UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2009 question paper

for the guidance of teachers

0445 DESIGN AND TECHNOLOGY

0445/04 Paper 4 (Technology), 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.

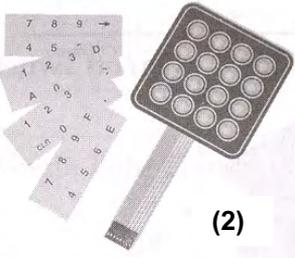- CIE will not enter into discussions or correspondence in connection with these mark schemes.

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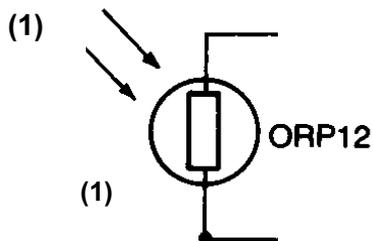
Section A

1 (a) **A** Framework
       B Shell

   (b) (i) Good strength to weight ratio (1) and combines the structural properties of both materials (1) [2]

       (ii) Plywood / internal doors / aircraft wing / display-board [1]

2

effort
(1)

fulcrum
(1)

load
(1)

[3]
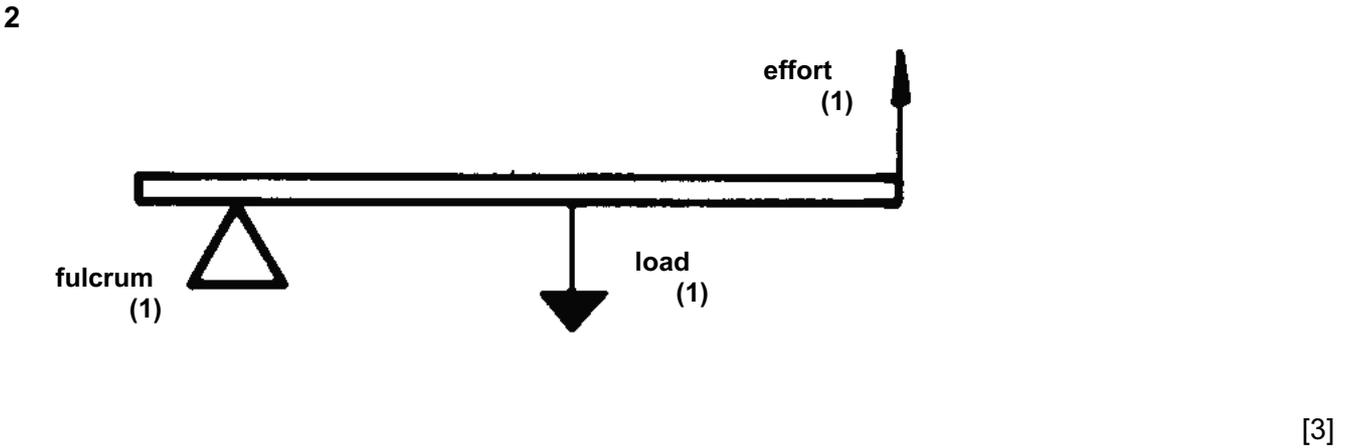
3 Complete the table showing a selection of electrical switches.

Type	Appearance	Application
REED **(1)**		Non-contact operation by magnet for detecting the opening or closing of doors/windows
Tilt		**DETECTS MOVEMENT** **(1)**
Membrane panel	**(2)**	Waterproof keypads

[4]

4 (a)

ORP12

(1)

(1)

[2]

   (b) Burglar alarm / movement detection / light level alarm   [1]

5 (a) Speed of the driven gear = speed of driver × gear ratio (R)
      R = Teeth on driver / Teeth on driven = 18 / 12 (1)
      R = 3 / 2 (1)
      Speed = 200 × 3 / 2 = 300 rpm (1)   [3]

   (b) Add an idler gear (1) between the driver and driven gears (1)   [2]

6 **OR**   [1]

7 Cantilever   [1]

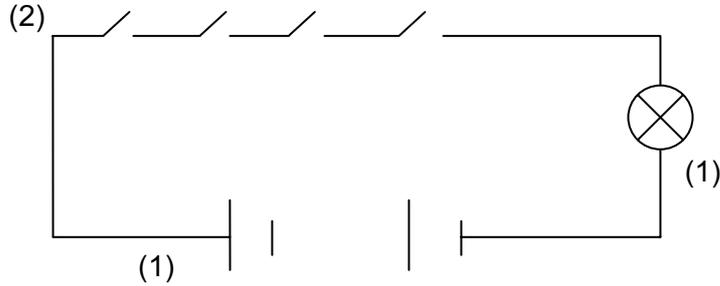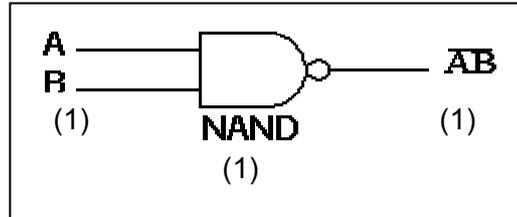8 First   [1]

9 Drilling machine / lathe   [1]

10 Reduce friction / reduce wear and tear / energy efficiency   [1]

Section B

11 (a) Washing machine programme controller / alarms

(b) (i)

(2)

(1)

(1)

[4]

(ii) Sketch the circuit symbol for a **NAND** gate.

