



Oxford Cambridge and RSA

**For issue on or after: 21 November 2022**

**Level 3 Cambridge Technical in Applied Science**

**05874 Unit 23: Scientific research techniques**

**Pre-release material**

**To prepare candidates for the examination taken on  
Wednesday 18 January 2023 – Afternoon**



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

Candidate number

First name(s) \_\_\_\_\_

Last name \_\_\_\_\_

Date of birth 

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**INSTRUCTIONS**

- **Seven** days before the exam, hand in this booklet to your teacher. This booklet will be given back to you at the start of the exam.
- Do **not** take any notes into the exam.
- At the end of the exam, hand in this booklet with your exam paper.

**INFORMATION**

- This document has **8** pages.

## Source A

### Measuring ketosis on a ketogenic diet

15th January 2019.

Article written by the editor of *Diabetes.co.uk*, the global diabetes community.

Adapted from - <https://www.diabetes.co.uk/keto/measuring-ketosis-on-a-keto-diet.html>

Ketosis is the process of burning body fat for energy and can be measured when following a low-carbohydrate ketogenic diet.

You don't have to test for ketones for a ketogenic diet to work but some people may find it helps to check they're on track and to tailor their diet towards more effective weight loss.

Whilst ketosis is a natural process in the body, it's important to know the safety implications of being on a ketogenic diet which will apply to people on certain diabetes and blood pressure medications.

### How measuring ketosis can help

Whilst we can all measure our weight to see whether weight loss is occurring, there are a number of reasons why measuring ketosis can be better.

Our weight can go up and down through the day but this won't tell us whether we are actually burning body fat. Simply going to the toilet, for example, will involve a certain loss of body weight but that won't give us any idea of whether we've burned any body fat over the past hour or two.

Additionally, if you're exercising and putting on muscle, the scales will only show weight loss, stalling, or a gain in weight, and won't show you whether you're gaining muscle whilst also losing body fat.

Measuring ketone levels, therefore, can help much more directly, as the production of ketones is a direct result of fat-burning.

Just as blood sugar levels vary through the day, depending on what we've eaten and how our body is coping with metabolising the food, ketone levels can also change through the day in response to the food we eat and how our body copes in response.

### How to measure ketones

There are a few different methods of measuring ketones, and each have their pros and cons.

#### Urine ketone strips

Urine testing strips are cheap but measuring ketones in the urine rather than the breath or blood tends to be less accurate. The results from urine testing strips also reflect ketone levels over the past few hours rather than at the time of testing. Testing ketones in the urine is good if you just want a rough idea of the level of ketosis you're hitting.

#### Blood ketone tests

Blood ketone tests can be performed using certain blood glucose meters that have been specifically designed to test for ketones. Blood tests are the most accurate method of measuring ketone levels but the cost of the test strips is relatively expensive if you intend to test your ketones on a regular basis.

#### Breathalyser

It is possible to measure ketones on the breath. The method is not as accurate as blood ketone tests but is better than urine test strips. Another advantage of using a breathalyser is that it involves a single up-front cost, which means that once you have the device, you can test your ketone levels as often as you wish. This can be useful for people seriously looking to understand how well they're achieving ketosis through the day.

## When to measure ketones

When and how often to test ketones will depend on what you're looking to find out. If you're looking to compare whether you're achieving ketosis from day to day or week to week, then it makes sense to test at the same time (or times) of day. This will ensure you get consistent results.

As ketones vary through the day, and are affected by different types of meal and exercise, you may want to test at different times through the day to see how your level of ketosis varies.

The ketone breathalyser is very useful for this as you don't pay for each test as you do with, say, blood ketone testing strips.

## Guideline targets

The sweet spot for weight loss is a ketone level of 1.5 to 3.0 mmol dm<sup>-3</sup>. This level of nutritional ketosis is recommended by researchers Stephen Phinney and Jeff Volek.

Ketone levels of 0.5 to 1.5 mmol dm<sup>-3</sup>, light nutritional ketosis, is also beneficial although not to the degree of full nutritional ketosis.

The longer you stay within these levels, particularly within the sweet spot of nutritional ketosis, the more fat you will burn and the more effective your weight loss efforts will be. If you are starting (or re-starting) a ketogenic diet, it can take up to a few weeks for your body to switch to using ketones as its main fuel source so don't give up too early.

## Achieving ketosis

A number of factors can influence the achievement of ketosis. Carbohydrate intake, protein intake and level of exercise are primary factors.

For detail on how each of these factors can affect ketosis and weight loss, read our guide to weight loss on a low-carbohydrate diet [1].

## Ketosis with type 1 diabetes

Ketosis becomes a slightly more complicated topic when it involves people with type 1 diabetes or who are otherwise completely reliant on insulin. If this applies to you, it is important that you understand the difference between ketosis and ketoacidosis. If you are in any doubt, it's important that you discuss your insulin management with your doctor or consultant.

[1] <https://www.diabetes.co.uk/diet/low-carb-and-weight-loss.html>

**Source B**

'Diet and Exercise Effects on Breath Acetone Concentration Measured Using an Enzymatic Electrochemical Sensor', Barbara Landini, Paul Cranley, James McIntyre, Phoenix, AZ; Lake Jackson, TX; Midland, MI, [www.levlcare.com](http://www.levlcare.com). Item removed due to third party copyright restrictions. Link to material: <https://levlcare.com/wp-content/uploads/2019/10/Diet-and-Exercise-Effects-on-Breath-Acetone.pdf>

**Research notes:**

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A series of horizontal dotted lines for writing, spanning the width of the page.



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