

## Answers Swaminathan

1. (a)(ii)  $h_2 - h_1 = -\frac{4C}{T^3} (p_2 - p_1)$ ,  $s_2 - s_1 = -R \ln \left( \frac{p_2}{p_1} \right) - \frac{3C}{T^4} (p_2 - p_1)$
- (b)(i) 4.523 kg/s, 1495.4 kw, 4264.7 kw
- (ii) 760.1 kw, 1079.6 kw
- (iii) 5.986 Mw
- (iv) 986 kw - high because of exergy loss during heat addition
- 2 (b)(i) 0.142
- (ii) 156.85°C
- (c) 194.8 kJ/kg 53.18 kJ/kg - use multiple pressure levels
- 3 (b)(ii) 0.1495
- (iii) 404 kg/s
- (iv) 41.3% with feed heating and 38.8% without feed heating
- (v) 1.374 Mw 1.1%
- 4 (a)(i)  $T_{1/2} = \frac{\ln 2}{\lambda}$
- (b)  $8.789 \times 10^{-13}$  J
- (d)(i) 2.0 kw
- (ii) 0.016 kg
- (e)  $2.904 \times 10^{-5} \text{m}^3$
- 5 (b) 0.293
- 6 (b)  $X_{\text{CO}_2} = 0.0127$ ,  $X_{\text{CO}} = 0.2221$ ,  $X_{\text{H}_2\text{O}} = 0.0342$ ,  $X_{\text{H}_2} = 0.2006$ ,  $X_{\text{N}_2} = 0.5302$
- 7 (d) 58.5%, 17.84 MPa

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