MADANI BOYS SCHOOL YEAR 7 HALF TERM 3

SCIENCE

Nutrition - Seven Components of a healthy diet

	Component	Needed For
1	Carbohydrates	Energy
2	Proteins	Cell growth and repair
3	Lipids (fats and oils)	Energy (used if carbohydrates run out)
4	Vitamins	Vital processes in the body
5	Minerals	E.g. iron for healthy blood, calcium for strong teeth and bones
6	Fibre	Moving food through digestive system
7	Water	All chemical reactions in body

Energy Requirements

BASIC ENERGY REQUIREMENT (BER) — energy needed to maintain essential bodily functions.

Daily BER = 5.4 × 24 × body mass

in kJ/day — in kg

Total energy needed in a day = daily BER + extra energy for activities

E.g. 1 hour walking uses around 800 kJ of energy.

The heavier and more active you are, the more energy you need.

Three possible effects of an unbalances diet

	Effect	Caused by	Possible consequences
1	Obesity (weighing over 20% more than the recommended weight for your height)	Taking in more energy from food than is used up.	Health problems, e.g. high blood pressure, heart disease.
2	Starvation	Lack of food.	Slow growth, greater risk of infection, irregular periods.
3	Deficiency diseases E.g. lack of vitamin C can cause scurvy.	Lack of vitamins or minerals.	E.g. scurvy leads to problems with skin, joints and gums.

Digestion – The Digestive System

DIGESTION — the process of breaking down food so the nutrients can be absorbed into the blood.

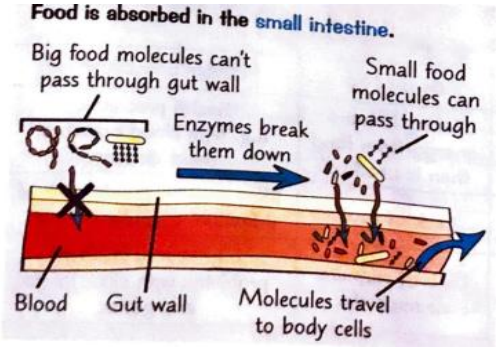
ENZYMES — biological catalysts (things that speed up chemical reactions in the body).

The intestines contain a lot of good bacteria, which:

- **produce enzymes that help with digestion.**
- **help to stop harmful bacteria from growing and making you ill.**

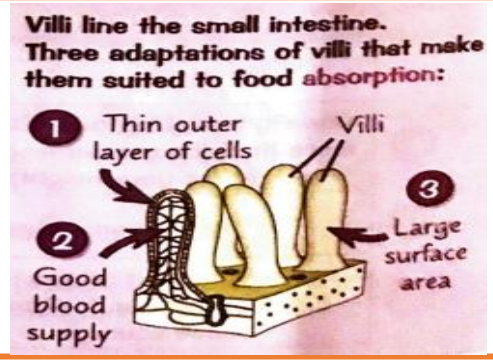
Absorption of Food

Food is absorbed in the small intestine.



Villi

Villi line the small intestine. Three adaptations of villi that make them suited to food absorption:



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SCIENCE

Resistance

RESISTANCE — anything in a circuit that slows down the flow of current.

Resistance is measured in ohms, Ω.

$$\text{Resistance} = \text{Potential Difference} \div \text{Current}$$
(of a component)

If resistance increases and potential difference stays the same, current decreases.

If potential difference increases and resistance stays the same, current increases.

Conductors

CONDUCTOR — a component or material that easily allows electricity to pass through it.

e.g. metals 

They have low resistance. 

The lower the resistance of a component, the better it is at conducting electricity. E.g. a bulb with a resistance of 2 Ω is a better conductor than a bulb with a resistance of 3 Ω.

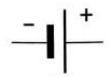
Insulators

INSULATOR — a component or material that doesn't easily allow electricity to pass through it.

e.g. wood 

They have high resistance. 

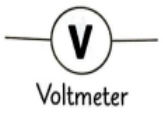
Circuit Symbols



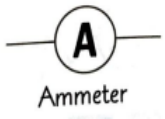
Cell (a single energy source)

Battery (two or more cells put together)

Switch open



Voltmeter



Ammeter

Motor

Buzzer

Switch closed

Bulb

CIRCUIT DIAGRAM — a simplified drawing of a real circuit using circuit symbols.

