CHEMISTRY

BOOKS - MTG WBJEE CHEMISTRY (HINGLISH)

CHEMICAL ENERGETICS

Wb Jee Workout Single Option Correct Type

1. Which of the following is the correct relation of the first law of thermodynamics?

A. $\Delta = q - W$

B. $\Delta E = \Delta q + \Delta W$

C. $\Delta E = q + W$

D. $\Delta E = \Delta q + W$

Answer: C

View Text Solution

2. An open system

A. can neither lose nor gain energy

B. can lose or gain energy

C. can gain or lose matter

D. can lose or gain both matter or energy

Answer: D

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3. Which of the following conditions will always lead to a non-spontaneous change?

A. Positive ΔH and positive ΔS

B. Negative ΔH and negative ΔS

C. Positive ΔH and negative ΔS

D. Negative ΔH and positive ΔS

Answer: C

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4. The correct relationship between free energy change in a reaction and the corresponding equilibrium constant K_c is

A. $\Delta G = RT \ln K_c$

B. $\Delta G = -RT\ln K_c$

C. $\Delta G^\circ = RT\ln K_c$

D. $\Delta G^\circ = -RT\ln K_c$

Answer: D

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5. The enthalpy change for a reaction does not depend upon the

A. physical states of reactants and products

B. use of different reactants for the same product

C. nature of intermediate reaction steps

D. difference in initial or final temperatures of involved substances.

Answer: C

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6. For a thermodynamically reversible reaction in a galvanic cell at temperature T, which one of the following is false?

A. $-\Delta G = w_{\max}$

B. $\Delta G^{\circ} = -RT\ln K_c$

C. $\Delta G = -FE_{cell}$

D. $\Delta H = T\Delta S$

Answer: D

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7. $\Delta G = \Delta H - T\Delta S$ was given by

A. Faraday

B. Kirchhoff

C. Einstein

D. Gibbs-Helmholtz

Answer: D

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8. Unit of entropy is

A. $JK^{-1}\text{mol}^{-1}$

B. $J\text{mol}^{-1}$

C. $J^{-1}K^{-1}\text{mol}^{-1}$

D. $JK\text{mol}^{-1}$

Answer: A

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9. If a process is both endothermic and spontaneous, then

A. $\Delta S > 0$

B. $\Delta S < 0$

C. $\Delta H < 0$

D. $\Delta G > 0$

Answer: A

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10. For which reaction change of entropy will be positive?

A. $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

B. $HCl(g) + NH_3(g) \Leftrightarrow NH_4Cl(s)$

C. $NH_4NO_3(s) \Leftrightarrow N_2O(g) + 2H_2O$

D. $MgO(s) + H_2(g) \Leftrightarrow Mg(s) + H_2O(l)$

Answer: C

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11. Which expression is correct for the work done in adiabatic reversible expansion of an ideal gas?

A. $nRT\ln V_2/V_1$

B. $C_V(T_2 - T_1)$

C. $P\Delta V$

D. $-\int_1^2 PdV$

Answer: B

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12. For a reaction $A(g) \Leftrightarrow B(g)$ Boat equilibrium, the partial pressure of B is found to be one fourth of the partial pressure of A. The value of ΔG^2 for the reaction $A \rightarrow B$ is

A. RT In 4

B. - RT In 4

C. RT log 4

D. - RT log 4

Answer: A

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13. The second law of thermodynamics says that in a cyclic process

A. work cannot be converted into heat

B. heat cannot be converted into work

C. work cannot be completely converted into heat

D. heat cannot be completely converted into work

Answer: D

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14. Which of the following statements is false ?

A. Work is a state function.

B. Temperature is a state function

C. Change of state is completely defined when initial and final states are specified

D. Work appears at the boundary of the system.

Answer: A

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15. The heat measured for a reaction in a bomb calorimeter is

A. ΔG

B. ΔH

C. ΔE

D. $P\Delta V$

Answer: C

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16. Which of the following thermodynamic relations is correct?

A. dG = VdP-SdT

B. dE = PdV + TdS

C. dH=-VdP + TdS

D. dG = VdP + SdT

Answer: A

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17. Which of the following is/are the intensive property?

