



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Mark scheme

June 2003

GCSE

Design and Technology Systems and Control

3546

Foundation

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Design and Technology: Systems and Control Technology**Foundation Tier****Section A Mechanisms Focus****Question 1**

- (a) Identify the following components
- | | | |
|-------|---------------------|----------|
| (i) | resistor | (1 mark) |
| (ii) | capacitor | (1 mark) |
| (iii) | transistor | (1 mark) |
| (iv) | fuse | (1 mark) |
| (v) | motor | (1 mark) |
| (vi) | push to make switch | (1 mark) |
- 6 Marks**
- (b)
- | | | |
|-------|----------------------------------|----------|
| (i) | rotary – pulley, accept circular | (1 mark) |
| (ii) | linear – pulley load | (1 mark) |
| (iii) | oscillating – pendulum | (1 mark) |
| (iv) | reciprocating – piston | (1 mark) |
- 4 Marks**
- (c) Name the two parts of the mechanism indicated by the arrows
- | | | |
|------|----------|----------|
| (i) | follower | (1 mark) |
| (ii) | cam | (1 mark) |
- 2 Marks**
- (d)
- | | |
|--|-----------|
| Microswitch included | (1 mark) |
| Guard included | (1 mark) |
| Sensible activation mechanism evident | (1 mark) |
| Microswitch in series with on off switch | (1 mark) |
| Quality of drawings | (2 marks) |
- 6 marks**
- Total 18 marks**

Question 2

- (a) Correctly labelling missing pin numbers – 1 mark for each correct
- Pin 1 – ground or 0v
Pin 2 – trigger
Pin 3 – output
Pin 8 – 9V or supply voltage (or ‘voltage’ alone) (4 marks)
- Inserted with the correct **POLARITY** or **ORIENTATION** or **DIRECTION** or **BIAS** (1 marks)
- 5 marks**
- (b) Circling correct capacitor (C1) (1 mark)
Circling correct resistor (R2) (1 mark)
2 marks
- (c) (i) 330 ohm (1 mark)
(ii) tolerance (1 mark)
(iii) to control the input voltage / current
indication of controlling voltage across the LED (2 marks)
4 marks
- (d) Use of a holder/socket
Heat sinking
Insert correct way around
Care with pins / static (2 marks)
Or other suitable
2 marks
- (e) 2 marks for suitable method – single mark for poor method (2 marks)
2 marks for quality of drawing – single mark for poor drawing (2 marks)
4 marks

Total 17 Marks

Question 3

- (a) worm gear / worm wheel / worm **1 mark**
- (b) bevel gear **1 mark**
- (c) faster **1 mark**
- (d) Output gear – appropriate size (1 mark)
Use of idler gear to determine direction. (1 mark)
Output gear shown as having twice the number of teeth not to scale (1 mark)
Quality of drawing (1 mark)
Compound gear maximum 2 marks
4 marks
- (e) (i) Enclosed gearing (1 mark)
Microswitches (1 mark)
Or other suitable
- (ii) suitable response 1 mark e.g. assembly time (1 mark)
need for lubrication
cost of manufacture
3 marks
- Total 7 marks**

Question 4

- (a) (i) Injection moulding **1 mark**
- (ii) Adding hopper (1 mark)
Adding split mould (1 mark)
2 marks
- (b) Drawing has a web added (2 marks)
Quality of drawing (2 marks)
4 marks
- (c) (i) Thermoplastic (1 mark)
(ii) Re-melting (1)
Reference to granulation – up to 2 marks (2 marks)
3 marks
- (d) Drawing of a simple nut and bolt with washers for max mark (2 marks)
Other suitable fixing (e.g. self tap screw, rivet) = 1
Quality of drawing up to 2 max (2 marks)
4 marks
- Total 14 marks**

Question 5

- (a) Rises slowly 1mk (1 mark)
Falls quickly 1mk (1 mark)
2 marks
- (b) (i) inclusion of axle (1 mark)
inclusion of driver body (1 mark)
appropriate cam, i.e. pear or eccentric (1 mark)
correct motion would be produced (1 mark)
good drawing (1 mark)
5 marks
- (ii) Dowel plastic axle friction painting (5 marks)
In the order above – one mark for each correct response
5 marks
- Total 12 marks**

