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CHEMISTRY

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CHEMICAL THERMODYNAMICS

Question

1. A system absorbs 1000 J of heat and does work equivalent to 350 J. Calculate the change in internal energy of the system.

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2. Calculate w and ΔU for the conversion of 1 mole of water at $100^{\circ}C$ to steam at 1 atm pressure. Heat of vaporisation of water at $100^{\circ}C$ is $40670 J mol^{-1}$.

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3. One mole of an ideal gas expands against a constant external pressure of 1 atm from a volume of 10 litres to 30 litres. Calculate the work done by the gas.

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4. Two moles of an ideal gas expand isothermally and reversibly from a volume of 1 litre to 10 litre at $27^\circ C$. What is the maximum work done?

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5. Find out the heat absorbed and work done when 5 L ofan ideal gas at 10 atm pressure expands to 20L isothermally (1) into vacuum (ii) against a constant external pressure of 1 atm (iii) to a final volume 20L reversibly.

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6. Heat of combustion of methane at constant volume and 298 K has been found to be $-885.0 kJ mol^{-1}$. Calculate the enthalpy of combustion under constant pressure. $(R = 8.314 J mol - K^{-1})$.

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7. Calculate the difference between heats of reaction at constant pressure and constant volume for the following reaction at $25^{\circ} C, 2C(6)H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(l)$.

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8. Calculate the enthalpy of formation of OH-ions at 25ºC from the following thermochemical data:

$H_2O(l) \rightarrow H^+(aq) + OH^-(aq), \Delta H^{\circ} = 57.3 kJ$

$H_2(g) + 1/2O_2(g) \rightarrow H_2O(l), \Delta H^{\circ} = -258.9 kJ$

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9. .0.50 g of benzoic acid was subjected to combustion in a calorimeter when the temperature of the calorimeter system was found to rise by $0.55^{\circ}C$. Calculate the enthalpy of combustion of benzoic acid (i) at constant volume (ii) at constant pressure. The thermal capacity of the calorimeter including water was found to be $23.85 kJK^{-1}$.

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10. The enthalpy of combustion of glucose, $C_6H_{12}O_6(s)$ is $-2816 kJmol^{-1}$ at $25^{\circ}C$. Calculate ΔH_f° for glucose. The ΔH_f° values for CO_2 (g) and H_2O(l) are -393.5 and -285.9 $kJmol^{-1}$, respectively.

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11. Calculate the standard enthalpy change for the reaction $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ Given that the standard enthalpies of formation of $CH_4(g), CO_2(g),$ and $H_2O(l)$ are -74.8 kJ mol^-1, -393.5 kJ mol^-1 $\text{and } -285.8 kJ$mol^-1` respectively.

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12. Calculate the enthalpy change for the transition, graphite $\Leftrightarrow$ diamond from the $\Delta H^{\circ}_{\text{comb}}$ values of $-393.5kJmol^{-1}$ and $-395.4kJmol^{-1}$ for graphite and diamond, respectively.

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13. Integral enthalpy of solution for one mole of KCl dissolved in 20 moles of water is +15.9kJ. When 1 mole is dissolved in 200 moles of water, ΔH is 18.6k). Calculate the enthalpy of dilution.

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14. Calculate the entropy change in the melting of 1kg of ice at $0^{\circ}C$. Heat of fusion of ice $= 334.72Jg^{-1}$.

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15. The following data is known about the melting of KCl, $\Delta H = 7.25 kJmol^{-1}$, and $\Delta S = 0.007 kJK^{-1}mol^{-1}$. Calculate its melting point.

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16. Calculate the free energy change on dissolving one mole of sodium chloride at $25^{\circ}C$. Lattice energy $= -777.8 kJmol^{-1}$ hydration energy $= -774 kJmol^{-1}$ of $NaCl$, ΔS at $25^{\circ}C = 0.043 kJmol^{-1}K^{-1}$.

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17. For the reaction $Ag_2O(s) \Leftrightarrow 2Ag(s) + 1/2O_2(g)$, calculate the temperature at which free energy change ΔG is equal to zero. ΔH for the reaction $= +30.56 kJ$ and $\Delta S = +0.066 kJK^{-1}$ at 1 atm pressure. Predict the nature of the reaction (i) below this temperature, (ii) above this temperature.

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18. For the reaction: $2A_2O(s) \to 4Ag(s) + O_2(g)$, $\Delta H = 61.17kJ$ and $\Delta S = 132JK^{-1}at298K$ and 1 atm. Show that the reaction is not spontaneous at the given temperature. Above what temperature will the reaction become spontancous?

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19. The equilibrium constant for the reaction $CO_2(g) + H_2(g) \Leftrightarrow CO(g) + H_2O(g)$ at 298 K is 73. Calculate the value of the standard free energy change. $\left(R = 8.314Jmol^{-1}K^{-1}\right)$.

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Level I

1. In .... process, work is done at the expense of internal energy.

A. isothermal

B. isochoric

C. adiabatic

D. isobaric

Answer: C

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2. In an adiabatic process, no transfer of heat takes place between system and surroundings. Choose the correct option for free expansion of an ideal gas under adiabatic condition from the following.

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

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

C. $q = 0, \Delta T = 0W = 0$

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

Answer: C

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3. Which of the following equations correctly represents the standard heat of formation $\left(\Delta H_f^\circ\right)$ of methane?

A. $C_{(\text{diamond})}+2H_2\rightarrow CH_{4(g)}$

B. $C_{(\text{graphite})}+2H_{2(g)}\rightarrow CH_4$

C. $C_{(\text{graphite})}+2H_{2(g)}\rightarrow CH_{4(g)}$

D. $C_{(\text{graphite})}+24h\rightarrow CH_{4(g)}$

Answer: C

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4. For an isolated system, $\Delta U=0$. What will be ΔS?

A. 0

B. >0

C. <0

D. ≥ 0

Answer: B

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5. If a gas has 2 atm and 5 atm pressure at $30^\circ C$ and $27^\circ C$ respectively. Then it will

A. cool on expansion

B. warm on expansion

C. no change on expansion

D. None of the above

Answer: B

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6. In which of the following conditions a chemical reaction cannot occur? : ΔH and ΔS increases and $T\Delta S > \Delta H$, ΔH and ΔS decrease and $T\Delta S > \Delta H$, ΔH increases and ΔS decreases, ΔH decreases and ΔS increases

A. ΔH and ΔS increases and $T\Delta S > \Delta H$

B. ΔH and ΔS decrease and $T\Delta H > T\Delta S$

C. ΔH increases and ΔS decreases

D. ΔH decreases and ΔS increases

Answer: C

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7. For the reaction of one mole zinc dust with one mole sulphuric acid in a bomb calorimeter, ΔU and w corresponds to:

A. $\Delta u < 0, w = 0$

B. $\Delta U < 0, w < 0$

C. $\Delta U > 0, w = 0$

D. $\Delta U > 0, w > 0$

Answer: A

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8. Calculate the work done when 1 mol of an ideal gas is compressed reversibly from 1 bar to 4 bar at a constant temperature of 300 K

A. $3.45kJ$

B. $-8.02kJ$

C. $18.02kJ$

D. $-14.01kJ$

Answer: B

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9. The enthalpy of neutralization of oxalic acid by a strong base is-25.4kcal mol^{-1}. The enthalpy of neutralization of strong acid and strong base is– 13.7 kcal eq^{-1}. The enthalpy of dissociation of oxalic acid is:

A. 1 kcal mol^{-1}

B. 2 kcal mol^{-1}

C. 18.55 kcal mol^{-1}

D. 11.7 kcal mol^{-1}

Answer: C

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10. What is the value of internal energy change $(\Delta U) at 27^\circ C$ of a gaseous reaction:$2A_{2(g)} + 5B_2(g) \rightarrow 2A_2B_5(g)$ (whose heat change at constant pressure is–50700J)? $\left(R = 8.314 JK^{-1} mol^{-1}\right)$

A. $-50700J$

B. $-63171J$

C. -38229

D. $+38229J$

Answer: B

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11. What would be the heat released when an aqueous solutions containing 0.5 mole of HNO_3 is mixed with 0.3 mole of OH^- (enthalpy of neutralization is -57.1 kJ)

A. $-28.5kJ$

B. $-17.1kJ$

C. $-45.7kJ$

D. $-1.7kJ$

Answer: B

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

A. $\Delta H = 0$

B. $\Delta H = \Delta U$

C. $\Delta H < \Delta U$

D. $\Delta H > \Delta U$

Answer: C

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13. Standard entropies of$X_2, Y,_2$ and XY_3 are 60,40 and 50 $JK^{-1}mol^{-1}$ respectively. For the reaction:

$$\frac{1}{2}X^2 + \frac{3}{2}Y_2 \rightarrow XY_3$$

$\Delta H = -30kJ$ to be at equilibrium, the temperature will be:

A. 1000 K

B. 1250 K

C. 500 K

D. 750 K

Answer: D

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14. 4.48 Lofan ideal gas at S.T.P requires 12 calories to raise its temperature by $15^\circ C$ at constant volume. The C_p of the gas is:

A. $3calmol^{-1}$

B. $4calmol^{-1}$

C. $7calmol^{-1}$

D. $6calmol^{-1}$

Answer: D

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15. The Haber's process for production of ammonia involves the equilibrium: $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ Assuming ΔH° and ΔS° for the reaction do not change with temperature, which of the statements is true? $\left(\Delta H^\circ = -95 kJ \text{ and } De < sS^\circ = -190 JK^{-1}\right)$

