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MARKSCHEME

May 2001

DESIGN TECHNOLOGY

Higher Level

Paper 2

13 pages

Section B

Extended response questions - quality of construction

- Extended response questions for HL P2 carry a mark total of 20. Of these marks, 17 are awarded for content and 3 for the quality of construction of the answer.

- Three aspects are considered:
  expression of relevant ideas with clarity
  linking of ideas (relevant or irrelevant) in a logical sequence
  for design using appropriate communication methods.

- The 3 quality marks are to be awarded according to the following criteria:

Clarity of argument:

1 mark Consistently expresses relevant ideas with clarity.

'Designer' logic:

1 mark Demonstrates planning; design contexts and relevant examples; prioritises issues

Communication:

1 mark Employs techniques; (graphs, flowcharts, algorithms, appropriate communication, diagrams, annotations of graphs, tables and charts, 2D / 3D sketches etc.)

- It is important to judge this on the overall answer, taking into account the answers to all parts of the question. Although, the part with the largest number of marks is likely to provide the most evidence.

- Candidates that score very highly on the content marks need not necessarily automatically gain the two points for the quality of construction (and vice versa).

- The important point is to be consistent in the awarding of the quality points. For **sample scripts for moderation** the reason why quality marks have been awarded should be stated.

- Indicate the award of quality marks by writing **Q3**, **Q2**, **Q1** or **Q0** in **red** at the end of the answer.

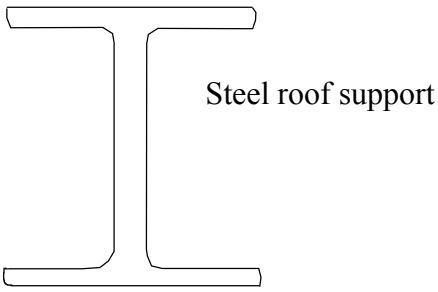
1. (a) (i) *Award **[1]** for 48 tiles and a further **[1]** if the calculation to find the result is present and correct.*

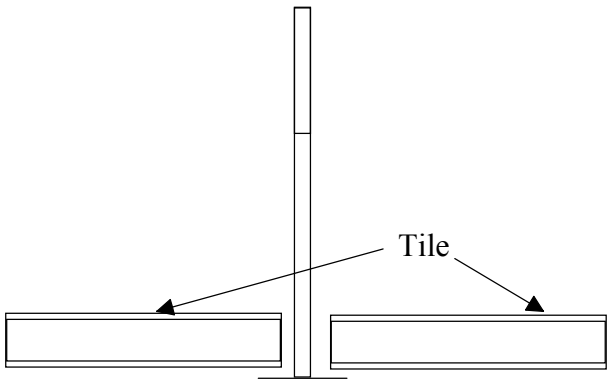
(ii) *Award **[1]** calculating area of ceiling, i.e. 27 m^2, and **[1]** for 101.79 kg (including units) (101.8 kg also acceptable) and a further **[1]** if the calculations are present and correct.*

(b) *Award **[1]** for the value 5 and a further **[1]** if the substitutions in the formula are correct, up to a maximum of **[2]**.*

$$\frac{(48-28)}{4} = 5 \text{ hangers}$$

(c) *Lots of different possibilities in solving this problem. Award **[1]** for drawing of suitable solution and **[1]** for annotation with materials used up to a maximum of **[2]**.*





(d) *Award **[2]** for a description of each factor up to a maximum of **[4]**.*

- resistance to damp conditions
- resistance to greasy conditions
- non-flammable (or statement about resistance to fire)
- reduce noise
- easily cleaned or replaced if unable to be cleaned
- non-crumble (or a statement saying that bits must not drop into food)
- chemically inert
- non-toxic
- thermal expansion
- colour
- ventilation should be considered

2. (a) *Award **[1]** for each correct reason up to a maximum of **[2]**.*

- to aid development of a new or improved product.
- to ensure that the product fulfils the specification
- to ensure fitness for purpose
- to act as a feedback channel into the design process
- to ensure that the product continues to reach safety legislation.

