



T-LEVELS
THE NEXT LEVEL QUALIFICATION

T Level resource improvement project

T Level in Science: developmental activities

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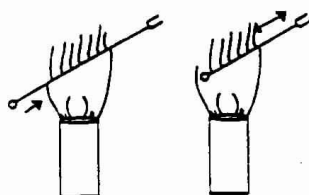
Developmental activity one – A10.3

Use the factsheet below to produce a poster that can be displayed in a laboratory as guidance for carrying out aseptic techniques. Consider how the information should be displayed using both text and images to convey it in a quick visual way.

Laboratory safety and aseptic techniques – factsheet

When performing experiments, each person is responsible for their own safety and that of their colleagues and should consider the following:

- all cultures should be treated as if they were dangerous
- never pipette cultures by mouth
- hand-to-mouth operations, such as eating, drinking and the licking of labels, are forbidden
- label and tape Petri dishes
- report all incidents of spillage, apply disinfectant to the spillage and mop up with a paper towel, placing it in an autoclavable plastic bag after use
- always wash your hands after handling microorganisms
- ensure that any minor cuts or abrasions are covered with a waterproof dressing
- swab the bench with Virkon solution before and after microbiological work
- all windows and doors should be kept closed in order to reduce the possibility of airborne contamination
- always work in the vicinity of a Bunsen burner as the updraught from the flame will help to prevent contamination
- sterilise all implements before and after use: inoculating loops and forceps should be dipped in 70 per cent alcohol then heated in a Bunsen flame – to prevent spluttering of droplets from the loop as they heat up, gradually draw the inoculating loop through the flame, heating the handle end first, allow the loop to become red hot, move it up and down in the flame and then allow it to cool for a few seconds before use

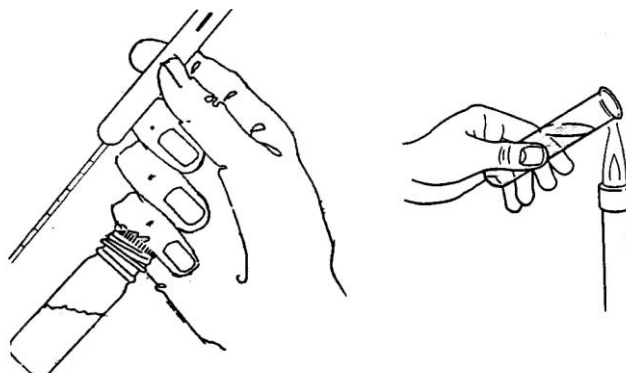


- the necks of all tubes, bottles and flasks should be passed through a Bunsen flame before and after all operations
- never incubate microbiological cultures at temperatures above 25°C
- never examine live cultures of bacteria and do not open dishes of bacteria once colonies have grown

Aseptic techniques have been developed to prevent contamination of cultures and operators by foreign organisms.

Method of infection	Remedy
Inhalation of aerosols (ie water droplets containing bacteria or fungal spores). These are formed when culture vessels are opened carelessly and organisms transferred incorrectly.	Use aseptic techniques
Skin contact as a result of breakage or spillage	Swab with antiseptic (see disposal below)
Ingestion as a result of pipetting cultures by mouth	Never pipette orally; always use teat pipettes

Bacteria and fungal spores are in the air around us, on our clothes and bodies and in dust, etc. It is therefore important to follow set procedures when handling cultures of microorganisms. These procedures have been designed to minimise the risk of contamination both from and to the environment. Techniques should be practised several times as a dry run before working with cultures so that any initial difficulties can be overcome.



Disposal

Used cultures should be quickly disposed of as they are a potential hazard to anyone working in the laboratory and often become a source of contamination to other cultures.

Sterilisation by autoclaving

This method relies on steam at 121°C to kill the microorganisms. Contaminated glassware may be autoclaved directly after first loosening caps on screw-top containers. Plastic Petri dishes containing agar cultures can be autoclaved in a suitable container such as an autoclavable bag and then disposed of in the refuse bin.

