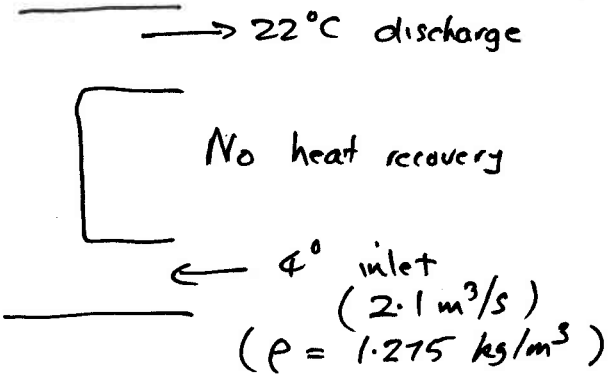
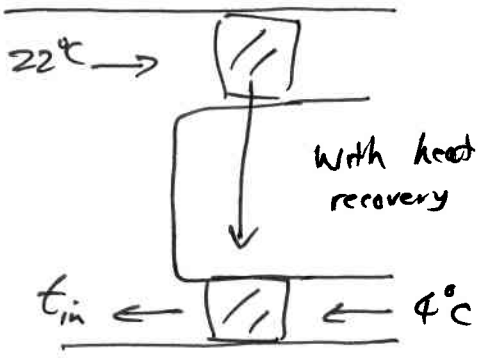
Qu. 4 In each case determine the energy & cost savings





In each case: thermal ratio = $\frac{t_{in} - 4}{22 - 4}$

(i) thermal wheel: $0.89 = \frac{t_{in} - 4}{22 - 4}$ $\therefore t_{in} = 20°C$

Heat saving = $\dot{m} C_p \Delta T$ = $2.1 \times 1.275 \times 1.01 \times (20 - 4)$

= 43.3 kW

Over 1000 hrs energy = 43.3×10^3 kWh

Cost saving (NB 3.6 kWh = 1 MJ) = $43.3 \times 10^3 \times 3.6 \times 0.45$ p

= £700.7

$\therefore$ Break even time = $\frac{1753}{700.7}$ = 2.5 yrs

(ii) run-around coils: $0.43 = \frac{t_{in} - 4}{22 - 4}$ $\therefore t_{in} = 11.7°C$

& repeating above rates gives a break-even time =

$\frac{1102}{337.3}$ = 3.27 yrs

(iii) heat pump: $1.2 = \frac{t_{in} - 4}{22 - 4}$ $\therefore t_{in} = 25.6°C$

$\dot{Q} = 2.1 \times 1.275 \times 1.01 \times (25.6 - 4)$ = 58.4 kW

Cost saving (heating) = $58.4 \times 10^3 \times 3.6 \times 0.45$ p = £946.3 p.a

Cost of running heat pump = $\frac{58.4}{5.2} \times 2.9 \times 1000$ p = £325.7 p.a

Net saving is £946.3 − £325.7 = £620.6

$\therefore$ Break-even time = $\frac{£5000}{620.6}$ = 8 years Option (i) looks best