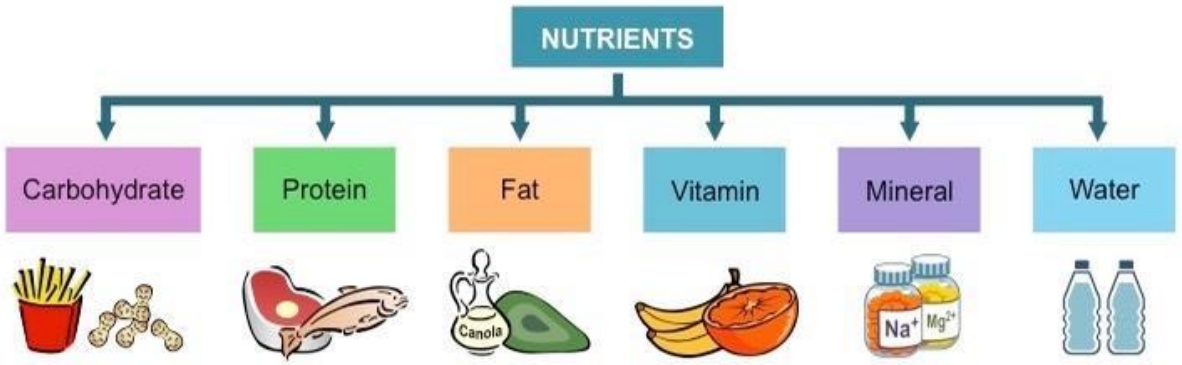
Year 13

IB BIOLOGY

D1 Human Nutrition



Name:

Teacher: Mr Trent

D1 Human Nutrition

Essential Idea

A balanced diet is essential to human health

Understandings

D1.U1 Essential nutrients cannot be synthesised by the body, therefore they have to be included in the diet

D1.U2 Dietary minerals are essential chemical elements

D1.U3 Vitamins are chemically diverse carbon compounds that cannot be synthesised by the body

D1.U4 Some fatty acids and some amino acids are essential

D1.U5 Lack of essential amino acids affects the production of proteins

D1.U6 Malnutrition may be caused by a deficiency, imbalance or excess of nutrients in the diet

D1.U7 Appetite is controlled by a centre in the hypothalamus

D1.U8 Overweight individuals are more likely to suffer hypertension and type II diabetes

D1.U9 Starvation can lead to breakdown of body tissue

Applications:

D1.A1 Production of ascorbic acid by some mammals, but not others that need a dietary supply

D1.A2 Cause and treatment of phenylketonuria (PKU)

D1.A3 Lack of Vitamin D or calcium can affect bone mineralization and cause rickets or osteomalacia

D1.A4 Breakdown of heart muscle due to anorexia

D1.A5 Cholesterol in blood as an indicator of the risk of coronary heart disease

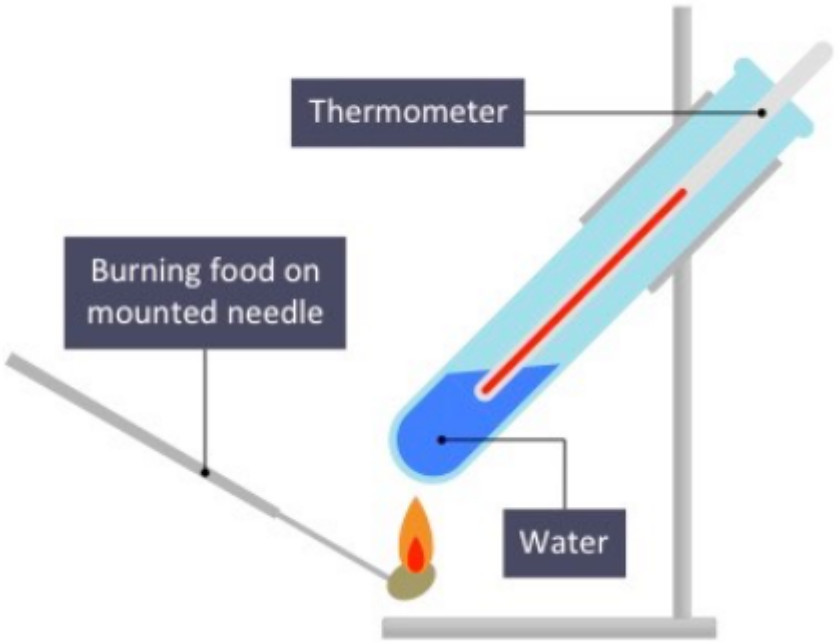
Skills:

