Version 1: 1005

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Design and Technology: Systems and Control Technology Higher Tier
Specification 3546

Mark Scheme

2005 examination - June series

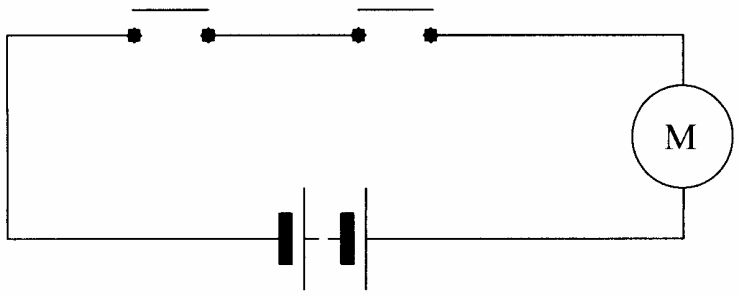
Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination.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

Higher Tier

Section A Mechanisms Focus

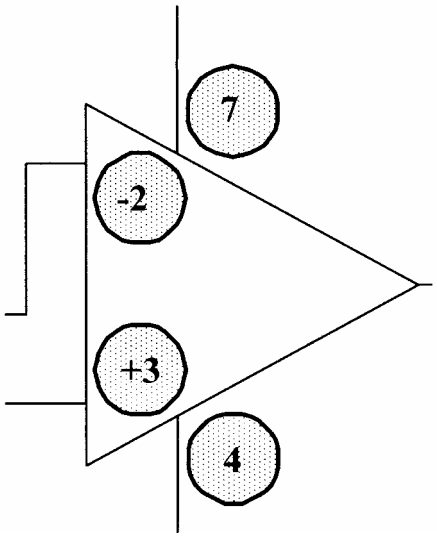
	Question 1					
	(a)	**(i)**	Thermistor or A			(1 mark)
		(ii)	Temperature			(1 mark)
	(b)	Potentiometer or variable resistor or B or preset or VR				
	(c)	Correct position of thermistor (bottom)			1 mark	
		Correct symbol for thermistor			1 mark	
		Quality of drawing the correct top symbol			2 marks	
		(Any recognisable symbol for 1 mark)				
		Correct position of variable resistor (top)			1 mark	
		Correct symbol for variable resistor (resistor no)			1 mark	
		Quality of drawing the correct bottom symbol			2 mark	(8 marks)
		(Any recognisable symbol for 1 mark)				
						Total 11 marks

	Question 2				
	(a)	Quality of drawing		2 marks	
		Correct use of AND function with PTM switches		2 marks	
		Correct AND function with incorrect switches:		1 mark	
		Correct circuit symbols in the correct position		4 marks	
		1 mark for each symbol			
			Motor output only:	2 marks	
			Any additional output:	1 mark	
			Motor not controllable:	0 marks	(10 marks)
					
	(b)	**(i)**	Logic	1 mark	
		(ii)	AND OR (1 each in correct order)	2 marks	(3 marks)
		(iii)	0	1 mark	
			0	1 mark	
			0	1 mark	
			1 (1 mark each)	1 mark	(4 marks)
					Total 17 marks

Question 3

(a) Cutouts – 1 mark for each (anywhere on disc, hole or slot) 2 marks
Appropriately designed slots to allow light to pass through disc 1 mark
Quality of response (0 if poor quality) 1 mark (4 marks)

(b) 1 mark for each correctly labelled part
1 mark for 2 and 3 wrong way around

				(4 marks)
	(c)	Injection moulding/compression moulding		
		Extrusion and vacuum forming (vac form no)	(1 mark)	
	(d)	Appropriate method of construction – light – large wind collection area	1 mark	
		(0 marks if inappropriate for two of above reasons)		
		Appropriate materials		
		(2 if entirely appropriate – light and easy to join – 1 stated materials)	2 marks	
		Quality of drawing		
		(2 clear and well executed – 1 recognisable response – 0 very poor)	2 marks	(5 marks)
				Total 14 marks

