GCSE

Technology and Design

Summer 2010

Mark Schemes

Issued: October 2010

NORTHERN IRELAND GENERAL CERTIFICATE OF SECONDARY EDUCATION (GCSE)
AND NORTHERN IRELAND GENERAL CERTIFICATE OF EDUCATION (GCE)

MARK SCHEMES (2010)

Foreword

Introduction

Mark Schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of 16- and 18-year-old students in schools and colleges. The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes therefore are regarded as a part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.

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Rewarding Learning

General Certificate of Secondary Education
2010

Technology and Design

Foundation Tier

[G9501]

WEDNESDAY 26 MAY, AFTERNOON

MARK SCHEME

			AVAILABLE MARKS
1	Dia variable resistor	[1]	
			
	Cam	[1]	
	Eye Wash	[1]	
	Pneumatic Control	[1]	
	Single Acting Cylinder	[1]	
	Dia LDR	[1]	
			
	Electronic	[1]	
	Output	[1]	
	Mechanical Control	[1]	
	Gear	[1]	10
2	**(a)** Plane, or wood plane, Jack plane	[1]	
	(b) To smooth, shape or remove or reduce material	[1]	
	(c) Wood; hardwood; softwood or even acrylic etc.	[1]	
	(d) To protect the blade	[1]	4
3	**(a)** Open loop system	[1]	
	(b) Closed loop system	[1]	
	(c) Feedback is a means of checking; maintaining or controlling a system	[2]	
	(d) To model or simplify a system	[2]	6
4	**(a)** **(i)** Plastic	[1]	
	(ii) Copper Wire	[1]	
	(b) **(i)** Acts as an Electrical Insulator	[1]	
	(ii) Acts as an Electrical Conductor	[1]	4

AVAILABLE MARKS

5 **(a)**

Plastic	Use	Characteristic
Melamine	**KITCHEN WORK SURFACES**	**SCRATCH PROOF**
Rigid polystyrene	**TOYS**	**LIGHTWEIGHT**

[4]

(b) Rigid polystyrene [1]

It can be heated and shaped; it is a thermoplastic etc. [2] 7

6 **(a)** **(i)** Arrow showing the handle rotating clockwise [1]

(ii) 120 rev/min [2]

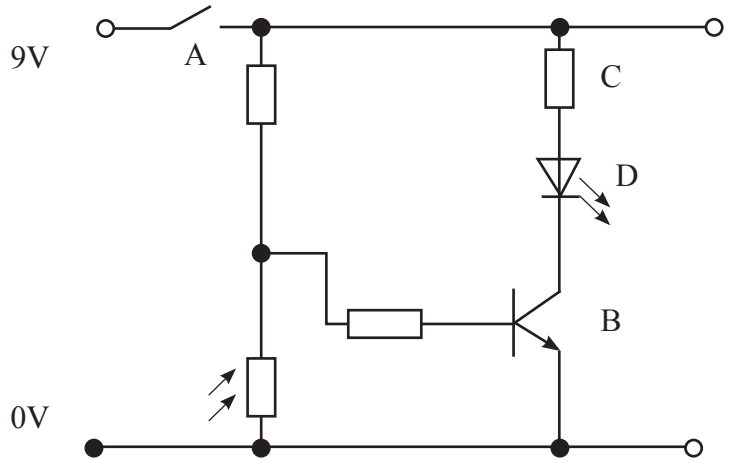
(b) **(i)** Idler gear [1]

(ii) Drum rotates in same direction as handle/or reverse direction relative to Fig. 5 [1]

(iii) None [1]

(iv) Belt drive or chain drive [1] 7

			AVAILABLE MARKS
7	**(a)** Circuit as shown		



[4]

(b) Transistor and LED [2]

(c) When switch A is closed the 9V supply is connected.

Any one:
- In daylight the resistance of LDR is low and voltage across it is also low.
- In dark conditions resistance of LDR is high and voltage across it is also high.

When this voltage is greater than 0.6V the transistor switches on.
This enables the LED to light. [5]

(d) Night light or other suitable answer [1]

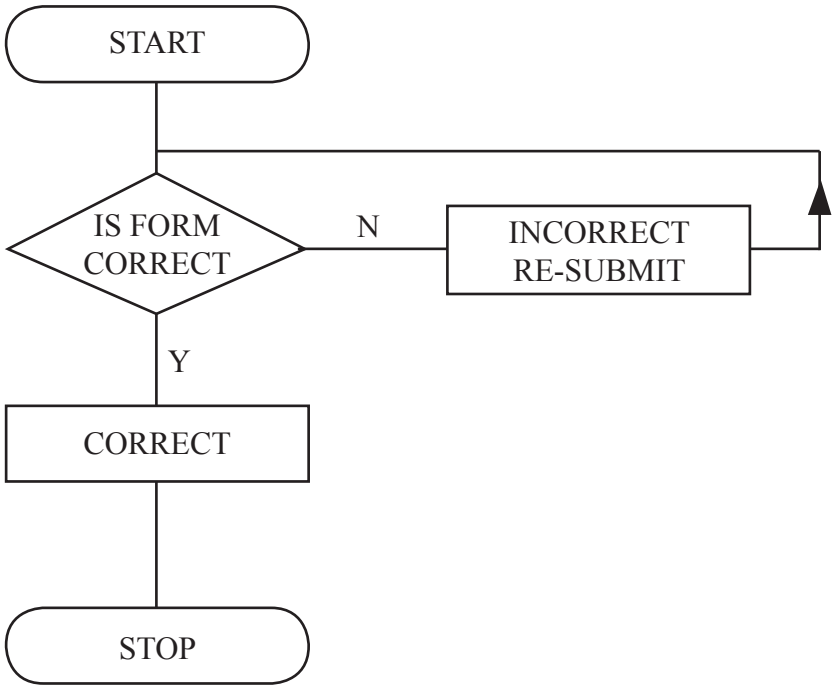
(e) Protective resistor for LED [1] 13

8 **(a)** Parallel [1]

