

Forensic Chemistry

1. The job of the forensic chemist is to identify materials and trace their origins

Outline precautions that may be necessary to ensure accuracy and prevent contamination of samples for analysis

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Distinguish between organic and inorganic compounds

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Explain that there are different classes of carbon compounds including:

hydrocarbons

alkanols

alkanoic acids

Which can be identified by distinguishing tests

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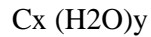
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2. Analysis of organic material can distinguish plant and animal material

identify that carbohydrates are composed of carbon, hydrogen and oxygen according to the formula :



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identify glucose as a monomer and describe the condensation reactions which produce:

sucrose as an example of a disaccharide

polysaccharides including glycogen, starch and cellulose

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describe the chemical difference between reducing and non-reducing sugars

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distinguish between plant and animal carbohydrates' composition in terms of the presence of:

- cellulose
- starch
- glycogen

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3. Because proteins are a major structural and metabolic component of all living organisms, the analysis of protein samples can be useful in forensic chemistry

Distinguish between protein used for structural purposes and the uses of proteins as enzymes

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Identify the major functional groups in an amino acid

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Describe the composition and general formula for amino acids and explain that proteins are chains of amino acids

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Describe the nature of the peptide bond and explain that proteins can be broken at different lengths in the chain by choice of enzyme

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Compare the processes of chromatography and electrophoresis and identify the properties of mixtures that allow them to be separated by either of these processes (use a table for your answer)

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4. DNA is an important compound found in all living things and is a most useful identification molecule

Outline the structure and composition of DNA (use a diagram)

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Explain why analysis of DNA allows identification of individuals

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Describe the process used to analyse DNA and account for its use in:

- identifying relationships between people
- identifying individuals

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5. Much forensic evidence consists of very small samples and sensitive analytical techniques are required

Explain what is meant by the destructive testing of material and explain why this may be a problem in forensic investigations

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identify, outline and assess the value of the following techniques in the analysis of small samples:
gas-liquid chromatography
high performance liquid chromatography

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Outline how a mass spectrometer operates and clarify its use for forensic chemists

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6. All elements have identifiable emission spectra and this can be used to identify trace elements

Describe the conditions under which atoms will emit light

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Identify that the emission of quanta of energy as electrons move to lower energy levels may be detected by humans as a specific colour

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Explain why excited atoms in the gas phase emit or absorb only certain wavelengths of light

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PRACTICAL TASKS

- solve problems and use available evidence to discuss the importance of accuracy in forensic chemistry
- solve problems and use available evidence to discuss ethical issues that may need to be addressed during an analytical investigation
- identify data, plan and perform first-hand investigations to determine a sequence of tests to distinguish between organic and inorganic compounds
- gather and process information from secondary sources to present information summarising a series of distinguishing tests to separate:
 - the groups of hydrocarbons
 - acids, bases and neutral saltsin the school laboratory and in the forensic chemist's laboratory
- choose equipment, plan and perform a first-hand investigation to carry out a series of distinguishing tests for the carbohydrates:
 - reducing and non-reducing sugars
 - starch
- use available evidence and perform first-hand investigations using molecular model kits, computer simulations or other multimedia resources to compare the structures of organic compounds including:
 - monosaccharides
 - starch
- perform first-hand investigations using molecular model kits, computer simulations or other multimedia resources to present information which describes the composition and generalised structure of proteins
- perform a first-hand investigation and gather first-hand information about a distinguishing test for proteins
- perform a first-hand investigation to carry out chromatography to separate a mixture of organic materials such as the pigments in plants
- perform a first-hand investigation and gather first-hand information to identify the range of solvents that may be used for chromatography and suggest mixtures that may be separated and identified by the use of these solvents
- perform a first-hand investigation to carry out the electrophoresis of an appropriate mixture and use available evidence to identify the characteristics of the mixture which allow it to be separated by this process
- analyse information to discuss the range of uses of DNA analysis in forensic chemistry and use available evidence in discussing the issues associated with its use in terms of the ethics of maintenance of data banks of DNA
- analyse and present information from secondary sources to discuss the ways in which analytical techniques may provide evidence about samples
- identify data, choose equipment, plan, and perform a first-hand investigation using flame tests and/or spectroscopy analysis as appropriate to identify and gather first-hand information to describe the emission spectrum of a range of elements including Na and Hg
- process and present information from secondary sources to analyse and identify individual elements present in a mixed emission spectrum and use available evidence to explain how such information can assist analysis of the origins of a mixture