D1.S1 Determination of the energy content of food by combustion

D1.S2 Use of databases of nutritional content of foods and software to calculate intakes of essential nutrients from a daily diet

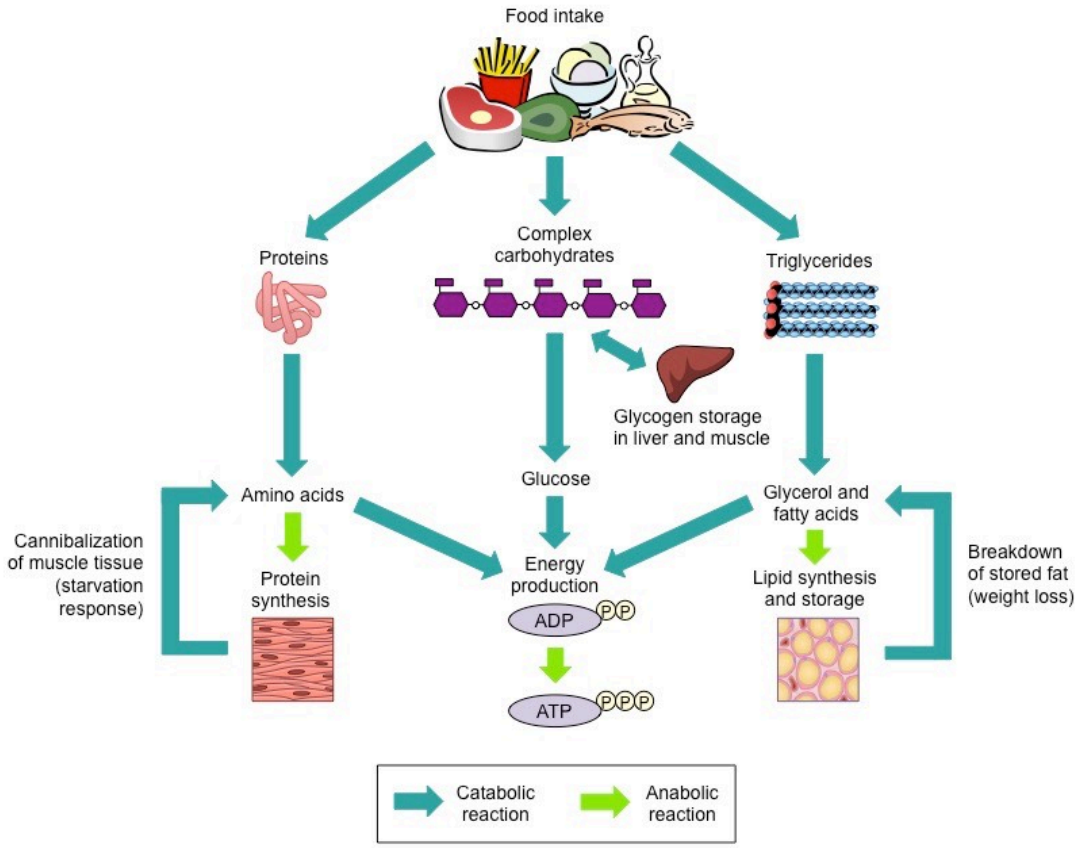
The equation for calculating the energy content of a food source via calorimetry is as follows:

Energy (joules) = Mass of water (g) × 4.2 (J/gºC) × Temperature increase (ºC)



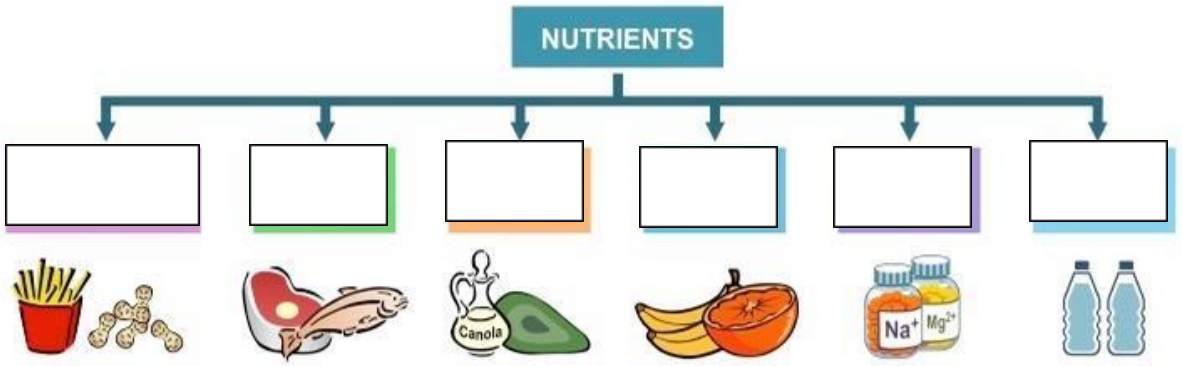
Nutrient Energy Summary

- Carbohydrates are preferentially used as an energy source because they are easier to digest and transport
- Lipids can store more energy per gram but are harder to digest and transport (hence are used for long-term storage)
- Protein metabolism produces nitrogenous waste products which must be removed from cells



D1.U1 Essential nutrients cannot be synthesised by the body, therefore they have to be included in the diet

List the 6 nutrient groups and write some examples underneath.