A. Ammonia dissociates spontaneously below 500 K.

B. Ammonia dissociates spontaneously above 500 K.

C. Ammonia dissociates at all temperatures.

D. Ammonia does not dissociate at any temperature.

Answer: A

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16. For a particular reaction, $\Delta H^\circ = -38.3 kJ$ and $\Delta S^\circ = -113. JK^{-1} mol^{-1}$. This reaction is:

A. spontaneous at all temperatures

B. non-spontaneous at all temperatures

C. spontaneous at temperatures below $66^\circ C$

D. spontaneous at temperatures above $66^\circ C$

Answer: D

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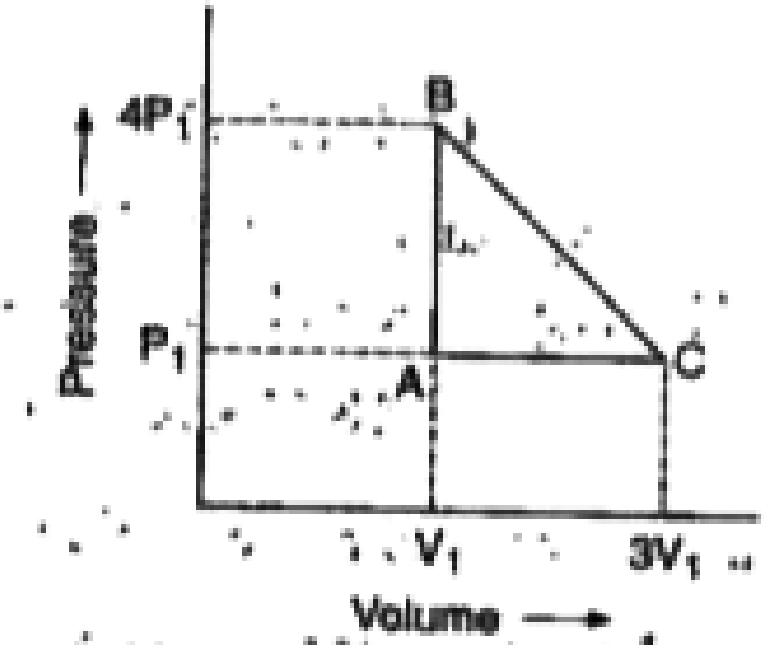
17. An ideal gas is taken around the cycle ABCA as: .



The work done in the cyclic process is :

A. $12P_1V_1$

B. $6P_1V_1$

C. $3P_1V_1$

D. P_1V_1

Answer: C

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18. Assuming that water vapour is an ideal gas, the internal energy (ΔU) when 1 mol of water is vapourized at 1 bar pressure and $100^{\circ} C$. (Molar enthalpy of vapourization of water at 1 bar and 373 K =41 kJ mol^{-1} and $R = 8.3 J mol^{-1} K^{-1}$) will be

A. $4.1 kJ mol^{-1}$

B. $3.7904 kJ mol^{-1}$

C. $37.904 kJ mol^{-1}$

D. $41.0 kJ mol^{-1}$

Answer: C

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19. A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 ml at a consiani temperature of $37.0^{\circ} C$. As it does so, it absorbs 208 J of heat. The value of qand'w for the process will be $\left(R = 8.31 Jmol^{-1}K\right)(\ln 7.5 = 2.01)$: $q = -208J, w = -208.\ J$, $q = -208J, w = +208J,$ $q = +208J, w = +208J,$ $q = +208J, w = -208J$

A. $q = -208J, w = -208.\ J$

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

C. $q = +208J, w = +208J$

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

Answer: D

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20. Which of the following statement is not correct?

A. Final temperature in reversible adiabatic expansion is greater than that in irreversible adiabatic expansion.

B. When heat is supplied to an ideal gas in isothermal process, kinetic energy of gas remains constant.

C. When an ideal gas is subjected to adiabatic expansion, it gets cooled.

D. Entropy increases when an ideal gas expands isothermally.

Answer: A

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21. What is the molar heat capacity of ethyl alcohol, C_2H_5OH, in units of J $mol^{-1} {}^{\circ}C^{-1}$ if its specific heat is $0.586 cal g^{-1} {}^{\circ}C^{-1}$?

A. $215 J mol^{-1} {}^{\circ}C^{-1}$

B. $135 J mol^{\circ}C^{-1}$

C. $113 J mol^{\circ}C^{-1}$

D. $256 J mol^{\circ}C^{-1}$

Answer: C

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22. If at 298 K the bond enèrgies of $C-H, C-C, C=C$ and $H-H$ are respectively 414, 347, 615, and 435 kJ mol^{-1} the value ofenthalpy change for the reaction,

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

A. $+250 kJ$

B. $-250 KJ$

C. $+125 kJ$

D. $-125 kJ$

Answer: D

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23. 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 change in entropy (ds), satisfy the criteria

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

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

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

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

Answer: B

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24. Oxygen gas weighing 64 g is expanded from 1 atm to 0.25 atm at $30^\circ C$. Calculate entropy change, assuming the gas to be ideal.

A. $23.\ 1JK^{-1}$

B. $25.0JK^{-1}$

C. $26.1JK^{-1}$

D. $22.4JK^{-1}$

Answer: A

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25. For the process $H_2O(l) \Leftrightarrow H_2O(g)$ at $T = 100^{\circ}C$ and 1 atmosphere pressure, the correct choice is

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

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

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

D. $\Delta S_{\text{system}} < 0 \text{ and } \Delta S_{\text{surroundings}} < 0$

Answer: B

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26. The enthalpy of a reaction at 273K is-3.57 kJ: What will be the enthalpy of reaction at 373 K if `Delta Cp= 0

A. -3.57

B. 0

C. $-3.57 \times \frac{373}{273}$

D. -375

Answer: A

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27. The gas absorbs 100 J heat and is simultaneously compressed by a constant external pressure of 1.50 atm from 8L to 2 L in volume-Hence, ΔU will be:

A. $-812.\ J$

B. 812 J

C. 1012J

D. 912 J

Answer: C

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28. The densities of graphite and diamond at298K are 2.25gcm and 3.31 gcm^{-3}, respectively. If the standard Gibbs energy difference (ΔG°) is equal to 1895 J$.mol^{-1}$, the pressure at which graphite will be transformed into diamond at 298K is.

A. $11.1 \times 10^{8} Pa$

B. $11.1 \times 10^{7} Pa$

C. $11.1 \times 10^{6} Pa$

D. $11.1 \times 10^{10} Pa$

Answer: A

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29. Consider 100 mL of a liquid contained in an isolated container at a pressure of 1 bar. The pressure is steeply increased to 100 bars. The volume of the liquid is decreased by 1 mL at this constant pressure. Find the value of AH. (given $\Delta U = 10J$)

A. $+680J$

B. $+990J$

C. $-680J$

D. $-990J$

Answer: B

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30. For the reaction, $2CO + O_2 \rightarrow 2CO_2, \Delta H = -560kJ$ Two moles of CO and one mole of O_2 are taken in a container of volume.1 L. They completely form two moles of CO_2 the gases deviated appreciably from ideal behaviour. If the pressure in the vessel changes from 70 to 40 atm, find the magnitude of `Delta U at 500 K.(1 L atm=0.1 kJ)

A. $-557kJ$

B. $+557kJ$

C. $-560kJ$

D. $+560kJ$

Answer: A

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31. Nitrogen dioxide, NO_2 an air pollutant, dissolves in rain-water to form a dilute solution of nitric acid. The equation for the reaction is:

$3NO_2(g) + H_2O(l) \rightarrow 2HNO_3(1) + NO(g)$

Calculate ΔS° for the reaction in JK^{-1}. The standard entropy of $HNO_3(l), NO(g), NO_2(g)$ and $H_2O(l)$ are 155.6,210.6,240.5 and 69.96 J $mol^{-1}K^{-1}$ respectively.

A. $155.\ 6JK^{-1}$

B. $-155.6JK^{-1}$

C. $269.\ 7JK^{-1}$

D. $-269.7JK^{-1}$

Answer: D

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32. The standard Gibbs energy change for a reaction is $\Delta G^{\circ} = -41.8kJmol^{-1}$ at 700 K and 1 atm. Calculate the equilibrium constant of the reaction at 700 K.

A. 1.314×10^{4}

B. 3.431×10^{4}

C. 3.431×10^{4}

D. 1.314×10^{3}

Answer: D

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33. The enthalpy change for a reaction does not depend upon

A. the physical states of reactants and products

B. use of different reactants for the same product

C. the nature of intermediate reaction steps

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

Answer: C

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

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

B. $+ve > 11, \ -ve$

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

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

Answer: A

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35. In a fuel cell, methanol is used as fuel and oxygen gas is used as an oxidizer. The reaction is $CH_3OH(l) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ At 298 K, standard Gibbs energies of formation for $CH_3OH(l)$, $H_2O(l)$ and $CO_2(g)$ are $-166.2, \ -237.2$ and $-394.4 kJmol^{-1}$ respectively. If standard enthalpy of combustion of methanol is $-726 kJmol^{-1}$ efficiency of the fuel cell will be:

A. $90\ \%$

B. $97\ \%$

C. 80%

D. 87%

Answer: B

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36. Calculate the equilibrium constant for the the reaction given below at 400K, if $\Delta H^{\circ} = 77.2 kJ mol^{-1}$ and $\Delta S^{\circ} = 122 JK^{-1} mol^{-1}$, $PCl_{s(s)} \rightarrow PCl_{3(g)}$

A. 1.958×10^{-3}

B. 1.958×10^{-4}

C. $1.\ 958 \times 10^{-2}$

D. $1.\ 958 \times 10^{2}$

Answer: B

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37. Which of the following equations corresponds to the definition of standard enthalpy of formation of methanol at 298 K?

