DP Design Technology Standard Level Paper 1 Set B

1 hour

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all questions.
- A calculator is required for this paper.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The maximum mark for the examination paper is [30 marks].

1. The design process is an iterative model made up of five stages.

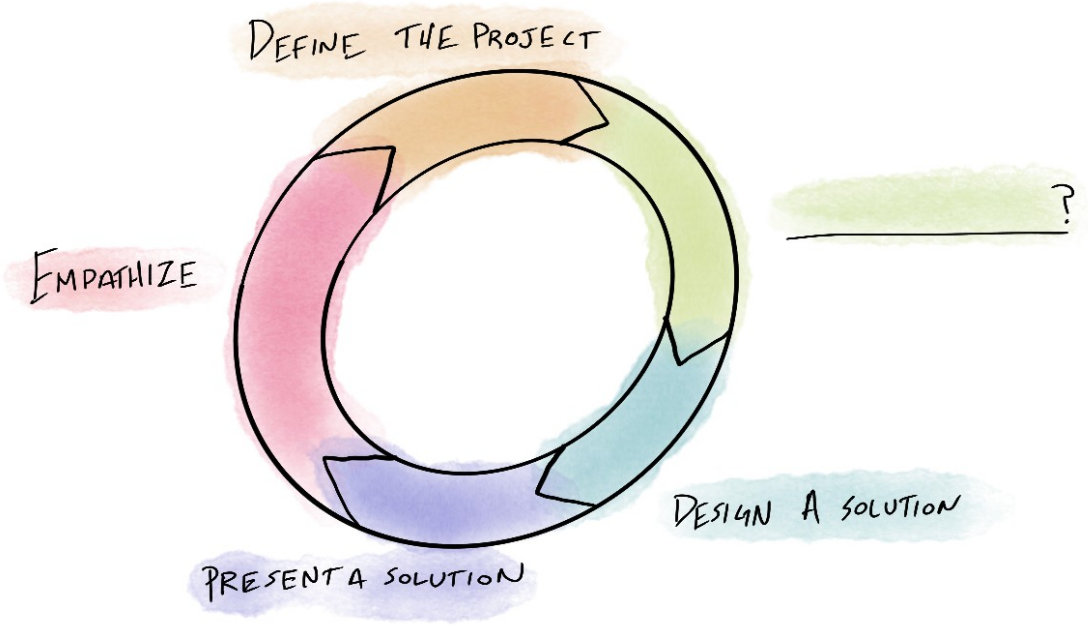


Figure 1: The five stages of the design process

Figure 1 shows the design process with one stage left unlabelled. Which stage is missing?

A. Select materials and processes

B. Manufacture and distribute

C. Ideate and model

D. Evaluate the completed product

2. KitchenAid has manufactured stand mixers since 1919. Current tilt-head models have a body of die-cast zinc alloy, a stainless steel bowl, and a hub at the front of the motor housing that accepts attachments such as a pasta roller or a grinder.

The hub fitting has not changed since the 1930s, so an attachment bought today fits a mixer built eighty years ago. The mixer is sold in more than thirty colours and new colours are released every year.



Figure 2: KitchenAid tilt-head stand mixers with a variety of attachments

Which property of stainless steel is most critical in its selection for the mixing bowl, see Figure 2?

A. Resistance to corrosion from acidic foods

B. Low density for ease of lifting and handling

C. High thermal conductivity when the bowl is heated

D. High elasticity under repeated bending

3. A tilt-head mixer weighs about 10 kg. Many owners store it in a low cupboard and lift it onto the worktop each time it is used.

Which limiting aspect of user capability most restricts who can use the mixer in this way?

A. Visual accuracy

B. Hearing threshold

C. Colour perception

D. Strength

4. An attachment bought today fits a KitchenAid mixer manufactured eighty years ago, see Figure 2.

Which design strategy for a circular economy does the unchanged hub fitting support?

A. Longevity

B. Dematerialization

C. Biodegradation

D. Recycling

5. KitchenAid releases the mixer in new colours each year while the mechanism inside remains unchanged.

Which form of obsolescence is most encouraged by this practice?

A. Functional obsolescence

B. Technological obsolescence

C. Planned obsolescence

D. Style obsolescence

6. The Aeron chair, designed by Bill Stumpf and Don Chadwick for Herman Miller in 1994, replaced the foam-and-fabric seat of a conventional office chair with a suspension mesh stretched across a frame. The mesh carries the sitter's weight and allows air to pass through it.

The Aeron is not sold as a single adjustable chair. It is made in three shell sizes, A, B and C, and the buyer selects the size that fits them.