A. Temperature

B. Viscosity

C. Density

D. All of these

Answer: D

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18. Highest entropy is in

A. water

B. hydrogen

C. mercury

D. graphite

Answer: B

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19. In a reversible adiabatic change ΔS is

A. equal to $nR\ln V_2 / V_1$

B. 0

C. equal to $C_V dT$

D. infinity

Answer: B

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20. When the value of entropy is greater, then the ability for work is

A. maximum

B. minimum

C. medium

D. any of these.

Answer: A

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21. In a closed insulated container a liquid is stirred with a paddle to increase the temperature which of the following is true?

A. $\Delta E = W \neq 0, q = 0$

B. $\Delta E = W = q \neq 0$

C. $\Delta E = 0, W = q \neq 0$

D. $W = 0, \Delta E = q \neq 0$

Answer: A

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22. Which of the following processes is accompanied by an increase in entropy?

A. Normal rubber band to stretched rubber band

B. Normal egg to hard boiled egg

C. Formation of NH_3 from N_2 and H_2

D. All of these

Answer: B

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23. What is the equilibrium constant, K for the following reaction at 400 K?

$2NOCl(g) \Leftrightarrow 2NO(g) + Cl_2(g)$

$\Delta H = 77.2kJ\text{mol}^{-1}$ and $\Delta S = 122JK^{-1}\text{mol}^{-1}$ at 400 K

A. 1.95×10^{-4}

B. 7.4×10^{-4}

C. 2.28×10^{-3}

D. 1.48×10^{-5}

Answer: A

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24. In the reactions, where enthalpy value determination is difficult by experiments, the enthalpy value can be calculated by

A. Kirchhoff's equation

B. Hess's law

C. Henry's law

D. van't Hoff law

Answer: B

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25. Identify the correct statement from the following in a chemical reaction

A. The entropy always increases.

B. The change in entropy along with suitable change in enthalpy decides the fate of a reaction.

C. The enthalpy always decreases.

D. Both the enthalpy and the entropy remains constant.

Answer: B

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26. Which of the following equations is not correct?

A. $\Delta G^{\circ} = -nFE^{\circ}$

B. $\Delta G^{\circ} = -RT\ln K$

C. $E^{\circ} = \frac{RT}{nF}\log K$

D. $\Delta G = \Delta G^{\circ} + RT\ln Q$

Answer: C

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27. A reaction occurs spontaneously if

A. $T\Delta S < \Delta H$ and both ΔH and ΔS are +ve

B. $T\Delta S > \Delta H$ and ΔH is +ve and ΔS is -ve

C. $T\Delta S > \Delta H$ and both ΔH and ΔS are +ve

D. $T\Delta S = \Delta H$ and both ΔH and ΔS are +ve

Answer: C

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28. Considering entropy (S) as a thermodynamic parameter, the criterion for the spontaneity of any process is

A. $\Delta S_{\text{system}} + \Delta S_{\text{surr}} > 0$

B. $\Delta S_{\text{system}} - \Delta S_{\text{surr}} > 0$

C. $\Delta S_{\text{system}} >$ 0 only

D. $\Delta S_{\text{surr}} >$ 0 only

Answer: A

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29. The heat of combustion of a compound

A. is always positive

B. is always negative

C. may be positive or negative

D. is zero at any stage of the reaction

Answer: B

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30. The apparatus used for measuring the heat changes of a reaction is called

A. a thermometer

B. a calorimeter

C. barometer

D. none of these.

Answer: C

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31. The difference between ΔH and ΔE at 300 K for the reaction

$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$ is

A. 30×8.314J/mol

B. -300×8.314J/mol

C. $3 \times 300 \times 8.314$J/mol

D. $-3 \times 300 \times 8.314 \text{J/mol}$

Answer: D

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32. Adiabatic reversible expansion of a gas is represented by

