CHEMISTRY

BOOKS - S DINESH & CO CHEMISTRY (HINGLISH)

CHEMICAL THERMODYNAMICS AND CHEMICAL ENERGETICS

Exercise

1. Which of the following does not come under the preview of thermodynamics?

A. Predicting the feasibility of chemical change

B. Predicting the extent of the chemical change

C. Rate at which chemical change occurs at particular set of conditions

D. Effect of temperature on the extent of reaction.

Answer: C

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2. Energy changes accompanying the chemical reactions can take place :

A. in the form of heat only

B. in the form of heat as well as light only

C. in the form of light only

D. in any form depending upon the nature of the system.

Answer: D

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3. A cup of tea placed in the room eventually acquires a room temperature by losing heat. The process may be considered close to

A. Cyclic process

B. Reversible process

C. Isothermal process

D. None of these

Answer: B

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4. A gaseous system changes from state $A(P_1, V_1, T_1)$ to $B(P_2, V_2, T_2)$, B to $C(P_3, V_3, T_3)$ and finally from C to A. The whole process may be called

A. Reversible process

B. Cyclic process

C. Isobaric process

D. Spontaneous process.

Answer: B

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5. A well stoppered thermo flask containing some ice cubes is an example of

A. closed system

B. open system

C. isolated system

D. non-thermodynamic system.

Answer: C

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6. Which among the following state functions is an extensive property of the system?

A. Temperature

B. Volume

C. Refractive index

D. Viscosity

Answer: B

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7. Which of the following is an intensive property?

A. Volume

B. Mass

C. Density

D. Energy

Answer: C

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8. Which among the following is not a state function?

A. Internal energy

B. Free energy

C. Work

D. Enthalpy

Answer: C

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9. Enerrgy can transfter from syetm to surroundings as work if

A. there if thermal equilibrium between system and surroundings

B. there if mechanical equilibrium between system and surroundings

C. if pressure of system gt atmospheric pressure

D. if pressure of system lt atmospheric pressure

Answer: C

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10. For the process to occur under adiabatic conditions, the correct condition is

A. $\Delta T = 0$

B. $\delta q = 0$

C. $\Delta P = 0$

D. $\delta W = 0$

Answer: B

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11. A chemical process is carried out in a thermostat maintained at $25^\circ C$.The process may be termed as

A. isobaric process

B. isoentropic process

C. adiabatic process

D. isothermal process.

Answer: D

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12. A thermodynamic state function is

A. One which obeys all the laws of thermodynamics

B. A quantity which is used to measure thermal changes

C. A quantity whose value is independent of the path

D. A quantity which is used to express pressure-volume work.

Answer: C

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13. The efficiency of a heat engine is maximum when

A. temperature of source is greater than that of sink

B. temperature of sink is greater than that 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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14. During isothermal expansion of an ideal gas its

A. Enthalpy remains constant

B. Enthalpy decreases

C. Internal energy increases.

D. Internal energy decreases.

Answer: A

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15. A gas expands isothermally and reversibly. The work done by the gas is

A. Zero

B. Maximum

C. Minimum

D. Cannot be determined

Answer: B

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16. A thermally isolated gaseous system can exchange energy with the surroundings. The mode of transference of energy can be

A. heat

B. work

C. heat and radiation

D. only radiations.

Answer: B

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17. Which among the following gives the expression for the reversible isothermal expansion of ideal gas ?

A. $-P\Delta V$

B. $-nRT\frac{\ln(V_2)}{V_1}$

C. Both A and B

D. Neither A nor B

Answer: B

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18. What is correct about isothermal expansion of the ideal gas?

A. $W_{rev} = W_{irr}$

B. $W_{rev} + W_{irr} = 0$

C. $W_{rev} > W_{irr}$

D. $q_{rev} = q_{irr}$

Answer: C

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19. Which of the following is correct for adiabatic expansion ideal gas?

A. $PV =$ constant

B. $PV^{\gamma} =$ constant

C. $PT^{\gamma} =$ constant

D. $TV^{\gamma} =$ constant

Answer: B

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20. Which of the following expression expressions is true for an ideal gas?

A. $\left(\frac{\delta V}{\delta T}\right)_P = 0$

B. $\left(\frac{\delta P}{\delta T}\right)_V = 0$

C. $\left(\frac{\delta E}{\delta V}\right)_T = 0$

D. $\left(\frac{\delta E}{\delta T}\right)_V = 0$

Answer: C

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21. The expression $[\delta H / \delta T]_V$ represents

A. Heat capacity at constant volume

B. Heat capacity at constant pressure

C. Enthalpy change

D. Entropy change

Answer: A

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22. The internal energy of one mole of a gas is

A. $\frac{3}{2}RT$

B. $\frac{1}{2}kT$

C. $\frac{1}{2}RT$

D. $\frac{3}{2}kT$

Answer: A

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23. Internal energy does not include

A. vibrational energy

B. rotational energy

C. energy arising by gravitational pull

D. nuclear energy.

Answer: C

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24. The formation of water from $H_2(g)$ and $O_2(g)$ is an exothermic process because :

A. $H_2(g)$ and $O_2(g)$ have a higher chemical energy than water

B. $H_2(g)$ and $O_2(g)$ have a lower chemical energy than water

C. $H_2(g)$ and $O_2(g)$ have a higher temperature than water

D. Energy consideration do no arise.

Answer: A

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25. In a change from state A to state B

A. q depends only on the initial and final state

B. w depends only on the initial and final state

C. ΔE depends only on the initial and final state

D. ΔE depends upon the path adopted by A to change into B.

Answer: C

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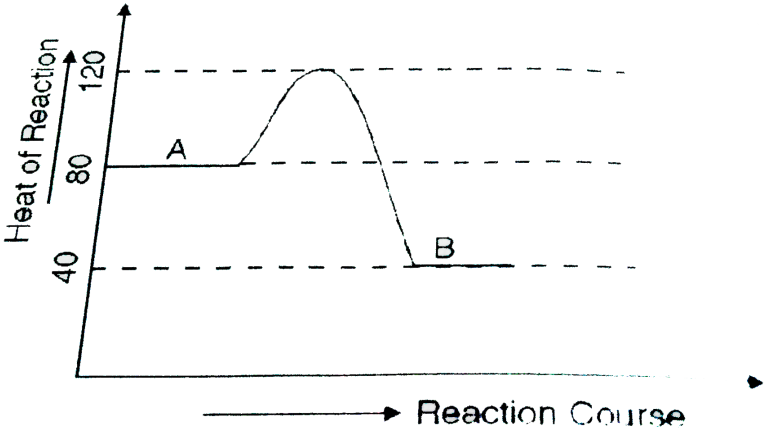
26. According to the diagram given below, the value of ΔH for conversation of A to B is



A. -40

B. $+40$

C. -120

D. $+120$

Answer: A

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27. When ammonium chloride is dissolved in water, the solution becomes cold. The change is

A. Endothermic

B. Exothermic

C. Supercooling

D. None of the above

Answer: A

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28. The enthalpies of formation of all the elements in their standard states are

A. Unity

B. Zero

C. $>$ Zero

D. < 1 but > 0

Answer: B

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29. A monoatomic neon molecule possesses

A. only potential energy

B. potential as well as vibrational energy

C. vibrational as well as translational energy

D. translational as well as potential energy

Answer: A

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30. The heat of combusion of benzne determined in a bomb calorimeter is $-870Kcalmol^{-1}$ at $298K$. The value of ΔE for the reaction is

A. $-1740kcalmol^{-1}$

B. $+870 kcal mol^{-1}$

C. $-870 kcal mol^{-1}$

D. $+1740 kcal mol^{-1}$

Answer: C

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31. An endothermic reaction is allowed to take place very rapidly in the air. The temperature of the surrounding air

A. remains constant

B. increases

C. decreases

D. cannot be answered as sufficient information is not available.

Answer: A

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32. The heat absorbed in a reaction at constant temperature and constant volume is

A. ΔE

B. ΔH

C. $-\Delta A$

D. $-\Delta G$

Answer: A

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33. In endothermic reactions

A. the heat is given to surroundings

B. $\Delta H = -ve$

C. $\Delta H = +ve$

D. $H_R > H_P$

Answer: C

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34. For the reaction,

$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$, which of the following statement is correct ?

A. $\Delta H = \Delta E$

B. $\Delta H \geq \Delta E$

C. $\Delta H > \Delta E$

D. $\Delta H = 0$

Answer: C

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35. The heat of reaction at constant volume (ΔE) and that at constant pressure (ΔH) are related as

A. $\Delta E = \Delta H + \Delta nRT$

B. $\Delta H = \Delta E - \Delta nRT$

C. $\Delta H = \Delta E + \Delta nRT$

D. $\Delta H = \Delta E + nRT$

Answer: C

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36. Under which of the following condition is the relation $\Delta H = \Delta U + P\Delta V$ valid for a closed system at

A. Constant pressure

B. Constant temperature

C. Constant temperature and pressure

D. Constant temperature, pressure and composition.

Answer: C

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37. For the gaseous reaction: $N_2O_4 \rightarrow 2NO_2$

A. $\Delta H > \Delta E$

B. $\Delta H < \Delta E$

C. $\Delta H = \Delta E$

D. $\Delta H = 0$, but ΔE may have any value.

Answer: A

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38. The heat of combustion of solid benzoic acid at constant volume is $-321.30kJ$ at $27^{\circ}C$. The heat of combustion at constant pressure is

A. $-321\cdot30-300R$

B. $-321\cdot30+300R$

C. $-321\cdot30-150R$

D. $-321\cdot30+900R$

Answer: C

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39. For hypothetical reaction

$A(g)+B(g)\rightarrow C(g)+D(g)$

Which of the following statements is correct ?

A. $\Delta H=\Delta E$

B. $\Delta H>\Delta E$

C. $\Delta H < \Delta E$

D. Unpredictable

Answer: A

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40. ΔE° of combustion of isobutylene is $-XkJmol^{-1}$. The value of ΔH° is

A. $= \Delta E^{\circ}$

B. $> \Delta E^{\circ}$

C. $= 0$

D. $< \Delta E^{\circ}$

Answer: D

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41. The difference between ΔH and ΔE at constant voluem is equal to

A. R

B. $p\Delta V$

C. $V\delta p$

D. $\frac{3}{2}R.$

Answer: C

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42. The reaction given below

$BaCI_2(s) + 2H_2O(l) \rightarrow BaCI_2.2H_2O, \Delta H^{\Theta} = -xkJ$ The value of ΔH^{Θ} represents

A. Enthalpy of solution

B. Enthalpy of dilution

C. Enthalpy of combustion

D. Enthalpy of hydration

Answer: D

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43. Enthalpy change of the reaction

$2H(g) \rightarrow H_2(g)$ is $-104kcal$

The $H-H$ bond dissociation energy is

A. $104kcal$

B. $-104kcal$

C. $-52kcal$

D. $+52kcal$

Answer: A

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44. According to latest sign conventions, the correct expression representing the first law of thermodynamics is

A. $\Delta E = q + W$

B. $\Delta E = \Delta H + PV$

C. $\Delta E = q - W$

D. All are correct

Answer: A

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45. 'If a system A is in thermal equilibrium with B and B is in thermal equilibrium with C, then A and C are in thermal equilibrium with each other.'' This is a statement of

A. Cyclic rule

B. Zeroth law of thermodynamics

C. First law of thermodynamics

D. Second law of thermodynamics

Answer: B

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46. According to Hess's law, the thermal effects of a reaction depends on

A. initial concentration of reactants

B. final conditions of the reacting substance

C. intermediate states of a reaction

D. initial and final conditions of the reacting substances.

Answer: D

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47. Hess's law states,

A. $H = E + PV$

B. It is not possible to create or destory energy

C. Enthalpy change of a given chemical reaction is same whether the process occurs in one or more sequence of steps

D. Total entropy of the universe remains constant.

Answer: C

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48. Which of the following statements relationship is not correct?

A. In exothermic reaction, the enthalpy of product is less than that of the reactants

B. $\Delta H_{fus} = \Delta H_{\subset l} - \Delta H_{vap}$

C. A reaction for which $\Delta H^{\circ} < 0$ and $\Delta S > 0$ is possible at all temperatures.

D. ΔH is less than ΔE for combustion of carbon to carbon dioxide.

Answer: D

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49. A hypothetical reaction, $A \rightarrow 2B$, proceeds via following sequence of steps

$$\begin{array}{ll} A \rightarrow C & \Delta H = q_1 \\ C \rightarrow D & \Delta H = q_2 \\ \frac{1}{2}D \rightarrow B & \Delta H = q_3 \end{array}$$

The heat of reaction is

A. $q_1 - q_2 + 2q_3$

B. $q_1 + q_2 - 2q_3$

C. $q_1 + q_2 + 2q_3$

D. $q_1 + 2q_2 - 2q_3$

Answer: C

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50. $N_2(g) + 2O_2(g) \rightarrow 2NO_2(g) + XkJ$

$2NO(g) + O_2(g) \rightarrow 2NO_2 + YkJ$

The enthalpy of formation of NO is

A. $(2X - 2Y)$

B. $X - Y$

C. $\frac{1}{2}(Y - X)$

D. $\frac{1}{2}(x - y)$

Answer: D

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51. Enthalpy of formation of compound is

A. always positive

B. always negative

C. can be either negative or zero

D. can be positive or negative

Answer: D

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52. The value of ΔH for the process given below, $NH_4OH(aq) \rightarrow NH_4^+ + OH^-$ is

A. positive

B. negative

C. zero

D. Unpredictable

Answer: A

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53. i. $H_2(g) + CI_2(g) \rightarrow 2HCI(g), \Delta H = -xkJ$

ii. $NaCI + H_2SO_4 \rightarrow NaHSO_4 + HCI, \Delta H = -ykJ$

iii. $2H_2O + 2CI_2 \rightarrow 4HCI + O_2, \Delta H = -zkJ$

From the above equations, the value of ΔH of HCI is

A. $-xkJ$

B. $-ykJ$

C. $-zkJ$

D. $-x/2kJ$

Answer: D

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54. The reaction

$SO_2(g) + 1/2O_2(g) \rightarrow SO_3(g)$ should be

A. Endothermic

B. Exothermic

C. $\Delta H = 0$

D. Unpredictable

Answer: B

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55. The enthalpy combustion of a substance

A. is always positive

B. is always negative

C. can be either zero or greater than zero

D. is unpredictable till calculations are done.

Answer: B

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56. Xg of ethanal was subjected to combustion in a bomb calorimeter and the heat produced is YJ. Then

A. $\Delta E_{combustion} = -XJ$

B. $\Delta E_{combustion} = -YJ$

C. $\Delta E_{combustion} = \dfrac{-44Y}{X} Jmol^{-1}$

D. $\Delta H_{combustion} = \dfrac{-44Y}{X} Jmol^{-1}$

Answer: C

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57. The enthalpy change for the process $C_{(\text{graphite})} \rightarrow C_{(g)}, \Delta H = +xkJ$ represents enthalpy of

A. fusion

B. sublimation

C. combustion

D. vaporization.

Answer: B

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58. $HA + OH^- \rightarrow H_2O + A^- + q_1 kJ$

$H^+ + OH^- \rightarrow H_2O + q_2 kJ$

The enthalpy of dissociation of HA is

A. $(q_1 + q_2)$

B. $(q_1 - q_2)$

C. $(q_2 - q_1)$

D. $-(q_1 + q_2)$

Answer: B

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59. The heat change accompanying the reaction

$2H_2(g) + O_2(g) \rightarrow 2H_2O(l):$

$\Delta H = -136 kcal$ is called

A. heat of combustion of hydrogen

B. heat of reaction

C. heat of formation of water

D. None of these

Answer: B

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60. When a solid melts there is

A. an increase in enthalpy

B. a decrease in enthalpy

C. no change in enthalpy

D. a decrease in internal energy.

Answer: A

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61. One gram-atom of graphite and one gram-atom of diamond were separately burnt to CO_2 . The amount of heat liberated was $393.5KJ$ and $305.4KJ$ respectively. It is apparent that

A. graphite has greater affinity for oxygen

B. diamond has greater affinity for oxygen

C. graphite is stabler than diamond

D. diamond is stabler than graphite.

Answer: C

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62. The reaction which shows heat of formation of water correctly is

A. $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l), \Delta H = -68.3 kcal$

B. $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(s), \Delta H = -68.3 kcal$

C. $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g), \Delta H = -68.3 kcal$

D. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l), \Delta H = -136.6 kcal$

Answer: A

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63. Heat of formation, ΔH_f° of an explosive compound like NCl_3 is -

A. positive

B. negative

C. zero

D. positive or negative

Answer: A

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64. The products of combustion of an aliphatic thiol (RSH) at 298 K are

A. $CO_2(g), H_2O(g)$ and $SO_2(g)$

B. $CO_2(g), H_2O(l)$ and $SO_2(g)$

C. $CO_2(l), H_2O(l)$ and $SO_2(g)$

D. $CO_2(g), H_2O(l)$ and $SO_2(l)$

Answer: B

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65. For the transition $C_{(\text{diamond})} \rightarrow C_{(\text{graphite})}, \Delta H = -1.5kJ.$ It follows that

A. graphite is stabler than diamond

B. diamond is stabler than graphite

C. graphite is endothermic

D. diamond is exothermic

Answer: A

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66. Which of the following statements is correct?

A. For exothermic reactions, ΔH is positive

B. For endothermic reactions, ΔH is negative

C. The $\Delta H_{Neutralization}$ for strong acid and strong base is always the same

D. The enthalpy of fusion, ΔH_{fus} is negative

Answer: C

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67. The heat liberated in the following reaction

$H^{+}(aq) + OH^{-}(aq) \rightarrow H_2O(l)$ is

A. $57.0kJ$

B. $60kJ$

C. $5.7kJ$

D. Unpredictable

Answer: A

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68. For the neutralisation of 1 mol of H_2SO_4 with 2 mols of $NaOH$ in dilute solutions the heat evolved is

A. $= 57.0kJ$

B. $< 57.0kJ$

C. $> 57.0kJ$

D. Unpredictable

Answer: C

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69. Enthalpy of neutralisation of all strong acids strong bases has the same value because

A. neutralisation leads to the formation of a salt and water

B. strong acids and bases are ionic substances

C. acids always give rise to H^+ ions and bases always furnish OH^- ions

D. the net chemical change involve the combination of 1 mol of H^+ ions and ions OH^- ions to form water.

Answer: D

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70. A solution of $200mL$ of $1MKOH$ is added to $200mL$ of $1MHCl$ and the mixture is well shaken. The rise in temperature T_1 is noted. The experiment is repeated by using $100mL$ of each solution and increase in temperature T_2 is again noted. Which of the following is correct?

A. $T_1 = T_2$

B. T_2 is twice as large as T_1

C. T_1 is twice as large as T_2

D. T_1 is four times as large as T_2

Answer: A

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71. The heats of neutralisation of four acids a, b, c and d when neutralised against a common base are 13.7, 9.4, 11.2 and 12.4 kcal respectively. The weakest among these acids is

A. a

B. b

C. c

D. d

Answer: B

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72. Enthalpy of neutralisation of $NaOH$ with H_2SO_4 is $-57.3kJmol^{-1}$ and with ethanoic acid $-55.2kJmol^{-1}$. Which of the following is the best explanation of this difference?

A. Ethanoic acid is weak acid and thus requires less $NaOH$ for neutralisation

B. Ethanoic acid is only partly ionized, neutralisation is therefore incomplete

C. Ethanoic acid is monobasic while H_2SO_4 is dibasic

D. Some heat is used to ionize the ethanoic acid completely.

Answer: D

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73. The temperature at which the Joule Thomson coefficient changes sign is called

A. Critical temperature

B. Inversion temperature

C. van der Waals' constant

D. Kelivin temperature

Answer: B

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74. In case of an ideal gas, Joule Thomson effect is

A. zero

B. positive

C. negative

D. infinite

Answer: A

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75. Which of the following gases show a heating effect when allowed to expand into a region of low pressure?

A. CO_2

B. NH_3

C. F_2

D. H_2

Answer: D

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76. When a gas is allowed to expand from a region of extremly high pressure to a region of extremly low pressure, there occurs a change of temperature. This phenomenon is associated with

A. First law of thermodynamics

B. Second law of thermodynamics

C. Joule-Thomson effect

D. Gibbs Helmholtz equation. II

Answer: C

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77. Joule Thomson coefficient is given by the expression

A. $\left(\frac{\delta T}{\delta P}\right)_H$

B. $\left(\frac{\delta T}{\delta V}\right)_H$

C. $\left(\frac{\delta E}{\delta P}\right)_V$

D. $\left(\frac{\delta S}{\delta T}\right)_P$

Answer: A

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78. Entropy of system depends upon

A. volume only

B. temperature only

C. pressure only

D. pressure, volume and temperature

Answer: D

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79. The units of entropy are

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

B. Jg^{-1}

C. $Jmol^{-1}$

D. $K^{-1}mol$

Answer: A

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80. Ammonium chloride when dissolved in water leads to a cooling sensation. The dissolution of ammonium chloride at constant temperature is accompanied by

A. increase in entropy

B. decrease in entropy

C. no change in entropy

D. no change in enthalpy

Answer: A

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81. An isolated system comprises the liquid in equilibrium with vapours. At this stage, the molar entropy of the vapour is

A. less than that of liquid

B. more than that of liquid

C. equal to zero

D. equal to that of liquid

Answer: D

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82. For the gaseous reaction involving the complete combustion of iso-butane

A. $\Delta H = \Delta E$

B. $\Delta H > \Delta E$

C. $\Delta H = \Delta E = 0$

D. $\Delta H < \Delta E$

Answer: B

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83. One of the following reactions involves decrease in entropy

A. Sublimation of dry ice

B. Crystallisation of salt from brine

C. Burning of rocket fuel

D. Decomposition of gaseous N_2O_4

Answer: B

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84. When a solid changes into liquid, the entropy

A. becomes zero

B. becomes minimum

C. increases

D. remains constant

Answer: C

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85. The least random state of water system is

A. ice

B. liquid water

C. steam

D. randomness is same in all

Answer: A

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86. Which of the following process has negative value of ΔS ?

