Biology B1

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**B1 Topic 1 Classification**

**Five Kingdoms:** animalia, plantae, fungi, protoctista and prokaryotes

**Phylum:** Comprising several classes

**Class:** Comprising several orders

**Order:** Comprising several families

**Family:** Comprising several genera

**Genus:** Contains several species with similar characteristics

**Species:** Group of organisms that have many features in common and produce fertile offspring*

* However, some organisms reproduce asexually, some hybrids are fertile
## Topic 1 Kingdoms

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Animalia</strong></td>
<td>multicellular, do not have cell walls, do not have chlorophyll, feed heterotrophically (cannot synthesise its own food)</td>
</tr>
<tr>
<td><strong>Plantae</strong></td>
<td>multicellular, have cell walls, have chlorophyll, feed autotrophically (uses light or chemical energy)</td>
</tr>
<tr>
<td><strong>Fungi</strong></td>
<td>multicellular, have cell walls, do not have chlorophyll, feed saprophytically (derives nourishment from dead or decaying organic matter)</td>
</tr>
<tr>
<td><strong>Protoctista</strong></td>
<td>unicellular, <strong>have a nucleus</strong></td>
</tr>
<tr>
<td><strong>Prokaryotes</strong></td>
<td>unicellular, <strong>have no nucleus</strong></td>
</tr>
</tbody>
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Viruses not classified as these are ‘non living’
Vertebrates are examples of Chordata (animals with a supporting rod running the length of the body).

Vertebrates can be classified into groups based on:

**Oxygen absorption:** Lungs, Gills & Skin

**Reproduction:** Internal fertilisation. External fertilisation **Oviparous** (egg laying). **Viviparous** (live birth)

**Thermoregulation:** **Homeotherms** (constant body temperature), **Poikilotherms** (varying internal temperature)

Many vertebrates are difficult to classify
Hybrid ducks (H):
Ducks hybridise readily, both in captivity and among wild populations. Identifying hybrids is fraught with difficulties. Not only are they highly variable but they do not always simply show a mix of each parent species' features. Indeed there are instances of hybrids bearing a more striking resemblance to a third species than to either of their two parent species.
Example of a key:

Binominal Classification (H): Animals may be given the same name in two different locations. Binominal Classification allows species to be clearly identified and this helps when studying or trying to conserve species.

Keys can take many forms – read carefully!

1.8(H)
1.10

American robin
(Turdus migratorius)

European robin
(Erithacus rubecula)
B1 Topic 1 Adaptation to environment

**Polar:**

Two layers of greasy, white fur:
Less easy to see, repels water and keeps bear dry.
Hair follicles are hollow to trap warm air.

Thick blubber:
Distributed under the skin,
acts as insulation

Black skin:
Absorbs any heat transmitted through the fur

Small surface to volume ratio

**Brown eyes:**
Adapted to reduce glare

**Big hairy paws:**
Don’t freeze and act like snowshoes.
B1 Topic 1 Adaption to environment

**Hydrothermal vents:**

**Tolerate large temperature changes:**
A layer of surface bacteria allow it to handle temperature changes of 40-90°C

**No light:**
Chemosynthesis not photosynthesis.

**Extreme pressure:**
Adapted to pressures 200 x greater than on the surface.

**Tentacles not eyes:**
With very little light it is better to ‘feel’ for prey.

**Example: Pompeii worm**
### B1 Topic 1 Darwin’s Theory of evolution

<table>
<thead>
<tr>
<th><strong>Variation</strong> – most populations of organisms contain individuals which vary slightly from one to another</th>
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<tr>
<td><strong>Over-production</strong> – most organisms produce more young than will survive to adulthood</td>
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<tr>
<td><strong>Struggle for existence</strong> – because populations do not generally increase rapidly in size there must therefore be considerable competition for survival between the organisms</td>
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<tr>
<td><strong>Survival</strong> - those with advantageous characteristics are more likely to survive this struggle</td>
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<tr>
<td><strong>Advantageous characteristics inherited</strong> – better adapted organisms are more likely to reproduce successfully passing on the advantageous characteristics to their offspring</td>
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<tr>
<td><strong>Gradual change</strong> – over a period of time the proportion of individuals with the advantageous characteristics in the population will increase compared with the proportion of individuals with poorly adapted characteristics, and the poorly adapted characteristics may eventually be lost</td>
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</table>
# Topic 1 Continuous / Discontinuous