A. $\left(\frac{T_1}{T_2}\right)^{\gamma} = \left(\frac{P_2}{P_1}\right)^{(\gamma-1)}$

B. $\left(\frac{T_1}{T_2}\right)^{\gamma} = \left(\frac{P_1}{P} - 2\right)^{(1-\gamma)}$

C. $\left(\frac{T_1}{T_2}\right)^{\gamma} = \left(\frac{P_1}{P_2}\right)^{(\gamma-1)}$

D. All of these

Answer: C

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33. The absolute enthalpy of neutralisation of the reaction:

$MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$ will be

A. $-57.33 kJ \text{mol}^{-1}$

B. greater than $-57.33 kJ \text{mol}^{-1}$

C. less than $-57.33 kJ \text{mol}^{-1}$

D. $57.33 kJ \text{mol}^{-1}$

Answer: C

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34. Equal volumes of molar hydrochloric acid and sulphuric acid are neutralised by dilute NaOH solution and x kcal and y kcal of heat are liberated respectively. Which of the following is true?

A. x=y

B. x=y/2

C. x=2y

D. None of the above

Answer: B

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35. If $\Delta G = \Delta H - T\Delta S$ and $\Delta G = \Delta H + T\left[\frac{d(\Delta G)}{dT}\right]_P$ then variation of EMF of cell , with temperature T, is given by

A. $\frac{\Delta S}{nF}$

B. $-\frac{\Delta S}{nF}$

C. $\frac{\Delta H}{nF}$

D. $\frac{\Delta G}{nF}$

Answer: A

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36. Consider the reaction: $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ carried out at constant temperature and pressure. If ΔH and ΔE are the enthalpy and internal energy changes for the reaction, which of the following expressions is true?

A. $\Delta H = 0$

B. $\Delta H = \Delta E$

C. $\Delta H < \Delta E$

D. $\Delta H > \Delta E$

Answer: C

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37. A plot of In K against 1/T (abscissa) is expected to be a straight line with intercept on ordinate axis equal to

A. $\frac{\Delta S^{\circ}}{2.303R}$

B. $\frac{\Delta S^{\circ}}{R}$

C. $-\frac{\Delta S^{\circ}}{R}$

D. $R \times \Delta S^{\circ}$

Answer: B

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38. “If system A is the thermal equilibrium with B and B is in thermal equilibrium with C then A and C are in equilibrium with each other." This is a statement of

A. Gauss's law of thermodynamics

B. Euler's reciprocity relationship

C. cyclic rule

D. zeroth law of thermodynamics.

Answer: D

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39. The efficiency of heat engine is maximum when

A. temperature of source gt temperature of sink

B. temperature of sink gt temperature of source

C. temperature difference of source and sink is minimum

D. temperature difference of source and sink is maximum.

Answer: D

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40. What would be the standard free energy change for the formation of methane at 298 K? The value of ΔH° for $CH_4(g) is -74.81 kJ \text{mol}^1$ and S° values for $C_{(\text{grap})} H_2(g)$ and $CH_4(g)$ are 5.70, 130.7 and $186.3 JK^{-1} \text{mol}^{-1}$ respectively.

A. -50.71

B. 47.56

C. 60.45

D. -74.8

Answer: A

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41. Which of the following is correct?

A. Evaporation of water causes an increase in disorder of the system.

B. Melting of ice causes a decrease in randomness of the system.

C. Condensation of steam causes an increase in disorder of the system.

D. There is practically no change in the randomness of the system when water is evaporated.

Answer: A

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42. The change in entropy, ΔS is positive for an endothermic reaction. If enthalpy change ΔH occurs at the same temperature T, then the reaction is feasible

A. at all temperatures

B. when $\Delta H > T\Delta S$

C. when $\Delta H < T\Delta S$

D. when $\Delta H = T\Delta S$

Answer: C

View Text Solution

43. Which of the following is false statement?

A. $(dE/dT) = 0$ for ideal gas

B. $K = e^{-\Delta G^{\circ}/RT}$

C. $\Delta G = -nFE^{\circ}_{cell}$

D. For an isothermal change $\Delta E = 0$

Answer: A

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44. Consider a class room of dimensions $5 \times 10 \times 3m^3$ at temperature $20^\circ C$ and pressure 1 atm. There are 50 peoples in the room, each losing energy at the average of 150 Joule/sec. Assuming that the walls ceiling, floor and furniture perfectly insulated and none of them absorbing heat, how much time will be needed for rising the temperature of air in the room to body temperature, i.e., $37^\circ C$. For air $C_p = \frac{7}{2}R$. Loss of air to the outside as the temperature rise may be neglected.

