General Certificate of Secondary Education
June 2012

Design and Technology: Systems and Control Technology 45651

(Specification 4565)

Unit 1: Written Paper

Post-Standardisation

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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COMPONENT NUMBER: 45651

COMPONENT NAME:
New Specification - GCSE Design and Technology (System and Control Technology)

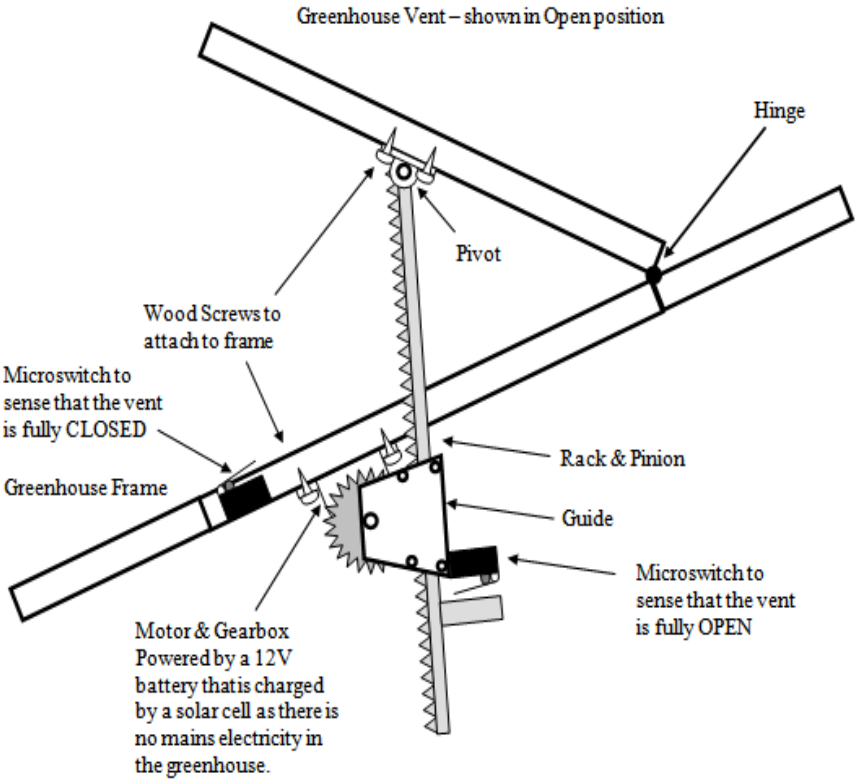
FOR EXAMINERS – PLEASE NOTE THAT IF YOU ARE UNSURE HOW TO AWARD A RESPONSE FROM A CANDIDATE, PLEASE SEEK CLARIFICATION OR ADVICE FROM YOUR TEAM LEADER OR THE PRINCIPAL EXAMINER.

Section A

Question	Part	Sub Part	Marking Guidance	Marks
1	a		List two things you should think about when designing the automatic vent for a greenhouse. Factors e.g. Power supply, Dimensions, Weather resistance, Materials. (2 x 1 mark) Reasons must support factors. E.g. To fully open the vent (2 x 1 mark)	Total **(4 marks)**
1	b		Any suitable research sources and information you would expect to find Testing existing vents – e.g. to find out what the competition products can do etc. (2 marks) One word or very weak answer (1 mark) Ideal plant environment– e.g. Light / Dark, Temperature, Moisture, Soil etc. (2 marks) One word or very weak answer (1 mark) Another Suitable source – e.g. Web site of rival Manufactures (1 mark) Not just “the web”, “Google”, “Internet” without amplification Information expected from this other suitable source – e.g. Price, Design (2 marks) One word or very weak answer (1 mark)	Total **(7 marks)**
1	c		Describe how the information from analysis and research may affect the final design. Clear statement of intended use of information. (2 marks) Some use of information. (1 mark)	Total **(2 marks)**