(b) Taper [1]

(c) Face [1] 3

			AVAILABLE MARKS
9	**(a)** Flow regulator Exhaust 5/2 valve Double acting cylinder 3/2 valve	[5]	
	(b) **(i)** 3/2 valve	[1]	
	(ii) 5/2 valve	[1]	
	(iii) flow regulator	[1]	8
10	1 mk for each correct box draw in correct sequence. 1 mk for each correct statement in each box. 1 mk for closing loop	[4] [4] [1]	9



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11	**(a)** **(i)** Brass	[1]	
	(ii) rigid; shape easily; attractive; can be polished; doesn't rust	[1]	
	(b) Hacksaw or junior hacksaw	[1]	
	(c) cross filing; draw filing; emery paper; polishing	[2]	
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12	**(i)** Lever Fulcrum	[1] [1]	
	(ii) Label cam Eccentric or circular cam	[1] [1]	
	(iii) The weight of the lever and the boat; load; gravity	[1]	
	(iv) A spring connected to front of the arm and display board/ extra weight on the front of boat	[1]	
	(v) Any **one**: Move the cam nearer to the fulcrum Use a larger diameter cam Use a cam with a larger lift	[1]	7

13 **(a)**

Joining Method	Permanent/Semi-permanent
Adhesives	**PERMANENT**
Panel pins	**SEMI-PERMANENT**
Nuts and bolts	**SEMI-PERMANENT**
Brazing	**PERMANENT**

[4]

	(b) wood screws, self-tapping screws	[2]	
	(c) Heated on a strip heater; bent on a former or jig after heated	[2]	8

14 (a) (i)

Method of Operation	Letter
Roller trip	**B**
Push Button	**C**
Lever	**D**
Plunger	**A**

[4]

(ii) Roller trip [1]

(b) (i) AND [1]

(ii) Safety or to confirm two actions etc [1]

(c) (i) OR [1]

(ii) To control an operation from either of two positions etc [1]

(iii) Shuttle Valve [1]

(iv) To isolate C when D is operated or vice versa or
To prevent air exhausting through one valve when the other is operated or
To allow either valve C or D to give a signal.
Allow any suitable explanation. [2]

AVAILABLE MARKS

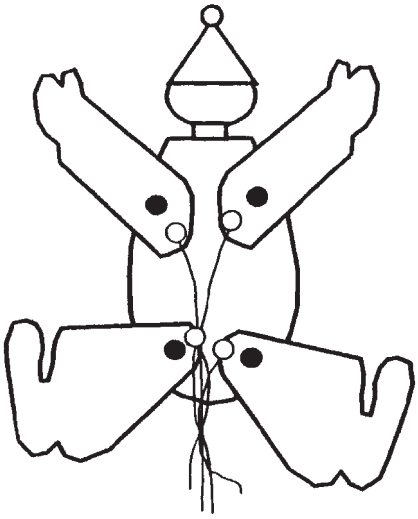
12

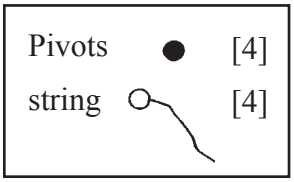
15 **(a)** String **input** with arms and legs **output** labelled on drg. [2]

(b) **(i)** Manufactured board [1]

(ii) MDF is easily shaped; readily available; easy to drill [2]

(c)





[8]

(d) The weight of the arms and legs make the string return [2]

AVAILABLE MARKS

15

The assessment of quality of written communication.

AVAILABLE MARKS

Marks are to be allocated to QWC in accordance with the following criteria.

Performance Level	**Criteria**	**Marks**
Threshold	Candidates spell, punctuate and use the rules of grammar with reasonable accuracy; they use a limited range of specialist terms appropriately.	0, 1, 2
Intermediate	Candidates spell, punctuate and use the rules of grammar with considerable accuracy; they use a limited range of specialist terms with facility.	3, 4
High	Candidates spell, punctuate and use the rules of grammar with almost faultless accuracy; deploying a range of grammatical constructions; they use a wide range of specialist terms adeptly and with precision.	5, 6

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Higher Tier

[G9502]

