



## 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:

- $\delta$  = 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 $\delta$ , (mm)
0	0	0
100	0.98067	0.1840
200	1.96134	1.1840
300	2.94201	1.7759
400	3.92268	2.3679
500	4.90335	2.9599

6/6 POINTS MORE

**ES4 1. BEAM LOAD**

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

INTRODUCTION: For this worksheet you should have completed the beam load experiment (Figure 1) and gathered your results. Use this worksheet to record your data, complete calculations and answer interpretation questions.

Call indicator: Aluminium Beam 0.5 mm x 2 mm

Plung blocks - set at given depths

**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)	12.7
Depth $d$ , (mm)	12.7
Length $L$ , (m)	0.3
Second Moment of Area $I$ , (m <sup>4</sup> )	$1.3151 \times 10^{-11}$
What is the material of the beam?	Aluminium
Young's Modulus $E$ , (N.m <sup>-2</sup> )	$6.90 \times 10^{10}$
K factor $K$	48

0/6 POINTS MORE

**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
- Encourages self-led learning



# SMART WORKSHEETS

ESSW

## 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 AI and interactive in nature, Smart Worksheets guide students through the 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, reducing the need for individual marking and enhancing teaching capabilities.

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 5

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

### LIGENCE 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