$q_u = 83 \cdot 92(T_u - T_o)$ ✓ 3/3

"Heat is lost from downstairs through the ceiling at a rate

$A_c U_c = 6 \times 10 \times 1 = 60 \text{ W/C}^\circ$ ✓

"Hence $q_{ud} = 60(T_u - T_d)$ ✓ 1/1

iii) $q_u = 83 \cdot 92(T_u - T_o)$

$= 83 \cdot 92(20 - 5)$

$= 1258 \cdot 8 \text{ W}$ ✓ 1/1

iv) "In equilibrium, heat is lost from the upstairs at the same rate as the upstairs gains heat by conduction from downstairs through the downstairs ceiling. ✓ 2/2

$q_u = q_b$

$83 \cdot 92(T_u - T_o) = -60(T_u - T_d)$

$83 \cdot 92(T_u - 5) = -60(T_u - 20)$

$83 \cdot 92T_u + 60T_u = 1200 + 419 \cdot 6$ ✓

$T_u = \frac{1619 \cdot 6}{143 \cdot 92} = 11 \cdot 25^\circ C$ ✗ I misread the "=" sign and ganomitted the "÷" sign. Hence the "x" marks. Be more clear! ✓ 1/1

$T_u = 11 \cdot 25^\circ C$ 3⁻/3

$q_u = 83 \cdot 92(T_u - T_o)$

$= 83 \cdot 92(11 \cdot 25 - 5) = 524 \cdot 5 \text{ W}$

v) Without zone heating ("I assume) the heating is on upstairs and downstairs from 7 o'clock in the morning until 11 o'clock in the evening.

With zone heating, during the day heat is saved at a rate $1258 \cdot 8 - 5245 = 734 \cdot 3 \text{ W}$ (between the hours of 7 and 11 o'clock) Heat is saved per year at a rate $7343 \times 60 \times 60 \times 12 \times 200 = 6 \cdot 344 \times 10^9 \text{ J}$ (per year) given that zone heating saves 12 hours heating 200 days per year ✓ 4/4

$\text{savings} = \frac{\text{heat saved}}{\text{heat value of 1 unit}} \times \text{cost per unit}$

$= \frac{6 \cdot 344 \times 10^9}{1000 \times 60 \times 60} \times 0 \cdot 05 = £88 \cdot 116$ ✓

As you used your rounded up values from above - can your answer now be correct to 3.d.p ?

3½/4