CHEMISTRY

BOOKS - DISHA CHEMISTRY (HINGLISH)

THERMODYNAMICS

Chemistry

1. In a closed container a liquid is stirred with a paddle to increase the temperature. Which of the following is true?

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

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

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

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

Answer: B

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2. One mole of a non-ideal gas undergoes a change of state (2.0 atm, 3.01, 95K) $\rightarrow$ (4.0 atm, 5.01, 245K) with a change in internal energy, $\Delta U = 30.0L$ atm. The change in enthalpy ΔH of the process in L atm is.

A. 40

B. 42.3

C. 44

D. Not defined because pressure is not constant

Answer: C

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3. Assuming that water vapour is an ideal gas, the internal energy change (ΔU) when 1 mol of water is vapourised at vapourisation of water at 1 bar and 373K=41 $kJmol^{-1}$ and R=8.3 $Jmol^{-1}K^{-1}$ will be

A. 41.00 kJ mol^{-1}

B. 4.100 kJ mol^{-1}

C. 3.7904 kJ mol^{-1}

D. 37.904 kJ mol^{-1}

Answer: D

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4. A piston filled with 0.04 mole of an ideal gas expands reversible from 50.0 mL to 375 mL at a constant temperature of $37.0^{\circ}C$. As it does so, it absorbs 208 J of heat. The values of q and w for the process will be: (R=3.14J/molK) (in 7.5=2.01)

A. q=+208J, w=-208 J

B. q=-208J,w=-208J

C. q=-208 J, w=++209J

D. q=+208J, w=+208J

Answer: A

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5. A mong the following the intensive property is (properties are)

A. molar conductivity

B. electromotive force

C. resistance

D. heat capacity

Answer: B

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6. The variation of heat of reaction with temperature is given

A. Van't Hoff equation

B. Clausius-Clapeyron equation

C. Nernst equation

D. Kirchoff's equation

Answer: D

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7. The difference between heats of reaction at constant pressure and constant volume for reaction:

$2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(l)$ at $25^\circ C$ in kJ is

A. -7.43

B. $+3.72$

C. -3.72

D. $+7.43$

Answer: A

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8. The enthalpy of vapourisation of water from the following two equations is:

$$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l), \Delta H = -286kJ$$

$$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g), \Delta H = -245kJ$$

A. 6.02 kJ

B. 40.5kJ

C. 62.3 kJ

D. 1.25 kJ

Answer: B

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9. For complete combustion of ethaol,

$$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(L)$$

the amount of heat produced as measured in bomb calorimeter, is 1364.47 kJ mol^{-1} at $25^{\circ}C$. Assuming ideality the enthalpy of combustion, $\Delta_c H$, for the reaction will be $\left(R = 8.314 kJ mol^{-1}\right)$

A. $-1366.95 kJ \quad mol^{-1}$

B. $-1361.95 kJ \quad mol^{-1}$

C. $-1460.95 kJ \quad mol^{-1}$

D. $-1350.50 kJ \quad mol^{-1}$

Answer: A

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10. The direction conversion of A to B is difficult, hence it is carried out by the following shown path:

Given $\Delta S_{(A \to C)} = 50c.u.$, $\Delta S_{(C \to D)} = 30e.u.$, $\Delta S_{(B \to D)} = 20c.u$, where c.u. is the entropy unit then $\Delta S_{(A \to B)}$ is

A. $+60e.u$

B. $+100e.u$

C. $-60e.u$

D. $-100e.u$

Answer: A

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11. The heat of combustion of $CH_4(g)$, C (graphite), $H_2(g)$ are 20kcal, -40 kcal-10 kcal respectively. The heat of formation of methane is

A. $-40kcal$

B. $+40kcal$

C. $-80.0kcal$

D. $+80kcal$

Answer: A

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12. From the following bond energies:

H-H bond enerwgy: 431.37 kJ mol^{-1}

C=C bond energy: 606.10 kJ mol^{-1}

C-C bond energy: 336.49 kJ mol^{-1}

C-H bond energy: 410.50 kJ mol^{-1}

Enthalpy for the reaction,

$$\begin{matrix} H & & H \\ | & & | \\ C & = & C \\ | & & | \\ H & & H \end{matrix} + H - H \rightarrow H - \begin{matrix} H & & H \\ | & & | \\ C & - & C \\ | & & | \\ H & & H \end{matrix} - H$$ will be