Developmental activity two – A6.3

Storage and management of information in the laboratory

In the course of work being carried out in a laboratory, large amounts of information will be produced. It has become increasingly important for data to be stored so that they can be retrieved at a later date.

1. Create a table like the one below and list the information that would be required for the efficient running of a laboratory.
2. In the table, suggest how information could be stored and then give options for other ways to store it and state whether they are safe and secure.

Information required for the efficient running of a lab	How could information be stored?	Is this safe and secure?	Other options for storage	Is this safe and secure?	Does it need to be secure?

Storage of records has changed enormously since the arrival of the first computers in the workplace. In most organisations large boxes or filing cabinets of documents have been replaced by hard drives and disks containing a vast amount of data.

Benefits of computer storage

There are some obvious advantages to storing information on a computer. Complete the table below to compare computer storage of records with traditional methods (paper, filing cabinets, etc).

	Computer storage	Traditional storage
Amount of space required		
Fire risk		
Speed at which records can be searched		
Ability to access records from different sites		

Ability to quickly update records		
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The data that might need to be stored in a laboratory may fall into one of several categories:

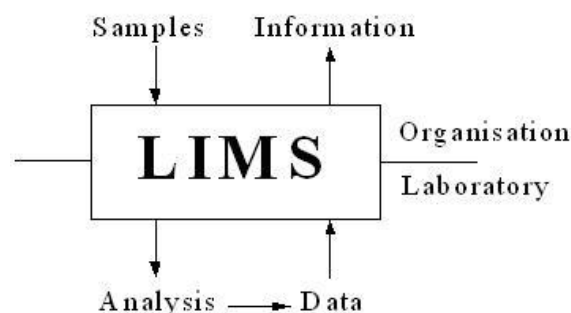
- data produced from research carried out in the laboratory
- data about staffing levels
- personal data about members of staff, etc.
- data about resources/equipment

All types of data will need careful management if they are to be kept safe and secure and be available at a later date.

How might the storage of data on a computerised system differ to that in a manual system?

Consider the different types of data that might be stored and how a computer system might be used to store this information. Think about the benefits of using a computer compared to a manual system.

Many laboratories have bought a laboratory information management system (LIMS), which is like an electronic filing cabinet. The system allows laboratories to input data in the form that they need in order to use it. They can customise the system so that they can input information relevant to their organisation.



The LIMS can store text and graphical documents and can use the data to produce relevant information such as investigation results. The LIMS can also be used to monitor good laboratory practice by, for example, monitoring sample collection, testing, quality assurance and outgoing results.

The system can alert the laboratory of incoming samples so that when they are received they can be barcoded and devices can be used to generate labels for quick error-free processing.

