

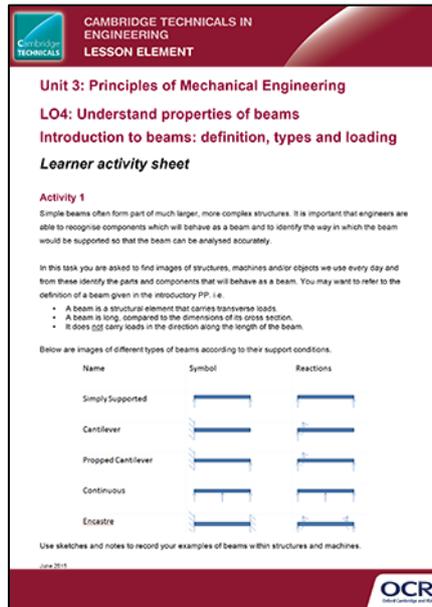
Unit 3: Principles of Mechanical Engineering

LO1: Understand systems of forces and types of loading on mechanical components

Introduction to beams: definition, types and loading

Instructions and answers for teachers

These instructions should accompany the OCR resource 'Understand systems of forces and types of loading on mechanical components – Introduction to beams: definition, types and loading' activity which supports Cambridge Technicals in Engineering Level 3.



**CAMBRIDGE TECHNICALS IN
ENGINEERING
LESSON ELEMENT**

Unit 3: Principles of Mechanical Engineering
LO4: Understand properties of beams
Introduction to beams: definition, types and loading
Learner activity sheet

Activity 1
Simple beams often form part of much larger, more complex structures. It is important that engineers are able to recognise components which will behave as a beam and to identify the way in which the beam would be supported so that the beam can be analysed accurately.

In this task you are asked to find images of structures, machines and/or objects we use every day and from these identify the parts and components that will behave as a beam. You may want to refer to the definition of a beam given in the introductory PP, i.e.

- A beam is a structural element that carries transverse loads.
- A beam is long, compared to the dimensions of its cross section.
- It does not carry loads in the direction along the length of the beam.

Below are images of different types of beams according to their support conditions.

Name	Symbol	Reactions
Simply Supported		
Cantilever		
Propped Cantilever		
Continuous		
Encastre		

Use sketches and notes to record your examples of beams within structures and machines.

June 2014

OCR
Oxford Cambridge and RSA

The Activity:

It is important that learners understand the different types of beams that exist and that the support conditions greatly affect the way the beam will behave. Only relatively simple beams (simply supported beams and cantilever beams) can be analysed using conditions of static equilibrium.

Engineers must ensure that a beam will work in the way that it was originally designed to work. For example, if a beam were designed as an encastre beam (with its ends held firmly to prevent rotation) but constructed as a simply supported beam it would almost certainly fail because the bending moments at the centre of the beam would be much higher than expected. For this reason there is considerable attention paid to the 'bearings', especially in large scale construction.

Learners must be familiar with both point loads and distributed loads applied to beams. Engineers also define loads as either 'dead' or 'live' depending on the nature of the source of the load: in general dead loads are constant and can be calculated accurately - so their effect on the beam can be accurately predicted. Live loads may fluctuate and are more difficult to predict accurately. In engineering practice live loads are given a higher 'factor of safety' to accommodate this level of uncertainty.



This activity offers an opportunity for English skills development.



This activity offers an opportunity for maths skills development.

Suggested timings:

Activity 1 1 hour

Activity 1

Show the learners PowerPoint Presentation: Beams – to introduce the contents of task 1.

In this task learners will be asked to identify beams as components of larger structures and machines. They are then asked to think about the support conditions that would apply to the beam component so that an engineer might be able to analyse its behaviour. Examples might be:

- the deck of a suspension bridge which is a continuous beam supported by hangars from the suspension cables;
- the trailer of an articulated lorry can be thought of as a simply supported beam spanning between the rear axle and the tractor unit;
- floor joists spanning between walls;
- a wall bracket holding a shop sign is a cantilever beam.

Simple beams often form part of much larger, more complex structures. It is important that engineers are able to recognise components which will behave as a beam and to identify the way in which the beam would be supported so that the beam can be analysed accurately.

In this task you are asked to find images of structures, machines and/or objects we use every day and from these identify the parts and components that will behave as a beam. You may want to refer to the definition of a beam given in the introductory PP. i.e.

- A beam is a structural element that carries transverse loads.
- A beam is long, compared to the dimensions of its cross section.
- It does not carry loads in the direction along the length of the beam.

Below are images of different types of beams according to their support conditions.

Name	Symbol	Reactions
Simply Supported		
Cantilever		
Propped Cantilever		
Continuous		
<u>Encastre</u>		

Use sketches and notes to record your examples of beams within structures and machines.



We'd like to know your view on the resources we produce. By clicking on the 'Like' or 'Dislike' button you can help us to ensure that our resources work for you. When the email template pops up please add additional comments if you wish and then just click 'Send'. Thank you.

OCR Resources: *the small print*

OCR's resources are provided to support the teaching of OCR specifications, but in no way constitute an endorsed teaching method that is required by the Board, and the decision to use them lies with the individual teacher. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources. We update our resources on a regular basis, so please check the OCR website to ensure you have the most up to date version.

© OCR 2015 - This resource may be freely copied and distributed, as long as the OCR logo and this message remain intact and OCR is acknowledged as the originator of this work.

OCR acknowledges the use of the following content: Maths and English icons: Air0ne/Shutterstock.com