A. $-243.6kJ \quad mol^{-1}$

B. $-120.0kJ \quad mol^{-1}$

C. $553.0kJ \quad mol^{-1}$

D. $5123.6kJ \quad mol^{-1}$

Answer: B

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13. The favourable conditions for a spontaneous are

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

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

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

D. $\Delta S = \Delta H, \Delta H = +ve, \Delta S = +ve$

Answer: A

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14. For which change $\Delta H \neq \Delta E$:

A. $H_2(g) + I_2(g) \rightarrow 2H(g)$

B. $HCl + NaOH \rightarrow NaCl$

C. $C(s) + O_2(g) \rightarrow CO_2(g)$

D. $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

Answer: D

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15. The species which by definition has ZERO standard molar enthalpy of formation at 298 K is

A. Br_2

B. $Cl_2(g)$

C. $H_2O(g)$

D. $CH_4(g)$

Answer: B

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16. For which of the following process, ΔS is negative?

A. $H_2(g) \rightarrow 2H(g)$

B. $N_2(g)(1atm) \rightarrow N_2(g)(8atm)$

C. $2SO_3(g) \rightarrow 2SO_2(g) + O_2(g)$

D. $C_{(\text{diamond})} \rightarrow C_{(\text{graphite})}$

Answer: B

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17. Given the following entropy vlaues (in $JK^{-1}mol^{-1}$) at 298 K ad 1 atm:

$H_2(g) : 130.6, HCl(g) : 186.7, Cl_2(g) : 223.0$

, $Cl_2(g) \rightarrow 2HCl(g)$ is

A. $+540.3$

B. 727.0

C. -166.9

D. 19.8

Answer: D

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18. In conversion of lime-atone to lime,

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ the value of ΔH° and ΔS° are +179.1 kJ mol^{-1} and 160.2 J/K respectively at 298 K and 1 bar. Assuming that ΔH° and ΔS° do not change with temperature, temperature above which conversion of lime-stone to lime will be spontaneous is

A. 1118 K

B. 1008 K

C. 1200 K

D. 845 K

Answer: A

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19. $(\Delta H - \Delta U)$ for the formation of carbon monoxide (CO) from its elements at 298 K is $\left(R = 8.314 kJ^{-1} \quad mol^{-1}\right)$

A. $-2477.57 J \quad mol^{-1}$

B. $2477.57 J \quad mol^{-1}$

C. $1 - 1238.78 J \quad mol^{-1}$

D. $1238.78 J \quad mol^{-1}$

Answer: D

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20. The incorrect expresion among the following is:

A. $\frac{\Delta G_{\text{system}}}{\Delta S_{\text{total}}} = -T$

B. In isothermal process, $w_{\text{reversible}} = -nRT \ \ln \frac{V_f}{V_i}$

C. $\ln K = \frac{\Delta H^\circ - T\Delta S^\circ}{RT}$

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

Answer: C

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21. The following two reactions are known:

$Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g), \Delta H = -26.8kJ$

$FeO(s) + CO(g) \rightarrow Fe(s) + CO_2(g), \Delta H = -16.5kJ$

The value of ΔH for the following reaction

$Fe_2O_3 + CO(g) \rightarrow 2FeO(s) + CO_2(g)$ is

A. $+6.2kJ$

B. $+10.3kJ$

C. $-43.3kJ$

D. $-10.3kJ$

Answer: A

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22. For a particular reversible reaction at temperature T. ΔH and ΔS were found to be both +ve. If T_e is the temperature at equilibrium, the reaction would be spontaneous when

A. $T_e > T$

B. $T > T_e$

C. T_e is 5 times T

D. $T = T_e$

Answer: B

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23. The standard enthalpy of formation of NH_3 is -46.0 kJ mol^{-1} and that of N_2 is -712 kJ mol^{-1}, the average bond enthalpy of N-H bond in NH_3 is

A. $-964kJ \quad mol^{-1}$

B. $+352kJ \quad mol^{-1}$

C. $+1056kJ \quad mol^{-1}$

D. $-1102kJ \quad mol^{-1}$

Answer: B

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24. Standard entropy of X_2, Y_2 and X_3, Y_3 are 60, 40 and 50 $JK^{-1}mol^{-1}$, respectively for the reaction.