Question 6

- (a) (i) Thermistor **1 mark**
- (ii) Correct symbol (1 mark)
Proportioned and quality drawing (1 mark)
Recognisable, but poor response (1 mark)
3 marks
- (b) Start (1 mark)
Turn on heater (or similar) (1 mark)
Turn off heater (or other similar) (1 mark)
(Heater referred to in either box would gain the mark)
3 marks
- (c) Correct symbol (1 mark)
0 (1 mark)
0 (1 mark)
1 (1 mark)
4 marks
- (d) 1 mark for each correctly labelled component **6 marks**
- (e) Protection diode (1 mark)
Prevent back emf from damaging the transistor (1 mark)
Reference to current flow (1 mark)
2 marks
- (f) Small control voltage in primary controls, large voltage in secondary circuit, small controls large
Large power voltage
Interface between high and low voltage systems
2 marks

Total 20 marks

Question 7

- (a) (i) ease of modification
speed
accuracy – or other suitable (2 marks)
- (ii) cost (1 mark)
training – or other suitable
- 3 marks**
- (b) Only allowed to be installed on one machine (1 mark)
Allowed to be installed on the number of machines mentioned on license (1 mark)
Unlawfully copying software for another user (1 mark)
- 3 marks**
- (c) No harmful chemicals (2 marks)
Automatically drilled (2 marks)
Cost of original equipment, training or other suitable (2 marks)
- Quality of response determines whether 1 or 2 marks
- 6 marks**
- (d) (i) Any suitable example (1 mark)
(ii) consistent quality (1 mark)
easy repeatability – or other suitable (1 mark)
- 3 marks**
- (e) Product placement (1 mark)
Internet advertising (1 mark)
Television advertising (1 mark)
Trade fairs – or other suitable (1 mark)
- 4 marks**

Total 19 marks

Question 8

Mechanism –	Entirely appropriate	max 5	
	Would function	max 3	
	Inappropriate	max 1	(5 marks)
Audible output –	Entirely appropriate	max 5	
	Would function	max 3	
	Inappropriate	max 1	(5 marks)
Use of materials	Appropriate	2 marks	
	Partially appropriate	1 mark	(2 marks)
Drawing quality	Very clear and appropriate	3 marks	
	Sufficient to convey ideas	2 marks	
	Poor but present	1 marks	(3 marks)
			Total 15 marks

PAPER TOTAL 125 MARKS

Section B Pneumatics Focus**Question 1**

- (a) Identify the following components
- (i) resistor (1 mark)
 - (ii) capacitor (1 mark)
 - (iii) transistor (1 mark)
 - (iv) fuse (1 mark)
 - (v) motor (1 mark)
 - (vi) push to make switch (1 mark)
- 6 marks**
- (b)
- (i) pressure source (or similar) (1 mark)
 - (ii) spring operated, spring return (1 mark)
 - (iii) reservoir, receiver (1 mark)
 - (iv) double acting cylinder or DAC (1 mark)
- 4 marks**
- (c) Name the two parts of the mechanism indicated by the arrows
- (i) piston rod (accept piston) (1 mark)
 - (ii) roller (1 mark)
- 2 marks**
- (d)
- Two valves drawn (1 mark)
 - Definite attempt at a circuit diagram (1 mark)
 - Connections in series (1 mark)
 - Output uses final arrow (1 mark)
 - Quality of drawings (2 marks)
- 6 marks**

Total 18 Marks

Question 2

- (a) Correctly labelling missing pin numbers – 1 mark for each correct
- Pin 1 – ground or 0v
 - Pin 2 – trigger
 - Pin 3 – output
 - Pin 8 – 9V or supply voltage (accept voltage) (4 marks)
- Inserted with the correct **POLARITY or ORIENTATION or DIRECTION or BIAS** (1 mark)
5 marks
- (b) Circling correct capacitor (C1) (1 mark)
Circling correct resistor (R2) (1 mark)
2 marks
- (c) i 330 ohm (1 mark)
ii tolerance (1 mark)
iii to control the input voltage, current (2 mark)
indication of controlling voltage across the LED (2 mark)
4 marks
- (d) Use of a holder/socket
Heat sinking
Insert correct way around
Care with pins, static
Or other suitable (2 marks)
2 marks
- (e) 2 marks for suitable method – single mark for poor method (2 marks)
2 marks for quality of drawing – single mark for poor drawing (2 marks)
4 marks