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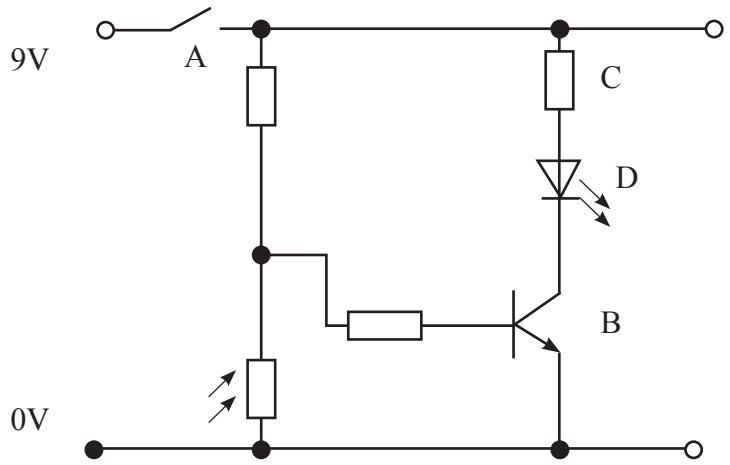

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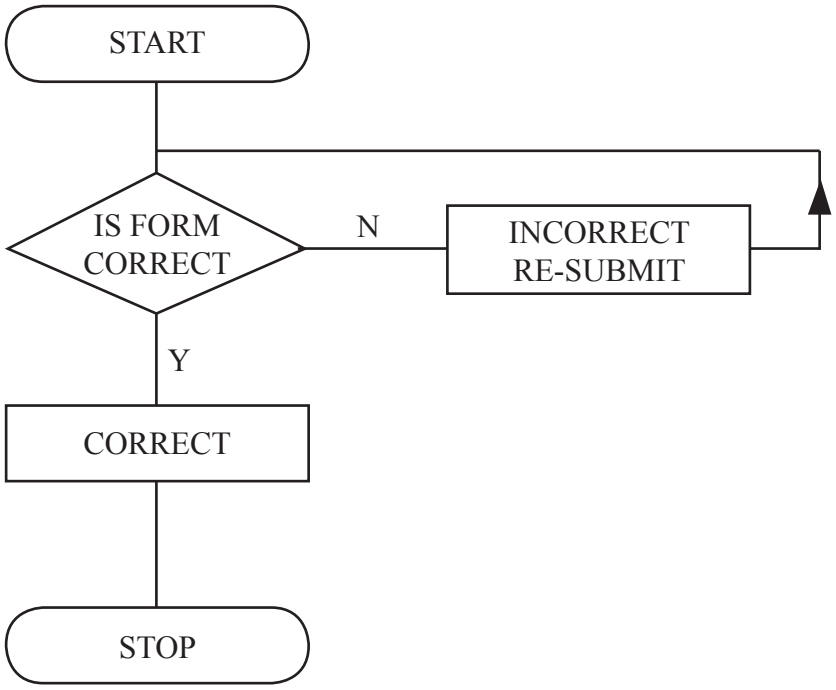

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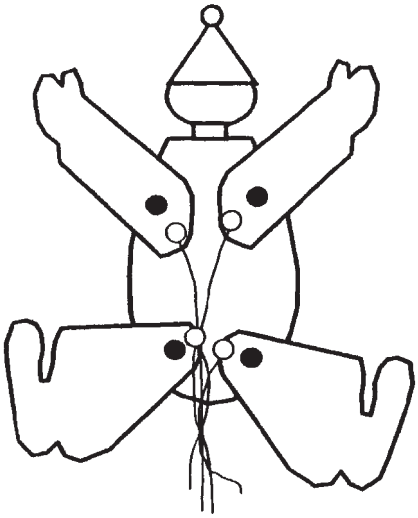
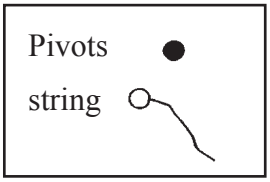




[8]

(d) The weight of the arms and legs make the string return [2] 15

AVAILABLE MARKS

Part 2

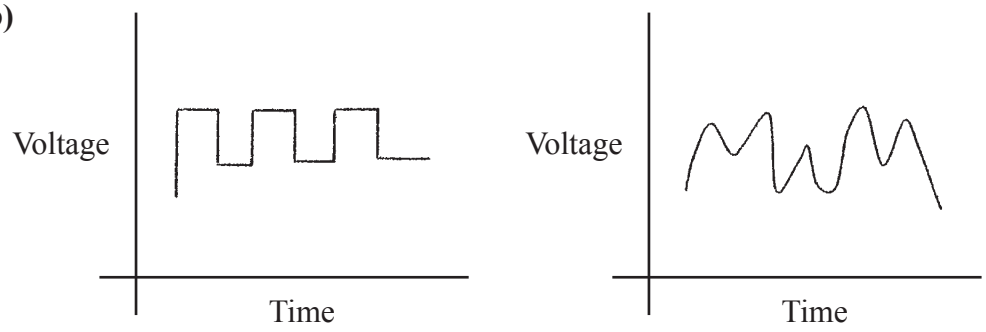
Answer any **two** questions

Option 1: Computer Systems and Control

16 (a) (i) Digital [1]

