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DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 2

Candidate session number

Tuesday 18 November 2014 (afternoon)

1 hour 45 minutes

Examination code

8 8 1 4 – 6 2 0 2

INSTRUCTIONS TO CANDIDATES

- 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.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[60 marks]*.

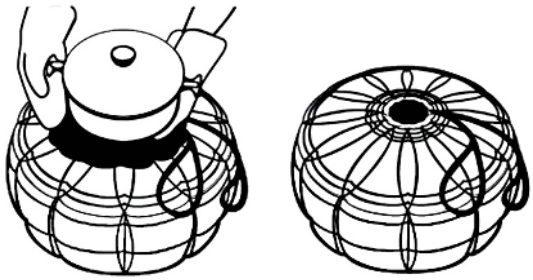
SECTION A

*Answer **all** questions. Write your answers in the boxes provided.*

1. **Figure 1** shows the Wonderbag designed by Sarah Collins who formed a company to produce and market the product. Sarah received inspiration for the Wonderbag when she was working with local communities in South Africa in 2007 and there was a series of electricity power cuts causing much disruption. In 2012 the multi-national company, Unilever ordered 600,000 Wonderbags as part of its marketing strategy for the South African market. A Wonderbag was distributed in urban areas to customers who purchased three packs of Rajah curry powder, which is manufactured by Unilever. By June 2012, over 500,000 of these had been distributed throughout South Africa. **Figure 2** shows how food that has been cooked for a short time in a pot on a conventional stove is then placed in the Wonderbag to continue cooking without the use of additional energy. The textile bag has two layers with recycled thermoplastic (polystyrene) material sealed between the layers. **Table 1** shows cooking times for typical foods using the Wonderbag and **Table 2** shows estimated cost saving for an average family over a year. **Table 3** (on page 5) shows design criteria and corporate objectives for the Wonderbag.

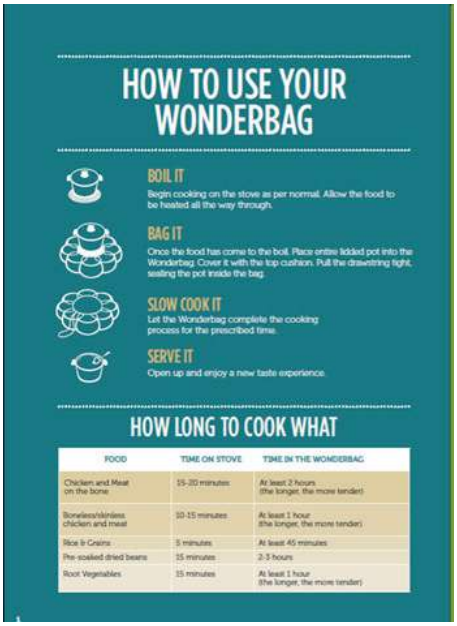
Figure 1: Wonderbag

Figure 2: Cooking pot placed in the Wonderbag



[Source: www.nb-wonderbag.com Heidi Otto/Jon de Bufanos]

Table 1: How to use your wonderbag



HOW TO USE YOUR WONDERBAG

BOIL IT
Begin cooking on the stove as per normal. Allow the food to be heated all the way through.

BAG IT
Once the food has come to the boil. Place entire lidded pot into the Wonderbag. Cover it with the top cushion. Pull the drawstring tight, sealing the pot inside the bag.

SLOW COOK IT
Let the Wonderbag complete the cooking process for the prescribed time.

SERVE IT
Open up and enjoy a new taste experience.

HOW LONG TO COOK WHAT

FOOD	TIME ON STOVE	TIME IN THE WONDERBAG
Chicken and Meat on the bone	15-20 minutes	At least 2 hours (the longer, the more tender)
Boneless/skinless chicken and meat	10-15 minutes	At least 1 hour (the longer, the more tender)
Rice & Grains	5 minutes	At least 45 minutes
Pre-soaked dried beans	15 minutes	2-3 hours
Root Vegetables	15 minutes	At least 1 hour (the longer, the more tender)

Table 2: How to wash your Wonderbag

HOW TO WASH YOUR WONDERBAG

Open out the Wonderbag™ so that it is completely flat. Then wash the bag and the lid by hand or in a washing machine and hang them out to dry. Do not tumble-dry your Wonderbag™.