Define “essential” as related to dietary nutrients.

D1.U4 Some fatty acids and some amino acids are essential

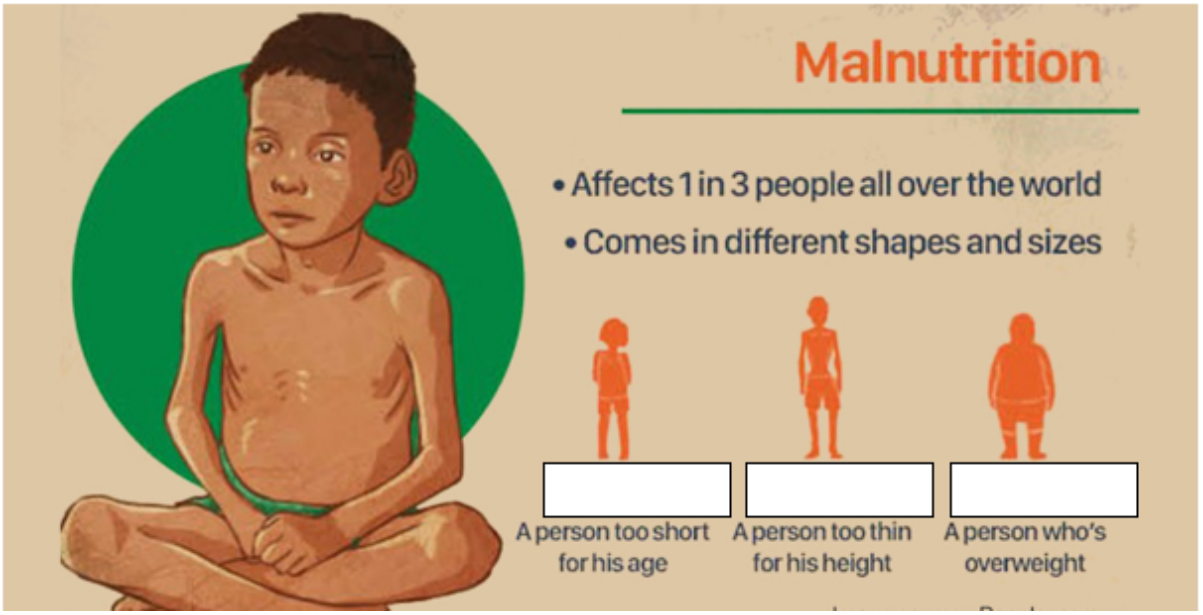
Essential	Conditionally Non-Essential	Non-Essential
Histidine	Arginine	Alanine
Isoleucine	Cystine	Asparagine
Leucine	Glutamine	Aspartate
Lysine	Glycine	Glutamate
Methionine	Proline	Serine
Phenylalanine	Tyrosine	
Threonine		
Tryptophan		
Valine		

- A shortage of one or more essential a_____ a_____ in the diet will prevent the production of specific proteins. This is known as p_____ deficiency malnutrition and the health effects will vary depending on the amino acid shortage

Define conditionally non-essential amino acids

D1.A2 Cause and treatment of phenylketonuria (PKU)
Watch this video and summarise your findings on Phenylketonuria
https://rarediseases.org/rare-diseases/phenylketonuria/

D1.U6 Malnutrition may be caused by a deficiency, imbalance or excess of nutrients in the diet



Outline two causes of malnutrition.

D1.U2 Dietary minerals are essential chemical elements
D1.U3 Vitamins are chemically diverse carbon compounds that cannot be synthesised by the body

Outline using examples the difference between a vitamin and a mineral.

