

# **MARKSCHEME**

**May 2002**

## **DESIGN TECHNOLOGY**

**Standard Level**

**Paper 2**

## Subject Details: Design Technology SL Paper 2 Markscheme

### Mark Allocation

Candidates are required to answer **ALL** questions in Section A (total 20 marks) **and any ONE** question in Section B (20 marks each). Maximum total = 40 marks.

### General

A markscheme often has more specific points worthy of a mark than the total allows (especially for essay questions). This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each marking point has a separate line and the end is signified by means of a semicolon (;).
- An alternative answer or wording is indicated in the markscheme by a '/'; either wording can be accepted.
- Words in ( ... ) in the markscheme are not necessary to gain the mark.
- The order of points does not have to be as written (unless stated otherwise).
- If the candidate's answer has the same 'meaning' or can be clearly interpreted as being the same as that in the mark scheme then award the mark.
- Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalising them for what they have not achieved or what they have got wrong.
- Remember that many candidates are writing in a second language; be forgiving of minor linguistic slips. Effective communication is more important than grammatical niceties.
- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalised. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with '**ECF**', error carried forward.
- Units should always be given where appropriate. Omission of units should only be penalised once. Indicate this by '**U-1**' at the first point it occurs. Ignore this, if marks for units are already specified in the markscheme.
- Do not penalise candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

## Section B

### Extended response questions - quality of construction

- ♦ Extended response questions for SL 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.

‘Designers’ logic:

**1 mark** Demonstrates ‘designer’s logic: 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 three 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.

**SECTION A**

1. (a) (i) PIR40 or PIR60; [1]  
(ii) 12 V; [1]  
[0] if units omitted.

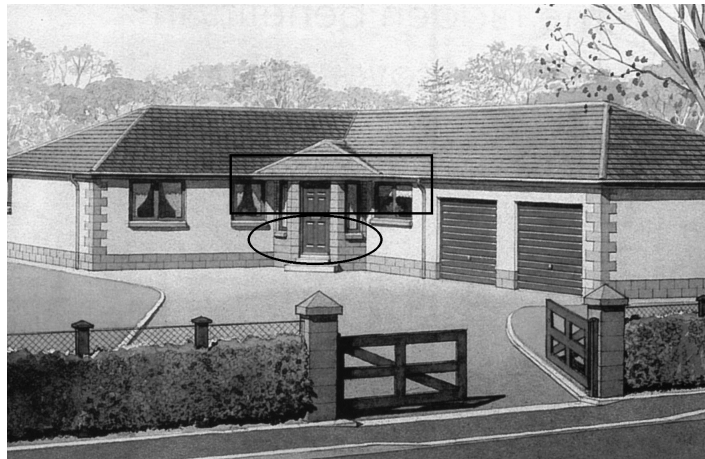
- (b) (i) Award [1] for correct calculation plus [1] for correct values chosen.

$$\frac{3.142 \times r^2}{12} \quad \frac{(3.142 \times 144)}{12} = 37.7 \text{ m}^2$$

Deduct [1] if units not given.

[2]

- (c) (i) PIR55; [1]  
(ii) Award [1] for sensor positioned in the rectangle (use discretion).



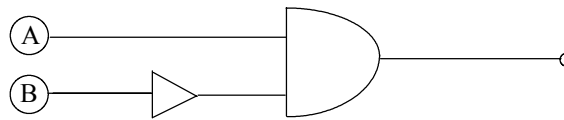
[1]

(c) (i) Award [1] for a correctly completed truth table.

Sensor A (Human)	Sensor B (Cat)	Solenoid
0	0	0
1	0	0
0	1	1
1	1	0

[1]

(ii)



for AND gate [1];  
for NOT gate [1];  
for correct wiring [1];

[3 max]

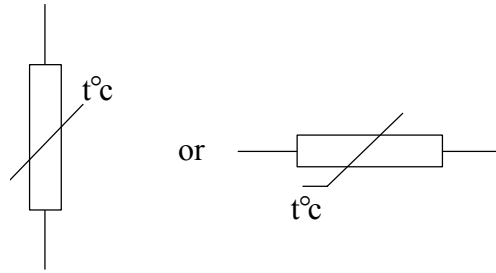
2. (a) Award [1] for each correct item from the list.

- brainstorming;
- user trips;
- observing user behaviour;
- obtaining user responses;
- information searches;

[3 max]

3. Award [1] for any mention of “a balanced combination of the main nutritional food groups”.  
Award [1] for mention of appropriateness to the person.

4. (a)



*Award [1] for a diagram as 5.1.14. ([0] if any part missing.)  
Accept **all** international symbols for thermistor.*

**[1]**

(b) *Award [1] for a statement saying essentially :-)*

“A thermistor varies its resistance in proportion to changes in temperature.”

*Award [1] for a statement saying essentially:-*

“The change in resistance can be made to change a voltage at the input of an op-amp.”