Electric Current

Electric Current

ELECTRIC CURRENT — the flow of charge around a circuit.

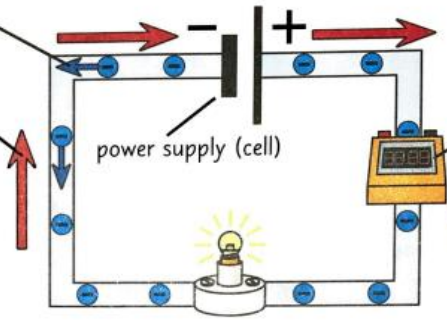
Current is measured in amperes, A.

Electric current can only flow if the circuit is complete.

Charges (negative electrons) move from negative to positive.

However, on circuit diagrams, current is shown as moving from positive to negative.

I know this is silly, but it's true.



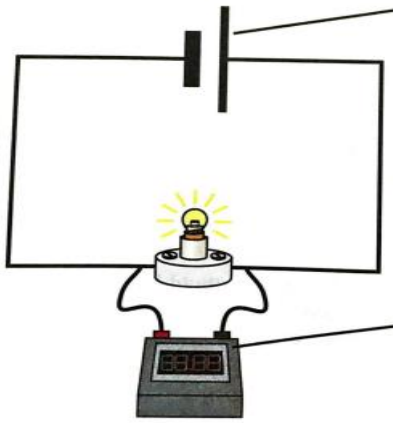
Ammeter — measures electric current through circuit.

Current is not used up — the amount of current that flows out of a cell is the same as the amount that flows back into it.

Potential Difference

POTENTIAL DIFFERENCE — the driving force that pushes charge round a circuit.

Potential difference is measured in volts, V.



Potential difference is provided by the power supply.

You can put power supplies (cells/batteries) together to make a bigger potential difference.

Voltmeter — measures potential difference across a component. (In this case, the bulb.)

Potential difference rating of:

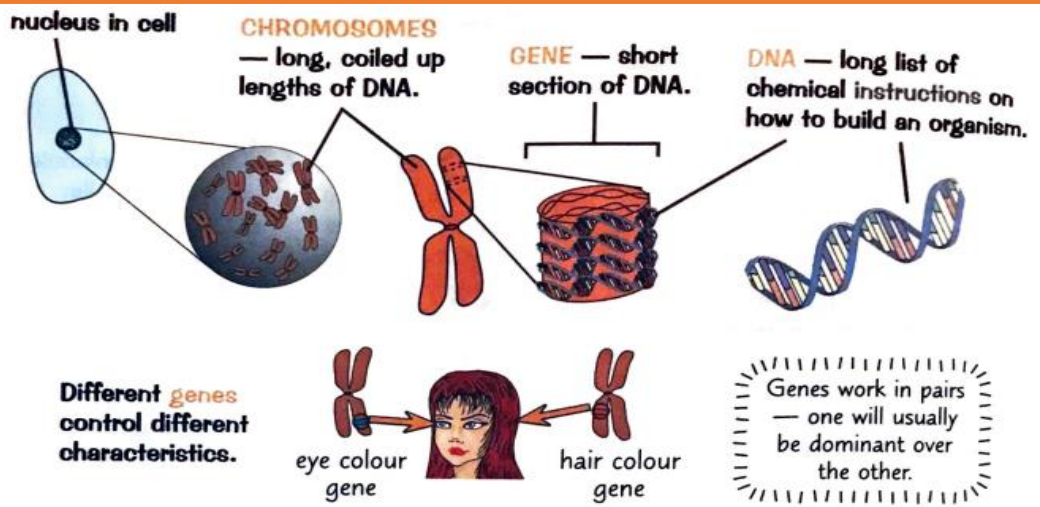
- a battery — tells you the potential difference it will supply.

- a bulb — tells you the maximum potential difference that you can put safely across it.