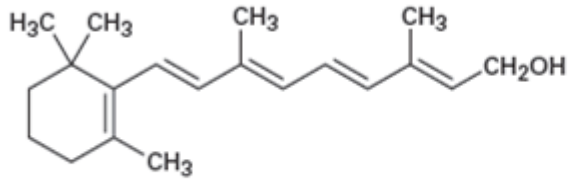
_____ are chemical elements required in small quantities as essential nutrients by organisms. Usually ionic in nature. Minerals include _____ (Ca), _____ (Mg), iron (Fe), phosphorus (P), _____ (Na), potassium (K) and chlorine (Cl)

_____ are organic molecules with complex chemical structures that are quite diverse and hence categorised by groups

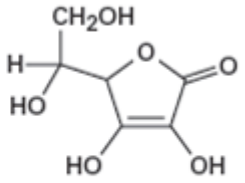
The functions of vitamins are as diverse as their structure, although many function as cofactors, _____ or _____.

Many vitamins are _____ as they cannot be synthesised by the body and their absence may cause a deficiency disease

Given a molecular diagram of a vitamin, determine if it is hydrophobic or hydrophilic.



Vitamin A
(retinol)



Vitamin C
(ascorbic acid)

Fat Soluble Vitamins
Vitamin A (Retinol)
Vitamin K
Vitamin E
Vitamin D

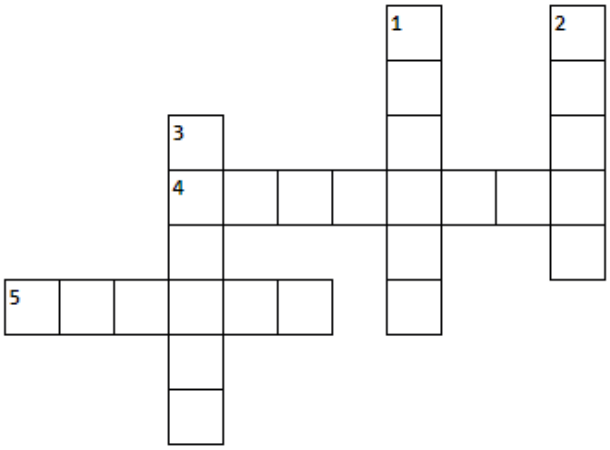
Water Soluble Vitamins	
Vitamin:	Name:
B1	Thiamine
B2	Riboflavin
B3	Niacin
B5	Pantothenic Acid
B6	Pyridoxine
B7	Biotin
B9	Folate
B12	Cobalamin
C	Ascorbic Acid

Compare the properties of water soluble and fat-soluble vitamins.

	Water Soluble	Fat Soluble
Dissolve in blood		
Storage in body		
Source		
Excess		
2 Examples		

D1.A3 Lack of Vitamin D or calcium can affect bone mineralization and cause rickets or osteomalacia
Complete the crossword using the ascorbic information below:

- **potent antioxidant** and also plays an important role in immune function
- is also involved in the synthesis of _____ (a structural protein) and in the synthesis of lipoproteins
- Helps in _____ **healing**
- Ascorbic acid is made internally by most mammals from monosaccharides – but it is **not produced by** _____
- _____and a general weakening of normal immune function
- include citrus fruits and orange juice.



Across

4. the synthesis of this structural protein and lipoproteins is facilitated by ascorbic acid

5. - the type of fruits with high vitamin C concentrations

Down

1. - Ascorbic acid is produced by most mammals but not these.

