seen or smelled in food it is possibl
poisoning without realising the potential danger.
- Pathogenic bacteria which cause food poisoning are present in humans and
on to other humans through handling food.
- Dust, dirt and soil contain pathogenic bacteria. This is why it is important
- Raw food, such as uncooked chicken, contains pathogenic bacteria which ca
at the correct temperatures will kill bacteria making the food safe to eat.
- Bacteria are not killed when raw food is frozen but remain dormant until it
chicken isn't thawed and then cooked quickly at the correct temperatures,
becoming a potential food poisoning risk.
- The danger zone for food is between the temperatures of 5 °C and 63 °C. If food
(the danger zone) then bacteria can start to grow and divide every 10–20 min
poisoning risk.
- The optimum conditions for bacteria to grow are warmth, time, moisture a
food is kept for long enough at room temperature, it will develop bacteria w
- Cooking food at correct temperatures can kill pathogenic bacteria. Food th
start growing bacteria. In some people this may only cause a slight gastric
be fatal. The elderly, the very young or those who are ill or recovering fro

food poisoning due to compromised immune systems. Unborn babies can b
pregnant women should take care.
- Food poisoning can be caused by storing food incorrectly. Raw food and h
separately to ensure that cross-contamination does not occur, e.g. raw chic
fridge to prevent juices dripping onto other food items.
- Food poisoning can be caused by pathogenic bacteria from raw food being
surfaces or chopping boards to other foods.
- Food poisoning can be caused by eating cooked rice which has been left to
- Food poisoning can be caused by pathogenic bacteria present in milk and d
seafood, and cooked meat and poultry, with the biggest risk being when ra
are combined.
- Food poisoning can be caused by harmful toxins called mycotoxins which e
toxic and some can be used in food production.

Buying food

Things to think about (p. 63)
Storage rota in so that food with a short shelf life is used before food w
stored acco with items with a short shelf life stored in front of items with a lo

Things to think about (p. 64)
Examples could include:
- allergy sufferers – should pay attention to the list of ingredients and special wa
from allergens and safe for consumption for them (allergens are usually printed
- lactose intolerant people – should pay attention to milk content in the food so th
- people with high blood pressure – should pay attention to salt/sodium level in t
- people with coronary heart disease / a high blood cholesterol level – should che
saturated fat or enriched with phytosterols, which help to lower blood choleste
out by a health or nutrition claim)
- people with a vitamin deficiency – can check whether the food contains a given
or added during fortification)
- people for whom animal welfare is important – can see whether the food was p
welfare standards, e.g. organic or free-range
- people who cannot cook – may find preparation instructions useful
- date marks – can be useful for people concerned about food waste issues, as the
with a short date if they know they won't be able to eat it by that time, etc.

Check your understanding
1) A **2)** B **3)** A (1 mark for each, max. 3 marks)

4) 1 mark for identifying, 1 mark for explaining why it is efficient (max. 4 marks)
Any two from:
- it includes information about food allergens, so foods which contain them
by people allergic to specific foods
- it includes date marks, which help to identify whether the food is still fresh
- it includes storage conditions, which help to as ther the buyer/con
food in the correct conditions at home
- it provides an ingredient list, wh s to decide whether a food is high-
will require any special skills
- it should be und hat the consumer knows that the food couldn't
anybody o rom the food manufacture to the shop

Other suital ve may be accepted.

5) 1 mark ach correct, max. 4 marks
a use by
b best before
c best before
d use by

Storing food

1) C **2)** D **3)** A (1 mark for each correct, max. 3 marks)

4) 1 mark for identifying, 1 mark for explaining why it is efficient (max. 4 marks)
Any two from:

- Sealed bags and containers protect the food inside from the air – as a resul and oxidation cannot happen.
- Closed boxes and bags protect the food inside from pests and microorganis material, so the food cannot be spoilt.
- Packaging protects the food inside from sunlight – so that the vitamins do value of the food is maintained.
- Packaging contains information about the food – so that the consumer can him/her, e.g. free from allergens or free from glute
- Packaging contains a date mark, which say r th food is fresh and point in time.
- Packaging protects from lea the leaking juice, e.g. from meat, d products in the shopp bas or in the fridge.
- Packaging can d to maintain cool temperatures, so that the food mi nnot multiply.

Other answers may be accepted.

