T-LEVELS | Institute for Apprenticeships & Technical Education

T Level Technical Qualification in Science

Occupational specialism assessment (OSA)

Laboratory Sciences

Assignment 2 - Part B

Assignment brief

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Contents

Experimental practical

Scenario

A lake in a nature reserve has become polluted and algal bloom has grown. One possible cause of algal bloom is milk or milk-based contamination of water. Water can be tested for the presence of lactose, which is a milk sugar, before the wastewater is discharged into the environment. Lactose can be broken down with lactase to produce glucose and galactose. The concentration of glucose can be measured using a colorimeter if glucose has been reacted with Benedict's solution.

Task 1

1(a): Using the given stock solution of glucose, make a series of known concentrations and carry out a Benedict's reaction on each concentration. Use the colorimeter and the known standard of glucose to form a set of data for use in calculating the glucose in the wastewater following the standard operating procedure (SOP) and the safety information provided. During this activity, you will be observed by an assessor to make judgements on your practice. (23 marks) (3 hours)

1(b): Calculate the concentration of the glucose in the wastewater samples from data from task 1(a) and produce a suitable format to display this data. (12 marks) (3 hours)

Information for assessors

Setting up the assessment

Before the task

The assessor must:

- remind the student that all health and safety procedures **must** be followed during the assessment (the student may see the checklist below)
- ask the student to locate all relevant safety equipment and emergency procedures specific to the laboratory where the task is taking place

After the task

The assessor must complete the below checklist prior to marking the rest of the task. All criteria must be checked and signed by the assessor. In addition to the below checklist, an observation checklist is completed to show the allocation of marks against student practice.

In the event that a student performs a task in an unsafe manner, the assessor may stop the assessment, and the student will not be able to complete the assessment at this time.

Please note that in the event of 1 minor incident where the assessor can see that there is no immediate safety concern, and where the assessor can intervene, the assessor may provide a prompt to the student.

An example of this would be if a student lifts their goggles onto their forehead in order to see the curvette more clearly, and then forgets momentarily to place the goggles back over their eyes. The assessor should not stop the assessment in this instance and may remind the student to put their goggles back over their eyes. They should inform the student that if they make the same error again, that they would need to stop the assessment.

Assessor checklist

The student:

☐	can locate all relevant safety equipment and emergency procedures specific to the individual laboratory
☐	used appropriate personal protective equipment (PPE) correctly and effectively throughout the practical procedure (for example, laboratory coat fastened, splash proof eye protection and gloves worn correctly at all times)
☐	followed all appropriate safety guidelines and procedures when handling materials, disposing of waste materials and during clean up of any spills
☐	cleaned up the bench and work surfaces satisfactorily at the end of the task

Standard operating procedure

Process title: quantitative test for measuring reducing sugar in wastewater

Introduction:

Benedict's reagent contains alkaline copper II sulfate which are reduced by most mono and disaccharides. This reaction takes place within a high temperature water bath and the concentration of sugars can be measured from colour changes as Cu2+ ions are reduced to Cu+ ions. A colorimeter can assess the concentration of the glucose within this solution if based on a calibration curve of known standards.

Risk assessment

Substance, equipment, or procedure	Hazard	Risk	Control(s)
Benedict's solution	Irritation	Harmful if exposed to the eyes. May be harmful if swallowed, inhaled, or exposed to the skin. May affect the blood, heart, and central nervous system. May cause skin discoloration.	Wear gloves, lab coats and splashproof goggles. Wipe down any spill and avoid ingestion.
Water bath	Hot water	Burns to face and hands.	Wear gloves and splashproof goggles. Remove boiling tubes using tongs.

Procedure

Reagents:

Benedict's reagent Contains slightly-alkaline 0.07M Copper sulfate solution	

Relevant laboratory health, safety, and environmental and regulatory requirements.

Control of Substances Hazardous to Health (COSHH) – irritants

Standard Benedict's solution:

- 173g sodium citrate
- 100g sodium carbonate (hydrated)
- 17.3g copper sulphate

- diluted to 1 litre with distilled water

Preparing a calibration curve:

1. use 0.02M glucose solution to make up samples ranging in concentration from 2 to 20mM
2. to 5cm^3 of each dilution add 5cm^3 of Benedict's solution
3. place each sample in a boiling water bath for 6 minutes
4. replace the tubes in a rack; make sure each tube is labelled; allow precipitated copper to settle to the bottom of the tubes
5. measure the intensity of the unprecipitated blue Cu (II) ions using a colourimeter; use the special tubes provided, and measure against a blank (water only) using a red filter; use a pipette to transfer the liquid to the colorimeter tubes
6. plot a graph of transmission of light against concentration of glucose – this is the calibration curve
7. unknown solutions can be taken through the same procedure and their absorbance converted to concentration with the help of the calibration curve
8. if you have a colorimeter with a knob to control wavelength, then take readings over the scale of the meter – at each wavelength, set the 0 with a water blank and then take a reading with your solution
9. use the wavelength which shows the greatest absorption – probably in the red end of the spectrum
10. if your colorimeter has filters, then carry out the above procedure with each filter and then choose the filter which gives the greatest absorption

Emergency/spillage procedure

What to do in the event of spill

Benedict’s solution – wipe up solution spills and rinse well.

Fixed sample solutions – wipe up spills and rinse well.

Emergency first aid procedures in event of exposure

Benedict’s solution

Eye:

- check for and remove contact lenses, if present and easy to do
- immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally
- get medical attention if symptoms occur

Ingested:

- rinse mouth – do not induce vomiting unless directed to do so by medical personnel
- if vomiting occurs, keep head low so that vomit does not enter lungs

- never give anything by mouth to an unconscious person
- call a doctor if symptoms occur

Spilt on the skin or clothing:

- wash skin with soap and plenty of water for at least 15 minutes
- remove contaminated clothing and shoes – wash clothing before reuse
- call a doctor if symptoms occur

Disposal procedures

Benedict's solutions

There should be no need to dispose of waste in this procedure. Reagent should remain in labelled bottles.

Glucose reacted with Benedict's solution

Unused fixed water samples and used samples with Benedict's – pour into Benedict waste bucket provided.

Any specific storage requirements

There is no requirement for storage during this procedure.

References

Safety data sheet www.science.cleapss.org.uk/resource/SSS004-Food-testing-1.pd

www.nwmissouri.edu/naturalsciences/sds/b/Benedict's%20reagent.pdf

www.fscimage.fishersci.com/msds/90749.htm

Document information

The T Level Technical Qualification is a qualification approved and managed by the Institute for Apprenticeships and Technical Education.

Owner: Head of Assessment Design

Change History Record

Version	Description of change	Approval	Date of Issue
v1.0	Post approval, updated for publication.		January 2021
v1.1	NCFE rebrand		September 2021