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4 Results and Discussion of Results

In Chapter 1 it was noted in the report on the resistivity of iron that:
• the results section presented data in the form of tables;
• the discussion of results was concerned with the comparison of the experimental results with the standard value; and
• errors in the results were explained in the discussion.

1. Consider the following examples of discussion of results.

Example 1
Aim of experiment: To determine the modulus of elasticity for several materials by using circular bending.

Summary of final results

<table>
<thead>
<tr>
<th></th>
<th>Mild Steel</th>
<th>Tool Steel</th>
<th>Brass</th>
<th>Dural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulus of elasticity $(E)$ from experiment (kN/mm²)</td>
<td>205</td>
<td>207</td>
<td>104</td>
<td>72</td>
</tr>
<tr>
<td>Generally accepted value</td>
<td>207</td>
<td>207</td>
<td>97</td>
<td>70</td>
</tr>
</tbody>
</table>
### Discussion of Results

Comparison of the experimentally determined values of modulus of elasticity with those generally quoted for these materials mostly shows a good agreement. The value obtained for brass which is 104 kN/mm² is somewhat higher than the quoted value of 97 kN/mm².

It must be realised, however, that no exact comparison is possible when the composition and treatment of the beam made of brass are not known.

The slight lack of straightness in the beams seemed to have no effect on the quality of the individual graphs or on the modulus of elasticity. As the determined values of modulus of elasticity are close to those generally accepted, it may be stated that the circular bending test is a suitable method for determining the elastic modulus of any material. This type of test is more economical than a full scale tensile test, as there is no need to have an expensive tensile testing machine, no need to have the specimens machined with precision, and the test can be carried out quickly.

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(a) Underline the phrases which are used to express comparison with generally accepted values.
(b) How does the writer explain the difference between the result for brass and the generally accepted value?
(c) What is the writer's purpose in the final paragraph?
(d) What tense is used in this discussion? Are there any verbs which are not in that tense? Can you think of a reason for this?

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2. Now consider the following discussion.

### Example 2

**Aim of Experiment:** To determine whether two springs made of different metals obey Hooke's Law.

**Theory and Method:** If a spring obeys Hooke's Law, we will find that when it is subjected to a longitudinal force, the extension is proportional to the load.

In the experiment the spring is clamped vertically and masses are added to the scale pan at the lower end. The extension of the spring is measured each time. A set of readings for unloading the pan are also taken.

In this experiment one spring is made of steel and the other is made of copper. The results obtained are shown in the graph on page 26.
Discussion of Results

The graph shows the results obtained for both the steel spring and copper spring. The points obtained during loading are marked with a triangle (△) and the points obtained during unloading are marked with an inverted triangle (▽).

The points obtained for the steel spring lie on a straight line, and, therefore, the extension is proportional to the load. The spring thus obeys Hooke's Law. The points obtained when the load is removed are on the same line. In other words, when the load is removed the spring returns to its original length. Therefore there is no permanent strain.

One point lies significantly off the line, that is the fifth point obtained during loading. This is probably due to incorrect reading of the scale, and the point has been ignored in drawing the line.

Examination of the graph for the copper spring, however, shows very different results. Initially there is a linear relationship between extension and load but subsequently the extension increases more rapidly for equal increases in load. The line drawn from the points obtained during unloading is linear again, but the points are higher than those obtained during loading. The spring has undergone permanent strain because the elastic limit was exceeded during loading.
(a) Which tense is mainly used in this discussion?
(b) Are there any other tenses used? Can you say why it is used?
(c) There are a number of expressions describing a linear relationship. List these.
(d) One of the results obtained was inaccurate. State which sentence describes this.
(e) How does the writer explain the inaccuracy mentioned in question (d)?

Summary

In a discussion of results we do some of the following:
• Compare our experimental results with accepted values.
• Compare our experimental results with each other.
• Explain errors.
• Describe a linear relationship as shown in a graph.
• Comment on trends shown by a graph.
• Comment on the suitability of the method used in the experiment.

In Units Five, Six, Seven and Eight the writing of discussion of results will be looked at in greater detail.