A. $C_{(\text{graphite})} + 2H_{2(g)} + \frac{1}{2}O_{2(l)} \rightarrow CH_3OH_{(g)}$

B. $C_{(\text{diamond})} + 2H_{2(g)} + \frac{1}{2}O_{2(l)} \rightarrow CH_3OH_{(g)}$

C. $2C_{(\text{graphite})} + 4H_{2(g)} + O_{2(g)} \rightarrow 2CH_3OH_{(l)}$

D. $C_{(\text{graphite})} + 2H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow CH_3OH_{(l)}$

Answer: D

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38. Molar heat capacity of water in equilibrium with ice at constant pressure is

A. Zero

B. Infinity (∞)

C. $40.45kJK^{-1}mol^{-1}$

D. $75.48JK^{-1}mol^{-1}$

Answer: B

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39. Standard molar enthalpy of formation of CO_2 is equal to

A. Zero.

B. The standard molar enthalpy of combustion of gaseous carbon.

C. The sum of standard molar enthalpies of formation of CO_2 and O_2

D. The standard molar enthalpy of combustion of carbon (graphite).

Answer: D

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40. When an ideal diatomic gas is heated at constant pressure, the fraction of the heat supplied which increases the internal energy of the gas is

A. $2/5$

B. $3/5$

C. $3/7$

D. $5/7$

Answer: B

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41. The enthalpies of combustion of S, SO_2 and H_2 are $-298.2, -98.7$ and $-287.3. kJmol^{-1}$ respectively. If enthalpy of the reaction $SO_{x(g)}+H_2O_{(f)}\rightarrow H_2SO_{4(f)} is -130.2kJmol^{-1}$, the enthalpy of formation of H_2SO_4 is

A. $-814.4kJmol^{-1}$

B. $-650.3kJmol^{-1}$

C. $-554.\ 2kJmol^{-1}$

D. $-435.5kJmol^{-1}$

Answer: A

Watch Video Solution

42. Which of the following thermodynamic relation is correct?

A. $dG = VdP - SdT$

B. $dH = VdP - SdT$

C. $dH = \ -VdP + TdS$

D. $dG = VdP + SdT$

Answer: A

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43. Calculate average molar heat capacity at constant volume of gaseous mixture contained 2 mole of each of two ideal gases $\left(C_{v\,,m}=\frac{3}{2}R\right)$ and $B\left(C_{v\,,m}=\frac{5}{2}R\right)$,

A. R

B. 2R

C. 3R

D. 8R

Answer: B

Watch Video Solution

44. What is the melting point of benzene if $\Delta H_{\text{fusion}}=9.95k\frac{J}{m}ol$ and $\Delta S_{\text{fusion}}=35.7JK^{-1}{'}mol^{-1}$?

A. $278.7^{\circ}C$

B. $278.7K$

C. $300K$

D. $298K$

Answer: B

Watch Video Solution

45. Combustion of sucrose is used by aerobic organisms for providing energy for the life sustaining processes. If all the capturing of energy from the reaction is done through electrical process (non P-V work) then calculate maximum available energy which can be captured by combustion of 34.2 gm of sucrose

Given: $\Delta H_{\text{combustion}}$ (sucrose) $= -6000kJmol^{-1}$ $\Delta S_{\text{combustion}} = 180J/K.mol$ and body temperature is 300 K

A. $600kJ$

B. $594.6kJ$

C. $5.4kJ$

D. $605.4kJ$

Answer: D

Watch Video Solution

46. The molar heat capacities of Iodine vapour and solid are 7.8 and 14 cal/mol respectivelyifenthalpy of sublimation of iodine is 6096 cal/mole at $200^\circ C$, then what is ΔU (internal energy change) at$250^\circ C$ in cal/mol

A. 5360

B. 4740

C. 6406

D. 5880

Answer: B

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47. In .... process, work is done at the expense of internal energy.

A. isothermal

B. isochoric

C. adiabatic

D. isobaric

Answer:

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48. In an adiabatic process, no transfer of heat takes place between system and surroundings. Choose the correct option for free expansion of an ideal gas under adiabatic condition from the following.

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

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

C. $q = 0, \Delta T = 0, W = 0$

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

Answer:

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49. Which of the following equations correctly represents the standard heat of formation $\left(\Delta H_f^\circ\right)$ of methane?

A. $C_{(\text{diamond})} + 2H_2 \rightarrow CH_{4(g)}$

B. $C_{(\text{graphite})} + 2H_{2(g)} \rightarrow CH_{4(l)}$

C. $C_{(\text{graphite})} + 2H_{2(g)} \rightarrow CH_{4(g)}$

D. $C_{(\text{graphite})} + 4H \rightarrow CH_{4(g)}$

Answer:

Watch Video Solution

50. For an isolated system, $\Delta U = 0$. What will be ΔS?

A. 0

B. > 0

C. < 0

D. ≥ 0

Answer:

Watch Video Solution

51. If a gas has 2 atm and 5 atm pressure at $30^{\circ} C$ and $27^{\circ} C$ respectively. Then it will

A. cool on expansion

B. warm on expansion

C. no change on expansion

D. None of the above

Answer:

Watch Video Solution

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52. In which of the following conditions a chemical reaction cannot occur?

: ΔH and ΔS increases and $T\Delta S > \Delta H$, ΔH and ΔS decrease and $T\Delta S > \Delta H, \Delta H$ increases and ΔS decreases, ΔH decreases and ΔS increases

A. ΔHand ΔS increases and ΔAS $>$ ΔH

B. ΔH and ΔS decrease and ΔH $>$ TΔ

C. ΔH increases and ΔS decreases

D. ΔH decreases and ΔS

Answer:

Watch Video Solution

53. For the reaction of one mole zinc dust with one mole sulphuric acid in a bomb calorimeter, ΔU and w corresponds to:

A. $\Delta U > 0, w = 0$

B. $\Delta U < 0, w < 0$

C. $\Delta U > 0, w = 0$

D. $\Delta U > 0, w > 0$

Answer:

Watch Video Solution

54. Calculate the work done when 1 mol of an ideal gas is compressed reversibly from 1 bar to 4 bar at a constant temperature of 300 K

A. $3.\ 45kJ$

B. $-8.\ 02kJ$

C. $18.\ 02kJ$

D. $-14.01 kJ$

Answer:

Watch Video Solution

55. The enthalpy of neutralization of oxalic acid by a strong base is-25.4kcal mol^{-1}. The enthalpy of neutralization of strong acid and strong base is–13.7 kcal eq^{-1}. The enthalpy of dissociation of oxalic acid is:

A. $1kcalmol^{-1}$

B. $2kcalmol^{-1}$

C. $18.55kcalmol^{-1}$

D. $11.7kcalmol^{-1}$

Answer:

Watch Video Solution

56. What is the value of internal energy change $(\Delta U)at27^{\circ}C$ of a gaseous reaction:$2A_{2(g)}+5B_2(g)\rightarrow 2A_2B_5(g)$ (whose heat change at constant pressure is–50700J)? $\left(R=8.314JK^{-1}mol^{-1}\right)$

A. $-50700J$

B. $-63171J$

C. $-38229J$

D. $+38229J$

Answer:

Watch Video Solution

57. What would be the heat released when an aqueous solutions containing 0.5 mole of HNO_3 is mixed with 0.3 mole of OH^- (enthalpy of neutralization is -57.1 kJ)

A. $-28.5kJ$

B. $-17.1kJ$

C. $-45.7kJ$

D. $-1.7kJ$

Answer:

Watch Video Solution

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

A. $\Delta H = 0$

B. $\Delta H = \Delta U$

C. $\Delta H < \Delta U$

D. $\Delta H > \Delta U$

Answer:

Watch Video Solution

59. Standard entropies of $X_2, Y_{,2}$ and XY_3 are 60,40 and 50 $JK^{-1}mol^{-1}$ respectively. For the reaction:

$$\frac{1}{2}X^2 + \frac{3}{2}Y_2 \rightarrow XY_3$$

$\Delta H = -30kJ$ to be at equilibrium, the temperature will be:

A. 1000 K

B. 1250 K

C. 500 K

D. 750 K

Answer:

Watch Video Solution

60. 4.48 Lofan ideal gas at S.T.P requires 12 calories to raise its temperature by $15^\circ C$ at constant volume. The C_p of the gas is:

A. $3calmol^{-1}$

B. $4calmol^{-1}$

C. $7calmol^{-1}$

D. $6calmol^{-1}$

Answer:

Watch Video Solution

61. The Haber's process for production of ammonia involves the equilibrium: $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ Assuming ΔH° and ΔS° for the reaction do not change with temperature, which of the statements is true? $\left(\Delta H^\circ = -95kJ \text{ and } De < sS^\circ = -190JK^{-1}\right)$

A. Ammonia dissociates spontaneously below 500 K.

B. Ammonia dissociates spontaneously above 500K.

C. Ammonia dissociates at all temperatures.

D. Ammonia does not dissociate at any temperature.

Answer:

