



Oxford Cambridge and RSA

Friday 16 June 2023 – Morning

**A Level in Design and Technology:
Product Design**

H406/02 Problem Solving in Product Design

Resource Booklet

Time allowed: 1 hour 45 minutes



INSTRUCTIONS

- Use this Resource Booklet to answer **all** the questions.
- You should spend **35 minutes** reading this Resource Booklet.
- Do **not** send this Resource Booklet for marking. Keep it in the centre or recycle it.

INFORMATION

- This document has **12** pages.

ADVICE

- Read this Resource Booklet carefully **before** you start your answers.

The stimulus in this booklet relates to issues and opportunities that may be encountered by changes in office working arrangements.

Remote and Flexible Working Arrangements

It has been reported that prior to 2020, around 5% of employees worked mainly from home and around 30% occasionally worked from home. These numbers have increased rapidly in recent years. Working from home for many people has changed attitudes to this concept with many employees now enjoying the wellbeing and productivity benefits that come from working away from a traditional office-based environment.

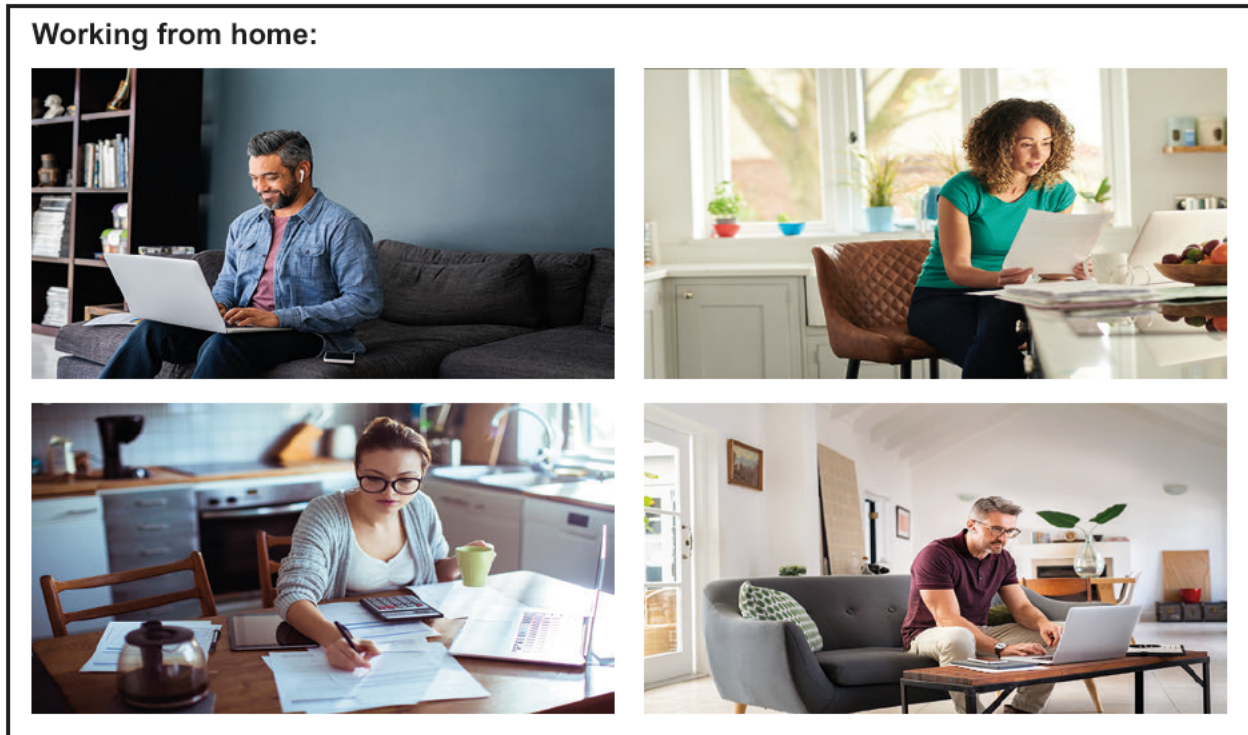


Fig. 1

Health and Wellbeing

In February 2021, the Royal Society for Public Health (RSPH) surveyed employees to identify the physical and mental impacts of working from home. This survey provided valuable information which has been used by designers and manufacturers to better meet the needs of these stakeholders.

