

MARK SCHEME for the October/November 2008 question paper

0445 DESIGN AND TECHNOLOGY

0445/04

Paper 4 (Technology), maximum raw mark 50

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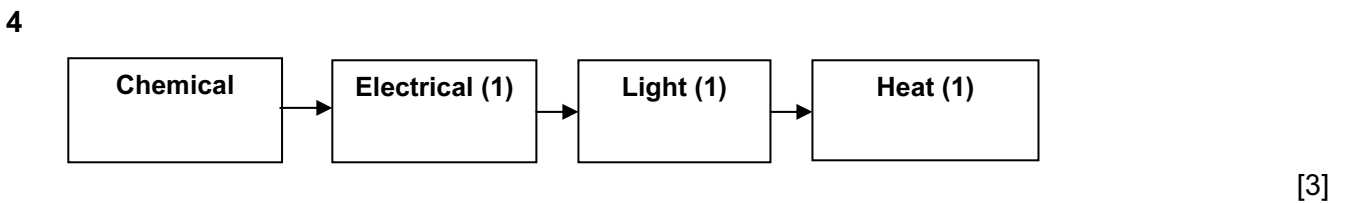
Section A

1 (a) Temperature [1]

(b) Freezer, microwave, oven, car frost alarm... [1]

2 Linear, rotary, reciprocating, oscillating [3]

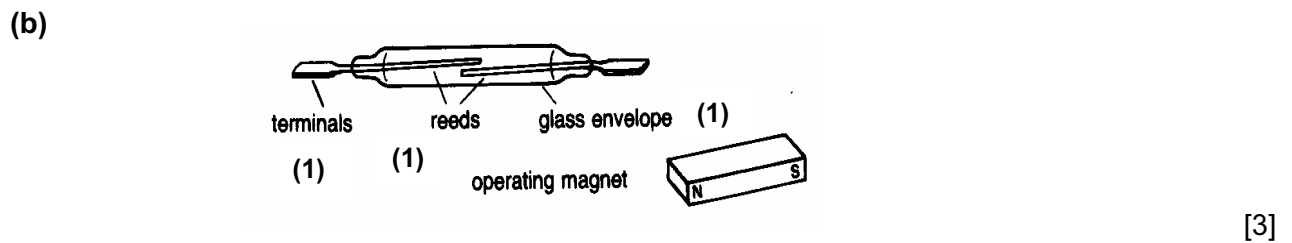
3 Load (1); Effort (1); Fulcrum (1) [3]



5 (a) Car steering/pillar drill/ [1]

(b) Rotary (1) to Linear (1) change in direction or axis (1) [3]

6 (a) Burglar alarm sensor on window/door [1]



(c) Burglar alarm sensor on window/door [1]

7 Modelling a circuit (1) using discrete components in a pegboard (1) [2]

8 Distance [1]

9 (a) Torsion [1]

(b) Drive shafts [1]

10 Pulleys/Belts [1]

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Section B

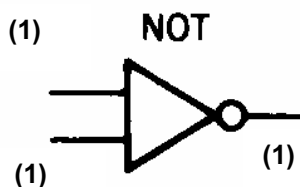
Answer **one** question from this section.

- 11 (a)** Water completes the circuit (1) this causes electricity to flow down through the base circuit (1) triggering the transistor. This allows a larger current to flow through the collector/emitter circuit activating the relay and thus the pump circuit (1) [3]
- (b)** Limits the voltage across the base circuit (1) and thus sets the correct base current (1) biasing (1) the transistor. [3]
- (c)** It protects the transistor (1) from back e.m.f. generated by the relay coil (1). [2]
- (d)** Acts as an interface device (1) between low current transistor circuit (1) and the high current pump circuit (1). [3]
- (e)** Adding a second transistor (1) to make a Darlington pair (1). [2]
- (f)** $R_T = V / I = 9 / 0.001$ (1)
 $R_1 + R_2 = R_T = 9\text{k}\Omega$
 $R_2 = V / I = 2 / 0.001 = 2 \text{ k}\Omega$ (1)
 Check: $R_1 = 7 / 0.001 = 7 \text{ k}\Omega$ $7\text{k}\Omega + 2\text{k}\Omega = 9\text{k}\Omega$ (1) [3]
- (g) (i)** A series of coloured bands (1) on the resistor body correspond to figures in a system to give the value. [1]
- (ii)** The degree of accuracy (1) of the resistor value in practice (1). [2]
- (h) (i)** Truth table for a NOT gate.