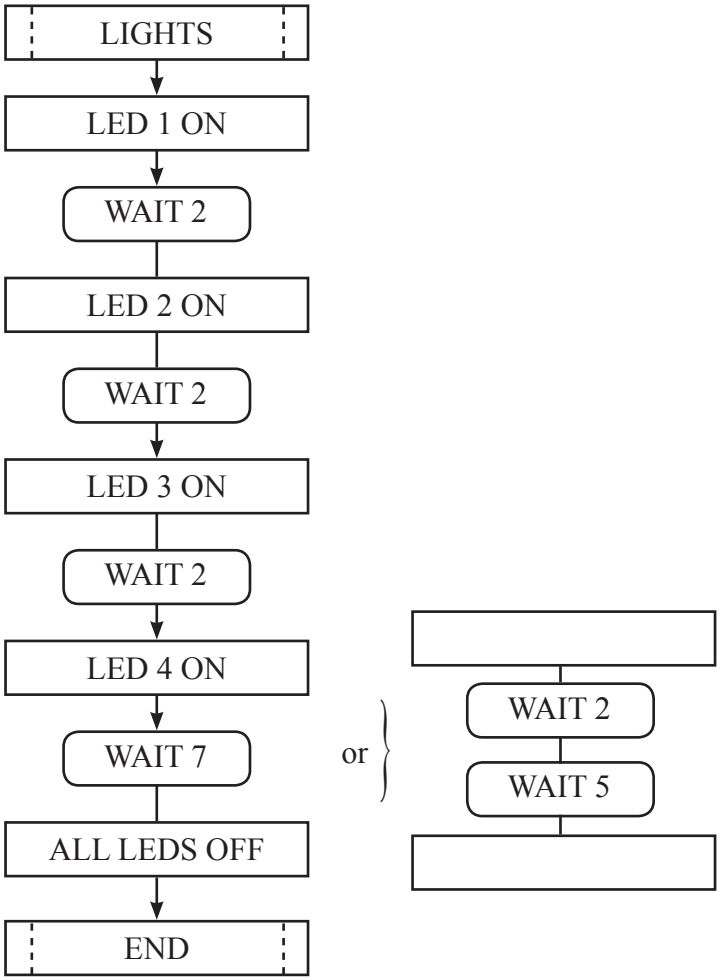
(ii) Analogue [1]

(b)



[2]

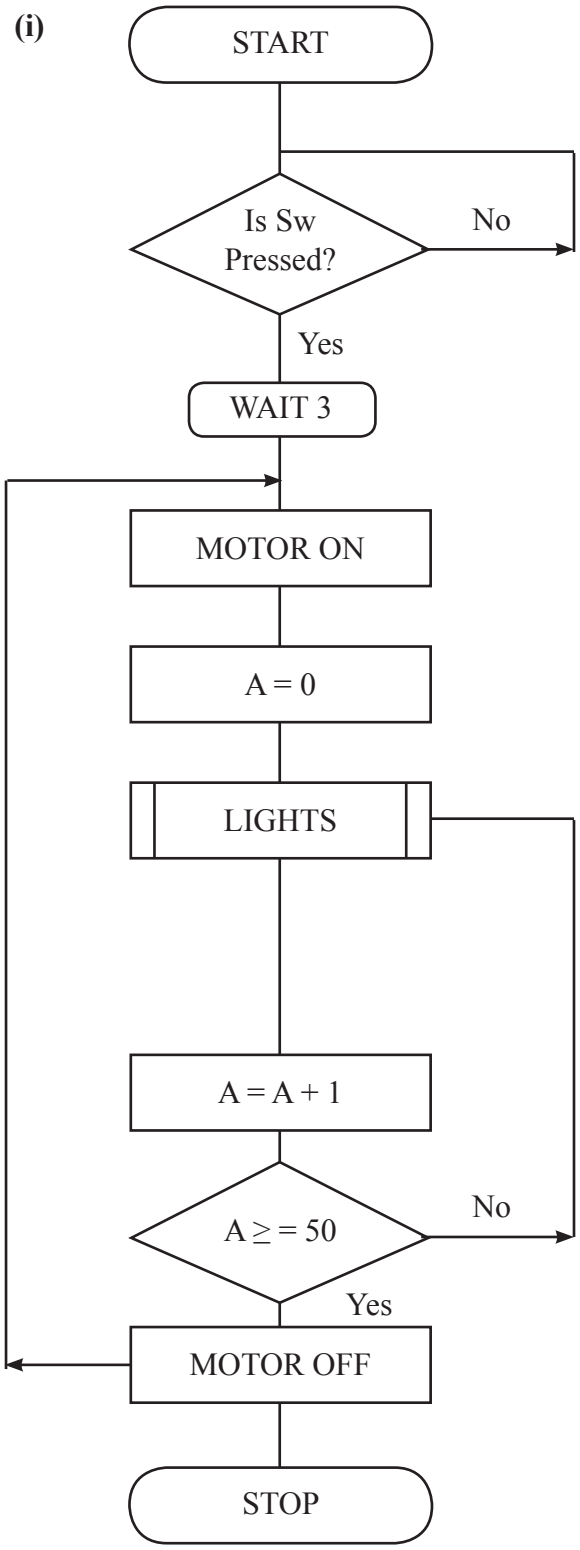
(c)



[4]

AVAILABLE MARKS

(d) (i)



[10]

(ii) Return Loop [2]

20

AVAILABLE MARKS

17 (a) (i) Interface protects the computer; amplify the signal; make physical connects easily [2]