RSPH survey findings:	Musculoskeletal problems:
<ul style="list-style-type: none"> • 46% took less exercise • 39% had developed musculoskeletal problems • 26% worked from either a sofa or a bedroom • 48% that worked from a sofa or bedroom had developed musculoskeletal problems 	<p>These are conditions that can affect joints, bones, muscles and sometimes connective tissue such as nerves. According to NHS England, poor musculoskeletal health has a huge impact on workers, their employers, the NHS and the wider economy. Over 30 million working days are lost every year in the UK and they account for up to 30% of GP consultations in England.</p>

Fig. 2

Home Office Equipment

In order to address the health and wellbeing issues that workers are experiencing at home, the RSPH has called for employees to have access to equipment and a remote assessment to support them with their physical health.

OCR Accountants

OCR Accountants is a large accountancy firm with over one thousand employees nationally. It is assessing the needs of its employees when working at home.

OCR Accountants is keen for employees to be equipped with ergonomic chairs and desks that are designed to minimise musculoskeletal problems.

It identifies an office design company to work with called Smart Space.

Smart Space's services include:

- office layout design
- supply of home office furniture
- supply of office furniture
- supply of digital technology equipment
- design and manufacture of bespoke office spaces.

Smart Space designers use the anthropometric data shown in **Fig. 3A** and **Fig. 3B** when designing furniture and office spaces.

