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DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 2

Thursday 11 November 2010 (afternoon)

1 hour 45 minutes

Candidate session number

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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 of Section A in the spaces provided.
- Section B: answer one question from Section B. Write your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

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SECTION A

*Answer **all** the questions in the spaces provided.*

1. Pallets are used to distribute products, *e.g.* canned drinks (see **Figure 1**). They are produced in different standard sizes (see **Table 1**). The European palette (EPAL) (see **Figure 2** and **Figure 5**) is now emerging as the global standard. EPAL pallets are made of wood and are marked with the EPAL logo (see **Figure 3**). The pallets are handled using a pallet truck or fork lift truck (see **Figure 4**) so products must not project beyond the edges of the pallet.

Figure 1: Drinks cans on a pallet

[Source: Source: www.rexam.com. Used with permission.]

Figure 2: A European standard pallet

[Source: http://www.packagingnews.co.uk /news/981749/Epal-warns-against-unsafe-unauthorised-pallet-repairs/. Used with permission (www.epal.eu).]

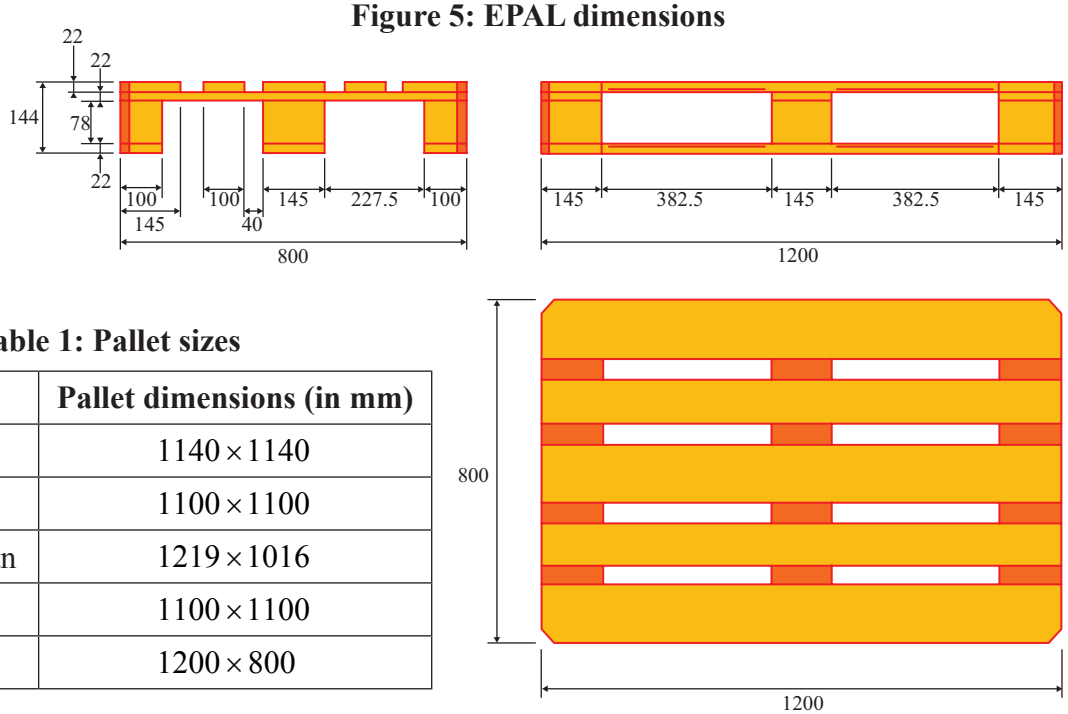
Figure 3: The EPAL logo

[Used with permission (www.epal.eu).]

Figure 4: A pallet truck

[Image reproduced courtesy of Hytsu Group]

Figure 5: EPAL dimensions



[Source: adapted from http://en.wikipedia.org /wiki/File:Plan_palette-europe.svg. Original image by Wikipedia contributor WhiteTimberwolf.]

Table 1: Pallet sizes

Pallet	Pallet dimensions (in mm)
Australian	1140 × 1140
Korean	1100 × 1100
North American	1219 × 1016
Asian	1100 × 1100
European	1200 × 800

(This question continues on the following page)

(Question 1 continued)

(a) (i) Calculate the total length of 145 mm wide 22 mm thick timber required to construct the EPAL pallet. *[2]*

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(ii) Outline **one** reason why products loaded onto a pallet must not project beyond the edges of the pallet. *[2]*

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(b) (i) State **one** advantage of the pallets being made of wood. *[1]*

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(ii) Outline **one** advantage of the design of the EPAL pallet enabling it to be lifted from each of its sides. *[2]*

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(c) (i) Outline **one** advantage of the pallets being labelled with the EPAL logo. *[2]*

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(ii) Explain the need for global standards for pallet sizes. *[3]*

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(Question 1 continued)

The first ring-pull (see **Figure 6**) was invented in 1962 by Ermal C Fraze of Dayton, Ohio. The design was patented and licensed for use by can manufacturers. This design of ring-pull came off the can completely and became a common form of litter. People often dropped the ring-pulls into the cans and sometimes even swallowed them by accident. Stay-on ring-pulls were invented by Daniel F Cudzik in Richmond, Virginia in 1975. They have replaced the pull-tabs in many parts of the world.

Figure 6: Fraze's original ring-pull design

[Source: http://en.wikipedia.org/wiki/File:Beverage_pull_tab.jpg, photo by G. Allen Morris III.]