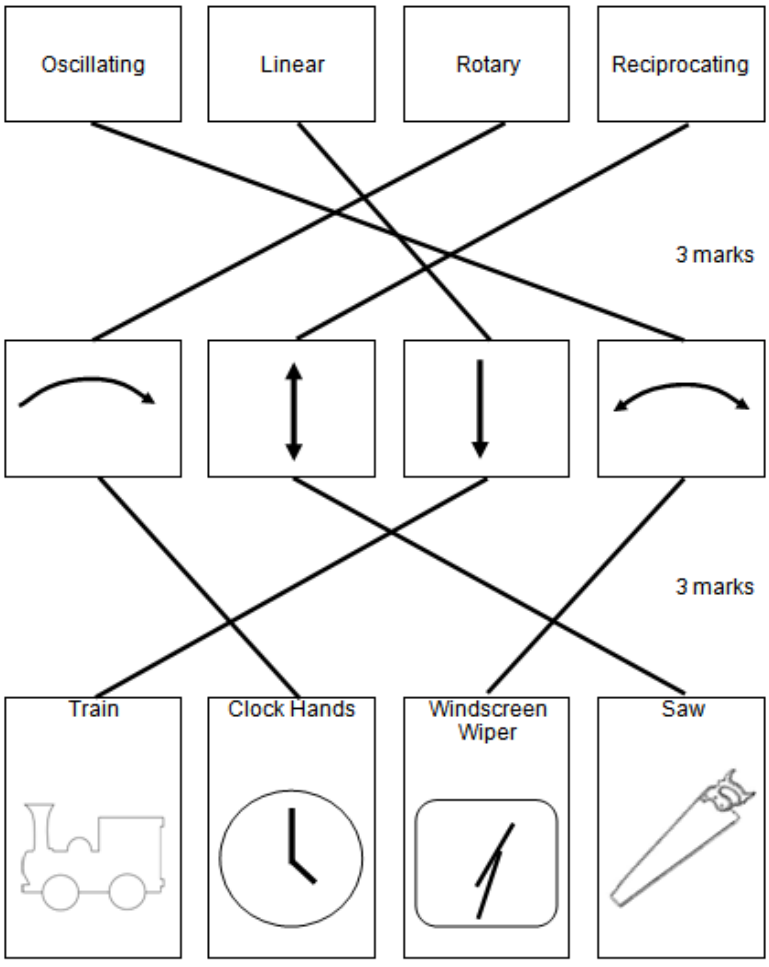
1	d		Give **four** design requirements for your automatic vent for a greenhouse. 1 mark for suitable Requirement x4 1 mark for suitable Explanation x4 Requirement e.g. Must be able to open the vent 200mm (1 mark) Explanation e.g. To fully open the vent (1 mark) Requirement e.g. Must be made from water resistant materials (1 mark) Explanation e.g. So that it doesn't break in the rain (1 mark) Requirement e.g. Must stop if obstructed (1 mark) Explanation e.g. So that it doesn't cause an injury (1 mark) Requirement e.g. Must be built to last at least for 2 years (1 mark) Explanation e.g. So there are no warranty claims (1 mark) Explanations must match the requirement	Total **(8 marks)**

2			Question 2 is about designing the actuator for automatic vent for the greenhouse. • a system that can fully open the vent 1 mark for a system that can open the vent partially 2 marks for a system that can open the vent fully, All components identified (2 marks) • a method to stop 'opening' when the vent is open 1 mark for a weak description, e.g. a switch or timer 2 marks for a good description e.g. a Microswitch that is operated when fully open (2 marks) • a system that can fully close the vent 1 mark for a system that can close the vent partially 2 marks for a system that can close the vent fully, All components identified (2 marks) • a method to stop 'closing' when the vent is closed 1 mark for a weak description, e.g. a switch 2 marks for a good description e.g. a Microswitch that is operated when fully closed (2 marks) • a secure method of attachment to the greenhouse frame. 1 mark for a weak description, e.g. glue 2 marks for a good description e.g. brackets, screws, nuts etc. (2 marks) • a suitable power source for the system 1 mark for a weak description, e.g. battery 2 marks for a good description e.g. 12V Battery, Motor 3 marks for a very good description e.g. A 12V Battery charged by a solar cell so that it is self sufficient (3 marks) e.g.	