A. 502.3 sec

B. 411.3 sec

C. 602.2 sec

D. 702.4 sec

Answer: B

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45. A cylinder of gas is assumed to contain 11.2 kg of butane. If a normal family needs 20,000 kJ of energy per day for cooking, how long will the cylinder last if the enthalpy of combustion, $\Delta H = -2658kJ$ for butane?

A. 30.5 days

B. 25.66 days

C. 40.6 days

D. 10.66 days

Answer: B

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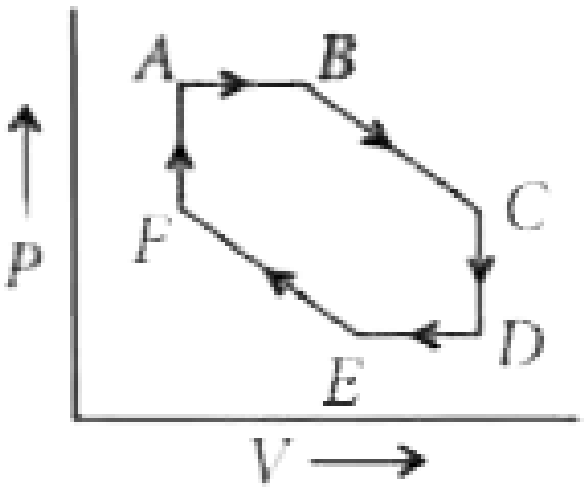
Wb Jee Workout One Or More Than One Option Correct Type

1. Which inferences have been accurately drawn from the given plot?



(Temperature at A, B and F is T_1 and at C, D and E is T_2, $T_1 > T_2$)

A. $B \rightarrow C$ is an adiabatic expansion and temperature falls from T_1 to T_2

B. $E \rightarrow F$ is an adiabatic compression and temperature increases from T_2 to T_1

C. $E \rightarrow A$ is an isothermal and isochoric process.

D. $C \rightarrow D$ is an adiabatic and isobaric process.

Answer: A::B

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2. Which of the following statements is/are correct?

A. Heat like work is a way of transferring energy.

B. Heat is not a property of the system, whereas the temperature is a property of the system.

C. Reactions which are accompanied by the evolution of heat are called endothermic reactions

D. Those reaction in which heat is absorbed are called exothermic reactions

Answer: A::B::C

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3. What would be the standard internal energy change for the reaction,

$OF_2(g) + H_2O(g) \rightarrow O_2(g) + 2HF(g)$

at 298 K? The standard enthalpies of formation of $OF_2(g), H_2O(g), HF(g)$ are +20, +250 and -270 kJ mol^{-1}

A. $352 \times 10^2 kJ$

B. $410 \times 10^5 kJ$

C. $3.12 \times 10^2 kJ$

D. $5.26 \times 10^4 kJ$

Answer: C

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4. Which of the following statements is/are correct?

A. The entropy of the universe increases and tends towards the maximum value

B. All natural processes are generally irreversible.

C. For reversible isolated processes, at equilibrium change of entropy is zero

D. For irreversible isolated processes, entropy at equilibrium change gt 0

Answer: A::B::C::D

View Text Solution

5. For the reaction between CO_2 and graphite,

$CO_2(g) + C(s) \rightarrow 2CO(g), \Delta H = 170kJ \text{ and } \Delta S = 179JK^{-1}$

At equilibrium, the reaction will be non-spontaneous at

A. 300K

B. 500K

C. 900K

D. 1100K

Answer: A::B::C

View Text Solution

6. Identify the correct statements regarding entropy.

A. At absolute zero temperature, the entropy of all crystalline substances is not taken to be zero

B. At absolute zero temperature, the entropy of a perfectly crystalline substance is positive.

C. At absolute zero temperature, entropy of a perfectly crystalline substance is taken to be zero.

D. At $0^\circ C$, the entropy of a perfectly crystalline substance is taken to be zero.

Answer: C

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7. Choose the incorrect combination(s).

