



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. $41.00 \text{ kJ mol}^{-1}$

B. $4.100 \text{ kJ mol}^{-1}$

C. $3.7904 \text{ kJ mol}^{-1}$

D. $37.904 \text{ kJ mol}^{-1}$

Answer: D

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4. A piston filled with 0.04 mole of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of 37.0°C . As it does so, it absorbs 208 J of heat. The values of q and w for the process will be:

($R=3.14 \text{ J/molK}$) (in 7.5=2.01)

A. $q=+208 \text{ J}$, $w=-208 \text{ J}$

B. $q=-208 \text{ J}$, $w=-208 \text{ J}$

C. $q=-208 \text{ J}$, $w=+209 \text{ J}$

D. $q=+208 \text{ J}$, $w=+208 \text{ J}$

Answer: A



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5. Among 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

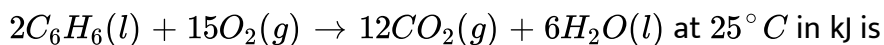
D. Kirchoff's equation

Answer: D



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



A. -7.43

B. $+3.72$

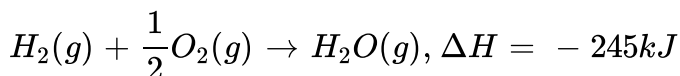
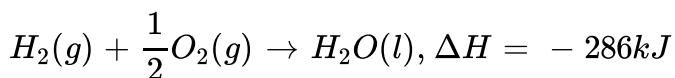
C. -3.72

D. $+7.43$

Answer: A

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



A. 6.02 kJ

B. 40.5kJ

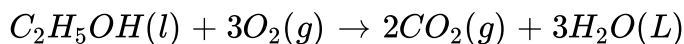
C. 62.3 kJ

D. 1.25 kJ

Answer: B

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9. For complete combustion of ethaol,



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

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

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

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

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

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

$$\Delta S_{(A \rightarrow C)} = 50 \text{ c. u.}, \Delta S_{(C \rightarrow D)} = 30 \text{ e. u.}, \Delta S_{(B \rightarrow D)} = 20 \text{ c. u.},$$

where c.u. is the entropy unit then $\Delta S_{(A \rightarrow B)}$ 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

12. From the following bond energies:

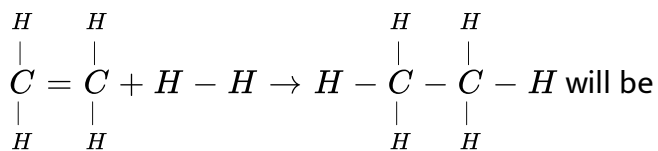
H-H bond energy: $431.37 \text{ kJ mol}^{-1}$

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

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

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

Enthalpy for the reaction,



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

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

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

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

Answer: B

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

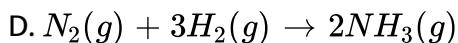
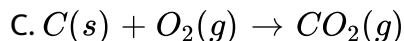
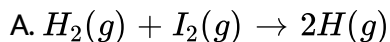
D. $\Delta S = \Delta H$, $\Delta H = +ve$, $\Delta S = +ve$

Answer: A



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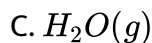
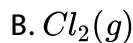
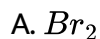
14. For which change $\Delta H \neq \Delta E$:



Answer: D

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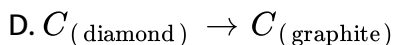
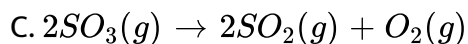
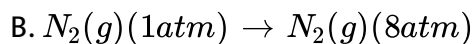
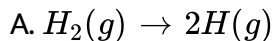
15. The species which by definition has ZERO standard molar enthalpy of formation at 298 K is



Answer: B

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



Answer: B

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17. Given the following entropy values (in $JK^{-1}mol^{-1}$) at 298 K and 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-stone to lime,

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ the value of ΔH° and ΔS° are $+179.1 \text{ kJ mol}^{-1}$ 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 ($R = 8.314 \text{ kJ}^{-1} \text{ mol}^{-1}$)

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

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

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

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

Answer: D

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20. The incorrect expression among the following is:

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

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

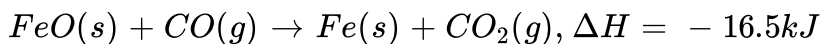
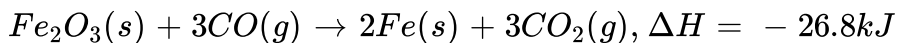
C. $\ln K = \frac{\Delta H^\circ - T\Delta S^\circ}{RT}$

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

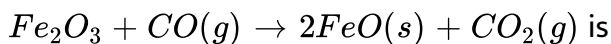
Answer: C

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21. The following two reactions are known:



The value of ΔH for the following reaction



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 $-46.0 \text{ kJ mol}^{-1}$ and that of N_2 is -712 kJ mol^{-1} , the average bond enthalpy of N-H bond in NH_3 is

