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M06/4/DESTE/SP2/ENG/TZ0/XX/M

# MARKSCHEME

## May 2006

## DESIGN TECHNOLOGY

## Standard Level

## Paper 2

14 pages

If you do not have a copy of the current Design Technology Guide, please request one from IBCA.

## SECTION A

**1.** (a) (i) *Award **[1]** for correct data and **[1]** for correct answer in millimetres only – award **[1]** only for leaving out units.*

12 + (4 x 18) + 22;
106 mm; ***[2]***

(ii) *Award **[1]** for a correct reason and **[1]** for a brief explanation.*

Foot space;
So person can comfortably stand closer to the bench/better access to the worksurface/stops damage to unit; ***[2]***

(b) (i) *Award **[1 max]** for correct answer.*

So that all people using the units can reach across the units to turn on sockets, *etc.*; ***[1]***

(ii) *Award **[1]** per correct relevant point in an explanation.*

same scale, person and kitchen relate in terms of proportion;
can explore ergonomic issues more easily, *e.g.* vertical reach, horizontal reach;
can develop design without actually building the units ***[3]***

(c) (i) *Award **[1]** for identifying an advantage of distributing the kitchen units as flat packs.*

Reduced volume (space) / more units can be transported on distribution vehicle;
Easier to handle / constructed units are much more susceptible to damage;
Manufacturer does not need to assemble units pre distribution / fewer operations to be undertaken in factory; ***[1 max]***

(ii) *Award **[1]** per correct relevant point in an explanation of how the components would be flat packed to prevent their damage during distribution. Good responses are likely to show the distinct points on an annotated diagram.*

Cardboard or similar material between components to prevent scratching if they move across each other;
Some sort of protection for edges, *e.g.* polystyrene or other foam type material to absorb knocks;
Cardboard and band (plastic material) to hold pack together;
If the components are packed in weight order with the heaviest components at the bottom, the pack must then be labelled with a 'This Way Up' label; ***[3 max]***

**2.** (a) *Award **[1]** for correctly stating a fixed cost.*

Cost of machinery;
Cost of factory/land on which factory built;
Design costs; ***[1 max]***

(b) *Award **[1]** for each relevant correct point in a distinct explanation of how fixed costs are reflected in the cost of an individual product item.*

A manufacturer must determine the number of items that will be produced to pay back the fixed costs (the breakeven point);
Total fixed costs are divided by this number;
This cost is added to the variable costs for producing the item; ***[3]***

**3.** (a) *Award **[1]** for a definition to the effect of:*

Designing in a way that takes account of the environmental impact of the product throughout its life; ***[1]***

(b) *Award **[1]** for each distinct correct point in an explanation of how legislation promotes green design. Do not award **[3 marks]** for a list of distinct points.*

Minimising pollution can increase manufacturing costs;
Financial penalties can be imposed on manufacturers who cause environmental pollution;
Some businesses will not behave responsibly unless forced to do so;

Legislation can enforce product labelling to indicate what material(s) the product is made of;
This means that on disposal the material can be recycled;
Increasingly there is a market for green products and product labelling supports this market;

Take-back legislation requires manufacturers to take back products at the end of their useful life;
Manufacturers will be encouraged to make products from materials that are less polluting on disposal, *e.g.* biodegradable materials, or materials that can be more easily recycled;
Manufacturers will be encouraged to ensure that products can be disassembled easily to facilitate disposal/recycling; ***[3 max]***

## SECTION B

**4.** (a) (i) *Award **[1]** for an appropriate definition to the effect of:*

A style or trend; ***[1]***

(ii) *Award **[1]** for an appropriate reason and **[1]** for a brief explanation.*

Handle;
Style / colour / location / shape;

Door material;
Style / colour / location / shape;

Door design;
Central opening/door display; ***[2 max]***

(iii) *Award **[1]** for correct relevant point*

Planned obsolescence has a predictable impact on time scale of the product lifecycle;
Fashion has a less predictable impact on the time scale of the product lifecycle; ***[2]***