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62. For a particular reaction, $\Delta H^{\circ} = -38.3 kJ$ and $\Delta S^{\circ} = -113. JK^{-1} mol^{-1}$. This reaction is:

A. spontaneous at all temperatures

B. non-spontaneous at all temperatures

C. spontaneous at-temperatures below $66^{\circ} C$

D. spontaneous at temperatures above $66^{\circ} C$

Answer:

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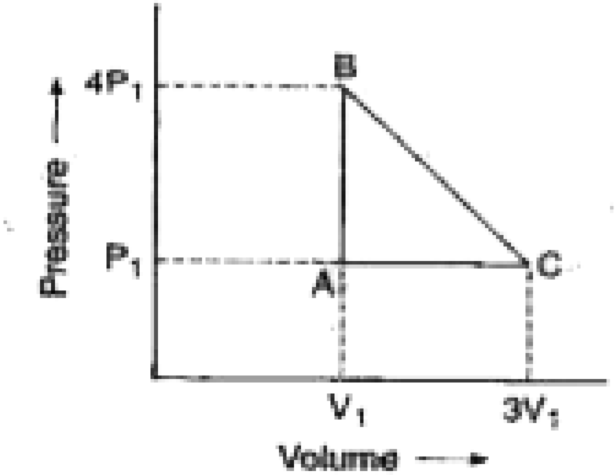
63. An ideal gas is taken around the cycle ABCA as:



The work done in the cyclic process is :

A. $12P_1V_1$

B. $6P_1V_1$

C. $3P_1V_1$

D. P_1V_1

Answer:

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64. Assuming that water vapour is an ideal gas, the internal energy (ΔU) when 1 mol of water is vapourized at 1 bar pressure and $100^{\circ} C$. (Molar enthalpy of vapourization of water at 1 bar and 373 K =41 kJ mol^{-1} and $R = 8.3 J mol^{-1} K^{-1}$) will be

A. $4.1 kJ mol^{-1}$

B. $3.7904 kJ mol^{-1}$

C. $37.904 kJ mol^{-1}$

D. $41.0 kJ mol^{-1}$

Answer:

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65. A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of $37.0^{\circ} C$. As it does so, it absorbs 208 J of heat. The values of q and w for the process will be: (R=8.314 J/mol K) (In 7.5=2.01)

A. $q = -208J, w = 0208J$

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

C. $q = +208J, w = +208J$

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

Answer:

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66. 'Which of the following statement is not correct?

A. Final temperature in reversible adiabatic expansion is greater than that in irreversible adiabatic expansio

B. When heat is supplied to an ideal gas in isothermal process, kinetic energy of gas remains constant.

C. When an ideal gas is subjected to adiabatic expansion, it gets cooled.

D. Entropy increases when an ideal gas expands isothermally.

Answer:

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67. What is the molar heat capacity of ethyl alcohol, C_2H_5OH, in units of J $mol^{-1} {}^\circ C^{-1}$ if its specific heat is $0.586 cal g^{-1} {}^\circ C^{-1}$?

A. $215 J mol^{-1} {}^\circ C^{-1}$

B. $135 J mol^{-1} {}^\circ C^{-1}$

C. $113 J mol^{-1} {}^\circ C^{-1}$

D. $256 J mol^{-1} {}^\circ C^{-1}$

Answer:

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68. If at 298 K the bond enèrgies of $C-H, C-C, C=C$ and $H-H$ are respectively 414, 347, 615, and 435 kJ mol^{-1} the value ofenthalpy change for the reaction,

$H_2C=CH_2(g)+H_2(g)\rightarrow H_3C-CH_3(g)at298K$ will be,

A. $+250kJ$

B. $-250kJ$

C. $+125kJ$

D. $-125kJ$

Answer:

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69. 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 change in entropy (ds), satisfy the criteria

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

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

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

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

Answer:

Watch Video Solution

70. Oxygen gas weighing 64 g is expanded from 1 atm to 0.25 atm at $30^{\circ}C$. Calculate entropy change, assuming the gas to be ideal.

A. $23.1JK^{-1}$

B. $25.0JK^{-1}$

C. $26.1JK^{-1}$

D. $22.4JK^{-1}$

Answer:

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71. For the process $H_2O(l) \Leftrightarrow H_2O(g)$ at $T = 100^\circ C$ and 1 atmosphere pressure, the correct choice is

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

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

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

D. $\Delta S_{\text{system}} < 0 \text{ and } \Delta S_{\text{surroundings}} < 0$

Answer:

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72. The enthalpy of a reaction at 273 K is-4.58 kJ. What will be the enthalpy of reaction at 373 K if $\Delta C_p = \ 0$

A. $-4.\ 58$

B. 0

C. $-3.57 \times \frac{373}{273}$

D. -458

Answer:

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73. The gas absorbs 150 J heat and is simultaneously compressed by a constant external pressure of 1.50 at from 8L to 2 L in volume. Hence, ΔU will be:

A. $-812J$

B. $1062J$

C. $1012J$

D. $912J$

Answer:

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74. The densities of graphite and diamond at298K are 2.25gcm and 3.31 gcm^{-3}, respectively. If the standard Gibbs energy difference (ΔG°) is equal to 1895 J.mol^{-1}, the pressure at which graphite will be transformed into diamond at 298K is.

A. $11.1 \times 10^{8} Pa$

B. $11.1 \times 10^{7} Pa$

C. $11.1 \times 10^{6} Pa$

D. $11.1 \times 10^{10} Pa$

Answer:

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75. Consider 100 mL of a liquid contained in an isolated container at a pressure of 1 bar. The pressure is steeply increased to 100 bars. The volume of the liquid is decreased by 1 mL at this constant pressure. Find the value of AH. (given $\Delta U = 10 J$)

A. $+680J$

B. $+990J$

C. $-680J$

D. $-990J$

Answer:

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76. Consider the given reaction $2CO + O_2 \rightarrow 2CO_2, \Delta H = -560kJ$ Two moles of CO and one mole of O_2 are taken in a container of volume 1 L. They completely form two moles of CO_2, the gases deviated appreciably from ideal behaviour. If the pressure in the vessel changes from 70 to 40 atm, find the magnitude of $\Delta U at 500K$. $(1 L atm = 0.1kJ)$

A. $-557kJ$

B. $+557kJ$

C. $-560kJ$

D. $+560kJ$

Answer:

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77. Nitrogen dioxide, NO_2 an air pollutant, dissolves in rain-water to form a dilute solution of nitric acid. The equation for the reaction is: $3NO_2(g) + H_2O(l) \rightarrow 2HNO_3(1) + NO(g)$

Calculate ΔS° for the reaction in JK^{-1}. The standard entropy of $HNO_3(l), NO(g), NO_2(g)$ and $H_2O(l)$ are 155.6,210.6,240.5 and 69.96 J $mol^{-1}K^{-1}$ respectively.

A. $155.6jK^{-1}$

B. $-155.\ 6JK^{-1}$

C. $269.\ 7JK^{-1}$

D. $-269.7JK^{-1}$

Answer:

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78. The standard Gibbs energy change for a reaction is $\Delta G^{\circ} = -41.8kJmol^{-1}$ at 700 K and 1 atm. Calculate the equilibrium constant of the reaction at 700 K.

A. 1.314×10^4

B. 3.431×10^4

C. 3.431×10^3

D. 1.314×10^3

Answer:

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79. The enthalpy change for a reaction does not depend upon

A. the physical states of reactants and products

B. use of different reactants for the same product

C. the nature of intermediate reaction steps

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

Answer:

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80. For a spontaneous reaction, the 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:

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81. In a fuel cell, methanol is used as fuel and oxygen gas is used as an oxidizer. The reaction is $CH_3OH(l) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ At 298 K, standard Gibbs energies of formation for $CH_3OH(l), H_2O(l)$ and $CO_2(g)$ are $-166.2, \ -237.2$ and $-394.4 kJ mol^{-1}$ respectively. If standard enthalpy of combustion of methanol is $-726 kJ mol^{-1}$ efficiency of the fuel cell will be:

A. 90%

B. 97%

C. 80%

D. 87%

Answer:

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82. Calculate the equilibrium constant for the the reaction given below at 400K, if

$\Delta H^\circ = 77.2 kJ mol^{-1}$ and $\Delta S^\circ = 122 JK^{-1} mol^{-1}, PCl_{s(s)} \rightarrow PCl_{3(g)}$

A. 1.958×10^{-3}

B. 1.958×10^{-4}

C. 1.958×10^{-2}

D. 1.958×10^{2}

Answer:

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83. Which of the following equations corresponds to the definition of standard enthalpy of formation of methanol at 298 K?

