B2

Homeostasis – control of blood glucose, body temperature and water at **optimum** levels
Stimuli – change to environment (light, sound, pain, temperature etc)
Receptors – detect stimuli (Change in the environment) - Sense organs (eyes, nose, ears, tongue, skin) have many **receptors**
Coordination centres – brain, spinal cord or pancreas
Effector – muscles and glands that respond
Stimulus → receptor → coordinator → effector → response

Nervous system
Reflex arc: Stimulus → receptor → Sensory, Relay, Motor Nerves → Muscle or gland
Synapse – electrical impulse → chemical → electrical impulse

Endocrine system
Glands release chemicals called **hormones** into blood stream. Hormone travels in blood to **target organ**. Much slower than nervous system but acts for longer e.g. insulin, glucagon, adrenalin, thyroxine

Pituitary gland is the 'master gland'. Other glands include pancreas (insulin and glucagon, thyroid (neck - thyroxine), adrenal (on top of kidneys - adrenaline) ovaries (Oestrogen) and testes (testosterone)

Blood Glucose Control Coordination centre = pancreas **(Negative feedback cycle)**
Too high: **INSULIN –** glucose moves **into cells** from blood (liver and muscle cells) – stored as **GLYCOGEN**
Too low: **GLUCAGON**- Glycogen broken down and glucose moves **out of cells** to the blood

Type 1 diabetes: Not enough insulin produced by pancreas (Patients given injections of insulin)
Type 2 diabetes: Liver and muscle cells do not respond to insulin (Patients given carbohydrate controlled diet and exercise) – obesity is a risk factor

Menstrual Cycle
uterus breaks down (period), uterus builds up, egg released every 28 days (**ovulation**). If met by sperm = baby, If not = cycle restarts

FSH – made in pituitary – matures egg
LH – made in pituitary – releases egg
Oestrogen and progesterone– made in ovaries – maintains uterus lining and stops FSH

Contraception
Hormonal methods: contains oestrogen and/or progesterone to stop FSH (eggs do not mature)
Oral pill (short term), injection or skin patch (long term)
Non-hormonal methods: Condoms or diaphragm are a barrier to sperm meeting egg. Spermicide kills the sperm. Surgery can be used to sterilise males and females. Intrauterine devices prevent implantation of embryo

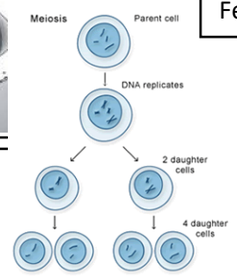
Increasing fertility
FSH and LH can be used as fertility drugs.
IVF involves giving FSH and LH to mature and release many eggs. Eggs collected from female, sperm collected from male. Fertilisation happens in a laboratory and eggs develop to embryos. Embryos placed in mothers uterus
Negatives of IVF: low success rate, emotionally and physically stressful, multiple births can be dangerous to mother and babies. Ethical concerns about unused embryos being destroyed

Adrenaline (HT)
Produced in adrenal gland (on top of kidneys) in times of **fear and stress**
Increases heart rate → more oxygen and glucose to brain and muscles → more aerobic respiration → more energy

Thyroxine (HT)
Produced in thyroid gland (neck) and stimulates the **basal metabolic rate** (how fast respiration happens).
It is important for **growth and development**.
Negative feedback:
If Thyroxine too low, TSH hormone released from pituitary = more Thyroxine released
If Thyroxine too high, TSH hormone stopped = less Thyroxine released

Sexual Reproduction: male + female gametes = mixing of genes = variation
Asexual Reproduction: one parent divides = no mixing of genes = no variation (clones)

Meiosis cell division makes gametes (happens in ovary or testes)
Copies of DNA made, cell **divides twice** to make **4 gamete cells** (each have only one set of chromosomes)
All gametes are **genetically different** with **half** the number of chromosomes of parent cell (e.g. only 23 in humans).
Fertilisation restores the full number of chromosomes (e.g. back to 46 in human embryo)



	R	r
R	RR	Rr
r	Rr	rr

25% rr
Homozygous recessive

DNA forms **chromosomes** – two **polymer** strands make a **double helix**
Gene: small section of DNA that codes for a sequence of amino acids to make a protein
Genome: all the genetic material in an organism – studying this helps us to understand genetic disorders and migration patterns

Alleles: different versions of a gene
Phenotype: characteristic in words (red /white), **genotype:** allele code (Rr)
Homozygous (rr, RR), **Heterozygous** (Rr)
Dominant: only one allele needed (Polydactyl – too many fingers and toes)
Recessive: both alleles needed (Cystic Fibrosis – disorder of the membranes)
Carrier: no symptoms, one recessive allele

Single gene characteristics: mice fur colour, red-green colour blindness
Characteristics are usually controlled by multiple genes e.g. height
Male XY, Female XX (23rd pair of chromosomes)