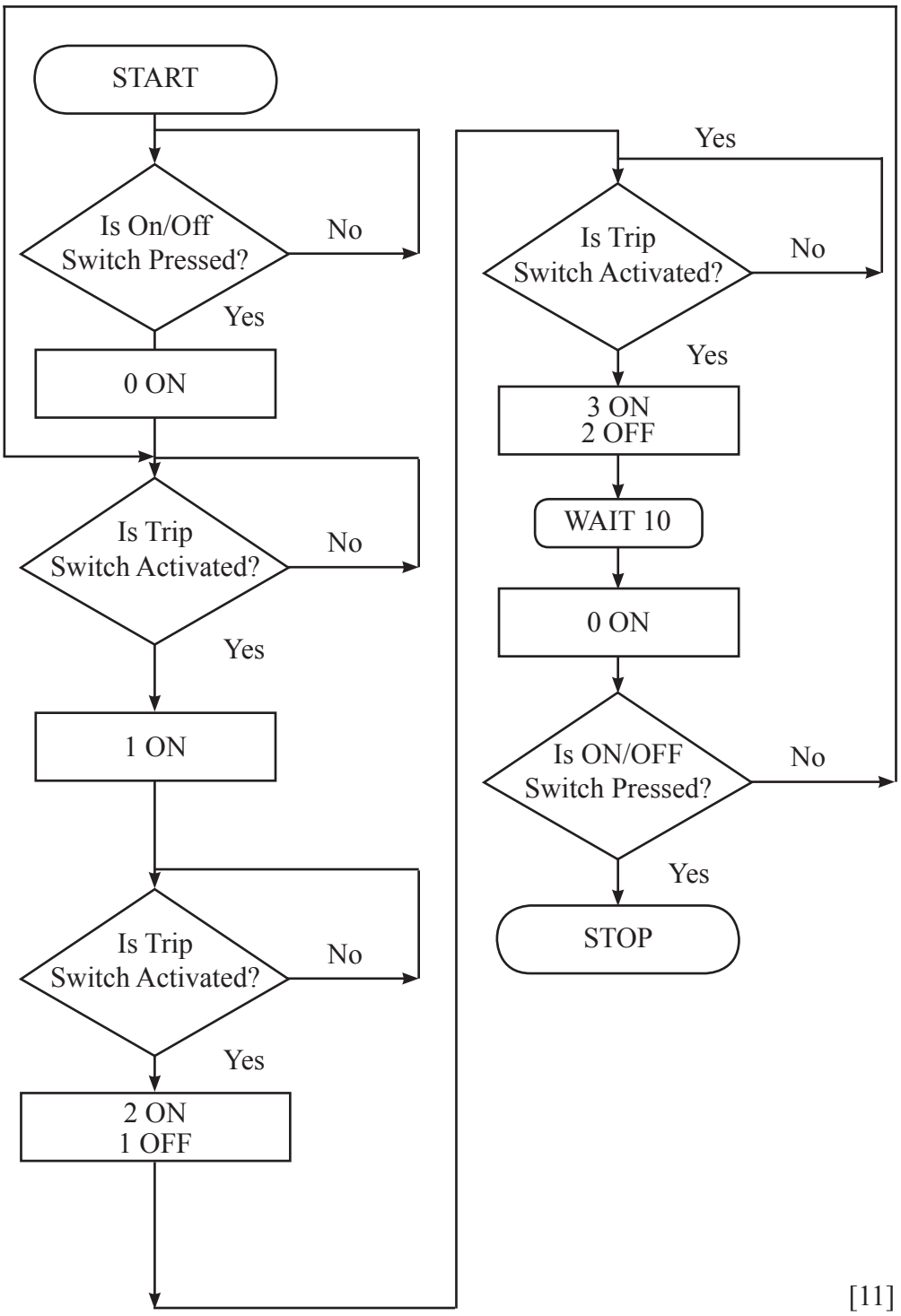
(ii)

Components	Input/Output
LED	**OUTPUT**
Reed Switch	**INPUT**
Buzzer	**OUTPUT**
Motor	**OUTPUT**
Position Sensor	**INPUT**

[5]

AVAILABLE MARKS

(b)



[11]

(c) TV display; Digital clock; calculator; microwave; washing machine [2]

20

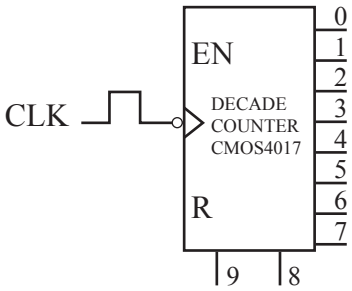
Option 2: Electric Systems and Control

18 (a) (i) DIL = Dual in Line [1]

(ii) IC = Integrated Circuit [1]

(iii) Decade = 10 outputs [1]

(b) (i)



[2]

(ii)

High Voltage represented by a 1, Low voltage represented by a 0 [2]

(c) (i) As each pulse arrives one of the outputs will go high every five minutes. This starts with pin 0 and happens one after the other but only one output remains on at any one time

1 Mk for one high every five minutes
1 Mk for reference to one after the other ie sequence/timing
2 Mk for starting at pin 0
1 Mk for reference to only one high at any one time. [5]

(ii) Pin 3 [1]