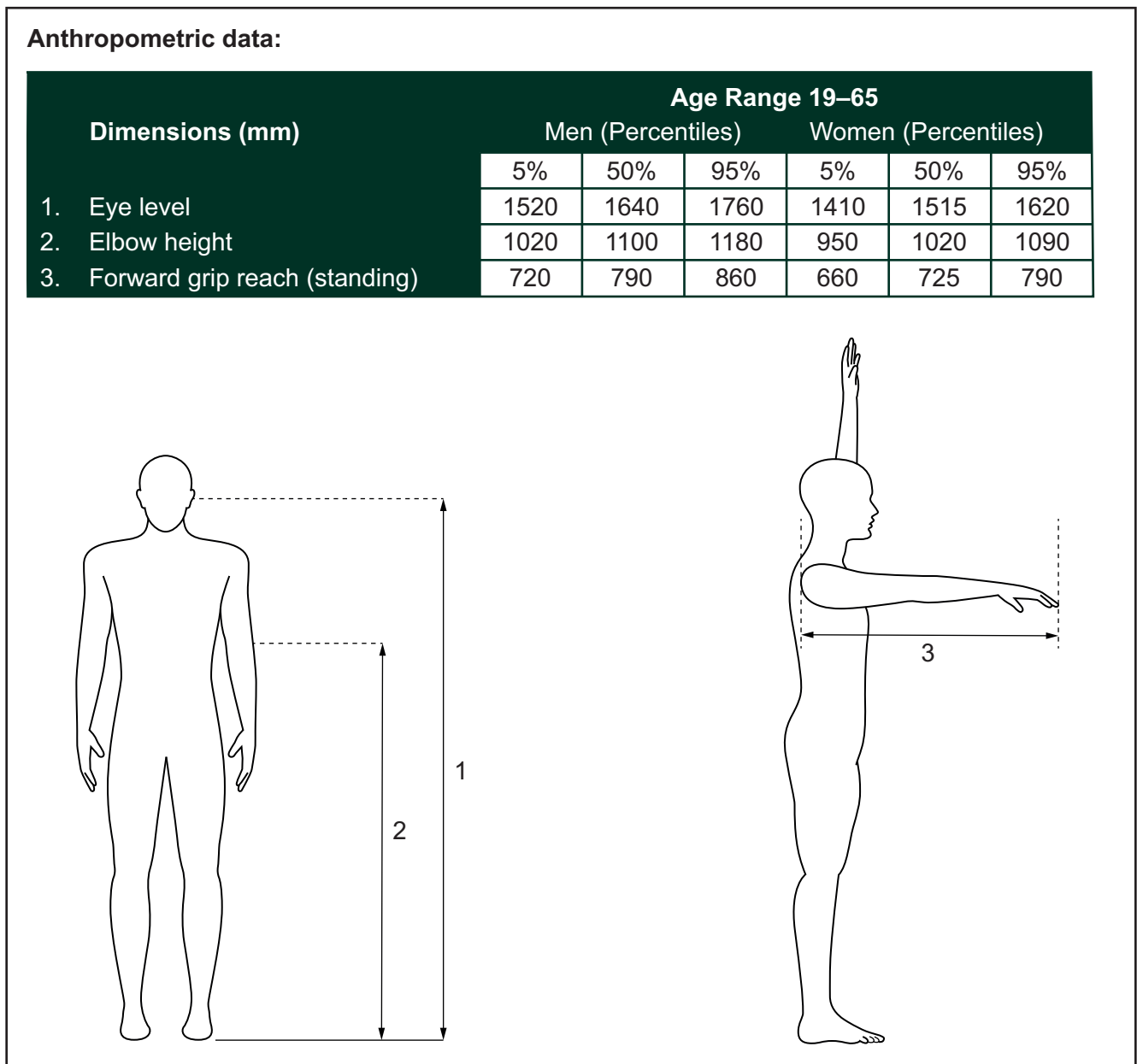


Fig. 3A

Anthropometric data continued:

Dimensions (mm)	Age Range 19–65					
	Men (Percentiles)			Women (Percentiles)		
	5%	50%	95%	5%	50%	95%
1. Sitting height	860	915	970	800	855	910
2. Sitting eye height	740	800	860	700	750	800
3. Sitting shoulder height	570	615	660	530	580	630
4. Sitting elbow height	210	250	290	190	235	280
5. Thigh thickness	130	155	180	120	150	180
6. Popliteal height (lower leg length)	410	450	490	370	410	450
7. Lateral arm span	1670	1810	1950	1520	1650	1780
8. Elbow fingertip length	440	475	510	400	430	460