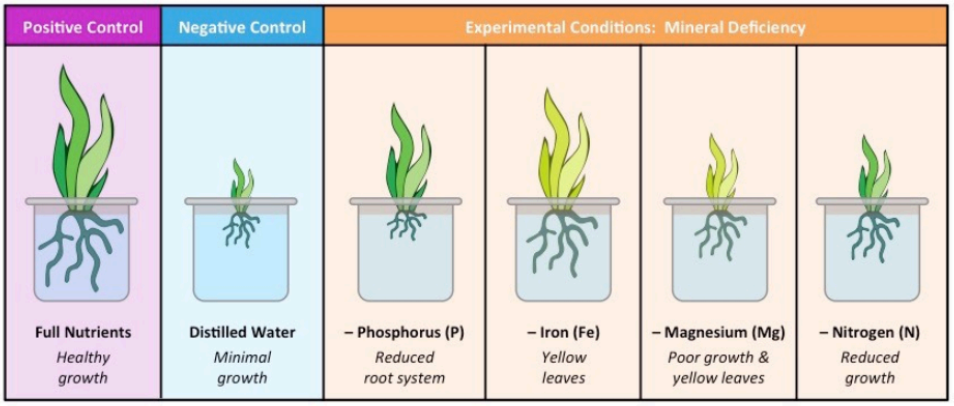
2. - scab or healing of a clot

3. - the pirates diseased caused by vitamin C deficiency

Minerals in Plant Development

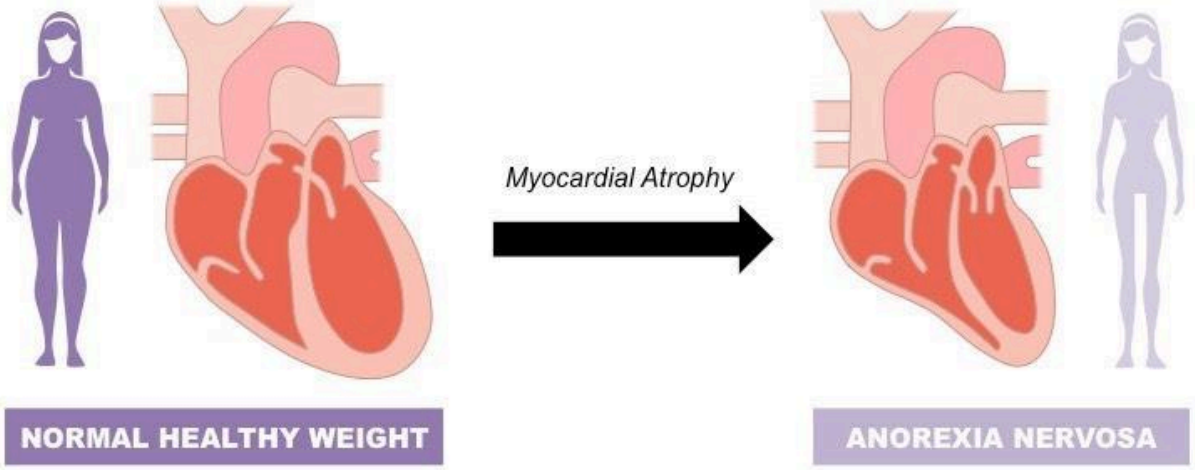
_____is an important component of chlorophyll (required for photosynthesis)

_____ is an inorganic salt found within the sap of a plant (maintains water potential)

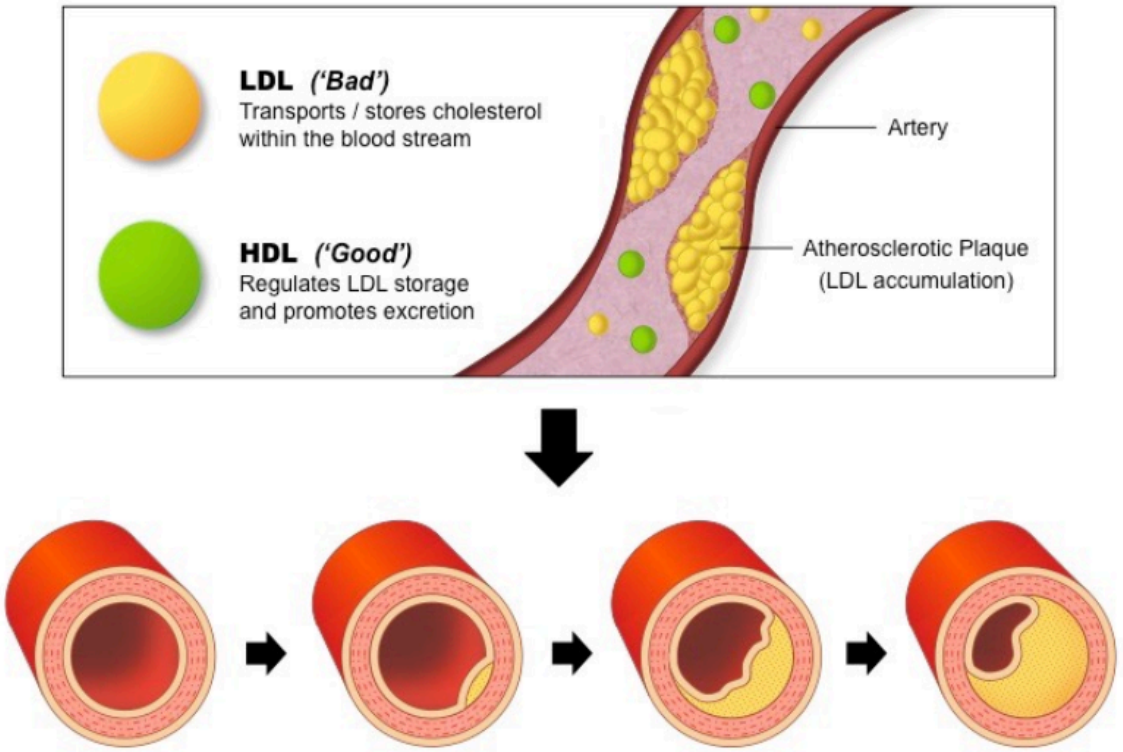


D1.U9 Starvation can lead to breakdown of body tissue
D1.A4 Breakdown of heart muscle due to anorexia