### Continuous:
- No distinct category
- Wide variation

![Histogram of Height](image)

### Discontinuous:
- Distinct category
- Fewer genes
- Unaffected by environment

![Images of Tongue](image)

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**Genetic variation:** Different characteristics as a result of mutation or reproduction

**Environmental variation:** Caused by an organism’s environment (acquired characteristics)
B1  Topic 1 Speciation

Speciation (H):
Can occur as a result of geographical isolation. All the following are flightless birds that have developed, from a single ancestor, whilst a long way apart and over a very long time:

Darwin observed speciation in finches of the Galapagos islands and published his ideas in his book the *Theory of Evolution*. This theory publication was subject to peer review and discussed at scientific conferences before being accepted.
B1  Topic 1 Emergence of resistance

Darwin’s Theory and DNA studies help explain the emergence of resistance such as the spread of resistance to antibiotics.

This also occurs in microorganisms and can even be seen in rats that have developed a resistance to the poison Warfarin.
Genes are ‘sections’ of the DNA and can exist on each strand in alternative forms called alleles. Alleles may be dominant or recessive and give rise to differences in inherited characteristics:
The allele for Brown eyes (B) is dominant, the allele for Blue eyes (b) is recessive.

Two identical alleles (BB or bb) are called homozygous, two different alleles (Bb) are called heterozygous.

Heterozygous cross (Bb x Bb) will probably result in 25% Brown Homogenous (BB), 50% Brown Heterozygous (Bb) and 25% Blue Homogenous (bb). Brown eyes 3:1.
**B1 Topic 1 Genetic disease**

**Sickle Cell Disease:**
(Caused by double recessive alleles)
*Blocked blood vessels
*Tired
*Short of breath
*Painful joints

**Cystic Fibrosis:**
(Caused by double recessive alleles)
*Persistent coughing
*Difficult breathing
*Build up of mucus
*Frequent infection
*Weight loss

**Pedigree analysis (H):**
Pedigree charts show which members of a family suffer from a disorder. Doctors then use the chart to analyse the probability of inheriting a disease.
Homeostasis:
The maintenance of a stable internal environment

The skin and thermoregulation:
If the body gets too hot:
The nerve endings detect this. In the dermis: Sweat glands secrete sweat onto the surface of the skin, this evaporates lowering body temperature. Sebaceous gland excretions emulsify sweat preventing it being lost as droplets. Hairs on the skin lay flat and erector muscles relax to increase heat loss. Blood vessels dilate increasing the flow of blood to the surface of the skin where heat can be lost to the air.

If the body gets too cold:
Erector muscles contract, hairs stand on end trapping air that acts as insulation Blood vessels constrict, reducing the flow of blood to the surface hence reducing heat loss.
**Hypothalamus:**
This monitors the temperature of the blood, sending signals to the blood vessels in the dermis in response. Therefore, regulating blood temperature.

**Vasoconstriction, Vasodilation (H):**
Vasodilation results in a widening of the blood vessels, this increases blood flow and heat loss. Vasoconstriction narrows the blood vessel, reducing blood flow / heat loss.

**Negative feedback (H):**
Feedback is needed to prevent temperature change from running away and to keep the body at an optimum 37°C.
### Endocrine glands:
Endocrine glands produce hormones which can be transported by the blood to their target organs.

**Insulin:**
* Blood hormone levels are regulated by the hormone insulin which is produced in the pancreas.
* Excess blood sugar is converted by insulin to glycogen in the liver.