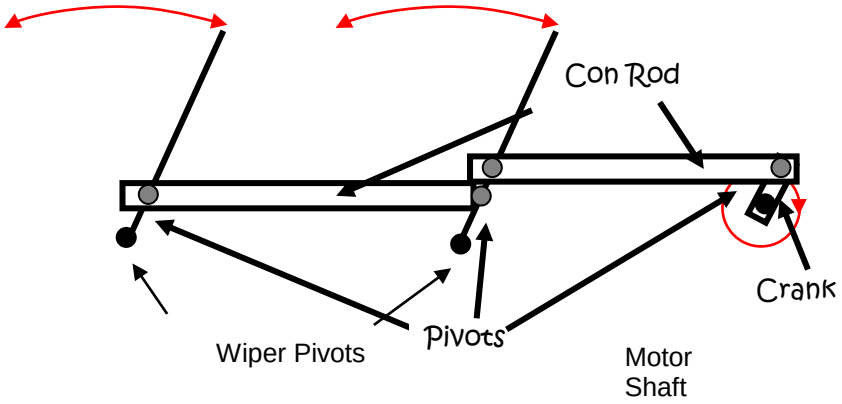
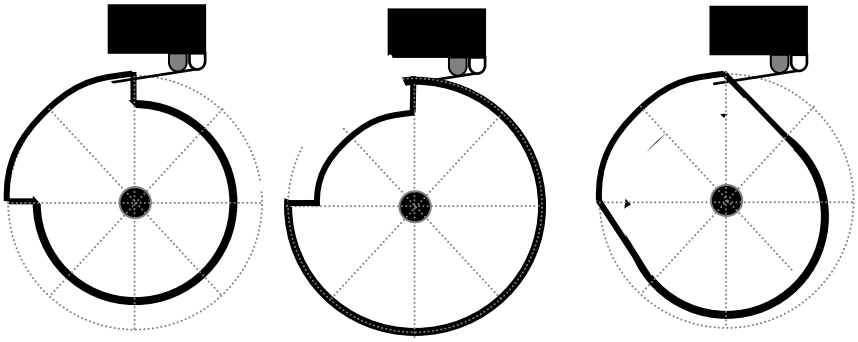


