

**MARK SCHEME for the May/June 2010 question paper
for the guidance of teachers**

0445 DESIGN AND TECHNOLOGY

0445/42

Paper 42 (Systems and Control), maximum raw mark 50

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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Page 2	Mark Scheme: Teachers' version	Syllabus
	IGCSE – May/June 2010	0445

Section A

1 Input: Rotary (CW)
Output: Reciprocating

2 (a) Eccentric [1]

(b) Follower [1]

3

Method	Example of use
Spur gears	Lathe gear box (1)
Bevel gears	Hand drill (1)
Rack and pinion	Car steering system (1)

[3]

4 Reduce friction/wear and tear/smooth running [1]

5 (a) (i) Crane tower/building framework/pylons [1]

(ii) Tanker/boat hull/car body [1]

(b) (i) Tension [1]

(ii) Force x perpendicular distance from pivot [2]

6 Increases rigidity (1) and ability to withstand buckling (1)
Distribution of loading (1) [2]

7 Strain gauge/Dial gauge [1]

8

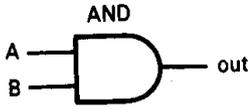
Meter	Units measured	Example of use
Ammeter	AMPS (1)	Measure current flowing through a transistor.
Voltmeter	Volts	Measure voltage across a potential divider. (1)
Multi-meter (1)	OHMS (1)	Check the continuity of an electrical lead.

[4]

Page 3	Mark Scheme: Teachers' version	Syllabus
	IGCSE – May/June 2010	0445

- 9 (a) LDR (Light dependant resistor)
- (b) Protects (1) the Transistor from back EMF (1) created by the coil of the relay.

10

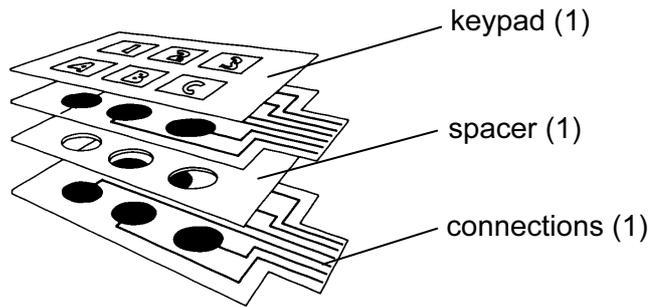


[2]

[Total: 25]

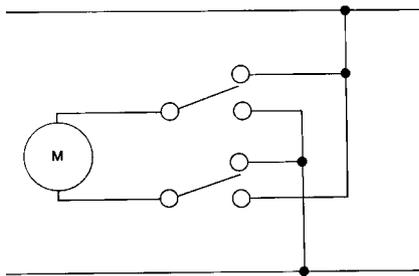
Section B

- 11 (a) (i) Reed switch [1]
- (ii) A burglar alarm (1) on a bicycle that is activated when the bike is moved (1). [2]
- (iii)



[3]

(b)



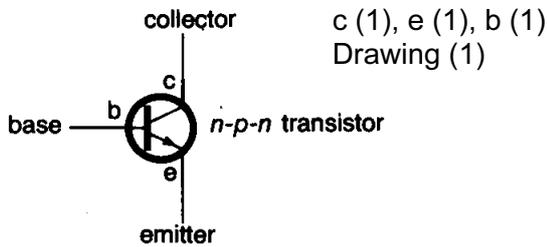
Appropriate example (1)
 Circuit works (1)
 Correctly drawn to convention (1)

[3]

Page 4	Mark Scheme: Teachers' version	Syllabus
	IGCSE – May/June 2010	0445

(c) (i) A small current flowing at the base (1) enables a large current (1) to flow in the collector/emitter circuit (1).

(ii)



[4]

(d) Clamp a heat sink (1) to leg that is being soldered (1)

[2]

(e) Burglar alarm system/washing machine controller

[1]

(f) (i) OR

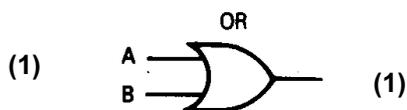
[1]

(ii)

A	B	Q
0	0 (1)	0
0	1	1 (1)
1	0	1
1	1 (1)	1

[3]

(iii)



[2]

12 (a)

Pulley System	Input	Output Direction	Output Speed
A	Clockwise	Anticlockwise (1)	Increased
B	Clockwise	Clockwise (1)	Increased
C	Anticlockwise (1)	Clockwise	Decreased (1)

[4]

(b) speed of driven = $\frac{\text{speed driver} \times \text{Ø of driver}}{\text{Ø of driven}}$ (1)

speed of driven = $\frac{1000 \text{ rpm} \times 90 \text{ mm}}{30 \text{ mm}}$ (1)

speed of driven = 3000 rpm (1)

[3]

(c) (i) Record player turntable/vacuum cleaner/sewing machine (1)

[1]

(ii) Wedge into their pulley wheels (1) to avoid slipping (1)

[2]

(iii) Pillar drill/lathe/car engine fan belt (1)

[1]

(d) (i) Velocity Ratio = $\frac{\text{Teeth on driver gear}}{\text{Teeth on the driven gear}}$ (1)

VR = 12 / 24 (1)