*Type 1 diabetes is caused by a lack of insulin. It can be controlled by injections of insulin and, because the body cannot lower blood sugar levels, both diet and exercise.

* Type 2 diabetes occurs when the body becomes resistant to insulin. * Can be controlled by exercise and diet.
* Strong links to obesity (BMI)

(H) Blood glucose levels are regulated by glucagon causing the conversion of glycogen to glucose
Gravitropism, or Geotropism, is caused by the plant hormone auxin. Auxin slows the growth of cells in the root and stimulates growth in stems. As a result, stems grow up and roots grow down.

In light, auxin is concentrated on the shaded side of the stem. Auxin causes cell elongation so the stem will grow towards the light.

Gibberellins are plant hormones that also regulate development and growth.
Rooting powders contain growth hormones that make stems quickly develop roots.

Selective weedkillers:
Kill some plants but not others. Growth hormones are absorbed by specific plants, this causes the plants to grown too rapidly and then die. Useful for removing dandylions from lawns or thistles from wheat crops.

Fruit ripening:
Hormones can be used to speed up or slow down fruit ripening. This can be useful if fruit has a long way to travel or will be on display for some time.

Seedless fruit:
Auxins applied to unpollinated plants will produce seedless fruit.
The C.N.S. consists of the brain and spinal chord, linked to sense organs by nerves. Neurones: Receptors are specialised cells, usually in the sense organs, that detect changes in the environment. Stimuli such as touch, pressure, pain, chemicals, temperature or sound are turned into electrical impulses which pass along neurones to the CNS and the brain. Dendron: Dendrons collect electrical signals Axon: Axons pass the electrical signals onto other dendrites Myelin sheath: Signals pass down the dendrons and axons which are protected and insulated by a myelin sheath.
Sensory neurones: transmit impulses inwards from sensors

Relay neurones: within the CNS, pass on electrical impulses generated by the stimuli.

Motor neurones: transmit signals from the CNS to muscles and glands elsewhere in the body.

Myelin sheath protects and insulates nerve fibres and also increases the rate of transmission.

2.23
B1 Topic 2 Reflex arc
B1 Topic 3 Drugs

A drug is a chemical substance, such as a narcotic or hallucinogen, that affects the C.N.S., causing changes in psychological behaviour and possible addiction.

**Stimulants:**
Increase the speed of reaction and speed of transmission at the synapse. Includes caffeine.

**Depressants:**
Drugs, including alcohol, that slow down the activity of the brain.

**Painkillers:**
Including morphine, drugs that block nerve impulses transmitting pain signals.

**Hallucinogens:**
Including LSD, these psychotic agents cause a profound distortion in the sense of perception of reality.
Carbon Monoxide: Reduces the oxygen carrying capacity of the blood.

Nicotine: Addictive drug

Tar: Carcinogen (causes cancer)

Carbon Monoxide:
Reduces the oxygen carrying capacity of the blood.

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Addictive drug

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Transplant ethics:
Liver transplants for alcoholics?
Heart transplants for the clinically obese?
Supply of organs?

Smoking related deaths:
- Cancer, including lung cancer 39.70%
- Heart disease 21.20%
- Chronic bronchitis & emphysema 20.10%
- Other, including stroke 18.3%
- Passive smoking 0.70%

Alcohol problems:
Short term: Blurred vision, lowering of inhibitions, slowing of reactions.

Long term: Cirrhosis of the liver, brain damage.
Pathogens cause infectious diseases:
They can be spread:

**In water:** including cholera bacterium

**By food:** including *Salmonella* bacterium

**Airborn:** (eg sneezing), including influenza virus

**By contact:** including athlete’s foot fungus

**In body fluids:** including HIV

**Via animal vectors:** including:
- i housefly: dysentery bacterium
- ii *Anopheles* mosquito: malarial protozoan
Physical barriers:
The human skin forms a physical outer barrier.

Whilst inside the body a mucus layer on the surface of cells traps particles in the respiratory tract which are then wafted out by cilia on the surface.