Input	Output
0	1
1	0

[3]

(ii)

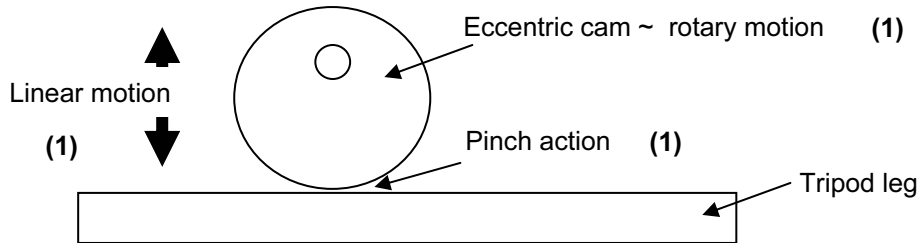


[3]

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12 (a) Cranked handle increases the moment (1) for the user. This makes a greater MA and thus easier operation with less effort (1) [2]

(b)



[3]

(c) Maintain stability of centre column (1) thus ensures smooth motion of the rise and fall of the camera platform (1).
Stability (1)/stop legs splaying (1) [2]

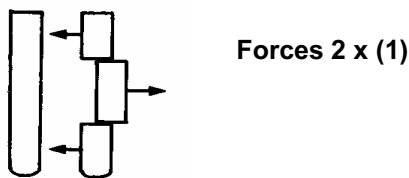
(d)



[2]

(e) Handle has a pinion gear, which meshes with rack on column (1) this allows movement up or down by turning the handle (1) [3]

(f)

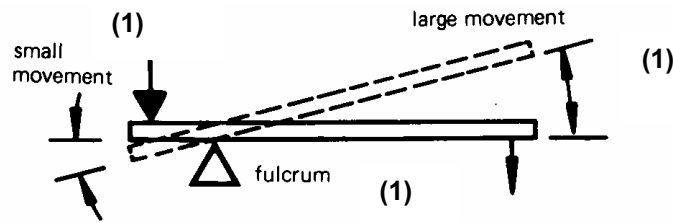


[2]

(g) (i) A lever provided MA (1) this means less effort is needed (1). [2]

(ii) 2nd. order [1]

(iii)



[3]

(h) (i) Using “Meccano” (1) pieces bolted together (1). [2]

(ii) CAD/card and paper fasteners [1]

(iii) Allows adjustment of sizes, positions of pivots etc. (1) without using expensive materials (1). [2]

13 (a) Compression ~ top of beam (1)
Tension ~ bottom of beam (1) [2]

(b) As symmetrical $R_L = R_R$ (1) = 50N (1) [2]

(c) Name	Diagram	Use
Ribs	A 3D perspective drawing of a rectangular tray-like structure with several parallel, raised ribs along its length.	Plastics packaging [1]
Lamination/Sandwich [1]	A 3D perspective drawing of a sandwich panel consisting of three layers. The top and bottom layers are labeled 'Stiff material' and the middle layer is labeled 'Soft material'.	Display board
Triangulation	A 2D line drawing of a roof truss structure, showing a triangular arrangement of beams supported by a horizontal base.	Roof truss [1]
Folding	A 3D perspective drawing of a rectangular box made from folded cardboard, showing the flaps and the hollow interior.	Cardboard packaging [1]

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- (d) The greatest area of material is concentrated at the outer edges (1) this is where the maximum loads are located (1). This saves on materials and keeps the mass of the beam low (1). [3]
- (e) (i) This is the elastic region (1) where material elongates proportionally and when the load is removed the material returns to its original length (1). [2]
- (ii) This is the plastic region (1) where the material once deformed will not return to its original shape (1). [2]
- (iii) The material breaks or fails. [1]
- (f) (i) Stress = load / c/s area = $800\text{N}/4\text{ mm}^2$ (1)
Stress = 200 N/mm^2 (1) units (1) [3]
- (ii) Explain the effect on the stress would be reduced (1) to 50N/mm^2 (1) [2]
- (iii) Strain = change of length/original length
Strain = $0.04\text{ mm}/20\text{ mm}$ (1)
Strain = 0.002 (1) units (1) [3]