A. $C_{(\text{graphite})} + 4H_{2(g)} + O_{2(g)} \rightarrow CH_3OH_{(g)}$

B. $C_{(\text{diamond})} + 2H_{2(g)} + 1/2O_{2(g)} \rightarrow CH_3OH_{(l)}$

C. $C_{(\text{graphite})} + 4H_{2(g)} + O_{2(g)} + O_{2(g)} \rightarrow 2CH_3OH_{(l)}$

D. $C_{(\text{graphite})} + 2H_{2(g)} + 1/2O_{2(g)} \rightarrow CH_3OH_{(l)}$

Answer:

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84. Molar heat capacity of water in equilibrium with ice at constant pressure is

A. Zero

B. Infinity (∞)

C. $40.45kJK^{-1}mol^{-1}$

D. $75.48JK^{-1}mol^{-1}$

Answer:

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85. Standard molar enthalpy of formation of CO_2 is equal to

A. Zero

B. The standard molar enthalpy of combustion of gaseous carbon.

C. The sum of standard molar enthalpies of formation of CO and O_2

D. The standard molar enthalpy of combustion of carbon (graphite)

Answer:

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86. When an ideal diatomic gas is heated at constant pressure, the fraction of the heat supplied which increases the internal energy of the gas is

A. $2/5$

B. $3/5$

C. $3/7$

D. $5/7$

Answer:

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87. The enthalpies of combustion of S, SO_2 and H_2 are $-298.2, -98.7$ and $-287.3. kJmol^{-1}$ respectively. If enthalpy of the reaction $SO_{x(g)} + H_2O_{(f)} \rightarrow H_2SO_{4(f)} is - 130.2kJmol^{-1}$, the enthalpy of formation of H_2SO_4 is

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B. $-650.4kJmol^{-1}$

C. $-554.2kJmol^{-1}$

D. $-435.\ 5kJmol^{-1}$

Answer:

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88. Which of the following thermodynamic relation is correct?

A. $dG = VdP - SdT$

B. $dU = PdV + TdS$

C. $dH = -VdP + TdS$

D. $dG = VdP + SdT$

Answer:

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89. Calculate average molar heat capacity at constant volume of gaseous mixture contained 2 mole of each of two ideal gases $\left(C_{v,m} = \frac{3}{2}R\right)$ and $B\left(C_{v,m} = \frac{5}{2}R\right)$,

A. R

B. 2R

C. 3R

D. 8R

Answer:

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90. What is the melting point of benzene if $\Delta H_{\text{fusion}} = 9.95k\frac{J}{m}ol$ and $\Delta S_{\text{fusion}} = 35.7JK^{-1}{}'mol^{-1}$?

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C. 300 K

D. 298 K

Answer:

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Given: $\Delta H_{\text{combustion}}$ (sucrose) $= -6000 kJmol^{-1}$ $\Delta S_{\text{combustion}} = 180 J / K. mol$ and body temperature is 300 K

A. $600 kJ$

B. $594.6 kJ$

C. $5.4 kJ$

D. $605.4 kJ$

Answer:

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92. The molar heat capacities of Iodine vapour and solid are 7.8 and 14 cal/mol respectivelyifenthalpy of sublimation of iodine is 6096 cal/mole at $200^\circ C,$ then what is ΔU (internal energy change) at$250^\circ C$ in cal/mol

A. 5360

B. 4740

C. 6406

D. 5880

Answer:

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Level Ii

1. Which of the following statements is correct?

A. The presence of reacting species in a covered beåkėr is an example of open system

B. There is an exchange of energy as well as matter between the system and the surroundings in a closed system

C. The presence of réactants in a closed vessel made up of copper'isáŋ example of a closed system

D. The presence of reactants in a thermoflask or any other closed insulated vessel is an example of a closed system

Answer: C

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2. How many joules of heat are absorbed when 70.0 g of water is completely vaporised at its boiling point? (L_v=2260 kJ/kg)

A. $23.4kJ$

B. $7.0kJ$

C. $15.81kJ$

D. $158.2kJ$

Answer: D

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3. An ideal gas is allowed to expand against a constant pressure of 2 bar from 10 L to 50 L in one step. The amount of work done by the gas is x. If the same expansion were carried out reversibly, will the work done be higher or lower than the earlier case?

A. Lower

B. Higher

C. Same as before

D. Can't anything

Answer: B

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4. The enthalpy of reaction for the reaction: $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)} is\Delta, H^{-} = -572kJmol^{-1}$ What will be the standard enthalpy for the formation of $H_2O_{(l)}$?

A. $-572kJmol^{-1}$

B. $+57kJmol^{-1}$

C. $+286kJmol^{-1}$

D. $-286kJmol^{-1}$

Answer: D

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5. In a calorimeter, the temperature increases by 6.12 K, the heat capacity of the system is $1.23 kJg^{-1}K^{-1}$. What is the molar heat of decomposition for NH_4NO_3?

A. $-7.53 kJ/mol$

B. $-398.1 kJ/mol$

C. $-16.1 kJ/mol$

D. $-602 kJ/mol$

Answer: D

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6. Equal volumes of monoatomic and diatomic gases at same initial temperature and pressure are mixed. The ratio of specific heats of the mixture (C_p/C_v) will be

A. 1

B. 2

C. 1.67

D. 1.5

Answer: D

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7. The heat liberated from the combustion of 0.5 g of carbon raised the temperature of 2000 g of water from $24^{\circ} C$ to $26^{\circ} C$. The heat of the combustion of carbon is

A. $-4kcal$

B. $-8kcal$

C. $-62kcal$

D. $-96kcal$

Answer: D

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8. The enthalpy change for the reaction,

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ Is -92.38 kJ at 298 K.

What is ΔU at 298 K?

A. $-92.38kJ$

B. $-87.42kJ$

C. $-97.34kJ$

D. $-89.9kJ$

Answer: B

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9. The specific heats of l_2 in vapour and solid states are 0.031 and 0.055 cal/g respectively. The heat of sublimation of iodine at 200°C is $6.096kcalmol^{-1}$. The heat of sublimation of iodine at $250^\circ C$ will be:

A. $3.8 kcal mol^{-1}$

B. $4.8 kcal mol^{-1}$

C. $2.28 kcal mol^{-1}$

D. $5.8 kcal mol^{-1}$

Answer: D

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10. Temperature of I mole of a gas is increased by 1° at constant pressure. Work done is

A. 2 cal

B. 3 cal

C. 4 cal

D. 5 cal

Answer: A

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11. The bond dissociation energies for Cl_2, $I_2$and ICI are 242.3, 151 and 211.3 kJ/mol respectively. The enthalpy of sublimation of iodine is 62.8 kJ/mol. What is the standard enthalpy of formation of ICI (g)?

A. $-211.3kJ/mol$

B. $-14.6kJ/mol$

C. $16.8kJ/mol$

D. $33.5kJ/mol$

Answer: C

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12. Standard entropies of$X_2, Y_{,2}$ and XY_3 are 60,40 and 50 $JK^{-1}mol^{-1}$ respectively. For the reaction:

$$\frac{1}{2}X^2 + \frac{3}{2}Y_2 \rightarrow XY_3$$

$\Delta H = -30kJ$ to be at equilibrium, the temperature will be:

A. 750 K

B. 1000 K

C. 1250 K

D. 500 K

Answer: A

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13. The heat liberated when 1.89 g of benzoic acid is burnt in a bomb calorimeter at 25ºC increases the temperature of 18.94 kg of water by 0.632ºC. If the specific heat of water at $25^\circ C$ is 0.998 calg^(-1)deg^(-1),` the value of heat of combustion of benzoic acid is:

A. $88.1kcal$

B. $783.606kcal$

C. $981.1kcal$

D. $871.2kcal$

Answer: B

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14. Assuming $\triangle H^0$ and S^o do not change with temperature. Calculate, the boiling point of liquid A using the thermodynamic data given below:

Thermodynamic

$$\begin{vmatrix} A(l) \\ -130 \\ 100 \end{vmatrix}\begin{vmatrix} A(g) \\ -100 \\ 200 \end{vmatrix}$$

A. 300 K

B. 130 K

C. 150 K

D. 50 K

Answer: A

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15. The amount of heat released, when 20 mL of 0.5 M NaOH is mixed with 100 mL of 0.1 M HCl, is x kJ.The heat of neutralization (in kJ mol^{-1}) is:

A. $-100x$

B. -50%

C. $+100x$

D. $+50x$

Answer: A

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16. On the basis of following thermochemical data : $\left[\Delta_f G^\circ H^+(aq) = 0\right]$

$H_2O_{(l)} \rightarrow H^+_{(aq)} + OH^-_{(aq)}, \Delta H = 57.32kJ, H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(l}$

The value of enthalpy of formation of OH-ion at$25^\circ C$is:

A. $-22.88kJ$

B. $-228.88kJ$

C. $+228.88kJ$

D. $-343.52kJ$

Answer: B

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17. The standard enthalpy of formation of NH_3 is $-46kJmol^{-1}$. 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. $-1056kJmol^{-1}$

B. $-1102kJmol^{-1}$

C. $-964kJmol^{-1}$

D. $+352kJmol^{-1}$

Answer: D

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18. $Fe_2O_{3(s)} + \frac{3}{2}C \rightarrow \frac{3}{2}CO_{2(g)} + 2Fe_{(s)}, \Delta H^\circ = +234.1kJ$

$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}, \Delta H^\circ = -393.5kJ$

Use these equations and AH° values to calculate ΔH° for this reaction:

$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$

A. $-1648.7kJ$

B. $-1255.3kJ$

C. $-1021.2kJ$

D. $-129.4kJ$

Answer: A

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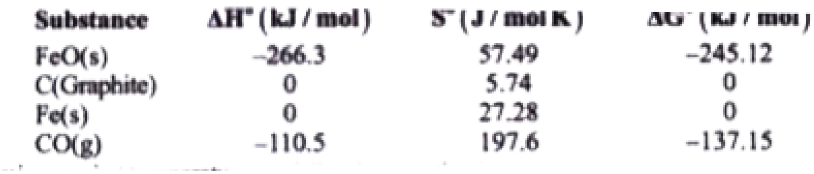
19. Given the following data:



Substance	ΔH° (kJ / mol)	S° (J / mol K)	ΔG° (kJ / mol)
FeO(s)	–266.3	57.49	–245.12
C(Graphite)	0	5.74	0
Fe(s)	0	27.28	0
CO(g)	–110.5	197.6	–137.15

Determine at what temperature the following reaction is spontaneous?