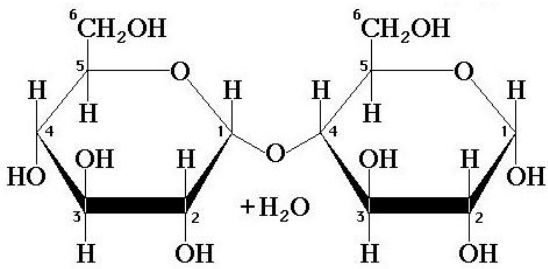
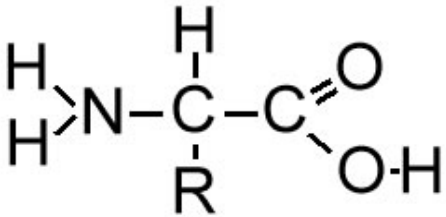
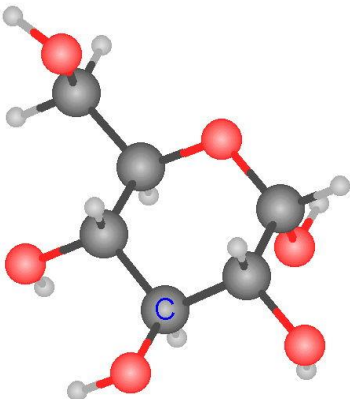
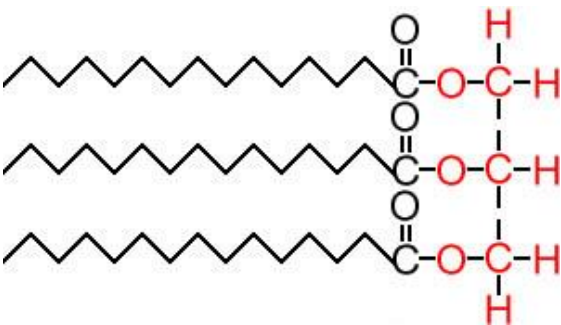
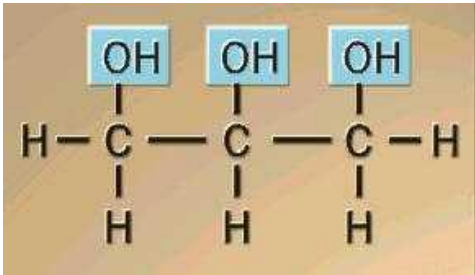
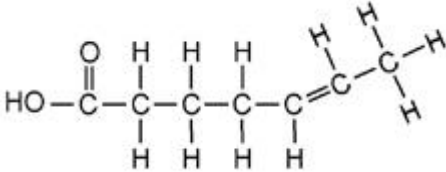
A hand-held device can be used to enter the samples into the LIMS. The samples can then be put through the testing procedure with minimal work for the technical staff.

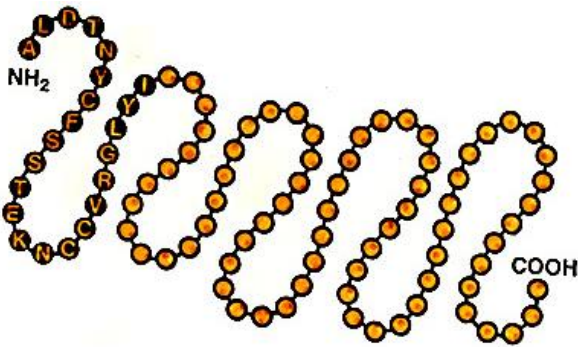
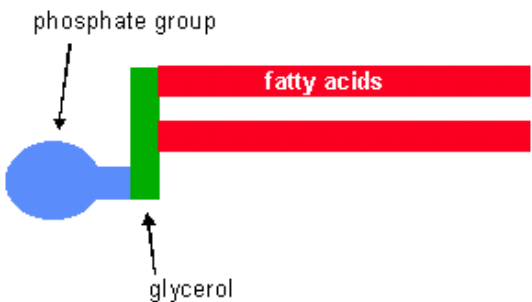
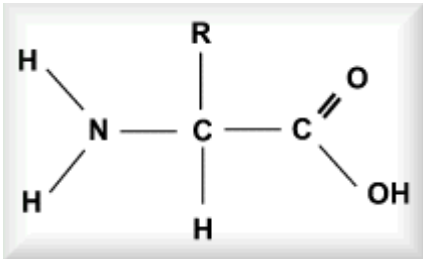
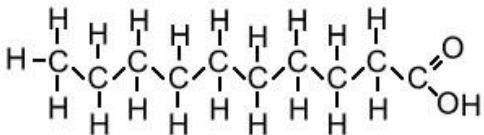
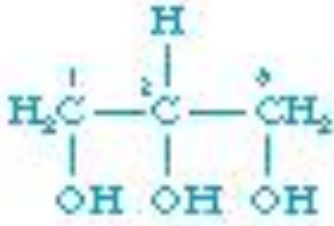
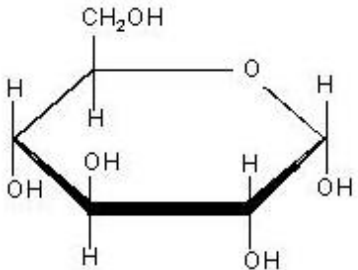
The LIMS can also be used to monitor stock levels so that ingredients or products do not fall below safe levels for the company to continue working. Depending on the