MADANI BOYS SCHOOL YEAR 8 HALF TERM 3

SCIENCE

Chromosomes, Genes and DNA



Variation

VARIATION — the differences between all living things.

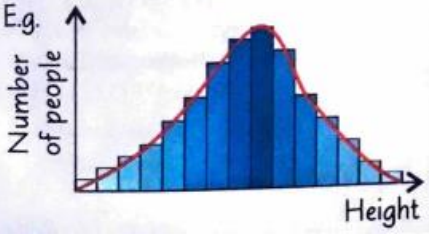
Variation between species occurs because their genes are all very different.

Variation within a species occurs because of:

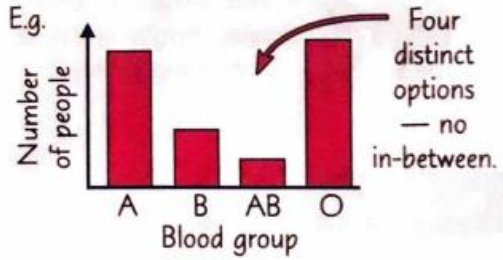
- differences in genes
- environmental factors (e.g. the conditions an organism lives in).

Differences between members of same species (e.g. skin colour) are known as characteristic features.

CONTINUOUS VARIATION — where a characteristic feature can have any value within a certain range, e.g. height or weight.



DISCONTINUOUS VARIATION — where a characteristic feature can only take certain values, e.g. human blood group.



Inheriting Characteristics

HEREDITY — the process by which genes are passed down from parents to offspring.

In humans, sex cells have 23 chromosomes and body cells have 46.

Sex cells contain chromosomes (half the number that's in body cells)

reproduction

Chromosomes pair up. There's one copy of each gene from the mother and one copy from the father.

fertilised egg

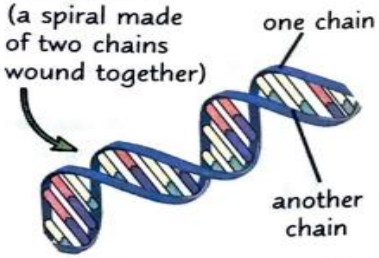
Baby inherits mixture of parents' genes and so a mixture of their characteristics.

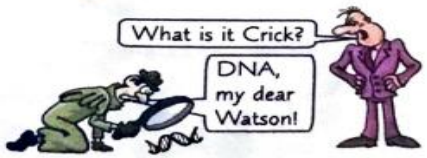
The First Model of DNA

Crick and Watson were the first scientists to build a model of DNA.

X-ray data from Wilkins and Franklin helped them understand that DNA was a double helix.

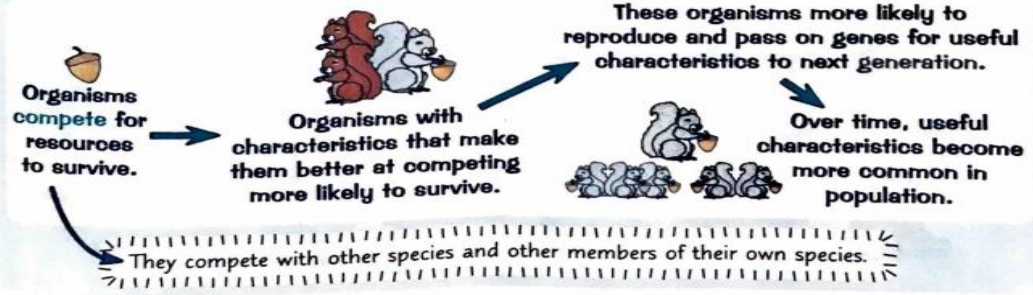
Double helix (a spiral made of two chains wound together)





Natural Selection

NATURAL SELECTION — the process by which a characteristic gradually becomes more (or less) common in a population.



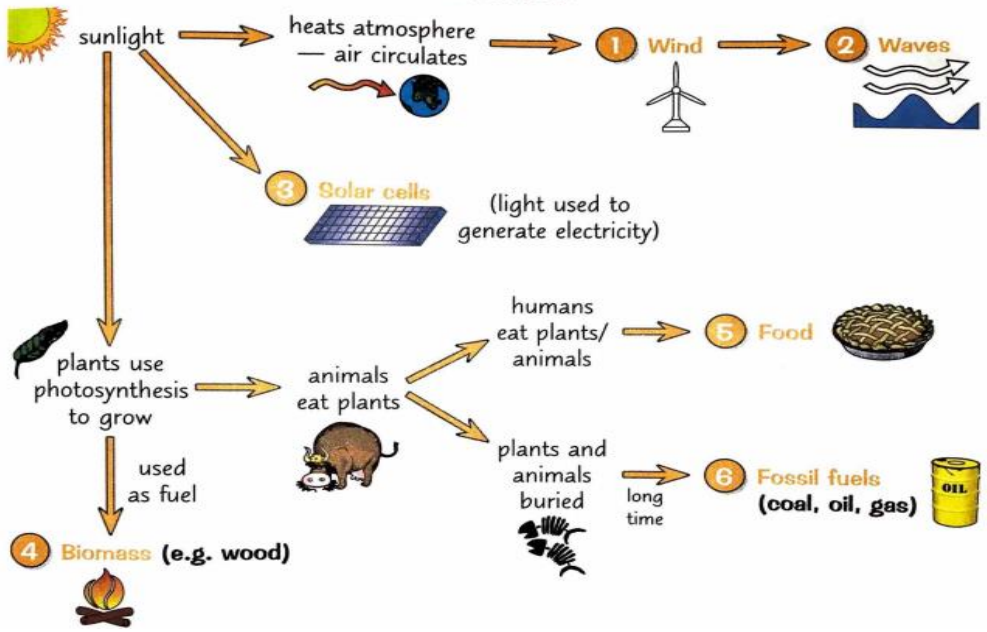
MADANI BOYS SCHOOL YEAR 8 HALF TERM 3

SCIENCE

Energy Resources

Six Energy Resources

The Sun supplies almost all of the energy on Earth — it is transferred to different stores before we use it.



Renewable and Non-Renewable Resources

We use energy resources for things such as:

generating electricity **heating** **transport**

NON-RENEWABLE RESOURCES	Energy resources that will run out one day.	E.g. fossil fuels (take too long to replenish)
RENEWABLE RESOURCES	Energy resources that will never run out.	E.g. solar energy, wind, waves, plants

One problem with renewable resources is unreliability — e.g. it's not always windy or sunny.

Calculating Energy Transfers

ELECTRICAL APPLIANCE — anything that needs electricity to work.

Appliances transfer energy electrically to other stores.

POWER RATING — amount of energy an appliance transfers per second when working at its recommended maximum power.

energy transferred — Power — how fast energy is transferred.

Equation	$E = P \times t$ (t = time)		
Units	joules, J	watts, W	seconds, s
	kilowatt-hours, kWh	kilowatts, kW	hours, h

You could use either of these sets of units in the equation.

Electricity at Home

Electricity meters record amount of energy transferred in kWh. 44281.25 kWh

energy transferred in a time period = meter reading at end – meter reading at start

This is then used to calculate fuel bills.

energy transferred in kWh

$$cost = E \times price$$

price per kWh

Appliances with higher power ratings cost more to run — they transfer more energy in a set time period.

Energy in Food

All food contains energy — we need to take in the right amount of energy each day.

Food labels tell you how much energy is in the food, measured in kJ.

You might also see food labels that give energy in kcals — that's just a different unit.

You can use this information to compare different foods.

MADANI BOYS SCHOOL YEAR 9 HALF TERM 3

SCIENCE

Topic

Global Challenges

Monitoring and Maintaining the Environment

- Describe how you can sample the animals and plants that are present in a habitat.
- Explain how to estimate population sizes from a sample.
- Explain how human activity has resulted in changes in biodiversity.

Feeding the Human Race

- Describe techniques for increasing food production, including selective breeding.
- Describe how to genetically engineer an organism.
- Explain how bacteria are genetically engineered to produce hormones.
- Explain the use of antibiotic resistant markers in genetic engineering.
- State what is meant by biotechnology, and give examples of how it is used in agriculture.

