UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

0445 DESIGN AND TECHNOLOGY

0445/42 Paper 4 (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.

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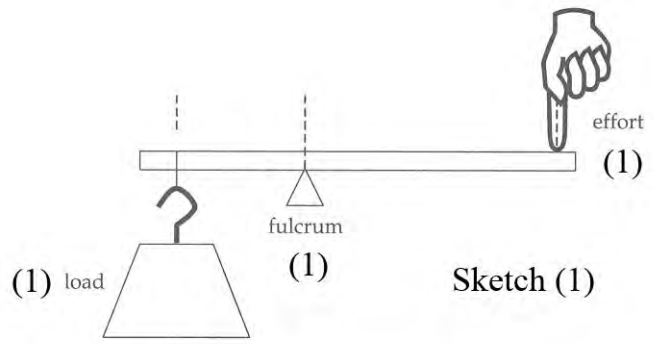
Section A

1 Linear
Rotary
Reciprocation [1]
Oscillation [1]

2 e.g.



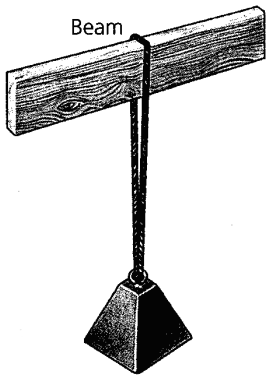
[4]

3 e.g. Car jack [1]

4 Static force does not move (1) dynamic force has greater effect due to the effects of gravitational force (1) which adds to the impact of the applied force (1). [3]

5 e.g. Legs of stool [1]

6



Turned edge on (1)

Sketch (1)

[2]

7 e.g. Name: Bracing [1]
Example: Diagonal member of a gate [1]

8 Small size, bright light, robust, different colours [2]

9 **(a)** Switch on capacitor charges up (1). When voltage at the base of the transistor re volts it switches on (1). The output LED is energised (1).

(b) Allows adjustment (1) of length of time before transistor switches on (and thus LED lights up) (1) [2]

(c) Electrolytic [1]

Section B

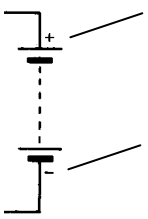
10 **(a)** TP = 1.1 × CR (1)
TP = 1.1 × 0.001F × 1000Ω (1)
TP = 1.1 Seconds (1) [3]

(b) **(i)** Push to make (PTM) [1]

(ii) Allows enough electricity to charge the capacitor (1) but does not stay switched on (1). [2]

(c) Purpose of R_2 is to limit the current flowing through the LED (1) and so protect it from overload and failure (1). [2]

(d) **(i)** Sketch and label the circuit symbol for a 9 V battery.



Positive (1)

Drawing (1)

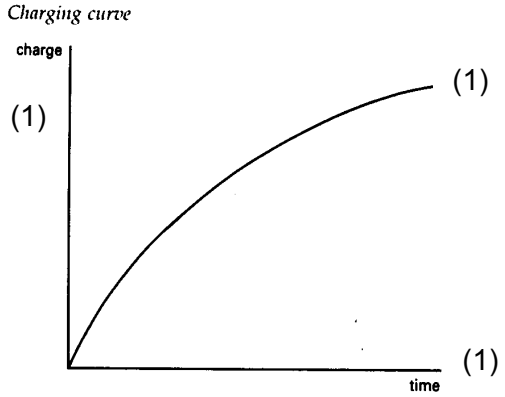
Negative (1)

[3]

(ii) Size (1), Safety (1), Portability (1), Remote location (1) [3]

(iii) Chemical (1) to Electrical (1) to Light (1) [3]

(e)



(1)

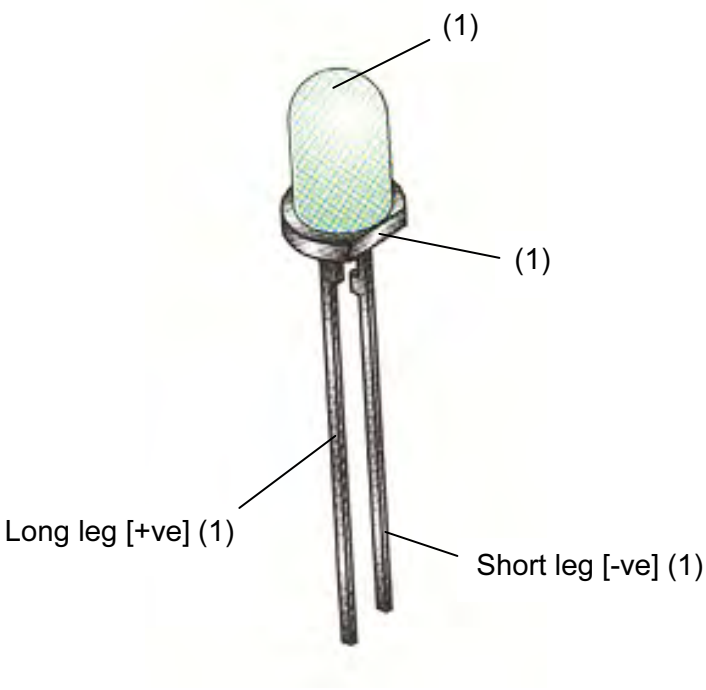
(1)

(1)

Quality of sketch (1)

[4]

(f)



[4]

11 (a) (i) Equal magnitude (1) opposite direction (1) [2]

