Edexcel IAL Biology A-level

6.16-6.20 - Forensic Techniques

Flashcards

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Describe the stages of the carbon cycle

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Describe the stages of the carbon cycle

1. Photosynthesising plants remove CO_2 from the atmosphere
2. Eating passes carbon compounds along a food chain
3. Respiration in plants and animals returns CO_2 to the atmosphere
4. Organisms die and decompose. Saprotrophs break down dead material and release CO_2 via respiration
5. Combustion of materials (e.g. wood, fossil fuels) releases CO_2

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What is a saprotroph?

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What is a saprotroph?

An organism that feeds by extracellular digestion, e.g. fungi

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Describe extracellular digestion by saprotrophs

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Describe extracellular digestion by saprotrophs

- Release enzymes which catalyse the breakdown of dead plant and animal material into simpler organic matter
- Absorb the products of digestion

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Give some examples of organisms that play an important role in decay

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Give some examples of organisms that play an important role in decay

- **Detritivores** - feed on dead organic matter
- **Saprotrophs** - feed by extracellular digestion

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How can extent of decomposition help determine how long a body has been dead?

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How can extent of decomposition help determine how long a body has been dead?

Bodies in similar environmental conditions show regular patterns of decay

fresh → bloated → decaying → dry

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How can DNA fragments be amplified *in vitro*?

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How can DNA fragments be amplified *in vitro*?

polymerase chain reaction (PCR)

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What is PCR (Polymerase Chain Reaction)?

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What is PCR (Polymerase Chain Reaction)?

A biochemical technique used to amplify (produce many copies of) sections of DNA. It has many applications including in forensics where it is used to produce more DNA samples for genetic fingerprinting

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What is Taq DNA polymerase?

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What is Taq DNA polymerase?

A thermally stable enzyme that synthesises a double-stranded molecule of DNA from a single template strand using complementary nucleotides

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What does the reaction mixture in the first stage of PCR contain?

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What does the reaction mixture in the first stage of PCR contain?

- DNA fragment to be amplified
- Complementary primers to bind to start of fragment
- Free nucleotides to attach to exposed bases
- DNA polymerase to join nucleotides on new strand

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Summarise the process of using PCR

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Summarise the process of using PCR

1. Heat to 95℃ to break H-bonds between DNA strands
2. Cool to 54℃ to allow primers to bind
3. Heat again to 70℃ to activate DNA polymerase and allow free nucleotides to anneal
4. New DNA acts as template for next cycle

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How can DNA probes be used to locate specific alleles?

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How can DNA probes be used to locate specific alleles?

The probe is designed so that its sequence is complementary to the allele you want to find.

They are labelled, amplified using PCR, then added to a sample of single stranded DNA.

The probe will bind if the allele is present

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What is gel electrophoresis?

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What is gel electrophoresis?

A technique that separates nucleic acid fragments or proteins by size using electric current

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How does gel electrophoresis work?

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How does gel electrophoresis work?

- DNA fragments of varying lengths are placed at one end of a slab of agarose gel
- Electric current applied. DNA fragments move towards the positive end of the gel as DNA has a negative charge
- Shorter fragments travel further. The pattern of bands created is unique to every individual

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What is DNA profiling?

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What is DNA profiling?

A method of comparing DNA sequences by cutting them into fragments and comparing the fragments with each other for genetic identification or determining genetic relationships

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What can DNA profiling be used for?

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What can DNA profiling be used for?

- Identifying individual organisms
- Determining genetic relationships

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What are STRs?

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What are STRs?

- Short Tandem Repeats
- Sections of repeated nucleotides within introns that produce variation in individuals

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How does DNA profiling work?

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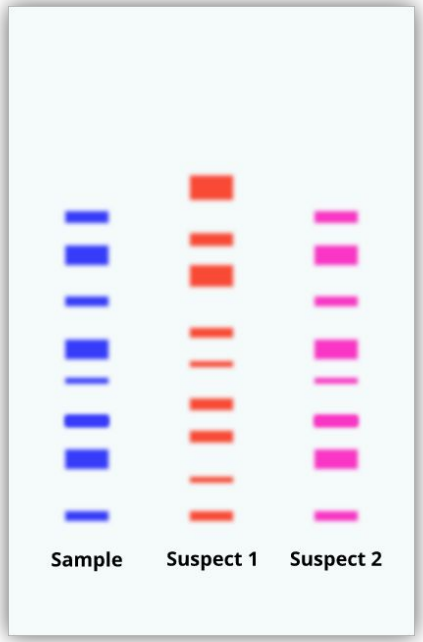
How does DNA profiling work?

1) DNA is extracted and purified from the sample
2) Amplification using PCR (primers are used to attach tags to STRs)
3) The DNA is then cut into small fragments using restriction endonucleases
4) The DNA fragments are then separated using gel electrophoresis and the banding pattern is analysed



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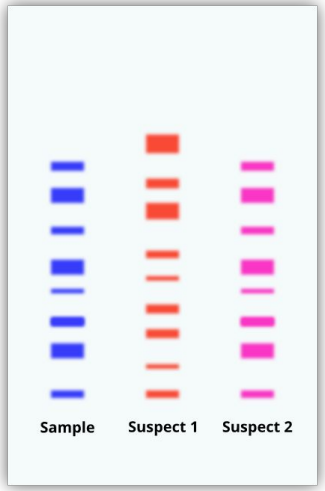
In the results shown in the graphic below, which suspect's DNA matches the sample found at the crime scene?



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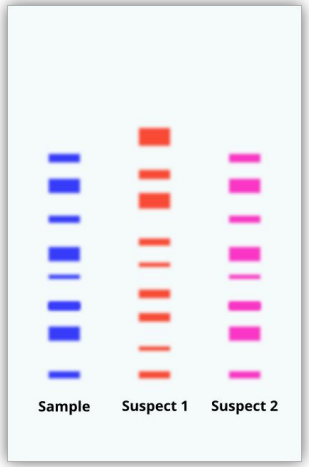
In the results shown in the graphic below, which suspect's DNA matches the sample found at the crime scene?

Suspect 2



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Name five factors that can help determine time of death.

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Name five factors that can help determine time of death.

- Seral stage of succession
- Level of decomposition
- Forensic entomology (types of insects in body)
- Extent of muscle contraction
- Body temperature

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How can seral stage of succession help determine how long a body has been dead?

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How can seral stage of succession help determine how long a body has been dead?

Predictable sequence of ecological succession. Different organisms colonise corpse at each stage e.g. necrophagous species first. Use a succession database

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What is forensic entomology?

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What is forensic entomology?

Determines age of insects on a corpse using known life cycles. Measured in accumulated day degrees, which represents physiological time.

Alongside knowledge of seral stages, can accurately determine post mortem interval

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How can body temperature help determine how long a body has been dead?

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How can body temperature help determine how long a body has been dead?

Metabolic reactions stop, so body temperature decreases at a predictable rate

Only applicable up to 24 hours after death since body reaches same temperature as surroundings

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How can degree of muscle contraction help determine how long a body has been dead?

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How can degree of muscle contraction help determine how long a body has been dead?

Observe the extent of rigor mortis (muscle stiffening which occurs after death).

Only applicable up to 36 hours after death

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