A. Dissolution of sugar in water

B. Stretching of rubber band

C. Decomposition of lime stone

D. Evaporation of water.

Answer: B

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87. Which of the following describes the criterion of spontaneity?

A. $\Delta S_{(Total)} > 0$

B. $\Delta G_{T \quad P} > 0$

C. $\Delta H_{T \quad P} > 0$

D. None of above

Answer: A

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88. Which law of thermodynamics helps in calculating the absolute entropies of various substances at different temperatures?

A. First law

B. Second law

C. Third law

D. Zeroth law

Answer: C

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89. When the egg is hard boiled, there is

A. increase in disorder

B. decrease in disorder

C. no change in disorder

D. ΔG is negative

Answer: A

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90. For the reversible process, the value of ΔS is given by the expression:

A. $\Delta H / \Delta T$

B. $T \div q_{(rev)}$

C. $q_{(rev)} \times T$

D. $q_{(rev)} \div T$

Answer: D

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91. In any natural process

A. The entropy of universe remains constant

B. The entropy of universe tends towards maximum

C. The entropy of universe tends towards minimum

D. Any of the above can happen

Answer: B

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92. For which of the following cases is

$\Delta S = \Delta H / T$

A. adiabatic process

B. a process for which $\Delta C_P = 0$

C. an isothermal reversible phase change

D. a process at constant pressure.

Answer: C

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93. In a reversible process,

$\Delta S_{sys} + \Delta S_{surr}$ is

A. > 0

B. < 0

C. ≥ 0

D. $= 0$

Answer: D

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94. According to third law of thermodynamics, the entropy at $0K$ is zero for

A. elements in their stable form

B. perfectly crystalline solids

C. substances at 1atm and $25^\circ C$

D. N_2O

Answer: B

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95. Which of the following has highest entropy?

A. Water

B. Graphite

C. Mercury

D. Hydrogen

Answer: D

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96. The total entropy change for a system and its surroundings increases, if the process is

A. reversible

B. inversible

C. exothermic

D. endothermic

Answer: B

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97. Which of the following provide exceptions to third law of thermodynamics ?

A. Crystals of CO

B. Crystals of ice

C. Crystals of CO_2

D. All the above

Answer: D

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98. Which thermodynamics property provides a measure of randomness in the system ?

A. Enthalpy

B. PV-work

C. Free energy

D. Entropy

Answer: D

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99. Which one of the following is correct ?

A. $-\Delta G = \Delta H - T\Delta S$

B. $\Delta H = \Delta G - T\Delta S$

C. $\Delta S = (1)/(T)[\Delta G - \Delta H]$

D. $\Delta S = (1)/(T)[\Delta H - \Delta G]$

Answer: D

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100. An endothermic gaseous reaction,

$$\frac{1}{2}X + Y \to 2Z$$

proceeds spontaneously at $27^\circ C$ because

A. $\Delta H < 0, \Delta S < 0$

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

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

D. $\Delta H > 0, \Delta S < 0$

Answer: B

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101. The sign of ΔG for the process of melting of ice at $273K$ and 1 atm pressure is

A. positive

B. negative

C. neither positive nor negative

D. either positive nor negative

Answer: C

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102. For a hypothetical reaction

$A + B \rightarrow C$ if $\Delta G^{\circ} > 0$

A. the reaction tends to proceed slowly towards formation of C

B. the increase in temperature increases the yield of C

C. A and B predominates in the reaction mixture

D. C predominates in the reaction mixture

Answer: C

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103. The free energy change for a reversible reaction at equilibrium is

A. infinite

B. zero

C. positive

D. negative

Answer: B

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104. At $27^\circ C$ for reaction,

$$C_6H_6(l) + \frac{15}{2}O_2(g) \rightarrow 6CO_2(g) + 3H_2O(l)$$

proceeds spontaneously because the magnitude of

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

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

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

D. $\Delta H > 0$ and $T\Delta S < 0$

Answer: B

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105. A particular reaction at $27^{\circ}C$ for which $\Delta H > 0$ and $\Delta S > 0$ is found to be non-spontaneous. The reaction may proceed spontaneously if

A. the temperature is decreased

B. the temperature is increased

C. the temperature is kept constant

D. it is carried in open an vessel at 27°

Answer: B

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106. Which of the following expression defines the physical significance of free energy change?

A. $-\Delta G = w_{(non-\exp)}$

B. $-\Delta G = \ -w_{(non-\exp)}$

C. $\Delta G = -w_{(\exp)}$

D. $\Delta G = w_{(\exp)}$

Answer: B

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107. A gas is allowed to expand reversibly under adiabatic conditions. What is zero for such a process ?

A. $\Delta G = 0$

B. $\Delta T = 0$

C. $\Delta S = 0$

D. None of these

Answer: C

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108. The hypothetical gaseous reaction

$A + B \rightarrow AB$

A. should be exothermic

B. should be endothermic

C. does not involve enthalpy change

D. cannot be predicted.

Answer: A

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109. For a process $H_2O(s) \rightarrow H_2O(l) at 273K$

A. $G(\text{ice}) = G(\text{water}) = 0$

B. $G(\text{ice}) = G(\text{water}) \neq 0$

C. $G(\text{ice}) > G(\text{water})$

D. $G(\text{ice}) < G(\text{water})$

Answer: A

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110. For the process

$\text{Dry ice} \rightarrow CO_2(g)$

A. Both ΔH and ΔS are positive

B. ΔH is -ve while ΔS is positive

C. ΔH is -ve while ΔS is negative

D. Both ΔH and ΔS are negative

Answer: A

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111. The non- expansion work of a system

A. Equals decrease in free energy

B. Equals decrease in internal energy

C. Equals increase in enthalpy

D. Equals increase in internal energy

Answer: A

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112. For the percipitation reaction of $Ag^{\oplus}$ ions with $NaCI$, which of the following statements is true?

A. ΔH for the reaction is zero

B. ΔG for the reaction is zero

C. ΔG for the reaction is negative

D. $\Delta G = \Delta H$

Answer: C

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113. Heat of neutralisation of $NaOH$ and HCl is $-57.46kJ/$ equivalent. The heat of ionisation of water in kJ/mol is :

A. $-57.3kJmol^{-1}$

B. $-114.6kJmol^{-1}$

C. $+57.3kJmol^{-1}$

D. $+114.6kJmol^{-1}$

Answer: C

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114. The enthalpy change for a given reaction at $298K$ is $-x cal mol^{-1}$. If the reaction occurs spontaneously at $298K$, the entropy change at that temperature

A. can be negative but numerically larger than $x/298 cal K^{-1}$

B. can be negative but numerically smaller than $x/298 cal K^{-1}$

C. cannot be negative

D. cannot be positive

Answer: B

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115. One litre-atmosphere is approximately equal to

A. $19.2kJ$

B. $101J$

C. $8.31J$

D. $831J$

Answer: B

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116. The heat change at constant volume for the decomposition of silver (I) oxide is found to be $30.66kJ$. The heat change at constant pressure will be

A. $30.66kJ$

B. $> 30.66kJ$

C. $< 30.66kJ$

D. Unpredictable

Answer: B

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117. The maximum efficiency of a steam engine operating between $110^\circ C$ and $25^\circ C$

A. $20\ \%$

B. $22.2\ \%$

C. $25\ \%$

D. $30\ \%$

Answer: B

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118. What per cent T_1 is of T_2 for a heat engine whose efficiency is $10\ \%$

A. $92\ \%$

B. $10\ \%$

C. 90%

D. 100%

Answer: C

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119. An engine operating between $100^{\circ}C$ and $0^{\circ}C$ takes $453.6kcal$ of heat. How much useful work can be done by it ?

A. $508.8kJ$

B. $453.6kcal$

C. $508.8kcal$

D. None

Answer: A

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120. Theheat capacity of liquid water at constant pressure, C_P is $18 cal deg^{-1} mol^{-1}$. The value of heat capacity of water at constant volume, C_V, is approximately

A. $18 cal deg^{-1} mol^{-1}$

B. $16 cal deg^{-1} mol^{-1}$

C. $10.8 cal deg^{-1} mol^{-1}$

D. cannot be predicted.

Answer: B

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121. A gas is allowed to expand at constant temperature from a volume of $1.0L$ to $10.0L$ against an external pressure of 0.50 atm. If the gas absorbs $250J$ of heat from the surroundings, what are the values of q and ΔE ? (Given $1L\text{atm} = 101J$)

A. $\begin{array}{ccc} q & w & \Delta E \\ 250J & -455J & -205J \end{array}$

B. $\begin{array}{ccc} q & w & \Delta E \\ -250J & -455J & -710J \end{array}$

C. $\begin{array}{ccc} q & w & \Delta E \\ 250J & 455J & 710J \end{array}$

D. $\begin{array}{ccc} q & w & \Delta E \\ 250J & 455J & 205J \end{array}$

Answer: A

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122. For the reaction between CO_2 and graphite:

$CO_2(g) + C(s) \rightarrow 2CO(g)$,

$\Delta = 170kJ$ and $\Delta S = 170.\ JK^{-1}$. The reaction will be spontaneous at :

A. $298K$

B. $500K$

C. $900K$

D. $1200K$

Answer: D

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123. A system has internal energy equal to U_1, $450J$ of heat is taken out of it and $600J$ of work is done on it. The final energy of the system will be

A. $(E_1 + 150)$

B. $(E_1 + 1050)$

C. $(E_1 - 150)$

D. None of these

Answer: A

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124. Entropy of vaporisation of water at $100^{\circ}C$, if molar heat of vaporisation is $9710 cal mol^{-1}$ will be

A. $20 cal mol^{-1} K^{-1}$

B. $26 cal mol^{-1} K^{-1}$

C. $24 cal mol^{-1} K^{-1}$

D. $28 cal mol^{-1} K^{-1}$

Answer: D

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125. For decomposition of Ag_2O into 2 mol of $Ag(s)$ and $1/2$ mol of $O_2(g)$. The heat absorbed is $30.66J$, when the process is carried out at constant volume. The process is carried out at constant volume. The value of $\Delta H$of process is

A. $-30.66J$

B. $+30.66J$

C. $+32.66K$

D. Unpredictable

Answer: D

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126. One moles of anhydrous AB dissolves in water and liberates $21.0Jmol^{-1}$ of heat. The valueof ΔH^{Θ} (hydration) of AB is $-29.4Jmol^{-1}$. The heat of dissolution of hydrated salt $AB.2H_2O(s)$ is

A. $50.4Jmol^{-1}$

B. $8.4Jmol^{-1}$

C. $-50.4Jmol^{-1}$

D. $-8.4Jmol^{-1}$

Answer: B

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127. The standard entropies of $N_2(g), H_2(g)$ and $NH_3(g)$ are $191.5, 130.5, 192.6 JK^{-1} mol^{-1}$. The value of ΔS^0 during the formation of 1 mole of ammonia is

A. $-98.9 JK^{-1} mol^{-1}$

B. zero

C. $+129.4 JK^{-1} mol^{-1}$

D. $-29.4 JK^{-1} mol^{-1}$

Answer: A

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128. For hypothetical reversible reaction

$1/2A_2(g) + 3/2B_2(g) \rightarrow AB_3(g), \Delta H = -20kJ$if standard entropies of $A_2, B_2,$ and AB_3 are $60, 40$ and $50 JK^{-1} mol^{-1}$ respectively. The above reaction will be equilibrium at

A. $400 K$

B. $500 K$

C. $250 K$

D. $200 K$

Answer: B

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129. If ΔH_f° of $Icl(g)$, $Cl(g)$ and $I(g)$ is 17.57, 121.34 and $106.96 Jmol^{-1}$ respectively. Then bond dissociation energy of $I - Cl$ bond is

A. $35.15 Jmol^{-1}$

B. $106.69 Jmol^{-1}$

C. $210.73 J mol^{-1}$

D. $420.9 J mol^{-1}$

Answer: C

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130. If the enthalpy of combustion of C(graphite) is $-393.3 kJ mol^{-1}$, then for producing $39.3 kJ$ of heat the amount of carbon required is

A. $1.5 mol$

B. $0.5 mol$

C. $1.2 g$

D. $12 mg$

Answer: C

Watch Video Solution

131. An ideal gas expands from $10^{-3}m^3$ to $10^{-2}m^3$ at 300 K against a constant pressure of $10^5 Nm^{-2}$. The workdone is

A. $-0.9kJ$

B. $-900kJ$

C. $270kJ$

D. $-270kJ$

Answer: A

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132. The equilibrium constant for certain reaction is 100. If the value R is given to be $2calK^{-1}mol^{-1}$, then standard Gibb's free energy change will be

A. $-2.764kcal$

B. $2.674kcal$

C. $2.764kcal$

D. none of these

Answer: D

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133. Bond dissociation energy of $O_2(g)$ is $xkJmol^{-1}$. This means that

A. xkJ of energy is required to break one O_2 molecule into atom

B. xkJ of energy is required to break 1 mole of $O = O$ bond in gaseous state

C. xkJ of energy is needed to convert $O(g)$ in $O^{-1}(g)$

D. xkJ of energy is required to break $O = O$ bonds in $16g$ of O_2 gas.

Answer: B

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134. $H_2O(l) \rightarrow H_2O(g)$, $\Delta H = +43.7kJ$

$H_2O(s) \rightarrow H_2O(l)$, $\Delta H = +6.05kJ$

The value of $\Delta H_{(\subset \lim ation)}$ of ice is

A. $49.75kJmol^{-1}$

B. $37.65kJmol^{-1}$

C. $43.7kJmol^{-1}$

D. none of these

Answer: A

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135. Given that

$CH_4(g) + 360kJ \rightarrow C(g) + 4H(g)$

$C_2H_6(g) + 620kJ \rightarrow 2C(g) + 6H(g)$

The value of $C - C$ bond energy is

A. $260kJmol^{-1}$

B. $180kJmol^{-1}$

C. $130kJmol^{-1}$

D. $80kJmol^{-1}$

Answer: D

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136. For a reaction

$Br_2(l) + Cl_2(g) \rightarrow 2BrCl$ at $300K$ the value of $\Delta H = 7kcal$ and ΔS is $25calK^{-1}$. The free energy change is

A. $-500cal$

B. $7493cal$

C. $18kJ$

D. $150kcal$

Answer: A

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137. At what temperature, ΔG of a reaction is equal to $-5.2kJmol^{-1}$? ΔH and ΔS of the reaction are respectively $145.6kJmol^{-1}$ and $116JK^{-1}$.

A. $1300^{\circ}C$

B. $130K$

C. $1300K$

D. $130^{\circ}C$

Answer: C

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138. For a reaction

$A(g) + 3B(g) \rightarrow 2C(g)$, $\Delta H^\circ = -24kJ$

The value of ΔG° is $-9kJ$. The standard entropy change of reaction is

A. $5JK^{-1}$

B. $50JK^{-1}$

C. $500JK^{-1}$

D. $0.5JK^{-1}$

Answer: B

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139. Consider the following reaction at equilibrium

$2Fe^{2+}(aq) + Cu^{2+} \rightarrow 2Fe^{3+}(aq) + Cu$

When the reaction comes to equilibrium, what is the cell voltage ?

A. $0.43V$

B. $1.11V$

C. $0.78V$

D. $0V$

Answer: D

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140. A gas absorbs 400J of heat and expands by $2 \times 10^{-3}m^3$ against a constant pressure of $10^5 Nm^{-2}$. The cahnge in internal energy of gas is

A. Zero

B. $200J$

C. $-600J$

D. $-200J$

Answer: B

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141. The enthalpy of formation of ammonia is $-46.0 kJmol^{-1}$. The enthalpy for the reaction $2N_2(g) + 6H_2(g) \rightarrow 4NH_3(g)$

A. $-46.0kJ$

B. $46.0kJ$

C. $184.0kJ$

D. $-184.0kJ$

Answer: D

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142. Which one of the following relations is incorrect ?

A. $\Delta H = \Delta G + T\Delta S$

B. $\Delta H = \Delta G - T\Delta S$

C. $\Delta S = \frac{(\Delta H - \Delta G)}{T}$

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

Answer: B

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143. The work done by the system in a cyclic process involving one mole of an ideal monoatomic gas is $-50kJ / cyc \le$. The heat absorbed by the system per cycle is

A. Zero

B. $50kJ$

C. $-50kJ$

D. $250kJ$

Answer: B

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144. The work done by the system in the conversion of $1 mol$ of water at $100^{\circ} C$ and 760 torr to steam is $-3.1 kJ$. Calculate the ΔE for the conversion (Latent heat of vaporisation of water is $40.65 kJ mol^{-1}$)

A. $43.75 kJ$

B. $101.35 kJ$

C. $37.55 kJ$

D. $-40.65 kJ$

Answer: C

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145. If $\Delta H_f(X)$, $\Delta H_f(Y)$, $\Delta H_f(R)$ and $\Delta H_f(S)$ denote the enthalpies of formation of X, Y, R and S respectively, the enthalpy of the reaction $X + Y \to R + S$ is given by

A. $\Delta H_f(X) + \Delta H_f(Y)$

B. $\Delta H_f(R) + \Delta H_f(S)$

C. $\Delta H_f(X) + \Delta H_f(Y) - \Delta H_f(R) - \Delta H_f(S)$

D. $\Delta H_f(R) + \Delta H_f(S) - \Delta H_f(X) - \Delta H_f(Y)$

Answer: D

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146. The enthalpy of the reaction $H_2(g) + \frac{1}{2}O_2(g) \to H_2O(g)$ is ΔH_1 and that of $H_2(g) + \frac{1}{2}O_2(g) \to H_2O(l)$ is ΔH_2. Then

A. $\Delta H_1 > \Delta H_2$

B. $\Delta H_1 = \Delta H_2$

C. $\Delta H_1 < \Delta H_2$

D. $\Delta H_1 + \Delta H_2 = 0$

Answer: A

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147. The enthalpy of the reaction :

$H_2O_2(l) \rightarrow H_2O(l) + \frac{1}{2}O_2(g)$ is $-23.5 kcal mol^{-1}$ and the enthalpy of formation of $H_2O(l)$ is $-68.3 kcal mol^{-1}$. The enthalpy of formation of $H_2O_2(l)$ is

A. $-44.8 kcal mol^{-1}$

B. $44.8 kcal mol^{-1}$

C. $-91.8 kcal mol^{-1}$

D. $91.8 kcal mol^{-1}$

Answer: A

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148. One mole of a gas absorbs 200 J of heat at constant volume. Its temperature rises from 298 K to 308 K. The change in internal energy is :-

A. $200J$

B. $-200J$

C. $200 \times \frac{308}{298}J$

D. $200 \times \frac{298}{308}J$

Answer: A

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149. Work done on a system when one mole of an an ideal gas at 500 K is compressed isothermally and reversibly to 1/10th of its original volume (R $= 2$ cal).

A. $500kcal$

B. $1.51kcal$

C. $-23.03kcal$

D. $2.303kcal$

Answer: D

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150. For the reversible isothermal expansion of one mole of an ideal gas at 300 K, from a volume of $10dm^3$ to $20dm^3$, ΔH is -

A. $1.73kJ$

B. $-1.73kJ$

C. $3.46kJ$

D. Zero

Answer: D

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151. The latent heat of vaporisation of water at $100^{\circ} C$ is $540 cal g^{-1}$. Calculate the entropy increase when one mole of water at $100^{\circ} C$ is evaporated

A. $26 cal K^{-1} mol^{-1}$

B. $1.82 cal K^{-1} mol^{-1}$

C. $367 cal K^{-1} mol^{-1}$

D. $540 \times 18 cal K^{-1} mol^{-1}$

Answer: A

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152. Given that $\frac{1}{2} S_8(s) + 6O_2(g) \rightarrow 4SO_3(g), \Delta H^{\circ} = -1590 kJ$

The standard enthalpy of formation of SO_3 is

A. $-1590 kJmol^{-1}$

B. $-397.5 kJmol^{-1}$

C. $-3.975 kJmol^{-1}$

D. $+397.5 kJmol^{-1}$

Answer: B

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153. For the process

$NH_3(g) + HCI(g) \rightarrow NH_4CI(s)$

A. Both ΔH and ΔS are +ve

B. ΔH is -ve ΔS is +ve

C. ΔH is +ve ΔS is -ve

D. Both ΔH and ΔS are -ve

Answer: D

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154. The enthalpy change at $298K$ of the reaction $H_2O_2(l) \rightarrow H_2O(l) + \frac{1}{2}O_2(g)$ is $-23.5 kcal mol^{-1}$ and enthalpy of formation of $H_2O_2(l)$ is $-44.8 kcal mol^{-1}$. The enthalpy of formation of $H_2O(l)$ is

A. $-68.3 kcal mol^{-1}$

B. $68.3 kcal mol^{-1}$

C. $-91.8 kcal mol^{-1}$

D. $91.8 kcal mol^{-1}$

Answer: A

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155. If $S+O_2 \rightarrow SO_2, \Delta H = -298.2 \text{ kJ mole}^{-1}$

$SO_2 + \frac{1}{2}O_2 \rightarrow SO_3 \Delta H = -98.7 \text{ kJ mole}^{-1}$

$SO_3 + H_2O \rightarrow H_2SO_4, \Delta H = -130.2 \text{ kJ mole}^{-1}$

$H_2 + \frac{1}{2}O_2 \rightarrow H_2SO_4, \Delta H = -287.3 \text{ kJ mole}^{-1}$

the enthlapy of formation of H_2SO_4 at 298 K will be

A. $-814.4kJ$

B. $-650.3kJ$

C. $-320.5kJ$

D. $-433.5kJ$

Answer: A

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156. The entropy change for the fusion of $1mol$ of a solid which melts at

$27^\circ C$ is (latent heat of fusion $= 600kcalmol^{-1}$)

A. $2 cal deg^{-1}$

B. $22.2 cal deg^{-1}$

C. $180 kcal deg$

D. $0.5 cal^{-1} deg$

Answer: A

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157. The heat change for the following reaction at $298K$ and constant pressure is $+7.3kcal$

$$A_{\circ}B(s) \rightarrow 2A(s) + \frac{1}{2}B_2(g), \Delta H = +7.3kcal$$

The heat change at constant volume would be

A. $+7.3kcal$

B. More than $7.3kcal$

C. Less than $7.3kcal$

D. Zero

Answer: C

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158. Which of the following equations express ΔH as heat of combustion ?