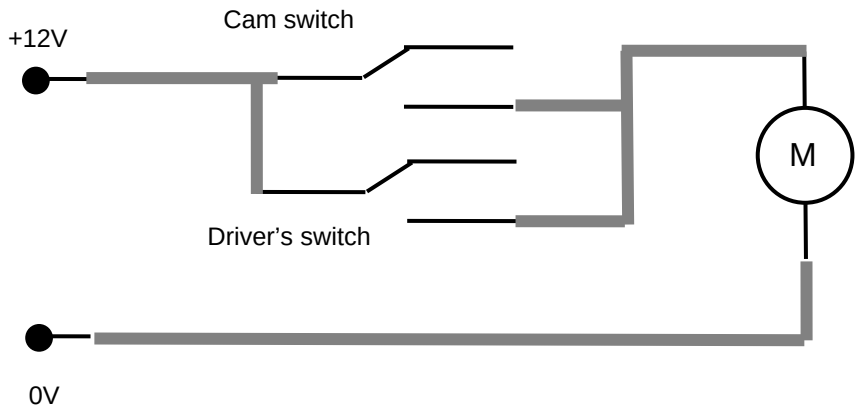
Total **(13 marks)**

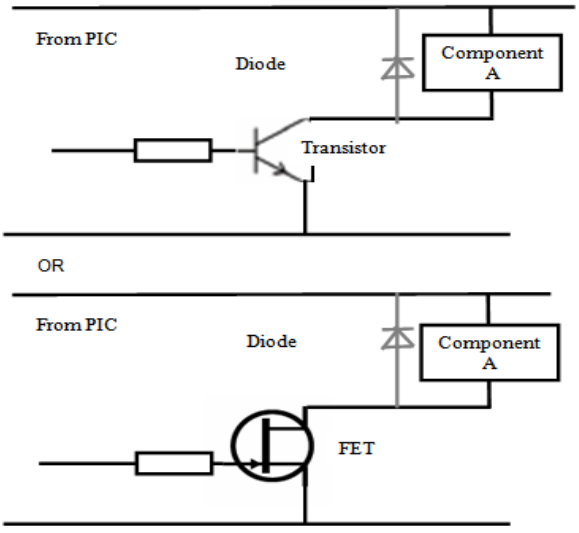
Section B

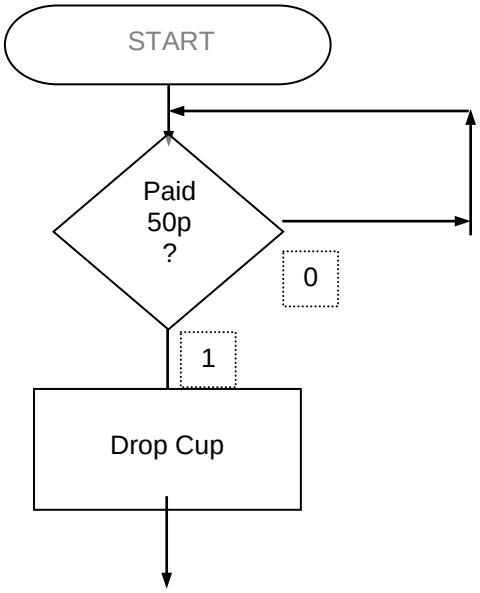
Question	Part	Sub Part	Marking Guidance	Marks
3	a		Question 3 is about types of motion and mechanisms Draw connecting lines to link the description to the correct arrow and example. 1 mark for each correct line. Award 1 mark for each correct line up to a maximum of 3 per row. No mark for the last line as it can only go in the remaining place. If a line is not the only line leaving / entering the top or bottom of a box, award 0 marks for that line. This is to prevent a candidate who draws every combination getting credit.  	Total **(6 marks)**

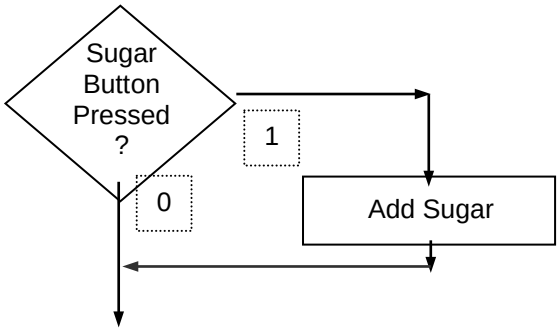
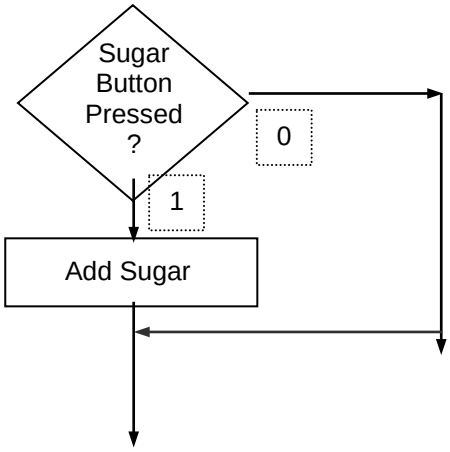
3	b		Draw and name a mechanism that will convert Rotary motion into Oscillating motion 1 mark for a recognizable sketch of a mechanism that will convert Rotary motion into Oscillating motion OR 2 marks for a clear sketch of a mechanism that will convert Rotary motion into Oscillating motion 1 mark for correctly labelling the majority of components. 1 mark for correctly naming the mechanism drawn e.g. Crank and Slider, Cam and Follower, Treadle linkage	Total **(4 marks)**
3	c		Draw and name a mechanism that will transfer rotary motion through 90° 1 mark for a recognizable sketch of a mechanism that will transfer rotary motion through 90° OR 2 marks for a clear sketch of a mechanism that will transfer rotary motion through 90° 1 mark for correctly labelling the majority of components. 1 mark for correctly naming the mechanism drawn e.g. Bevel Gears, Crown Gears, Worm	Total **(4 marks)**
3	d		Draw and name a mechanism that will increase or decrease the speed of rotation. 1 mark for a recognizable sketch of a mechanism that will increase or decrease the speed of rotation OR 2 marks for a clear sketch of a mechanism that will increase or decrease the speed of rotation 1 mark for correctly labelling the majority of components. 1 mark for correctly naming the mechanism drawn e.g. Gears, Chain and Sprocket, Pulley and Belt	Total **(4 marks)**

4	a		On the diagram below show how the motor could continually move the two wipers in the required motion. 1 Mark for each of the following; • Correct labels • Moving a wiper • Moving a wiper in correct motion • Moving both wipers in correct motion • Moving both wipers continuously (ignoring proportions) • Drawn neatly in proportion e.g.  	Total **(6 marks)**
4	b		The car windscreen wiper system uses a cam and a switch to ensure that the wipers always stop at the bottom of the windscreen after the driver turns them off. • 1 mark for a recognisable cam • 1 mark for the switch should be operated for approx. 90° • 1 mark for the switch should be not operated for approx. 270° • 1 mark for the cam outline drawn between the dotted guide circles Note – The cam can have a smooth edge. Accept NC or NO switch e.g. 	Total **(4 marks)**