(ii) Greater magnitude (1) opposite direction (1) [2]

(b) (i) Converts the direction of motion (1) through 90° (1), e.g. vertical to horizontal (1) [3]

(ii) Handbrake [1]

(c) $10\text{kg} \times 0.1\text{m} = 1\text{kg} \times d$ (1)

$d = \frac{1\text{kgm}}{1\text{kg}}$ (1)

$d = 1\text{m}$ (1) [3]

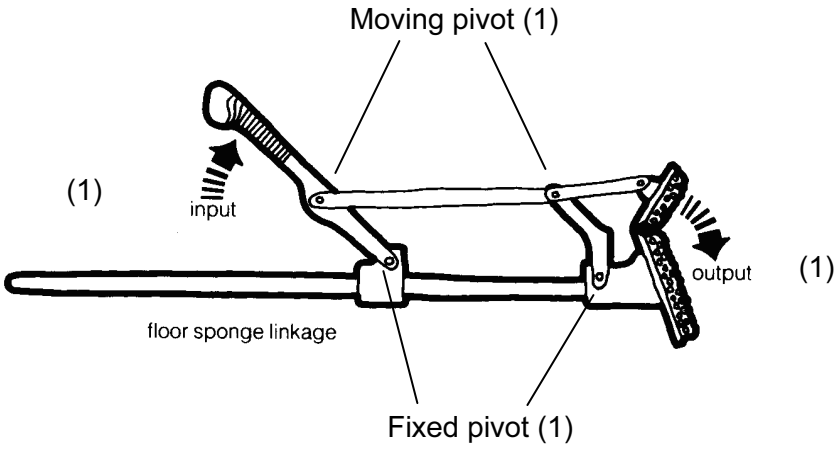
(d) A moment of force is the product (1) of force (1) and distance (1) acting at a point in a system. [3]

(e) The ratio (1) between the distance of the tracing arm pivot to the drawing arm pivot (1) determines the amount of magnification / reduction of the image produced (1). [3]

(f) (i) e.g. The clamp on a vacuum forming machine for holding the plastics sheet. [1]

(ii) Two links are on a common pivot (1), when the force is applied the free end is constrained to move in a straight line (1) and the maximum force occurs when the links are in a straight line (1). [3]

(g) (i)



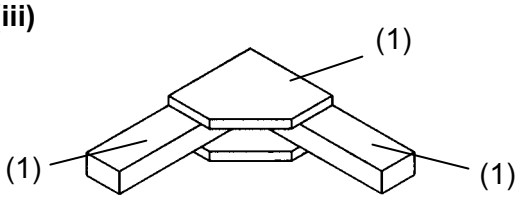
Input and output might be reversed. [2]

(ii) Fixed and moving pivot shown 2 × (1) [2]

12 (a) (i) Roof truss / framework [1]

(ii) Triangulation (1) increases rigidity (1)
Avoid collapse / buckling / failure (1) [2]

(iii)



[3]

(b) Folding a sheet (1) improves its stiffness / rigidity (1). [2]

(c) (i) Part **C** is a Reinforced beam [1]

(ii) e.g. It is used in construction of bridges / buildings [1]

(d) (i) Welding / gluing / riveting [1]

(ii) Self tapping screws / nut and bolt [1]

(e) $R_A + R_B = 28$ kN
Moments at R_A
$28\text{ kN} \times 3.8\text{ m} = R_B \times 12.9\text{ m}$ (1)

$$R_B = \frac{28\text{ kN} \times 3.8\text{ m}}{12.9\text{ m}}$$ (1)

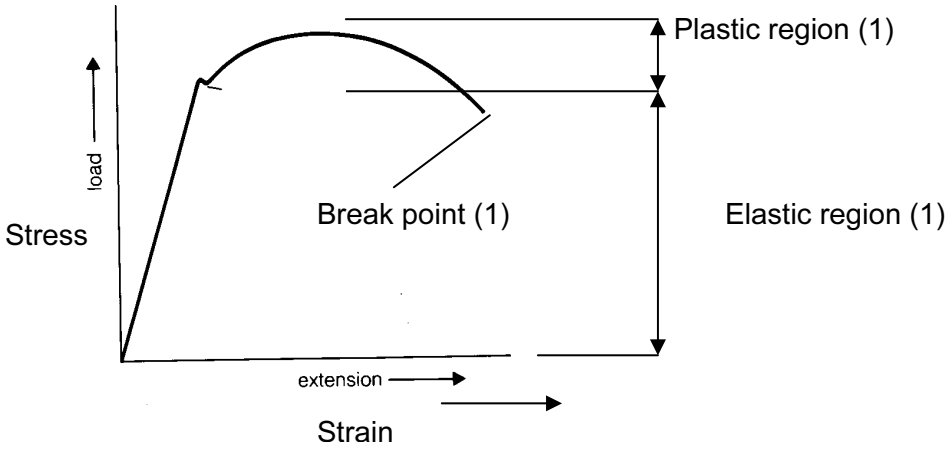
$R_B = 8.25$ kN (1)
$R_A = 28\text{ kN} - 8.25\text{ kN} = 19.75\text{ kN}$ (1) [4]

(f) **(i)** Because they are hollow sections (1) and offer a greater strength to weight rati

(ii) Table leg / column / pillar

(iii) The maximum forces on the beam act at its outer limits (1) therefore the beam needs a greater area of material there (1) to distribute the greater loading more efficiently (1). [3]

(g)



[3]