$FeO(s) + C$ (Graphite) $\rightarrow Fe(s) + CO(g)$

A. 298 K

B. 668 K

C. 966 K

D. $\Delta G^\circ is + ve$ hence the reaction will never be spontaneous

Answer: C

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20. Calculate the increase in internal energy of 1 kg of water at $100^\circ C$ when it is converted into steam at the same temperature and at 1 atm

(100 kPa). The density of water and steam are $1000 kgm^{-3}$ and $0.6 kgm^{-3}$ respectively. The latent heat of vapourisation of water $2.25 \times 10^6 Jkg^{-1}$

A. $2.99 \times 10^6 J$

B. $3.24 \times 10^6 J$

C. $3.02 \times 10^6 J$

D. $2.08 \times 10^6 J$

Answer: D

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21. Oxidizing power of chlorine in aqueous solution can be determined by the parameters indicated below:

$\frac{1}{2}Cl_2(g) \xrightarrow{\frac{1}{2}\Delta_{diss}H^\circ} Cl(g) \xrightarrow{\Delta_a H^\circ} Cl^-(g) \xrightarrow{\Delta_{lm}H^\circ} Cl^-(aq)$ The energy involved in the conversion of $\frac{1}{2}Cl_2(g)$ to $Cl^-(g)$ (using the data, $\Delta_{diss}H^\circ)(Cl_2) = 2400 kJmol^{-1} \Delta_{eg}H^\circ(Cl) = -349 kJmol^{-1}, \Delta_{iyd}H^\circ($

A. $+152kJmol^{-1}$

B. $-610kJmol^{-1}$

C. $850kJmol^{-1}$

D. $+120kJmol^{-1}$

Answer: B

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22. A steam boiler made up of steel weighs 900 kg. The boiler contains 400 kg of water. Assuming 70% of the heat is delivered to boiler and water, how much heat is required to raise the temperature of the whole from $10^{\circ}C \rightarrow 100^{\circ}C$? Heat capacity of steel is 0.11 kcal $kg^{-1}K^{-1}$ and heat capacity of water is 1 kcal $kg^{-1}K^{-1}$

A. 65321 kcal

B. 64157 kcal

C. 6869 kcal

D. 66549 kcal

Answer: B

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23. If for the reaction at $300K, 2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}, \Delta_r H = -1202 kJ mol^{-1}, \Delta, S =$

The total entropychange $(\Delta S)_r$ and Gibbs energy change during the course of reaction$(\Delta. G)$ are respectivelv:

A. $3.79 \times 10^3 J, \ -1136.\ 9kJ$

B. $3.79 \times 10^3 J, \ +1000J$

C. $+1000J, 379 \times 10^3 J$

D. $-1136.9kJ, 3.79 \times 10^3 J$

Answer: A

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24. The lattice energy of NaCl is +788 kJ mol^{-1}. The enthalpies of hydration of Na^{+}(g) and Cl^{-} (g) ions are $-406kJmol^{-1}$ and $-378kJmol^{-1}$ respectively. The enthalpy of solution of NaCl(s) in water is

A. $786kJmol^{-1}$

B. $4kJmol^{-1}$

C. $-4kJmol^{-1}$

D. $-792kJmol^{-1}$

Answer: C

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25. Using the data given below, pick the correct statement about the reaction:

$TiO_2(s)+2Cl_2g)\rightarrow TiCl_4(l)+O_2(g)$ [Given that Δ_fH° for $TiO_2(s), TiCl_4(l), Cl_2(g)$ and $O_2(g)$ are

$-944.7, -804.22, 0.0, 0.0 kJ mol^{-1}$ respectively. Also ΔS° for $TiO_2(s), TICl_4(l), Cl_2(g)$ and $O_2(g)$ are $50.3, 252.3, 233.0, 205.1 J mol^{-1} K^{-1}$, respectively.]

A. The reaction is exothermic at standard conditions.

B. The standard entropy is favourable for the reaction in forward direction.

C. The reaction is not spontaneous at standard condition at $25^{\circ} C$.

D. Reaction becomes spontaneous at higher temperature.

Answer: C

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26. 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 statements is correct?

A. $(T_f)_{rev} = (T_f)_{\text{irrev}}$

B. $T_f = T_i$ for both reversible and irrevarsible processes.

C. $(T_f)_{\text{irrev}} > (T_f)_{rev}$

D. $T_f > T_i$ for a reversible process but $T_f = T_i$ for an irreversible process.

Answer: B

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27. $H_{2(g)} + \frac{1}{2}O_2 \rightarrow H_2O_{(l)}, \Delta H_{298K} = -68.32kcal$. Enthalpy of vapourization of water at 1 atm and $25^\circ C$ is $10.52kcal$. The standard enthalpy of formation (in kcal) of water vapour at $25^\circ C$ is

A. 10.52

B. -78.84

C. $+57.80$

D. -57.80

Answer: D

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28. Given that,$NH_{3(g)} + 3Cl_{2(g)} \Leftrightarrow NCl_{3(g)} + 3HCl_{(g)}, \ -\Delta H_1$

$N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}, \Delta H_2$

$H_{2(g)} + Cl_{2(g)} \Leftrightarrow 2HCl_{(g)}, \Delta H_3$

The enthalpy of formation fo $NCl_{3(g)}$ in terms of $\Delta H_1, \Delta H_2$ and ΔH_3 is

A. $\Delta_f H = -\Delta H_1 - \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$

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

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

D. $\Delta_f H = -\Delta H_1 + \frac{\Delta H_2}{2} + \frac{3}{2}\Delta H_3$

Answer: A

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29. One mole of an ideal gas at 300 K is heated at constant volume (V_1) until its temperature is doubled, then it is expanded isothermally till it reaches the original pressure. Finally, the gas is cooled at the constant pressure till system reached to the half of original volume (V_2). Determine the total work done$(V_f/2)$ in calories: [Use in $2-0.70, K=2calK^{-1}mol^{-1}$]

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30. 1 mol of an ideal gas undergoes reversible isothermal expansion from an initial volume V, to a final volume, $10V_1$ and does 10 kJ of work. The initial pressure was $1\times10^7Pa.\ a$) Calculate V_1, b) if there were 2 mol of gas, what must have been its temperature?

A. $2.21\times10^{-4}, 120.\ 13K$

B. $4.34\times10^{-4}, 261.13K$

C. $1.01\times10^{-4}, 60.06K$

D. $3.21\times10^{-4}, 161.13K$

Answer: B

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31. The heat evolved on combustion of 1g starch $(C_6H_{10}O_5)_n$ into CO_2 and $H_2O_{(l)} is 17.49 kJg^{-1}$. Compute the enthalpy of formation of 1g starch. Given $\Delta H_f^\circ of H_2O_{(l)} = -285.85 kJmol^{-1}, \Delta H_f^\circ of CO_2 = -392.5 kJmol^{-1}$.

A. $-5.9 kJmol^{-1}$

B. $-11.81 kJmol^{-1}$

C. $-295 kJmol^{-1}$

D. $+11.81 kJmol^{-1}$

Answer: A

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32. Given the following thermo chemical equations:

$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}, \Delta H^{\circ} = -113.2 kJmol^{-1}$,

$2N_2O_{2(g)} + 3O_{2(g)} \rightarrow 4NO_{2(g)}, \Delta H^{\circ} = 28.0 kJmol^{-1}$ calculate ΔH° for this reaction, $N_2O_{2(g)} \rightarrow 2NO_{(g)}$

A. $-99.2 kJmol^{-1}$

B. $+99.2 kJmol^{-1}$

C. $+101.2 kJmol^{-1}$

D. $-101.2 kJmol^{-1}$

Answer: B

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33. Diborane is a potential rocket fuel which undergoes combustion according to the reaction,

$B_2H_{6(g)} + 3O_{2(g)} \rightarrow B_2O_{3(s)} + 3H_2O_{(g)}$

From the following data, calculate the enthalpy change for the combustion of diborane:

$$2B_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow B_2O_{3(s)}, \Delta H = -1273kJmol^{-1},$$

$$H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(l)}, \Delta H = -286kJmol^{-1}$$

$$H_2O_{(l)} \rightarrow H_2O_{(g)}, \Delta H = 44kJmol^{-1},$$

$$2B_{(s)} + 3H_{2(g)} \rightarrow B_2H_{6(s)}, \Delta H = 36kJmol^{-1}$$

A. $1273kJmol^{-1}$

B. $-1273kJmol^{-1}$

C. $-2035kJmol^{-1}$

D. $-22035kJmol^{-1}$

Answer: D

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34. Calculate the equilibrium constant for a reaction at 400 K given that $\Delta H^{\circ} = 308.3kJmol^{-1}$ and $\Delta S = 0.857kJK^{-1}mol^{-1}at400K.$