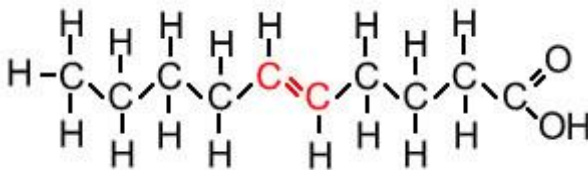
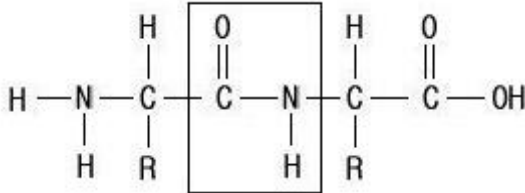
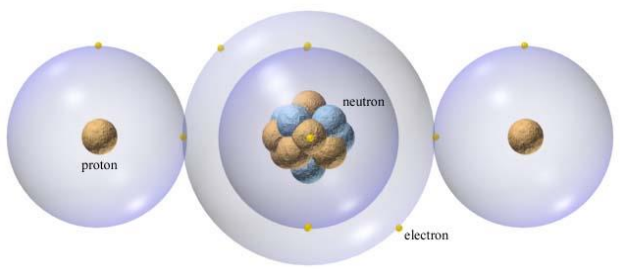
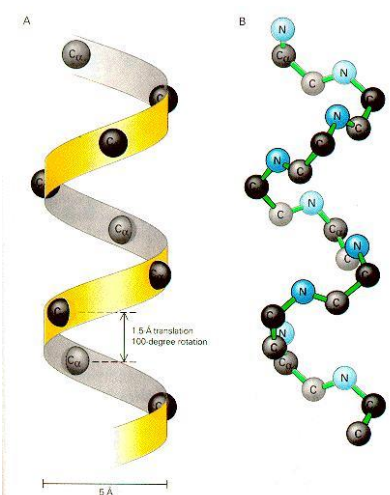
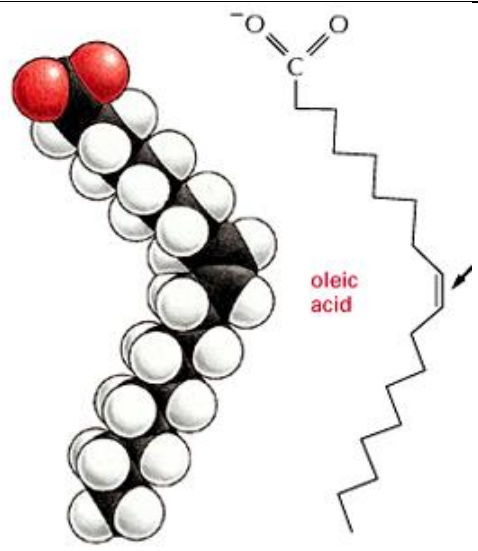
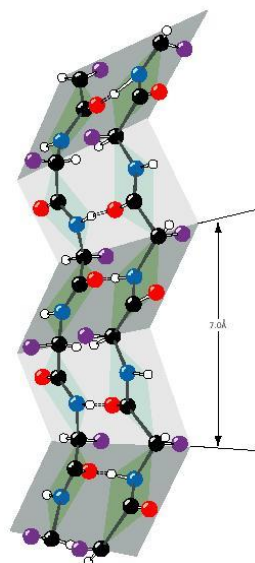
organisation and how sophisticated the LIMS is, much of the laboratory documentation can be taken over by the system.