(iii) 555 Astable
Will continually pulse until the power is removed/
Output turns on/off continuously.
Turns on/off for set periods of time. [2]

555 Monostable
A circuit which is either on or off ie one stable state.
Pin 3 is turned on for a set period of time before turning off and remaining off [2]

(iv) Astable Circuit [1]

(v) Because the pulses are required to arrive in a set continuous Pattern. [2]

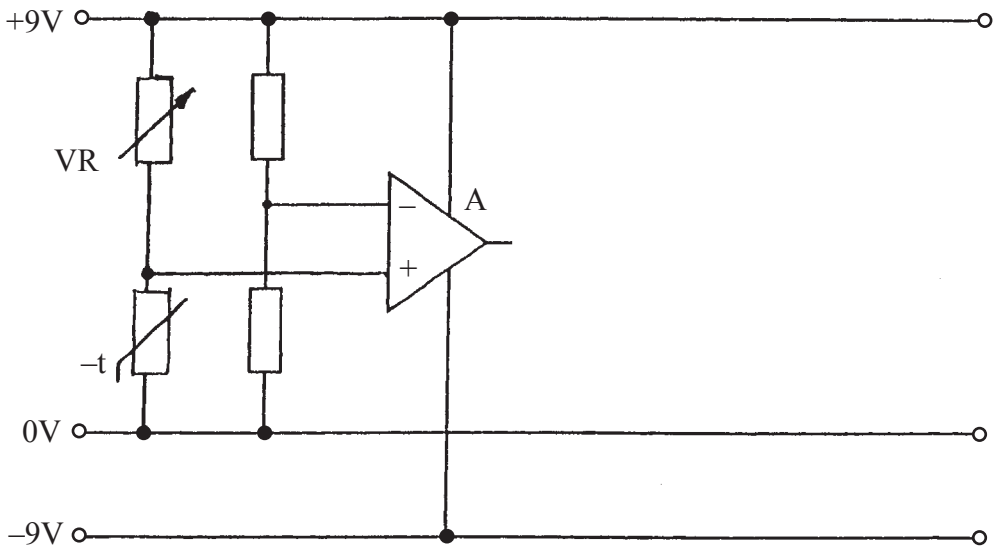
20

AVAILABLE MARKS

19 (a) (i) Component A = Operational Amplifier or Comparator [1]

(ii) Series or as a potential divider [1]

(b) VR = 1, VR connected at + 9v rail = 1
Thermistor = 1 , Thermistor connected at 0v rail = 1
Correct line to + pin on op amp = 1,
Connection to = 9v and 0v rails = 1.



[6]

(c) (i) Reference voltage labelled (- pin) [1]

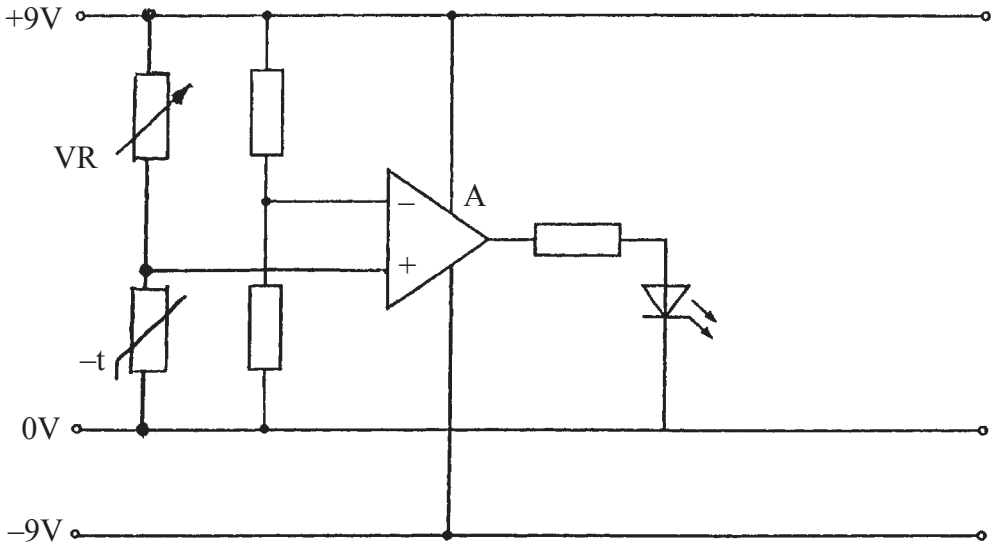
(ii) 4.5 Volts [1]

Use of formula on page 2 of examination paper
Or Because R1 = R2 = 9/2 = 4.5Volts
Or Because both resistors are the same value then the voltage drop across each will be the same. [2]

(iii) The reference voltage of 4.5V is fixed by Rl and R2. This reference voltages is then compared with the variable input at the + pin and determines when the output from the op amp will go high. [2]

AVAILABLE MARKS

(d) 1 LED, 1 Protective resistor, 1 for correct connections [3]



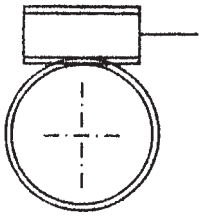
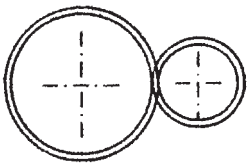
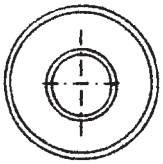
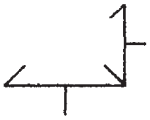
Temp falls = increase in thermistor resistance = 1