	ΔH	ΔS	Temperature	Spontaneity
(a)	+	–	any T	Non-spontaneous
(b)	–	–	low T	Non-spontaneous
(c)	+	+	low T	Spontaneous
(d)	–	+	any T	Spontaneous

View Text Solution

8. Which of the following conditions is not favourable for the feasibility of a process?

A. $\Delta H = -ve, T\Delta S = -ve$ and $T\Delta S < \Delta H$

B. $\Delta H = +ve, T\Delta S = +ve$ and $T\Delta S = \Delta H$

C. $\Delta H = -ve, T\Delta S = +ve$and $\Delta H > T\Delta S$

D. $\Delta H = +ve, T\Delta S = +ve$ and $\Delta H > T\Delta S$

Answer: B::D

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9. Which of the following statements is/are correct?

A. $2.303\frac{\log P_2}{P_1} = \frac{\Delta H_{vap}}{R}\frac{[T_2 - T_1]}{T_1 T_2}$ is clausius -clapeyroh euation.

B. $\frac{\Delta H_{vap}}{\text{boiling point}} = 88 J\text{mol}^{-1}K^{-1}$ is called Trouton's rule

C. $\Delta C_V = \frac{\Delta H_2 - \Delta H_1}{T_2 - T_1}$ is kirchoff's equation

D. $\Delta G = \Delta H + T(\partial(\Delta G)/\partial T)_P$ is called Gibbs - Helmholtz equation.

Answer: A::B::D

View Text Solution

10. Which of the following statements is/are correct about internal energy?

A. The absolute value of internal energy cannot be determined.

B. For an adiabatic process $\Delta E = 0$

C. The measurement of heat change during a reaction by bomb calorimeter is equal to the internal energy change.

D. Internal energy is an extensive property.

Answer: A::C::D

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Wb Jee Previous Years Questions Single Option Correct Type

1. The change in entropy (dS) is defined as

A. $dS = \delta q / T$

B. $dS = dH / T$

C. $dS = \delta q_{rev} / T$

D. $dS = (dH - dG) / T$

Answer: C

View Text Solution

2. For isothermal expansion of an ideal gas, the correct combination of the thermodynamic parameters will be

A. $\Delta U = 0, Q = 0, w \neq 0$ and $\Delta H \neq 0$

B. $\Delta U \neq 0, Q \neq 0, w \neq 0$ and $\Delta H = 0$

C. $\Delta U = 0, Q \neq 0, w = 0$ and $\Delta H \neq 0$

D. $\Delta U = 0, Q \neq 0, w \neq 0$ and $\Delta H = 0$

Answer: D

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3. Mixing of two different ideal gases under isothermal reversible condition will lead to

A. increase of gibbs free energy of the system

B. no change of entropy of the system

C. increase of entropy of the system

D. increase of enthalpy of the system .

Answer: C

View Text Solution

4. The condition for spontaneity of a process is

A. lowering of entropy at constant temperature and pressure

B. lowering of Gibbs free energy of system at constant temperature and pressure

C. increase of entropy of system at constant temperature and pressure

D. increase of Gibbs free energy of the universe at constant temperature and pressure.

Answer: B

View Text Solution

5. Pressure-volume (PV) work done by an ideal gaseous system at constant volume is (where E is internal energy of the system)

A. $\Delta P / P$

B. 0

C. $-V\Delta P$

D. $-\Delta E$

Answer: B

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6. The values of ΔH and ΔS of a certain reaction are $-400kJmol^{-1}$ and $-20kJmol^{-1}K^{-1}$ respectively. The temperature below which the reaction spontaneous is

A. 100K

B. $20^{\circ}C$

C. $20K$

D. $120^{\circ}C$

Answer: C

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7. The enthalpy of vaporization of a certain liquid at its boiling point of $35^{\circ}C$ is $24.64kJmol^{-1}$. The value of change in entropy for the process is

