

Experiment 4: Urine Analysis

*An investigation and comparison
of 'urine' samples*

THE SET UP

1. Summary

A series of experiments taking the format of an investigation. Synthetic urine samples are tested for pH, smell and glucose and compared to that of a criminal.

This experiment is suitable to be demonstrated by the teacher, but with a lot of input from the students.

2. Context

You can use this experiment when covering pH scales, acids, alkalines, diabetes, kidneys or the excretory system.

3. Apparatus

- Test tubes x 5
- Test tube rack
- Teat pipettes x 2
- Urea
- Glucose
- Hydrochloric acid - dilute
- Sodium chloride
- Yellow food colouring
- Clinistix - glucose only
- Universal indicator

4. Preparation

You can create very realistic urine from urea, sodium chloride, water and yellow food colouring.

The aim of the experiment is to match the sample of a criminal with one of four samples that you have made up.

Set up the samples and then duplicate one as the test sample.

Use a litre of water, a teaspoon of salt and a few drops of yellow food colouring. Split into samples and change the pH by adding different amounts of acid and adding glucose to one sample. Add a teaspoon of urea to all but one.

Make the suspects sample one without glucose, but with urea and 5ml of dilute acid.

5. Safety

- Urea is toxic and an irritant so pupils should take care while handling it
- Hydrochloric acid is corrosive and can be an irritant
- Universal indicator may be highly flammable and harmful
- Goggles should be worn and hands washed at the end of the experiment

THE DEMONSTRATION

1. Procedure

- Start with a beaker of apple juice that you say is urine and explain that we are going to test it for glucose, pH, smell and taste
- Drink some and watch the reaction
- Then either demonstrate or have the students test the samples for smell, glucose and pH in that order
- Compare each result to that of the criminal until there is a match

2. Suggested Script Ideas

"A terrible crime has happened and as forensic scientists we have been asked by the police to match the urine samples of four suspects to this one from the scene of the crime.

<Hold up apple juice>

We are going to test for glucose, pH, smell and taste

<Dip in finger then take a swig and wait for reaction>

Actually that would be a rubbish and dangerous way of testing. Why?

<Pause>

*Because urine is the waste from the body which includes toxins, a fancy name for poisons.
Not a good thing to drink!*

*However some doctors and midwives used to taste urine to try and detect diabetes which
meant that sugar was in the urine so it tasted sweet.*

Actually that wasn't the sample anyway - this is and we will fill in the chart as we test.

So testing for glucose first using a clinitix.

Normal urine shouldn't have glucose in it, if there is glucose it could be a sign of diabetes.

<Test result shown for all 4 and recorded on the board>

Next we test the pH using the universal indicator

<Test result shown and recorded on the board>

And finally the smell - what does it smell like?

<Record the result>

So it would seem that our criminal is sample ..."

THE CONCLUSION

1. Explanation

All of our urine has a different smell, probably taste, pH and glucose levels and so can be used with a wide range of other tests to identify us.

2. Useful Questions and Answers

Q) **Will our urine change depending on what we eat or drink?**

A) *Yes, it is just our body's way of getting rid of excess water, salts and poisonous waste such as urea. Beetroot, for example, can turn urine red.*

Q) **What other things can you test urine for?**

A) *Protein, alcohol levels, drugs – illegal and performance enhancing, sugar, pregnancy (hormones) and diseases.*

Q) **Does urine have any uses?**

A) *On compost heaps it speeds the breakdown of matter as it contains nitrogen. It has been used for making black powder that was a form of gunpowder. It used to be collected as part of the wool dyeing process.*

Q) **In a survival situation should you drink urine?**

A) *This is debatable. The US army says not in its survival manuals due to the high levels of poisonous waste. You could however extract the water from it using distillation or a solar still.*