(b) (i) *Award **[1]** for each correct answer.*

No finishing required except where the extrusion is cut;
Volume production;
The handles can be made hollow shapes; ***[2 max]***

(ii) *Award **[1]** for an appropriate way in which extrusion can be regarded as a clean technology and **[1]** for a brief explanation.*

Extrusion can result in hollow shapes using less material;
Less material means less energy use/less consumption of natural resources;

Extrusion minimises the amount of energy used in production;
Only the material being used in the product is heated up;

Extrusion results in less wasted material;
Extrusion is a shaping process not a wasting process; ***[2 max]***

(c) (i) *Award **[1]** per correct relevant point.*

They indicate the energy consumption of a product;
They enable comparison of energy consumption with other products;
Owners can estimate running costs over period of time; ***[2 max]***

(ii) *Award **[1]** for identifying an appropriate way in which the design can be modified to minimise the environmental impact and **[1]** for each distinct point in an explanation **[max 3 per stage]**.*

**Production:**
Use clean technologies for the manufacture of the product;
This will reduce materials consumed during production;
Will reduce energy consumption during production;
Will reduce pollution from production;

**Distribution:**
Carefully design packaging to ensure recyclability/reuse of packaging after distribution, by appropriate selection of material and labelling;
Effective packaging can use a considerable amount of material which is just disposed when the product is put into use – appropriate labelling will ensure that the material is reused;
Designing the packaging so that it can be returned to the manufacturer for reuse would reduce the energy consumption required for recycling;

**Distribution:**
Carefully design packaging to minimise weight of product/packaging during distribution;
The heavier that the combined product/packaging is the more energy will be required for its distribution;
Reducing the combined weight will reduce the energy required during distribution;

**Utilization:**
Selection of a motor for the pump of the refrigerator that is energy efficient;
This will reduce energy consumption during use;
Reduced energy consumption will reduce environmental impact;

**Utilization:**
Selection of a motor for the pump of the refrigerator that it runs quietly;
This will reduce noise pollution during use;
Hence will reduce environmental impact of product;

**Utilization:**
Design the refrigerator so that it uses standard parts;
Standard parts are easier to locate facilitating repair of the product rather than disposal if it becomes defective;
Repairing the product extends the product life;

**Disposal:**
Design the refrigerator so that it is easy to disassemble and reuse/recycle the parts;
Use of screws and appropriate choice of materials will ensure that the product can be disassembled on disposal;
Riveting is not easy to disassemble so would reduce the likelihood of the product parts being recycled/reused;

**Disposal:**
Design the refrigerator so that it uses standard parts;
Standard parts have a higher value and so are likely to be removed and recycled for use in the repair and production of other products;
Non-standard parts have no reuse value and are less likely to be reused and therefore must be made of recyclable materials;

**Disposal:**
Select a refrigerant gas that does not damage the atmosphere;
CFC refrigerants released into the atmosphere cause depletion of the ozone layer;
Ensure that the refrigerant gas can be removed from the refrigerator on disposal and reused; ***[9 max]***

**5.** (a) (i) *Award **[1]** for an appropriate definition to the effect of:*

The use of consumer reports and newspaper items in researching aspects of design development; ***[1]***

(ii) *Award **[1]** for an appropriate advantage of using a performance test and **[1]** for an appropriate disadvantage;*

**Advantages:**
Accurate/quantitative data is obtained;
Good to confirm factors of safety, *etc.;*
Ensures the swing will hold the weight of the child;

**Disadvantages:**
Costly;
Time consuming;
Test product to destruction;
May not replicate the way that users use/abuse the product so do not relate to real-life; ***[2 max]***

(iii) *Award **[1]** for identifying an appropriate way in which legislation may constrain the designers of the swing seat and **[1]** for a brief explanation.*

