Part I – A

1. 50.022 m	2. 8.8E+7 N/m^2	3. 5 g	4. ADCB	5. T_1	6. (c)	7. (2)	8. (a)
9. 1092.6 K or 819.45 ^oC	10. Rln4 or 11.62 J/K	11. 50 J/K	12. m=4,8,12..	13. 9 μm	14. 2E-3 m	15. 2800	16. 5 μm

Part I – B

1. 5 g	2. (c)	3. 50.022 m	4. 8.8E+7 N/m^2	5. 9 μm	6. (2)	7. (a)	8. m=4,8,12..
9. 1092.6 K or 819.45 ^oC	10. 2800	11. 5 μm	12. ADCB	13. T_1	14. Rln4 or 11.62 J/K	15. 2E-3 m	16. 50 J/K

Part II

1. (1) $2\cdot\Delta d = \Delta m\cdot\lambda$. $2(0.4\times10^{-3}) = 1600\cdot\lambda. \Rightarrow \lambda = 5\times10^{-7}$ m = 500 nm

(b) $2(n-1)L = \Delta m\cdot\lambda$. $n = 1 + \Delta m\cdot\lambda/(2L) = 1 + 360\cdot6\times10^{-7}/(2\cdot2\times10^{-2}) = 1.0054$.

2. (1) $W_{BC} = -P_B (V_C - V_B) = -3\times10^5 (0.4-0.09) = -93$ kJ; $\Delta E_{int, BC} = 100-93 = 7$ kJ

(2) $W_{DA} = -P_D (V_A - V_D) = - 10^5 (0.2-1.2) = 100$ kJ; $\Delta E_{int, DA} = -150+100 = -50$ kJ

(3) $\Delta E_{int, AB} = 0 - (7-50) = 43$ kJ

(4) $\Delta E_{int, CD} = 0 \Rightarrow Q = -W = nRT \ln(V_f/V_i) = 1.2\times10^5 \ln(1.2/0.4) = 120(\ln3)$ kJ

3. (1) In a steady rate, $k_1 A\left(\frac{T_h - T}{L}\right) = k_2 A\left(\frac{T - T_c}{L}\right) \Rightarrow T = \frac{k_1 T_h + k_2 T_c}{k_1 + k_2} = 60\ ^oC$

(2) $\frac{dQ}{dt} = k_1 A\left(\frac{T_h - T}{L}\right) = 16$ W

(3) $\frac{\Delta Q_1}{\Delta t} = k_1 A\frac{\Delta T}{L}, \frac{\Delta Q_2}{\Delta t} = k_2 A\frac{\Delta T}{L} \Rightarrow \frac{d}{dt}(Q_1 + Q_2) = \frac{dQ}{dt} = (k_1 A + k_2 A)\frac{\Delta T}{L} = 72$W

4. (1) $W_{eng} = P_A V_A \ln(\frac{V_B}{V_A}) + P_B(V_C - V_B) = 2$ atm×10 L ln(20/10) + 1 am×(10-20)L = 1.4 kJ - 1kJ = 0.4 kJ

(2) $\Delta E_{int, AB} = 0 \Rightarrow Q_{AB} = -W_{AB} = 1.4$ kJ

$T_A = \frac{P_A V_A}{nR}; T_C = \frac{P_C V_A}{nR} \Rightarrow \Delta T = T_A - T_C = \frac{(2-1)\times10^5\cdot10\times10^{-3}}{R} = \frac{10^3}{R}$; $Q_{CA} = nC_V\Delta T = \frac{3}{2}R\cdot\frac{10^3}{R} = 1.5$ kJ

$\Rightarrow Q_{in} = Q_{AB} + Q_{CA} = 2.9$ kJ

(3) $Q_{out} = Q_{BC} = nC_p\Delta T = (5/2)(nR\Delta T) = (5/2)P_B\Delta V_{BC} = -2.5$ kJ

(4) $e = \frac{W_{eng}}{Q_{in}} = \frac{0.4}{2.9} = 13.8\%$

(5) $S_{AB} = \frac{Q_{AB}}{T_A} = \frac{Q_{AB}}{P_A V_A} nR = 5.81$ J/K