Knowledge Organiser

Food & Nutrition

Topic: Food Science - Heat transfer & cooking methods

Knowledge Organiser

Food & Nutrition

Topic: Food Science - Heat transfer & cooking methods

Why Food Is Cooked

Food Safety

Kills pathogenic bacteria moulds & toxins especially in high risk foods
improves shelf life
i.e. Milk pasteurised, tinned toms

Would you rather eat a pig or sausage?

Aesthetics

Texture – easier to chew & digest; Softens foods (veg, rice, pasta)
Tenderises meat (must be careful of overcooking); Pleasant - crispy

Taste - Chemical reactions take place i.e. caramelisation
Bring out & intensifies flavour (i.e. Roasting, & removing water)
Combines flavours i.e. chicken curry absorbing spices.

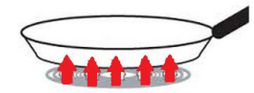
Appearance - Colour i.e. Dextrinisation of toast, browning of meat

Variety I.e. beef – bbq burger, dry fry mince, stew beef, grilled steak

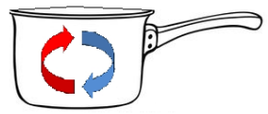
Heat Transfer

Heat energy – must be moved or transferred to cook food

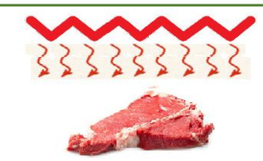
Conduction
E.g. Frying pan
Direct heat from a hot surface (i.e. pan, tin – metal as good conductors)
Heat makes the molecules vibrate, vibrations pass on to heat the whole food (from pan to food)



Convection
E.g. Boiling water
Heat transfer through a gas or liquid. When liquid/air is heated – it warms near the surface.
Heat rises and is replaced with cooler liquid which was originally above. This leads to circulation (or convection currents) until all of the liquid is hot. This also occurs in oven with gas/air.
Fan ovens - moves air around = even cooking times, similar temperatures – faster heating, less energy



Radiation
E.g. grills and toasters and microwaves
Through 'waves' or infrared rays – like the sun heating up the earth
No 'direct' contact with a heat source
Food absorbs the heat
Microwaves - 'micro' 'waves' which penetrate the food

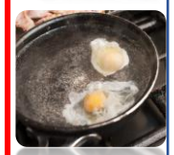


Cooking Methods

Water based

Boiling (conduction & convection)
Food cooked in a boiling liquid (usually water)
A harsh method – not suitable for delicate foods (i.e. Fish)
Foods: Usually starchy foods
+ healthy – no fat/oil needed, Low energy use (if a lid is used)
– water soluble vitamins are lost in water, flavour & appearance not improved.

Simmering (conduction & convection)
Like boiling but lower temperature so more gentle
Foods: soup, curry, pasta sauces
+ Preserved nutrients more than boiling

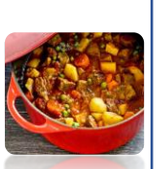


Poaching (conduction & convection)
Pan of liquid. Below 100°C (80°C)
Foods: Eggs, fish and fruit
+Gentle method, keeps food tender
- Loses some vitamins in water, & no flavour improvements
BUT, can poach in a sauce to add flavour i.e. fish in milk

Blanching (conduction & convection)
Part cooked in boiling water then placed into cold/iced water to stop cooking
+Preserves the colour, texture & vitamins, Removes/rinses harsh flavours i.e. onions go milder; Shrivels skins on tomatoes/potatoes– easier to remove
Prepares fruit & veg for freezing – destroys enzyme=stops enzyme action.

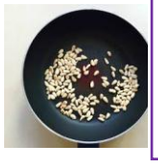
Steaming (convection)
Steam from boiling water cooks the food
Foods: Fish, rice, veg
+No fat, no direct contact with the water means vitamins are retained
-Low in flavour. Delicate foods only due to gentle method, not tough meats

Sous vide (conduction)
Packaged and vacuum sealed, then heated slowly at a specific temperature.
+Consistent results, good results with texture and flavour retained.
- no browning of foods especially meats & expensive equipment required.