Therefore voltage increase at + pin = 1

When greater than ref voltage of 4.5v output will go high = 1 [3] 20

AVAILABLE MARKS

20 (a)

Symbol	Name of Symbol
	**Worm and worm wheel**
	**Meshed gears**
	**Compound gear**
	**Meshed bevel gears**

[4]

(b) (i) GR = No. of teeth of driven gear/ No. of teeth of driver gear
= 50/10 = 5:1 [2]

(ii) Speed of driven gear = No of teeth of driver gear × speed of driver gear/No. of teeth of driven gear
= 10/50 × 2800 = 560 rpm [2]

(c) (i) GR = No. of teeth of driven gear/ No. of teeth of driver gear
= 120 × 120/10 × 10 = 144:1 [4]

(ii) Speed of driven gear = No of teeth of driver gear × speed of driver gear/No. of teeth of driven gear
= 10 × 10 × 2800/120 × 120 = 19.44 rpm [5]

(iii) Second Gear System
It will allow the rotation to go much slower [3]

20

		AVAILABLE MARKS
21 **(a)**	Oscillating Reciprocating Rotating [3]	
(b) **(i)**	Any **one**: Hard wearing or durable Heat resistant High frictional property [1]	
(ii)	@ pivot cm = acm $400 \times 600 = F \times 200$ [1]	
	$\frac{400 \times 600}{200} = F$ [1]	
	$1200 = F$ [1]	
(c) **(i)**	Bevel [1]	
(ii)	Worm and wormwheel [1]	
(iii)	Mechanical advantage $= \frac{2400}{40}$ [1]	
	$= 60$ [1]	
(iv)	$\frac{45}{30} \times 4$ [1]	
	$= 6$mm [1]	
(v)	velocity ratio $= \frac{\pi \times 400}{6}$ [2]	
	$= 209.4$ [1]	
(vi)	Any **two**: Use a greater gear ratio for A to B Use a greater crank radius Use a greater thread pitch [4]	20

AVAILABLE MARKS

22 **(a)** **(i)** Reservoir [1]

(ii) Flow regulator or flow restrictor [1]

(b) **(i)** $F = P \times A$

$A = \frac{F}{P}$ [1]

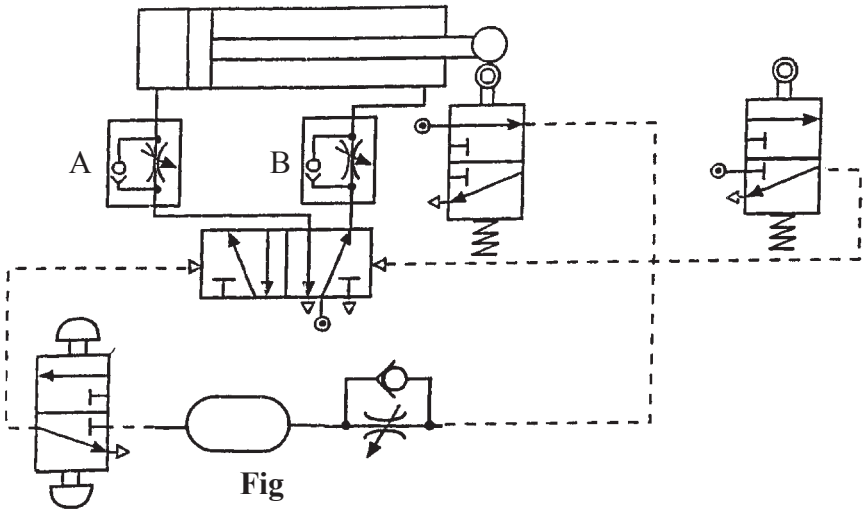
$= \frac{300}{0.6}$ [1]

$= 500mm^2$ [1]

(ii) The piston Reciprocates [1]

(iii) Adjust the restrictor on valve B [2]

(iv) Two components shown [1]
Components in correct order [1]
Components in correct position [1]



Fig

(c) **(i)** A outstrokes [1]
B **and** C outstroke [2]
A instrokes [1]
B instrokes [1]
C instrokes [1]

(ii) Insert a 3/2 valve at the instroke position of C [1]
Connect the signal from this valve to supply port of start valve. [1]
Change start valve to button return [1] 20

