

UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua
Sidang 1988/89

MAC/April 1989

RGW 121 Sains Alam Sekitar I

Masa : (3 jam)

Sila pastikan bahawa kertas peperiksaan ini mengandungi LAPAN muka surat yang tercetak sebelum anda memulakan peperiksaan ini.

Jawab LIMA soalan: TIGA daripada Bahagian A dan DUA daripada Bahagian B.

Bahagian A

1. (a) Senaraikan 5 elemen iklim yang mustahak di dalam merekabentuk bangunan berteraskan iklim. Jelaskan secara ringkas unit-unit sukatan, peralatan dan kepentingan setiap elemen di atas.
- (b) Kawasan luar bangunan begitu penting di dalam iklim panas-lembap tropika. Jelaskan kepentingan dan peranan perkara-perkara berikut:

Pergerakan udara, peneduhan, tumbuh-tumbuhan dan perlindungan hujan.

(20 markah)

2. (a) Apakah yang dimaksudkan dengan penebatan haba? Jelaskan jenis-jenis penebatan ini dan penggunaannya di dalam rekabentuk bumbung dan dinding bangunan.
- (b) Anda dikehendaki merekabentuk alat peneduhan dengan menggunakan 'jangka sudut bayang' dan 'carta suria' yang dibekalkan. Tingkap yang perlu dilindungi berukuran 1.5m tinggi dan 3.0m lebar. Dinding 'menghala arah $210^{\circ}U$ dan tebal dinding ini ialah 200mm. Andaikan bangunan berada pada latitud $4^{\circ}U$ dan peneduhan perlu mulai jam 9.00 pagi sehingga jam 5.00 petang.

(20 markah)

3. (a) Apakah yang dimaksudkan dengan ventilasi untuk kesihatan? Jelaskan kaedah yang sesuai untuk memenuhi keperluan ini.
- (b) Rumah Melayu merupakan salah satu contoh reka-bentuk tempatan yang banyak menerapkan keperluan alir udara di dalam bangunan. Kemukakan contoh-contoh untuk menjelaskan kenyataan di atas dengan bantuan lakaran.
- (20 markah)
4. (a) Jelaskan beberapa kaedah kawalan sinaran matahari langsung untuk mencegah daripada masuk ke dalam bangunan. Nyatakan kebaikan dan keburukan setiap kaedah yang dicadangkan.
- (b) Kira nilai kehantaran terma (Nilau U) binaan-binaan berikut:
- (i) Binaan bumbung terdiri daripada asbestos simen berombak setebal 30mm, lapisan siling selari dengan bumbung setebal 13mm. Rongga udara setebal 50mm di antara dua lapisan direntangi foil aluminium bermuka dua.
- (ii) Binaan bumbung yang sama tetapi rongga udaranya diisikan dengan bulu kaca.
- (20 markah)

Bahagian B

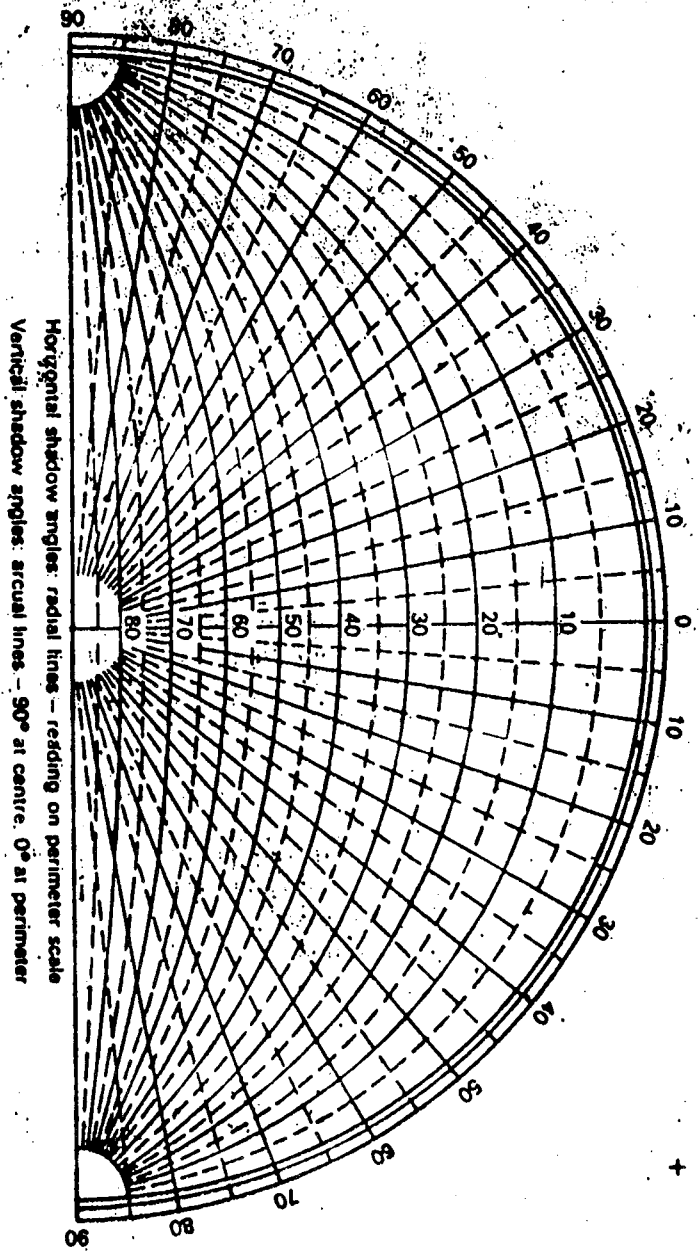
5. Apakah punca-punca pencemaran udara di Malaysia? Bincangkan kesan-kesan pencemaran ini.
- (20 markah)
6. Sediakan sebuah karangan tentang undang-undang dan piawaian yang berkaitan dengan pencemaran persekitaran di Malaysia.
- (20 markah)