Stewing (stew in hob, casserole in oven) **(convection)**
Slow cooked in ovenproof pot with a lid, in liquid
Mixture of simmering & steaming
+Tough & large cuts of meat– tenderised ; Nutrients retained' Absorbs juices
– Slow

Braising – same as stewing but meat is seared first – by frying
+ Same advantages as stewing plus juices/moisture is sealed in & edges are caramelises for flavour



Dry methods

Baking - (Convection, Conduction & Radiation)
In an oven with no fat added
Foods – cake, potato
+Improves texture (crisp), taste & appearance (browns)
Healthy – no fat added
-Very specific temperatures & times needed; Dries out food; Energy use (longer time, high temperature)

Roasting (Convection, Conduction & Radiation)
In an oven with fat added
Basting – using own fat
Foods – meat, potatoes
+ Browns ; Food stays moist; Crisp & tasty;
Use fat for other foods (i.e. Gravy); can make meat 'rare' inside which can be desirable/
- Unhealthy, slow and energy use.

Grilling (radiation in grill, radiation & conduction for griddle)
Very high temp – from above or below food
BBQ similar but over coals lower for longer
Foods: tender meats, vegetables
+Cooks quickly at high temp; Makes crisp & golden
Healthy – No fat & fat drains out; Smoky if BBQed
- Hard to evenly cook a food – edges can burn with middle raw; bad for high risk foods
Raw foods being added to BBQ/grill can cause cross contamination; Only for tender cuts of meat

Dry fry (conduction)
In pan, no fat added & natural fat melts
Foods: Fatty meats. nuts, seeds, spices(called toasting)
Starts at low temperature then increase when fat melts
+No fat; Taste and smell ADDS Flavour
-Time – low start; Small range of food

Fat/Oil Based methods (Frying) (all conduction)

Shallow frying
Little bit of oil in a frying pan
Food: Meat, eggs, fish, pancakes
+ Not as much oil as deep frying; Crispy texture
-Less healthy than water based, solid fats from food melt in

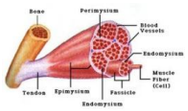
Deep drying
Food submerged into boiling fat
+Very crispy texture, Quick
-Dangerous – fire risk, and unhealthy

Stir frying
Wok with a little but if oil
Healthier than deep frying and shallow frying
Food: Usually noodles, veg and a protein so balanced
Has to be small foods for quick cooking, move around
+Very quick, retains nutrients
-Needs constant attention, move foods to prevent burning

Sweating - to soften
Lightly frying vegetables to remove moisture. No browning.

Cooking meats
Rule!
Tough meats – Low & Slow
Tender – Hot & Quick

Collagen keeps the muscles together & attached to the bone.
Muscles that work hard have a lot of collagen. Collagen makes meat tough. But with time, heat & moisture, collagen transforms into gelatin.
Gelatin & melted fat makes slow-cooked tough cuts tender.
Consider cows - chew grass all day, so their cheeks develop muscle, therefore collagen. To make them tender, cook for a long time at a low temperature.
In comparison, fillet steak has barely any muscle. This needs cooking quickly at a high temperature, and is usually served rare.



Useful sites
Video: tinyurl.com/ya2pqe28
Cooking Methods: tinyurl.com/yaf7gmmr
Jamie Oliver Cooking Methods (videos & recipes): tinyurl.com/ydxgjwep

Key Words

Conduction – heat energy is transferred by direct contact;
Convection - when particles with heat energy in a liquid/gas move & take the place of particles with less heat
Radiation - heat transfer transmitted through space by waves. (no direct contact)
Aesthetics – attractiveness – in food, usually linked to taste, texture, appearance and smell.
Simmer – cooking method just below boiling point while bubbling gently
Poach - cooking method by submerging in a liquid, such as water, milk, stock or wine. At a low temperature
Blanch - part cooked in boiling water, removed, & plunged into iced/cold water to halt cooking (fruit/veg).
Stew cooking by long slow simmering in a pot/pan
Braise - stewing but seared beforehand to seal in moisture and caramelise edges for flavour
Bake – cooking in dry heat without direct contact to a flame/heat source typically in an oven.
Roast - baking with the aid of fat or oil.
Grill - cooking that involves dry heat applied to the surface of food, from above or below.
Collagen - connective tissue in protein, contributes to meat tenderness and texture.

What might be asked in an exam?
Grade 1-3 :State the type of cooking method, explain reasons food is cooked
Grade 4-6 : Explain and compare the types of heat transfer and methods
Grade 7+: Evaluate which cooking methods and heat transfer is best for a range of foods

Exam preparation