AVAILABLE MARKS

23 **(a)**

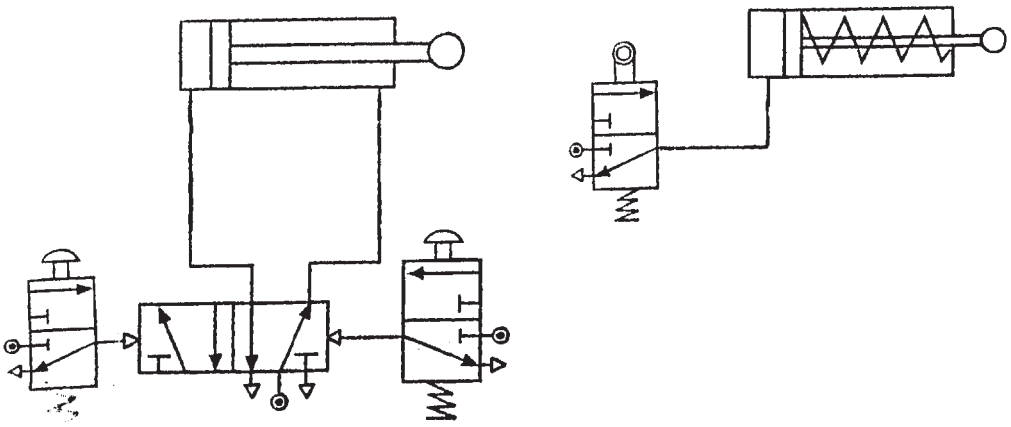
Number of ports	3
Number of switching positions	2
Method of operation	solenoid

[3]

(b) **(i)** Valve A controls the flow of air to the air bleed [1]
Valve B controls the speed of the cylinder piston [1]

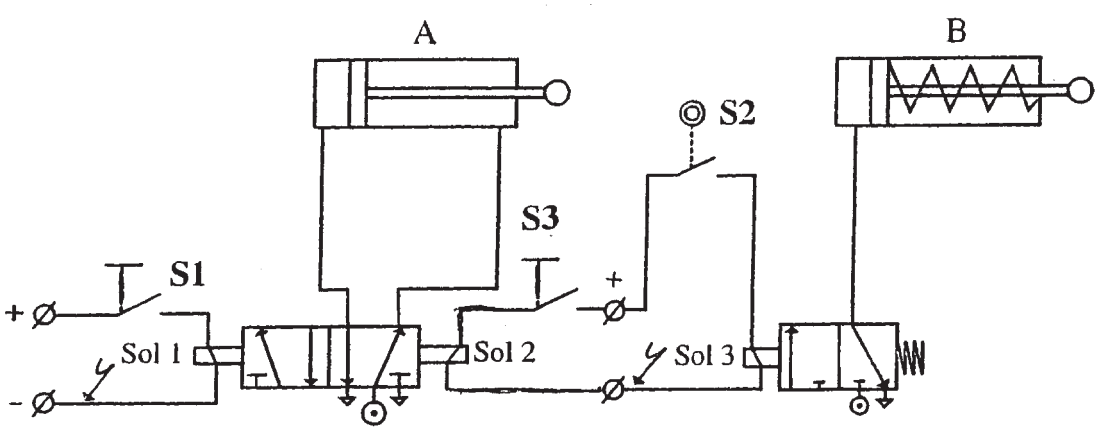
(ii) Parcel covers air bleed [1]
Pressure rises and switches valve C [1]
Cylinder outstrokes and pushes parcel off belt [1]

(c) 3/2 start valve spring return [1]
Connection to 5/2 [1]
3/2 valve at outstroke of A [1]
Connection to cylinder B [1]
Reset valve connected to 5/2 valve [1]

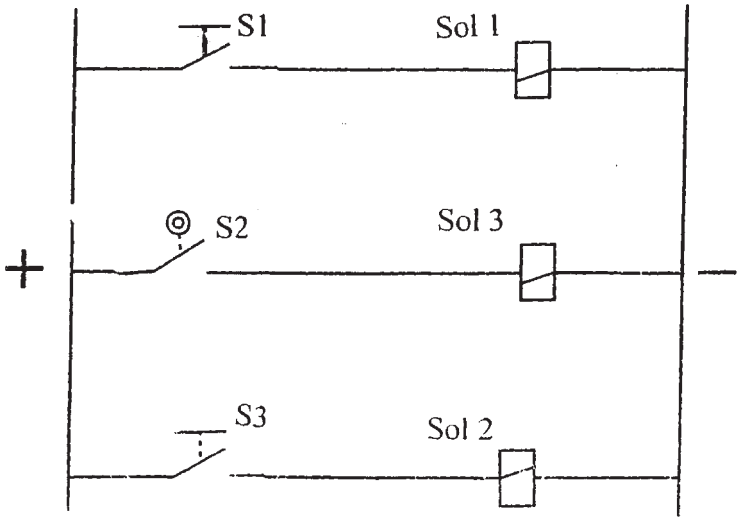


AVAILABLE MARKS

(d) S1 switch connected to sol 1 [1]
Push button operation [1]
S2 roller operated at A+ connected to sol 3 [1]
S3 push button connected to sol 2 [1]



Ladder Diagram
S1 – Sol 1 [1]
S2 – Sol 3 [1]
S3 – Sol 2 [1]



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The assessment of quality of written communication.

Marks are to be allocated to QWC in accordance with the following criteria.

Performance Level	Criteria	Marks
Threshold	Candidate spell, punctuate and use the rules of grammar with reasonable accuracy; they use a limited range of specialist terms appropriately.	0, 1, 2, 3
Intermediate	Candidate spell, punctuate and use the rules of grammar with considerable accuracy; they use a limited range of specialist terms with facility.	4, 5, 6
High	Candidate spell, punctuate and use the rules of grammar with almost faultless accuracy; deploying a range of grammatical constructions; they use a wide range of specialist terms adeptly and with precision.	