4	c		1 mark for Microswitch	Total **(1 mark)**
4	d		On the circuit below connect the motor and both switches to the power supply to ensure that the wipers; • The Cam switch OR the Drivers switch is ON 1 mark for each of the following connections • +12V to Cam Switch • +12V to Driver's Switch • Cam Switch to Motor • Driver's Switch to Motor • Motor to 0V Credit other correct circuits Disallow connections above if other incorrect connections are attached to them. e.g.  	Total **(5 marks)**

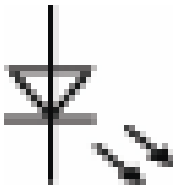
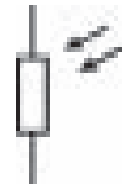
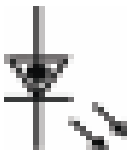
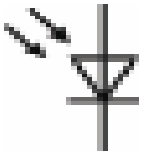
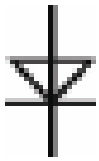
5	a		Question 5 is about a simple Coffee Vending Machine. List two Health & Safety considerations for a Coffee Vending Machine 1 mark for requirement, e.g. No sharp edges 2 marks for requirement with reason e.g. No sharp edges so the user does not get hurt. X2	Total **(4 marks)**
5	b		The hot water valve needs to be controlled by the coffee vending machine control system. State the most suitable component that could be used to operate the valve. I mark for 'solenoid' or 'pneumatic'	Total **(1 mark)**
5	c		The control system is running on a PIC. State how this should be connected to the component given in 5b, name any components used. 1 mark for a Transistor or FET Labelled 1 mark for a Transistor or FET Sketched correctly 1 mark for a Transistor or FET connected correctly (no short circuits) 1 mark for Diode sketched and connected correctly e.g.  	Total **(4 marks)**

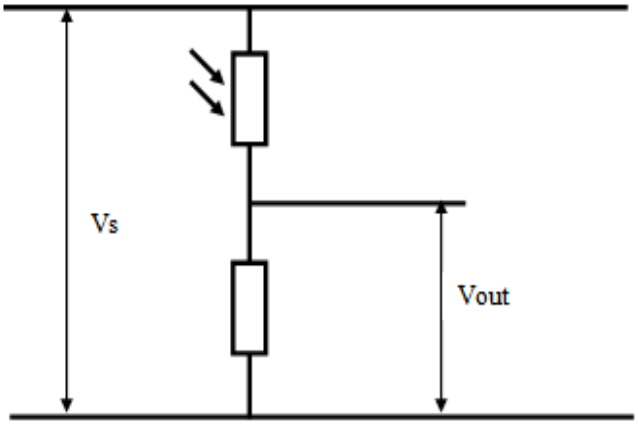
5	d	i	The Coffee Vending Machine operates as follows: The machine waits for the customer to insert a 50p coin and then drops a cup. Draw a simple flowchart to show how this would be represented. Correct Symbol and Text (1 mark) Correct Arrows with direction of flow shown (1 mark) Correct States (1 Mark) Note – Accept either rectangle or parallelogram for output. e.g.  	Total **(3 marks)**

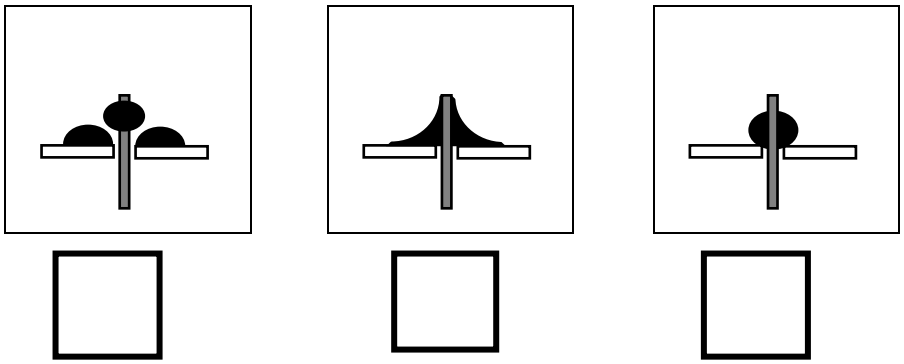
5	d	ii	If the customer presses the Sugar button the machine adds sugar. Draw a simple flowchart to show how this would be represented. Correct Symbol and Text (1 mark) Correct Arrows with direction of flow shown (1 mark) Correct States (1 Mark) Correct flow from either decision (1 Mark) Note – Accept either rectangle or parallelogram for output. e.g.  OR 	Total **(4 marks)**

