**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**International General Certificate of Secondary Education**

# MARK SCHEME for the October/November 2008 question paper

# 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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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UNIVERSITY of CAMBRIDGE
International Examinations

## Section A

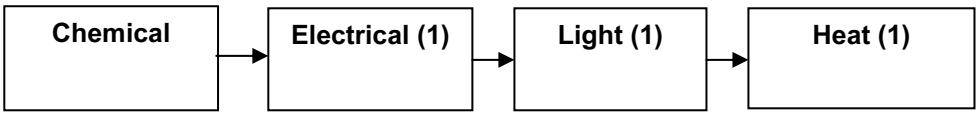
**1** **(a)** Temperature [1]

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

**2** Linear, rotary, reciprocating, oscillating [3]

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

**4**



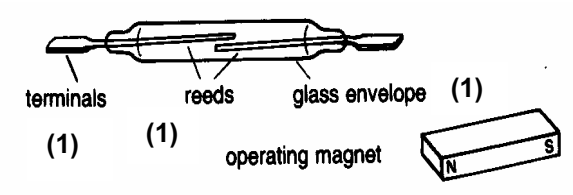

[3]

**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]

**(b)**




[3]

**(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]

**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)
$R_1 + R_2 = R_T = 9k\Omega$
$R_2 = V / I = 2 / 0.001 = 2\ k\Omega$ (1)
Check: R1 = 7 / 0.001 = 7 kΩ  7kΩ + 2kΩ = 9kΩ (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]

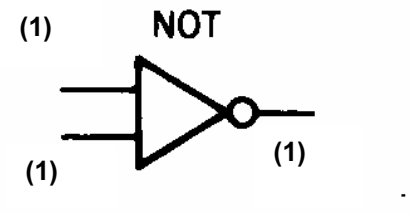
**(ii)** The degree of accuracy (1) of the resistor value in practice (1). [2]

**(h) (i)** Truth table for a NOT gate.

| Input | Output |
|---|---|
| 0 | 1 |
| 1 | 0 |

[3]

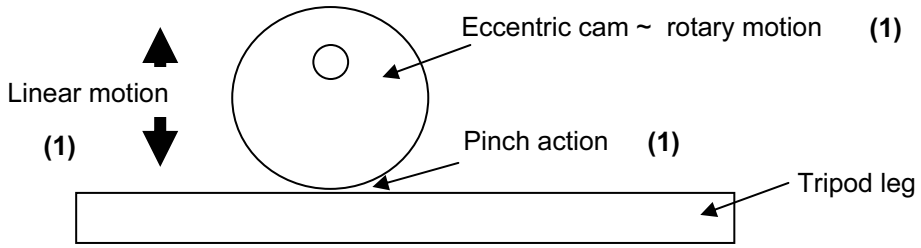
**(ii)**




[3]

**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]

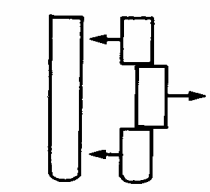
**(c)** Maintain stability of centre column (1) thus ensures smooth motion of the rise and fall of the camera platform (1).
Stability (1)/stop legs splaying (1) [2]

**(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)**



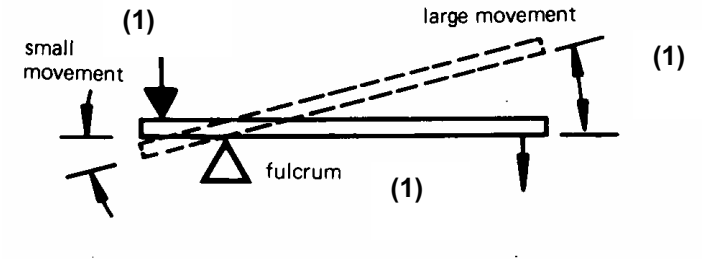
**Forces 2 x (1)**

[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]

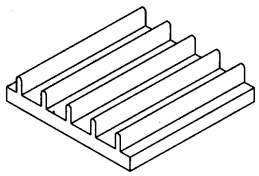
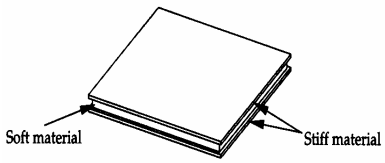
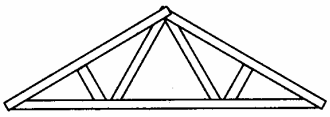
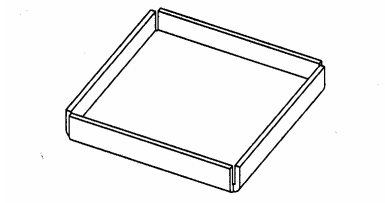
**(ii)** CAD/card and paper fasteners [1]

**(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 |  | **Plastics packaging [1]** |
| **Lamination/Sandwich [1]** |  | Display board |
| Triangulation |  **[1]** | **Roof truss [1]** |
| Folding |  | **Cardboard packaging [1]** |

**(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 = 800N/4 $mm^2$ (1)
Stress = 200 $N/mm^2$ (1) units (1) [3]

**(ii)** Explain the effect on the stress would be reduced (1) to 50$N/mm^2$ (1) [2]

**(iii)** Strain = change of length/original length
Strain = 0.04 mm/20 mm (1)
Strain = 0.002 (1) units (1) [3]