	Question 4			
	(a)	Suitability of mechanism		
		Will reciprocate continuously	4 marks	
		Moves one way	3 marks	
		Some movement	2 marks	
		An attempt	1 mark	(4 marks)
		Notes on construction/materials/components/operation Each item mentioned give 1 mark (tick up to 4)		(4 marks)

		Quality of drawing		
		Well produced in appropriate style	2 marks	
		Recognisable as a response	1 mark	(2 marks)
	(b)	Facility to pause at top/bottom		
		Includes a dwell at top and bottom	4 marks	
		Would pause at top or bottom	3 marks	
		Stops	2 marks	
		An attempt	1 mark	(4 marks)
		Notes explaining how system works		
		Detailed explanation of system	3 marks	
		Some aspects explained	2 marks	
		Simple labelling only	1 mark	(3 marks)
		Quality of drawing		
		Well produced in appropriate style	2 marks	
		Recognisable as a response	1 mark	(2 marks)
				Total 19 marks

	Question 5			
	(a)	Suitability of lever modification		
		Lever modified and suitable	2 marks	
		Partially functional – a straight lever	1 mark	(2 marks)
		Suitability of cam – designed for 3 presses		
		Entirely appropriate – correct number of lobes/suitable profile	3 marks	
		Partially functional	2 marks	
		An attempt	1 mark	(3 marks)
		CAM can be drawn anywhere		
		Quality of drawing		
		Well produced in appropriate style	2 marks	
		Recognisable as a response	1 mark	(2 marks)
	(b)	Suitability of idea		
		90° bend and return	4 marks	
		Allows a bend and return	3 marks	
		Will bend	2 marks	
		An attempt	1 mark	(4 marks)
		Quality of drawing		
		Well produced in appropriate style	2 marks	
		Recognisable as a response	1 mark	(2 marks)
				Total 13 marks

	Question 6				
	(a)	Formula 10 * 100 = B * 25			
		If there is understanding of Principle of Moments give credit		1 mark	
		Working B = 40		1 mark	
		Units kN		1 mark	
		If answer is just 40 kN give		3 marks	(3 marks)
	(b)	Formulas and transposition – if there is an understanding of Principle of Gear Ratios give credit		1 mark	
		Correct speed of intermediate shaft		2 marks	
		Correct ratio of final drive shaft		1 mark	
		Correct answer 30T		1 mark	
		If answer is just 30T give		5 marks	(5 marks)
	(c)	**(i)**	Any push to make / microswitch / push to break / LDR / Reedswitch / infra red emit and receive / Limit Switch		(1 mark)
		(ii)	Quality of idea (beam solution ok if a photoswitch circuit is suggested) (2 uses a proximity/positional switch – 1 an attempt)	2 marks	
			Quality of drawing		
			(Well produced in appropriate style 1 – poor quality response 0)	1 mark	(3 marks)
					Total 12 marks

	Question 7				
	(a)	Credit for each cell correct			
				Any suitable comment	
		Exposed gearing on mechanical components	Entrapment or similar	Enclosing guards	2 marks
		Fumes from etching tanks	Inhalation of fumes	Well ventilated area	2 marks
		Drilling holes using a pillar drill	Entrapment Loose parts Swarf Chuck keys present	Remove chuck keys Wear goggles Brush work area	2 marks
		Soldering components to a PCB	Inhalation of fumes Splashes Burns	Ventilated area (not credit if given before) Safety glasses	2 marks (8 marks)

	(b)	Credit for each cell correct				
		Make PCB or similar	*Etch resist coated copper clad board*	*Etching tank, chemicals, tongs*	1	
		Drilling PCB	PCB Board	Drill and suitable drill bit	2	
		Insert components from back and solder to copper tracks	*PCB, resistors, LEDs, 555 chip, capacitor*	Soldering iron etc	1	
		Cut off surplus wire	*NONE*	Side cutters or similar	1	
		Check continuity	*Completely soldered circuit*	Any meter	1	(6 marks)
						Total 14 marks