A. -964 kJ mol^{-1}

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

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

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

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. -300 kJ/mol and -1300 kJ/mol, respectively. The standard enthalpy of cumbusion per gram of glucose at $25^\circ C$ is

A. $+2900kJ$

B. $-2900kJ$

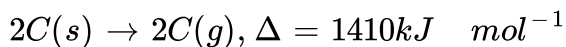
C. $-16.11kJ$

D. $+16.11kJ$

Answer: C

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27. Using the data provided, calculate the multiple 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})



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 $-10.5 \text{ kcal mol}^{-1}$ and enthalpy of neutralisation of CH_3COOH with strong base is $-12.5 \text{ kcal mol}^{-1}$. Enthalpy of ionisation of NH_4OH will

A. $3.2 \text{ kcal mol}^{-1}$

B. $2.0 \text{ kcal mol}^{-1}$

C. $3.0 \text{ kcal mol}^{-1}$

D. $4.0 \text{ kcal mol}^{-1}$

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 from its constituent elements is

A. -681 kJ

B. -284 kJ

C. $+965 \text{ kJ}$

D. 1360 kJ

Answer: B



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30. The lattice energy of solid NaCl is $180 \text{ kcal mol}^{-1}$ and enthalpy 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, $\Delta H = 36.06 \text{ kJ}$

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

C. endothermic, $\Delta H = 60.12 \text{ kJ}$

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

Answer: A



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32. Which of the following statement is incorrect?

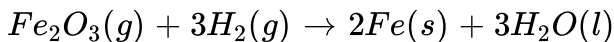
- A. The standard enthalpy of reaction is the enthalpy change for a reaction when all the participating substances are in their standard states
- B. The standard state of a substance at a specified temperature is its pure form at 1 bar.
- C. The standard state of solid iron at 298 K is pure iron at 1 bar
- D. standard conditions are denoted by adding the superscript \ominus to the symbol ΔH . G., $-\Delta H^\ominus$

Answer: C



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33. The ΔH at 358 K for the reaction



Given that $\Delta H_{298} = -33.29 kJ mol^{-1}$ and C_p for

$Fe_2O_3(s)$, $Fe(s)$, $H_2O(l)$ and H_2 and 103.8, 25.1, 75.3 and $28.8 kJ / K$

mol

A. $-28.136 kJ mol^{-1}$

B. $-38.3 kJ mol^{-1}$

C. $42.5 kJ mol^{-1}$

D. $56.2 kJ mol^{-1}$

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 $1.5 \text{ kcal mol}^{-1}$ and enthalpy of neutralisation of the strong acid with a strong base is -57.3 kJ eq^{-1} . what is the % ionisation of the weak acid in molar solution (assume the acid 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 $273.0 \text{ kJ mol}^{-1}$.

If $N \equiv N$ and F-F bond energies are in the ratio 6:1, their magnitudes will be

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

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

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

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

Answer: D

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36. Consider the following process?

$$\Delta H(\text{kJ/mol})$$

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

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

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

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

A. 525 kJ/mol

B. -175 kJ/mol

C. -325 kJ/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. $q = -2.303nRT \log \frac{V_2}{V_1}$

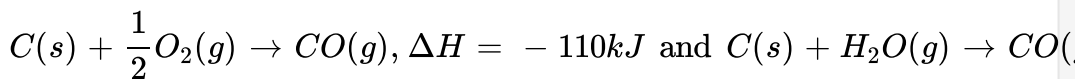
C. $q = -P_{\text{exp}} nRT \log \frac{V_1}{V_2}$

D. none of these

Answer: A

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38. From the following data ΔH of the following reactions



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

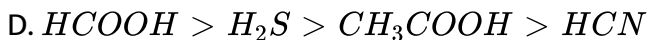
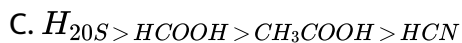
D. 3:2

Answer: A



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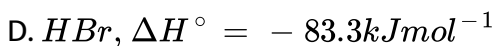
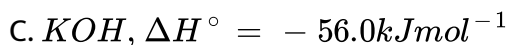
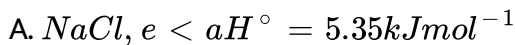
39. The heats of neutralisation of CH_3COOH , $HCOOH$, HCN and H_2S are -13.2, -13.4, -2.9 and -3.8 kcal per equivalent respectively. Arrange the acids in increasing order of strength



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?



Answer: B

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

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

A. +, -, +

B. -, +, -

C. -, +, +

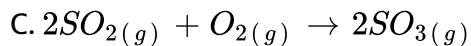
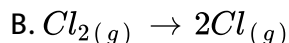
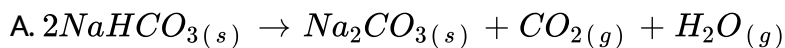
D. +, +, -

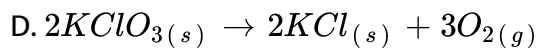
Answer: B



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43. Choose the reaction with negative ΔS value.





Answer: C



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