SAFETY TIPS

- NEVER put a pot of half-eaten or lukewarm food in the Wonderbag™.
- Keep your Wonderbag™ away from flames. The fumes from burning polystyrene are dangerous.
- Do not use heavy cast-iron pot. It could be too hot and cause the polystyrene balls to melt.
- Do not transfer a dish from the oven to the Wonderbag™ if the oven is hotter than 180°C.
- When in use, keep the Wonderbag™ away from small children as they might tip over the hot pot inside.

TIP 1: Use your Wonderbag™ when you have to transport cold or frozen foodstuffs. For instance, it keeps frozen pieces frozen for up to 12 hours.

TIP 1: The Wonderbag™ is an efficient warming oven. It keeps heated plates and prepared meals warm for considerable periods of time.

COOKING TIPS

- Use the right size pot for the amount of food you want to cook. Heat is retained more effectively when the pot is full.
- As there is no evaporation when cooking in the Wonderbag™, add less liquid to your dishes than usual.
- Place a dish cloth in the bottom of the bag to keep it clean and to protect the fabric.

[Source: www.nb-wonderbag.com Heidi Otto/Jon de Bufanos]

(This question continues on the following page)

(Question 1 continued)

(a) (i) State the ideas generating technique that stimulated the concept of the Wonderbag. *[1]*

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(ii) State the purpose of using the thermoplastic (polystyrene) material in the construction of the Wonderbag. *[1]*

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(iii) Outline **one** limitation of the use of the Wonderbag for cooking most of a family's meals. *[2]*

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(Question 1 continued)

(b) (i) Outline **one** maintenance consideration for the selection of the textile material for the Wonderbag. *[2]*

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(ii) List **two** manufacturing techniques for producing the Wonderbag. *[2]*

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(c) (i) State **one** variable which may affect the data in **Table 2**. *[1]*

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(ii) Discuss **one** limitation of the use of the cooking times in **Table 1** for the quality of the food cooked in the Wonderbag. *[3]*

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(Question 1 continued)

Table 3: Wonderbag design criteria and corporate objectives

Design criteria:
Reduction of carbon dioxide emissions
Reduction of accidents in the kitchen
Labour saving for users
Less water usage due to evaporation
Less food spoilage by overcooking on stoves
30% saving of an average family fuel usage
Manufactured locally in African countries
Company corporate objectives:
100 million bags will be distributed globally by 2020
1 billion women and families no longer forced to use cooking fires, and living and eating more healthily
100,000 jobs created globally
100 million tons of carbon saved

[Source: www.nb-wonderbag.com
Heidi Otto/Jon de Bufanos]

(d) (i) With reference to the company corporate objectives in **Table 3**, state the amount of carbon which would be saved per home. *[1]*

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(Question 1 continued)

(ii) Discuss **one** advantage for the multinational company, Unilever, of sponsoring the Wonderbag. *[3]*

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(e) (i) Outline **one** reason why the Wonderbag may be considered an example of appropriate technology. *[2]*

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(ii) Outline **one** safety issue for the Wonderbag which may impact on the data for the reduction of accidents. *[2]*

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2. (a) State the main source of power for production prior to the Industrial Revolution. *[1]*

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(b) Discuss the impact of steam power on the scale of production during the early stages of the Industrial Revolution. *[3]*

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3. (a) Describe the difference between elastic and plastic strains. *[2]*

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(b) Describe what is meant by moment arm. *[2]*

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4. (a) State the type of energy water has in a reservoir as part of a hydroelectric power system. *[1]*

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(b) Compare capital costs with manufacturing costs for a large hydroelectric power system. *[3]*

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5. (a) Describe the structure and bonding of thermoset plastic materials. *[2]*

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(b) Outline why thermosetting plastics are suitable for compression moulding. *[2]*

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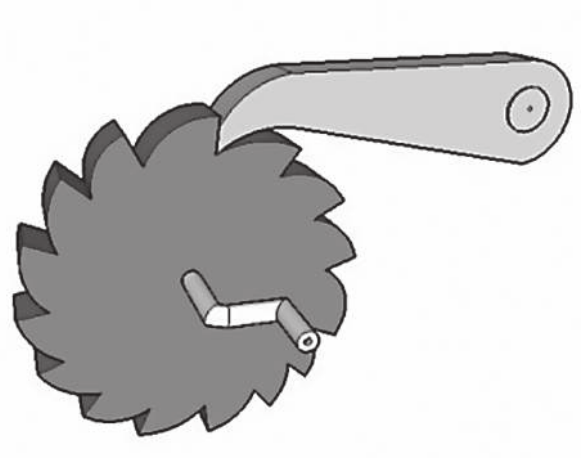
6. (a) State the type of mechanism used in lifting devices shown in **Figure 3**. *[1]*

Figure 3: A mechanism



[Source: www.technologystudent.com. ©V. Ryan.]