Herman Miller operates a programme that takes back used Aeron chairs, replaces worn components and resells them.



Figure 3: The Herman Miller Aeron chair

(Question continues on next page)

(Question 6 continued)

(a) Which strategy for accommodating variation in body size does the A, B and C shell range represent?

A. Designing for the average user

B. Providing a range of sizes

C. Adjustability

D. Designing for the extremes

(b) Which benefit does the suspension mesh give a sitter over a long working day, see Figure 3?

A. It reduces the force needed to adjust the chair

B. It lowers the chair's centre of mass when reclined

C. It allows heat and moisture to pass away from the body

D. It widens the range of seat heights available to the sitter

(c) A user whose dimensions fall outside all three shell sizes cannot be fitted by the Aeron range.

Which statement about inclusive design does this best illustrate?

A. Inclusive design requires anthropometric data to be applied

B. Inclusive design applies only to users with disabilities

C. Inclusive design always increases the cost of a product

D. Inclusive design is not always possible

(d) Which material requirement is most critical for the suspension mesh, see Figure 3?

A. Recovery of shape after sustained loading

B. High thermal conductivity across the frame members

C. A low coefficient of friction at the contact surface

D. Transparency to visible light

(e) Which circular economy strategy does Herman Miller's take-back and resale programme represent?

A. Downcycling

B. Reconditioning

C. Dematerialization

D. Recycling

7. In 2012 a teenager with cerebral palsy (A neurological and physical developmental disorder) wrote to Nike asking for a shoe he could put on without help. Nike's response became the FlyEase range.

The Go FlyEase, released in 2021, has no laces. Its sole is hinged across the middle and rests in either of two stable positions, open and closed. A tensioner band holds it in whichever position it is in. The wearer steps into the open shoe and presses the heel down to close it.

Nike tested the shoe with athletes both with and without disabilities.



Figure 4: The Nike Go FlyEase in its open and closed positions

(a) Which inclusive design strategy does the Go FlyEase best demonstrate, see Figure 4?

A. Providing a range of sizes

B. Designing for the extremes

C. Adjustability

D. Designing for the average user

(b) Nike tested the shoe with athletes who did not have disabilities as well as those who did.

Which benefit of this decision is most relevant to inclusive design?

A. It reduced the overall cost of the research programme

B. It allowed the shoe to be sold at a higher retail price

C. It shortened the development timeline for the product

D. It showed whether the solution also served other users

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(Question 7 continued)

(c) A design team wants to understand the difficulties a wearer has when putting on a shoe unaided.

Which user-centred research method would produce the most useful data?

A. A literature review of published academic studies

B. A questionnaire sent to a large national sample

C. User observation of the task being performed

D. A focus group discussion with regular wearers

(d) Before any shoe was manufactured, the team built simple hinged models from card and foam to check how the sole would fold.

Which type of prototype is this?

A. A low fidelity prototype

B. A high fidelity prototype

C. A virtual prototype

D. A production prototype

(e) The team later produced wearable samples in the final materials and gave them to athletes to train in.

What is the main purpose of a prototype used in this way?

A. To communicate the concept to the company's marketing department

B. To confirm that the hinge geometry is possible

C. To gather performance data from users in real conditions

D. To reduce the cost of manufacture

8. Microsoft released the Zune portable music player in 2006, five years after the iPod. The Zune had a larger screen than the iPod of the time, an FM radio, and a wireless feature that let a user send a song to another Zune, which the recipient could play three times within three days.

Music bought for the Zune could be played only on a Zune, and music a customer had already bought for an iPod could not be transferred to one. Microsoft ended production in 2011.



Figure 5: Mr. K's first-generation Microsoft Zune, 20 years later

(a) A product analysis of the Zune is carried out in 2007, see Figure 5.

Which of the following is best recorded as a **strength**?

A. The restriction of shared songs to three plays

B. The size of the existing iPod user base

C. The inability to transfer previously purchased music

D. The screen size compared with competing players

(b) Zune owners could not transfer music they had already paid for onto a player of a different brand.

Which responsibility of the designer does this restriction most clearly conflict with?

A. The responsibility to ensure a product is safe to use

B. The responsibility to the needs of the user

C. The responsibility to minimise material consumption

D. The responsibility to meet international standards

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(Question 8 continued)

(c) A team reviewing the Zune concludes that the problem the product set out to solve had been wrongly defined from the start.

At which stage of the design process should this have been identified?