A
B
(1)   NAND   (1)
(1)

[3]

(iii) Complete the truth table below for a **NAND** gate.

Input A	Input B	Output
0	0	1
0	1	1
1	0	1
1	1	0

[3]

(b) (i)

Flat edge (–ve connection) (1)

Short leg negative (1)

Sketch quality (1)
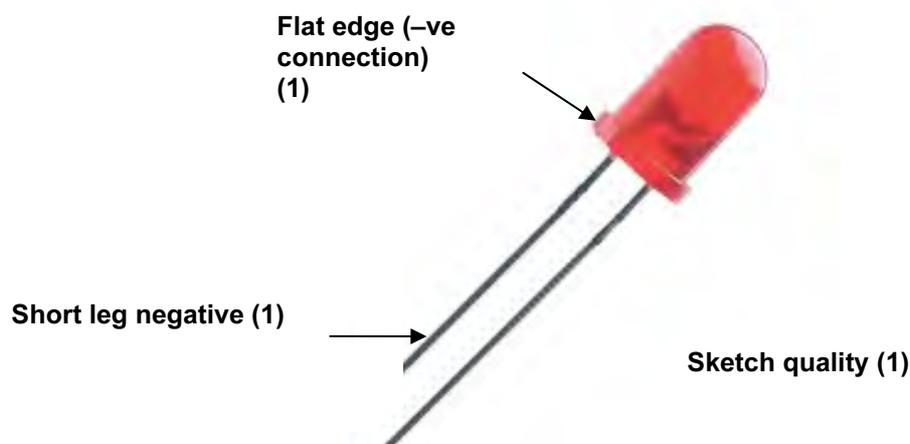
[3]

(ii) Protective resistor (1) that reduces current flow through LED (1) [2]

(iii) V = IR
I = V / R (1)
I = 9 / 470 (1)
I = 0.019 A (1) [3]

(iv) 1 Last longer / more robust [1]
2 Smaller / range of colours [1]

(v) Parallel [1]
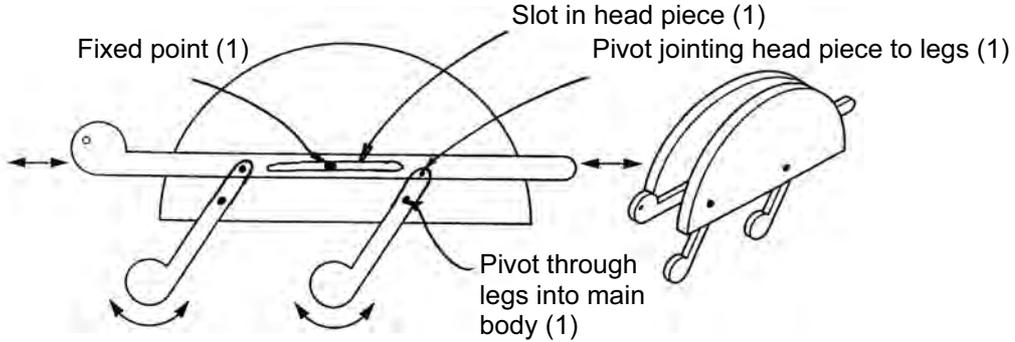
(c) 1st: Yellow [1]
2nd: Violet [1]
3rd: Brown [1]

12 **(a)** Head: Reciprocating
Legs: Oscillating

(b) Quality of response (1)

Slot in head piece (1)

Fixed point (1)   Pivot jointing head piece to legs (1)

Pivot through
legs into main
body (1)

[5]

(c) (i) Annotations (1)
Quality of response (1)

Slot and peg limits travel (2)
Part **(c)(ii)**

Bell crank
levers (2)
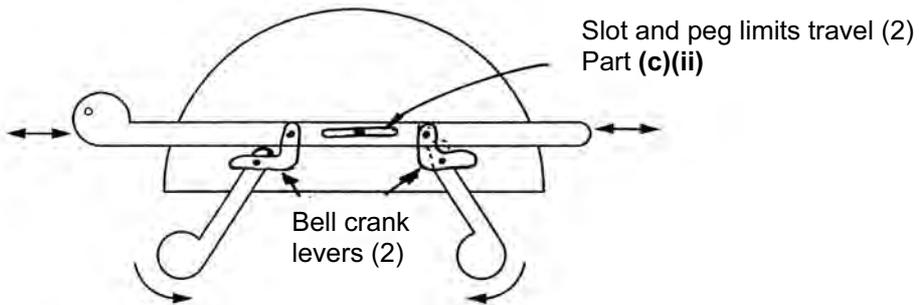
[4]