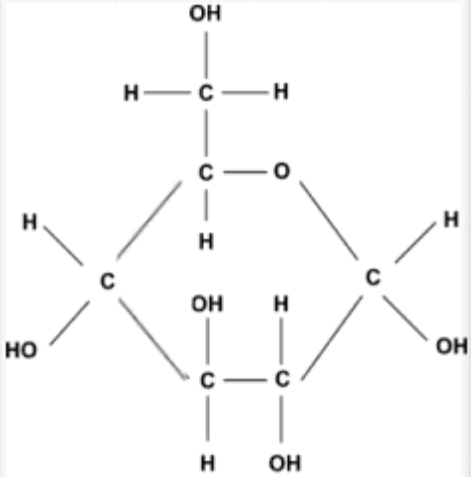
Developmental activity three – B2.1

Identify what is shown in the diagrams, writing your answers in the boxes below.

	 phosphate group fatty acids glycerol
	
	

Stretch and challenge: explain the suitability of the structure of the larger molecules in terms of their function.

Developmental activity four – A6.8

1. Identify the four stages of data collecting.

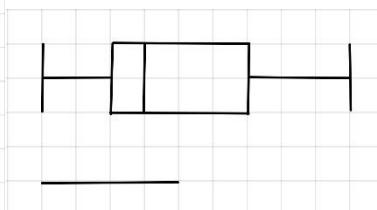
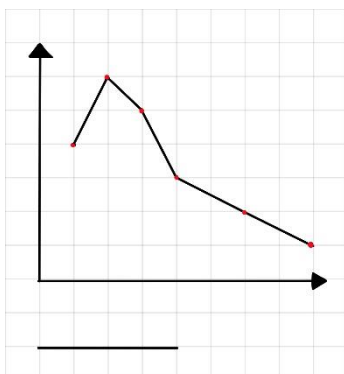
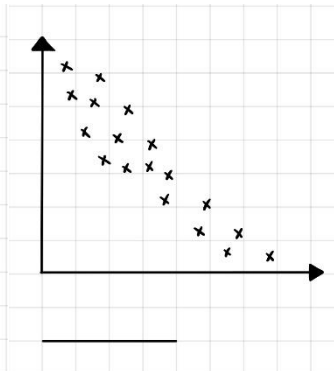
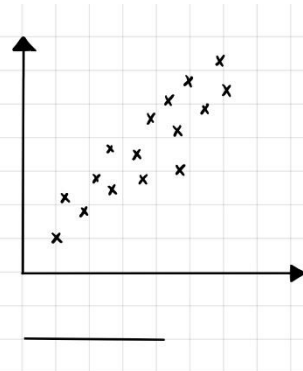
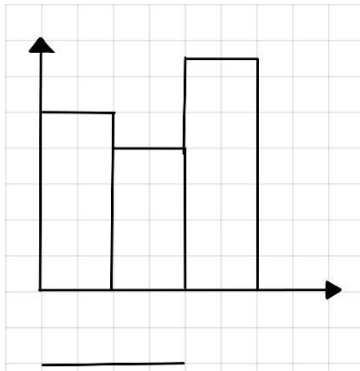
i)

ii)

iii)

iv)