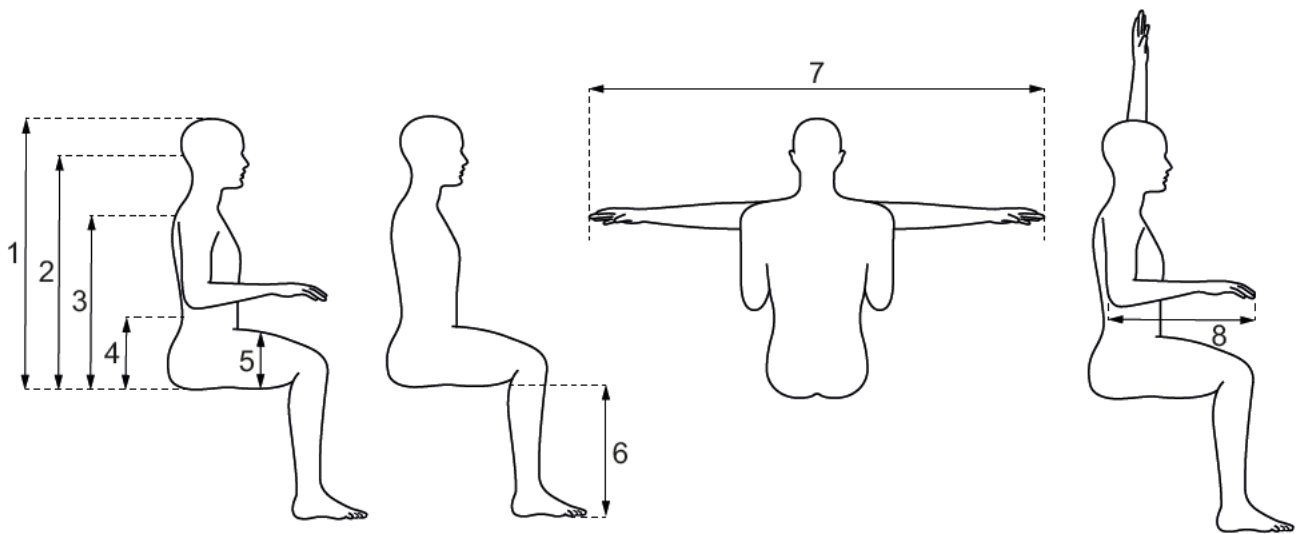


Fig. 3B

Home office products:

Smart Space recommends an ergonomic chair and standing desk that have proven popular with other clients for use by office workers at home.

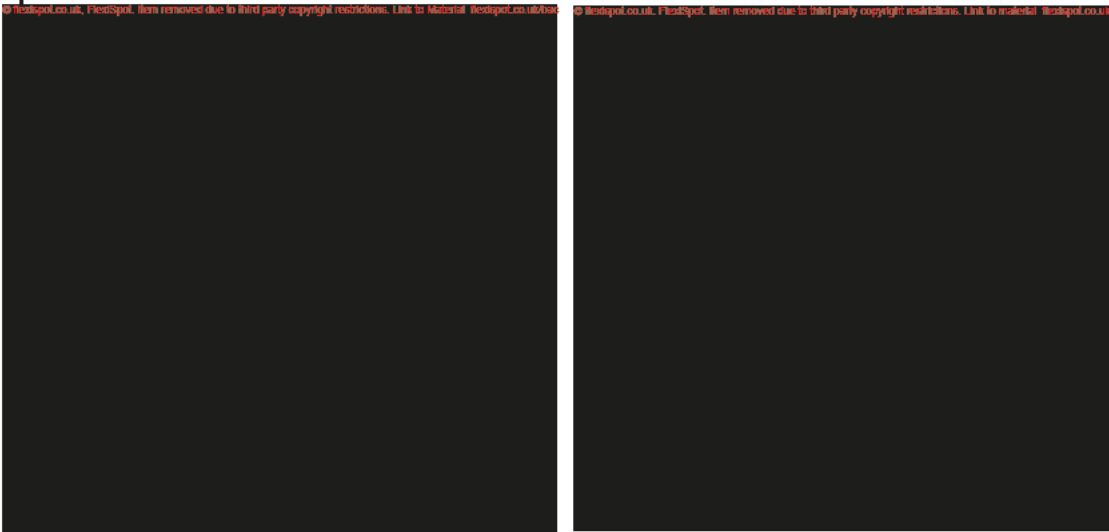


Fig. 4

Standing Desks

One solution to address musculoskeletal problems is to improve posture by working at a standing desk. These desks can be used when seated or standing. They have mechanisms that enable them to be raised from a seated height to one that can be stood at. Studies show that there is a reduction in discomfort and pain when people use standing desks.

The Stand-Hi standing desk below has been recommended for staff working from home.

Stand-Hi standing desk:







- £569.99
- Easy clean desktop
- Load capacity: 125 kg
- Lifting speed: 38 mm/s
- Desktop: 1200 mm × 600 mm

Materials:

- Desk frame: mild steel
- Cable tidy: polypropylene



Desktop finish options:

<p>Natural:</p> <ul style="list-style-type: none"> • Bamboo • Oak • Walnut 	<p>Melamine:</p> <ul style="list-style-type: none"> • Black • White • Marble
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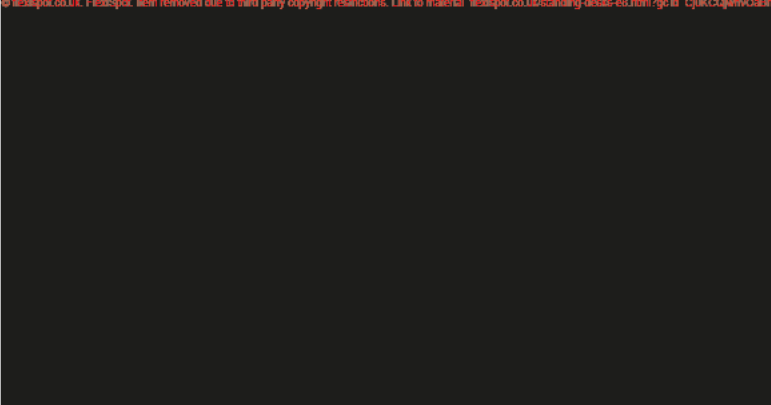







