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88056202

DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 2

Monday 7 November 2005 (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. **Figure 1** shows a mobile phone held in the hand of an user. **Figure 2** and **Figure 3** show current models of mobile phones, that have different user interfaces. **Figure 2** is a phone that displays only simple text, whilst **Figure 3** is a phone that has a larger screen to enable the user to display e-mail messaging and images.

Figure 1

Figure 2

Figure 3

(This question continues on the following page)

(Question 1 continued)

Research shows that most mobile phone text messaging is done by the thumb of the left hand. **Figure 4** shows a special device for measuring thumb reach. **Table 1** lists anthropometric data collected in a study using the device. The top line gives male data from the study whilst the second line (underlined) gives female data.

Figure 4 (Reach Testing Rig)

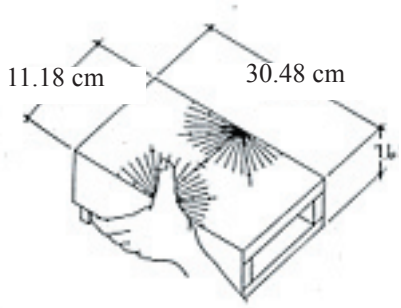

Table 1 – Anthropometric data collected from test rig

Dimension*	Mean	Standard Deviation	5th Percentile	95th Percentile
Thumb reach at 45 deg	6.90 6.23	0.67 0.69	5.77 5.31	8.03 7.38
Thumb reach at 90 deg	6.77 6.15	0.69 0.54	5.77 5.31	7.69 6.90
Most comfortable thumb angular displacement	55 44	14.97 13.59	33 34	86 82
Maximum thumb angular displacement	115 115	100 107	100 107	132 133
Thumb reach at maximum angular displacement	6.80 5.90	5.46 4.97	5.46 4.97	7.69 6.90

* Measurements are in centimeters or degrees as appropriate

[Source: Gilbert, Hahn, Gilmore and Schurman (2003)]

(This question continues on the following page)

(Question 1 continued)

(a) (i) State the area of the screen in Figure 2. *[1]*

. . . . . .

(ii) State the thumb reach for 5th percentile males at 90 deg. *[1]*

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(iii) Identify the value that the designer would take as the "most comfortable thumb angular displacement" when designing the mobile phone. *[2]*

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(b) (i) List **two** limitations of collecting ergonomic data using a reach testing rig as shown in Figure 4. *[2]*

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(ii) List **two** design considerations relating to the buttons on the phone with the larger screen in Figure 3. *[2]*

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(Question 1 continued)

(c) (i) Define *ergonomics*. *[1]*

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(ii) List **three** factors, other than visual factors, which may influence a potential buyer when choosing a phone product. *[3]*

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(Question 1 continued)

As manufactures and consumers become more aware of issues concerning quality control and product recycling, products are being encoded with data that gives relevant information. **Figure 5** and **Figure 6** show two different methods by which product information is displayed in their mouldings. (These Figures are for two different products.)

Figure 5

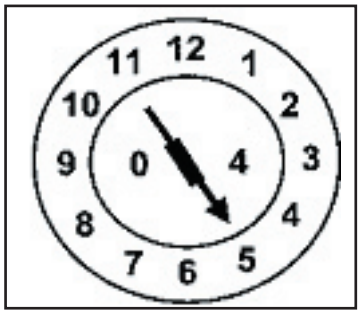

Figure 6

REG DES 54637
DESIGN K DAVIES
P DAVIES

>Polypropylene<

	1	2	3	4	5	6	7	8	9	10	11	12
03						◆	◆	✓	◆	◆	◆	◆
04	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
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(Question 1 continued)

(d) (i) Referring to Figure 5, state the month and the year in which the product was manufactured. *[1]*

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(ii) State **one** piece of information in addition to when the product was manufactured that could be obtained from the information shown in Figure 6. *[1]*

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(iii) List **two** advantages of including the additional information, such as that shown in Figure 6, into the product. *[2]*

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(e) (i) State how the study of anthropometrics helps the designer to make design decisions relating to the final shape of the mobile phone. *[1]*

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(ii) Explain how the cover for the mobile phone would be produced. *[3]*

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2. (a) Define *thermal expansion.* *[1]*

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(b) Explain why thermal expansion is important in the design of railway lines (tracks). *[3]*

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3. (a) Describe the technique of *sintering*. *[2]*

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(b) List **two** advantages of *sintering*. *[2]*

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4. (a) Define *product life cycle*. *[1]*

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(b) Discuss the role of the designer in the product cycle. *[3]*

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5. (a) Define *clean technology*. *[1]*

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(b) Explain **one** way in which quantitative data on pollution and waste are used to support legislation relating to cleaner manufacture. *[3]*

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6. (a) Describe the structure of Kevlar® (aramid) fibre. *[2]*

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(b) List **two** reasons why Kevlar™ is used for the manufacture of sails for high-performance yachts. *[2]*

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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. **Figure 7** and **Figure 8** show a chair manufactured by the company Stoke. The frame is manufactured from laminated timber. The seat, backrest and leg rest are manufactured from plywood covered with plastic foam and a textile material.

Figure 7

Figure 8

(a) (i) State **one** property of timber which makes the material suitable for lamination. *[1]*

(ii) Outline **one** disadvantage of the use of polyurethane foam for the chair. *[2]*

(iii) Discuss why a composite of nylon and cotton has been chosen for the chair. *[3]*

(b) Explain **one** ergonomic consideration for the design of the chair. *[3]*

(c) Outline **one** safety factor not related to ergonomics for the design of the chair. *[2]*

(d) Explain the relevance of Young's modulus in selecting the material for the design of the chair frame. *[9]*

8. **Figure 9** shows a table lamp made by an Italian company, Luxo Italiana. It features small wheels on the bottom surface for ease of movement. The "head" remains parallel to the work surface when its height is altered. The body is made from glass reinforced nylon.

Figure 9

[Source: *The Best Tables, Chairs and Lights"* by Mel Byars]

(a) State the technique used to manufacture the lamp body. *[1]*

(b) (i) State **one** advantage of using pyrex glass for the reflector. *[1]*

(ii) Outline **one** advantage of using glass reinforced nylon for the body of the lamp. *[2]*

(c) (i) Describe the design of the lamp as an example of a moment arm. *[3]*

(ii) Explain the forces acting on the structure when adjusting the lamp head. *[4]*

(d) Discuss how the form of the lamp has influenced its function. *[9]*

9. **Figure 10** shows two electric kettles. Kettle "A" was designed in 1908 and manufactured by AEG. It is made from stainless steel with a wooden handle. Kettle "B" was designed in 1987 and is made from a thermosetting plastic. It is automatic and has a water level indicator and a thermostat which switches the kettle off after the water reaches boiling point.

Figure 10

Kettle A

Kettle B

(a) (i) State **one** advantage of using chromed steel for part of the body of kettle A. *[1]*

(ii) List **three** aesthetic characteristics of the design of kettle A. *[3]*

(b) Outline how the structure and bonding of the plastic material makes it suitable for injection moulding kettle B. *[3]*

(c) Compare the design of the handle for each kettle in relation to safety. *[4]*

(d) Discuss how energy considerations have influenced the design of kettle B. *[9]*