

Mark Scheme (Results) Summer 2008

GCSE

GCSE Design & Technology: Systems & Control Technology (1974) Paper 2H

1974 2H Mark Scheme

Question Number	Answer	Mark
1 (a)	<p>Three each of the following, one under each heading:</p> <p>Specification points Reasons</p> <p>(i) Market</p> <ul style="list-style-type: none"> • Point: It must be cost effective/cheap • Reason: so that more people buy them • Point: It must have a LED indicator • Reason: To give confidence that it is working • Point: It must be easy to test • Reason: Safety/make sure it is working • Point: It must have a quick release screw • Reason: Easy to change the batteries <p>(ii) Quality</p> <ul style="list-style-type: none"> • Point: The battery must last a long time • Reason: To keep the alarm working • Point: Must keep going during a fire/fireproof • Reason: To alert if fire is close to the alarm • Point: It must be easy to change the batteries • Reason: Fitted to the ceiling/hands above head • Point: It must have a smoke vent • Reason: So it can detect smoke quickly <p>(iii) Environment</p> <ul style="list-style-type: none"> • Point: It must be made from recyclable materials • Reason: To conserve the earth's resources • Point: It must be discrete in the home • Reason: So it fits the surroundings • Point: It must be made from white plastic • Reason: White goes with any colour scheme <p><i>Some flexibility should be given as some points may cross over descriptions.</i></p>	<p>(2)</p> <p>(2)</p> <p>(2)</p>

1 (b)(i)	<p>Two reasons given:</p> <ul style="list-style-type: none"> • Light (1) • Rigid (1) • Does not rust (1) • Non-magnetic (1) • Easily shaped / die caste (1) • Easy to recycle (1) <p style="text-align: right;">(2 x 1)</p>	(2)
1 (b)(ii)	<p>Two reasons given:</p> <ul style="list-style-type: none"> • The bracket can be the same colour as the case (1) • It is a low temperature process (1) • Plastic layer protects - sharp edges - scraping ceiling (1) • It is a self finishing process (1) <p style="text-align: right;">(2 x 1)</p>	(2)
1 (c)	<p>Two properties given with two reasons:</p> <p>Property: Good conductor of electricity Reason: Small power loss</p> <p>Property: Is malleable Reason: Easy to produce/ can bend without breaking</p> <p>Property: Not magnetic Reason: Will not be affected by electro-magnetic devices</p> <p>Property: Does not corrode easily Reason: Long component life</p> <p>Property: Ductile Reason: Can be drawn into a wire</p> <p style="text-align: right;">(2 x 1) (2 x 1)</p>	(4)
1 (d)	<p>Two electronic quality control checks named:</p> <ul style="list-style-type: none"> • Detection to activation time/working check (1) • Test button function ease (1) • PCB continuity check (1) • Battery to PCB check (1) • LED function check (1) <p style="text-align: right;">(2 x 1)</p>	(2)
1 (e)	<p>One way described:</p> <ul style="list-style-type: none"> • The tracks are close together making it the only viable method • Complicated PCB needs to fit into small space • Tracks may be laid at 45 degrees to save space <p style="text-align: right;">(2 x 1)</p>	(2)

1 (f)(i) & (ii)	<p>(i) The alarm sound must be clearly heard.</p> <ul style="list-style-type: none"> • A loud buzzer/siren sounds which is loud enough to be heard all over the house. • When smoke is detected an electronic timing circuit drives a high frequency buzzer • The vent in the case allows a loud sound to be emitted <p style="text-align: right;">(2 x 1)</p> <p>(ii) Have a means of fixing to a ceiling.</p> <ul style="list-style-type: none"> • An aluminium ceiling bracket has two slots which screws go through to fix to the ceiling • The case slots onto the ceiling bracket and is held in place by the quick release screw <p style="text-align: right;">(2 x 1)</p>	<p style="text-align: center;">(2)</p> <p style="text-align: center;">(2)</p>
Total for question		22

