Exercise walk-through

2.1 Models, materials and iterative prototyping

International Baccalaureate · IB Diploma · Design Technology · SL

INTERNATIONAL BACCALAUREATE · IB DIPLOMA · DESIGN TECHNOLOGY · SL • EXERCISE SHEET

2.1 Models, materials and iterative prototyping

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS prototype • iteration

Objective

Models, materials and iterative prototyping. Original classroom practice for IB SL; not an official IB paper.

1 Key knowledge and worked examples

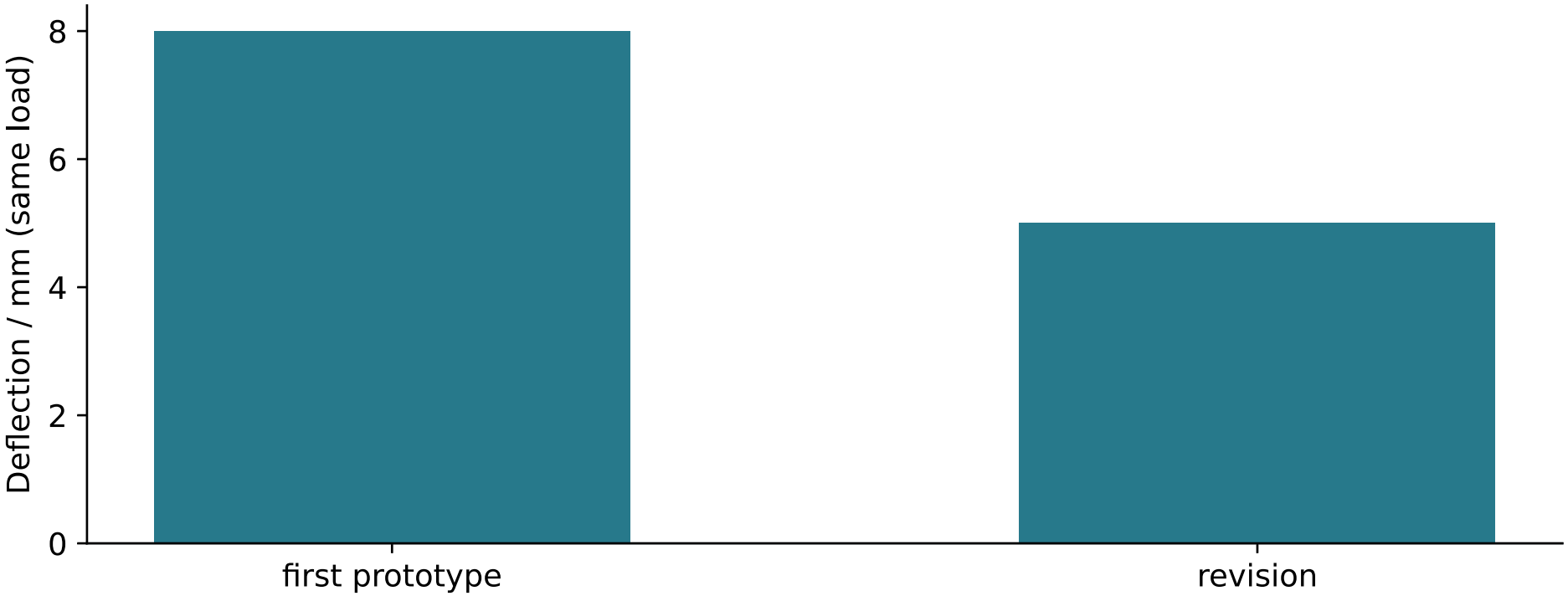
What would explain this observation?

- A cardboard **prototype** can reveal reach and arrangement without proving that the final material is strong enough. Different models answer different questions.

Build the model

- A model represents selected features of a design.
- A prototype supports testing before or during development.
- Material selection depends on mechanical properties, manufacture, use conditions and end-of-life choices.

- prototype: A developing version used to test a solution.
- **iteration** : Revision guided by evidence and repeated testing.



Choose evidence that can test it

- State what each model includes and omits.
- Compare tests with the same load, geometry and conditions.
- Iteration means using evidence to revise a solution and testing the revision against the original success criteria.

In the lab: Make a low-risk model under school workshop rules. Record dimensions, material, process and test method. Use photographs, measurements and user feedback as evidence. Machines and load tests require teacher supervision and approved guards.

Work from known quantities

- Known: a beam prototype deflects 8 mm under a stated load; a revision deflects 5

mm under the same conditions.

- Reduction = (8-5)/8×100 = 37.5%.
- The result supports greater stiffness in that test, not proof of every strength or fatigue property.

Your turn: Deflection falls from 10 mm to 6 mm under equal conditions. Find percentage reduction.

■ Check the conclusion and its limits

- Stiffness is resistance to elastic deformation; strength concerns failure stress.
- A visually accurate model need not reproduce material behaviour.

Not true: An attractive model proves the final product mechanical safety. Appearance

is not performance. Mechanical safety depends on material, geometry and manufacturing; a good-looking model proves only that the design looks right.

Key:

- A model represents selected features of a design.
- State what each model includes and omits.
- Watch for: stiffness is resistance to elastic deformation; strength concerns failure stress.

■ Write from a 25 percent reduction

- A beam deflects 12 mm. A revision deflects 9 mm under the same load, geometry and conditions.
- Find the percentage reduction. Cardboard can test arrangement without proving the

final material.

Exercises 2.1·2.3

2.1 What can a scale appearance model establish directly? Choose one answer.

- **A** All production costs
- **B** Full-size fatigue strength
- **C** Its represented layout and form [1]

2.2 Deflection falls from 10 mm to 6 mm under equal conditions. Find percentage reduction. Show the relation, substitution and units. [2]

2.3 Decide whether this claim is true and justify: An attractive model proves the final product mechanical safety. [2]

Exercises 2.1·2.3

2.1 What can a scale appearance model establish directly? Choose one answer.

- **A** All production costs
- **B** Full-size fatigue strength
- **C** Its represented layout and form [1]

2.1 C An appearance model reproduces layout and form only; it cannot demonstrate fatigue strength or production cost because those depend on real materials and processes the model does not share.

2.2 Deflection falls from 10 mm to 6 mm under equal conditions. Find percentage reduction. Show the relation, substitution and units. [2]

2.2 reduction=(10−6)/10×100=40%.

2.3 Decide whether this claim is true and justify: An attractive model proves the final product mechanical safety. [2]

2.3 False. Appearance is not performance. Mechanical safety depends on material, geometry and manufacturing; a good-looking model proves only that the design looks right.

Exercises 2.4·3.1

2.4 A developing version used to test a solution: write the technical term. [1]

3.1 Fictional prototypes deflect 8 and 5 mm under one equal load. Find reduction and propose evidence distinguishing stiffness from failure strength. [4]

Exercises 2.4·3.1

2.4 A developing version used to test a solution: write the technical term. [1]

2.4 prototype. prototype means A developing version used to test a solution.

3.1 Fictional prototypes deflect 8 and 5 mm under one equal load. Find reduction and propose evidence distinguishing stiffness from failure strength. [4]

3.1 Reduction 37.5% supports greater stiffness at that load. Controlled load-deflection and supervised strength evidence test different properties. Record geometry, supports and material.