CAMBRIDGE
OCR

For issue on or after: Monday 17 November 2025

Level 3 Cambridge Technical in Applied Science

05874 Unit 23: Scientific research techniques

Pre-release material

To prepare candidates for the examination taken on Friday 16 January 2026 – 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 | D | D | M | M | Y | Y | Y | Y |

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 other 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

‘Feel Omega 3’ and algae [1]

Adapted from: **wearefeel.com**

Why do I need to supplement with Omega 3?
The fatty acids found in Omega 3 are essential for humans to thrive, especially when it comes to brain health. It can be tricky to obtain Omega 3 through food alone, so supplementation is the best option for most people. Heart UK recommends a combined amount of 500 mg of eicosapentaenoic acid and docosahexaenoic acid (EPA + DHA) per day to gain the most health benefits.

Consuming fish regularly can be risky due to the heavy metals and contamination found within fish sources. The latest and most effective way to increase your intake of Omega 3 is by supplementing with the most direct source, which is algae.

Who is it suitable for?
Feel Omega 3 is the perfect daily supplement for everyone, but also those who are vegan, vegetarian, pregnant, or simply looking for a more sustainable and cleaner source than fish. It also appeals to a new generation of consumers who are looking for an environmentally friendly source that still provides the health benefits of EPA and DHA.

What is algae and how is it grown?
Microalgae are one of the oldest plant-like organisms found on the whole planet. They play an important role in the marine food chain as well as producing many nutrients which are vital for human health. We have chosen an alga called *Schizochytrium sp.*, which is well researched for safety.

Our algae are grown in a controlled environment which is 100% contaminant free. They are grown in unpolluted fermentation pools which do not interfere with the marine ecosystem. The algae are then harvested and processed using gentle water extraction and pressing processes to obtain the purest Omega 3 oils. The purity of the algae is regularly monitored to ensure they contain no heavy metals, PCB or contaminants, unlike marine sources.

[1] https://wearefeel.com/
**Note to candidates: There is no direct link to the part of Feel’s website quoted here. To access it, when logged on to Feel’s website, use the search tool (magnifying glass) to enter ‘Omega-3’ then click on ‘Learn more’*

Source B

Outdoor pilot-scale cultivation and techno economic assessment of a novel omega-3 eicosapentaenoic acid over-producing *Nannochloropsis oculata* strain [2]

Adapted from: **Sciencedirect.com**

Microalgae represent an emerging sustainable source of bioactive products for the health market, including carotenoids, vitamins, and omega-3 (Kumar et al., 2022). The demand for nutraceutical products and super-functional foods is growing as people become more health-conscious (Ghosh et al., 2022; Paterson et al., 2023). Omega-3 eicosapentaenoic acid (EPA) is a notable component of microalgae that reduces the risk of chronic diseases such as cancer, heart disease, and arthritis, while also enhancing muscle metabolic flexibility and strength (Gammone et al., 2019). *N. oculata*, a unicellular oleaginous microalga, is one such species that has a relatively high EPA content (Sousa et al., 2022). Although low-cost fish and krill oils are presently the primary sources of omega-3 (Cecchin et al., 2022), the growing demand for fish and fish oil will require a more sustainable source, with microalgae the primary replacement candidates. However, the cost of the overall process needs to be reduced (Barros de Medeiros et al., 2022).

[2] https://www.sciencedirect.com/science/article/pii/S2589014X23003535

Source C

The use of green sludge

Adapted from: **The Green Sludge That Could Transform Our Diets – by Abigail Beale [3]**

“Our global food system fails on its most profound premise to provide humanity with healthy and food-secure lives,” says Asaf Tzachor, who leads research on global food security and emerging technologies at the Centre for the Study of Existential Risk at the University of Cambridge.

Last year, Tzachor visited a small-scale microalgae farm in Iceland. The farm uses geothermal electricity to power LEDs that light transparent tubes called photobioreactors. Inside the photobioreactors, wastewater and carbon dioxide from electricity generation, along with the LED lights, fuel the growth of the microalgae.

“From an ecological footprint perspective, cultivating microalgae in the Icelandic facility is extremely efficient, as opposed to other algae cultivation methods,” Tzachor says. The process removes carbon from the atmosphere so is net carbon negative, according to Algaennovation. On top of this, there are no herbicides or pesticides needed, and no waste produced to contaminate the environment.

[3] https://www.bbc.com/future/bespoke/follow-the-food/the-green-sludge-that-could-transform-our-diets.html

Source D

Microalgae cultures in photobioreactors [4]

Adapted from: **Mass Cultivation of Freshwater Microalgae**
J. Masojídek, G. Torzillo, in Reference Module in Earth Systems and Environmental Sciences, 2014

The simplest cultivation system is an illuminated transparent plastic tube containing the algal suspension, mixed by a stream of CO_2-enriched air.

Photobioreactors have a number of advantages: reproducible cultivation conditions; reduced risk of contamination; low CO_2 losses; and smaller area requirements. On the downside, the system must be cooled and degassed since any excessive oxygen produced by the growing cultures can reduce growth.

The algal suspension is continuously circulated by a pump. Cooling is maintained by submerging the tubes in a pool of water, by heat exchangers, or by spraying water onto the photobioreactor surface.

Adapted from: **Conversion of bioenergy materials to secondary fuels**
Ahmed Alengebawy, Mohamed Samer, in Reference Module in Earth Systems and Environmental Sciences, 2023

After the inoculation period, the algae can be incubated. Then, the algae should be transplanted into the photobioreactors. The production method can be summarised as follows: growing algae in photobioreactors with direct sunlight, i.e., white light (wavelength: 400–700 nm) at 35 °C, injecting CO_2, with constant stirring and pH adjusted to 7.4 for 21 days, to create algal biomass, where, after harvesting, the algal biomass will be subjected to chemical transesterification to produce biodiesel.

Adapted from: **Algal biofilms: potential wastewater treatment applications and biotechnological significance**
Kanishka Srivastava, K. Chandrasekhar, in Application of Biofilms in Applied Microbiology, 2022

Besides their carbon sequestration property, microalgae readily absorb and utilise nitrogen, phosphorus, and many heavy metals from wastewater. Thus, playing a role in cleaning not only the air but also the water of pollution. These two properties of algal biofilms are exploited in wastewater treatment with simultaneous use of the produced algal biomass in the production of a variety of bioproducts like biofuels, bioplastic, skincare products, fertilisers, nutraceuticals etc.

[4] https://www.sciencedirect.com/topics/immunology-and-microbiology/photobioreactor

Research notes: