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Design technology
Higher level and standard level
Paper 2

15 May 2026

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

Session number

1 hour 30 minutes

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Instructions to students

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.



Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

1. Hiking, backpacking or simply sitting and observing wildlife outside helps people to feel connected with the environment and therefore helps to combat stress.

During winter it can be uncomfortable to sit outside in the cold for long periods of time and for some people it can negatively impact their health.

A multidisciplinary design team who love the outdoors, felt they could design a chair to keep users warm in winter. This resulted in the design of the Portable Insulated Chair, see **Figure 1**.

Figure 1: Portable Insulated Chair



The lightweight and portable chair designed for disassembly includes accessible screws that can be reused, allowing it to fit into a small backpack with an option for gradual heat to keep the user warm in low temperatures.

Due to the novel texture of the fabric, the warmth allows the users to stay comfortable whilst controlled heat spreads throughout the chair.

(This question continues on the following page)



(Question 1 continued)

- (a) (i) Which data scale could be used to gather feedback from users about the comfort of the Portable Insulated Chair? [1]

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- (ii) The Portable Insulated Chair was designed for disassembly.

Outline **two** design for disassembly aspects of the Portable Insulated Chair that can extend the lifespan of the product. [2]

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- (b) (i) Describe **two** aesthetic characteristics that relate to the Portable Insulated Chair. [2]

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- (ii) To further understand users' evaluations of the chair, qualitative data was used. Outline **two** limitations of qualitative data. [2]

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(Question 1 continued)

- (c) (i) State **two** benefits of using intellectual property (IP) to protect the Portable Insulated Chair.

[2]

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- (ii) Explain how finite element analysis (FEA) testing can help the designer of the Portable Insulated Chair to manufacture a more durable product.

[3]

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- (d) (i) Define **one** advantage of selecting carbon fibre as a material for the Portable Insulated Chair frame.

[1]

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- (ii) Describe what happens when the stress on a material is overloaded beyond its yield point.

[2]

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(Question 1 continued)

- (e) (i) Outline **two** advantages of working in a multidisciplinary team. [2]

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- (ii) Explain **three** product innovations incorporated within the Portable Insulated Chair as a result of technology push. [3]

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2. AXESS cookware utensils are designed by Peter King whose wife loved to cook but struggled with arthritis, which made holding kitchen utensils challenging. His design originated from prototypes that he created to help her, utilizing a mattified rubber material that enables users to hold the tool firmly.

This inspired the product range and name “Sure Hold”, see **Figure 2**, which includes the Sure Hold Vegetable Peeler.

Peter King’s designs remain accessible and have since evolved to reach a wider audience ensuring continued enjoyment of cooking and healthy eating for people with reduced motor skills.

Figure 2: Sure Hold Vegetable Peeler and measuring jug with rubberised handles



[Source: romiri / iStock.]

(This question continues on the following page)



(Question 2 continued)

- (a) AXESS also designs food storage boxes made from polyethylene terephthalate (PET).

List **two** reasons why PET is often used for food packaging.

[2]

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- (b) Identify why consumers of first-to-market technologies are characterized as both innovators and trendsetters.

[2]

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3. Mixed reality (MR) which combines interactions between the physical and the virtual worlds is increasing interest in interaction design for virtual reality (VR) within wide-ranging industries, from Education to Aerospace and beyond (**Figure 3a** and **Figure 3b**).

Mixed reality (MR) interfaces can be accessed by the user through wearing mixed reality glasses. The spatial software maps the physical environment and matches the size of the virtual interface to the size of the user's hand for ease, comfort and reach.

Figure 3a: Architectural student using MR spatial software to design a building



[Source: FatCamera / iStock.]

Figure 3b: An air taxi concept using MR spatial software to simulate a virtual flight within a city



[Source: © Mantas Zilicius | Dreamstime.com.]

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28EP08

(Question 3 continued)

Explain **three** physiological benefits of interacting with objects through a mixed reality (MR) software interface, as opposed to physical interactions.

[3]

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4. Explain **three** reasons why taxi or car sharing applications, such as Uber and Lyft, are classified as disruptive innovation.

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Section B

Answer **one** question. Answers must be written within the answer boxes provided.

5. Climate change issues are becoming more concerning, and vehicle (car) manufacturers are constantly looking for new alternatives to petrol or diesel (gas) fuel which pollutes the air.

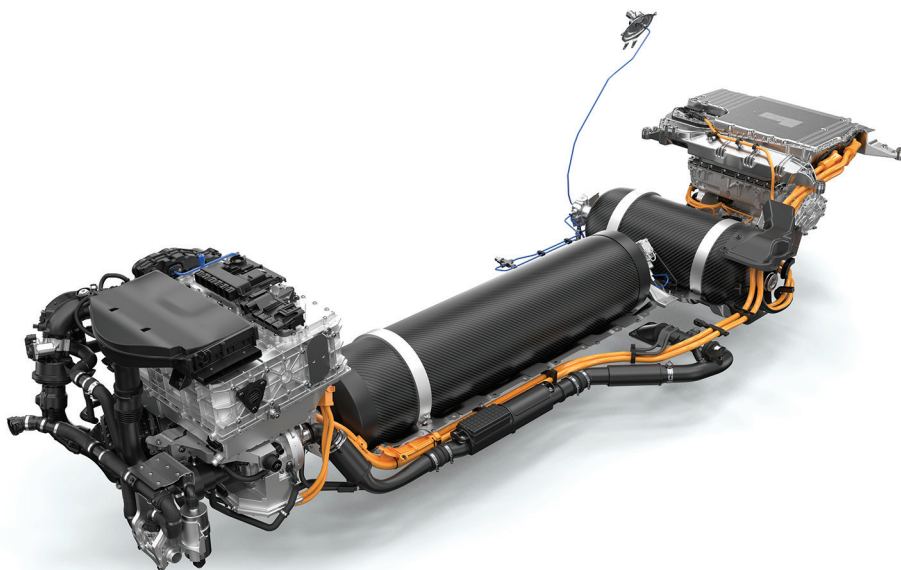
BMW are pioneering a redevelopment of the internal combustion engine (ICE) and have developed a new alternative to electric vehicles (EV) in the form of the BMW iX5 Hydrogen vehicle (car), see **Figure 4**.

Figure 4: The BMW iX5 Hydrogen vehicle (Car)



BMW states “Just like a battery electric vehicle (BEV), a hydrogen or fuel cell electric vehicle (FCEV) has an electric drive and identical electric motor”.

Figure 5: Hydrogen fuel cell for the BMW iX5 Hydrogen vehicle (car)



(This question continues on the following page)



(Question 5 continued)

BMW predicts that hydrogen fuelled vehicles (cars) will overtake electric vehicles (EVs) in the very near future, as consumers are constantly demanding cleaner cars. BMW claim that the iX5 Hydrogen vehicles (cars) offer an “emission-free vehicle, unlike diesel cars” owing to its hydrogen fuel cell, see **Figure 5**.

- (a) Describe **one** environmental benefit of the hydrogen cell-fuelled BMW iX5 Hydrogen (FCEV) compared to a traditional petrol or diesel (gas) fuelled BMW internal combustion engine (ICE).

[2]

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- (b) Suggest **one** driver for invention of the BMW iX5 Hydrogen vehicle (car).

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(Question 5 continued)

- (c) Describe **two** approaches to prolonging the BMW iX5 Hydrogen’s vehicle product life cycle within its maturity phase. Use **two** sub headings: ***aesthetics*** and ***marketing strategies***.

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(Question 5 continued)

**Figure 6: Virtual reality
(VR) model of BMW iX5**

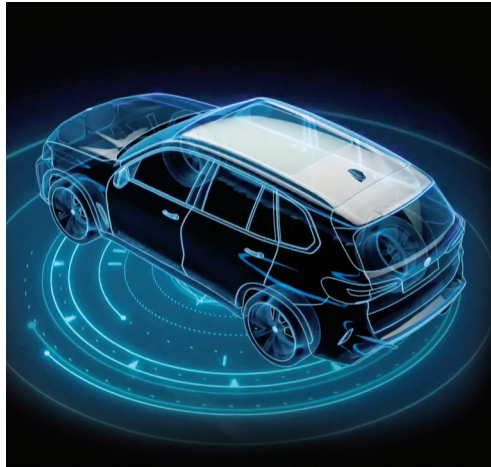


Figure 7: A design engineer viewing the BMW iX5 Hydrogen's parts via a VR manual



[Source: FatCamera / iStock.]

(This question continues on the following page)



28EP14

(Question 5 continued)

- (d) BMW are one of the first automotive design companies to use virtual reality (VR) models viewed by VR headsets to support design, manufacture and marketing.

Explain how the use of virtual reality (VR) models may impact the pre-production, manufacturing **and** marketing of the BMW iX5 Hydrogen fuelled vehicles (cars) as shown in **Figure 6** and **Figure 7**.

[9]



Turn over

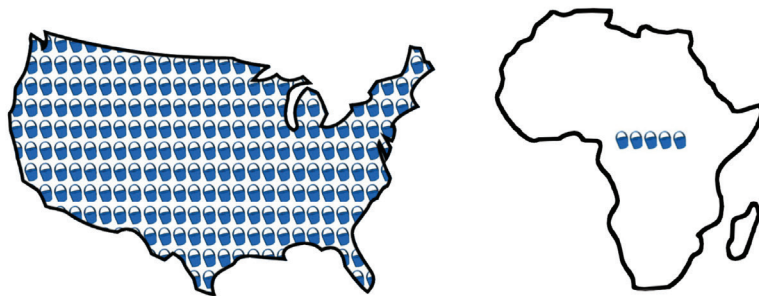
6. World Vision states that the average distance that communities walk for water in Africa and Asia is 3.7 miles (6 kilometres). Clean water is a basic human need, however access to it is limited for much of the world's population.

For villagers in remote areas, many of them children, finding water can mean a long walk to the source, followed by a physically tiring return journey carrying the heavy containers, see **Figure 8**. Villagers are often exhausted or become injured when collecting the water, so designers developed an innovative solution for transporting it.

Figure 8: Regional water consumption data comparison



The Long Walk to Water
The average North American family uses more than 300 gallons (1,136 litres) of water per day, while the average family in Africa only uses 5 gallon (19 litres).



Inspired by the water crisis in Rural Africa, the Hippo Roller designers were recognized for their invention in 1997 by the South African Bureau of Standards and awarded the “Design for Development Award”.

(This question continues on the following page)



(Question 6 continued)

Figure 9: Hippo Roller website

[Hippo Hub](#)
[About Us](#)
[StoryMaps](#)
[450 Club](#)
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HIPPO Hub!

SIMPLE IDEAS. CHANGING LIVES.
HOW FAR WOULD YOU WALK FOR CLEAN DRINKING WATER?

Did You Know?

Of the 8 billion people living on Earth, 2.1 billion are impacted by severe water scarcity.
That's more than 25% of the global population!

Hippo Rollers in These Countries!

Rolling with Rotary International

Celebrate the Work of Rotary, and the Deployment of Hippo Rollers ...

[Explore](#)

Rolling with Swim for Rivers

Hippo Roller partners with Swim for Rivers to deploy over a thousand...

[Explore](#)

Rolling in Zambia

Hippo Roller brings water portability to Zambian villagers.

[Explore](#)

Rolling in Chad

Hippo Roller partnered with a local NGO in Chad to help with water...

[Explore](#)

Rolling in Lesotho

Rotary International funded Hippo Rollers to uplift teenage mothers...