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

B. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

C. $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

D. $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$

Answer: C

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159. The enthalpy of formation of ammonia is $-46.0KJmol^{-1}$. The enthalpy change for the reaction $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ is :

A. $+46.0kJ$

B. $+92.0kJ$

C. $-23kJ$

D. $-92kJ$

Answer: B

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160. The heat evolved in combustion of benzene is given by the following equation :

$C_6H_6 + 15/2O_2 \rightarrow 3H_2O + 6CO_2 : \Delta H = \ -3264.6kJ$

Which of the following quantities of heat will be evolved when $39g$ of benzene are burnt in an open container ?

A. $-816.15kJ$

B. $-1632.3kJ$

C. $-6528.2kJ$

D. $-2848.45kJ$

Answer: B

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161. ΔG for a reaction at $300K$ is $-16kcal$ and ΔH is $-10kcal$. The entropy of the reaction is

A. $20caldeg^{-1}$

B. $86.6caldeg^{-1}$

C. $166caldeg^{-1}$

D. $100caldeg^{-1}$

Answer: A

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162. Enthalpy of neutralisation of NH_4OH and HCl is numerically

A. $57.1 kJmol^{-1}$

B. $< 57.1 kJmol^{-1}$

C. $> 57.1 kJmol^{-1}$

D. Zero

Answer: B

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163. The following are the heats of reactions -

(i) ΔH_f° of $H_2O_{(l)} = -68.3\text{K cal mol}^{-1}$

(ii) $\Delta H_{\text{comb.}}^\circ$ of $C_2H_2 = -337.2\text{K cal mol}^{-1}$

(iii) $\Delta H^{\circ}_{\text{comb.}}$ of $C_2H_4 = -363.7\text{K cal mol}^{-1}$

Then heat change for the reaction $C_2H_2 + H_2 \rightarrow C_2H_4$ is -

A. $-716.1kcal$

B. $+337.2kcal$

C. $-41.8kcal$

D. $-579.5kcal$

Answer: C

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164. The heat of combustion of $CH_{4(g)}, C_{(g)}$ and $H_{2(g)}$ at $25^{\circ}C$ are -212.4 K cal, -94.0 K cal and -68.4 K cal respectively, the heat of formation of CH_4 will be -

A. $+54.4kcal$

B. $-18.4kcal$

C. $-375.2kcal$

D. $+212.8kcal$

Answer: B

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165. One mole of ice is converted into water at 273 K. The entropies of $H_2O(s)$ and $H_2O(l)$ are 38.20 and 60.01 J $mol^{-1}K^{-1}$ respectively. Calculate the enthalpy change for this conversion a ?

A. $59.54Jmol^{-1}$

B. $5954Jmol^{-1}$

C. $595.4Jmol^{-1}$

D. $320.6Jmol^{-1}$

Answer: B

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166. The equilibrium constant for a reaction is 10. What will be the value of ΔG^{Θ}? $R = 8.314 JK^{-1} mol^{-1}, T = 300K.$

A. $-5527 kJmol^{-1}$

B. $-5.527 kJmol^{-1}$

C. $-55.27 kJmol^{-1}$

D. $+5.527 kJmol^{-1}$

Answer: B

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167. One mole of an ideal gas expanded freely and isothermally at $300K$ from 5 litres to 10 litres. If ΔE is 0, then ΔH is

A. $5 cal$

B. $5 \times 300 cal$

C. zero

D. $-2 \times 5 \times 300 cal$

Answer: C

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168. For the reaction

$C_6H_{12}(l) + 9O_2(g) \rightarrow 6H_2O(l) + 6CO_2(g)$, $\Delta H = -936.9 kcal$

Which of the following is true ?

A. $-936.9 = \Delta E - (2 \times 10^{-3} \times 298 \times 3) kcal$

B. $+936.9 = \Delta E + (2 \times 10^{-3} \times 298 \times 3) kcal$

C. $-936.9 = \Delta E + (2 \times 10^{-3} \times 298 \times 2) kcal$

D. $-936.9 = \Delta E - (20.0821 \times 298 \times 3) kcal$

Answer: A

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169. Given that the data for neutralization of weak acid (HA) and strong acid is :

$$HA + OH^- \to A^- + H_2O, \Delta H = -41.80 kJ$$

$$H^+ + OH^- \to H_2O, \Delta H = + -55.90 kJ$$

The enthalpy of dissociation of weak acid would be

A. $-97.20 kJ$

B. $+97.70 kJ$

C. $-14.10 kJ$

D. $14.10 kJ$

Answer: D

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170. A system absorbs $10kJ$ of heat at constant volume and its temperature rises from $27^\circ C$ to $37^\circ C$. The ΔE of reaction is

A. $100kJ$

B. $10kJ$

C. 0

D. $1kJ$

Answer: B

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171. How many kcal of heat is evolved by the complete neutralisation of one mole sulphuric acid with $NaOH$?

A. $13.7kcal$

B. $27.4kcal$

C. $6.85kcal$

D. none of these

Answer: B

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172. Given $\Delta_i H^{\Theta}(HCN) = 45.2kJmol^{-1}$ and $\Delta_i H^{\Theta}(CH_3COOH) = 2.1kJmol^{-1}$. Which one of the following facts is true?

A. $pK_a(HCN) = pK_a(CH_3COOH)$

B. $pK_a(HCN) > pK_a(CH_3COOH)$

C. $pK_a(HCN) < pK_a(CH_3COOH)$

D. $pK_a(HCN) = \left(\frac{45.50}{2.1}\right)pK_a(CH_3COOH)$

Answer: B

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173. Calculate the work done when 1.0 mol of water at $373K$ vaporises against an atmosheric pressure of $1.0atm$. Assume ideal gas behaviour.

A. $-6200J$

B. $-306J$

C. $-3100J$

D. $-1550J$

Answer: C

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174. The maximum efficiency of heat engine operating between 100° and $25^\circ C$ is

A. 25%

B. 30%

C. $20.0\ \%$

D. $10\ \%$

Answer: C

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175. A gas absorbs $250J$ of heat and expands from 1 litre to 10 litres against the pressure 0.5 atmosphere at constant temperature. The values of q, w and ΔE are respectively

A. $+250, -455J, -205J$

B. $250J, 455J, 205J$

C. $-250J, 205J, 455J$

D. $-205J, -250J, -455J$

Answer: A

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176. Which of the following value of ΔH_f° represent that the product is least stable ?

A. $-94.0kcalmol^{-1}$

B. $-231.6kcalmol^{-1}$

C. $+21.4kcalmol^{-1}$

D. $+64.8kcalmol^{-1}$

Answer: D

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177. The enthalpies of formation of N_2O and NO are respectively 82 and $90kJmol^{-1}$. The enthalpy of reaction

$2N_2O(g) + O_2(g) \rightarrow 4NO(g)$ is

A. $8kJ$

B. $88kJ$

C. $-16kJ$

D. $196kJ$

Answer: D

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178. The value of ΔH_{O-H} is $109kcalmol^{-1}$. Then formation of one mole of water in gaseous state from $H_2(g)$ and $O_2(g)$ is acccompained by

A. release of $218kcal$ of energy

B. release of $109kcal$ of energy

C. absorption of $218kcal$ of energy

D. Unpredictable

Answer: A

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179. The heat of combustion of yellow phoshphorus and red phosphorus are $-9.91 KJmol^{-1}$ and -8.78 KJ/mol respectivaly. The heat of transition from yellow phosphrous to red phosphorus is

A. $-18.69kJ$

B. $+1.13kJ$

C. $+18.69kJ$

D. $-1.13kJ$

Answer: D

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180. For a system in equilibrium, $\Delta G = 0$, under conditions of constant

A. temperature and pressure

B. temperature and volume

C. pressure and volume

D. energy and volume

Answer: A

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181. In the reversible reaction of the type $A + B \Leftrightarrow AB$, in general.

A. neither of the reactions will be endothermic

B. both forward and backward reactions are exothermic

C. forward reactions will be exothermic

D. backward reaction will be exothermic

Answer: C

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182. Given

$C(s) + O_2(g) \rightarrow CO_2(g), \Delta H = -395kJ$

$S(s) + O_2(g) \rightarrow SO_2(g), \Delta H = -295kJ$

$CS_2(l) + 3O_2(g) \rightarrow CO_2(g) + 2SO_2(g), \Delta H = -1110kJ$

The heat of formation of $CS_2(l)$ is

A. $125kJmol^{-1}$

B. $31.25kJmol^{-1}$

C. $62.5kJmol^{-1}$

D. $250kJmol^{-1}$

Answer: A

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183. In an electrochemical cell, if E° is the e.m.f. of the cell involving $'n'$ mole of electrons, then ΔG° is

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

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

C. $E^{\circ} = nF\Delta E^{\circ}$

D. $\Delta G = nF / E^{\circ}$

Answer: B

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184. If the enthalpy of vaporisation of water is $186.5 J mol^{-1}$, then entropy of its vaporisation will be

A. $0.5 JK^{-1} mol^{-1}$

B. $1.0 JK^{-1} mol^{-1}$

C. $1.5 JK^{-1} mol^{-1}$

D. $2.0 JK^{-1} mol^{-1}$

Answer: A

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185. The ΔH value for reaction

$C + \frac{1}{2}O_2 \rightarrow CO$ and $CO + \frac{1}{2}O_2 \rightarrow CO_2$ are 100 and $200kJ$ respectively. The heat of reaction for $C + O_2 \rightarrow CO_2$ will be

A. $50kJ$

B. $100kJ$

C. $150kJ$

D. $300kJ$

Answer: D

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186. Given :

$C(\text{diamond}) + O_2 \rightarrow CO_2, \Delta H = -395kJ$

$C(\text{graphite}) + O_2 \rightarrow CO_2, \Delta H = -393kJ$

The enthalpy of formation of diamond from graphite is

A. $+2.0kJ$

B. $-1.5kJ$

C. $-788kJ$

D. $788kJ$

Answer: A

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187. The law of Lavoisier and Laplace illustrates

A. the priniciple of conservation of energy

B. equivalence of mechanical and thermal energy

C. the priniciple of conservation of matter

D. equivalent of mechanical and chemical energy.

Answer: A

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188. For the reaction

$H_2 + I_2 \Leftrightarrow 2NHI, \Delta H = 12.40 kcal$. The heat of formation (ΔH) of HI is

A. $12.4 kcal$

B. $-12.4 kcal$

C. $-6.20 kcal$

D. $6.20 kcal$

Answer: D

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189. According to the reaction

$C_6H_6 + 15/2O_2 \rightarrow 3H_2O + 6CO_2$

($\Delta H = -3264.6 kJ/mol$) the energy evolved when $3.9g$ of benzene is burnt in air will be

A. $163.23 kJ/mol$

B. $326.4 kJ/mol$

C. $32.64 kJ/mol$

D. $3.624 kJ/mol$

Answer: A

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190. Thermodynamic equilibrium involves

A. Chemical equilibrium

B. Mechanical equilibrium

C. Thermal equilibrium

D. All of the above simultaneously

Answer: D

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191. In general, for exothermic reactions to be spontaneous

A. temperature should be high

B. temperature should be zero

C. temperature should be low

D. temperature has no effect

Answer: C

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192. The heat of neutrasation of a strong acid and a strong alkali is $57.0 KJmol^{-1}$. The heat released when 0.5 mole of HNO_3 solution is mixed with 0.2 mole of KOH is

A. $57.0kJ$

B. $11.40kJ$

C. $28.5kJ$

D. $34.9kJ$

Answer: B

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193. Which of the following is true for a reaction $H_2O(l) \rightarrow H_2O(g)$ at $100^\circ C$, 1 atm. Pressure

A. $\Delta H = \Delta E$

B. $\Delta E = 0$

C. $\Delta H = 0$

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

Answer: D

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194. The free energy change $\Delta G = 0$, when

A. the system is at equilibrium

B. catalyst is added

C. reactants are intially mixed throughly

D. the reactants are completely consumed.

Answer: A

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195.

$$\begin{array}{llll} Given: & C + 2S \rightarrow CS_2 & \Delta H = 117kJ \\ & C + O_2 \rightarrow CO_2 & \Delta H = -393kJ \\ & S + O_2 \rightarrow SO_2 & \Delta H = -297kJ \end{array}$$

The heat is combustion of CS_2 to form CO_2 and SO_2 is

A. $-1104kJmol^{-1}$

B. $+1104kJmol^{-1}$

C. $+807kJmol^{-1}$

D. $-807kJmol^{-1}$

Answer: A

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196. The enthalpies of combustion of carbon and carbon monoxide are $-390kJmol^{-1}$ and $-278kJmol^{-1}$ respectively. The enthalpy of formation of carbon monoxide is

A. $668kJmol^{-1}$

B. $112kJmol^{-1}$

C. $-112kJmol^{-1}$

D. $-668kJmol^{-1}$

Answer: C

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197. The combustion reaction occuring in an automobile is $2C_8H_{18}+25O_2(g)\rightarrow 16CO_2(g)+18H_2O(g)$ This reaction is accompanied with:

A. $+, -, +$

B. $-, +, -$

C. $-, +, +$

D. $+, +, -$

Answer: B

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198. Latent heat of vaporisation of a liquid at $500K$ and 1 atm pressure is $10.0kcal/mol$. What will be the change in internal energy (ΔE) of 3 mol of liquid at same temperature?

A. $13.0kcal$

B. $-13.0kcal$

C. $27.0kcal$

D. $-27.0kcal$

Answer: C

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199. The table given below lists the bond dissociation energy (E_{diss}) for single covalent bonds formed between C and atoms A, B, D, E.

Bond	$E_{\text{diss}}\left(\text{kcal mol}^{-1}\right)$
$C-A$	240
$C-B$	382
$C-D$	276
$C-E$	486

Which of the atoms has smallest size ?

A. D

B. E

C. A

D. B

Answer: B

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200. The enthalpy of formation for $C_2H_4(g)$, $CO_2(g)$ and $H_2O(l)$ at $25^\circ C$ and 1 atm. Pressure be 52, -394 and $-286 kJmol^{-1}$ respectively. The enthalpy of combustion of $C_2H_4(g)$ will be

A. $+1412kJmol^{-1}$

B. $-1412kJmol^{-1}$

C. $+141.2kJmol^{-1}$

D. $-141.2kJmol^{-1}$

Answer: B

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201. For a reaction to occur spontaneously

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

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

C. ΔH must be nagative.

D. ΔS must be nagative.

Answer: A

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202. For a process to be spontaneous

A. ΔG must be $-ve$

B. ΔG should be $+ve$

C. ΔH must be $-ve$

D. ΔS must be $-ve$

Answer: A

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203. A particular reaction has a negative value for the free energy change. Then at ordinary temperature

A. It has a large $-ve$ value for the entropy change

B. It has a large $+ve$ value for the entropy change

C. It has small $+ve$ value for enthalpy change

D. It has a $+ve$ value for the entropy change and a $-ve$ value for the enthalpy change

Answer: D

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204. The calorific value of fat is

A. less than that of carbohydrates and protein

B. less than that of protein but more than carbohydrates

C. less than that of carbohydrates but more than that of protein.

D. more than that of carbohydrate and protein.

Answer: D

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205. The heat of formation of the compound in the following reaction is

$H_2(g) + Cl_2(g) \rightarrow 2HCl(g) + 44kcal$

A. $-44kcalmol^{-1}$

B. $-22kcalmol^{-1}$

C. $11kcalmol^{-1}$

D. $-88kcalmol^{-1}$

Answer: B

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206. When water is added to quick lime, the reaction is

A. explosive

B. endothermic

C. exothermic

D. photochemical

Answer: C

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207. Which relation is correct ?

A. $\Delta G = \Delta H - T\Delta S$

B. $\Delta G = \Delta H + T\Delta S$

C. $\Delta G = T\Delta S - \Delta H$

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

Answer: A

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208. Variation of heat of reaction with temperature is known as

A. Vant Hoff's isotherm

B. Vant Hoff's isochore

C. Kirchoff's equation

D. Kemmerling equation

Answer: C

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209. Enthalpy of reaction ΔH is expressed as

A. $\Delta H = \sum H_P - \sum H_R$

B. $\Delta H = dH_P + dH_R$

C. $\Delta H = \frac{dH_P}{dH_R}$

D. $\Delta H = \frac{\sum H_P}{\sum H_R}$

Answer: A

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210. Heat capacity is

A. $\frac{dQ}{dT}$

B. $dQ \times dT$

C. $\sum Q.\frac{1}{dt}$

D. none of these

Answer: A

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211. Given that $C+O_2 \rightarrow CO_2, \Delta H^\circ = -xKJ$ and $2CO+O_2 \rightarrow 2CO_2, \Delta H^\circ = -yKJ$ The enthalpy of formation of carbon monoxide will be

A. $y-2x$

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

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

D. $2x-y$

Answer: C

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212. The enthalpy change of a reaction does not depend on

A. state of reactants and products

B. nature of reactants and products

C. different intermediate reactions

D. initial and final enthalpy change of reaction

Answer: C

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213. Given : $S_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow SO_{3(g)} + 2XKcal$

$SO_{2(s)} + \frac{1}{2}O_{2(g)} \rightarrow SO_{3(g)} + YKcal$

The heat of formation of SO_2 is : $-$

A. $(2x - y)$

B. $(2x + y)$

C. $(x + y)$

D. $2x / y$

Answer: A

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214. $NH_3(g) + 3Cl_2 \rightarrow NCl_3(g) + 3HCl(g), \Delta H_1$

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g), \Delta H_2$

$H_2(g) + Cl_2(g) \rightarrow 2HCl(g), \Delta H_3$

The heat of formation of NCl_3(g) in the terms of

$\Delta H_1, \Delta H_2, \Delta H_3$ is :

A. $\Delta H_f = -\Delta H_1 + \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$

B. $\Delta H_f = \Delta H_1 + \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$

C. $\Delta H_f = \Delta H_1 - \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$

D. None of the above

Answer: A

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215. When enthalpy and entropy change for a chemical reaction are -2.5×10^3 cals and 7.4 cals deg^{-1} respectively. Predict that reaction at 298 K is

A. spontaneous

B. reversible

C. irreversible

D. non-spontaneous

Answer: A

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216. The bond dissociation energy of gaseous H_2, Cl_2 and HCl are $104, 58$ and $103 kcal mol^{-1}$ respecitvely. Calculate the enthalpy of formation for HCl gas.

A. $-44 kcal$

B. $-88 kcal$

C. $-22 kcal$

D. $-11 kcal$

Answer: C

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217. At constant $T$and$P$,Which of the following statements is correct for the reaction,

$$CO(G) + \frac{1}{2}O_2(g) \rightarrow CO_2(g),$$

A. $\Delta H = \Delta E$

B. $\Delta H < \Delta E$

C. $\Delta H > \Delta E$

D. ΔH is independent of the physical states of reactants.

Answer: B

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218. A reaction is not feasible if

A. ΔH is positive and ΔS is also positive

B. ΔH is positive and ΔS is negative

C. ΔH is negative and ΔS is also negative

D. ΔH is negative and ΔS is positive

Answer: B

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219. One mole of an ideal gas at $300K$ is expanded isothermally from an inital volume of 1 litre to 10 litres. The ΔE for this process is $(R = 2calmol^{-1}K^{-1})$

A. $163.7cal$

B. $1381.1cal$

C. 9 lt atm

D. zero

Answer: D

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220. Identify the correct statement regarding entropy

A. At absolute zero of temperature, the entropy of perfectly crystalline substance is $+ve$

B. At absolute zero of temperature entropy of perfectly crystalline substance is taken to be zero

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

D. At absolute zero of temperature, the entropy of all crystalline substance is taken to be zero

Answer: B

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221. The reaction is sontaneous if the cell potential is

A. Positive

B. Negative

C. Zero

D. Infinite

Answer: A

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222. In an endothermic reaction, the value of ΔH is

A. Zero

B. Positive

C. Negative

D. Constant

Answer: B

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223. Enthalpy of an exothermic reaction is always

A. positive

B. negative

C. zero

D. may be positive or negative.

Answer: B

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224. ΔH for solid to liquid transitions for protein A and B are $2.73 kcal / mol$ and $3.0 kcal / mol$ .The two melting points are $0^{\circ} C$ and

$30^{\circ}C$ respectively. The entropy changes ΔS_A and ΔS_B at two transition temperatures are related as

A. $\Delta S_A = \Delta S_B$

B. $\Delta S_A < \Delta S_B$

C. $\Delta S_B < \Delta S_A$

D. $\Delta S_B \frac{300\Delta S_A}{273}$

Answer: C

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225. The heat absorbed at constant volume is equal to the system's change in

A. enthalpy

B. entropy

C. entropy × temperature

D. internal energy

Answer: D

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226. Which of the following holds good to the laws of thermodynamics for the reaction

$C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(l)$

A. $\Delta H = \Delta E + RT$

B. $\Delta H = \Delta E - RT$

C. $\Delta H = \Delta E + 2RT$

D. $\Delta H = \Delta E - 2RT$

Answer: D

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227. For a melting of a solid at $25^\circ C$, the fusion process requires energy equivalent to2906joules o be added to system considering the process to be reversible at fusion point, the entropy change of the process is

A. $9.75JK^{-1}$

B. $11.272JK^{-1}$

C. $2.33JK^{-1}$

D. insufficient data

Answer: A

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228. The difference between ΔH and ΔU for the combustion of methane at $27^\circ C$ will be (in $Jmol^{-1}$)

A. $8.314 \times 27 \times (-3)$

B. $8.314 \times 300 \times (-3)$

C. $8.314 \times (300) \times (-2)$

D. $8.314 \times 300 \times 1$

Answer: C

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229. The heat of neutralisation is maximum when

A. sodium hydroxide is neutralised by acetic acid

B. ammonium hydroxide is neutralised by acetic acid

C. ammonium hydroxide is neutralised by hydrochloric acid

D. sodium hydroxide is neutralised by hydrochloric acid

Answer: D

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230. According to the second law of thermodynamics, a process (reaction) is spontaneous, if during the process

A. ΔS universe > 0

B. ΔS universe $= 0$

C. ΔH system > 0

D. $\Delta S \text{universe} = \Delta S \text{system}$

Answer: A

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231. The law of thermodynamics that provides the basis for the determination of absolute entropy of a substance is

A. Zeroth law

B. First law

C. Second law

D. Third law

Answer: D

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232. The heat of combustion of graphite and carbon monoxide respectively are $393.5 kJmol^{-1}$ and $283 kJmol^{-1}$. Thus, heat of formation of carbon monoxide in $kJmol^{-1}$ is

A. $+172.5$

B. -110.5

C. -10760

D. -676.5

Answer: B

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233. In order to decompose 9 grams of water 142.5 KJ heat is required. Hence the enthalpy of formation of water is

A. $-142.5kJ$

B. $+142.5kJ$

C. $-285kJ$

D. $+285kJ$

Answer: C

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234. In an adiabatic expansion of an ideal gas -

A. $W = -\Delta E$

B. $W = \Delta E$

C. $\Delta E = 0$

D. $W = 0$

Answer: B

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235. The free energy change for a reversible reaction at equilibrium is

A. > 0

B. < 0

C. equal to zero

D. unpredictable

Answer: C

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236. Which of the following conditions regarding the chemical process ensures its sponteneity at all temperatures

A. $\Delta H < 0 , \Delta S < 0$

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

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

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

Answer: C

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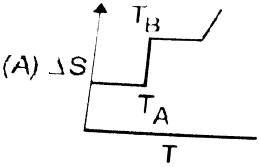
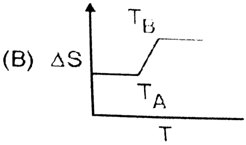
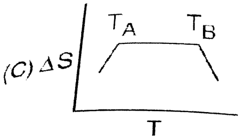
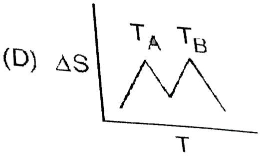
237. If for a given substance, melting point is T_B and freezing point is T_A then correct variation of entropy is by graph between entropy change and temperature is

A. 