A. $704JK^{-1}mol^{-1}$

B. $80JK^{-1}mol^{-1}$

C. $24.64JK^{-1}mol^{-1}$

D. $7.04JK^{-1}$ "mol"^(-1)`

Answer: B

View Text Solution

8. Given that

$C + O_2 \rightarrow CO_2, \Delta H^\circ = -xkJ$

$2CO + O_2 \rightarrow 2CO_2, \Delta H^\circ = -ykJ$

The heat of formation of carbon monoxide will be

A. $\frac{y - 2x}{2}$

B. $y + 2x$

C. $2x - y$

D. $\frac{2x - y}{2}$

Answer: A

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9. The value of ΔH for cooling 2 mole of an ideal monoatomic gas from $225^\circ C$ to $125^\circ C$ at constant pressure will be $C_P = \frac{5}{2}R$

A. 250 R

B. $-500R$

C. $500R$

D. $-250R$

Answer: B

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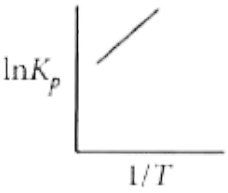
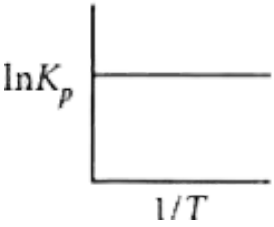
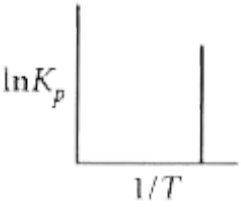
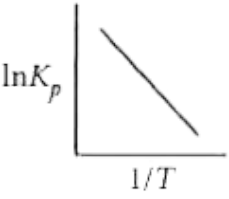
10. Which of the following plots represents an exothermic reaction?

A. 

B. 

C. 

D. 

Answer: A

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11. The condition for a reaction to occur spontaneously is

A. ΔH must be negative

B. ΔS must be negative

C. $(\Delta H - T\Delta S)$ must be negative

D. $(\Delta H + T\Delta S)$ must be negative.

Answer: C

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12. The heat of neutralisation of a strong base and a strong acid is 13.7 kcal. The heat released when 0.6 mole HCl solution is added to 0.25 mole of NaOH is

A. 3.425 kcal

B. 8.22 kcal

C. 11.645 kcal

D. 13.7 kcal

Answer: A

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13. For the equilibrium, $H_2O(l) \Leftrightarrow H_2O_{(v)}$, which of the following is correct?

A. $\Delta G = 0, \Delta < 0, \Delta S < 0$

B. $\Delta G < 0, \Delta H > 0, \Delta S > 0$

C. $\Delta S > 0, \Delta H = 0, \Delta S > 0$

D. $\Delta G = 0, \Delta H > 0, \Delta S > 0$

Answer: D

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14. For the reaction $X_2Y_4(l) \rightarrow 2XY_2(g)$ at 300 K the values of ΔU and ΔS are 2 kcal and $20 cal K^{-1}$ respectively. The value of ΔG for the reaction is

A. -3400 cal

B. 3400 cal

C. -2800 cal

D. 2000 cal.

Answer: C

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15. During a reversible adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio $\frac{C_P}{C_V}$ for the gas is

A. $3/2$

B. $7/2$

C. $5/3$

D. $9/7$

Answer: A

View Text Solution

16. At constant pressure, the heat of formation of a compound is not dependent on temperature, when

A. $\Delta C_P = 0$

B. $\Delta C_V = 0$

C. $\Delta C_P > 0$

D. $\Delta C_P < 0$

Answer: A

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Wb Jee Previous Years Questions One Or More Than One Option Correct Type

1. For a spontaneous process, the correct statement(s) is

A. $\left(\Delta G_{system}\right)_T, P > 0$

B. $\left(\Delta S_{system}\right) + \left(\Delta S_{surr}\right) > 0$

C. $\left(\Delta S_{system}\right)_T, P < 0$

D. $\left(\Delta U_{system}\right)_T, V > 0$

Answer: B::C

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2. Among the following, the extensive variables are

A. H (enthalpy)

B. P (pressure)

C. E (internal energy)

D. V (volume)

Answer: A::C::D

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