$\frac{1}{2}X_2 + \frac{3}{2}Y_2 \rightarrow XY_3, \Delta H = -30kJ,$ to be at equilibrium, the temperature will be

A. 1250 K

B. 500 K

C. 750 K

D. 1000 K

Answer: C

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25. A heat engine absorbs heat Q_1 at temperature T_1 and heat Q_2 at temperature T_2, work done by the engine is J $(Q_1 + Q_2)$ this data

A. violatews 1st law of thermodynamics

B. violates 1st law of thermodynamics if Q_1 is -ve

C. violates 1st law of thermodynamics of Q_2 is -ve

D. doesnot violate 1st law of thermodynamics

Answer: A

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26. The standard enthalpies of formation of $CO_2(g), H_2O(l)$ and glucose(s) at $25^\circ C$ are -400 kJ/mol. -300kJ/mol and -1300 kJ/mol, respectively. The standard enthalpy of cumbusion per gram of glucose at $25^\circ C$ is

A. $+2900kJ$

B. $-2900kJ$

C. $-16.11kJ$

D. $+16.11kJ$

Answer: C

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27. Using the data provided, calculate the mutliple bond energy (kJ mol^{-1}) of a $C \equiv C$ bond in C_2H_2. That energy is (take the bond energy of a C-H bond as 350 kJ mol^{-1})

$2C(s) + H_2(g) \rightarrow HC \equiv CH(g), \Delta H = 225kJmol^{-1}$

$2C(s) \rightarrow 2C(g), \Delta = 1410kJ \quad mol^{-1}$

$H_2(g) \rightarrow 2H(g), \Delta H = 330kJ \quad mol^{-1}$

A. 1165

B. 837

C. 865

D. 815

Answer: D

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28. The enthalpy of neutralisation of NH_4OH and CH_3COOH is -10.5 kcal mol^{-1} and enthalpy of neutralisation of CH_3COOH with strong base is -12.5 kcal mol^{-1}. Enthalpy of ionistion of NH_4OH will

A. 3.2 kcal mol^{-1}

B. 2.0 kcal mol^{-1}

C. 3.0 kcal mol^{-1}

D. 4.0 kcal mol^{-1}

Answer: B

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29. The enthalpy change of formation of $CO_2(g)$ is -393 kJ mol^{-1} and that of $H_2O(l)$ is -286 kJ mol^{-1}. The enthalpy of combustion of one mole of ethanol (C_2H_5OH) is -1360. the enthalpy change for the formation of one mole of ethanol form its constituent elements is

A. $-681kJ$

B. $-284kJ$

C. $+965kJ$

D. $1360kJ$

Answer: B

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30. The lattice energy of solid NaCl is 180 kcal mol^{-1} and enthaly of solution is 1 kcal mol^{-1}. If the hydration energies of Na^+ and Cl^- ions are in the ratio 3:2, what is the enthalpy of hydration of sodium ion?

A. $-107.4 \text{ kcal } mol^{-1}$

B. $107.4 \text{ kcal } mol^{-1}$

C. $71.6 \text{ kcal } mol^{-1}$

D. $-71.6 \text{ kcal } mol^{-1}$

Answer: A

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31. A certain reaction is non spontaneous at 298K. The entropy change during the reaction is 121 JK^{-1}. If the reaction is endothermic or exothermic, the minimum value of ΔH for the reaction is

A. endothermic, $\Delta H = 36.06kJ$

B. exothermic, $\Delta H = -36.06kJ$

C. endothermic, $\Delta H = 60.12kJ$

D. exothermic, $\Delta H = -60.12$kJ

Answer: A

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32. Which of the following statement is incorrect?

A. The standard enthalpy of reaction is the enthalpy change for a reaction when all the participating substnaces are in their standard states

B. The standard state of a substance at a specified temperatuer is its pure form at 1 bar.

C. The standard state of solid iron at 298 K is pure iron at 1 bar

D. standard conditions are denoted by adding the superscipt Θ to the symbol $\Delta He.$ G., $-\Delta H^{\Theta}$

Answer: C

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33. The ΔH at 358 K for the reaction

$Fe_2O_3(g) + 3H_2(g) \rightarrow 2Fe(s) + 3H_2O(l)$

Given that $\Delta H_{298} = -33.29kJmol^{-1}$ and C_p for $Fe_2O_3(s), Fe(s), H_2O(l)$ and H_2 and $103.8, 25.1, 75.3$ and $28.8kJ/K$ mol