B. 

C. 

D. 

Answer: A

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238. When 1 mole of gas is heated at constant volume. Temperature is raised from 298 to $308K$. Heat supplied to the gas is $500J$. Then which stamenet is correct?

A. $q = W = 500J, \Delta U = 0$

B. $q = \Delta U = 500J, W = 0$

C. $q = W = 500J, \Delta U = 500$

D. $\Delta U = 0, q = W = -500J$

Answer: B

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239. Enthalpy of $CH_4 + \frac{1}{2}O_2 \to CH_3OH$ is negative. If enthalpy of combustion of CH_4 and CH_3OH are x and y respectively, then which relation is correct?

A. $x > y$

B. $x < y$

C. $x = y$

D. $x \geq y$

Answer: B

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240. The heat required to raise the temperature of a body by $1K$ is called

A. specific heat

B. thermal capacity

C. water equivalent

D. None of these

Answer: B

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241. A heat engine absorbs heat Q_1 at temperature T_1 and Q_2 at temperature T_2 . Work done by the engine is $(Q_1 + Q_2)$. This data:

A. violates $1st$ law of thermodynamics

B. violates $1st$ law of thermodynamics if Q_1 is negative

C. violates $1st$ law of thermodynamics if Q_2 is negative

D. does not violates first law of thermodynamics

Answer: D

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242. An endotthermic reaction is non-spontaneous at freezing point of water and becomes feasible at its boiling point, then:

A. ΔH is $-ve$, ΔS is $+ve$

B. ΔH and ΔS both are $+ve$

C. ΔH and ΔS both are $-ve$

D. ΔH is $+ve$, ΔS is $-ve$

Answer: B

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243. Compounds with high heat of formation are less stable because

A. it is difficult to synthesise them

B. energy rich state leads to instability

C. high temperature is required to synthesise them

D. molecules of such compounds are distrubed

Answer: B

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244. Which of the following statements is true ?

A. ΔG may be lesser or greater or equal to ΔH

B. ΔG is always proportional to ΔH

C. ΔG is always greater than ΔH

D. ΔG is always less than ΔH

Answer: A

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245. The intensive property among these quantities is

A. mass

B. volume

C. enthalpy

D. mass/volume

Answer: D

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246. An adiabatic expansion of an Ideal gas always has

A. decrease in temperature

B. $q=0$

C. $W=0$

D. $\Delta H=0$

Answer: B

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247. The favourable conditions for a spontaneous reaction 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. $T\Delta S = \Delta H, \Delta H = +ve, \Delta S = +ve$

Answer: A

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

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

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

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

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

Answer: A

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249. $C(\text{diamond}) \rightarrow C(\text{Graphite}), \Delta H = -ve$. Then shows that

A. Graphite is more stable than diamond

B. Graphite has more energy than diamond

C. Both are equally stable

D. Stability cannot be predicted

Answer: A

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250. If a reaction involves only solids and liquid, which of the following is true

A. $\Delta H < \Delta E$

B. $\Delta H = \Delta E$

C. $\Delta H > \Delta E$

D. $\Delta H = \Delta E + RT\Delta n$

Answer: B

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251. Mechanical work is specially important in systems that contain

A. solid-liquid

B. liquid-liquid

C. solid-solid

D. gases

Answer: D

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252. The law formulated by Nernst is

A. First law of thermodynamics

B. Second law of thermodynamics

C. Third law of thermodynamics

D. Both A and B

Answer: C

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253. Heat exchanged in a chemical reaction at constant temperature and pressure is called

A. entropy change

B. enthalpy change

C. internal energy change

D. free energy change

Answer: B

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254. Heat of combustion ΔH° for $C(s), H_2(g)$ and $CH_4(g)$ are $94, -68$ and $-213 Kcal/mol$. Then ΔH° for $C(s) + 2H_2(g) \rightarrow \Delta CH_4(g)$ is

A. $-17 kcal$

B. $-111 kcal$

C. $-170 kcal$

D. $85 kcal$

Answer: A

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255. The enthalpy of formation of ammonia is $-46.2 mol^{-1}$. The enthalpy change for the reaction

$2NH_3 \rightarrow N_2 + 3H_2$ is

A. $42.0 kJ$

B. $64.0kJ$

C. $80.0kJ$

D. $92.0kJ$

Answer: D

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256. The molar heat capacity of water at constant pressure, C_P, is $75JK^{-1}mol^{-1}$. When $1.0kJ$ of heat is supplied to $100g$ of water which is free to expand, the increase in temperature of water is

A. $6.6K$

B. $1.2K$

C. $2.4K$

D. $4.8K$

Answer: C

257. What is the entropy change (in $JK^{-1}mol^{-1}$) when one mole of ice is converted into water at $0^{\circ}C$?

(The enthalpy change for the conversion of ice to liquid water is $6.0KJmol^{-1}$ at $0^{\circ}C$)

A. 21.98

B. 20.13

C. 2.013

D. 2.198

Answer: A

258. For which one of the following equation is $\Delta H^{\circ}_{reaction}$ equal to ΔH°_{f} for the product ?

A. $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

B. $N_2(g) + O_2(g) \rightarrow N_2O_3(g)$

C. $CH_4(g) + 2Cl_2(g) \rightarrow CH_2Cl_2(l) + 2HCl(g)$

D. $Xe(g) + 2F_2(g) \rightarrow XeF_4(g)$

Answer: D

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259. If a $298K$ the bond energies of $C-H, C-C, C=C$ and $H-H$ bonds are respectivly $414, 347, 615 KJmol^{-1}$, the vlaue of enthalpy change for the reaction

$H_2C = CH_2(g) + H_2(g) + H_2(g) \rightarrow H_3C - CH_3(g)$ at $298K$ will be

A. $+250kJ$

B. $-250kJ$

C. $+125kJ$

D. $-125kJ$

Answer: D

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260. The enthalpy change for a reaction does not depend upon:

A. the physical states of reactants ad products

B. use of different reactants for the same product

C. the nature of intermediate reaction steps.

D. the differences in initial or final temperature of involved substances

Answer: C

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261. In an irreversible process taking place at constant T and P and in which only pressure-volume work is being done, the change in Gibbs free energy (dG) and the change in entropy (dS) satisfy the criteria

A. $(dS)_{V,E} < 0, (dG)_{T,P} < 0$

B. $(dS)_{V,E} > 0, (dG)_{T,P} < 0$

C. $(dS)_{V,E} = 0, (dG)_{T,P} = 0$

D. $(dS)_{V,E} = 0, (dG)_{T,P} > 0$

Answer: B

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262. The internal energy change when a system goes fromk state A to B is $40kJmol^{-1}$. If the system goes from A to B by a reversible path and returns to state A by an irreversible path, what would be the net change in internal energy?

A. $40kJ$

B. $> 40kJ$

C. $< 40kJ$

D. zero

Answer: D

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263. 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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264. The enthalpies of formation of Al_2O_3 and Cr_2O_3 are $-1596KJ$ and $-1134KJ$ respectively. ΔH for the reaction

$2Al + Cr_2O_2 \rightarrow 2Cr + Al_2O_3$ is

A. $-1365kJ$

B. $+2730kJ$

C. $-2730kJ$

D. $-462kJ$

Answer: D

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265. Enthalpy of formation of HF and HCl are $-161kJ$ and $-92kJ$ respectively. Which of the following statements is incorrect ?

A. The affinity of fluorine to hydrogen is greater than the affinity of chlorine to hydrogen

B. HF is more stable than HCl

C. HCl is more stable than HF

D. HF and HCl are endothermic compounds.

Answer: C

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266. Heat liberated when $100mL$ of $1NNaOH$ is neutralised by $300mL$ of $1NHCl$

A. $22.92kJ$

B. $17.19kJ$

C. $11.46kJ$

D. $5.73kJ$

Answer: D

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267. Which of the following has ΔS° greater than zero

A. $CaO(s) + CO_2(g) \Leftrightarrow CaCO_3(s)$

B. $NaCl(aq) \Leftrightarrow NaCl(s)$

C. $NaNO_3(s) \Leftrightarrow Na^+(aq) + NO_3^-(aq)$

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

Answer: C

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268. The system in which there is no exchange of matter, work, or energy from the surroundings is

A. closed

B. isolated

C. adiabatic

D. isothermal

Answer: B

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269. A gas can expand from $100 mL$ to $250 mL$ under a constant pressure of 2 atm. The work done by the gas is

A. 30.38 joule

B. 25 joule

C. $5k$ joule

D. 16 joule

Answer: A

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270. Hess's law states that

A. the standard enthalpy of an overall reaction is the sum of the enthalpy changes in individual reactions.

B. enthalpy of formation of a compound is same as the enthalpy of decompostion of the compound into constituent elements, but with opposite sign.

C. at constant temperture the pressure of a gas is inversely proportional to its volume

D. the mass of a gas dissolved per litre of a solvent is porportional to the pressure of the gas in equilibrium with the solution.

Answer: A

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271. The free energy change for the following reactions are given below

$C_2H_2(g) + \frac{5}{2}O_2(g) \rightarrow 2CO_2(g) + H_2O(l), \Delta G^\circ = -1234kJ$

$C(s) + O_2(g) \rightarrow CO_2(g), \Delta G^\circ = -394kJ$

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l), \Delta G^\circ = 237kJ$

What is the standard free energy change for the reaction

$H_2(g) + 2C(s) \rightarrow C_2H_2(g)$?

A. $209kJ$

B. $-2259kJ$

C. $+2259kJ$

D. $209kJ$

Answer: D

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272. In the thermodynamics which one of the following is not an intensive property ?

A. Pressure

B. Density

C. Volume

D. Temeprature

Answer: C

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273. The value of $\Delta H - \Delta E$ for the following reaction at $27^{\circ} C$ will be

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

A. $8.314 \times 27 \times (-2)$

B. $8.314 \times 300 \times (-2)$

C. $8.314 \times 27 \times (-2)$

D. $8.314 \times 273 \times (1)$

Answer: D

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274. For the reaction,

$A(s) + 3B(s) \rightarrow 4C(s) + D(l)$

ΔH and ΔU are related as-

A. $\Delta H = \Delta U$

B. $\Delta H = \Delta U + 3RT$

C. $\Delta H = \Delta U + RT$

D. $\Delta H = \Delta U - 3RT$

Answer: A

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275. If $(I) C+O_2 \rightarrow CO_2, Q_1$

$(II) C+\frac{1}{2}O_2 \rightarrow CO, Q_2$

$(III) CO+\frac{1}{2}O_2 \rightarrow CO_2, Q_3$

The heats of reaction Q_1 and Q_2 are -12, -10 respectively. Then $Q_3 =$

A. -2

B. 2

C. -22

D. -16

Answer: A

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

A. $\Delta S_{\text{surroundings}} > 0 \text{only}$

B. $\Delta S_{\text{system}} + \Delta S_{\text{surroundings}} > 0$

C. $\Delta S_{\text{system}} + \Delta S_{\text{surroundings}} < 0$

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

Answer: B

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277. Standard enthalpy and standard entropy changes for the oxidation of ammonia at $298K$ are $-382.64kJmol^{-1}$ and $-145.6jK^{-1}mol^{-1}$ respectively. Standard Gibbs energy change for the same reaction at $298K$ is

A. $-523.2kJmol^{-1}$

B. $-22.1kJmol^{-1}$

C. $-339.3kJmol^{-1}$

D. $-439.3kJmol^{-1}$

Answer: C

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278. The enthalpy of the reaction $H_2(g)+\frac{1}{2}O_2(g) \rightarrow H_2O(g)$ is ΔH_1 and that of $H_2(g)+\frac{1}{2}O_2(g) \rightarrow H_2O(l)$ is ΔH_2. Then

A. $\Delta H_1 < \Delta H_2$

B. $\Delta H_1 + \Delta H_2 = 0$

C. $\Delta H_1 > \Delta H_2$

D. $\Delta H_1 = \Delta H_2$

Answer: A

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279. When $50cm^3$ of $0.2NH_2SO_4$ is mixed with $50cm^3$ of $1NKOH$, the heat liberated is

A. $11.46kJ$

B. $57.3kJ$

C. $573kJ$

D. $573J$

Answer: D

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280. How much energy is released when 6 mole of octane is burnt in air ? Given ΔH_f° for $CO_2(g), H_2O(g)$ and $C_8H_{18}(l)$ respectively are $-490, -240$ and $+160KJ/mol$

A. $-6.2MJ$

B. $-37.4MJ$

C. $-35.5MJ$

D. $-20.0MJ$

Answer: B

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281. For the equilibrium

$H_2O(1) \Leftrightarrow H_2O(g)$

at 1 atm $298K$

A. standard free energy change is equal to zero $(\Delta G^\circ = 0)$

B. free energy change is less than zero $(\Delta G < 0)$

C. standard free energy change is less than zero $(\Delta G^\circ < 0)$

D. standard free energy change is more than zero $(\Delta G^\circ > 0)$

Answer: A

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282. 1 mol of H_2SO_4 in mixed with 2 mol of $NaOH$. The heat evolved will be

A. $57.3kJ$

B. $2 \times 57.3kJ$

C. $57.3/2kJ$

D. cannot be predicted.

Answer: B

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283. In a reversible process,

$\Delta S_{sys} + \Delta S_{surr}$ is

A. > 0

B. < 0

C. ≥ 0

D. $= 0$

Answer: D

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284. For the reaction $N_2 + 3H_2 \Leftrightarrow 2NH_3, \Delta H = ?$

A. $\Delta E + 2RT$

B. $\Delta E - 2RT$

C. $\Delta E + RT$

D. $\Delta E - RT$

Answer: B

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285. One mole of a perfect gas expands isothermally to ten times its original volume. The change in entropy is

A. $0.1R$

B. $2.303R$

C. $10.0R$

D. $100.0R$

Answer: B

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286. An ideal gas expands from $1 \times 10^{-3} m^3$ to $1 \times 10^{-2} m^3$ at $300K$ againts a constant pressure of $1 \times 10^5 Nm^{-2}$. The work done is :

A. $-900J$

B. $900kJ$

C. $270kJ$

D. $-900kJ$

Answer: A

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287. The enthalpies of combustion of carbon and carbon monoxide are -393.5 and -283 kJ mol^{-1} respectively. The enthaly of formation of carbon monoxide per mole is :

A. $110.5kJ$

B. $-110.5kJ$

C. $-676.5kJ$

D. $676.5kJ$

Answer: B

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288. One mole of an ideal gas is expanded freely and isothermally at $300K$ from 10 litres to 100 litres. If $\Delta E = 0$, the value of ΔH is

A. $10kJ$

B. $200kJ$

C. $-200kJ$

D. Zero

Answer: D

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289. A cylinder of gas supplied by Bharat Petroleum is assumed to contain $14kg$ of butane. If a normal family requires 20,000 kJ of energy per day for cooking, butane gas in the cylinder lasts

$(\Delta_C H^\circ$ of $C_4H_{10} = -2658 kJmol^{-1})$

A. 15 days

B. 20 days

C. 50 days

D. 40 days

Answer: D

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290. The value of ΔH and ΔS for five different reaction are given below.

Reaction	$\Delta H (kJmol^{-})$	$\Delta S (JK^{-}mol^{-})$
I	$+98.0$	$+14.8$
II	$+55.5$	$+14.8$
III	$+28.3$	-84.8
IV	-40.5	$+24.6$
V	$+34.7$	0.0

On the basis of these values, predict which one of these will be spontaneous at all temperature?

A. Reaction I

B. Reaction II

C. Reaction III

D. Reaction IV

Answer: D

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291. A process is taking place at constant temperature and pressure. Then

A. $\Delta H=\Delta E$

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

C. $\Delta H=0$

D. $\Delta S = 0$

Answer: C

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292. ΔH and ΔS for a reaction are $+30.558 kJmol^{-1}$ and $0.66 kJmol^{-1}$ at 1 atm pressure. The temperature at which free energy is equal to zero and the nature of the reaction below this temperature are

A. $483K$, spontaneous

B. $443K$,non- spontaneous

C. $443K$, spontaneous

D. $463K$,non- spontaneous

Answer: D

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293. What would be the heat released when an aqueous solution containing $0.5 mol$ if HNO_3 is mixed with 0.3 mol of OH^{-1} (enthalpy of neutralisation is $-57.1kJ$)

A. $28.5kJ$

B. $17.1kJ$

C. $45.7kJ$

D. $1.7kJ$

Answer: B

Watch Video Solution

294. 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 both ΔH and ΔS are $+ve$

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

D. $T\Delta S < \Delta H$ and ΔH is $+ve$ and ΔS is $-ve$

Answer: B

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295. The absolute enthalpy of neutralization of the reaction,

$MgO(s) + 2HCl(aq.) + H_2O(l)$ will be

A. less than $-57.33kJmol^{-1}$

B. $-57.33kJmol^{-1}$

C. greater than $-57.33kJmol^{-1}$

D. $57.33kJmol^{-1}$

Answer: C

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296. For a spontaneous reaction, ΔG, equilibrium constant (K) and E°_{cell} will be respectively:

A. $-ve, \ > 1, +ve$

B. $+ve, \ > 1, -ve$

C. $-ve, \ < 1, -ve$

D. $-ve, \ > 1, -ve$

Answer: A

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297. Consider the reaction: $N_2 + 3H_2 \Leftrightarrow 2NH_3$ carried out at constant pressure and temperature. If ΔH and ΔU are change in enthalpy and change in internal energy respectively, then:

A. $\Delta = 0$

B. $\Delta = \Delta U$

C. $\Delta H < \Delta U$

D. $\Delta H > \Delta U$

Answer: C

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298. If the bond dissociation energies of XY, X_2 and Y_2(all diatomic molecules) are in the ratio $1 : 1 : 0.5$ and $\Delta_f H$ of XY is $-200 kJmol^{-1}$. The bond dissociation energy of X_2 will be :

A. $100 kJmol^{-1}$

B. $200 kJmol^{-1}$

C. $800 kJmol^{-1}$

D. $400 kJmol^{-1}$

Answer: C

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299. Which of the following pairs of a chemical reaction is certaion to result a spontaneous reaction ?

A. exothermic and decreasing disorder

B. endothermic and increasing disorder

C. exothermic and increasing disorder

D. endothermic and decreasing disorder

Answer: C

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300. Which of the following is nor correct ?

A. Dissolution of NH_4Cl in excess of water is an endothermic process

B. Neutralisation is always exothermic

C. The absolute value of enthalpy (H) can be determined experimentally

D. The heat of reaction ar constant volume is denoted by ΔE

Answer: C

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301. If the heat of neutralization for a strong acid - base reaction is $-57.1kJ$, what would be the heat released when $350cm^3$ at $0.20MH_2SO_4$ is mixed with $650cm^3$ of $0.10MNaOH$?