[\[Explore\]](#)

Rolling in Mozambique

Cargill and Hippo Roller teamed up to help chicken farmers in...

[Explore](#)

Rolling in Tanzania

The United Nations World Food Programme used Hippo Rollers to...

[Explore](#)

Rolling in Zimbabwe with Littlefield

C Connie Littlefield, a humanitarian for Zimbabwe, touched the lives o...

[Explore](#)

The Hippo Roller carries 90 litres (19.8 gallons) of water rolled on the ground, by either pushing or pulling, and because the weight rests on the ground the containers can be easily moved, even by children.

The Hippo Roller has reduced the time and physiological effort needed to transfer water from the source, increasing the villagers' well-being and reducing the time it takes to carry the water back.

(This question continues on page 19)



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(Question 6 continued)

- (a) Rogers' characteristics of innovation is well known for characterizing aspects of innovation

Outline the term given to product improvements over previous generations. [2]

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- (b) Suggest which percentile range and correlating age range designers should use when designing the hand grip of the Hippo Roller stating the reason for your answer. [3]

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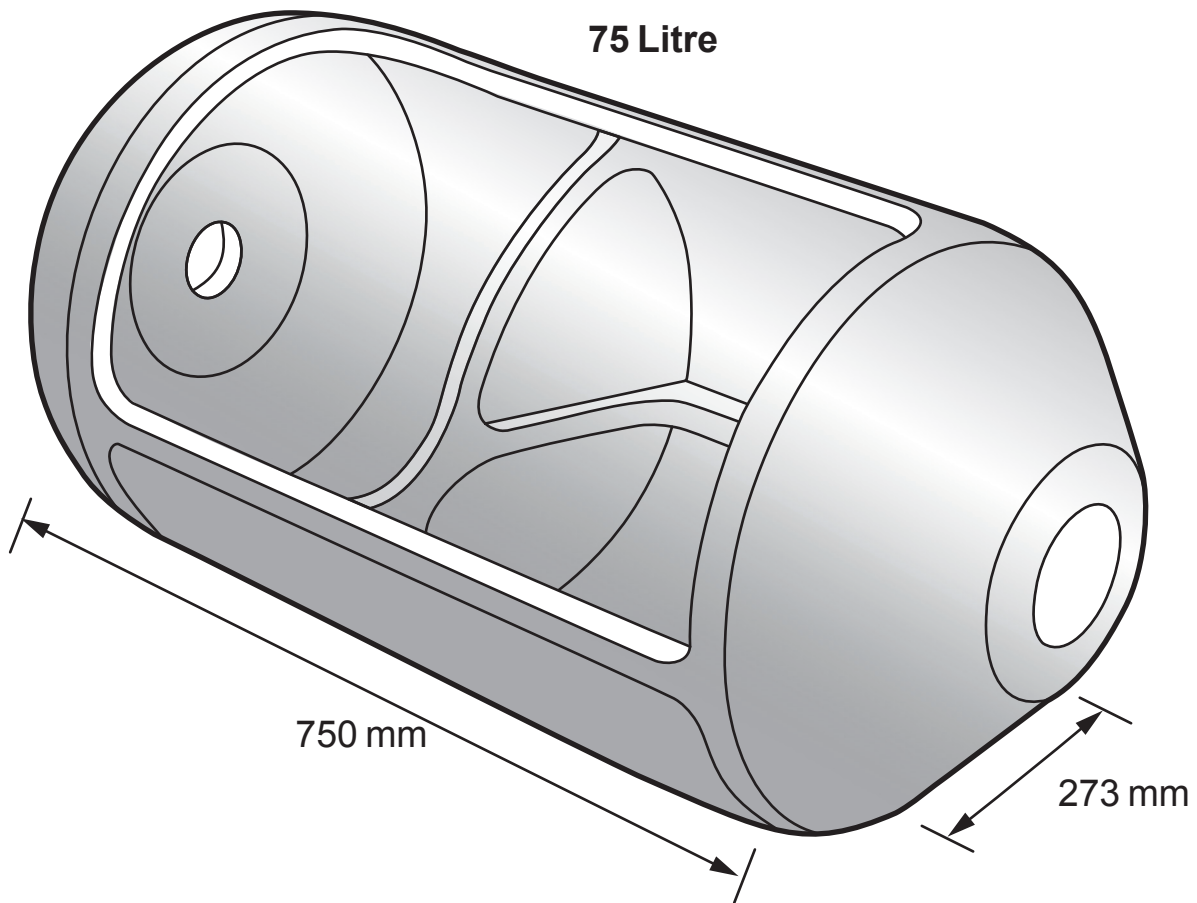
(c) Two different size Hippo Rollers were designed to enable the full age range of remote villagers to easily transport up to either, 75 litres (19.8 gallons), or 90 litres (23.8 gallons) of water across challenging, often rough, terrain. Therefore, the Hippo Roller requires thin walls to minimize its weight.