Legislation may identify safety requirements, e.g. the spaces between parts of the frame or seat or frame/seat;
These may ensure that a child's head/fingers could not get trapped in the frame and cause injury;

Legislation may identify/limit the materials that can be used for the construction of the swing seat;
Some materials may be dangerous during use; ***[2 max]***

(b) (i) *Award **[1]** for identifying an appropriate consideration in the selection of the material for the swing seat and **[1]** for a brief explanation.*

Resistance to damp environments / ultraviolet light;
The swing seat is designed for outdoor use and it is important that the material does not rot;

Toughness;
So seat does not crack;

Appropriate resistance to pulling forces;
The material must not deform under the weight of its child user;

Aesthetic considerations;
The texture/colour of the material must be attractive to children; ***[2 max]***

(ii) *Award **[1]** for an appropriate suggestion and **[1]** for a brief explanation.*

Texture;
The cable will be held by children using the swing seat and must not cause injury.

Tensile strength;
Ensure that the cable does not stretch or break during use. ***[2 max]***

(c) (i) *Award **[1]** for method of cutting and **[1]** for description.*

Finishing may be needed to enhance the aesthetic appeal of the pipe – colour/texture;
Finishing may be needed to enhance the way the pipe can resist deterioration in damp environments;
Cutting and machining the pipe to length produces a rough edge, which will need to be smoothed or an end cap added; ***[2 max]***

(ii) *Award **[1]** for an appropriate joining technique used in the manufacture of the swing set and **[1]** for each additional point of explanation, **[3 max]** per joining technique.*

Fasteners;
*e.g.* bolts/screws;
can be used to secure the side bars on the A-frame of the swing set;

Fusing;
*e.g.* by welding;
Could be used to join the metal legs of the frame/cross-bar to the component at the end of the cross-bar;

Adhesives;
glue/laminating;
Could be used as an alternative to welding to join the metal legs of the frame to component at the end of the cross-bar;

Stitching;
Could be used to stitch the fabric on the swing set seat;
This would to form a channel through which the metal or plastic pile of the frame could be fitted; ***[9 max]***

**6.** (a) (i) *Award **[1]** for an appropriate definition to the effect of:*

The most efficient way of designing and producing a product from the manufacturer's point of view; ***[1]***

(ii) *Award **[1]** for an appropriate way in which a manufacturer may use mathematical modelling to ensure cost-effectiveness and **[1]** for a brief explanation.*

Using spreadsheet software;

What/if calculations of costs of manufacture if different materials/techniques were used;
Thus designer can minimize the amount of materials used to produce the car; ***[2 max]***

(iii) *Award **[1]** for identifying a cost-effective material and **[1]** for a brief explanation.*

Plastic / thermoplastic;
Cheap material / cheap to process material / can be recycled; ***[2]***

(b) (i) *Award **[1]** for each correct reason why a full size working model might be produced.*

Performance testing;
Safety tests / fuel consumption testing; ***[2]***

(ii) *Award **[1]** for identifying the correct scale of production and **[1]** for a brief explanation.*

One-off production;
Most economical – no need and too expensive to develop tooling for volume production; ***[2]***

(c) (i) *Award **[1]** per correct relevant point and **[1]** for a brief explanation.*

Communicating design to potential customers/market research;
Provides a realistic view of the shape of the car;

The clay can be reshaped;
This enables its reuse for other models and for redesign of the car subject to comments; ***[2 max]***

(ii) *Award **[1]** for each distinct point of the explanation **[3 max]** per stage.*

**Mathematical model**
No consumption of raw materials in production;
No noise or other pollution;
No disposal issues;

**Full scale working model**
Consumption of raw materials;
Designer must consider material consumption, energy issues, disposal issues;
Enables a number of design considerations before going into full production;

**Clay model**
Clay can be reused which avoids disposal issues;
Clay model shaped by craft production methods therefore low energy considerations;
Clay is a natural material and getting it has environmental impact – consumption of natural resources; ***[9 max]***