(b) *Award **[1]** for explaining that performance tests are used as a means of evaluating products that would be hazardous if tested in user trials. Award a further **[2]** for statements by the candidate that relate safety helmets (hard hats) as requiring performance tests rather than user trials. It would be dangerous to wait for an incident to occur as a means of testing the helmet.*

3. (a) (i) *Award **[1]** for definition of manufacturing process: 'A general term for making products covering a range of techniques'.*

(ii) A composite is composed by two or more materials ***[1]***
Weaving allows the combination of the materials ***[1]***
Weaving allows for design features to be built in, *e.g.* strengthened sections to overcome stress or to provide extra stiffness ***[1]***

(b) Properties of traditional materials can be a constraint, *e.g.* ceramic is hard but not tough ***[1]***. Identify a design context where traditional properties are a constraint, *e.g.* for engines which need a combination of ceramic hardness but not brittleness and its thermal properties ***[1]***. In ceramic engines ceramics are sintered with metals to create a composite with appropriate mechanical properties and thermal properties ***[1]***. Any relevant examples should be accepted by the examiner.

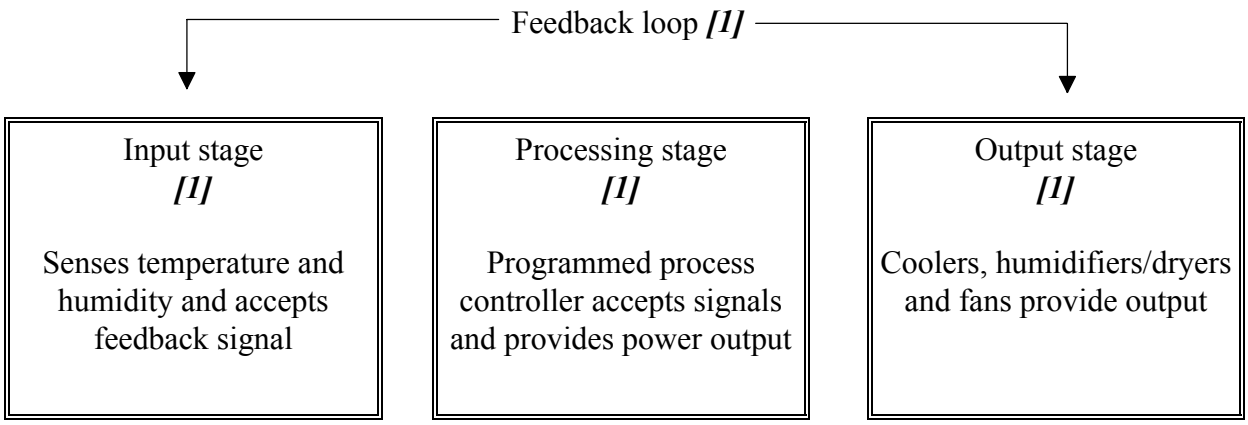
4. (a) *Award **[1]** for any suitable example, e.g. a driver driving a car.*

(b) *Award **[1]** for each correct identification up to a maximum of **[2]**.*

(i) Thermistor ***[1]*** or temperature dependent resistor ***[1]***

(ii) Semiconductor diode ***[1]*** or diode ***[1]***

(c) *Award **[1]** for each correctly annotated block as below, up to a maximum of **[4]**.*



SECTION B

5. (a) (i) VR1 sets the gain for the system ***[1]*** by adjusting the feedback ***[1]*** total. *Award **[2]**.*

(ii) the power amplifier amplifies the signal from the operational amplifier ***[1]***
the signal will then power the motor driving the solar collector ***[1]***

(b) (i) *Award **[2]** for explaining underdamping either in text or by a reproduction of the diagram.*

(ii) *Award **[2]** for stating that underdamping leads to oscillation of the output around the ideal position, often called 'hunting'.*

(c) The candidate should produce a reasoned statement that compares and contrasts the use of renewable and other sources or energy. The statement should contain references as follows: -

*Up to **[3]** for explaining why solar energy is exploited.*

- fossil fuels are a finite resource ***[1]***
- fossil fuels (use thereof) produce environmentally damaging waste products ***[1]***
- costs and environmental damage in obtaining fossil fuels ***[1]***
- solar energy has costs but is renewable and 'clean'***[1]***