7. Buat nota ringkas tentang perkara berikut:

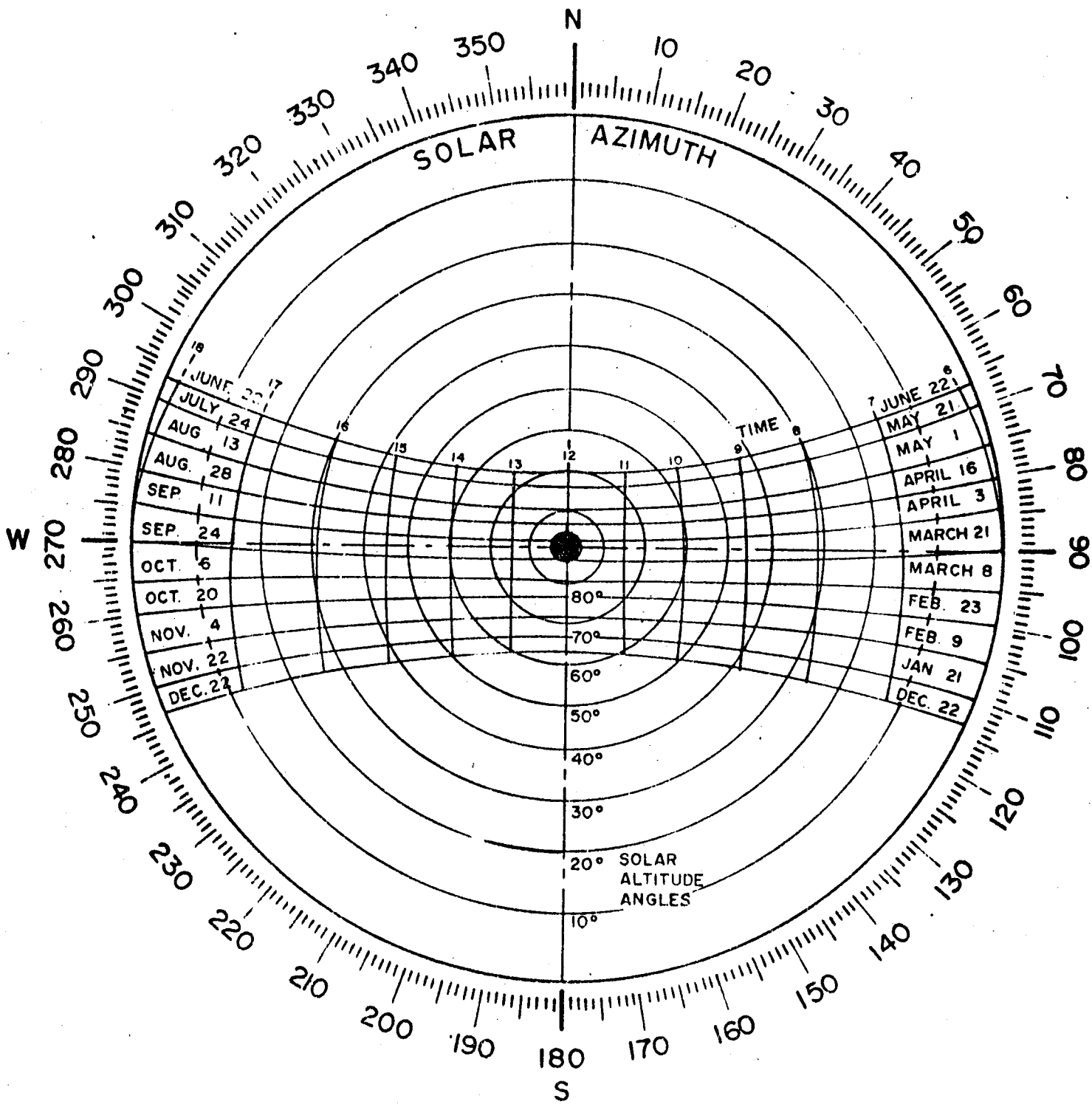
- (a) Penilaian kesan ke atas alam sekitar (Environmental Impact Assessment - EIA)
- (b) Punca-punca utama pencemaran air.
- (c) Pencemaran hingar.
- (d) Jenis penyerap-penyerap hingar.