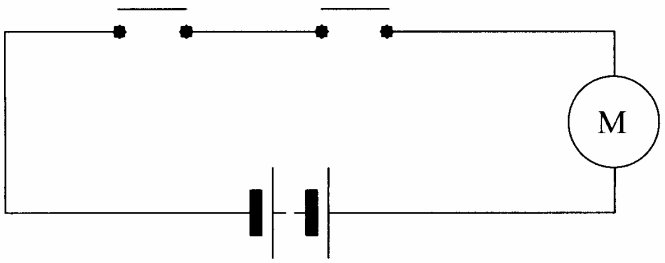
	Question 8			
	(a)	Lines were given in grouped statements on the question therefore each line needs to be largely correct to gain a mark. (Missing commas are not to be penalised). (Flow chart method is acceptable) If a line is missing but sequence starts again give credit i.e. **two** consecutive statements are correct		
		If input A = 1 or input B – 1 run Turnoff Output C, Turnon Output D Wait 5		
		Turnoff Output D, Turnon Output E	1 mark	
		Turnoff Output F, Turnon Output G, Turnon Output H	1 mark	
		Wait 15	1 mark	
	*	Turnoff Output H, Flash Output G	1 mark	
	*	Turnoff Output E, Flash Output D	1 mark	
		Wait 5	1 mark	
	**	Turnoff Output G, Turnon Output F	1 mark	
	**	Turnoff Output D, Turnon Output C	1 mark	
	End		1 mark	(9 marks)
	(b)	Lines 7 or 8 modified as below see * above		
		Turnoff Output H, Flash Output G, **Turnon Output J** Or Turnoff Output E, Flash Output D, **Turnon Output J**		
		1 mark for correct location of Turnon command 1 mark for correct format e.g. Turnon Output J		

		Lines 10 or 11 modified as below see ** above		
		Turnoff Output G, Turnon F, **Turnoff Output J** Or Turnoff Output D, Turnon F, **Turnoff Output J**		
		1 mark for correct location of Turnoff command 1 mark for correct format e.g. Turnoff Output J		(4 marks)
			Total 13 marks	

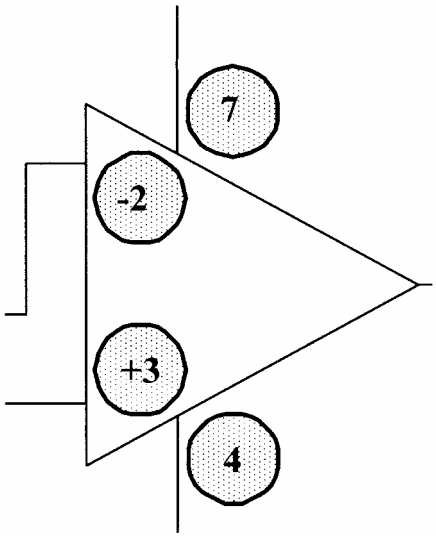
	Question 9			
	(a)	(i) & (ii) Stating appropriate example **MUST BE** health and safety related	2 x 1 mark	
		An attempt at giving a reason 1 mark	2 x 2 marks	(6 marks)
		A well stated relevant reason 2 marks		
	(b)	Safety system may use any appropriate method (Fuses, earths and pressure release are stated in the spec) Guard for 1 mark		
		An attempt at describing an appropriate safety system	1 mark	
		A well described appropriate safety system	2 marks	(2 marks)
		Appropriate benefits **to customers** e.g. increased product quality – lowering of prices due to method of production		
		A vague unqualified benefit	1 mark	
		A well stated and appropriate benefit	2 marks	(2 marks)
	(c)	A CAM method is required		
		Naming an appropriate CNC device	1 mark	
		(milling machine or named machine e.g. CAMM2 ok)		
		Naming and describing of the use of appropriate CNC output	2 marks	(2 marks)
		Mention of design: 1 mark		
		Mention of making: 1 mark		
			Total 12 marks	
		TOTAL MARKS ON PAPER 125		