2. Label the following diagrams with the correct terms from the box below.



Table

Bar chart

Flow chart

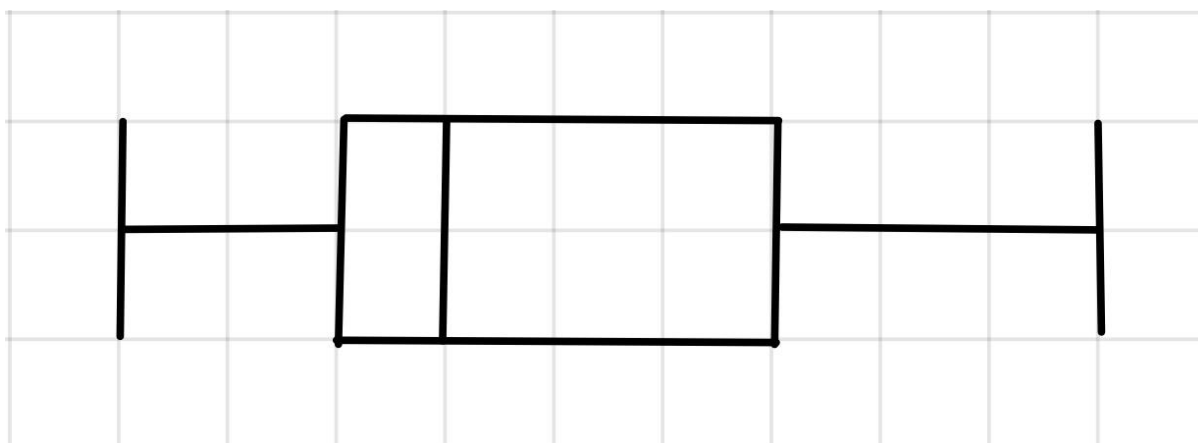
Scatter graph

Box plot

Line graph

Scatter graph

3. Label the features of the following diagram with the correct terms from the box below.



Lower quartile range

Maximum value

Upper quartile range

Minimum value

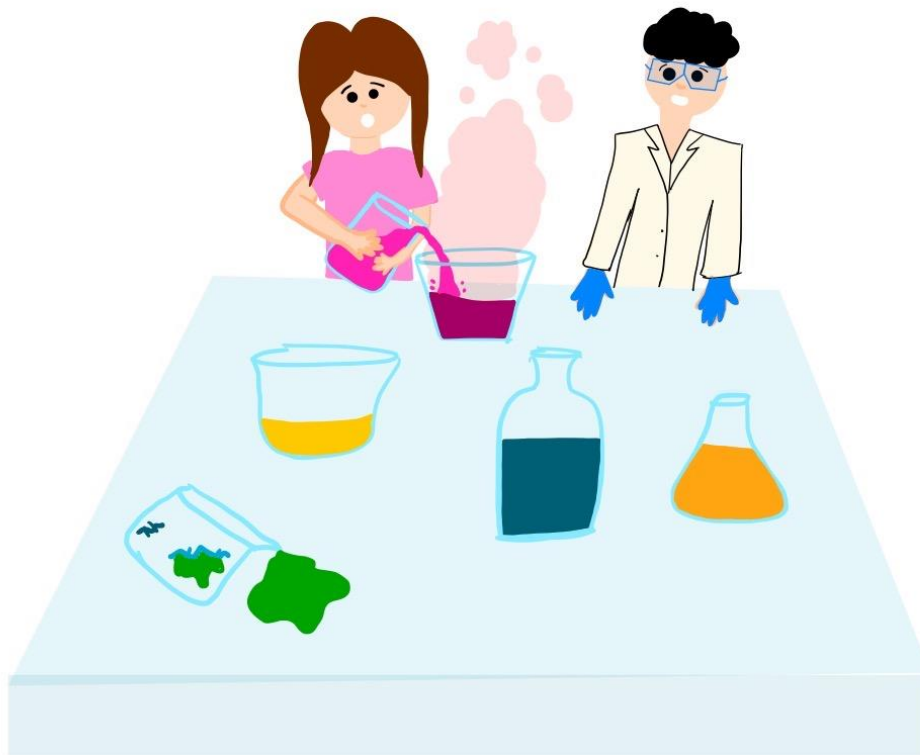
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Developmental activity five – A6.6

Minimising errors occurring in a scientific setting

1. What is an error?

2. Circle the errors occurring in the following scientific setting.



3. List the types of error that can occur in a scientific setting. Some of these have already been outlined for you.

Instrumental errors
Human errors

4. Give examples of the types of error listed in question three.

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5. Explain how some of these errors can be minimised in a scientific setting. List at least four suggestions.

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