



SMART WORKSHEETS

ESSW

Enhancing teaching capabilities and complementing students' learning with the use of ready-made, online and auto-graded assessments that are compatible with selected experimental kits in the Engineering Science range.

THEORETICAL CALCULATIONS

Calculate the *theoretical* deflection values using the following equation:

$$\delta = \frac{WL^3}{KEI}$$

Where:

- δ = Deflection of the beam.
- W = Load.
- L = Length.
- E = Young's Modulus.
- I = Second Moment of Area.
- K = K factor.

Mass m, (g)	Load W, (N)	Deflection δ , (mm)
0	0	0
100	0.98067	1.1840
200	1.96134	1.7759
300	2.94201	2.3679
400	3.92268	2.9599
500	4.90335	

6 POINTS

ES4 1. BEAM LOAD

Aims:

- To show the relationship between load and deflection for a beam.

INTRODUCTION

Use this worksheet to record your data, complete calculations and answer interpretation questions.

DATA COLLECTION

Use the table below (Table 1) to record the properties of the beam that you used in this experiment.

Property	Value
Breadth b, (mm)	
Depth d, (mm)	
Length L, (m)	
Second Moment of Area I, (m ⁴)	1.3151 x 10 ⁻¹¹
What is the material of the beam?	Aluminium
Young's Modulus E, (N.m ⁻²)	6.90 x 10 ¹⁰
K factor K	48/200

0 POINTS

SAMPLE SMART WORKSHEET ASSOCIATED TO THE ES4 BEAM LOAD EXPERIMENT

KEY BENEFITS FOR EDUCATORS

- Save academic time from repetitive tasks
- Gain insight into student learning progress
- Inspire and boost student confidence
- Enhance communication and collaboration with students
- Get students to think for themselves

KEY BENEFITS FOR STUDENTS

- Gain confidence with post laboratory assessments
- Enable mastery of key engineering principles
- Practise anywhere, anytime
- Immediate, personalised feedback and instant overall scoring
- Encourage self-led learning



DESCRIPTION

Smart Worksheets are a collection of ready-made, online and auto-graded assessments that complement practical teaching and experimental lab work, enabling students to test their understanding of an associated Engineering Science kit experiment.

They are designed to actively encourage and empower learning by testing students' ability to correctly record experiment observations, and undertake data analysis, calculation practice, graphing and evaluation of experimental results.

Powered by a unique assessment engine that recognises individual errors, Smart Worksheets guide students through an assessment with instant, personalised feedback based on the accuracy of data submitted, providing them the means to master key engineering principles. Smart Worksheets automatically mark and track a student's progress for the educator, enhancing the overall teaching experience with no time spent marking papers.

These Smart Worksheets aim to bring mutual benefits to both educators and students by positively transforming the teaching and learning experience.

KEY FEATURES

- Ready-made, auto-graded assessments associated to an ES experiment kit
- Customisable dashboard
- Interactive and dynamic learning environment
- Announcements sharing course news and new materials
- Instant, personalised feedback and immediate overall assessment scoring
- Interactive and editable graphs
- Auto solve
- Student performance reports
- Timeline mode to enable educators to replay student learning

LICENCES

Universities and colleges access the worksheets through their learning management system:

PURCHASING OPTIONS:

- Full suite of 13 worksheets **OR**
- A selection of any five

Both options require the purchase of either 100, 500 or 1,000 units. They can also be bought in multiples.

LICENCE TERMS:

- Annual academic licence
- Set-up included
- Maintenance and support included
- Licences must be used within the current academic year of subscription

STANDARD FEATURES

- Supplied with comprehensive self-help materials

OPTIONAL ANCILLARY FOR ENGINEERING SCIENCE KITS

- Forces (ES2)
- Moments (ES3)
- Deflection of Beams and Cantilevers (ES4)
- Torsion of Circular Sections (ES5)
- Tensile Tester (ES6)
- Drive System (ES11)
- Gear Trains (ES13)
- Simple Mechanisms (ES14)

WORKSHEETS CURRENTLY AVAILABLE

FORCES AND MOMENTS (ES2 AND ES3):

- Centre of Gravity
- Triangle of Forces
- Principle of Moments
- Levers

DEFLECTION OF BEAMS (ES4):

- Beam Load
- Beam Dimensions
- Beam Length

TORSION (ES5):

- Torque and Diameter

STRENGTH OF MATERIALS (ES6):

- Tensile Testing

DRIVE SYSTEMS (ES11 AND ES13):

- Chain Drive
- Belt Drive
- Spur Gears

SIMPLE MECHANISMS (ES14):

- Crank and Slider

SYSTEM REQUIREMENTS

To ensure you get the best experience with the Smart Worksheets, please use a tablet, laptop or desktop with one of the following supported browsers:

BROWSER	REQUIREMENTS
Chrome	Latest version (any operating system)
Firefox	Latest version (any operating system)
Edge	Latest version (Windows)
Safari	Version 13 +
iOS	Version 13+

SERVERS:

- Servers based in US for US customers
- Servers based in EU for non-US customers