Figure 7: Cudzik's stay-on tab design

[Source: http://en.wikipedia.org/wiki/File:Drinking_can_ring-pull_tab.jpg by Marcos André.]

(d) (i) Identify why Cudzik's design is an example of constructive discontent. *[2]*

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(ii) Outline **one** advantage of the stay-on ring-pull end over the earlier design, apart from it not being able to be thrown away as litter or swallowed. *[2]*

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(e) (i) State the class of lever that Cudzik's ring-pull design is an example of. *[1]*

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(ii) Explain **one** ergonomic consideration in the design of the lever for Cudzik's ring-pull. *[3]*

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2. (a) State **one** psychological factor related to the ergonomics of a design. *[1]*

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(b) Discuss the influence of perception when collecting data relating to psychological factors. *[3]*

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3. (a) Identify **one** impact of automation on working conditions. *[2]*

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(b) Outline **one** way in which automation has improved the type and range of products available to consumers. *[2]*

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4. (a) State **one** advantage of developing a freehand perspective drawing for use with consumers. *[1]*

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(b) Explain why a designer would produce both an orthographic drawing and an isometric drawing of a product. *[3]*

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5. (a) State which stage of its development the laptop computer is in. *[1]*

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(b) Explain how for many products, *e.g.* laptop computers, the product cycle can be extended. *[3]*

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6. (a) Define *design for process*. *[1]*

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(b) Explain **one** way in which design for process can contribute to a green design strategy. *[3]*

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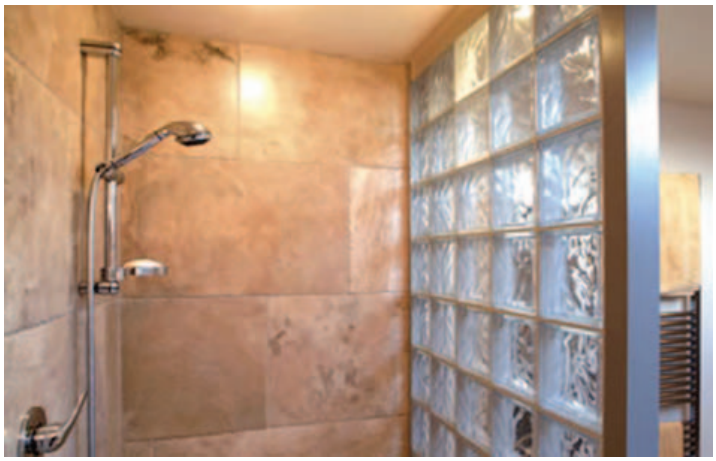
SECTION B

*Answer **one** question. Write your answers on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.*

7. Glass has become extremely fashionable as a structural material. **Figure 8** shows a shower screen made from glass blocks.

Figure 8: Glass blocks used as a shower screen



[Glass Blocks: Clear Flemish, Safewall End post silver/grey by GLASSBLOCKS.CO.UK.]

(a) (i) Define *daylighting*. *[1]*

(ii) Outline **one** way in which the use of glass blocks in the production of the shower screen contributes to daylighting. *[2]*

(iii) Outline **one** way in which daylighting contributes to reductions in energy consumption in buildings. *[2]*

(b) (i) List **two** criteria for the selection of the adhesive to join the blocks together to form the shower screen. *[2]*

(ii) Identify **one** disadvantage of using an adhesive to join the blocks to form the shower screen. *[2]*

(c) (i) Identify **one** disadvantage of using glass as a structural material. *[2]*

(ii) Explain **three** reasons, apart from its transparency, why glass is increasingly used as a structural material. *[9]*

8. **Figure 9** shows a glued laminated timber (Glulam) beam. Glulam beams are increasingly used in the construction industry.

Figure 9: Glulam beam

[Image of school building in Cornwall, UK, used with permission of Lamisell Ltd (www.lamisellbeams.com).]

(a) (i) State **one** advantage of laminating timber. *[1]*

(ii) Describe how lamination contributes to the strength of the beam shown in **Figure 9**. *[2]*

(iii) Describe how Glulam differs from plywood. *[2]*

(b) (i) Describe how the shape of the beam makes the most effective and economic use of materials. *[2]*

(ii) Describe the importance of a factor of safety in the design of beams. *[2]*

(c) (i) Outline **one** benefit of using Glulam beams in the construction industry. *[2]*

(ii) Discuss **three** issues relating to the consideration of timber as a sustainable resource. *[9]*

9. Increasingly, solar energy is being harvested through large solar projects comprising vast areas of photovoltaic panels, *e.g.* on factory roofs (see **Figure 10**). In such projects the cost per Watt is a more important consideration than the efficiency of energy conversion.

Figure 10: A solar roof plant

[© Uwe Lein, AP Images. Used with permission.]

(a) (i) Define *field trial*. *[1]*

(ii) Outline **one** reason why it would be important to conduct a field trial before embarking on the construction of a large solar project. *[2]*

(iii) Outline **one** reason why solar power can be regarded as a clean technology. *[2]*

(b) (i) Identify how the Bellagio principles would help in the evaluation of a proposal for a large solar project. *[2]*

(ii) Outline **one** reason why the cost per Watt is a more important consideration in the evaluation of a solar project than the overall efficiency of energy conversion. *[2]*

(c) (i) Identify **one** disadvantage of solar power. *[2]*

(ii) Explain **three** ways in which life cycle analysis would be used in the evaluation of a proposal for a large solar project. *[9]*