50% XY male

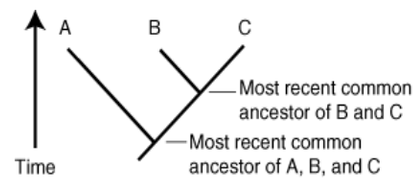
	X	Y
X	XX	XY
X	XX	XY

Embryo screening
IVF used to create many embryos, tested for genetic disorders
+ stop suffering of sick child, + Stop disorder being passed on to next generations,
+ Less cost to NHS
– Discard embryos, - Illegal for anything other than some genetic diseases, - surgical risks for mother, - some costs for process

Gene Therapy
Involves inserting copies of normal alleles into the chromosomes of individuals with faulty alleles via nose sprays or modified viruses.
+ can stop suffering +Less cost to NHS
- Ethical concerns over modifying human DNA

Evolution
Darwin – Theory of Natural Selection = formation of new species over time (simple life started **3 billion years ago**)
1. **Variation in a population must exist -** caused by mutation of DNA
2. Environmental change (temperature, predator, prey, disease)
3. Competition
4. Survival of the fittest
5. Breed and Pass on DNA
6. New species formed when individuals **can not breed to produce fertile young**

Darwin was not originally accepted due to religious beliefs, not enough evidence, no understanding of genes and other theories were believed



Antibiotic resistance
1. Variation in bacteria population cause by mutations of DNA (make some resistance to antibiotics)
2. Antibiotic introduced
3. Competition
4. Survival of the fittest – if resistant they survive
5. Divide and pass on DNA

Resistant strain spreads as there is no effective treatment **(MRSA)**
Doctors should not prescribe antibiotics for viruses, patients should complete course of antibiotics, we should not use antibiotics to treat agriculture animals (cows, sheep). Expensive, difficult and slow to develop new antibiotics

Selective breeding (artificial selection)
Humans breed animals or plants with desired characteristics – e.g. high yield of meat or milk, domestic dogs, large flowers

1. Select parents with desired characteristics
2. Breed together
3. Select children with desired characteristic
4. Breed together (inbreeding)
5. Continue over many generations

Inbreeding can lead to problems with inherited diseases or defects e.g. deafness or cancers in some dog breeds

Genetic Engineering
Place DNA from one organism in another. e.g human insulin gene placed in bacteria DNA
(HT) cut with **Enzymes** → inserted into **vector** (plasmid or virus) → product collected (insulin) or inserted into required cells in early stage of development (e.g. embryo or seed)

Genetically modified crops
+ Crops of high quality (high yield, disease and pest resistant, bigger and better fruit)
+ Create crops with extra nutrients
- Create superweeds that destroy biodiversity and effect wild flowers and insects
- Hard to control where pollen goes
- Concerns that there may be side effects – lack of research

Fossils
Remains of organisms from millions of years ago
Only happens if full decay does not occur (lack of oxygen or suitable temperature of pH)
Bones, footprints, burrows or rootlet traces **replaced by minerals**

Fossil record is incomplete as many organisms were **soft bodied** or fossils destroyed by **geological activity** (volcanoes and earthquakes)

Extinction
Caused by new disease, predators, competitors, climate change of catastrophic event

Ecosystems
Interaction between **biotic** (living) and **abiotic** (non- living) factors
Abiotic: Light intensity, temperature, moisture levels, soil pH, mineral ions, wind intensity and direction, carbon dioxide levels for plants and oxygen levels for aquatic animals
Biotic: food, predators, pathogens and competition

Animals compete for food, mates and territory
Plants compete for light, space, water and mineral ions

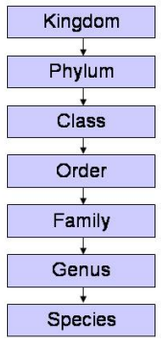
Interdependence is when species depend on one another for food, shelter, pollination and seed dispersal.

A **stable community** is one where all the species and environmental factors are in balance and the population size remains fairly constant. This is more likely to happen if biodiversity (variety of life) is high

Food chains
All energy comes from the sun. Plants use photosynthesis to make glucose – which can then be eaten.
Plants are **producers** of biomass for all life
Producer → primary consumer → secondary consumer → tertiary consumer

Predator prey cycles
- as prey numbers increases, less competition for predator, so predator numbers increase
- As prey number decrease, more competition for predator (starve), so predator numbers decrease