Chemical barriers:
Pathogens need to get inside the body to spread infection. Once they are inside they will find ideal conditions. However, the hydrochloric acid in the stomach kills micro-organisms and provides some protection against salmonella and other harmful bacteria.

Lysozymes in tears, saliva, human milk, mucus and even perspiration are enzymes that can damage the cell walls of bacteria.
Antibacterial plants: Plants, such as Marjoram have natural antibacterial properties. These can be crushed or made into oils for use by humans.

Antibiotics: These substances kill bacteria or stop their growth inside the body. They do not work against viruses. Failure to complete a course of antibiotics or increased exposure through the food we eat can lead to resistant strains of bacteria (such as MRSA (H)).

Antifungal: Antifungal agents, like athletes foot cream, kill fungi.

Antiseptics: Used on the skin to destroy bacteria. Disinfectants destroy bacteria on non-living surfaces.
**B1 Topic 3 Interdependence Eutrophication**

**Interdependence:**
A dynamic relationship between all living things.

A change to any one population can have a significant knock on effect on others.

**Eutrophication:**
When the environment becomes enriched with nutrients. Often results in algal blooms in lakes and eventually plants and animals compete for oxygen.

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![Diagram of Interdependence and Eutrophication](image-url)
B1 Topic 3 Energy transfer

Useful energy:
Some energy is transferred to less useful forms at each trophic level and it is this loss/reduction of energy at each consumer level that limits the length of the foodchain.

Pyramid of numbers:
These pyramids show bars that represent the available energy at each trophic level. They could just as easily show the mass at each level.
**B1**  
**Topic 3 Parasitism Mutualism**

**Parasites:**  
Parasites require the presence of other species in order to survive. These are just a few examples:

- Fleas
- Head lice
- Tapeworm

**Mutualism:**  
Organisms that live together for mutual benefit. These are just a few examples:

- Cleaner fish
- Oxpeckers. Birds that clean other species
- Nitrogen fixing bacteria in legumes (H)
- Chemosynthetic bacteria in tube worms in deep sea vents (H)
Even as the populations of Western countries are reaching their peak, with the advent of better health care and other factors, others are continuing to grow at a rapid rate.

Human population growth places great strain on the chances of other animals, they develop the land, use the food and poison the water.
Various species can be used as indicators to the quality of water or air.

Bloodworms and Sludge worms have adapted to thrive in polluted conditions whereas stonefly larvae and freshwater shrimps are very sensitive to dissolved oxygen levels.

Both Blackspot fungus on roses and Lichen on walls, trees, houses and gravestones are easily killed by sulfur dioxide in the atmosphere. They are indicators of clean air.
Plastics:
Plastics can be recycled but come in many types and forms. Sorting is time consuming and expensive.

Metals:
Metal extraction requires a great deal of energy and used metals fetch a very high price – one reason why thieves strip lead off roofs and copper wires from railway lines.

Paper:
Paper can be recycled to cardboard very easily. The production of white paper involves strong chemicals and is linked to high levels of pollution.
Carbon on Earth is recycled:

- During photosynthesis plants remove carbon dioxide from the atmosphere
- Carbon compounds pass along a food chain
- During respiration organisms release carbon dioxide into the atmosphere
- Decomposers release carbon dioxide into the atmosphere
- Combustion of fossil fuels releases carbon dioxide into the atmosphere
*Nitrogen gas in the air cannot be used directly by plants and animals
*Nitrogen-fixing bacteria living in root nodules or the soil can fix nitrogen gas
*Action of lightning can convert nitrogen gas into nitrates
*Decomposers break down dead animals and plants
*Soil bacteria convert proteins and urea into ammonia
*Nitrifying bacteria convert this ammonia to nitrates
*Plants absorb nitrates from the soil

*Nitrates are needed by plants to make proteins for growth
*Nitrogen compounds pass along a food chain or web
*Denitrifying bacteria convert nitrates to nitrogen gas

**Topic 3 Nitrogen Cycle (H)**

3.27(H)