A. $-28.136kJmol^{-1}$

B. $-38.3kJmol^{-1}$

C. $42.5kJmol^{-1}$

D. $56.2kJmol^{-1}$

Answer: A

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34. The enthalpy of a neutralisation of a weak acid in 1 M solution with a strong base is -56.1 kcal mol^{-1} if the enthalpy of ionisation of acid is 1.5

kcal mol^{-1}. If the enthalpy of ionisation of acid is 1.5 kcal mol^{-1} and enthalpy of neutralisation of the strong acid with a strong base is -57.3 kJ eq^{-1}. what is the % ionistion of the weak acid in molar solution (assume the aciid is monobasic)

A. 25

B. 20

C. 15

D. 10

Answer: B

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35. ΔH_f° of NF_3 is -113 kJ mol^{-1} and N-F bond energy is 273.0 kJ mol^{-1}. If $N \equiv N$ and F-F bond energies are in the rates 6:1, their magnetudes will be

A. 780.0 kJ mol^{-1}, 130 kJ mol^{-1}

B. 840 kJ mol^{-1}, 140 kJ mol^{-1}

C. 950.0 kJ mol^{-1}, 158.3 kJ mol^{-1}

D. 941.3 kJ mol^{-1}, 156 kJ mol^{-1}

Answer: D

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36. Consider the following process?

$\Delta H(kJ/mol)$

$1/2A \rightarrow \quad +150$

$3B \rightarrow 2C + D \quad -125$

$E + A \rightarrow 2D \quad +350$

For B+D $\rightarrow$ E+2C, ΔE will be

A. 525 kJ/mol

B. $-175kJ/mol$

C. $-325kJ/mol$

D. $325kJ/mol$

Answer: B

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37. For an isothermal reversible expansion process, the value of q can be calculated by the expression

A. $q = 2.303nRT\log\frac{V_2}{V_1}$

B. $q = -2.303nRT\log\frac{V_2}{V_1}$

C. $q = -P_{\exp}nRT\log\frac{V_1}{V_2}$

D. none of these

Answer: A

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38. From the following data ΔH of the following reactions

$C(s)+\frac{1}{2}O_2(g)\rightarrow CO(g), \Delta H=-110kJ$ and $C(s)+H_2O(g)\rightarrow CO($

Calculate the mole composition of the mixture of steam and oxygen on being passes over coke at 1273 K, keeping temperature constant.

A. $1:0.6$

B. 0.6:1

C. $2:3$

D. $3:2$

Answer: A

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39. The heats of neutralisation of $CH_3COOH, HCOOH, HCN$ and H_2S are -13.2,-13.4-2.9 and -3.8 kcal per equivalent respectively. Arrange the acids in increasing order of strength

A. $HCOOH > CH_3COOH > H_2S > HCN$

B. CH_(3)COOH gt HCOOH gt H_(20S gt HCN`

C. $H_{20S} > HCOOH > CH_3COOH > HCN$

D. $HCOOH > H_2S > CH_3COOH > HCN$

Answer: A

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40. Which of the following salts should cause maximum cooling when 1 mole of it is dissolved in the same volume of water?

A. $NaCl, e < aH^\circ = 5.35kJmol^{-1}$

B. $KNO_{30}, \Delta H^\circ = 53.5kJmol^{-1}$

C. $KOH, \Delta H^\circ = -56.0kJmol^{-1}$

D. $HBr, \Delta H^\circ = -83.3kJmol^{-1}$

Answer: B

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41. Read the following statements carefully and choose the correct option

(i) Internal energy U of the system is a state function.

(i) Internal energy U of the system is a state fuction.

(ii) -w shows, that work is done on the system.

(iii) +w shows,that work is done by the system

A. (i) and (ii) are correct

B. (ii) and (iii) are correct

C. (i) and (iii) are correct

D. only (i) is correct

Answer: D

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42. Consider the following reaction occurring in an automobile $2C_8H_{18}(g) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(g)$ ltbr. The sign of $\Delta H, \Delta S$ and ΔG would be

A. $+, -, +$

B. $-, +, -$

C. $-, +, +$

D. $+, +, -$

Answer: B

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43. Choose the eraction with negative ΔS value.

A. $2NaHCO_{3(s)} \rightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$

B. $Cl_{2(g)} \rightarrow 2Cl_{(g)}$

C. $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$

D. $2KClO_{3(s)} \rightarrow 2KCl_{(s)} + 3O_{2(g)}$

Answer: C

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