A. $37.1kJ$

B. $3.71kJ$

C. $3.17kJ$

D. $0.317kJ$

Answer: B

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302. The heats fo neutralization of HCl with NH_4OH and $NaOH$ with CH_3COOH are $-51.4kJeq^{-1}$ and $-50.6kJeq^{-1}$, respectively. The heat of neutralization of acetic acid with NH_4OH will be

A. $-44.6kJeq^{-1}$

B. $-50.6kJeq^{-1}$

C. $-51.4kJeq^{-1}$

D. $-57.4kJeq^{-1}$

Answer: A

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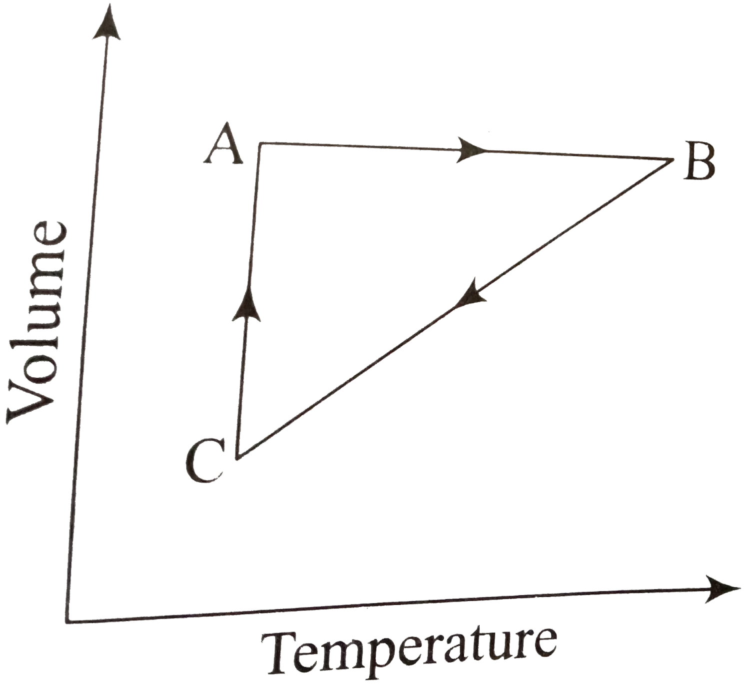
303. Five mole of a gas put through a series of change as shown below graphically in a cyclic process. The processes $A \rightarrow B, B \rightarrow C$ and $C \rightarrow A$, respectively, are



A. isochoric, isobaric, isothermal

B. isobaric, isocharic, isothermal

C. isothermal,isobaric, isochoric

D. isochoric,isothermal,isobaric

Answer: A

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304. A process is taking place at constant temperature and pressure. Then

A. ΔH

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

C. $\Delta H = 0$

D. $\Delta S = 0$

Answer: C

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305. One mole of a perfect gas expands isothermally to ten times its original volume. The change in entropy is

A. $0.1R$

B. $2.303R$

C. $10.0R$

D. $100.0R$

Answer: B

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306. $A \rightarrow B$, $\Delta H = 4kcalmol^{-1}$, $\Delta S = 10calmol^{-1}K^{-1}$. Reaction is spontaneous when temperature is

A. $400K$

B. $300K$

C. $500K$

D. none of these

Answer: C

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307. The sublimation energy of I_2 (solid) is 57.3 KJ/mole and enthalpy of fusion is 15.5 KJ/mole. The enthalpy of vapourisation of I_2 is

A. $41.8kJ/mol$

B. $-41.8kJ/mol$

C. $72.8kJ/mol$

D. $-72.8kJ/mol$

Answer: A

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308. For the reaction:

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g), \Delta H = -571kJ$

bond enegry of $(H-H) = 435kJ$ and of $(O=O) = 498kJ$. Then, calculate the average bond enegry of $(O-H)$ bond using the above data.

A. 484

B. -484

C. 271

D. -271

Answer: A

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309. The standard molar heats of formation of ethane, carbon dioxide, and liquid water are $-21.1, -94.1,$ and $-68.3kcal,$ respectively. Calculate the standard molar heat of combustion of ethane.

A. $-372kcal$

B. $162kcal$

C. $-340kcal$

D. $183.5kcal$

Answer: A

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310. 0.06 mole of KNO_3 is added to $100cm^3$ of water at $298K$. The enthalpy of $KNO_3(aq)$ solution is $35.8kJmol^{-1}$. After the solute is dissolved, the temerature of the solution will be

A. $293K$

B. $298K$

C. $301K$

D. $304K$

Answer: A

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311. Which of the following equations does not correctly represent the first law of thermodynamcis?

A. isothermal process : $q = -w$

B. cyclic process : $q = -w$

C. isocharic process : $\Delta E = q$

D. adiabatic process : $\Delta E = -w$

Answer: D

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312. For the reaction

$$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$$

ΔH and ΔS are $-283kJ$ and $-87JK^{-1}$, respectively. It was intended to carry out this reaction at 1000,1500,3000, and 3500 K. At which of these temperatures would this reaction be thermodynamically spontaneous?

A. 1500 and $3500K$

B. 3000 and $3500K$

C. $1000, 1500$ and $3000K$

D. $1500, 3000$ and $3500K$

Answer: C

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313. The enthalpy of vaporisation of liquid water using the data

$$H_2(g)+\frac{1}{2}O_2(g)\rightarrow H_2O(l)\ ,\Delta H=\ -285.77kJ/mol$$

$$H_2(g)+\frac{1}{2}O_2(g)\rightarrow H_2O(g),\Delta H=\ -241.84kJ/mol$$

A. $+43.93kJ/\text{mole}$

B. $-43.93kJ/\text{mole}$

C. $+527.61kJ$

D. $-527.61kJ$

Answer: A

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314. The enthalpy of certain reaction at $273K$ is $-20.75kJ$. The enthalpy of the same reaction at $373K$ provided heat capacities fo reactants and products are the same) will be

A. $-20.75kJ$

B. $-2075kJ$

C. zero

D. $-20.75 \times \frac{373}{273}kJ$

Answer: A

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315. The bond energies of $C = C$ and $C - C$ at $298K$ are 590 and $331kJmol^{-1}$, respectively. The enthalpy of polymerisation per mole of ethaylene is

A. $+259kJmol^{-1}$

B. $+72kJmol^{-1}$

C. $-259kJmol^{-1}$

D. $-72kJmol^{-1}$

Answer: D

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316. Water is supercooled to $-4^{\circ}C$. The enthalpy (H) is

A. same as ice at $-4^{\circ}C$

B. more than ice at $-4^{\circ}C$

C. same as ice at $0^{\circ} C$

D. less than ice at $-4^{\circ} C$

Answer: D

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317. When 0.1 mol of a gas absorbs $41.75J$ of heat at constant volume, the rise in temperature occurs equal to $20^{\circ} C$. The gas must be

A. triatomic

B. diatomic

C. polyatomic

D. monoatomic

Answer: B

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318. If $150kJ$ of energy is needed for muscular work to walk a distance of one km, than how much of gulcose one has to consume to walk a distance of five km, provided only 30% energy is available for muscular work.The enthalpy of combustion of glucose is $3000kJmol^{-1}$

A. $75g$

B. $30g$

C. $180g$

D. $150g$

Answer: D

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319. A process is spantaneous at a given temperature if

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

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

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

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

Answer: C

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320. Enthalpy is equal to

A. $T^2\left[\frac{\delta(G/T)}{\delta T}\right]_P$

B. $-T^2\left[\frac{\delta(G/T)}{\delta T}\right]_P$

C. $T^2\left[\frac{\delta(G/T)}{\delta T}\right]_V$

D. $-T^2\left[\frac{\delta(G/T)}{\delta T}\right]_V$

Answer: B

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321. Which one of the following sets of units represents the smallest and the largest amout of energy, respectively?

A. J and erg

B. erg and cal

C. cal and eV

D. lit atm and J

Answer: D

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322. If $K < 1$ then the value of ΔG° will be

A. 1.0

B. Zero

C. Negative

D. Positive

Answer: D

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323. During isothermal expansion of an ideal gas, its:

A. internal energy increases

B. enthalpy increases

C. enthalpy reduces to zero

D. enthalpy remains unchanged

Answer: D

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324. For a reaction $A+2B \rightarrow C+D$, if $\Delta H=-25kcal, T=300K$ and $\Delta S=90cal$, then the reaction is

A. reversible at $300K$

B. irreversible at $300K$

C. equilibrium, at $300K$

D. none of these

Answer: B

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325. ΔG° for a reaction is $46.06kcalmol^{-}$. K_P for the reaction at $300K$ is

A. 10^{-8}

B. $10^{-22.22}$

C. $10^{-33.55}$

D. none of these

Answer: C

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326. For an ideal gas expanding adiabatically in vacuum,

A. $\Delta H = 0$

B. $\Delta H > 0$

C. $\Delta H < 0$

D. None of these

Answer: A

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327. How many calories are required to heat $40g$ of argon from $40^{\circ} C$ to $100^{\circ} C$ at constant volume? $\left(R = 2calmol^{-1}K^{-1}\right)$

A. 120

B. 2400

C. 1200

D. 180

Answer: D

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328. If one mole of ammonia and one mole of hydrogen chloride are mixed in a closed container to form ammonium chloride vapor, then

A. $\Delta H < \Delta U$

B. there is no relationship

C. $\Delta H > \Delta U$

D. $\Delta H = \Delta U$

Answer: A

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329. If an endothermic reaction occurs spontaneously at constant T and P, then which of the following is true

A. $\Delta G > 0$

B. $\Delta H > 0$

C. $\Delta S > 0$

D. $\Delta S < 0$

Answer: C

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330. $4.48L$ of an ideal gas at STP requires 12 cal to raise its temperature by $15^{\circ}C$ at constant volume. The C_P of the gas is

A. $3cal$

B. $4cal$

C. $7cal$

D. $6cal$

Answer: D

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331. Change in internal energy when $4kJ$ of work is done on the system and $1kJ$ of heat is given out of the system is

A. $+1kJ$

B. $-5kJ$

C. $+5kJ$

D. $+3kJ$

Answer: D

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332. Which of the ions in the table below would have the largest value of enthalpy of hydration?

Ionic radius in nm Charge of ion

A. $\begin{array}{ll} \text{Ionic radii in nm} & \text{Charge of ion} \\ 0.0065 & +2 \end{array}$

B. $\begin{array}{ll} \text{Ionic radii in nm} & \text{Charge of ion} \\ 0.095 & +1 \end{array}$

C. $\begin{array}{ll} \text{Ionic radii in nm} & \text{Charge of ion} \\ 0.135 & +2 \end{array}$

D. $\begin{array}{ll} \text{Ionic radii in nm} & \text{Charge of ion} \\ 0.169 & +1 \end{array}$

Answer: A

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333. A piece of ice kept at room temperature melts of its own. This reaction is governed by which law ?

A. First law of thermodynamics

B. Zeroth law of thermodynamics

C. Second law of thermodynamics

D. Third law of thermodynamics

Answer: C

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334. A pressure cooker reduces cooking time because

A. food particles are efffectively mashed

B. water boils at higher temperture inside the pressure cooker

C. food is cooked at constant volume

D. loss of heat due to radiation is minimum

Answer: B

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335. Calculate the work invoved when 1 mol of an ideal gas is compressed reversibly from 1.00 bar to 5.00 bar at a constant temperature of $300K$.

A. $4.01kJ$

B. $-8.02kJ$

C. $18.02kJ$

D. $-14.01kJ$

Answer: A

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336. The enthalpy of neutralization of oxitic acid by strong acid is $25.4 kcalmol^{-1}$. The enthalpy of neutralization of strong acid and strong base is $-13.7 kcalequil^{-1}$. The enthalpy of dissociation of $H_2C_2O_4 \Leftrightarrow 2H^+ + C_\circ O_4^{2-}$ is

A. $1.0 kcalmol^{-1}$

B. $2.0 kcalmol^{-1}$

C. $18.55 kcalmol^{-1}$

D. $11.7 kcalmol^{-1}$

Answer: B

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337. An endothermic reaction has a positive internal energy change ΔU. In such a case, what is the minimum value that activation energy can have ?

A. ΔU

B. $\Delta U = \Delta H + \Delta nRT$

C. $\Delta U = \Delta H - \Delta nRT$

D. $\Delta U = E_a + RT$

Answer: C

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338. The reaction $A \to B$, $\Delta H = +24kJ/\text{mole}$. For the reaction $B \to C, \Delta H = -18kJ/\text{mole}$. The decreasing order of enthalpy of A, B, C follow the order

A. A, B, C

B. B, C, A

C. C, B, A

D. C, A, B

Answer: B

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339. For a chemical reaction, ΔG will always be negative if,

A. ΔH and $T\Delta S$ both are positive

B. ΔH and $T\Delta S$ both are negative

C. ΔH is negative and $T\Delta S$ is positive

D. ΔH is positive and $T\Delta S$ is negative

Answer: C

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340. In which reaction there will be increase in entropy ?

A. $Na(s) + H_2O(l) \rightarrow NaOH(aq) + 1/2H_2(g)$

B. $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

C. $H_2(g) + 1/2O_2(g) \rightarrow H_2O(l)$

D. $Cu^{2+} + 4NH_3(g) \rightarrow \left[Cu(NH_3)_4\right]^{2+} aq$

Answer: A

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341. A chemical reaction cannot occur at all if its

A. ΔH is $+ve$ and ΔS is $-ve$

B. ΔH is $-ve$ and ΔS is $+ve$

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

D. ΔH and ΔS are $-ve$ but $\Delta H > \Delta S$

Answer: C

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342. Rate of a reaction can be expressed by Arrhenius equation as:

$k = Ae^{-E_a / RT}$

In this equation, E_a represents:

A. The energy above which not all the colliding molecules will react

B. The energy below which colliding molecules will not react

C. The total energy of the reacting molecules at temperature T

D. The fraction of molecules with energy greater than the activation enrgy of the reaction.

Answer: B

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343. $BaSO_4$ is insoluble in water due to its

A. High hydration energy

B. High lattice energy

C. High ionization energy

D. High kinetic energy

Answer: B

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344. Given that $\Delta h_f(H) = 218kJ/mol$. Express the $H-H$ bond energy in $Kcal/mol$

A. 52.15

B. 9.11

C. 104

D. 52.53

Answer: C

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345. Calculate ΔH° for the reaction

$Na_2O(g) + SO_3(g) \rightarrow Na_2SO_4(s)$

Given the following

$(i) Na(s) + H_2O(l) \rightarrow NaOH(s) + \frac{1}{2}H_2(g), \Delta H^\circ = -146 kJ$

$(ii) Na_2SO_4(s) + H_2O(l) \rightarrow 2NaOH(s) + SO_3(g), \Delta H = +418 kJ$

$(iii) 2Na_2O(s) + 2H_2(g) \rightarrow 4Na(s) + 2H_2O(l), \Delta H = +259 kJ$

A. $+823 kJ$

B. $-581 kJ$

C. $-435 kJ$

D. $+531 kJ$

Answer: B

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346. For the reaction

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, which of the following is correct regarding ΔH ?

A. $\Delta H = \Delta U + RT$

B. $\Delta H = \Delta U + 2RT$

C. $\Delta H = \Delta U - 2RT$

D. $\Delta H = \Delta U - RT$

Answer: C

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347. Given that $dE = TdS - PdV$ and $H = E + PV$, which one of the following relations is true ?

A. $dH = TdS + VdP$

B. $dH = SdT + VdP$

C. $-dH = SdT + VdP$

D. $dH = dE + PdV$

Answer: A

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348. The activation energies of two reactions are E_1 & E_2 with $E_1 > E_2$. If temperature of reacting system is increased from T_1 (rate constant are k_1 and k_2) to T_2 (rate constant are k_1^1 and k_2^1) predict which of the following alternative is incorrect.

A. $\frac{k_1'}{k_1} = \frac{k_2'}{k_2}$

B. $\frac{k_1'}{k_1} > \frac{k_2'}{k_2}$

C. $\frac{k_1'}{k_1} < \frac{k_2'}{k_2}$

D. $\frac{k_1'}{k_1} = \frac{k_2'}{k_2'}$

Answer: B

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349. A reaction cannot take place spontaneously at any temperture when

A. both ΔH and ΔS are positive

B. both ΔH and ΔS are negative

C. ΔH is negative and ΔS is positive

D. ΔH is zero and ΔS is positive

Answer: B

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350. The heat of atomisation of $PH_3(g)$ and $P_2H_4(g)$ are $954 kJmol^{-1}$ and $1485 kJmol^{-1}$ respectively. The $P-P$ bond energy in $kJmol^{-1}$ is

A. 213

B. 426

C. 318

D. 1272

Answer: A

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351. $NH_3(g) + 3Cl_2 \rightarrow NCl_3(g) + 3HCl(g), \Delta H_1$

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g), \Delta H_2$

$H_2(g) + Cl_2(g) \rightarrow 2HCl(g), \Delta H_3$

The heat of formation of NCl_3(g) in the terms of

$\Delta H_1, \Delta H_2, \Delta H_3$ is :

A. $\Delta H_f = -\Delta H_1 + \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$

B. $\Delta H_f = \Delta H_1 + \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$

C. $\Delta H_f = \Delta H_1 + \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$

D. None of the above

Answer: D

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352. If 1 mole of an ideal gas expands isothermally at $37^{\circ}C$ from 15 litres to 25 litres, the maximum work obtained is :

A. $12.87J$

B. $6.43J$

C. $8.57J$

D. $2.92J$

Answer: A

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353. The heat liberated when $1.89g$ of benzoic acid is burnt in a bomb calorimeter at $25^{\circ}C$ increases the temperture of $18.94kg$ of water by

$0.632^{\circ} C$. If the specific heat of water at $25^{\circ} C$ is $0.998 cal / g\deg$, the value of the heat of combustion of benzoic acid is

A. $88.1 kcal$

B. $771.4 kcal$

C. $981.1 kcal$

D. $871.2 kcal$

Answer: B

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354. The source of energy in a cellular reaction is

A. chemical energy

B. light energy

C. heat energy

D. solar energy

Answer: A

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355. The work differential, dw, is

A. a state function

B. an inexact differential

C. exact differential

D. None of the above

Answer: C

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356. Three moles of an ideal gas expanded spotaneously into vacuum. The work done will be

A. infinity

B. $10J$

C. zero

D. $5J$

Answer: C

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357. Which is correct for an endothermic reaction ?

A. ΔE is negative

B. ΔH is negative

C. ΔH is positive

D. ΔH is equal to zero

Answer: C

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358. For an adiabatic process :

A. $T =$ constant

B. $q = 0$

C. $q =$ constant

D. $W = 0$

Answer: C

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359. The enthalpy change in the reaction :

$2CO + O_2 \rightarrow 2CO_2$

is termed as

A. enthalpy of reaction

B. enthalpy of fusion

C. Enthalpy of combustion

D. enthalpy of formation

Answer: C

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360. In a reversible isothermal process, the change in internal energy is :

A. zero

B. positive

C. Negative

D. None of the above

Answer: A

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361. Based on the following thermochemical equations

$H_2O(g) + C(s) \rightarrow CO(g) + H_2(g), \Delta H = 131 KJ$

$CO(g) + 1/2O_2(g) \rightarrow CO_2(g), \Delta H = -282 KJ$

$H_2(g) + 1/2O_2(g) \rightarrow H_2O(g), \Delta H = -242 KJ$

$C(s) + O_2(g) \rightarrow CO_2(g), \Delta H = X KJ$

The value of X will be

A. $-393kJ$

B. $-655kJ$

C. $+393kJ$

D. $+655kJ$

Answer: A

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362. The heat of formation of water is $260kJ$. How much H_2O is decomposed by $130kJ$ heat ?

A. $0.25mol$

B. 1 mol

C. 0.5 mol

D. 2 mol

Answer: C

Watch Video Solution

363. Which equation is correct for adiabatic process ?

A. $Q = \ +W$

B. $Q = 0$

C. $\Delta E = Q$

D. $P + \Delta V = 0$

Answer: A

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364. The amount of heat evolved when $500cm^3 0.1 M HCl$ is mixed with $200cm^3$ of $0.2 M NaOH$ is

A. $2.292 kJ$

B. $1.292 kJ$

C. $0.292 kJ$

D. $3.393 kJ$

Answer: A

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365. Enthalpy of vapourization of benzene is $+35.3kJmol^{-1}$ at its boiling point of $80^{\circ}C$. The entropy change in the transition of the vapour to liquid at its boiling points [in $K^{-1}mol^{-1}$] is

A. -441

B. -100

C. $+441$

D. $+100$

Answer: D

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366. For one mole of an ideal gas, increasing the temperature from $10^{\circ}C$ to $20^{\circ}C$

A. increases the average kinetic energy by two times

B. increases the rms velocity by $\sqrt{2}$ times

C. increases the rms velocity by two times

D. increases both the average kinetic energy and rms velocity, but not significantly

Answer: D

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367. Based on the first law of thermodynamics, which one of the following is correct?

A. For an isocharic process : $\Delta U = -q$

B. For an adiabatic process : $\Delta U = -w$

C. For an isothermal process : $q = +w$

D. For a cyclic process : $q = -w$

Answer: D

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368. Gibb's free energy G is defined as

A. $G = H - TS$

B. $G = H + TS$

C. $G = U - TS$

D. $G = U + TS$

Answer: A

Watch Video Solution

369. A spontaneous reaction is impossible if

A. both ΔH and ΔS are negative

B. both ΔH and ΔS are positive

C. ΔH is negative and ΔS is positive

D. ΔH is positive and ΔS is negative

Answer: D

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370. The standard enthalpy of formation of $H_2(g)$ and $Cl_2(g)$ and $HCl(g)$ are $218kJ/mol$, $121.88kJ/mol$ and $-93.31kJ/mol$ respectively. Calculate standard enthalpy change in kJ for

$$\frac{1}{2}H_2(g)+\frac{1}{2}Cl_2(g)\rightarrow HCl(g)$$

A. `+431.99

B. -262.14

C. -431.99

D. $+247.37$

Answer: B

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371. Changes in a system from a initial state to the final state were made by a different manner that ΔH remains same but q changes because

A. ΔH is a path function and q is a state function

B. ΔH is a state function and q is a path function

C. both ΔH and q are state function

D. both ΔH and q are path function

Answer: B

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372. In which of the following reactions, the enthalpy is the least ?

A. $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

B. $HCl + NH_4OH \rightarrow NH_4Cl + H_2O$

C. $HCl + NaOH \rightarrow NaCl + H_2O$

D. $HCN + NH_4OH \rightarrow NH_4CN + H_2O$

Answer: D

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373. According to the first law of thermodynamics which of the following quantities represents change in a state function ?