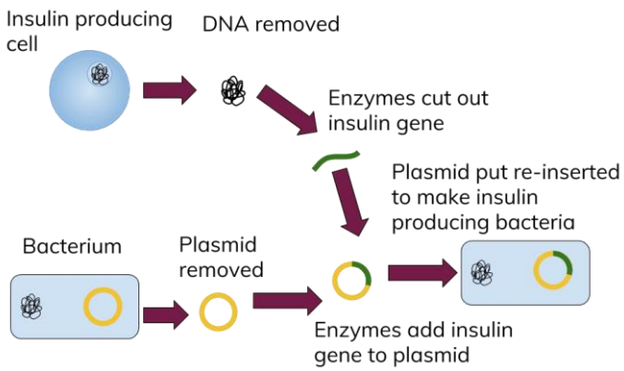
Linnaeus's System of Classification

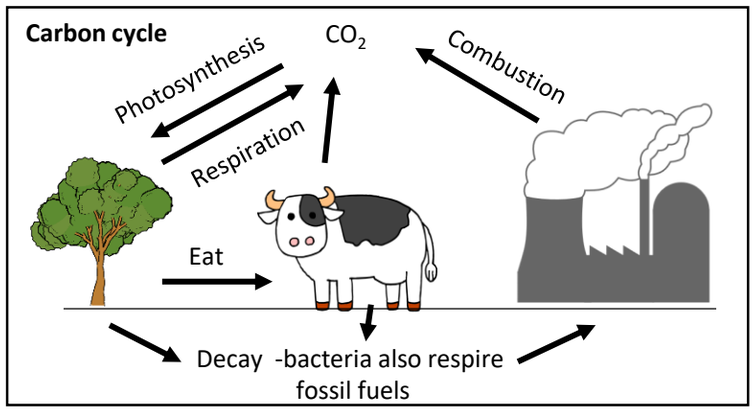


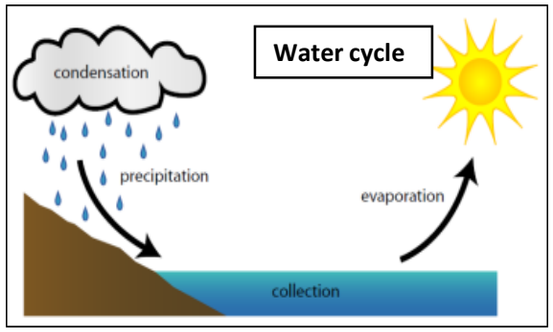
Carl Linnaeus classified living things into groups called taxon.
Binomial System of naming : *Genus species e.g. Homo sapiens*
Carl Woese developed **3 domain system** : **archae** (primitive bacteria), **bacteria** (true bacteria) and **eukaryota** (plants, animals, fungi and protists)

Adaptations - structural, behavioural or functional
e.g. Desert rat – large ears = large surface area for heat loss (S), goes underground to avoid heat in middle of the day (B), Does not sweat to conserve water (F)
e.g. Cactus – spikes = low surface area to conserve water (S), extensive roots to get more water (S), Fragrant flowers to attract pollinators (F)

Extremophile – adapted to live in extreme environments such as high temperature, pressure, salt concentration e.g. deep sea vent

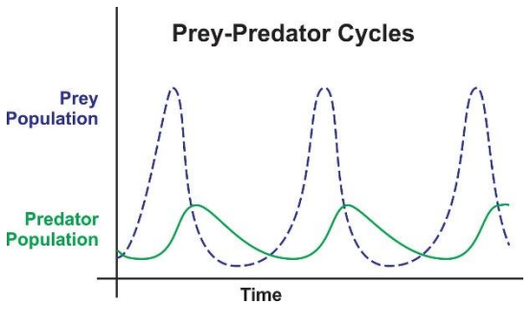






Maintaining Biodiversity

1. Breeding programmes for endangered species
2. Protect and regenerate rare habitats
3. Reduce deforestation
4. Recycle resources rather than sending to landfill
5. Reduce use of electricity to avoid carbon emissions
6. Encourage farmers to have field margins and hedgerows



Sustainability
Rapid population growth and increased standard of living = more resources used and more **waste = reduced biodiversity**
Water – sewage, fertiliser, toxic chemicals
Air– sulfur dioxide (acid rain), carbon dioxide (global warming)
Land – rubbish in landfill, toxic chemicals

Humans build, quarry and farm to destroy habitat
Peat bog destruction
+ Cheap compost for gardens and farms + Fuel
- Reduces Biodiversity - Carbon emission released when burnt

RP1: Reaction Time – Read info carefully to check IV in Question
e.g. IV = affect of caffeine intake on reaction time
DV = distance caught on ruler – converted to reaction time using conversion table
CV = same hand, same person, start at 0 on ruler, same amount of sleep, food

RP2a: Investigate population size

1. Random sampling – create a grid using 2 tape measure and randomly select coordinates e.g. 2m and 10m – place a transect
2. Count number of dandelions in 10 different quadrats
3. **(total Area/ area sampled) x number of plants = population size**

e.g. if area surveyed is 400m^2 and each quadrat is 0.5m x 0.5m and 45 dandelions found …
((400/(0.5 x 0.5 x 10)) x 45 = estimated 7,200 dandelions
Use more quadrats to ensure sample is **representative**

RP2b: The effect of an abiotic factor on distribution

1. Lay a transect line (tape measure)
2. Measure light intensity and number of daisies in each quadrat
3. Systematic sampling – use a quadrat every 2m (regular intervals)
4. Repeat to see if results are repeatable, compare with others to see if reproducible