Frame colour options:

- Black
- White

Desk frame dimensions:



Measurements in mm (not to scale)

Fig. 5

Note: lifting mechanism not shown

Hot-desking

With employees increasingly working from home, businesses have been able to save on costs by reducing the size of office spaces. This has led to open plan offices and working spaces with desks and chairs that are shared by a number of users. In many office spaces of this nature, an employee may work in different locations each time they come into the office.

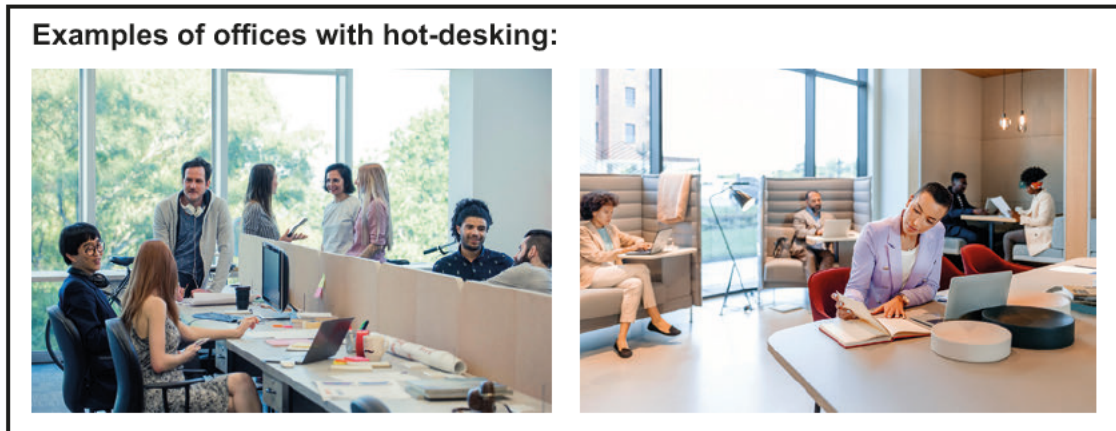


Fig. 6

OCR Accountants is considering options to move to cheaper premises with hot-desks for workers at the heart of the design of the new office plan.

Digital Technology

To facilitate this new way of working, OCR Accountants has consulted the digital technology specialists at Smart Space to identify the most efficient way of working, whilst also minimising musculoskeletal problems.

The specialists advise that all employees should be provided with a set of laptop accessories for home use and at the hot-desk in the office.

The following products have been recommended:

