Revision practice

International Baccalaureate · IB Diploma · Design Technology · HL

Original open focus revision; complete specification coverage remains unfinished.

1 Designing for actual users

- ergonomics
- specification

■ Question 1

Which is a testable requirement?

- The handle must be nice
- The handle must sustain a defined 100 N supervised test load
- The designer must like it

Available marks: 2.

Worked answer

The handle must sustain a defined 100 N supervised test load

- Choose data for the target population and task. Clearance often needs a larger-user percentile; reach may need a smaller-user percentile. A single mean dimension cannot satisfy every design constraint.

■ Question 2

A use force is 30 N and selected safety factor 3. Find target load.

Available marks: 4.

Worked answer

90 N

- Appropriate relation; consistent substitution; correct result; meaningful unit and interpretation.

A specification is not a list of vague wishes such as nice or strong. User testing should evaluate measurable requirements and reveal conflicting needs.

2 Ergonomics: fit a range of users

- anthropometry
- ergonomics

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Question 1

Which decision is most defensible when a fixed control is unreachable for some intended users?

- Test a closer or adjustable position against the specified user range
- Use only the largest measured reach
- Assume the average guarantees access

Available marks: 2.

Worked answer

Test a closer or adjustable position against the specified user range

- A clearance dimension often needs to consider larger relevant body dimensions, while reach can require smaller relevant dimensions. Neither principle automatically selects a universal percentile. The measured population, posture, clothing, capability and task determine relevance. Consider physical, perceptual and cognitive demands together rather than assuming body size explains every usability issue.

Question 2

A stated nearest-rank method uses ceil(p×n). For p=0.90 and n=20, find the rank.

Available marks: 4.

Worked answer

18 rank

- Appropriate relation; consistent substitution; correct result; meaningful unit and interpretation.

Percentile methods differ, especially for small samples. A percentile is not a percentage of a body dimension. An average dimension and a successful test by one user do not establish accessible design.

3 Models, materials and iterative prototyping

- prototype
- iteration

Question 1

What can a scale appearance model establish directly?

- Full-size fatigue strength
- Its represented layout and form
- All production costs

Available marks: 2.

Worked answer

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Its represented layout and form

- 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.

■ Question 2

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

Available marks: 4.

Worked answer

40 %

- Appropriate relation; consistent substitution; correct result; meaningful unit and interpretation.

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

4 Manufacture: tolerances, variation and inspection

- tolerance
- clearance

■ Question 1

Which dimensions determine the minimum worst-case clearance?

- Smallest hole minus largest shaft
- Largest hole minus smallest shaft
- Nominal hole plus nominal shaft

Available marks: 2.

Worked answer

Smallest hole minus largest shaft

- For a worst-case clearance model, subtract the largest shaft from the smallest hole for minimum clearance, and the smallest shaft from the largest hole for maximum clearance. The calculation assumes the stated dimensional limits and ideal geometry. Shape, alignment, temperature and measurement uncertainty can affect actual assembly.

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■ Question 2

A hole ranges from 12.0 to 12.4 mm and a shaft from 11.5 to 11.8 mm. Calculate minimum clearance.

Available marks: 4.

Worked answer

0.2 mm

- Appropriate relation; consistent substitution; correct result; meaningful unit and interpretation.

A tighter tolerance can increase cost, inspection time and waste, and may not improve the user outcome. A measuring instrument with a fine display does not automatically have the accuracy required to accept a part near its limit.

5 Design sustainability and production choices

- design for disassembly
- tolerance

■ Question 1

Which supports repairability?

- Permanent bonding of every part
- Accessible replaceable wear parts
- Hiding all fasteners without a plan

Available marks: 2.

Worked answer

Accessible replaceable wear parts

- Compare a common service over a stated lifetime. Separate fixed tooling cost from cost per item. Include repair, energy, transport and realistic end-of-life pathways rather than using a recycled label as the whole judgement.

■ Question 2

Fixed costs differ by 400 units and unit costs differ by 5. Find cost break-even quantity.

Available marks: 4.

Worked answer

80 items

- Appropriate relation; consistent substitution; correct result; meaningful unit and interpretation.

A cheaper process is not automatically preferable. Cost estimates need currency, quantity and assumptions, and prototypes do not prove mass-production consistency.

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