(20 markah)

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SOLAR CHARTS



Latitude 4° North

Utilisation
factors for roof
windows

| | | Surface reflectances | | | | | | | | | |
|----------------------------------|----------------------------|----------------------|------|------|------|------|------|------|------|--|--|
| Ceiling | 0.7 | | | | 0.5 | | | | 0.3 | | |
| Wall | 0.5 | 0.3 | 0.1 | 0.5 | 0.3 | 0.1 | 0.3 | 0.1 | 0.0 | | |
| <i>Ri</i> | <i>Utilisation factors</i> | | | | | | | | | | |
| <i>Shed roof</i> | | | | | | | | | | | |
| 0.6 | 0.34 | 0.30 | 0.27 | 0.34 | 0.30 | 0.27 | 0.30 | 0.27 | 0.27 | | |
| 0.8 | 0.40 | 0.39 | 0.36 | 0.40 | 0.39 | 0.36 | 0.39 | 0.36 | 0.35 | | |
| 1.0 | 0.45 | 0.43 | 0.41 | 0.44 | 0.42 | 0.41 | 0.42 | 0.41 | 0.38 | | |
| 1.25 | 0.50 | 0.47 | 0.46 | 0.50 | 0.47 | 0.45 | 0.47 | 0.45 | 0.44 | | |
| 1.5 | 0.52 | 0.49 | 0.47 | 0.51 | 0.49 | 0.47 | 0.49 | 0.46 | 0.46 | | |
| 2.0 | 0.57 | 0.55 | 0.53 | 0.56 | 0.53 | 0.52 | 0.53 | 0.52 | 0.51 | | |
| 2.5 | 0.59 | 0.56 | 0.55 | 0.59 | 0.56 | 0.55 | 0.55 | 0.52 | 0.52 | | |
| 3.0 | 0.62 | 0.60 | 0.59 | 0.62 | 0.59 | 0.58 | 0.59 | 0.58 | 0.56 | | |
| 4.0 | 0.64 | 0.63 | 0.61 | 0.64 | 0.63 | 0.61 | 0.61 | 0.60 | 0.60 | | |
| 5.0 | 0.68 | 0.65 | 0.65 | 0.66 | 0.65 | 0.63 | 0.63 | 0.62 | 0.62 | | |
| inf | 0.76 | 0.76 | 0.76 | 0.74 | 0.74 | 0.74 | 0.73 | 0.73 | 0.71 | | |
| <i>Saw-tooth roof (vertical)</i> | | | | | | | | | | | |
| 0.6 | 0.07 | 0.06 | 0.04 | 0.07 | 0.05 | 0.04 | 0.05 | 0.03 | 0.03 | | |
| 0.8 | 0.11 | 0.08 | 0.07 | 0.10 | 0.08 | 0.06 | 0.08 | 0.06 | 0.05 | | |
| 1.0 | 0.14 | 0.11 | 0.10 | 0.13 | 0.10 | 0.09 | 0.10 | 0.08 | 0.07 | | |
| 1.25 | 0.16 | 0.13 | 0.12 | 0.15 | 0.13 | 0.11 | 0.12 | 0.10 | 0.09 | | |
| 1.5 | 0.17 | 0.15 | 0.13 | 0.16 | 0.14 | 0.12 | 0.13 | 0.12 | 0.10 | | |
| 2.0 | 0.19 | 0.17 | 0.16 | 0.18 | 0.16 | 0.15 | 0.15 | 0.14 | 0.12 | | |
| 2.5 | 0.21 | 0.20 | 0.18 | 0.20 | 0.18 | 0.17 | 0.17 | 0.16 | 0.14 | | |
| 3.0 | 0.22 | 0.21 | 0.19 | 0.21 | 0.19 | 0.18 | 0.18 | 0.17 | 0.15 | | |
| 4.0 | 0.24 | 0.22 | 0.21 | 0.22 | 0.21 | 0.20 | 0.19 | 0.18 | 0.17 | | |