A. q_{rev}

B. $q_{rev} - w_{rev}$

C. q_{rev} / w_{rev}

D. $q_{rev} + w_{rev}$

Answer: D

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374. A $1.0g$ sample of substance A at $100^{\circ}C$ is added to $100mL$ of H_2O at $25^{\circ}C$. Using separate $100mL$ portions of H_2O, the procedure is repeated with substance B and then with substance C. How will the final temperatures of the water compare ?

Substance	Specific heat
A	$0.60Jg^{-1}$^(@)C^(-1)),(B,0.40 J g^(-1) $^{\circ}C^{-1}$
C	$0.20Jg^{-1}{^\circ}C^{-1}$

A. $T_C > T_B > T_A$

B. $T_B > T_A > T_C$

C. $T_A > T_B > T_C$

D. $T_A = T_B = T_C$

Answer: C

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375. The amount of heat evolved when $500cm^3 0.1MHCl$ is mixed with $200cm^3$ of $0.2MNaOH$ is

A. $2.292kJ$

B. $1.292kJ$

C. $0.292kJ$

D. $5.292kJ$

Answer: A

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376. Based on first law of thermodynamics, which one of the following is correct ?

A. For an isothermic process : $\Delta U = -q$

B. For an adiabatic process : $\Delta U = -w$

C. For an isothermal process : $q = +w$

D. For a cyclic process : $q = -w$

Answer: D

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377. The value of enthalpy change (ΔH) for the reaction

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

at $27^\circ C$ is $-1366.5 kJ mol^{-1}$.

The value of internal energy change for the above reactio at this temperature will be

A. $-1371.5 kJ$

B. $-1369.0 kJ$

C. $-1364.0 kJ$

D. $-1361.5 kJ$

Answer: C

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378. Which of the following is correct option for the free expansion of an ideal gas under adiabatic condition ?

A. $q = 0, \Delta T < 0, w \neq 0$

B. $q = 0, \Delta T \neq 0, w = 0$

C. $q \neq 0, \Delta T = 0, w = 0$

D. $q = 0, \Delta T = 0, w = 0$

Answer: D

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379. The entropy change involved in the isothermal reversible expansion of 2 moles of an ideal gas from a volume of $10 dm^3$ to a volume of $100 dm^3$ at $27^\circ C$ is

A. $35.8 J mol^{-1} K^{-1}$

B. $322 J mol^{-1} K^{-1}$

C. $42.3 J mol^{-1} K^{-1}$

D. $38.3 J mol^{-1} K^{-1}$

Answer: D

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380. Enthalpy change for the reaction

$2H(2)(g) \rightarrow 4H(g)$ is $-869.6kJ$

The dissociation energy of $H - - H$bond is:

A. $+217.4kJ$

B. $-431.8kJ$

C. $-869.6kJ$

D. $+434.8kJ$

Answer: B

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381. Consider the reaction,

$4NO_2(g) + O_2(g) \rightarrow 2N_2O_5(g), \Delta_rH = -111kJ.$ If $N_2O_5(s)$ is formed instead of $N_2O_5(g)$ in the above reaction, the Δ_rH value will be

(Given, ΔH of sublimation for N_2O_5 is $54kJmol^{-1}$)

A. $165kJ$

B. $+54kJ$

C. $+219kJ$

D. $-219kJ$

Answer: A

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382. In view of the signs of $\Delta_r G^0$ for the following reactions

$PbO_2 + Pb \rightarrow 2PbO, \Delta_r G^0 < 0$

$SnO_2 + Sn \rightarrow 2SnO, \Delta_r G^0 > 0$

Which oxidation state are more characteristic for lead and tin?

A. For lead $+4$ and for tin $+2$

B. For lead $+2$ and for tin $+2$

C. For lead $+4$ and for tin $+4$

D. For lead $+2$ and for tin $+4$

Answer: D

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383. Consider the following processes :-

	$\Delta H(kJ/mol)$
$\frac{1}{2}A \rightarrow B$	$+150$
$3B \rightarrow 2C + D$	-125
$E + A \rightarrow 2D$	$+350$

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

A. $525 kJ/mol$

B. $-175 kJ/mol$

C. $-325 kJ/mol$

D. $325 kJ/mol$

Answer: B

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384. At the sublimation temperature, for the process $CO_2(S) \rightarrow CO_2(g)$

A. ΔH, ΔS and ΔG will be negative

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

C. $\Delta H < 0, \Delta S > 0$ and $\Delta G < 0$

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

Answer: D

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385. Which of the following sets of conditions would result in a reaction that is spontaneous at high temperature but non-spontaneous at low temperature?

A. $\Delta H > 0, \Delta S > 0$

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

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

D. $\Delta H < 0, \Delta S < 0$

Answer: D

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386. The enthalpy of solution of sodium chloride is $4kJmol^{-1}$ and its enthalpy of hydration of ion is $-784kJmol^{-1}$. Then the lattice enthalpy of $NaCl$ (in $kJmol^{-1}$) is

A. $+788$

B. $+4$

C. $+398$

D. $+780$

Answer: A

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387. The standard enthalpy of formation of $C_2H_4(l)$, $CO_2(g)$ and $H_2O(l)$ are $52, 394$ and $-286kJmol^{-1}$ respectively. Then the amount of heat evolved by burning $7g$ of $C_2H_4(g)$ is

A. $1412kJ$

B. $9884kJ$

C. $353kJ$

D. $706kJ$

Answer: C

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388. In which of the following reactions,standard reaction entropy change(ΔS°)is positive and standard Gibb,s energy change(ΔG°) decreases sharply with increasing temperature?

A. $C(\text{graphite}) + 1/2O_2(g) \rightarrow CO_2(g)$

B. $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$

C. $Mg(s) + \frac{1}{2}O_2(g) \rightarrow MgO(g)$

D. $\frac{1}{2}C(\text{graphite}) + \frac{1}{2}O_2 \rightarrow \frac{1}{2}CO_2(g)$

Answer: A

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389. The enthalpy of fusion of water is $1.435kcal/\text{mole}$. The molar entropy change for melting of ice at $0^\circ C$ is

A. $10.52cal/(molK)$

B. $21.04cal/(molK)$

C. $5.260cal/(molK)$

D. $0.526cal/(molK)$

Answer: C

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390. Standard enthalpy of vaporisation$\Delta V_{vap}. H^{\Theta}$ for water at $100^{\circ} C$ is$40.66 kJmol^{-1}$.The internal energy of Vaporization of water at $100^{\circ} C\left(\text{in kJ mol}^{-1}\right)$is

A. $+37.56$

B. -43.76

C. $+43.76$

D. 40.66

Answer: A

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391. Using the data provided, calculate the multiple bond energy $\left(kJmol^{-1}\right)$ of a $C \equiv C$ bond in C_2H_2. That energy is (take the bond energy of a $C - H$ bond as $350kJmol^{-1}$).

$2C_{(s)} + H_{2(g)} \rightarrow C_2H_{2(g)}, \Delta = 225kJmol^{-1}$

$2C_{(s)} \rightarrow 2C_g), \Delta H = 1410kJmol^{-1}$

$H_{2(g)} \rightarrow 2H_{(g)}, \Delta H = 330kJmol^{-1}$

A. 1165

B. 837

C. 865

D. 815

Answer: D

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392. Equal volumes of two monoatomic gases,A, B, at the same temperature and pressure are mixed.The ratio of specific heats(C_p / C_v) of the mixture will be

A. 0.83

B. 1.50

C. 3.3

D. 1.67

Answer: D

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393. The incorrect expression among the following is

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

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

C. in isothermal process $W_{rev} = -nRT \ln \dfrac{V_f}{V_c}$

D. $\dfrac{\Delta G\text{system}}{\Delta S\text{total}} = -T$

Answer: A

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

A. The entropy always increases

B. The change in entropy along the 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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395. A gasesous system during a thermodynamic process does not undertake any volume changes, it is called

A. isochoric process

B. isobaric process

C. isothermal system

D. mesoentropic system

Answer: A

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396. Calculate the work done (in joules) when 0.2 mole of an ideal gas at $300K$ expands isothermally and reversible from an initial volume of 2.5 litres to the final volume of 25 litres.

A. 996

B. 1148

C. 11.48

D. 114.8

Answer: B

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397. 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

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

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

Answer: A

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398. Choose the reaction 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. $2KCIO_3(s) \rightarrow 2KCI(s) + 3O_2(g)$

Answer: C

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399. A chemical reaction is spontancous at $298K$ but non spontaneous at $350K$. Which one of the following is true for the reaction ?

A. $\begin{array}{cccc} & \Delta G & \Delta H & \Delta S \\ A & - & - & + \end{array}$

B. $\begin{array}{cccc} & \Delta G & \Delta H & \Delta S \\ B & + & + & + \end{array}$

C. $\begin{array}{cccc} & \Delta G & \Delta H & \Delta S \\ C & - & + & - \end{array}$

D. $\begin{array}{cccc} & \Delta G & \Delta H & \Delta S \\ D & + & - & + \end{array}$

Answer: C

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400. A gas expands from a volume of $1m^3$ to a volume of $2m^3$ against an external pressure of $10^5 Nm^{-2}$. The work done of the gas will be

A. $10^5 kJ$

B. $10^2 kJ$

C. $10^2 J$

D. $10^3 J$

Answer: B

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401. The equilibrium constant of a reaction is 0.008 at $298K$. The standard free energy change of the reaction at the same temperture is

A. $+11.96kJ$

B. $-11.96kJ$

C. $-5.43kJ$

D. $-8.46kJ$

Answer: A

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402. Which of the following statement is true ?

A. The total entropy of the universe is continuously decreasing

B. The total entropy of the universe remains same

C. The total entropy of the universe is continuously decreasing

D. The total entropy of the universe remains constant

Answer: A

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403. A piston filled with 0.04 mole of an ideal gas expands reversible from $50.0mL$ at a constant temperature of $37.0^{\circ}C$. As it does so, it absorbs $208J$ of heat. The value of q and W for the process will be $(R = 8.314J/molK, 1n7.5 = 2.01)$

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

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

C. $q = -208J, w = -208J$

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

Answer: B

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404. The standard enthalpies fo formation of $CO_2(g), H_2O(1)$, and glucose (s) at $25^{\circ}C$ are $-400kJmol^{-1}, -300kJmol^{-}$, and

$-1300 kJmol^{-1}$, respectively. The standard enthalply of combustion per gram of glucose at $25^\circ C$ is

A. $+2900 kJ$

B. $-2900 kJ$

C. $-16.11 kJ$

D. $+16.11 kJ$

Answer: C

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405. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l) + xkJ$ In the above reaction

A. $zkJmol^{-1}$ is the value of ΔH_f for water

B. ΔH_f of $H_2O(l)$ is $-xkJ$

C. ΔH_f of $H_2O(l)$ is $-x/2kJmol^{-1}$

D. ΔH_{comb} of H_2 is $-x/2kJmol^{-1}$

Answer: C::D

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406. For which of the following reaction, change of enthalpy equals the change in internal energy ?

A. $H_2 + I_2 \rightarrow 2HI$

B. $PCl_5(g) \rightarrow PCl_3(g) + Cl_2$

C. $2H_2O_2 \rightarrow 2H_2O_2 + O_2$

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

Answer: A::D

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407. Which of the following expression represent the criterion of spontaneity ?

A. $(\delta S)_{E}, V < 0$

B. $(\delta G)_{T,P} < 0$

C. $(\delta H)_{T,P} < 0$

D. $(\delta G)_{S,V} < 0$

Answer: B::D

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408. Which relations among the following is/are correct ?

A. $G = H - TS$

B. $PV = H - V$

C. $w = \Delta W - q$

D. $qv - qp = -\Delta nRT$

Answer: A::C::D

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409. Which statements among the following is /are incorrect ?

A. Absoulte value of heat content of the system can be easily determined by calorimetery.

B. Absoulte value of entropy cannot be known

C. Absolute value of internal energy cannot be known

D. Value of ΔG_f° cannot be determined.

Answer: A::D

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410. Second law of thermodynamics points out that

A. All the spontaneous processes are thermodynamically irreversible

B. Entrophy of universe is continuously increasing

C. Energy of universe is constant

D. Mass and energy are interconvertible

Answer: A::B

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411. which among the following is intensive quantity ?

A. Enthalpy

B. Temperature

C. Volume

D. Refractive index

Answer: B::D

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412. The following is(are) endothermic reaction (s):

A. combustion of methane

B. Decomposition of water

C. Dehydrogenation of ethane to ethylene

D. Conversion of graphite to diamond

Answer: B::C::D

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413. Among the following, the intensive property is (properties are) :

A. molar conductivity

B. electromotive force

C. resistance

D. heat capacity

Answer: A::B

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414. In a flask, colourless N_2O_4 is in equilibrium with brown-coloured NO_2. At equilibrium, when the flask is heated to $100^\circ C$ the brown colour deepens and on cooling, the brown colour became less coloured. The change in enthalpy ΔH for the ayatem is

A. Negative

B. Positive

C. Zero

D. Undefined

Answer: B

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415. The gas with the highest heat of combustion is :

A. Methane

B. Ethane

C. Ethene

D. Ethyne

Answer: B

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416. Given

$NH_3(g) + 3Cl_2(g) \rightarrow NCl_3(g) + 3HCl(g) + x_1$

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g) + x_2$

$H_2(g) + Cl_2(g) \rightarrow 2HCl(g) - x_3$

The heat of formation of $NCl_3(g)$

A. $-x_1 - \frac{x_2}{2} - \frac{3x_3}{2}$

B. $x_1 + \frac{x_2}{2} - \frac{3}{2}x_3$

C. $x_1 - \frac{x_2}{2} - \frac{3}{2}x_3$

D. $x_1 + x_2 + \frac{3x_3}{2}$

Answer: A

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417. A scientist needs a refrigeration machine to maintain temperature of $-13^\circ C$ for certain chemical process. How much work must be performed on the system during each cycle of its operation if $3000J$ of heat is to be withdrawn from the $-13^\circ C$ reservoir and discharged to the room at $+27^\circ C$? Assume that the machine operates at 100% of its theoretical efficiency.

A. $65000J$

B. $3000J$

C. $154J$

D. $133J$

Answer: B

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418. Under the same conditions, how many mL of $1MKOH$ and $0.5MH_2SO_4$solutions, respectively, when mixed to form a total volume of $100mL$, produces the highest rise in temperature?

A. $67, 33$

B. $33, 67$

C. $40, 60$

D. $50, 50$

Answer: D

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419. The standard molar heats of formation of ethane, carbon dioxide, and liquid water are -21.1, -94.1, and $-68.3 kcal$, respectively. Calculate the standard molar heat of combustion of ethane.

A. $372 kcal$

B. $-162 kcal$

C. $-240 kcal$

D. $-183.5 kcal$

Answer: A

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420. The enthalpy of combustion of H_2 , cyclohexene (C_6H_{10}) and cyclohexane (C_6H_{12}) are -241 , -3800 and $-3920 KJ$ per mol respectively. Heat of hydrogenation of cyclohexene is

A. $-121 kJ mol^{-1}$

B. $+121kJmol^{-1}$

C. $-242kJmol^{-1}$

D. $+242kJmol^{-1}$

Answer: A

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421. Which of the following is an endothermic reaction?

A. $2H_2 + O_2 \rightarrow 2H_2O$

B. $N_2 + O_2 \rightarrow 2NO$

C. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

D. $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

Answer: C

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422. The heat released when NH_4OH and HCl neutralise is

A. $13.7kcal$

B. $> 13.7kcal$

C. $< 13.7kcal$

D. None of the above

Answer: C

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423. The difference between the heats of reaction at constant pressure and a constant volume for the 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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424. Which of the following equations represents standard heat of combustion of CH_4 ?

A. $C(\text{diamond}) + 2H_2(g) \rightarrow CH_4(g)$

B. $C(\text{graphite}) + 2H_2(g) \rightarrow CH_4(g)$

C. $C(\text{diamond}) + 4H(g) \rightarrow CH_4(g)$

D. $C(\text{graphite}) + 4H(g) \rightarrow CH_4(g)$

Answer: B

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425. Identify the state quantiy among the following

A. q

B. $q - w$

C. $q + w$

D. q / w

Answer: C

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426. The ΔH_f° for $CO_2(g)$, CO(g) and $H_2O(g)$ are $-395.5, \ -110.5$ and $-241.8 \quad \text{kJ}mol^{-1}$ respectively. The standard enthalpy change in (in kJ) for the reaction

$CO_2(g) + H_2(g) \rightarrow CO(g) + H_2O(g)$ is

A. 524.1

B. 41.2

C. -262.5

D. -41.2

Answer: B

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427. Which of the following statement is false ?

A. Work is a state function

B. Temperature is a state function

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

D. Work appears at the boundary of the system.

Answer: A

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428. In thermodynamics, a process is called reversible when

A. surroundings and system change into each other

B. there is no boundary between system and surroundings

C. surrounding are always in equilibrium with system

D. system changes into surroundings spontaneously.

Answer: C

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429. One mole of non-ideal gas undergoes a change of state $(2.0\text{atm}, 3.0L, 95K) \rightarrow (4.0\text{atm}, 5.0L, 245K)$ with a change in internal energy, $\Delta U = 30.0 Latm$. The change in enthalpy (ΔH) of the process in $L\text{atm}$ is

A. 40.0

B. 42.3

C. 44.0

D. not defined because pressure is not constant

Answer: C

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430. Which of the following reactions will define ΔH_f° ?

A. $C(\text{diamond}) + O_2(g) \rightarrow CO_2(g)$

B. $\frac{1}{2}H_2(g) + \frac{1}{2}F_2(g) \rightarrow HF(g)$

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

D. $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$

Answer: B

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431. The enthalpy of vaporisation of a liquid is $30kJmol^{-1}$ and entropy of vaporisation is $75Jmol^{-1}K^{-1}$. The boiling point of the liquid at $1atm$ is :

A. $250K$

B. $400K$

C. $450K$

D. $600K$

Answer: B

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432. Two moles of an ideal gas is expanded isothermally and reversibly from 1 liter to 10 liter at $300K$. The enthalpy change (in kJ) for the process

A. $11.4kJ$

B. $-11.4kJ$

C. $0kJ$

D. $4.8kJ$

Answer: C

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433. One mole of monoatomic ideal gas at $T(K)$ is exapanded from $1L$ to $2L$ adiabatically under constant external pressure of 1 atm . The final tempreture of gas in kelvin is

A. T

B. $\frac{T}{2^{5/3-1}}$

C. $T-\frac{2}{3\times0.0821}$

D. $T+\frac{2}{3\times0.0821}$

Answer: C

434. An ideal gas is allowed to expand both reversibly and irreversibly in an isolated system. If T_i is the initial temperature and T_f is the final temperature, which of the following statement is correct ?

A. $(T_f)_{rev} = (T_f)_{irrev}$

B. $T_f = T_i$ for both reversible and irreversible process

C. $(T_f)_{irrev} > (T_f)_{rev}$

D. $T_f > T_i$ for reversible process but $T_f = T_i$ for irreversible process

Answer: B

435. The standard enthalpy of formation $\left(\Delta_f H^\circ\right)$ at $298K$ for methane $\left(CH_{4(g)}\right)$ is $-74.8kJmol^{-1}$. The additional information required to determine the average energy for $C-H$ bond formation would be :

A. The first four ionization of carbon and electron gain enthalpy of hydrogen

B. The dissociation energy of hydrogen molecule H_2.

C. The dissociation energy of H_2 and enthlpy of sublimation of carbon

D. latent heat of vaporisation of methane.

Answer: C

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436. $(\Delta H - \Delta U)$ for the formation of carbon monoxide (CO) from its elements at $298K$ is

$(R = 8.314K^{-1}mol^{-1})$

A. $-2477.57Jmol^{-1}$

B. $2477.57Jmol^{-1}$

C. $-1238.78Jmol^{-1}$

D. $1238.78Jmol^{-1}$

Answer: D

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437. The enthalpy and entropy change for the reaction,

$Br_2(l) + Cl_2(g) \rightarrow 2BrCl(g)$

are $30KJmol^{-1}$ and $105JK^{-1}mol^{-1}$ respectively. The temperature at which the raction will be in equilibrium is:

A. $450K$

B. $300K$

C. $285.7K$

D. $273K$

Answer: C

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438. The enthalpy of hydrogenation of cyclohexene is $-119.5kJmol^{-1}$. If resonance energy of benzene is $-150.4kJmol^{-1}$, its enthalpy of hydrogenation would be :

A. $-269.9kJmol^{-1}$

B. $-358.5kJmol^{-1}$

C. $-508.9kJmol^{-1}$

D. $-208.1kJmol^{-1}$

Answer: D

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439. The direct conversion of A to B is difficult, hence is carried out by the following shown path:

$\Delta(A \rightarrow C) = 50, \Delta S(C \rightarrow D) = 30, \Delta S(B \rightarrow D) = 20$ The entropy change for the process $A \rightarrow B$ is :

A. $+100 eV$

B. $+60 eV$

C. $-100 eV$

D. $-60 eV$

Answer: B

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440. Consider the following reactions:

(i) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$,

$\Delta H = \ = -X_1 Kjmol^{-1}$

(ii) $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l), \Delta H = -X_2 Kjmol^{-1}$

(iii) $CO_2(g) + H_2(g) \rightarrow CO(g) + H_2O(l)$,

$\Delta H = -X_3 KJmol^{-1}$

(iv) $C_2H_2(g) + \frac{5}{2}O_2(g) \rightarrow 2CO_2(g) + H_2O(l)$,

$\Delta H = +X_4 KJmol^{-1}$

Enthanlpy of formation of $H_2O(l)$ is

A. $+x_1 kJmol^{-1}$

B. $-x_2 kJmol^{-1}$

C. $+x_3 kJmol^{-1}$

D. $-x_4 kJmol^{-1}$

Answer: B

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441. Given the bond energies of $H-H$ and $Cl-Cl$ are $430kJmol^{-1}$ and $240kJmol^{-1}$, respectively, and $\Delta_f H^\circ$ for HCl is $-90kJmol^{-1}$. Bond enthalpy of HCl is

A. $245kJmol^{-1}$

B. $290kJmol^{-1}$

C. $380kJmol^{-1}$

D. $425kJmol^{-1}$

Answer: D

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442. In conversion of lime-stone to lime, $CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$ the values of ΔH° and ΔS° are $+179.1kJmol^{-1}$ and $160.2J/K$ respectively at $298K$ 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. $1118K$

B. $1008K$

C. $1200K$

D. $845K$

Answer: A

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443. Assuming that water vapour is an ideal gas, the internal energy change (ΔU) when 1 mole of water is vaporised at $1bar$ pressure and $100^\circ C$, (given: molar enthalpy of vaporization of water $41kJmol^{-1}$ at $1bar$ and $373K$ and $R = 8.3Jmol^{-1}K^{-1}$) will be :

A. $41.00kJmol^{-1}$

B. $4.100 kJmol^{-1}$

C. $3.7904 kJmol^{-1}$

D. $37.904 kJmol^{-1}$

Answer: D

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444. Identify the correct statement regarding a spontaneous process.