Section B Pneumatics Focus

	Question 1				
	(a)	**(i)**	Thermistor or A		(1 mark)
		(ii)	Temperature		(1 mark)
	(b)		Potentiometer or variable resistor or B		(1 mark)
	(c)		Correct position of thermistor (bottom)	1 mark	
			Correct symbol for thermistor	1 mark	
			Quality of drawing the correct top symbol	2 marks	
			Any recognisable symbol for 1 mark		
			Correct position of variable resistor (top)	1 mark	
			Correct symbol for variable resistor (resistor no)	1 mark	
			Quality of drawing the correct bottom symbol	2 marks	
			Any recognisable symbol for 1 mark		(8 marks)
					Total 11 marks

	Question 2				
	(a)		Quality of drawing	2 marks	
			Correct use of AND function with PTM switches	2 marks	
			Correct AND function with incorrect switches:	1 marks	
			Correct circuit symbols 1 mark for each in correct position (circuit will work)	4 marks	
			Correct output (motor under control and working)	2 marks	
			Any extra components added in error: 1 mark for output		(10 marks)
					
	(b)	**(i)**	Logic	1 mark	
		(ii)	AND OR (1 each in correct order)	2 marks	(3 marks)
		(iii)	0	1 mark	
			0	1 mark	
			0	1 mark	
			1	1 mark	(4 marks)

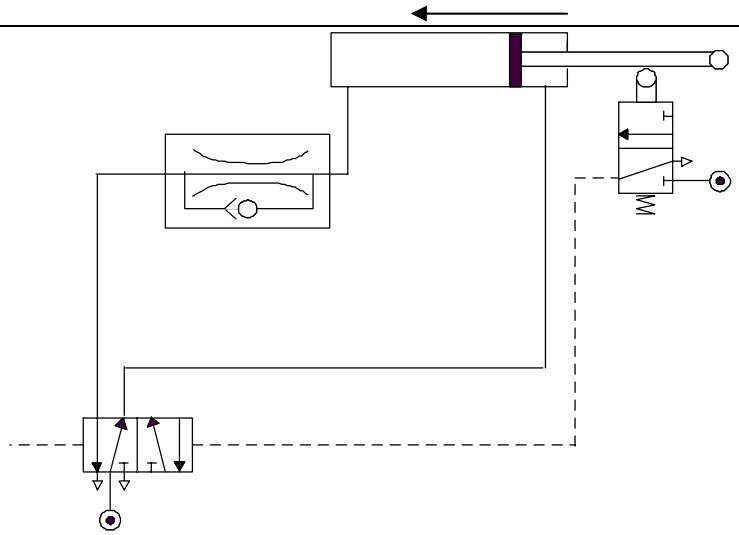
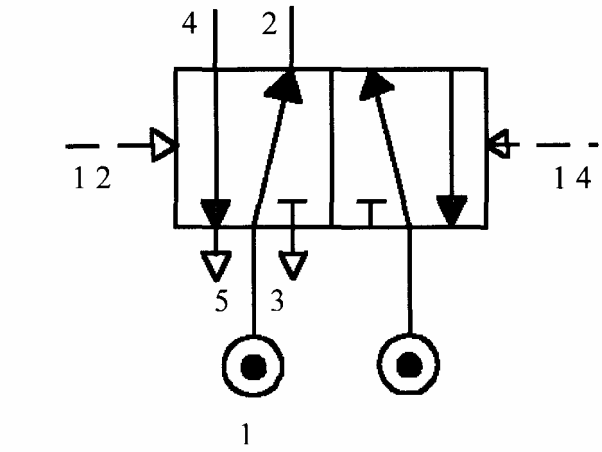
					Total 17 marks