| 5.0 | 0.25 | 0.24 | 0.23 | 0.23 | 0.22 | 0.21 | 0.20 | 0.20 | 0.18 | | |
| inf | 0.30 | 0.30 | 0.30 | 0.29 | 0.29 | 0.29 | 0.27 | 0.27 | 0.27 | | |
| <i>Saw-tooth roof (sloping)</i> | | | | | | | | | | | |
| 0.6 | 0.19 | 0.16 | 0.15 | 0.19 | 0.16 | 0.14 | 0.16 | 0.14 | 0.14 | | |
| 0.8 | 0.25 | 0.21 | 0.20 | 0.25 | 0.21 | 0.20 | 0.21 | 0.20 | 0.18 | | |
| 1.0 | 0.30 | 0.26 | 0.25 | 0.29 | 0.26 | 0.24 | 0.25 | 0.24 | 0.21 | | |
| 1.25 | 0.31 | 0.30 | 0.27 | 0.31 | 0.29 | 0.26 | 0.27 | 0.26 | 0.24 | | |
| 1.5 | 0.34 | 0.31 | 0.30 | 0.32 | 0.31 | 0.29 | 0.30 | 0.27 | 0.26 | | |
| 2.0 | 0.36 | 0.35 | 0.32 | 0.36 | 0.34 | 0.32 | 0.34 | 0.32 | 0.29 | | |
| 2.5 | 0.39 | 0.38 | 0.35 | 0.38 | 0.36 | 0.34 | 0.35 | 0.32 | 0.31 | | |
| 3.0 | 0.40 | 0.39 | 0.38 | 0.40 | 0.36 | 0.36 | 0.36 | 0.35 | 0.32 | | |
| 4.0 | 0.42 | 0.41 | 0.40 | 0.41 | 0.40 | 0.39 | 0.39 | 0.38 | 0.35 | | |
| 5.0 | 0.44 | 0.42 | 0.41 | 0.42 | 0.41 | 0.40 | 0.40 | 0.39 | 0.36 | | |
| inf | 0.49 | 0.49 | 0.49 | 0.48 | 0.48 | 0.48 | 0.45 | 0.45 | 0.42 | | |
| <i>Monitor roof (vertical)</i> | | | | | | | | | | | |
| 0.6 | 0.07 | 0.05 | 0.04 | 0.06 | 0.05 | 0.04 | 0.05 | 0.04 | 0.03 | | |
| 0.8 | 0.09 | 0.07 | 0.06 | 0.09 | 0.07 | 0.06 | 0.07 | 0.06 | 0.05 | | |
| 1.0 | 0.12 | 0.10 | 0.08 | 0.11 | 0.09 | 0.08 | 0.09 | 0.08 | 0.07 | | |
| 1.25 | 0.14 | 0.12 | 0.10 | 0.13 | 0.11 | 0.10 | 0.11 | 0.10 | 0.09 | | |
| 1.5 | 0.15 | 0.13 | 0.12 | 0.15 | 0.13 | 0.12 | 0.13 | 0.11 | 0.11 | | |
| 2.0 | 0.17 | 0.15 | 0.14 | 0.16 | 0.15 | 0.14 | 0.15 | 0.13 | 0.13 | | |
| 2.5 | 0.18 | 0.17 | 0.15 | 0.18 | 0.16 | 0.15 | 0.16 | 0.15 | 0.14 | | |
| 3.0 | 0.20 | 0.18 | 0.17 | 0.19 | 0.18 | 0.17 | 0.17 | 0.16 | 0.16 | | |
| 4.0 | 0.21 | 0.20 | 0.19 | 0.20 | 0.19 | 0.19 | 0.19 | 0.18 | 0.17 | | |
| 5.0 | 0.22 | 0.21 | 0.20 | 0.21 | 0.20 | 0.19 | 0.20 | 0.19 | 0.18 | | |
| inf | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.24 | 0.24 | 0.23 | | |

For other roof types see "Windows and environment" by W Burt *et al* (Pilkington)
or "Principles of natural lighting" by J Lynes (Elsevier)