A. Lowering of energy in the reaction process is the only criterion for spontaneity

B. For a spontaneous process in an isolated system ,the change in entropy is positive

C. Endothermic reaction are never spontaneous

D. Exothermic reactions are always spontaneous.

Answer: B

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445. The value of $\log_{10} K$ for a reaction $A \Leftrightarrow B$ is (Given: $\Delta_f H^{\Theta}_{298K} = -54.07 kJ mol^{-1}$,

$\Delta_r S^{\Theta}_{298K} = 10 JK^{=1} mol^{-1}$, and $R = 8.314 JK^{-1} mol^{-1}$

A. 5

B. 10

C. 95

D. 100

Answer: B

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446. For the process $H_2O(l)(1\text{bar}, 373K) \rightarrow H_2O(g)(1\text{bar}, 373K)$ the correct set of thermodynamic parameters is

A. $\Delta G = 0, \Delta S = +ve$

B. $\Delta G = 0, \Delta S = -ve$

C. $\Delta G = +ve, \Delta S = +ve$

D. $\Delta G = -ve, \Delta S = +ve$

Answer: A

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447. The bond dissociation energies for Cl_2, I_2 and ICl are $242.3, 151.0$ and $211.3kJ/\text{mole}$ respectively. The enthalpy of sublimation of iodine is $62.8kJ/\text{mole}$. What is the standard enthalpy of formation of $ICI(g)$ nearly equal to

A. $-211.3kJ/\text{mole}$

B. $-14.6kJ/\text{mole}$

C. $16.8kJ/\text{mole}$

D. $33.5kJ/\text{mole}$

Answer: C

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448. Which of the following are not state functions?

(I) $q+w$

(II)q

(III) w

(IV) $H-TS$

A. I and IV

B. II, III and IV

C. I, II and III

D. II and III

Answer: D

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449. For the gas phase reaction

$PCl_5 \rightarrow PCl_3(g) + Cl_2(g)$

which of the following conditions are correct?

A. $\Delta H = 0$ and $\Delta S < 0$

B. $\Delta H > 0$ and $\Delta S > 0$

C. $\Delta H < 0$ and $\Delta S < 0$

D. $\Delta H > 0$ and $\Delta S < 0$

Answer: B

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450. Bond dissociation enthalpy of H_2 , Cl_2 and HCl are 434, 242 and $431 KJmol^{-1}$ respectively. Enthalpy of formation of HCl is

A. $93kJmol^{-1}$

B. $-245kJmol^{-1}$

C. $-93kJmol^{-1}$

D. $+245kJmol^{-1}$

Answer: C

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451. Oxidising power of chlorine in aqueous solution can be determined by the parameters indicated below

$$\frac{1}{2}CL_2(g) \xrightarrow{\frac{1}{2}\Delta_{diss}H^{\Theta}} Cl(g) \xrightarrow{\Delta H^{\Theta}_{Eg}}$$

$$Cl^{-}(g) \xrightarrow{\Delta_{hyd}H^{\Theta}} Cl^{-}(aq)$$

The energy involved in the conversion of $\frac{1}{2}Cl_2(g)$ to

$Cl^{-}(aq)$

(Using the data $\Delta_{diss}H^{\ominus}_{Cl_2} = 240 KJmol^{-1}$)

$\Delta_{Eg}H^{\ominus}_{Cl} = -349 KJmol^{-1}$,

$\Delta_{Eg}H^{\ominus}_{Cl} = -381 KJmol^{-1}$) will be

A. $-850 kJmol^{-1}$

B. $+120 kJmol^{-1}$

C. $+152 kJmol^{-1}$

D. $-610 kJmol^{-1}$

Answer: D

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452. The bond dissociation energy of $B-F$ in BF_3 is $646 kJmol^{-1}$ whereas that of $C-F$ in CF_4 is $515 kJmol^{-1}$. The correct reason for higher $B-F$ bond dissociation energy as compared to that of $C-F$ in CF_4 is

A. Smaller size of B-atom as compared to that of C atom

B. Stronger the bond between B and F in BF_3 as compared to $C-F$ in CF_4

C. Significant $p\pi - p\pi$ interaction between B and F in BF_3 whereas there is no possibility of such interaction between C and F in CF_4

D. Lower degree of $p\pi - p\pi$ interaction between B and F in BF_3 than that between C and F in CF_4

Answer: C

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453. From the following bond energies

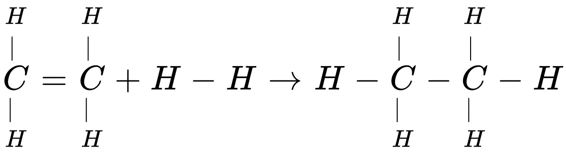
$H-H$ bond energy $431.37 kJmol^{-1}$

$C=C$ bond energy $606.10 kJmol^{-1}$

$C-C$ bond energy $336.49 kJmol^{-1}$

$C - H$ bond energy $410.5 kJ mol^{-1}$

Enthalpy for the reaction



$$\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} = \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} + H - H \rightarrow H - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - H$$

will be

A. $553.6 kJ mol^{-1}$

B. $1573.6 kJ mol^{-1}$

C. $-243.6 kJ mol^{-1}$

D. $-120.0 kJ mol^{-1}$

Answer: D

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454. The values of ΔH and ΔS for the reaction

$C(\text{graphite}) + CO_2(g) \rightarrow 2CO(g)$ are $170 kJ$ and $170 JK^{-1}$

respectively. The reaction will be spontaneous at

A. $990K$

B. $1140K$

C. $1100K$

D. $1110K$

Answer: A

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

A. $T = T_e$

B. $T_e > T$

C. $T_e < T$

D. T_e is 5 times T.

Answer: C

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456. The standard enthalpy of formation of NH_3 is $-46.0KJmol^{-1}$. If the enthalpy of formation of H_2 from its atoms is $-436KJmol^{-1}$ and that of N_2 is $-712KJmol^{-1}$, the average bond enthalpy of $N-H$ bond in NH_3 is

A. $-1102kJmol^{-1}$

B. $-964kJmol^{-1}$

C. $-352kJmol^{-1}$

D. $+1056kJmol^{-1}$

Answer: C

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457. Standard entropy of X_2 , Y_2 and XY_3 are $60, 40$ and $50 JK^{-1} mol^{-1}$, respectively. For the reaction, $\frac{1}{2}X_2 + \frac{3}{2}Y_2 \rightarrow XY_3, \Delta H = -30 KJ$, to be at equilibrium, the temperature will be:

A. $1000K$

B. $1250K$

C. $500K$

D. $750K$

Answer: D

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458. The bond energy (in kcal mol^{-1}) of a $C - c$ single bond is approximately

A. 1

B. 10

C. 100

D. 1000

Answer: C

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459. The entropy change involved in the isothermal reversible expansion of 2 moles of an ideal gas from a volume of $10dm^3$ to a volume of $100dm^3$ at $27^\circ C$ is

A. $35.8Jmol^{-1}K^{-1}$

B. $32.3Jmol^{-1}K^{-1}$

C. $42.3Jmol^{-1}K^{-1}$

D. $38.3Jmol^{-1}K^{-1}$

Answer: D

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460. If the enthaply change for the transition of liquid water to steam is 30 KJ mol^{-1} at 27° C . The entropy change for the process would be

A. $0.1Jmol^{-1}K^{-1}$

B. $100Jmol^{-1}K^{-1}$

C. $10Jmol^{-1}K^{-1}$

D. $1.0Jmol^{-1}K^{-1}$

Answer: B

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461. Enthalpy change for the reaction

$2H(2)(g) \rightarrow 4H(g)$ is $-869.6kJ$

The dissociation energy of $H - - H$bond is:

A. $+434.8kJ$

B. $+217.4kJ$

C. $434.8kJ$

D. $869.6kJ$

Answer: C

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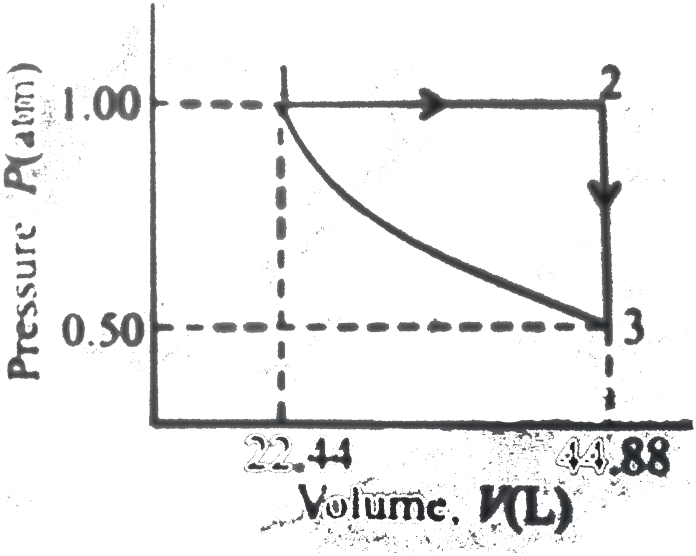
462. A sample consisting of $1mol$ of a mono-atomic perfect gas $\left(C_V = \frac{3}{2}R\right)$ is taken through the cycle as shown.



Temperature at points (1), (2) and (3) respectively is

A. $273K, 546K, 273K$

B. $546K, 273K, 273K$

C. $273K, 273K, 273K$

D. $546K, 546K, 273K$

Answer: A

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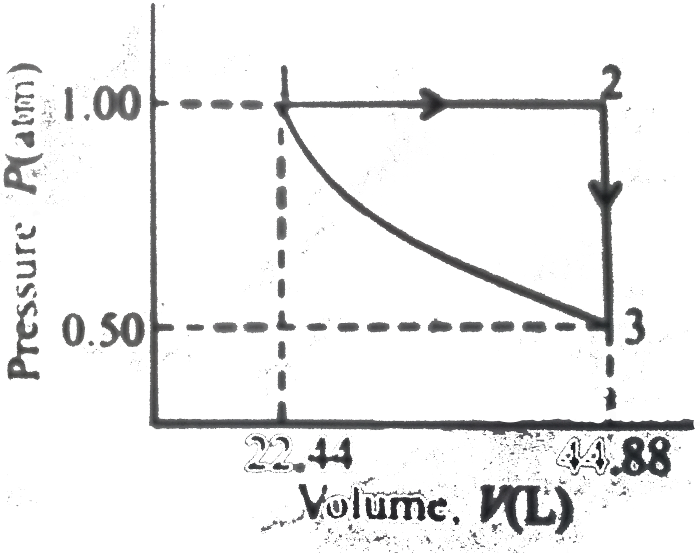
463. A sample consisting of $1 mol$ of a mono-atomic perfect gas $\left(C_V = \frac{3}{2}R\right)$ is taken through the cycle as shown.



ΔH for the overall cycle is

A. $+5.67 \times 10^3 J$

B. $-5.67 \times 10^5 J$

C. $-11.34 \times 10^3 J$

D. zero

Answer: D

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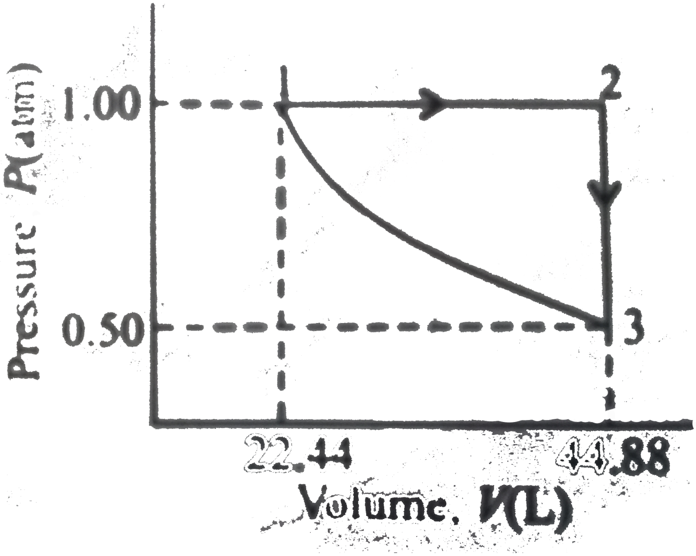
464. A sample consisting of $1 mol$ of a mono-atomic perfect gas $\left(C_V = \frac{3}{2}R\right)$ is taken through the cycle as shown.



ΔU for the process$(1 \rightarrow 2)$ is

A. $0.00J$

B. $+3.40 \times 10^3 J$

C. $-3.40J$

D. $-3.40 \times 10^3 J$

Answer: B

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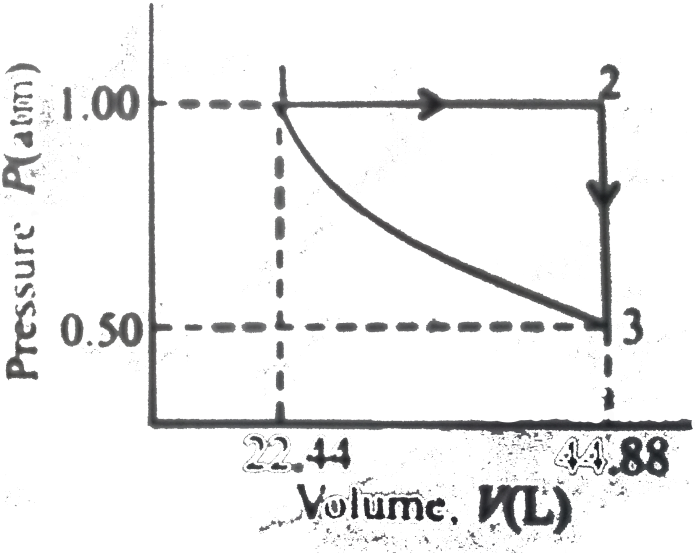
465. A sample consisting of $1mol$ of a mono-atomic perfect gas $\left(C_V = \frac{3}{2}R\right)$ is taken through the cycle as shown.



ΔU for the process $(2 \rightarrow 3)$ is

A. $0.00J$

B. $+3.40J$

C. $-3.40J$

D. None of these

Answer: C

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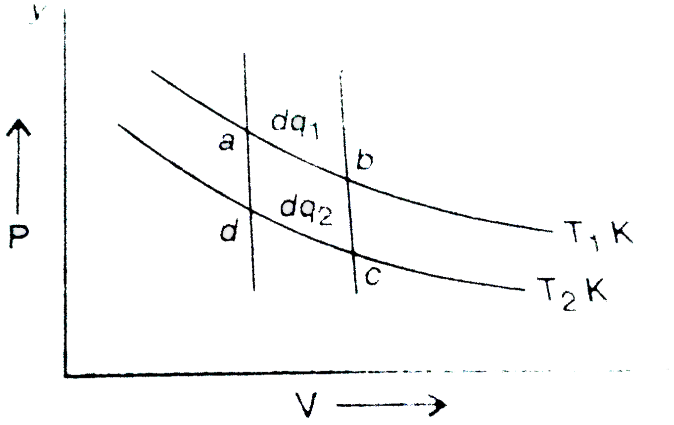

Irrespective of the path of the system in its reversible change, dq/T is same

For entire Carnot cycle

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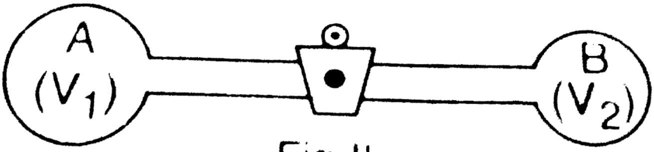

Fig-II

If the stop cock is opened, the gas will attain the volume $V_1 + V_2$.

Which of the following statement is correct about entropy ?

A. It is a function of temperature only

B. It is a function of pressure only

C. It is a function of volume only

D. It is a function of pressure, temperature and volume.

Answer: D

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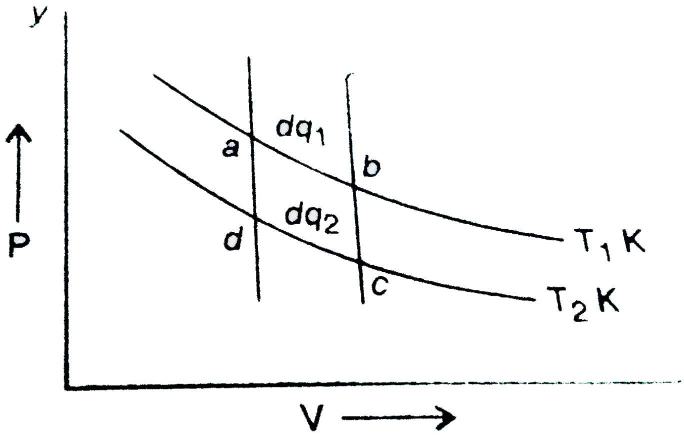

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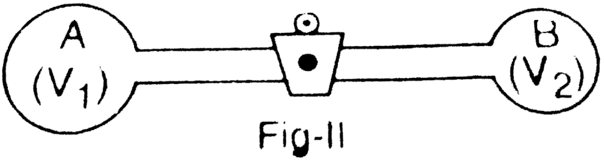

Fig-II

If the stop cock is opened, the gas will attain the volume $V_1 + V_2$.

Ethanol boils at $78.4^{\circ} C$ and standard enthalpy of vaporisation of ethanol is $42.4 kJ / mol$. Calculate the enthropy of vaporisation of ethanol

A. 0

B. $90 JK^{-1} mol^{-1}$

C. $50 JK^{-1} mol^{-1}$

D. $120.66 JK^{-1} mol^{-1}$

Answer: D

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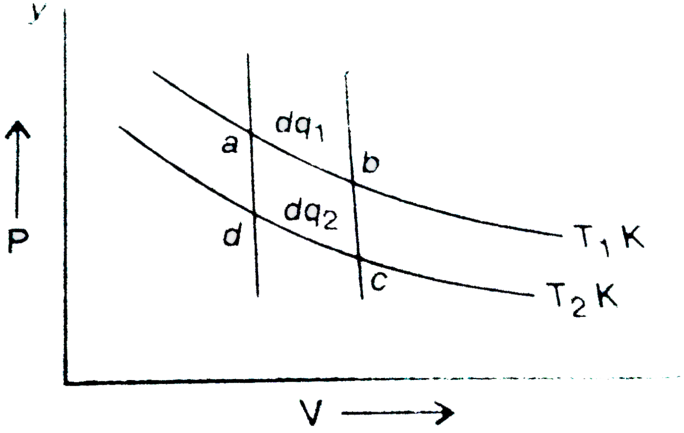

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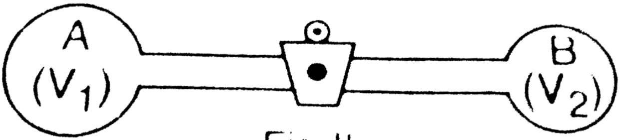

Fig-II

If the stop cock is opened, the gas will attain the volume $V_1 + V_2$.

In the figure-I, what will be the value of $\frac{dq}{T}$ along the line bc ?

A. 0

B. dq_1 / T

C. $\frac{dq_2}{T_2}$

D. $\frac{dq_1}{T_1} - \frac{dq_2}{T_2}$

Answer: A

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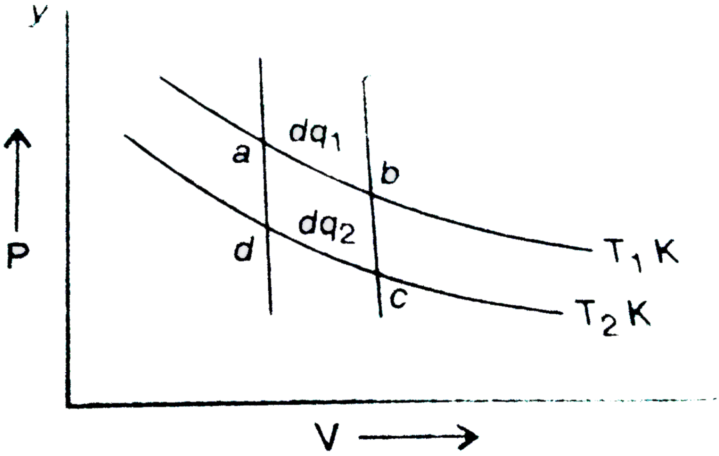

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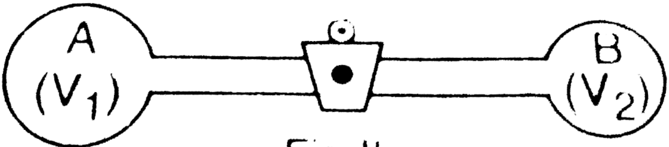

Fig-II

If the stop cock is opened, the gas will attain the volume $V_1 + V_2$.

In figure I, which is a reversible cyclic process, what will be the value of $\Delta U, \Delta H, \oint \frac{dq}{T}$ respectively ?