(ii) See Figure above   [2]

(iii)

Card backing board. (1)

Paper
fasteners

Card pieces (1)
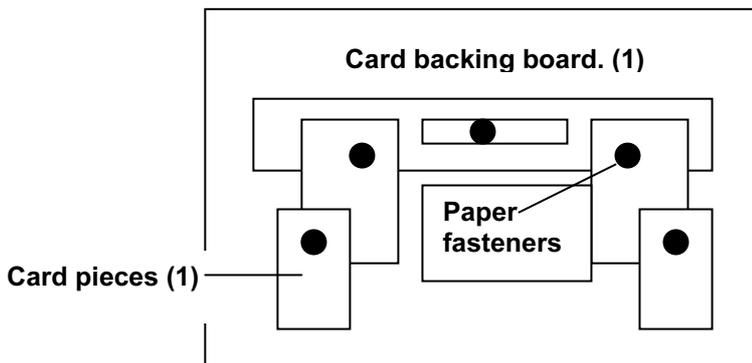
[3]

(iv) Saves materials (1); simulates movement exactly (1)   [2]

(d) (i) Guitar tuner

    (ii) Enables precise, small incremental movements (1) and enables great speed reduct... change axis of rotation (1)

    (iii) Ratio = 1: 40   [1]

    (iv) If the speed of the worm is 200 rpm calculate the output speed from the wormwheel.
Output speed = Input speed × 1 / 40
Output speed = 200 / 40 (1)
Output speed = 5 rpm (1)   [2]

13 (a) (i)
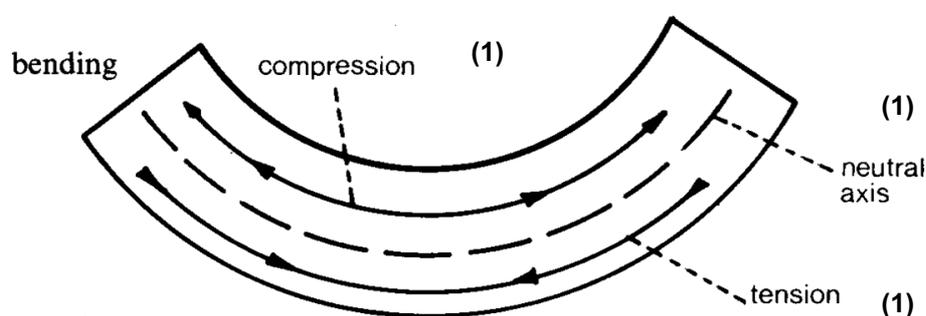
                                                           [3]

    (ii) Add vertical strip across the underside of the shelf   [3]

(b) Reactions at L and R.
R + L = 30 N
R × 1.2 = (0.25 × 10) + (0.55 × 15) + (0.95 × 5) (1)

$$R = \frac{2.5 + 8.25 + 4.75}{1.25} \text{ (1)}$$

R = 12.92 N (1)
L = 30N – 12.92 N = 17.08 N (1)   [4]

(c) (i)

[3]

(ii) Tension / Tensile [1]

(iii) All internal forces (1) are balanced by all external forces (1) [2]

(iv)

(a) Space diagram (1)
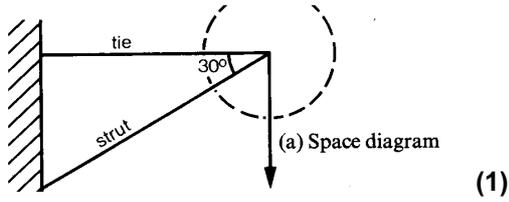
$F_T = 10 / Tan\ 30$ (1)
$F_T = 10 / 0.577 = 17.33$ N (1)

$F_S = 10 / Sin\ 30$ (1)
$F_S = 10 / 0.5 = 20.0$ N (1)

[5]

(d) (i)
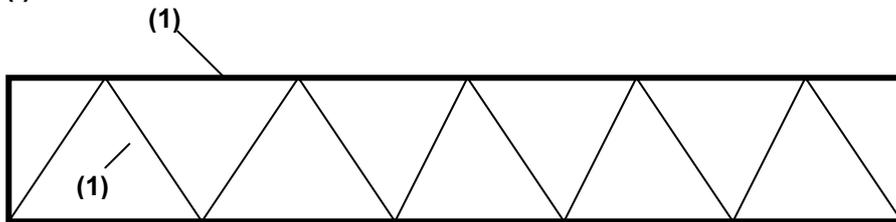
[2]

(ii) Good strength to weight ratio (1) and a low cost material (1) that can be recycled (1) [3]