A. Empathize and define the project

B. Ideate and model the solution

C. Design a solution for the user

D. Present a solution to the client and user

9. Hasbro launched the G.I. Joe action figure in 1964 at 12 inches (305 mm) tall, moulded in polymer and dressed in cloth uniforms.

The 1973 oil crisis raised the price of the oil from which the polymer was made. Hasbro reduced the figure to 8 inches (203 mm) in 1976, and in 1982 relaunched it at 3.75 inches (95 mm) with moulded-on clothing in place of cloth.



Figure 6: G.I. Joe figures at 12 inches (1964) and 3.75 inches (1980s)

(a) Which factor most directly drove the reduction in the figure's size, see Figure 6?

A. A change in the preferences of children

B. Safety regulations covering small parts

C. The rising cost of the raw material

D. The introduction of a new moulding technology

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(Question 9 continued)

(b) Which consequence of the 3¾ inch figure was most significant commercially?

A. The figure could be moulded in a wider range of colours

B. Vehicles and playsets could be sold at family prices

C. The figure became more durable in use

D. The figure needed less packaging material

(c) Moulded-on clothing replaced the cloth uniforms used on the 12 inch figure.

Which factor most influenced this change of material?

A. The recyclability of the materials being used

B. The weight of the finished figure

C. The appearance of the finished figure

D. The cost of assembling the smaller figure

10. Honda released the Super Cub in 1958. More than 100 million have been built since, making it the most produced motor vehicle of any kind.

Soichiro Honda and Takeo Fujisawa studied small motorcycles in Europe in 1956 and watched how delivery riders worked in Japanese cities. Riders carrying trays of food needed one hand free, and they wore ordinary clothes rather than protective riding clothing.

The Super Cub has a step-through frame with no tall bar to swing a leg over, a large moulded leg shield, and controls arranged so that the machine can be ridden without operating a clutch lever by hand.



Figure 7: The Honda Super Cub, 1958



Figure 8: A Super Cub used for deliveres

Question continues on next page

(a) Honda's designers watched delivery riders at work before beginning the design, see Figure 8.

Which user-centred research method is this?

A. Focus group

B. User observation

C. Questionnaire

D. Literature review

(b) The Super Cub was designed around the idea of a rider who carries food, wears ordinary clothes and travels short distances in a city.

What is this description an example of?

A. A design specification

B. A user journey map

C. A population stereotype

D. A primary persona

(c) Which ergonomic benefit does the step-through frame give the rider, see Figure 7?

A. It reduces the reach from the seat to the handlebars

B. It lowers the force needed to steer the machine

C. It removes the need to raise a leg high when mounting

D. It increases the ground clearance beneath the machine

(d) The leg shield is moulded in a polymer rather than pressed from steel, see Figure 7.

Which property of the polymer is most relevant to this application?

A. High electrical conductivity along its length

B. A high melting point under engine heat

C. Resistance to corrosion in wet conditions

D. High density for its given volume

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(Question 10 continued)

(e) Honda issued a brief requiring a machine that could be ridden one-handed by a rider in ordinary clothing.

What is this brief an example of?

A. A design specification

B. A product analysis report

C. An ideation tool

D. A user journey map of the task

(f) Before production began, Honda gave working Super Cubs to delivery riders to use for a month.

What is the main purpose of a prototype used in this way?

A. To confirm the appearance of the finished machine before launch

B. To reduce the cost of tooling

C. To gather data from users in the real working environment

D. To demonstrate the design to investors

(g) The Super Cub has remained in production for more than sixty years, and parts remain available for machines built decades ago.

Which designer responsibility does this best demonstrate?

A. Designing for the average user

B. Designing to meet international standards

C. Designing for safety in use

D. Designing against planned obsolescence

(h) The Super Cub's small engine consumes very little fuel per kilometre travelled.

Which dimensions of the triple bottom line does this most directly serve?

A. People only

B. Planet and profit

C. Profit only

D. People and profit

(i) Honda continues to supply replacement parts for Super Cubs built decades ago.

Which circular economy strategy does this most directly support?

A. Recycling

B. Dematerialization

C. Repair

D. Remanufacture

Markscheme

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1.	C	**6e.**	B	**10a.**	B
2.	A	**7a.**	B	**10b.**	D
3.	D	**7b.**	D	**10c.**	C
4.	A	**7c.**	C	**10d.**	C
5.	D	**7d.**	A	**10e.**	A
6a.	B	**7e.**	C	**10f.**	C
6b.	C	**8a.**	D	**10g.**	D
6c.	D	**8b.**	B	**10h.**	B
6d.	A	**8c.**	A	**10i.**	C
		9a.	C		
		9b.	B		
		9c.	D		