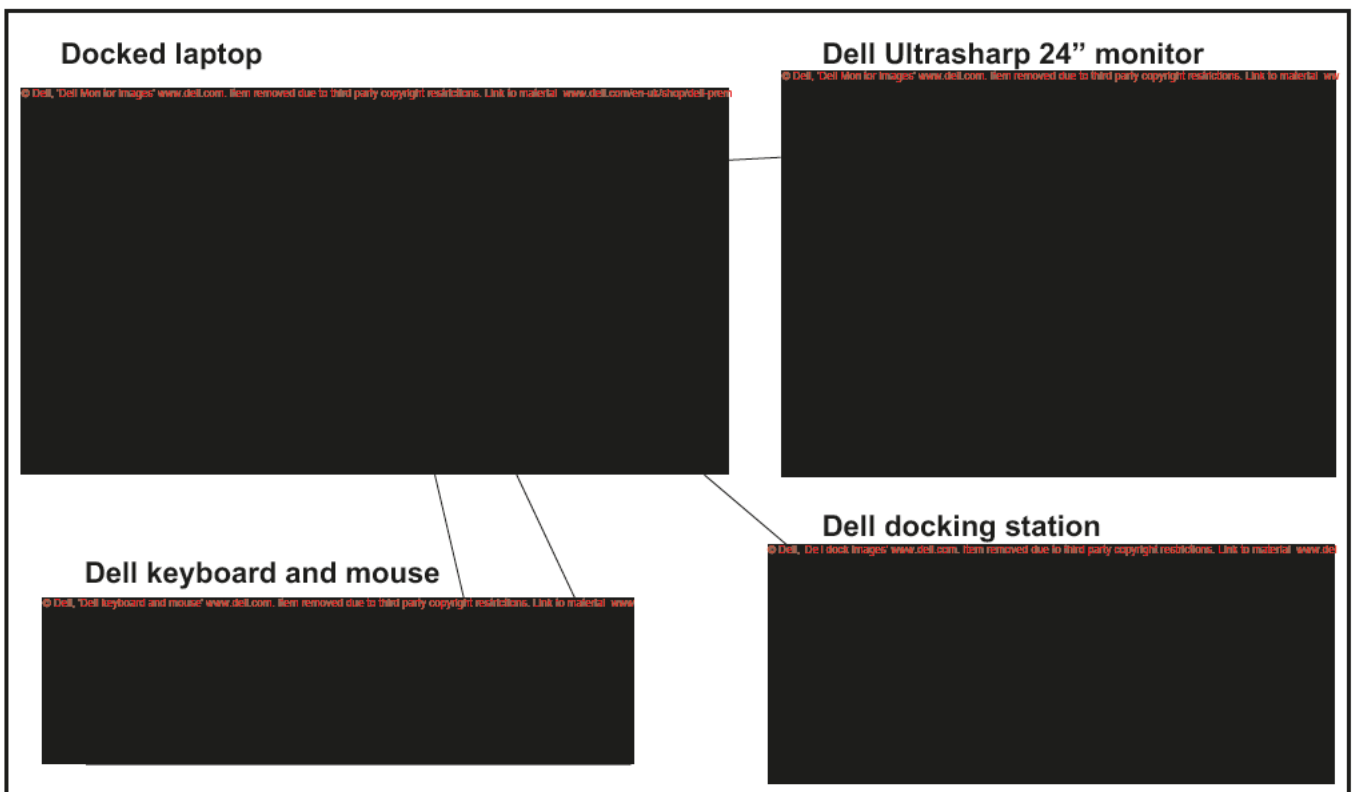


Fig. 7

Standing Desk Converter

Feedback from an employee survey has indicated that many employees do not have space within their homes for a dedicated office desk such as the Stand-Hi.

In order to provide workers with the benefits of a standing desk, whilst addressing bad posture issues when working with the laptops provided, OCR Accountants requires a compact solution for home use.

One proposal from the Smart Space design team is the Easy-Stand shown in **Fig. 8**. It is designed to be a low-carbon solution to meet OCR Accountants' needs.

Easy-Stand standing desk converter:

- £199.99
- Load capacity: 5 Kg
- Desktop: 1200 mm × 600 mm

Materials:

- 18 mm FSC birch plywood

Features:

- Adjustable shelf positions
- Upper shelf for laptops
- Optional middle shelf for mobile phones/tablets
- Wide keyboard shelf to suit a mouse or touchpad
- Supports laptops with screens up to 15"

Additional features:

- Portable
- Flat pack kit
- Compact storage

Assembly / disassembly:

- 10-minute assembly time
- Can be assembled by one person



Fig. 8

Design Optimisation

Smart Space designers are further developing the design of the Easy-Stand to optimise the design. One designer is exploring an option of replacing the current plywood shelves with polymer shelves to reduce weight.

A prototype polymer laptop shelf is shown in **Fig. 9**.

When load testing is undertaken on prototype shelves, they experience fracturing, breakages and product failures. The design team believes that this is as a result of a lack of structural integrity.