Monitoring and Maintaining Health

- Describe some common fungal, bacterial and viral infections in both plants and animals.
- Describe how communicable diseases can be spread between plants and animals.
- Explain how the spread of disease between plants and between animals can be reduced or prevented.
- Describe some examples of sexually transmitted infections.
- State some examples of non-specific body defence mechanisms.
- Describe the role of platelets and white blood cells in body defences.
- Explain how vaccines can be used to provide immunity to a disease.
- Evaluate data on vaccination programmes.
- Describe the action of antiseptics, antivirals, and antibiotics.
- Calculate the cross-sectional area of a zone of inhibition of an antibiotic drug.
- Describe how to use aseptic technique when working with bacteria.
- Describe how to isolate bacterial colonies for identification.
- Describe how new medicines are discovered, developed and tested for human use.

Non-communicable Diseases

- State some examples of non communicable diseases, including cardiovascular disease (CVD).
- Describe the link between lifestyle choices and some forms of non-communicable disease.
- Evaluate the different lifestyle, medical and surgical treatments for CVD.
- Describe the disadvantages of organ transplants.
- Describe some uses of stem cells and gene therapy in medicine.
- Discuss the ethics surrounding the use of stem cells.
- Describe the advances in medicine that may be made as knowledge of the genome increases.

Global Challenges

B6 Global challenges

Feeding the world

- ↑ food production by:
  1. ↑ photosynthesis (e.g., industrial greenhouses)
  2. using fertilisers (intensive farming, not organic farming)
  3. ↓ competition and pests (herbicides, insecticides, fungicides)
  4. selective breeding and genetic engineering
- sustainable food production can minimise use of chemicals:
  1. fish farming
  2. crop rotation
  3. biological control
  4. hydroponics

Biodiversity

- essential to maintaining a balanced ecosystem

↓

- deforestation
- agriculture (hedgerow removal, pesticides, herbicides)
- hunting and fishing
- pollution

↑

- conservation (international and local agreements, ecotourism)
- controlled grazing, fishing quotas, restricted human access
- captive breeding
- seed banks

Non-communicable disease

- cannot be spread
- caused by poor diet (deficiency or obesity), genetic disorders, or faulty body processes (e.g., uncontrolled cell division → **cancer**)

Smoking

- tar → cancer
- nicotine → ↑ heartbeat
- carbon monoxide → heart disease
- particulates → emphysema
- cilia destroyed → smoker's cough

Alcohol

- ethanol = depressant (slows nervous response)
- causes cirrhosis, heart disease, and brain damage

CVD

- smoking, alcohol, poor diet, too little exercise = ↑ risk
- ↓ smoking, ↓ alcohol, ↓ food, ↑ exercise = ↓ risk
- treated using drugs (e.g., statins), replacing valves, using stents, bypass surgery

Communicable disease

- can be spread between organisms
- caused by pathogens → infect body → replicate → damage cells/release toxins
- delay between infection and symptoms = incubation period

Animals

- spread by:
  1. bites
  2. contaminated food and drink
  3. air
  4. sex

Plants

- spread by:
  1. vectors
  2. direct contact
  3. wind

DEFENCES

- scabs to cover cuts
- phagocytes (engulf microorganisms)
- lymphocytes (antitoxins and antibodies)

PREVENTION

1. cover mouth when coughing/sneezing
2. don't touch contaminated objects, avoid animal bites
3. use condom, use clean sterilised needles
4. wash hands and cook food properly
5. drink clean water
6. destroy infected material

EXAMPLES OF COMMUNICABLE DISEASE

Animals

fungi → athlete's foot
bacteria → food poisoning
virus → HIV

Plants

fungi → Dutch elm disease (caused by elm beetles)
bacteria → crown gall
virus → tobacco mosaic

Prevention and treatment

- vaccination (dead or weakened microorganism used to create immunity)
- antiseptics
- antivirals
- antibiotics
- organ transplant
- stem cells to replace damaged tissue (e.g., Parkinson's)
- gene therapy (e.g., cystic fibrosis): healthy allele inserted into cells → correct proteins made (hard to get allele into correct cell, treatment repeated when cells replaced)