Anorexia nervosa is an _____ disorder in which individuals severely _____ the amount of food they intake

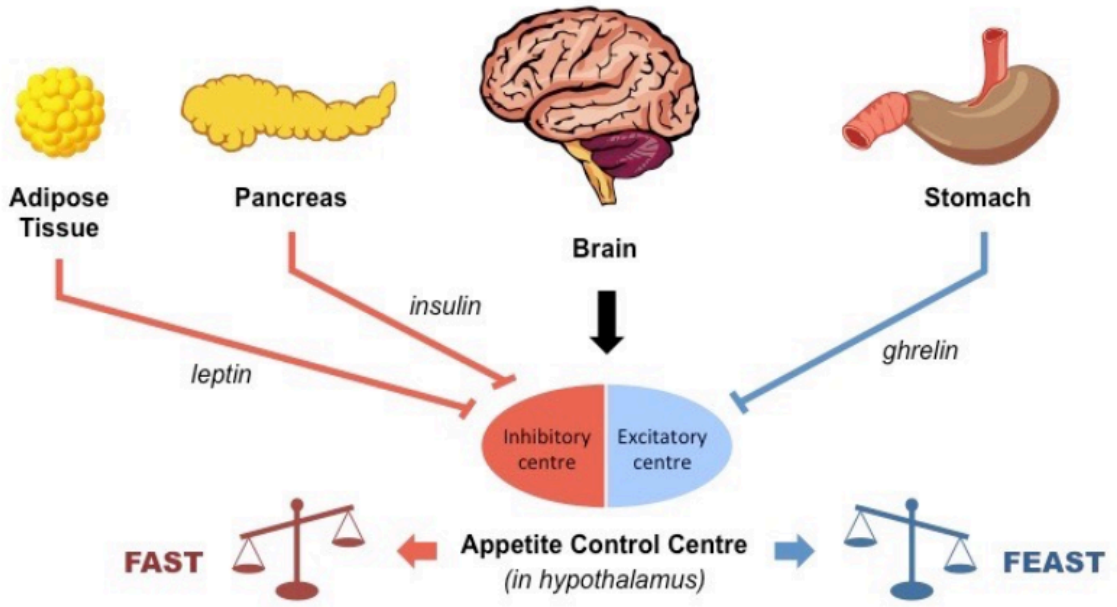


D1.A5 Cholesterol in blood as an indicator of the risk of coronary heart disease
D1.U8 Overweight individuals are more likely to suffer hypertension and type II diabetes



Elaborate on the statement 'Overweight individuals are more likely to suffer hypertension and type II diabetes.'

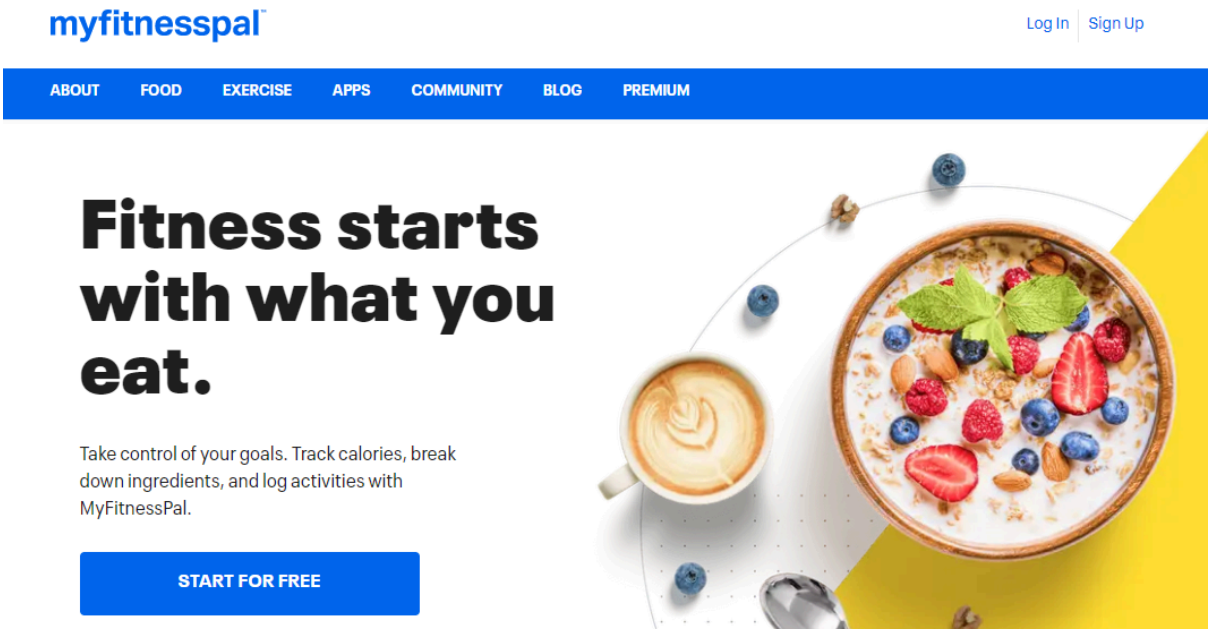
D1.U7 Appetite is controlled by a centre in the hypothalamus