A. 3.1959×10^4

B. 6.35×10^4

C. 9.25×10^4

D. 8.35×10^4

Answer: A

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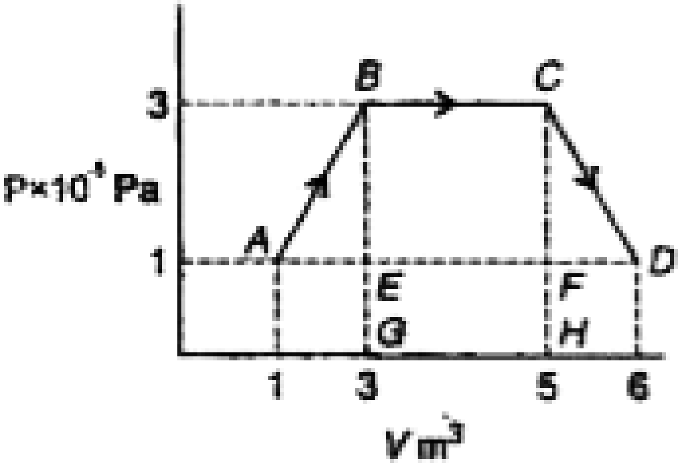
35. The net work done through a series of changes reported in figure for an ideal gas is:



A. $-600 kJ$

B. $-700kJ$

C. $-1200kJ$

D. $+1200kJ$

Answer: B

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

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

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

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

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

Answer: C

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37. The standard heat of combustion of Al is $-837.8 kJmol^{-1} at 25^{\circ}C$. If Al reacts with O_2 at $25^{\circ}C$, which of the following release 250 kJ of heat?

A. The reaction of 0.624 mol of Al

B. The formation of 0.624 mol of Al_2O_2

C. The reaction of 0.312 mol of Al

D. The formation of 0.150 mol of Al_2O_3

Answer: D

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38.

$$H_{2(g)}+\frac{1}{2}O_{2(g)}\rightarrow H_2O_{(l)}, BE(H-H)=x_1, BE(O=O)=x_2, BE($$

Latent heat of vaporisation of water liquid into water vapour $=x_4$, then heat of formation of liquid water is

A. $x_1 = \frac{x_2}{2} - x_3 + x_4$

B. $2x_3 - x_1 - \frac{x_2}{2} - x_4$

C. $x_1 + \frac{x_2}{2} - 2x_3 - x_4$

D. $x_1 + \frac{x_2}{2} - 2x_3 + x_4$

Answer: C

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39. A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of $37.0^\circ C$. As it does so, it absorbs 208 J of heat. The values of q and w for the process will be: (R=8.314 J/mol K) (In 7.5=2.01)

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

B. $q = +208J, w = +208J$

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

D. $q = -208J, w = -208J.$

Answer: C

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40. If for an ideal gas, the ratio of pressure and volume is constant and is equal to 1atmL^{-1}, the molar heat capacity at constant pressure would be

A. (3/2) R

B. 2R

C. (5/2)R

D. zero

Answer: B

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41. Two cylinders Aand B fitted with pistons contain equal amounts of an ideal gas (diatomic) at 300 K. Thie piston of A is free to move, while that of B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30 K, then the rise in temperature of the gas in B is

A. 30 K

B. 18 K

C. 50 K

D. 42 K

Answer: D

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42. 4 kg of ice at $-20^{\circ}C$ is mixed with 10 kg of water at $20^{\circ}C$ in an insulating vessel having a negligible heat capacity. Calculate the final mass of water remaining in the container, Given : Specific heat capacities of water and ice are $4.184kJK^{-1}kg^{-1}$ and $2.092kJK^{-1}kg^{-1}$, respectively. Molar enthalpy of fusion of ice is $334.7kJkg^{-1}$.

A. 8 kg

B. 10 kg

C. 12 kg

D. 14 kg

Answer: C

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43. If $\Delta_f H^\circ(CO, g) = -110.5kJmol^{-1}$ and $\Delta_f H^\circ(CO_2, g) = -393.5kJmol^{-1}$ the mass ofoxygen consumed in the reaction C (graphite) $+O_2(g) \rightarrow$ mixture of $CO(g) + CO_2(g)$ for which $\Delta H = -313.8kJmol^{-1}$ will be about

A. $24.0g$

B. $25.5g$

C. $27.5g$

D. $29.0g$

Answer: C

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44. The enthalpy of combustion of $H_2(g)$ at 298 K to give $H_2O(g)is - 249kJmol^{-1}$and bond enthalpies of H-H and $O = O$are $433kJmol^{-1}$ and $492kJmol^{-1}$ respectively. The bond enthalpy of O-H is

A. $464kJmol^{-1}$

B. $-464kJmol^{-1}$

C. $232kJmol^{-1}$

D. $-232kJmol^{-1}$

Answer: A

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45. If bond enthalpies of $(C-H)=413kJmol^{-1}, (C-C)=347.7kJmol^{-1}$, and $(C=C)=615.1kJmol^{-1}, \Delta_{C}H$ (C, graphite) $=718kJmol^{-1}$ and $\Delta_f H(H,g)=218kJmol^{-1}$, the enthalpy of formation of gaseous isoprene will be about $(CH_2=C(CH_3)CH=CH_2)$

A. $206.4kJmol^{-1}$

B. $-206.4kJmol^{-1}$

C. $103.2kJmol^{-1}$

D. $144kJmol^{-1}$

Answer: C

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46. If $\Delta_f G^\circ (H_2O, l) = -237.19 kJmol^{-1}$ and $\Delta_f G^\circ (H_2O. g) = -228.59 kJmol^{-1}$, the vapour pressure of water at 298 K would be about

A. $0.01 atm$

B. $0.02 atm$

C. $0.03 atm$

D. $0.05 atm$

Answer: C

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47. 36 mL of pure water takes 100 sec to evaporate from a vessel and heater connected to an electric source which delivers 806 watt. The $\Delta H_{\text{vaporization}} of H_2O$ is: 40.3 kJ/mol, 43,2 kJ/mol, 4.03 kJ/mol, 4.32 kJ/mol

A. 40.3 kJ/mol

B. 43,2 kJ/mol

C. 4.03 kJ/mol

D. 4.32 kJ/mol

Answer: A

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48. Consider the reaction at $300K, C_6H_6(l) + \frac{15}{2}O_2(g) \rightarrow 6CO_2(g) + 3H_2O(l), \Delta H = -3271kJ$

What is ΔU for the combustion of 1.5 mole of benzene at $27^\circ C$?

A. $-3667.25kJ$

B. $-4900.88kJ$

C. $-4906.5kJ$

D. $-3274.75kJ$

Answer: B

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49. A rigid and insulated tank of $3m^3$ volume is divided into two compartments. One compartment of volume of $2m^3$ contains an ideal gas at 0.8314 MPa and 400 K and while the second compartment of volume $1m^3$ contains the same gas at 8.314 MPa and 500 K. If the partition between the two compartments is ruptured, the final temperature of the gas is:

A. 420 K

B. 450 K

C. 480 K

D. 500 K

Answer: C

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50. The enthalpy of neutralization of a weak monoprotic acid (HA) in 1 M solution with a strong base is -55.95 kJ/mol. If the unionized acid is required 1.4 kJ/mol heat for it's complete ionization and enthalpy of neutralization of the strong monobasic acid with a strong monoacidic base is -57.3 kJ/mol. What is the % ionization of the weak acid in molar solution?

A. 1%

B. 3.57%

C. 35.7%

D. 10%

Answer: B

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51. Assertion : Work done during free expansion of an ideal gas whether reversible or irreversible is positive.

Reason : During free expansion, external pressure is always less than the pressure of the system.

A. If both (A)and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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52. Assertion : The solubility of most salts in water increases with rise of temperature.

Reason : For most of the ionic compounds. $\Delta_{sol}H^{\circ}$ is positive and the dissociation process is endothermic. : If both (A) and (R) are correct and

(R) are correct and (R) is the correct explanation of(A)., If both (A) and (R) are correct, but (R) is not the correct explanation of(A)., If(A) is correct, but (R) is incorrect., If both (A) and (R) are incorrect.

A. and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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53. Which of the following statements is correct?

A. The presence of reacting species in a covered beaker is an example of open system

B. There is an exchange of energy as well as matter between the system and the surroundings in a closed system

C. The presence of reactants in a closed vessel made up of copper is an example of a closed system

D. The presence of reactants in a thermoflask or any other closed insulated vessel is an example of a closed system

Answer:

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54. How many joules of heat are absorbed when 70.0 g of water is completely vaporised at its boiling point? (L_v=2260 kJ/kg)

A. $23.4kJ$

B. $7.0kJ$

C. $15.81kJ$

D. $158.7kJ$

Answer:

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55. An ideal gas is allowed to expand against a constant pressure of 2 bar from 10 L to 50 L in one step. The amount of work done by the gas is x. If the same expansion were carried out reversibly, will the work done be higher or lower than the earlier case?

A. Lower

B. Higher

C. Same as before

D. Can't anything

Answer:

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56. The enthalpy of reaction for the reaction: $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)} is\Delta, H^- = -572kJmol^{-1}$ What will be the standard enthalpy for the formation of $H_2O_{(l)}$?

A. $-572kJmol^{-1}$

B. $+57kJmol^{-1}$

C. $+286kJmol^{-1}$

D. $-286kJmol^{-1}$

Answer:

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57. In a calorimeter, the temperature increases by 6.12 K, the heat capacity of the system is $1.23kJg^{-1}K^{-1}$. What is the molar heat of decomposition for NH_4NO_3?