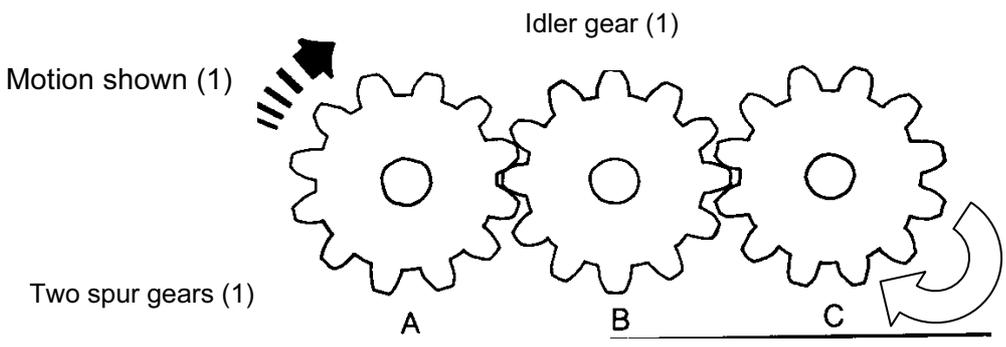
VR = 1 : 2 (1)

[3]

(ii) Decreased (1)

[1]

(iii)

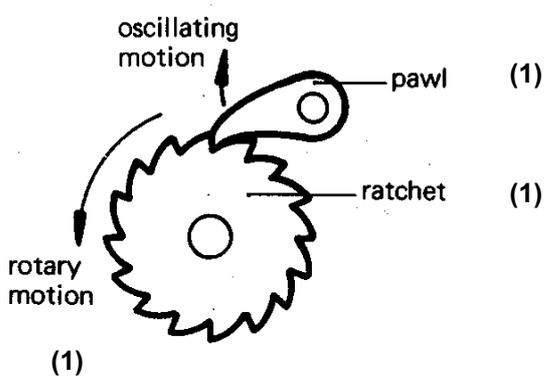


Accept schematic version

[3]

Page 6	Mark Scheme: Teachers' version	Syllabus
	IGCSE – May/June 2010	0445

- (e) (i) Winch/fishing reel
- (ii) Makes a shaft can rotate (1) in one direction only (1).
- (iii)

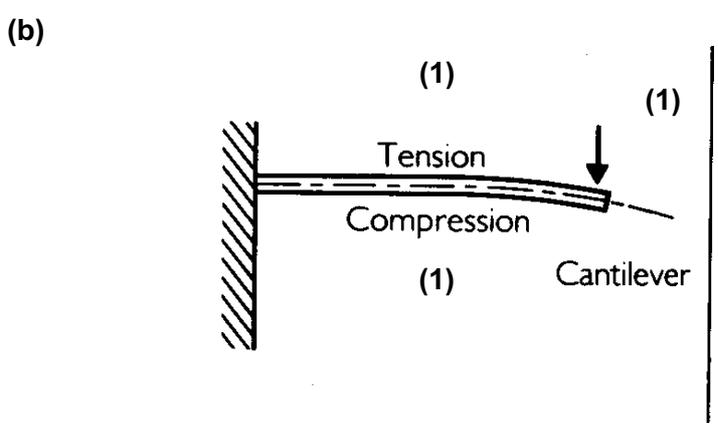


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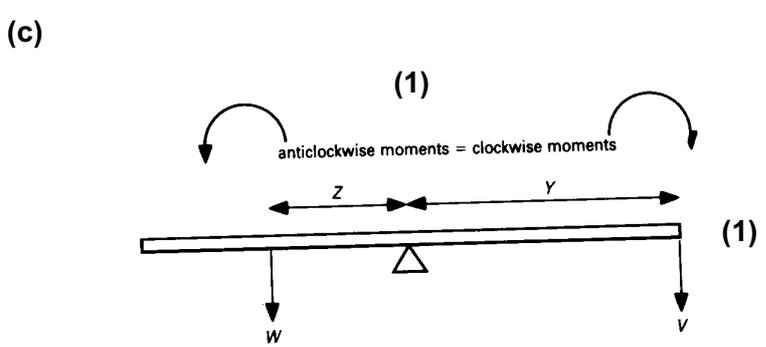
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13 (a) Cantilever

[1]



[3]



weight $W \times$ distance $Z =$ weight $V \times$ distance Y (1)

[3]

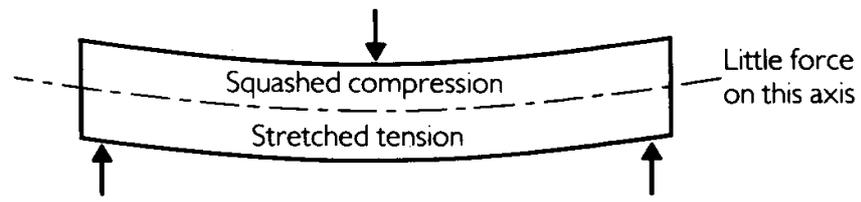
Page 7	Mark Scheme: Teachers' version	Syllabus
	IGCSE – May/June 2010	0445

- (d) Reaction at the wall = Force \times distance from the wall (1)
Reaction at the wall = 12N \times 600 mm (1)
Reaction at the wall = 7.2Nm (1)

- (e) Tubing has a good strength to weight ratio (1). It will support a load without placing too much load on the wall due to its own weight (1). [2]

- (f) (i) To distribute the load across a larger area (1) thus minimising the risk of a single fixing failure (1). [2]
(ii) Torsion [1]
(iii) The screw could shear (1) through its shaft (1)/or the screwhead could break off (1). [2]

- (g) (i) Increased rigidity of the frame (1) and thus more stability (1). [2]
(ii) Prevents the legs of the steps from splaying (1) thus making the steps safer and more robust (1). [2]
(iii) Increases the rigidity (1) and the capability to bear bending loads (1). [2]
(iv) Use notes and sketches to show the effect of loading on one of the stepladder treads.



[2]

[Total: 25]