The release of hormones can be triggered in a number of ways:

- Stretch receptors in the _____ and intestine become activated when ingested food swells these organs
- A_____ tissue releases hormones in response to fat storage
- The p_____ will release hormones in response to changes in blood sugar concentrations

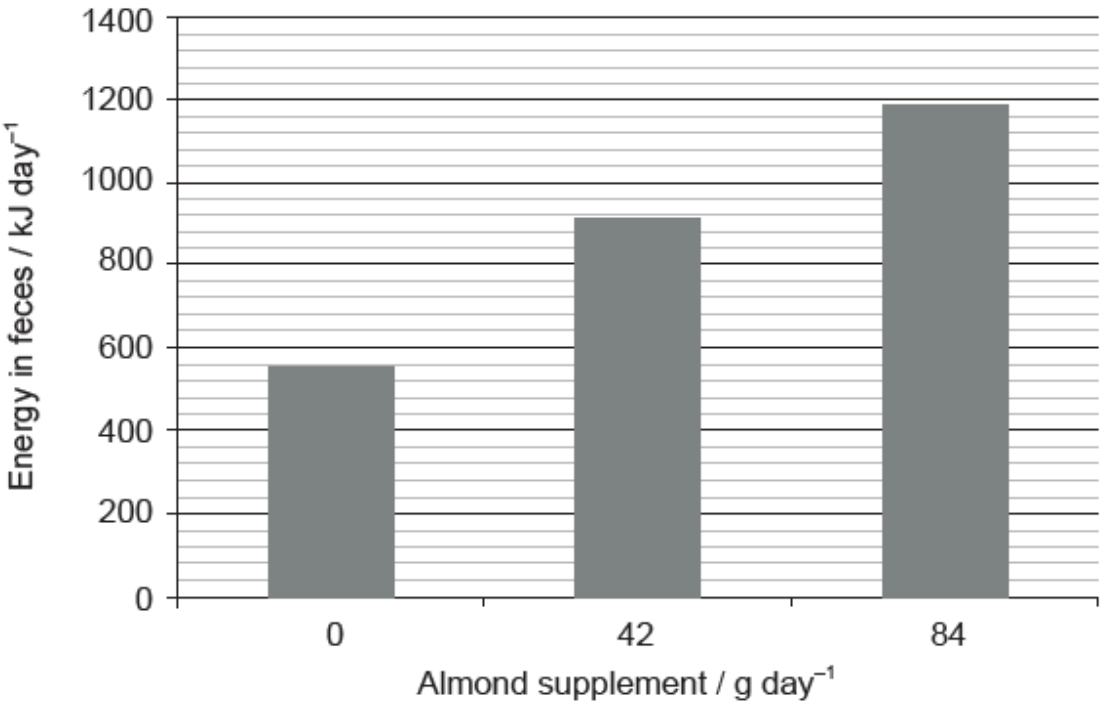
D1.S2 Use of databases of nutritional content of foods and software to calculate intakes of essential nutrients from a daily diet



1. Record your daily energy intake.
2. Compare your data to the recommended daily intake (RDI)

Daily Energy Intake = 8700 kJ						
Protein 50g	**Fat** 70g	**Saturated Fat** 24g	**Carbohydrate** 310g	**Sugars** 90g	**Sodium** 2300mg	**Dietary Fibre** 30g

1. Three groups of human volunteers were given different amounts of almond nuts added to a controlled diet for a period of 68 days. During that period the amount of energy released in their feces was measured



a. Using the data, discuss the implications for the advice given by dieticians to patients.

[2]

b. Describe how the energy content of food may be measured by combustion.