Total 17 marks

Question 3

- (a) *Button operated - 3 port valve – spring return – cylinder to exhaust – 2 position valve*
(Any 3 correct) **3 marks**
- (b) (0 marks if no attempt at a circuit) (2 marks)
Mainly correct drawing of components as a circuit diagram (1)
Any 3 correct components (2)
Flow regulator and reservoir in correct sequence (1 mark)
Quality of drawing (1 mark)
4 marks
- (c) Area of piston = $50 \times 50 \times 3.142$ (1 mark)
Correct area = 7855 mm^2 (1 mark)
Correct answer = $7855 \times 0.5 = 3927.5 \text{ Newtons}$ (1 mark)
3 marks
- Total 10 marks**

Question 4

- (a) (i) Injection moulding (1 mark)
1 mark
- (ii) Adding hopper (1 mark)
Adding split mould (1 mark)
2 marks
- (b) Drawing has a web added (2 marks)
Quality of drawing (2 marks)
4 marks
- (c) (i) Thermoplastic (1 marks)
(ii) Re-melting (1)
(iii) Reference to granulation (up to 2 marks) (2 marks)
3 marks
- (d) Drawing of a simple nut and bolt with washers for max mark (2 marks)
Other suitable fixing (e.g. self tap screw, rivet) = 1
Quality of drawing up to 2 max (2 marks)
4 marks
- Total 14 marks**

Question 5

- (a) When valve A is activated - the piston will go positive – (move) (1 mark)
When valve B is activated - the piston will go positive – (move) (1 mark)
This is an OR circuit

2 marks

- (b) (i) use of flow control valves (1 mark)
correct orientation of FCVs connected to exhaust (1 mark)
mainly correct connections for all components, (0 if copied) (1 mark)
quality of redrawn circuit diagram (2 marks)

5 marks

- (c) electronics / mechanics – any order (2 marks)
environments (1 mark)
aluminium (1 mark)
PICs (1 mark)
one mark for each correct response

5 marks**Total 12 marks**

Question 6

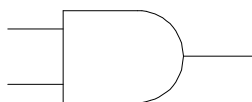
- (a) (i) thermistor (1 mark)
(ii) Correct symbol (1 mark)
Proportioned and quality drawing (1 mark)
Recognisable, but poor response (1)

3 marks

- (b) Start (1 mark)
Turn on heater (or similar) (1 mark)
Turn off heater (or other similar) (1 mark)
(Heater referred to in either box would gain the marks)

3 marks

- (c) Correct symbol (1 mark)
0 (1 mark)
0 (1 mark)
1 (1 mark)

**4 marks**

- (d) 1 mark for each correctly labelled component **6 marks**

- (e) Protection diode (1 mark)
Prevent back emf from damaging the transistor (1 mark)
Reference to current flow (1 mark)
2 marks

- (f) Small control voltage in primary controls, large voltage in secondary circuit, small controls large
Interface between high and low voltage systems

2 marks**Total 20 marks**

Question 7

- (a) (i) ease of modification
speed
accuracy – or other suitable (2 marks)
- (ii) cost (1 mark)
training – or other suitable
- 3 marks**
- (b) Only allowed to be installed on one machine (1 mark)
Allowed to be installed on the number of machines mentioned on license (1 mark)
Unlawfully copying software for another user (1 mark)
- 3 marks**
- (c) No harmful chemicals (2 marks)
Automatically drilled (2 marks)
Cost of original equipment, training or other suitable (2 marks)
- Quality of response determines whether 1 or 2 marks
- 6 marks**
- (d) (i) Any suitable example (1 mark)
(ii) consistent quality (1 mark)
easy repeatability – or other suitable (1 mark)
- 3 marks**
- (e) Product placement (1 mark)
Internet advertising (1 mark)
Television advertising (1 mark)
Trade fairs – or other suitable (1 mark)
- 4 marks**

Total 19 marks

Question 8

Pneumatic Mechanism – Entirely appropriate	max 5	
Would function	max 3	
Inappropriate	max 1	
		5 marks
Pneumatic Circuit design – Entirely appropriate	max 5	
Would function	max 3	
Inappropriate	max 1	
		5 marks
Use of components	Appropriate	(2 marks)
	Partially appropriate	(1 mark)
		2 marks
Drawing quality	Very clear and appropriate	(3 marks)
	Sufficient to convey ideas	(2 marks)
	Poor but present	(1 mark)
		3 marks
		Total 15 marks

PAPER TOTAL 125 MARKS