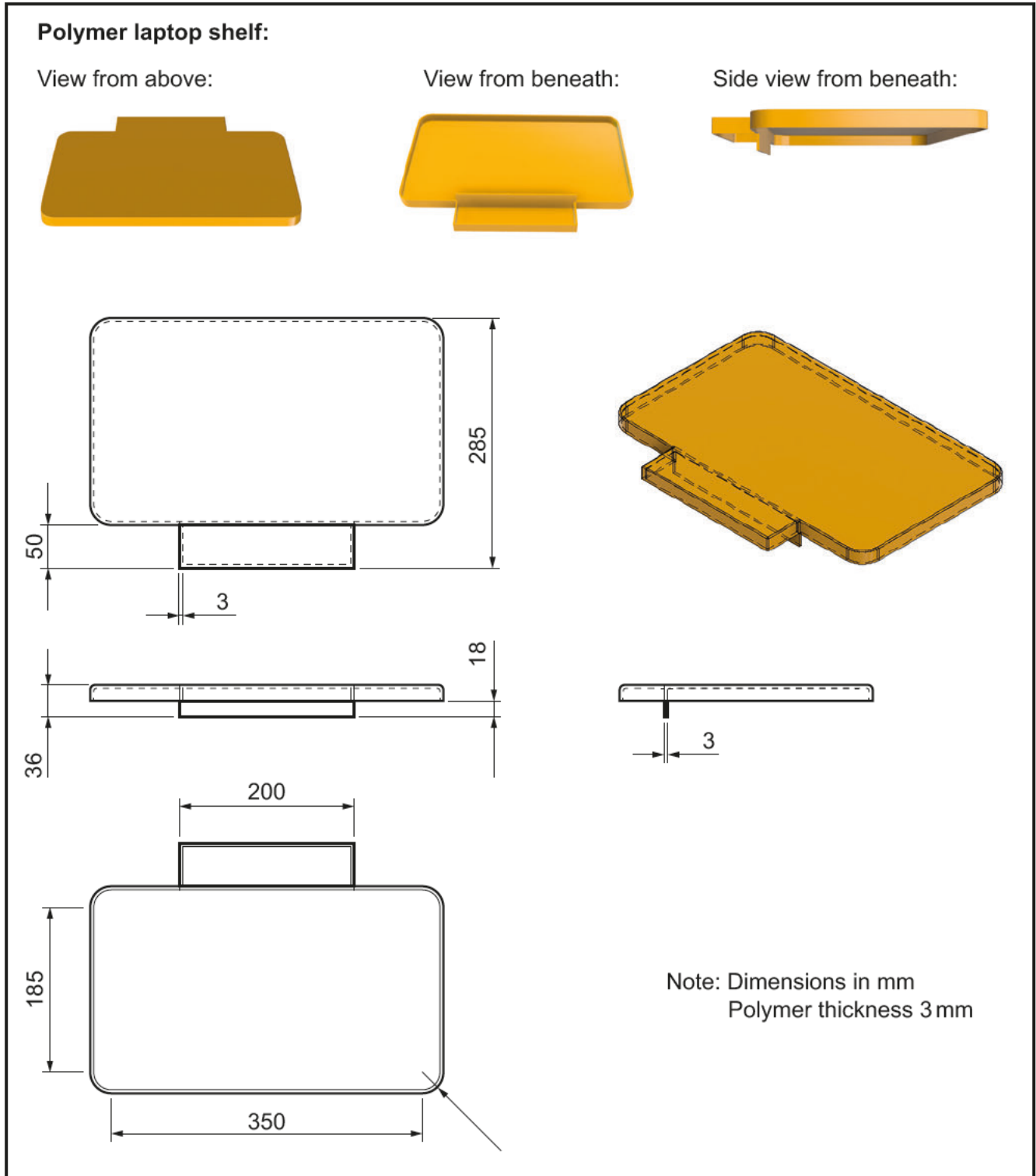


Fig. 9
(not to scale)

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