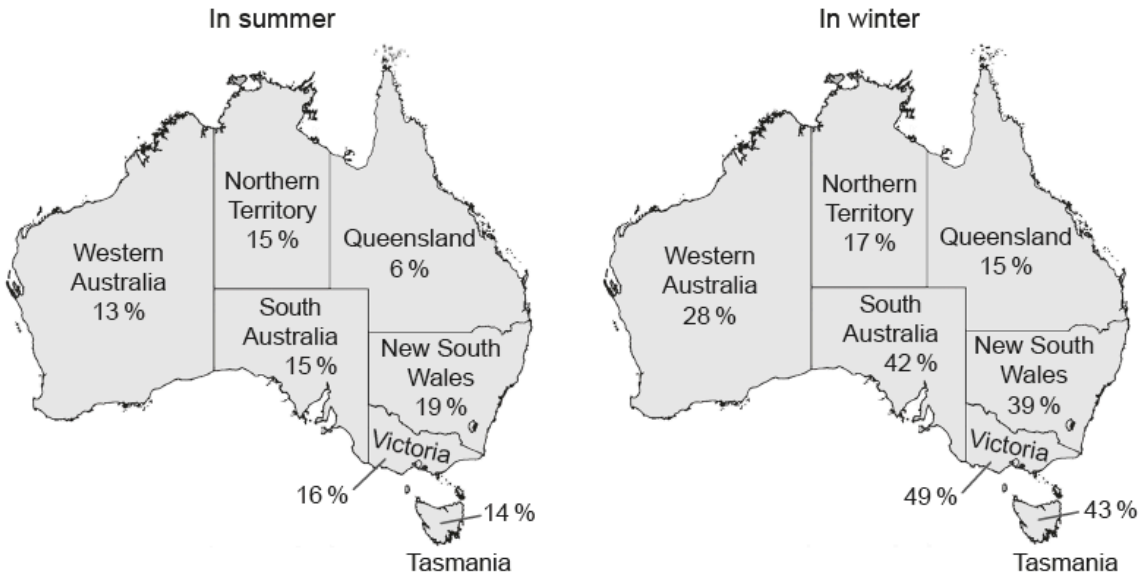
[3]

c. State **one** material **not** produced by the human body that is egested from the digestive system. [1]

d. Outline **one** consequence for the heart of the eating disorder anorexia nervosa.

[1]

Australia is in the Southern Hemisphere so December to February are summer months and June to August are winter months. Data on vitamin D deficiency levels were collected throughout the year for the Australian National Health Measures Survey. This was then used to analyse the seasonal effects of vitamin D deficiency. Vitamin D deficiency levels for those who had their blood samples taken in summer were compared with those who had them taken in winter. The maps show the vitamin D deficiency by state between 2011 and 2012.



2a. Identify which state had the smallest seasonal change in vitamin D levels.

[1]

2aiSuggest **one** reason why people in Victoria show such a large seasonal change in vitamin D levels.

[1]

2a.ii. Outline **one** effect of lack of vitamin D.

[2]

2b. Vitamins and minerals are both essential nutrients. Compare and contrast vitamins and dietary minerals.

[2]

a.

a. increasing the mass of almonds eaten increases the energy content of feces ✔

b. some of the energy consumed in foods may not be absorbed/is lost/egested in feces ✔

c. can't draw conclusions as the data is incomplete ✔

b.

a. A calorimeter/calorimetry is used ✔

b. food is burned/heated/combusted to release energy/heat ✔

c. the energy/heat is used to heat up water ✔

d. the rise in temperature of the water allows the energy in the food to be calculated ✔

e. energy from the food = specific heat capacity of water x mass of water x temperature rise ✔ *Accept alternative correct formula*

c.

cellulose/lignin/fibre ✔

d. breakdown/weakening of heart muscle
OR
electrolyte imbalance affecting the cardiac cycle
OR
low blood pressure/heart rate ✔

2a Northern Territory ✔

a.i.
less sun in winter than in summer
OR
colder in winter so cover up/indoors more
OR
skin has more exposure to sun in summer ✔

Accept other valid suggestions.

Accept vice versa.

a.ii.
a. «lack of vitamin D results in» calcium «ions» not absorbed from gut in sufficient quantities ✔

b. calcium salts not deposited or reabsorbed
OR
affects bone mineralization ✔

c. bones become softened/weakened ✔

d. can cause rickets «in children»/osteomalacia «in adults» ✔

<table>
<tr><th colspan="2"></th><th>Vitamins</th><th>Minerals</th></tr>
<tr><td>a.</td><td>similarity/comparison</td><td colspan="2">both required in minute/small quantities/are micronutrients
OR
both obtained in diet ✓</td></tr>
<tr><td rowspan="3">b.</td><td rowspan="3">difference/contrast</td><td>organic molecules/compounds</td><td>inorganic/ions/elements</td></tr>
<tr><td colspan="2">OR</td></tr>
<tr><td>example of function
eg essential in metabolic processes</td><td>example of function
eg maintaining osmolarity/synaptic transmission ✓</td></tr>
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