**[2]**

5. identifying 5th-95th covers most people **[1]**;  
identifying that ranges apply to particular user groups **[1]**;  
suggesting market size large if covering most people **[1]**;

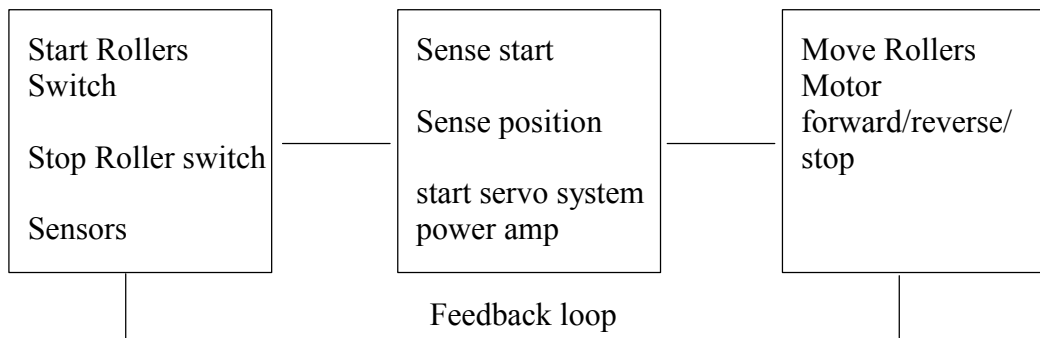
**[2 max]**

**SECTION B**

6. (a) (i) *Award [1] for each correct answer from the list.*  
 tensile strength;  
 stiffness;  
 toughness; **[2 max]**

- (ii) *Award [1] for each correct answer from the list.*  
 tensile strength – medium  
 stiffness – medium  
 toughness – high **[2 max]**

- (b) (i) *Award [1] for each box correctly annotated. Deduct a mark if the feedback loop is missed out.*



**[3 max]**

- (ii) *Award [1] for each correct answer from the list.*  
 light dependent resistor;  
 photo voltaic cell;

*(Allow even though they are not on the syllabus.)*

Proximity sensor, Photo Transistor, Photo diode **[2 max]**

- (c) *Award [1] for mentioning a servo control system, or Inverting or Non-Inverting or Differential amplifier system as each could be used if not appropriately.*

*Award [1] for each element in the circuit.*

- sensors and position setting devices;  
 op – Amp correctly set up for the circuit indicated (see above);  
 block diagram of power amp;  
 motor(s);  
 counters / displays; **[5 max]**

*Award [1] for mentioning feedback and [1] for critical damping.*

7. (a) (i) *Award [1] for each correct answer from the list.*  
designer can use future developments to solve problems;  
allows technical innovation to be included;  
allows developments in materials and manufacturing technology to be introduced; [2 max]
- (ii) *Award [1] for each correct answer from the list.*  
metal requires higher energy costs for recycling;  
plastics need identifying before appropriate recycling can occur;  
only Thermoplastics can be recycled;  
each metal needs treating in a different way adding costs;  
metal items need the finish applied to be removed; [2 max]
- (b) (i) *Award [1] for each correct answer from the list.*  
social values change in favour of one criteria against another;  
environmental concerns versus cost;  
workload expected versus cost;  
hedonistic values change;  
what is “in” today; [2 max]
- (ii) *Award [1] for each correct answer from the list.*  
materials can be changed to more environmentally suitable;  
manufacturing methods can be improved to provide environmentally acceptable  
use of material and energy;  
designer must resolve the conflict of cheaper materials against more expensive  
manufacturing process;  
product life can be extended by using more durable materials; [3 max]
- (c) *Award [1] for stating that the material chosen will affect the manufacturing method.*  
*Award [1] for each correct element from the list.*  
initial cost of introducing automation is high as it is a volume production method;  
some manufacturing methods do not lend themselves to automation;  
automation allows for greater repeatability and accuracy; [3 max]
- Award [1] for each part of a statement that essentially says:-*  
molding (injection) of plastic items for the vacuum cleaner could lead to greater  
productivity;  
molding (injection) gives greater accuracy;  
mass production will eventually bring down the cost per item;  
molded thermoplastics are recyclable; [3 max]
- Award [1] for a construction that says automation allied to high volume production allowed by  
the change of material means that a better cheaper product ensues.*



8. (a) (i) *Award [1] for a statement as defined in Appendix p168. First sentence only will qualify. Second mark for expansion of the statement to include changes in size (length, volume etc.).* [1]
- (ii) *Award [1] for a statement that essentially says that allowance must be made for size increase due to temperature change to prevent distortion. Award [1] for an expansion of the statement that says that structural integrity must not be compromised to allow for thermal expansion.* [2 max]
- (b) (i) *Award [1] for describing a physical model and a symbolic model. Award [1] for stating that physical models can be seen, tested and modified whilst symbolic models generate data and are mathematical.* [2 max]
- (ii) *Award [1] for each correct answer from the list.*  
test appearance;  
used in wind tunnel and other physical test commensurate with scale;  
used to explain construction, manufacture, etc.;  
used in marketing activities;  
used to view effects of modification; [2 max]
- (iii) *Award [1] for each correct answer from the list.*  
to calculate material needs;  
to calculate effects of stress on the structure and/or components;  
to test structural theory;  
to answer ‘what if’ questions;  
to generate data for a CAD/CAM program; [2 max]
- Allow for any unusual but seemingly correct answers.*

(c) *Award [1] for each advantage and [1] for each disadvantage identified.*

**Physical Models**

**Pros**

cheaper to produce than a prototype;  
can be loaded to destruction safely;  
can be scaled to fit into wind tunnels and other test rigs;  
can be used to explain details to non-technical people (clients, sponsors *etc.*);

**Cons**

scaling can generate unwanted errors;  
time consuming to produce;  
can be expensive in man hours;  
not very flexible once made;

**Symbolic models**

**Pros**

cheap to use (usually a computer program);  
allows technical questions to be asked and answered before production;  
test “what if” scenarios;  
allows rapid changes of parameters, very flexible;  
can be made to generate 3D and 2D drawings in CAD packages and change them in response to design parameter changes;

**Cons**

needs specialist knowledge to understand the answers and feed in the correct data;  
needs complex data input to be accurate;  
often generates more data than required;

*[6 max]*

*Award up to [2] for a problem identified and explained.*

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