Question Number	Answer	Mark
2 (a)(i)	<p>One gate named:</p> <ul style="list-style-type: none"> Nand <p><i>(Only acceptable answer)</i></p>	(1)
2 (a)(ii)	<p>One of the following:</p> <ul style="list-style-type: none"> Astables: 555 timer/PIC/Coupled transistors / logic gates / Op-amp 	(1)
2 (a)(iii)	<p>One of the following:</p> <ul style="list-style-type: none"> Transducer Driver: Transistor / Darlington pair/FET/Driver I/C / Op-amp 	(1)
2 (b)	<p>Two ways described:</p> <ul style="list-style-type: none"> A breadboard/prototype board could be used with real components Kits could be used with pre-made circuit blocks Veroboard / pinboard may be used with components soldered to them A computer program/Croc clips/Livewire may be used to simulate the system <p><i>(accept any named electronics program)</i></p> <p style="text-align: right;">(2 x 1) (2 x 1)</p>	(4)
2 (c)	<p>Four main stages given:</p> <ol style="list-style-type: none"> Expose / put into UV box Develop board Etch copper Drill component holes <p><i>(Only acceptable answers and must be in correct order)</i></p> <p style="text-align: right;">(2 x 1) (2 x 1)</p>	(4)
2 (d)	<p>Two advantages explained:</p> <ul style="list-style-type: none"> The machines may run all night/24/7 and therefore do no need rests They do not need light thereby saving on electricity Less manpower is needed thereby saving on wages They may work in a hostile environment therefore saves workers health The machine works faster therefore more boards produced in a fixed time <p style="text-align: right;">(2 x 1) (2 x 1)</p>	(4)

2 (e)	<p>Three reasons given:</p> <ul style="list-style-type: none"> • Repetition (1) • Accuracy (1) • Cuts down waste (1) • Less expensive for large quantities (1) • Complex shapes can be moulded (1) <p style="text-align: right;">(3 x 1)</p>	(3)
2 (f)(i)	<p>Two tasks given</p> <ul style="list-style-type: none"> • Exact measurements • Rendering • Assembling parts • Testing • Rotate <p style="text-align: right;">(2 x 1) (2 x 1)</p>	(4)
2 (f)(ii)	<p>One way described:</p> <ul style="list-style-type: none"> • The product may be rotated to view other sides • Backgrounds may be added to simulate real life • The electronics / batteries may be fitted to test for size <p style="text-align: right;">(2 x 1)</p>	(2)
Total for question		22

Question Number	Answer	Mark
3	<p>DESIGN IDEA 1</p> <p>Each point of specification has two marking points.</p> <p>1 mark should be awarded for evidence of each point of specification resolved in the design. For each specification point with both elements viably satisfied 2 marks For each specification point with only one element viably satisfied 1 mark Where the answer does not viably answer a specification point 0 marks</p> <p>Candidates may answer any specification point in either graphical form or by annotation. No marks are awarded for quality of communication.</p> <p>Specification point 1 Have a case that must fix securely to a surface</p> <ul style="list-style-type: none"> • Evidence to indicate that it will fix to a surface (1) E.g. Glue / Velcro / nuts & bolts / screws • Evidence to indicate that the fixing is secure (1) E.g. Appropriate glue / industrial Velcro / washers / locking nuts / self tapping screws <p>Specification point 2 Must have a method of sensing a front seat passenger and if they have not fastened their seatbelt</p> <ul style="list-style-type: none"> • Evidence to indicate that it senses a front seat passenger (1) E.g. LDR/membrane switch/pressure pad/push switch /infra-red(<i>no latching switch</i>) • Evidence to indicate that the seat belt is not fastened (1) E.g. Reed switch/push to make switch/key switch/micro switch/seat belt switch <i>(If a PTM is given for sensing a passenger and given for a seat belt unfastened both are to be credited)</i> <p>Specification point 3 Must give a brief audible warning before the car moves away</p> <ul style="list-style-type: none"> • Evidence to indicate that it gives an audible warning (1) E.g. Buzzer/bell/piezo/klaxon/siren • Evidence to indicate that it has timing device (1) E.g. 555/PIC/multivibrator/CR <p>Specification point 4 Must be made from materials and processes suitable for batch production</p> <ul style="list-style-type: none"> • Evidence to indicate that the material is suitable for batch production (1) • Evidence to indicate that the process is suitable for batch production (1) 	