[6]

[illegible]

(Question 6 continued)

Figure 10: Diagram showing internal construction of the 75 Litre Hippo Roller



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(d) The Hippo Roller team re-designed the method of carrying water by reducing the centre of gravity via the roller's long handle which reduced the physical burden on users.

Specifically discuss **three** distinct aspects: the distribution of load, the impact on posture **and** the reduction of fatigue.

[9]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings on the page.

7. TERRA is a digital “compass” created by design studios Modem Works and Panter & Tourron. It is an open-source customizable product that combines artificial intelligence (AI) and haptic technology.

TERRA is handheld and pocket-sized and was designed to enable people to go for long walks without their mobile phone, which could be considered a distraction.

Users build their own TERRA by simply downloading the open-source software, 3D printing the CAD files and assembling the necessary hardware components. To 3D print the TERRA the designers suggest using polylactic acid (PLA) an easy-to-use biodegradable plastic.

The inclusion of artificial intelligence (AI) enables TERRA to track and capture data about the users’ favourite walks. This enables future walks to be guided using vibration through haptic feedback, and the use of a light-up arrow compass interface to navigate, see **Figure 11** and **Figure 12**.

Figure 11: A user carrying TERRA

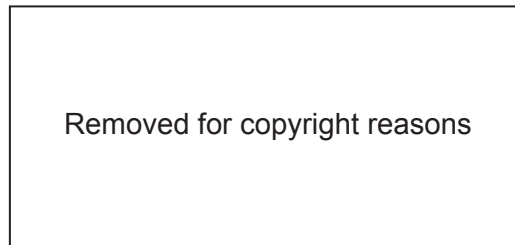
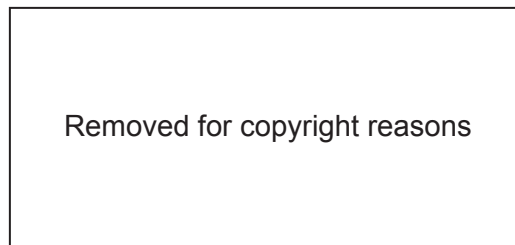


Figure 12: TERRA light up arrow interface



(This question continues on the following page)



(Question 7 continued)

- (a) TERRA is considered to be eco-friendly as it is made from a single plant-based polymer material.

Describe **one** reason why products that are made of multiple materials can be difficult to recycle.

[2]

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- (b) Explain how the inclusion of haptic feedback and the light up arrow user interface displayed on the outer casing enables the TERRA to guide users via their senses, see **Figure 11**.

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(Question 7 continued)

- (c) Rogers' characteristics of innovation impact on the rate of consumer adoption of an innovation, such as the TERRA.

Explain the role of relative advantage **and** observability on the rate of adoption of the TERRA.

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(Question 7 continued)

- (d) Explain how the design of the TERRA outer case, that is 3D-printed using PLA, enables a reduction of energy consumption at the pre-production, production **and** disposal stages of the life cycle.

[9]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins or other markings on the paper.

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