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(b) Explain how the design of the teeth in the mechanism shown in **Figure 3** enable it to work efficiently. *[3]*

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SECTION B

*Answer **one** question. Write your answers in the boxes provided.*

7. **Figure 4** shows the Suzuki Burgman Hydrogen Scooter. Suzuki is a long established manufacturer of scooters. The Burgman Hydrogen Scooter is hydrogen fuel cell powered. It was been designed in conjunction with a UK company, Intelligent Energy, who have expertise in hydrogen fuel cell technology. The scooter has a range of approximately 220 miles and can be filled up with hydrogen in 3 minutes. The scooter emits only water. Although hydrogen production is energy intensive, it is also available as an industrial by-product.

Figure 4: Suzuki Burgman Hydrogen Scooter

[Source: www.motorcycle.news.com]

(a) (i) Outline how the radical design of the Burgman Scooter will have contributed to high fixed costs. *[2]*

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(This question continues on the following page)

(Question 7 continued)

(ii) Outline how the Burgman Scooter is an example of the corporate strategy of market development. *[2]*

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(b) (i) Outline **one** reason why the appearance of the Burgman Scooter is similar to many other scooter models. *[2]*

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(ii) Discuss **one** potential limitation of the increased use of hydrogen generated as an industrial by-product to fuel vehicles such as the Burgman Scooter. *[3]*

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(Question 7 continued)

(c) (i) Outline **one** reason why an established company such as Suzuki wanted to collaborate with another company to design the Burgman Scooter. *[2]*

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(ii) Discuss **three** considerations for the consumer when deciding whether to purchase a Burgman Scooter. *[9]*

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8. **Figure 5** shows the Ventura Commute 2010 folding bicycle. It has a metal (steel) frame and 51 cm wheels with an integral carrying rack and bike stand. The maximum seat height is 84 cm and the bicycle weighs 13.8 kg. It folds down to 82 cm × 66 cm × 15 cm and is available in a finish of black, silver or white.

Figure 5: Ventura Commute 2010 folding bicycle

[Source: "Brompton1". Licensed under Copyrighted free use via Wikimedia Commons—http://commons.wikimedia.org/wiki/File:Brompton1.jpeg#mediaviewer/File:Brompton1.jpeg]

Figure 6: Bicycle when folded down

[Source: "Brompton5". Licensed under Copyrighted free use via Wikimedia Commons—http://commons.wikimedia.org/wiki/File:Brompton5.jpeg#mediaviewer/File:Brompton5.jpeg]

(a) (i) Describe the type of mechanism used for the brake system of a bicycle. *[2]*

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(ii) Outline **one** maintenance consideration for the chain drive mechanism used on bicycles. *[2]*

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(Question 8 continued)

(b) (i) Describe the type of load created by the rider on the bicycle. *[2]*

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(ii) Compare the design of the folding bicycle with a conventional non-folding bicycle in relation to product life. *[3]*

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(Question 8 continued)

(c) (i) Outline the permanent joining technique used to join parts of the metal frame of the bicycle. *[2]*

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(ii) Discuss benefits of the increased use of folding bicycles in relation to social, economic and environmental factors. *[9]*

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9. **Figure 7** shows the award winning Ole chair designed by Ludovica and Roberto Palomba and manufactured by Crassevig company from plywood with a hardwood (oak) surface veneer.

Figure 7: The Ole chair

[Source: www.bonluxat.com]

(a) (i) Outline **one** reason why the nature of the decorative design of the Ole chair increases manufacturing costs. *[2]*

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(ii) Outline **one** benefit of the design of the chair for portability. *[2]*

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(Question 9 continued)

(b) (i) Outline **one** advantage of using plywood for the chair in relation to strength-to-weight ratio. *[2]*

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(ii) Suggest **one** limitation of the design of the back of the chair relating to ergonomics. *[3]*

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(Question 9 continued)

(c) (i) Outline **one** potential safety issue for the design of the Ole chair. *[2]*

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(ii) Explain **three** important quality control considerations for the manufacture of the Ole chair. *[9]*

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