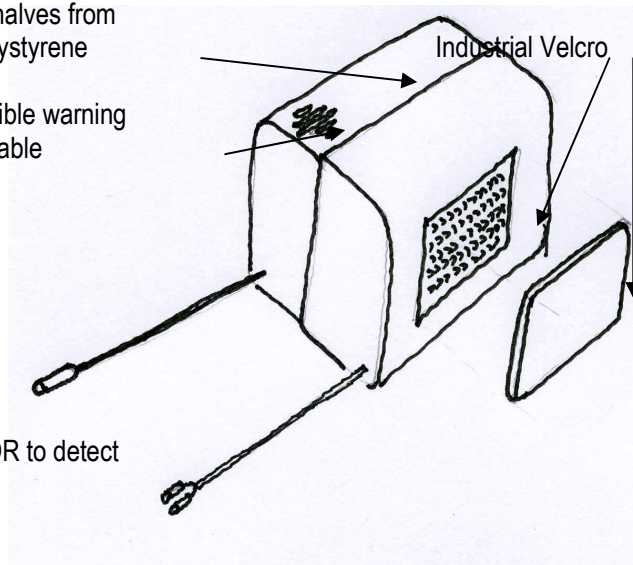
Possible graphical solution:
Design Idea 1

Case made in two halves from vacuum formed polystyrene

Buzzer to give audible warning run from a 555 Astable

Reed switch connected to the seat belt

Light and LDR to detect passenger



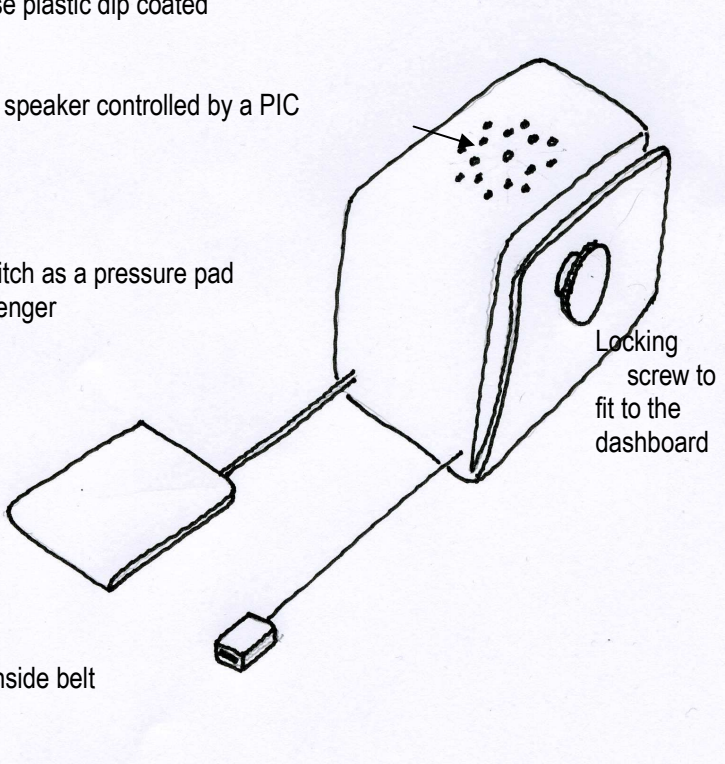
(8)

DESIGN IDEA 2

To score a mark for Design Idea 2, each specification point must be resolved again in the second design idea but the second design idea must be **technically / conceptually different in design and construction** from the first and not a simple variation on a theme to score the mark.

Use exactly the same criteria as design idea 1 to mark design idea 2.

- A different method of fixing to a surface (1)
- A different method of securely fixing to a surface (1)
- A different method of sensing a front seat passenger (1)
- A different method of sensing that the seat belt is not fastened (1)
- A different method of giving an audible warning (1)
- A different method of timing (1)
- A different material suitable for batch production (1)
- A different process suitable for batch production (1)

	<p>Possible graphical solution: Design Idea 2</p> <p>Aluminium case plastic dip coated</p> <p>Two tone loud speaker controlled by a PIC</p> <p>Membrane switch as a pressure pad to sense passenger</p>  <p>Micro-switch inside belt mechanism</p> <p>Locking screw to fit to the dashboard</p>	(8)
<p>3 (b)</p>	<p>Each point clearly evaluated.</p> <p>If a candidate has indicated design idea 1 and then evaluates design idea 2 for all or part of (i), (ii) & (iii) then the idea in greater evidence should be marked.</p> <p>The evaluation of the design must contain reference to either positive or negative aspects not just simply a description of the design.</p> <p>Award 1 mark for a correct evaluation / justification relating to each design feature and how it succeeds or fails.</p> <p>Repetition of original spec scores 0.</p>	
<p>3 (b)(i)</p>	<p>Evaluation of: The automatic warning system case must fix securely to a surface. Positive or negative reasons relating to:</p> <ul style="list-style-type: none"> • The method of fixing to surface • The security of fixing <p style="text-align: right;">(2 x 1)</p> <p><i>Eg. The Velcro is very easily added to the case but it could come loose with the movement of the car</i></p>	(2)

