叶茂林 2021155015

13-1 B

13-9

气体所做的功等于 p-V 图上过程曲线下面的面积.

$$\therefore W = \frac{1}{2}(P_B + P_A)(V_B - V_A) = 150J$$

13-2 B

13-3 C

13-4 B

13-11

空气对外做功 $W = p\Delta V = p(V_2 - V_1) = 500J$

$\Delta E = Q - W = 1.21 \times 10^3 J$

内能改变了 $1.21 \times 10^3 J$.

13-14

(1) $Q_P = \nu C_{p,m}(T_2 - T_1)$

$PV = \nu RT$

$C_{p,m} = \frac{7}{2}R$

$\therefore Q_P = 128.1J$

$Q_V = \nu C_{V,m}(T_2 - T_1)$

$C_{V,m} = \frac{5}{2}R$

$\therefore Q_V = 91.5J$

(2) $W_V = 0$

$\Delta E = Q_V - W_V = Q_V$

$\Delta E = Q_P - W_P$

$\therefore W_P = Q_P - \Delta E = Q_P - Q_V = 36.6J$

13-19

(1) $W = \int_{V_A}^{V_B} p\,dv = \int_{V_A}^{V_B} \frac{nRT}{V}\,dv = nRT\int_{V_A}^{V_B}\frac{1}{v}\,dv = P_A V_A \ln\frac{V_B}{V_A} = 2.77 \times 10^3 J$

$Q = \Delta \bar{E} + W = 0 + W = 2.77 \times 10^3 J$

(2) $W_{ACB} = W_{AC} + W_{CB} = 0 + P_C(V_B - V_C) = 2.0 \times 10^3 J$

$Q = \Delta E + W_{ACB} = 0 + W_{ACB} = 2.0 \times 10^3 J$

13-5 B

13-6 A

13-7 D

13-15

$\Delta E = Q_{ABC} + Q_{CA} - W_{ABC} - W_{CA}$

$\therefore Q_{CA} = W_{ABC} + W_{CA} - Q_{ABC} = -252J$

$\therefore$ 放热，传递的热量为 $-252J$

13-16

$\because P_A V_A = P_B V_B$

$\therefore \Delta E_{AB} = 0$

$\Delta E_{AB} = Q_{ACB} - W_{ACB}$

$\therefore W_{ACB} = Q_{ACB} = 700J$

$\Delta E = Q - W_{ACB} - W_{BD} - W_{DA}$

$\Delta E = 0$

$W_{BD} = 0$

$W_{DA} = P_D(-V_D + V_A) = -1200J$

$\therefore Q = -500J$

$\therefore$ 放热 500J

13-24

$\eta = \dfrac{W}{Q}$

$W = W_{AB} + W_{CD}$

$W_{AB} = \int_{V_1}^{V_2} p\,dv = \int_{V_1}^{V_2} \dfrac{nRT_1}{V}\,dv = nRT_1 \ln\dfrac{V_2}{V_1}$

$W_{CD} = \int_{V_2}^{V_1} p\,dv = \int_{V_2}^{V_1} \dfrac{nRT_2}{V}\,dv = nRT_2 \ln\dfrac{V_1}{V_2}$

$Q = Q_{AB} + Q_{DA}$

$Q_{AB} = W_{AB}$

$Q_{DA} = nC_{V,m}(T_1 - T_2)$

$C_{V,m} = \dfrac{5}{2}R$

$\therefore \eta = 15\%$

13-25

过程	内能变化 ΔE/J	做功 W/J	吸热 Q/J
A→B	0		1400
B→C		0	-200
C→D			-600
D→A	400	-400	0
ABCDA	0	42.9%	

13-27

$T_2 = 280k$

$\eta = 1 - \dfrac{T_2}{T_1} = 40\%$

$\eta' = 1 - \dfrac{T_2}{T_1'} = 50\%$

$\Delta T = T_1' - T_1 = 93.3k$

13-29

$\eta = 1 - \dfrac{T_2}{T_1}$

$T_2 = 300k$

$T_1 = 500k$

$P = \dfrac{W}{t} = \dfrac{Q\eta}{t} = \dfrac{1.8\times10^{11} \times 0.4}{3600} = 2\times10^7 W$

13-31

(1) $T_2 = 300k$

$T_1 = 500k$

$\eta = 1 - \dfrac{T_2}{T_1} = 40\%$

$\eta = 1 - \dfrac{Q_2}{Q_1} = \dfrac{W}{Q_1}$

$\therefore Q_1 = 5000J$

$Q_2 = Q_1 - W = 3000J$

$Q_1' = Q_2 + W' = 6000J$

$\eta' = \dfrac{W'}{Q_1'} = 50\%$

(2) $\eta' = 1 - \dfrac{T_2}{T_1'}$

$\therefore T_1' = 600k$