	Question 3			
	(a)	Cutouts – 1 mark for each anywhere on disc (hole or slot)	2 marks	
		Appropriately designed slots to allow light to pass through disc	1 mark	
		Quality of response (0 if poor quality)	1 mark	(4 marks)
	(b)	1 mark for each correctly labelled part		
		1 mark for 2 and 3 the wrong way around		
				(4 marks)
	(c)	Injection moulding / compression moulding / extrusion and vacuum forming. Vacuum form no		(1 mark)
	(d)	Appropriate method of construction – light – large wind collection area (0 marks if inappropriate for two of above reasons)	1 mark	
		Appropriate materials (2 if entirely appropriate – light and easy to join – 1 stated materials)	2 marks	
		Quality of drawing (2 clear and well executed – 1 recognisable response – 0 very poor)	2 marks	(5 marks)
				Total 14 marks

	Question 4			
	(a)	Will reciprocate continuously	4 marks	
		Moves one way	3 marks	
		Some movement	2 marks	
		An attempt	1 mark	(4 marks)

		Notes on construction/materials/components/operation Each item mentioned gains 1 mark (tick up to 4) (Accept block diagram approach for symbols)		(4 marks**)**
		Quality of drawing		
		Well produced in appropriate style	2 marks	
		Recognisable as a response	1 mark	(2 marks)
	(b)	Facility to pause at top/bottom		
		Includes a dwell at top and bottom	4 marks	
		Would pause at top or bottom	3 marks	
		Stops	2 marks	
		An attempt	1 mark	(4 marks)
		Notes explaining how system works Detailed explanation	3 marks	
		Some aspects explained	2 marks	
		Simple labelling only	1 mark	(3 marks)
		Quality of drawing Well produced in appropriate style	2 marks	
		Recognisable as a response	1 mark	(2 marks)
				Total 19 marks

	Question 5			
	(a)	Area = 3.142 * radius^2	1 mark	
		3.142 * 15 * 15 correct figures used 2 partial 1	2 marks	
		707 mm^2 1 mark for answer 1 mark for units	2 marks	(5 marks)
	(b)	Force = pressure * area	1 mark	
		10 000 = pressure * 707		
		pressure = 10000/707	2 marks	
		14.14 N/mm^2	2 marks	(5 marks)
		If the candidate has transferred an incorrect value from B5(a) give credit		
	(c)	Good description to show surface area is less (2) poor description (1)	2 marks	
		Using reference to formula force = pressure * area	1 mark	(3 marks)
		If a description shows understanding of formula, give credit		
				Total 13 marks

	Question 6			
		Piston direction		
	(a)			
		FCV – clear restriction on air out	2 marks	
		FCV in the correct line (exhaust side) but incorrect restriction	1 mark	
		FCV on wrong exhaust	1 mark	
		– correctly drawn	2 marks	
		– incorrectly drawn but box like	1 mark	(4 marks)
	(b)	Correct direction + piston	1 mark	
		Quality of symbol	1 mark	(2 marks)
	(c)			
				
		Labelling of correct pilot numbers 1, 2	2 marks	
		1, 4	2 marks	
		1 number or reversed numbers give 1 mark (applies at either end of valve)		(4 marks)

		(ii)	Quality of drawing: partly correct for 1 mark Fully correct for 2 marks		(2 marks)
					Total 12 marks

	Question 7					
	(a)			Accept suitable comment		
		Exposed gearing on mechanical components	Entrapment or similar	Enclosing guards	2 marks	
		Fumes from etching tanks	Inhalation of fumes	Well ventilated area	2 marks	
		Drilling holes using a pillar drill	Entrapment Loose parts Swarf Chuck keys present	Remove chuck keys Wear goggles Brush work area	2 marks	
		Soldering components to a PCB	Inhalation of fumes Splashes Burns	Ventilated area (not credit if given before) Safety glasses	2 marks	(8 marks)
	(b)	Credit for each cell correct				
		Make PCB or similar	*Etch resist coated copper clad board*	*Etching tank, chemicals, tongs*	1	
					2	
					1	
					1	
					1	