<p>3 (b)(ii)</p>	<p>Evaluation of: The automatic warning system must have a method of sensing a front seat passenger and if they have not fastened their seatbelt.</p> <p>Positive or negative reasons relating to:</p> <ul style="list-style-type: none"> • Sensing a front seat passenger • Sensing that the seat belt has not been fastened <p style="text-align: right;">(2 x 1)</p> <p><i>Eg. The LDR sensor would not work very well in the dark and it may be difficult to fit a magnet for the reed switch to the free part of the seat belt.</i></p>	<p>(2)</p>
<p>3(b)(iii)</p>	<p>Evaluation of: The automatic warning system must give a brief audible warning before the car moves away.</p> <p>Positive or negative reasons relating to:</p> <ul style="list-style-type: none"> • giving an audible warning • Method of timing <p style="text-align: right;">(2 x 1)</p> <p><i>Eg. The two tone gives a good clear audible warning which the loud speaker produces well.</i></p>	<p>(2)</p>
<p>Total for question</p>		<p>22</p>

Question Number	Answer	Mark
4 (a) (i)	For one mark <ul style="list-style-type: none"> • 1v or • 0.5v • 0.05v • 0.005v For two marks <ul style="list-style-type: none"> • 5V 	(2)
4 (a)(ii)	One way explained: <ul style="list-style-type: none"> • The resistance of the thermistor goes down therefore the voltage across it is less • The potential difference between the thermistor and VR2 changes. 	(2)
4 (a)(iii)	The action explained: <ul style="list-style-type: none"> • The relay coil is operated therefore the contacts will switch <i>(only acceptable answer)</i> 	(2)
4 (a)(iv)	The action stated: <ul style="list-style-type: none"> • It will reverse its direction/go backwards/go the other way <i>(only acceptable answer)</i> 	(1)
4 (b)(i)	<pre> graph TD Start([start]) --> Switch1[/Switch 1/] Switch1 --> Closed{closed?} Closed --> Input[/Input temperature/] Input --> Temp{=>15} Temp --> WaitRev[Wait 30] Temp --> WaitFwd[Wait 30] WaitRev --> OutputRev[/Output motor rev./] WaitFwd --> OutputFwd[/Output motor Fwd/] OutputRev --> Feedback OutputFwd --> Feedback Feedback --> Switch1 WaitRev -- Connection --> Switch1 WaitFwd -- Connection --> Switch1 </pre>	(4)

4 (c)	<p>Two developments described:</p> <ul style="list-style-type: none"> • A microwave oven can be programmed to defrost/cook to time/warm up/manufacturers instructions • A breadmaker can be programmed to make dough/bake different breads/cakes • A Dishwasher can be programmed to wash depending upon the load/ • An ice cream maker can be programmed to make sorbet / frozen yoghurt / fruit ice cream • A food processor can be programmed to liquidise / mix ingredients / make dough / whisk • A washing machine may automatically detect size of load / colour of fabrics / time / temperature <p style="text-align: right;">(2 x 1) (2 x 1)</p>	(4)
4 (d)	<p>One way explained:</p> <ul style="list-style-type: none"> • Manufacturers overheads may be reduced thereby passing savings onto the customer • Manpower is reduced therefore saving on wages • Machines may work in the dark therefore saving on electricity • Designs may be stored and reused therefore saving on initial fees <p>Machines work 24/7 therefore saving time</p> <p style="text-align: right;">(2 x 1)</p>	(2)
4 (e)(i)	<p>One moral issue given:</p> <ul style="list-style-type: none"> • Encourages waste (1) • Undervalues materials (1) • Provides developing world employment (1) <p style="text-align: right;">(1 x 1)</p>	(1)
4 (e)(ii)	<p>Two environmental issues given:</p> <ul style="list-style-type: none"> • Over use of landfill (1) • Uses more of the earth's resources (1) • Wasted energy in manufacture (1) • Extra transport pollution (1) • No reduction in ink/cartridge production (1) <p style="text-align: right;">(2 x 1)</p>	(2)
4 (e)(iii)	<p>One way described:</p> <ul style="list-style-type: none"> • Cases may be ground down and added to new granules • Cases may be cleaned and refilled with new ink <p style="text-align: right;">(2 x 1)</p>	(2)
Total for question		22
Total for paper		88