Thermal design data

Conductivities
of some materials

| | Density (kg/m ³) | k (W/m degC) |
|-----------------------------|---------------------------------|-----------------|
| <i>Insulating materials</i> | | |
| Asbestos, sprayed | 130 | 0.046 |
| | 240 | 0.075 |
| Cork | | |
| board | 145 | 0.042 |
| floor tiles | 540 | 0.085 |
| Felt, undercarpet | 120 | 0.045 |
| Fibreboard (softboard) | 300 | 0.057 |
| Glass wool | | |
| mat or quilt | 80 | 0.035 |
| blanket | 145 | 0.042 |
| Kapok, quilt | 20 | 0.035 |
| Mineral wool | | |
| felt | 50 | 0.039 |
| mat | 180 | 0.042 |
| Perlite, loose fill | 65 | 0.042 |
| Polystyrene board | 15 | 0.037 |
| | 25 | 0.034 |
| Polyurethane | | |
| foam | 30 | 0.026 |
| rigid board | 30 | 0.020 |
| Strawboard | 350 | 0.110 |
| Urea formaldehyde foam | 12 | 0.036 |
| | 15 | 0.032 |
| Vermiculite, loose fill | 100 | 0.065 |
| Wool wool slab | 500 | 0.100 |
| | 600 | 0.110 |
| <i>Building materials</i> | | |
| Asbestos cement sheet | 1360 | 0.25 |
| | 1600 | 0.40 |
| | 2000 | 0.55 |
| Asphalt roofing | | |
| with mineral filler | 1600 | 0.43 |
| with mastic asphalt | 2325 | 1.15 |
| Brickwork, average | 2200 | 1.30 |
| | 1800 | 0.96 |
| | 1500 | 0.65 |
| Cement render | 1800 | 0.53 |
| Cement screeds | | |
| sand- | 2000 | 0.63 |
| vermiculite- | 500 | 0.18 |
| expanded clay- | 750 | 0.25 |
| foamed slag- | 1200 | 0.30 |
| Chipboard | 800 | 0.15 |
| Concrete, dense | | |
| gravel aggregate | 2300 | 1.80 |
| | 2100 | 1.40 |
| expanded clay aggregate | 1600 | 0.73 |
| foamed slag aggregate | 1600 | 0.55 |
| clinker aggregate | 1400 | 0.57 |
| Hardboard | 600 | 0.08 |
| Metals | | |
| steel | 7830 | 58 |
| aluminium | 2675 | 220 |
| copper | 8938 | 350 |

Heat: active thermal controls

| | | |
|--------------|------|------|
| Plasterboard | 950 | 0.16 |
| Plastering | | |
| gypsum | 1280 | 0.46 |
| vermiculite | 640 | 0.20 |
| Plywood | 530 | 0.14 |
| Stone | | |
| sand- | 2000 | 1.30 |
| lime- | 2180 | 1.40 |
| marble | 2500 | 2.00 |
| granite | 2600 | 2.50 |
| slate | 2700 | 2.00 |
| Timber | | |
| softwood | 610 | 0.13 |
| hardwood | 700 | 0.15 |

Film or surface conductances (f) in W/m² degC

| Surface | Surface emittance | |
|---------------------------------|-------------------|------------|
| | High (0.9) | Low (0.05) |
| <i>Internal (f_i)</i> | | |
| Wall | 8.13 | 3.29 |
| Ceiling or floor | | |
| heat flow up | 9.43 | 4.59 |
| heat flow down | 6.67 | 1.78 |
| <i>External (f_e)</i> | | |
| Wall | | |
| sheltered | 12.50 | 9.09 |
| normal exposure | 18.18 | 14.93 |
| severe exposure | 33.33 | 33.33 |
| *Roof | | |
| sheltered | 14.29 | 11.11 |
| normal exposure | 22.22 | 18.87 |
| severe exposure | 50.00 | 50.00 |

Cavity conductances (C_v) in W/m² degC

| Type of cavity | Surface emittance | |
|--|-------------------|-------|
| | High | Low |
| <i>Unventilated cavities</i> | | |
| 5 mm | | |
| wall or heat flow up | 9.09 | 5.56 |
| heat flow down | 9.09 | 5.56 |
| 20 mm | | |
| wall or heat flow up | 5.56 | 2.86 |
| heat flow down | 4.76 | 0.94 |
| With multiple foil insulation | | |
| wall or heat flow up | — | 1.61 |
| heat flow down | — | 0.57 |
| <i>Ventilated cavities</i> | | |
| Between asbestos cement ceiling and dark metal | 6.25 | 3.33* |
| Between ceiling and asbestos cement roof | 7.14 | 4.00* |
| Between ceiling and tiled roof with sarking | 5.56 | 3.87* |
| In ordinary cavity walls | 5.56 | — |

* Bright metal underside of roof or foil lining on ceiling.