A. $0, 0, 0$

B. $0, 0, \frac{dq_1}{T_1}$

C. $0, 0, \frac{dq_2}{T_2}$

D. None of these

Answer: A

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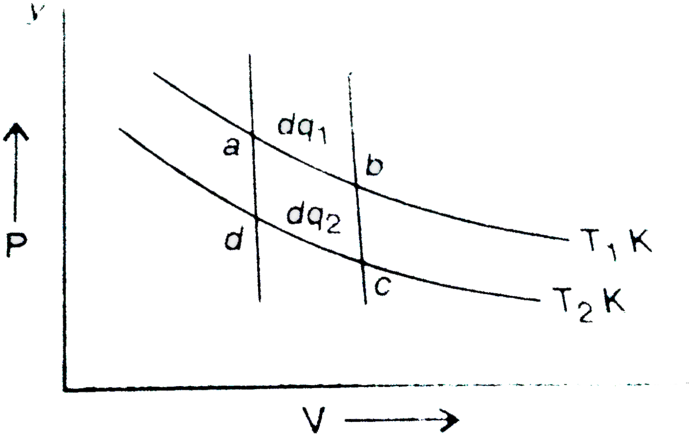

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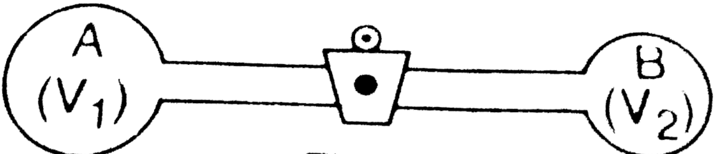

Fig-II

If the stop cock is opened, the gas will attain the volume V_1+V_2.

In a reversible isothermal expansion of the gas at TK as shown in figure II, the ΔS_{system}, $\Delta S_{\text{surroundings}}$ and $\Delta S_{\text{universe}}$ will be respectively

?

A. $R\frac{\ln(V_1+V_2)}{V_1}, 0, +ve$

B. $0, R\frac{\ln(V_1+V_2)}{V_1}, +ve$

C. $R\frac{\ln(V_1+V_2)}{V_2}, 0, +ve$

D. $R\frac{\ln(V_2+V_1)}{V_2}, 0, -ve$

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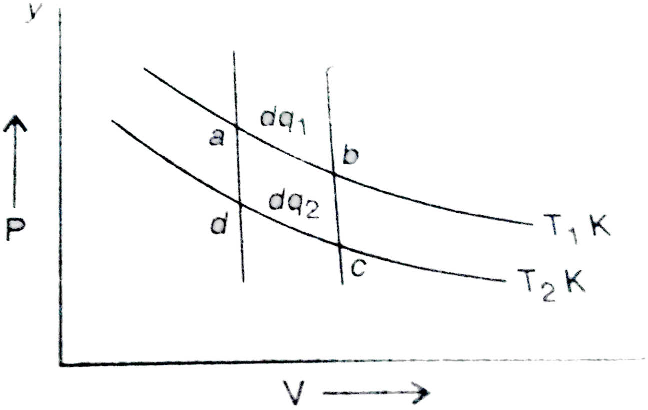

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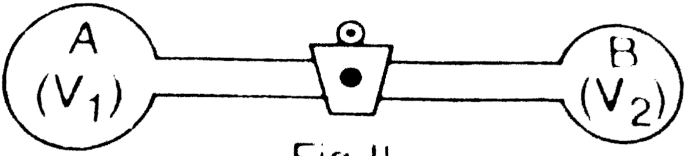

Fig-II

If the stop cock is opened, the gas will attain the volume $V_1 + V_2$.

In irreversible cyclic process, which of the following is correct ?

A. $\Delta S_{\text{universe}} > 0, \Delta S_{\text{system}} = 0, \Delta S_{surround \in gs} > 0$

B. $\Delta S_{\text{universe}} > 0, \Delta S_{\text{system}} > 0, \Delta S_{surround \in gs} = 0$

C. $\Delta S_{\text{universe}} > 0, \Delta S_{\text{system}} > 0, \Delta S_{surround \in gs} = 0$

D. $\Delta S_{\text{universe}} = 0, \Delta S_{\text{system}} = 0, \Delta S_{surround \in gs} = 0$

Answer: A

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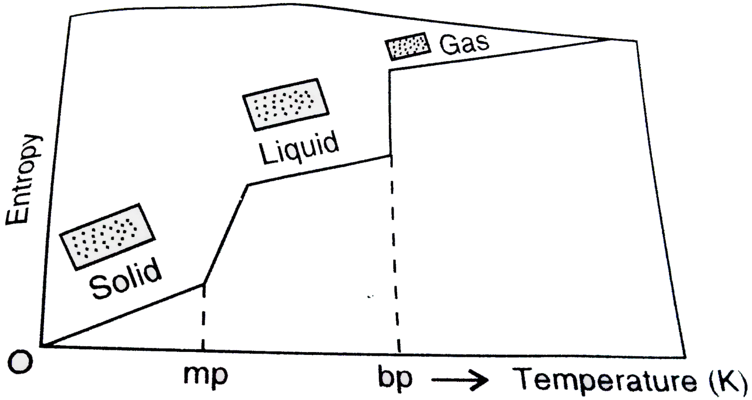
472. Energy is associated with the orientation and distribution of molecules in space. Disordered crystals have higher entropy than ordered crystals and diffused gases have higher entropy than compressed gases.



Entropy is also associated with molecular motion. As the temperature of a substance increases, random molecular motion increases hence entropy increases. Figure gives variation of entropy with temperature. At absolute zero $(- 273^{\circ} C)$ every substance is in solid state whose particles are rigidly fixed in a crystalline structure. If there is no residual orientational disorder, like that in CO, entropy of the substance is zero. Third law of thermodynamics states.

At the absolute zero of temperature the entropy of every substance become zero and does become zero in case of perfectly crystalline structure.

$unders\tan d(T \to 0)(LtS) = 0$

In case of CO and NO molecules in solid state, there is randomness even at $0K$ due to their dipole moments hence entropy in such cases is

not zero even at $0K$. As the temperature is raised, the molecules begin to vibrate. The number of ways in which the vibrational energy can be distributed increases with increases in temperature and the entropy of solid increases steadily as the temperature increaes. At the melting point (mp) of the solid, there is a discontinous jump in entropy because there are many more ways of arranging the molecules in the liquid than in the solid. An even greater jump in entropy is observed at the boiling point (bp) because molecules in the gas are to free to occupy a more larger volume and randomness increases.

Which of the following process is spontaneous?

A. Solid state

B. Liquid state

C. Gaseous state

D. Equal in all states.

Answer: C

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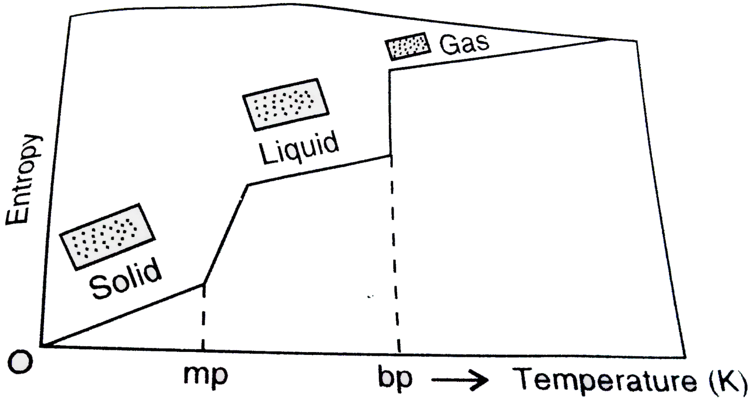

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Which of the following process is spontaneous?

A. Diffusion of perfume molecules from one side of the room to the other

B. Decomposition of solid $CaCO_3$

C. Heat flow from a cold object to a hot object

D. Climbing up a mountain.

Answer: A

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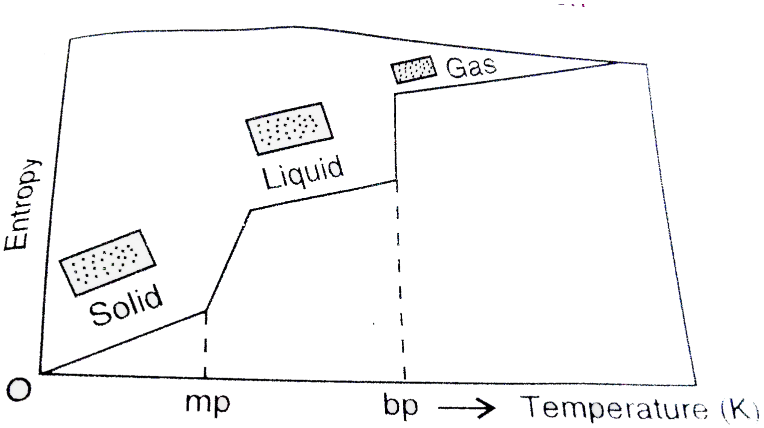

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Which has maximum entropy of vaporisation ?

A. Ethanol (l)

B. Benzene (l)

C. Toluene (l)

D. $CO_2(g)$

Answer: A

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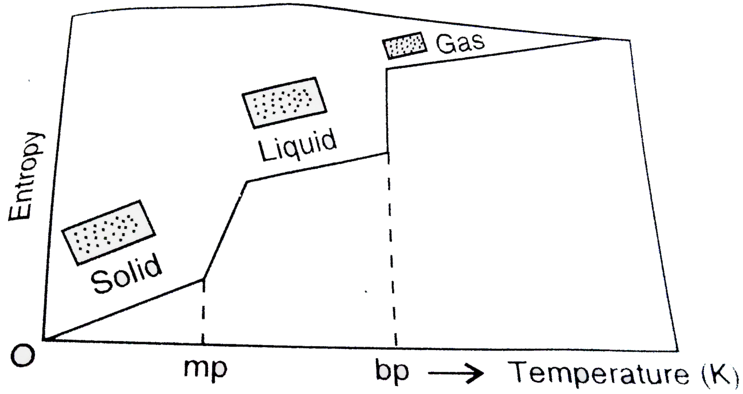
475. Energy is associated with the orientation and distribution of molecules in space. Disordered crystals have higher entropy than ordered crystals and diffused gases have higher entropy than compressed gases.



Entropy is also associated with molecular motion. As the temperature of a substance increases, random molecular motion increases hence entropy increases. Figure gives variation of entropy with temperature. At absolute zero $(-273^{\circ}C)$ every substance is in solid state whose particles are rigidly fixed in a crystalline structure. If there is no residual orientational disorder, like that in CO, entropy of the substance is zero. Third law of thermodynamics states.

At the absolute zero of temperature the entropy of every substance become zero and does become zero in case of perfectly crystalline structure.

$unders\tan d(T \rightarrow 0)(LtS) = 0$

In case of CO and NO molecules in solid state, there is randomness even at $0K$ due to their dipole moments hence entropy in such cases is

not zero even at $0K$. As the temperature is raised, the molecules begin to vibrate. The number of ways in which the vibrational energy can be distributed increases with increases in temperature and the entropy of solid increases steadily as the temperature increaes. At the melting point (mp) of the solid, there is a discontinous jump in entropy because there are many more ways of arranging the molecules in the liquid than in the solid. An even greater jump in entropy is observed at the boiling point (bp) because molecules in the gas are to free to occupy a more larger volume and randomness increases.

For the following reaction

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

If at $0K$, ΔS of this reaction is $X cal mol^{-1}$ then entropy of $CO_2(g)$ at $0K$ is

A. $-X cal$

B. $-2X cal$

C. $+X cal$

D. $0 cal$

Answer: C

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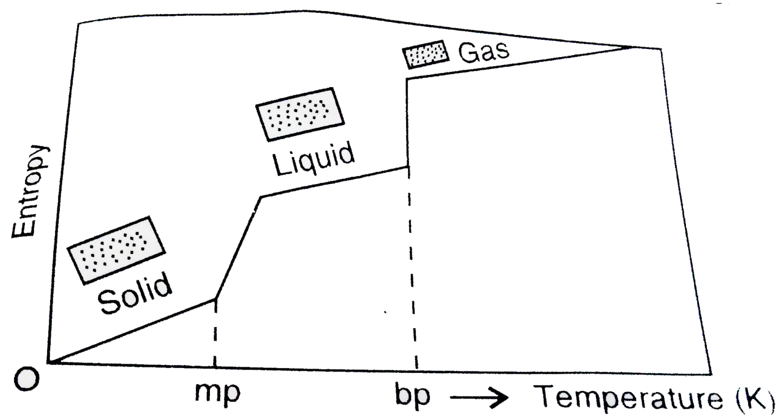

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Which has the highest entropy per mol of the substance ?

A. H_2 at $25^\circ C$ at 1 atm

B. H_2 at STP

C. H_2 at $100K$ at 1 atm

D. H_(2)at0 Kat1` atm

Answer: A

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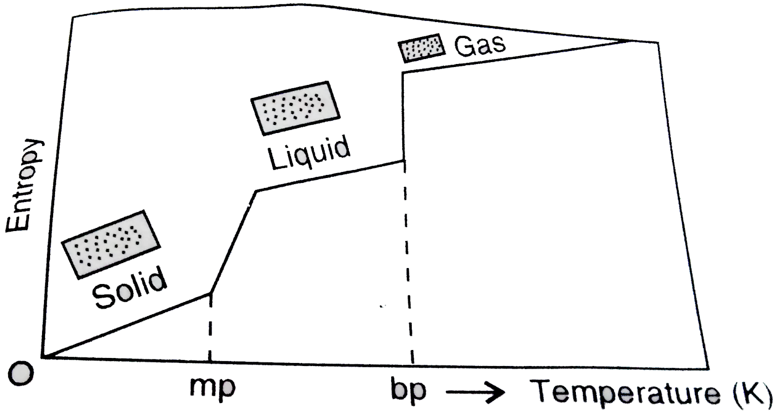

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Predict the sign of ΔS in the system for each of the following process

$(I)CO_2(s) \rightarrow CO_2(g)$

$(II)CaSO_4(s) \rightarrow CaO(s) + SO_3(g)$

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

$(IV)I_2(s) \rightarrow I_2(aq)$

A. $\begin{array}{cccc} I & II & III & IV \\ +ve & +ve & -ve & +ve \end{array}$

B. $\begin{array}{cccc} I & II & III & IV \\ +ve & -ve & -ve & +ve \end{array}$

C. $\begin{array}{cccc} I & II & III & IV \\ -ve & -ve & +ve & +ve \end{array}$

D. $\begin{array}{cccc} I & II & III & IV \\ +ve & -ve & -ve & -ve \end{array}$

Answer: A

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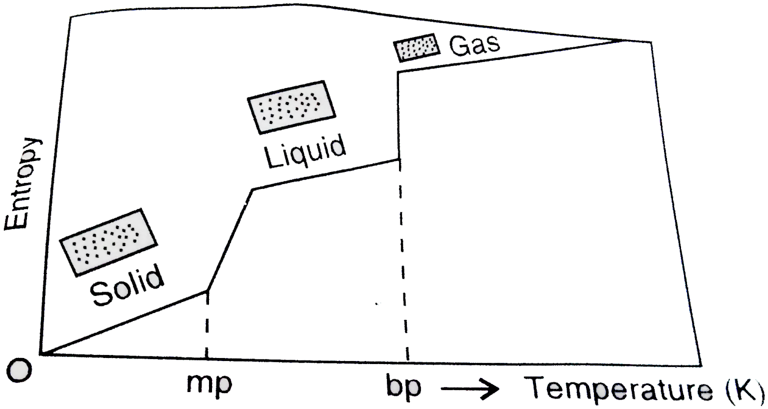

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Out of the following statements : I, II and $III. I$. A system may be a complex as a human body as simple as a mixture consiting of a drop of water.

$II.$ A large system is said to be microscopic when it consists of a large number of molecules, atoms or ions.

$III.$ Pressure, volume, temperature and surface area are some macroscopic properties.

Select correct statements

A. I, II, III

B. I, II

C. I, IV

D. II, III

Answer: A

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479. A gas expands against a constant external pressure so that the work done is $607.8J$. The work done in litre atmosphere is

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480. The number of state functions the following properties are

Temperature, Pressure, Volume, Heat capacity.

Density, pH of a solution, EMF of a cell.

Entropy, Free energy. Enthalpy, Surface tension, Viscosity, Boiling point.

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481. In a constant volume calorimeter, $3.5g$ of a gas with molecular weight 28 was burnt in excess oxygen at $298.0K$. The temperature of the calorimeter was found to increase from $298.0K \rightarrow 298.45K$ due to the combustion process. Given that the heat capacity of the calorimeter is $2.5kJK^{-1}$, find the numerical value for the enthalpy of combustion of the gas in $kJmol^{-1}$

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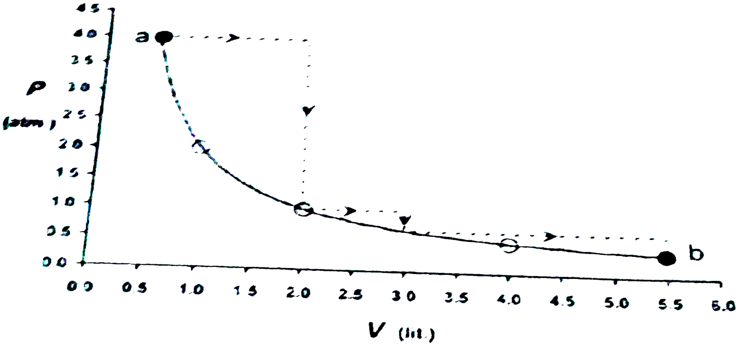
482. One mole of an ideal gas is taken from a to b along two paths denoted by the solid and the dashed lines as shown In the graph below. If the work done along the solid line path is W_s and that along the the dotted line path is w_d, then the integer closest to the ratio w_d / w_s is



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483. Assertion(A) : When sodium chloride dissolves in water, then Na^+ and Cl^- ions leaving the crystal lattice acquire far greater freedon.

Reason(R) : In thermodynamic terms, the formation of solution occurs with a favourable change in energy i.e., ΔH has a high positive value and $T\Delta S$ has a low negative value.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: C

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484. Assertion(A) : The mass and volume of a substance are the extensive properties and are proportional to each other.

Reason(R) : The ratio of mass of a sample to its volume is an intensive property

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: B

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485. Assertion (A): Enthalpy of graphite is lower than that of diamond.

Reason (R) : Entropy of graphite is lower than that of diamond.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: B

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486. Assertion(A) : For the combustion reactions, the value of ΔH is always negative.

Reason(R) : The combustion reactions are always endothermic.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: C

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487. Assertion(A) : The value of enthalpy of neutralization of a weak acid by strong base is numerically less than $57.1 kJ$.

Reason(R) : All OH^{-} ions of strong base are not completely neutralized by H^{+} ions obtained from acid.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: C

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488. Statement-1 : Many endothermic reactions that are not spontaneous at room temperature become spontaneous at high temperatures.

Statement-2: Energy of the system increases with increase in temperature.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: A

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489. Assertion(A) : Helium has lower entropy than CO_2 gas which has lower entropy than gaseous benzene.

Reason(R) : The larger the complexity of molecule, the larger is its absolute entropy.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: A

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490. Assertion: The enthalpy of formation of gaseous oxygen molecules at $298K$ and under1 atm is zero.

Reason: The entropy of formation of gaseous oxygen molecules under the same condition is zero.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

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491. Assertion(A) : Heat of vaporisation is always endothermic.

Reason(R) : Water is exithermic compound.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: B

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492. Assertion(A) : Endothermic compounds are stable than the exothermic componds.

Reason(R) : Endothermic compounds have positive enthalpy of formation.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: D

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493. Assertion(A) : q is a state function.

Reason(R) : q is a path function.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: D

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494. Assertion(A) : Heat of neutralisation is always less than zero.

Reason(R) : Neutralisation involves reactions between an acid and a base.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: B

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495. Assertion(A) : Absolute value of H cannot be determined.

Reason(R) : Absolute value of E cannot be determined.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: A

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496. Assertion(A) : Heat of neutralisation of HCl and $NaOH$ is same as that of H_2SO_4 with $NaOH$.

Reason(R) : HCl, H_2SO_4 and $NaOH$ are all strong electrolytes.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: A

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497. Assertion (A): The dissolution of gases in water is always an endothermic process.

Reason (R) : The dissolution of gases in water proceed with a negative value of ΔS.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: D

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498. Assertion(A) : The enthalpy of formation of O_2 at 1 atmospheric pressure and $298K$ is zero.

Reason(R) : The enthalpy of formation of all the elements at STP is zero.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: C

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499. Assertion(A) : Two systems which are both in thermal equilibrium with the third system are in thermal equilibrium with one another.

Reason(R) : The heat flows spontaneously from a system at high temperature to a system at low temperature.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: A

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500. Assertion(A) : The value of enthalpy of neutralisation of strong acid and weak base is numerically less than$57.1kJ$.

Reason(R) : All the H^{+} ions furnished by $1g$ equivalent of a strong acid are not completely neutralized by the OH^{-} ions from the weak base.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: A

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501. Assertion(A) : Standard entropy of O_2 gas is $> 0.$

Reason(R) : Entropy of free elements at the standard state conditions is equal to zero.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: C

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502. Assertion(A) : Decrease of free energy during the process under particular conditions provides a measure of its spontaneity.

Reason(R) : A spontaneous change must have +ve sign of ΔS_{total}.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: B

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503. Assertion:Absolute values of intenal energy of substances cannot be determined.

Reason:It is impossible to determine exact values of constituent energies of the substances.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: A

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504. Assertion: Mass and volume are extensive properties.

Reason: Mass/volume is also an extensive parameter.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: C

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505. Assertion: The heat absorbed during the isothermal expansion of an ideal gas against vacuum is zero.

Reason: The volume occupied by the molecules of an ideal gas is zero.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: C

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506. Assertion: The increase in internal energy (ΔE) for the vaporisation of 1 mole of water at 1 atm and $373K$ is zero.

Reason: For all isothermal processes $\Delta E = 0$.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: D

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507. Assertion: Molar entropy of vaporization of water is different from ethanol.

Reason: Water is more polar than ethanol.

A. Both $A$and R are true and R is the correct explantion of A

B. Both $A$and R are true and R is not a correct explantion of A

C. A is true but R is false

D. A is false but R is true

Answer: B

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