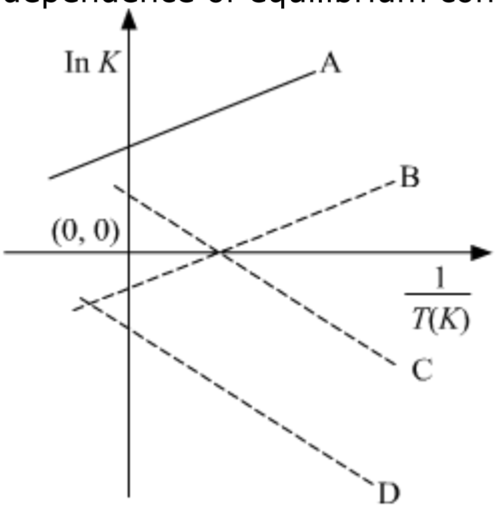
Thermodynamics

Q.No.1: Which of the following lines correctly show the temperature dependence of equilibrium constant, K, for an exothermic reaction?

JEE 2018

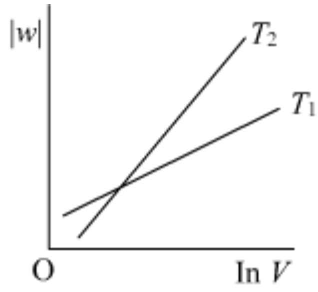


A. C and D
B. A and D
C. A and B
D. B and C

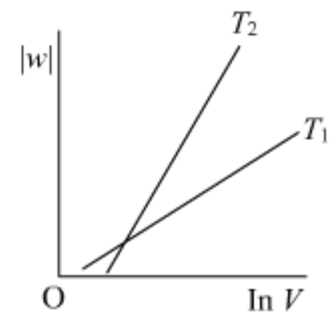
Q.No.2: Consider the reversible isothermal expansion of an ideal gas in a closed system at two different temperatures T_1 and T_2 ($T_1 < T_2$). The correct graphical depiction of dependence of work done (w) on the final volume (V) is :

JEE 2019

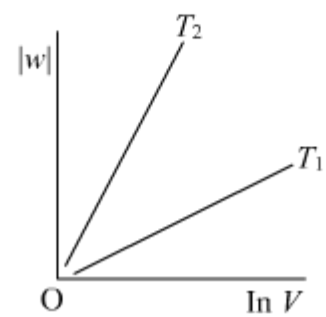
A.



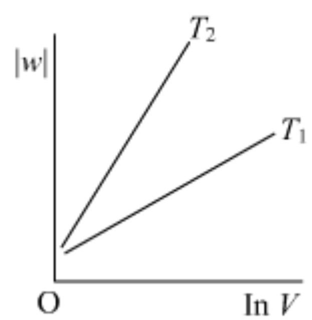
B.



C.



D.



Q.No.3: The entropy change associated with the conversion of 1 kg of ice at 273 K to water vapours at 383 K is:
(Specific heat of water liquid and water vapour are 4.2 kJ K^{-1} kg^{-1} and 2.0 kJ K^{-1} kg^{-1}; heat of liquid fusion and vapourisation of water are 334 kJ kg^{-1} and 2491 kJ kg^{-1}, respectively). (log 273 = 2.436, log 373 = 2.572, log 383= 2.583) **JEE 2019**

A. 7.90 kJ kg^{-1} K^{-1}

B. 2.64 kJ kg^{-1} K^{-1}

C. 8.49 kJ kg^{-1} K^{-1}

D. 9.26 kJ kg^{-1} K^{-1}

Q.No.4: A process has ΔH = 200 $Jmol^{-1}$ and ΔS = 40 JK^{-1} mol^{-1}. Out of the values given below, choose the minimum temperature above which the process will be spontaneous: **JEE 2019**

A. 20 K

B. 12 K
C. 5 K
D. 4 K

Q.No.5: The process with negative entropy change is : **JEE 2019**

A. Dissociation of $CaSO_4(s)$ to $CaO(s)$ and $SO_3(g)$
B. Sublimation of dry ice
C. Dissolution of iodine in water
D. Synthesis of ammonia from N_2 and H_2

Q.No.6: An ideal gas undergoes iso-thermal compression from 5 m^3 to 1 m^3 against a constant external pressure of 4 Nm^{-2}. Heat released in this process is used to increase the temperature of 1 mole of Al. If molar heat capacity of Al is 24 J mol^{-1} K^{-1}, the temperature of Al increases by : **JEE 2019**

A. $\frac{3}{2}\mathrm{K}$
B. 2 K
C. $\frac{2}{3}\mathrm{K}$
D. 1 K

Q.No.7: The reaction, $MgO(s) + C(s) \rightarrow Mg(s) + CO(g)$, for which $\Delta_r H^\circ = +491.1$ kJ mol^{-1} and $\Delta_r S^\circ = 198.0$ JK^{-1} mol^{-1}, is not feasible at 298 K. Temperature above which reaction will be feasible is : **JEE 2019**

A. 2040.5 K
B. 1890.0 K
C. 2480.3 K
D. 2380.5 K

Q.No.8: The standard reaction Gibbs energy for a chemical reaction at an absolute temperature T is given by $\Delta_r G^\circ = A - BT$
Where A and B are non-zero constants. Which of the following is **TRUE** about this reaction? **JEE 2019**

A. Endothermic if $A > 0$
B. Exothermic if $A > 0$ and $B < 0$
C. Endothermic if $A < 0$ and $B > 0$

D. Exothermic if B < 0

Q.No.9: Two blocks of the same metal having same mass and at temperature T_1 and T_2, respectively, are brought in contact with each other and allowed to attain thermal equilibrium at constant pressure. The change in entropy, ΔS, for this process is: **JEE 2019**

A. $C_p \ln \left[\frac{(T_1+T_2)^2}{4T_1T_2}\right]$

B. $2C_p \ln \left[\frac{(T_1+T_2)^{\frac{1}{2}}}{T_1T_2}\right]$

C. $2C_p \ln \left(\frac{T_1+T_2}{4T_1T_2}\right)$

D. $2C_p \ln \left[\frac{T_1+T_2}{2T_1T_2}\right]$

Q.No.10: The formula of a gaseous hydrocarbon which requires 6 times of its own volume of O_2 for complete oxidation and produces 4 times its own volume of CO_2 is C_xH_y. The value of y is ______. **JEE 2021**