5) Any four from (1 mark for each correct statement, max. 4 marks):

- Chicken is a high-risk food which is high in protein and high in moisture. T warmth, provides ideal conditions for bacteria to thrive.
- The correct temperature to cook chicken is at 75 °C or higher. If reheating, but preferably 82 °C. Cooking or reheating below these temperatures allow
- For storage, chicken should be frozen at -18 °C (this will slow down bacteri regrow during the thawing process).
- Frozen food such as chicken goes through the danger zone when thawing s ensure that the inside thaws while the outside of the chicken thaws. This n need thawing slowly at room temperature, which can necessitate the food a period of time. Cooking at the correct temperature will kill the bacteria.
- Temperature control is important when dealing with thawed chicken. Alth refrozen once thawed, poultry that has been defrosted can be refrozen if co temperatures.
- Temperature control is important when storing or defrosting raw chicken that the temperature of the appliances is at 5 °C or lower and that warm fo to prevent the temperature from rising. Temperatures above 5 °C put the c bacteria can start to grow and multiply.
- Cooked chicken which is served cold should be kept cool and eaten within can start to grow and multiply and the chicken should be disposed of.
- Hot food, such as cooked chicken, must be held at temperatures of at least
- Combining hot and cold foods can affect the temperature of food, either wa This can affect the temperature of cooked chicken, such as cooling it down start growing.
- Chicken is a high-risk food containing the risk of bacte al food poisoning a

Things to think about: (p. 74)
Food poisoning can be caused when bacteria grow in large numbers in food or by vir
animals, or by toxic moulds. Food poisoning from bacterial contamination of untreat
raw or insufficiently cooked can be the cause of *E. coli* and *Salmonella*. Beansprouts a
with temperature conditions (i.e. between 5 °C and 63 °C), this can enable bacteria to
conditions). Because of the danger from food poisoning, beansprouts should only be
or otherwise should be steamed or cooked until piping hot. Raw beansprouts should

Things to think about: (p. 75)
Pregnant women can transfer food poisoning to their unborn babies. This can have s
sometimes lead to miscarriage.

Things to think about: (p. 79)
Cross-contamination between salad items and chicken can occur from soil on unwash
grow on cooked chicken. Utensils, such as chopping boards and knives, can transfer
is important to use separate ones when preparing raw cook and cooked food.

Check your understanding

1) B **3)** C **4)** A **5)** A (1 mark for each, max. 5

6) Any four from (1 mark for each correct statement, max. 4 marks):

- The core temperature of food should be kept at the correct level for the req
- Although some foods are safe to be blanched briefly, most foods must be co
  recommended cooking times to ensure safety. Lower cooking temperature
  cooked for the recommended duration for that temperature.
- Food should be reheated at the correct temperature to kill bacteria. In son
  temperatures may adversely affect the texture or taste of food, it can rehea
  the required duration (e.g. red meat should reach at least 70 °C for at least
- Cooking food at the correct temperatures is important for prevention of ba
  stand for a minute after cooking can also help to kill bacteria as temperatu
  rise within this time.
- Cooking at the correct temperatures can help to kill bacteria, but some foo
  recommended temperatures of at least 75 °C. The following duration must
  temperatures: at least 45 minutes at 60 °C, at least 10 minutes at 65 °C and
- Gravy, sauces and soups should be simmering to ensure that they are cook
  This means that, after boiling, the heat should be reduced so that cooking c
  for the prescribed amount of time.
- Some foods should be cooled very rapidly to prevent bacterial growth with
  can be done using a blast chiller to cool food rapidly by circulating very col

Check your understanding

1) D **2)** A **3)** D **4)** A (1 mark for each correct, max. 4 marks

5) 1 mark for each method identified, 1 mark for a relevant explanation (max. 6 ma
The answers could include a reference to:

- **Method**: jam making
  Why/how it works: in jam, sugar binds water and makes it unavailable fo
  cannot multiply and cause food spoilage

- **Method**: pickling
  Why/how it works: when pickling food in brine, salt increases the osmoti
  draws water from the bacterial cells, which then c multiply; when pic
  solution is highly acidic, which disables gr t o os microorganisms

- **Method**: freezing
  Why/how it works: i f eez q ater changes its physical state from liqu
  unavailable fo t anisms; also, at low temperatures enzymes (prote
  th no a by bacteria for multiplying

- **M** ottling
  Why/how it works: in bottling, microorganisms are killed by high temper
  then sealed in sterilised containers (e.g. jars) which help to prevent contan
  and, therefore, prevent food spoilage

- **Method**: vacuum packing
  Why/how it works: in vacuum packing, all air is removed from the packag
  helps to prevent growth of aerobic bacteria, which require oxygen for grow
  not as effective in preventing growth of anaerobic bacteria

Accept other suitable answers.

Chapter 2: Quiz-ine

1. *Penicillium*
2. Mycotoxin
3. Danger zone
4. Best before
5. Diarrhoea
6. Enzyme
7. High risk
8. Tainting
9. Antibacterial
10. Preservative
11. Ambient
12. Pathogens
13. *Salmonella*

The shaded fields reveal this word: **contamin ti n**