

Test artificial urine samples for the presence of protein and glucose

Introduction

The urine of a patient has been tested and found to contain both protein and glucose. The presence of protein could indicate damage to the kidney and the presence of glucose is an indicator of diabetes. However, the urine samples have become mixed up in the lab. It is important that the person is identified so that they can be treated. There are four people that it could be. Test the four samples of urine to identify the owner of the original sample.

Apparatus

3 test tubes
 3 × 5 cm³ syringe
 1 × 10 cm³ measuring cylinder
 dropping bottle of biuret solution
 dropping bottle of Benedict's reagent
 4 × 30 cm³ solutions of artificial urine – Samples A, B, C and D

Access to:

water bath set at 80°C

Method

To test for glucose

1. Using a 10 cm³ measuring cylinder, add 5 cm³ of Sample **A** into a test tube
2. Add 5 cm³ Benedict's reagent and heat in a water bath set at 80°C
3. Observe and record any colour change
4. Repeat steps 1-3 with Samples **B**, **C** and **D**

To test for protein

1. Using a 10 cm³ measuring cylinder, add 5 cm³ of Sample **A** into a test tube
2. Using a syringe, add 2 cm³ of Biuret solution
3. Shake the test tube gently
4. Observe and record any colour change
5. Repeat steps 1-4 with Samples **B**, **C** and **D**

Analysis

1. Conclude which sample is from the original patient.

Risk Assessment

Hazard	Risk	Control measure
Biuret solution is an irritant	Biuret could get on to the skin when putting into the test tube	Wash hands immediately if amylase gets on to them/ wear laboratory gloves
	Biuret could get transferred to the eyes from the hands	Wear eye protection
Hot water can burn	Scalding of skin	Take care when removing tubes from water bath

Benedict's reagent and iodine solution are classed as low hazard by CLEAPSS at these concentrations.

Teacher / Technician notes

The artificial urine samples should be produced so that

A: contains protein only (albumin powder could be used)

B: contains glucose only (glucose powder could be used)

C: contains neither protein or glucose

D: contains both protein and glucose

The samples could be coloured with iodine to make them more authentic looking / alternatively a tea bag could be used to colour the samples.

The volumes of biuret and Benedict's reagent are intended as a guide only and centres may wish to use volumes that have previously been optimised at the centre.

Benedict's reagent can be purchased from a laboratory supplier or can be made

1 dm³ of Benedict's reagent contains:

100 g anhydrous sodium carbonate

173 g sodium citrate

17.3 g copper(II) sulphate pentahydrate

Protein

Biuret reagent can be purchased from a laboratory supplier or potassium hydroxide and dilute copper(II)sulphate solution can be used as an alternative.

Students should design their own table, but a suggested table format is shown below.

Sample	Biuret test observation	Protein present/absent	Benedict's test observations	Glucose present/absent
A				
B				
C				
D				

Working scientifically skills covered

1. Development of scientific thinking

Explain every day and technological applications of science: evaluate associated personal, social, economic and environmental implications and make decisions based on the evaluation of evidence and arguments

2. Experimental skills and strategies

Make and record observations and measurements using a range of apparatus and methods.

3. Analysis and Evaluation

Presenting observations and other data using appropriate methods.

Interpreting observations and other data, including patterns and trends, making inferences and drawing conclusions.