5	d	iii	The Vend Subroutine is shown below Describe the operation of the subroutine Valve ON described with reason (1 mark) Wait 5 Secs described with reason (1 mark) Valve OFF described with reason (1 mark) e.g. The Valve turns ON which lets water flow into the cup The process waits for 5 seconds to allow the cup to fill The Valve turns OFF which stops the water flowing into the cup	Total **(3 marks)**
5	d	iv	Explain the advantage of using subroutines in complex programs Weak advantage E.g. Quicker to write (1 mark) Strong advantage E.g. They save repeating parts of the process which saves design time (2 marks)	Total **(2 marks)**

6	a		Question 6 is about components. 1 mark for each correctly named component symbol	Total **(6 marks)**

Symbol	Component Name
	LED or Light Emitting Diode
	LDR or Light Dependent Resistor
	FLED or Flashing Light Emitting Diode
	Bi Colour or Dual Colour AND LED or Light Emitting Diode Note – allow wording meaning 2 colours plus LED
	Photo Diode
	Diode

6	b		Calculate the value of the total resistance of the following resistors in series  1 Mark for the correct formula 1 Mark for inserting the numbers 1 Mark for the correct answer 1 Mark for the correct units (note 14K7 is acceptable as the unit) Rt = R1 + R2 Rt = 4,700 + 10,000 Rt = 14,700 Ω or 14,700 Ohms or 14K7 or 14.7K	Total **(4 marks)**
6	c		Name this component 1 mark Capacitor 2 marks Polarised Capacitor (accept Electrolytic Capacitor)	Total **(2 marks)**
6	d		The circuit below is a light sensor. The resistance of the LDR is 5K and of the fixed resistor 10K. Calculate the output voltage (Vout) when Vs is 9 Volts.  1 Mark for the correct formula V2 = $\frac{R2}{R1+R2}$ x Vs 1 Mark for inserting the numbers V2 = $\frac{10K}{5K+10K}$ x 9 1 Mark for the correct answer V2 = 6V or 6 Volts 1 Mark for the correct units	Total **(4 marks)**

7	a		Tick the correctly soldered joint  ☐ ☐ ☐	Total **(1 mark)**
7	b		Name two different types of electronic test equipment. 1 mark for each example given e.g. multi-meter, logic probe, oscilloscope, continuity tester	Total **(2 marks)**

7	c		Describe how to find faults in a printed circuit board A high level response with a full and comprehensive explanation of all aspects of a suitable process. Response well structured with good use of appropriate design and technology terminology and showing a good grasp of grammar, punctuation and spelling. - (7– 8 marks) A medium level response with a good explanation of a Suitable process , however with some aspects of the process omitted. Response fairly well structured with some use of design and technology terminology with a small number of errors in grammar, punctuation. (5-6 marks) A low level response with a limited explanation of one part of the process with several errors. Response poorly structured with little or no use of design and technology terminology and with several errors in grammar, punctuation and spelling. (3-4 marks) An attempt at a response, no relevant description presented. No use of design and technology terminology and multiple errors in grammar, punctuation and spelling. (1-2 marks) e.g. An 8 Mark response; (First do a visual check for any breaks in tracks, poor soldering and missing, wrongly inserted or incorrect components. Then using a multi-meter, set to continuity mode, check that all tracks are connected and all components that are meant to be connected to each other are. Also check that tracks that are not meant to be connected are not short circuited. Connect the battery to the circuit and now, with the multi-meter set to voltage mode; check that the expected voltage is present at the expected points. If possible substitute alternative components e.g. swop the chip, to check that the components haven't broken (max 8 marks)	Total **(8 marks)**

7	d		Describe 2 possible problems of shipping faulty goods to customers 1 mark for each weak description of a problem e.g. • Poor sales • More faults • Bad image 2 marks for each good description of a problem e.g. • Increased costs due to replacement goods • Possible injury to users and compensation claims • Loss of trust of the brand with the public and loss of future sales (2 x 2 marks)	Total **(4 marks)**