*Up to **[3]** for identifying and explaining a context where exploitation of solar energy is of benefit, e.g, in a domestic situation **[1]**. Solar panels can be used to offset use of fossil fuels as:*

- low usage levels. Non-critical systems generally ***[1]***
- solar energy can be topped up with fossil fuel ***[1]***

*Up to **[3]** for identifying and explaining a context where exploitation of solar energy is not of benefit, e.g. industrial or transport situations **[1]**.*

- not easy to store solar energy in a cheap convenient form ***[1]***
- road vehicles need portable energy that is cheap, solar energy cannot easily provide that, therefore heavy investment in research needed ***[1]***

*Award up to **[9]** if all the above are covered cogently, reduce pro-rata for missed points.*

6. (a) (i) Plywood is a sheet material made from thin veneers (layers) of wood ***[1]*** glued together so that the grain direction is opposed ***[1]***, therefore preventing warping (twisting, buckling *etc*.). An annotated diagram of the structure would also be acceptable.

(ii) *Award **[1]** for each of the following up to **[2]** maximum.*

MDF (Medium Density Fibreboard)
Particle board
Hardboard
Blockboard
Laminboard

(b) (i) *Award **[1]** for one of the following statements*

- broadleaved ***[1]***
- different molecular structure ***[1]***
- grow in tropical regions ***[1]***
- grow in tropical and temperature regions ***[1]***
- lose leaves in winter/deciduous ***[1]***

N.B. *temperate on its own **[0]***

(ii) The candidate needs to make four distinct points for full marks.

- natural timber could not be shaped to provide the form needed ***[1]***.
- laminated timber can be formed into the curved shape required ***[1]***.
- to use natural timber, several pieces would need to be fixed together edgewise which would not be strong enough, to make it so would require a very thick piece thus destroying the aesthetics of the chair ***[1]***.
- lamination of a small cross section will provide the strength necessary for the chair to support itself ***[1]***.
- lighter ***[1]***.
- cheaper ***[1]***.

(c) *Award **[1]** for appropriate points on specification and **[1]** for explanation, four reasons will be awarded **[2]** each **[8 marks max]**.*

more heardwearing/durable/tough materials ***[1]*** rate of usage higher and in more public area ***[1]***
ease of maintenance ***[1]*** because they will get knocked about more ***[1]***
aesthetics ***[1]*** to look attractive and encourage customers ***[1]***
hygienic/ease of cleaning ***[1]*** because will need to be cleaned much more often than in the home/level of comfort ***[1]*** comfortable enough but not encouraging people to stay too long ***[1]***
safety issues ***[1]*** abuse in restaurant ***[1]***

7. (a) (i) Stiffness is calculated by dividing ***[1]*** the external load by the measured deflection ***[1]***.

(ii) *Up to **[2]** for two distinct points.*

Structures are designed to take higher loads than those they would normally be expected to support to ensure that they remain safe ***[1]***. Typical factors of safety may be 3 or 4 times the normal maximum load ***[1]***. This allows for unforeseen circumstances *e.g.* overloading of a bridge due to traffic backlogs ***[1]***.

(iii) *Award **[1]** for 'The permanent deformation of a solid subjected to a stress'.*

(b) (i) Iron is converted into steel in a furnace (where the carbon level in the molten iron is reduced) by blowing oxygen through the liquid metal ***[1]***.
Carbon forms Carbon Dioxide which bubbles off ***[1]***.

(ii) *Award up to **[2]** maximum for two distinct points.*

Iron is very hard and brittle ***[1]***.
Steel has a higher tensile strength ***[1]***.
is less brittle ***[1]***.
is tougher ***[1]***.

(c) Concrete is a ceramic composite ***[1]*** and is hard ***[1]*** and brittle ***[1]***. Mild steel is a metal ***[1]*** and is tough ***[1]*** and malleable ***[1]***. It can be 'designed' to produce light, flexible structures ***[1]*** able to withstand earth movement better than stiff ceramics such as concrete or stone or brick ***[1]***.

- can design in colours ***[1]***
- allows wider variety of shapes/styles ***[1]***
- aesthetics ***[1]***