A. $-7.53.\ k\frac{J}{m}ol$

B. $-398.1k\frac{J}{m}ol$

C. $-16.1k\frac{J}{m}ol$

D. $-602k\frac{J}{m}ol$

Answer:

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58. Equal volumes of monoatomic and diatomic gases at same initial temperature and pressure are mixed. The ratio of specific heats of the mixture (C_p / C_v) will be

A. 1

B. 2

C. 1.67

D. 1.2

Answer:

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59. The heat liberated from the combustion of 0.5 g of carbon raised the temperature of 2000 g of water from $24^\circ C$ to $26^\circ C$. The heat of the combustion of carbon is

A. $-4kcal$

B. $-8kcal$

C. $-62kcal$

D. $-96kcal$

Answer:

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60. The enthalpy change for the reaction,

$N_2(g)+3H_2(g)\to 2NH_3(g)$ Is -92.38 kJ at 298 K.

What is ΔU at 298 K?

A. $-92.38kJ$

B. $-87.42kJ$

C. $-97.34kJ$

D. $-89.9kJ$

Answer:

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61. The specific heats of l_2 in vapour and solid states are 0.031 and 0.055 cal/g respectively. The heat of sublimation of iodine at 200ºC is $6.096kcalmol^{-1}$. The heat of sublimation of iodine at $250^{\circ}C$ will be:

A. $3.8kcalmol^{-1}$

B. $4.8kcalmol^{-1}$

C. $2.28kcalmol^{-1}$

D. $5.8kcalmol^{-1}$

Answer:

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62. Temperature of I mole of a gas is increased by 1° at constant pressure. Work done is

A. 2 cal

B. 3 cal

C. 4 cal

D. 5 cal

Answer:

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63. The bond dissociation energies for $Cl_2, I_2$and ICI are 242.3, 151 and 211.3 kJ/mol respectively. The enthalpy of sublimation of iodine is 62.8

kJ/mol. What is the standard enthalpy of formation of ICl (g)?

A. -211.3 kJ/mol

B. -14.6 kJ/mol

C. 16.8 kJ/mol

D. 33.5 kJ/mol

Answer:

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64. Standard entropies of $X_2, Y_{,2}$ and XY_3 are 60,40 and 50 $JK^{-1}mol^{-1}$ respectively. For the reaction:

$$\frac{1}{2}X^2 + \frac{3}{2}Y_2 \rightarrow XY_3$$

$\Delta H = -30kJ$ to be at equilibrium, the temperature will be:

A. 750 K

B. 1000 K

C. 1250 K

D. 500 K

Answer:

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65. The heat liberated when 1.89 g of benzoic acid is burnt in a bomb calorimeter at 25°C increases the temperature of 18.94 kg of water by 0.632°C. If the specific heat of water at $25^\circ C$ is 0.998 calg^(-1)deg^(-1),` the value of heat of combustion of benzoic acid is:

A. $88.1kcal$

B. $771.1kcal$

C. $981.1kcal$

D. $871.2kcal$

Answer:

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66. Assuming $\triangle H^0$ and S^o do not change with temperature. Calculate, the boiling point of liquid A using the thermodynamic data given below:

Thermodynamic

$$\begin{vmatrix} A(l) \\ -130 \\ 100 \end{vmatrix}\begin{vmatrix} A(g) \\ -100 \\ 200 \end{vmatrix}$$

A. 300 K

B. 130 K

C. 150 K

D. 50 K

Answer:

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67. The amount of heat released, when 20 mL of 0.5 M NaOH is mixed with 100 mL of 0.1 M HCl, is x kJ.The heat of neutralization (in kJ mol^{-1}) is:

A. $-100x$

B. $-50x$

C. $+100x$

D. $+50x$

Answer:

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68. On the basis of following thermochemical data : $\left[\Delta_f G^\circ H^+(aq) = 0\right]$

$H_2O_{(l)} \rightarrow H^+_{(aq)} + OH^-_{(aq)}, \Delta H = 57.32kJ, H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(l}$

The value of enthalpy of formation of OH-ion at$25^\circ C$is:

A. $-22.88kJ$

B. $-228.88kJ$

C. $+228.88kJ$

D. $-343.52k$

Answer:

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69. The standard enthalpy of formation of NH_3 is $-46kJmol^{-1}$. 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. $+1066kJmol^{-1}$

B. $-1102kJmol^{-1}$

C. $-964kJmol^{-1}$

D. $+352kJmol^{-1}$

Answer:

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70. $Fe_2O_{3(s)} + \frac{3}{2}C \rightarrow \frac{3}{2}CO_{2(g)} + 2Fe_{(s)}, \Delta H^\circ = +234.1kJ$

$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}, \Delta H^\circ = -393.5kJ$

Use these equations and AHº values to calculate ΔH° for this reaction:

$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$

A. $-1648.7kJ$

B. $-1255.3kJ$

C. $-1021.2kJ$

D. $-129.4kJ$

Answer:

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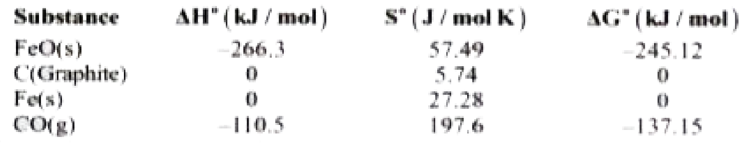
71. Given the following data:



Substance	ΔH° (kJ / mol)	S° (J / mol K)	ΔG° (kJ / mol)
FeO(s)	−266.3	57.49	−245.12
C(Graphite)	0	5.74	0
Fe(s)	0	27.28	0
CO(g)	−110.5	197.6	−137.15

Determine at what temperature the following reaction is spontaneous?

$FeO(s) + C$ (Graphite) $\rightarrow Fe(s) + CO(g)$

A. 298 K

B. 668 K

C. 966 K

D. ΔG° is + ve, hence the reaction will never be spontaneous

Answer:

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72. Calculate the increase in internal energy of 1 kg of water at $100^{\circ} C$ when it is converted into steam at the same temperature and at 1 atm (100 kPa). The density of water and steam are $1000 kgm^{-3}$ and $0.6 kgm^{-3}$ respectively. The latent heat of vapourisation of water $2.25 \times 10^{6} Jkg^{-1}$

A. $2.99 \times 10^{6} J$

B. $3.25 \times 10^{6} J$

C. $3.02 x 10^{6} J$

D. $2.08 \times 10^{6} J$

Answer:

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73. Oxidizing power of chlorine in aqueous solution can be determined by the parameters indicated below:

$\frac{1}{2}Cl_2(g) \xrightarrow{\frac{1}{2}\Delta_{diss}H^\circ} Cl(g) \xrightarrow{\Delta_a H^\circ} Cl^-(g) \xrightarrow{\Delta_{lm}H^\circ} Cl^-(aq)$The energy involved in the conversion of $\frac{1}{2}Cl_2(g)$ to $Cl^-(g)$ (using the data, $\Delta_{diss}H^\circ)(Cl_2) = 2400kJmol^{-1}\Delta_{eg}H^\circ(Cl) = -349kJmol^{-1}, \Delta_{iyd}H^\circ($

A. $+152kJmol^{-1}$

B. $-610kJmol^{-1}$

C. $-850kJmol^{-1}$

D. $+120kJmol^{-1}$

Answer:

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74. A steam boiler made up of steel weighs 900 kg. The boiler contains 400 kg of water. Assuming 70% of the heat is delivered to boiler and water, how much heat is required to raise the temperature of the whole from $10^\circ C \rightarrow 100^\circ C$? Heat capacity of steel is 0.11 kcal $kg^{-1}K^{-1}$ and heat capacity of water is 1 kcal $kg^{-1}K^{-1}$

A. 65321 kcal

B. 64157 kcal

C. 6869 kcal

D. 66549 kcal

Answer:

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75. If for the reaction at $300K, 2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}, \Delta_r H = -1202 kJ mol^{-1}, \Delta, S =$

The total entropychange $(\Delta S)_r$ and Gibbs energy change during the course of reaction$(\Delta. G)$ are respectivelv:

A. $3.79 \times 10^3 J, \ -1136.9J$

B. $3.79 \times 10^3 J, \ +1000J$

C. $+1000J, 3.\ 79 \times 10^3 J$

D. $-1136.9kJ, 3.\ 79 \times 10^3 J$

Answer:

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76. The lattice energy of NaCl is +788 kJ mol^{-1}. The enthalpies of hydration of Na^{+}(g) and Cl^{-} (g) ions are $-406kJmol^{-1}$ and $-378kJmol^{-1}$ respectively. The enthalpy of solution of NaCl(s) in water is

A. $786kJmol^{-1}$

B. $4kJmol^{-1}$

C. $-4kJmol^{-1}$

D. $-792kJmol^{-1}$

Answer:

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77. Using the data given below, pick the correct statement about the reaction:

$TiO_2(s) + 2Cl_2g) \rightarrow TiCl_4(l) + O_2(g)$ [Given that $\Delta_f H^\circ$ for $TiO_2(s), TiCl_4(l), Cl_2(g) \text{ and } O_2(g)$ are $-944.7, -804.22, 0.0, 0.0kJmol^{-1}$ respectively. Also ΔS° for $TiO_2(s), TICl_4(l), Cl_2(g) \text{ and } O_2(g)$ are $50.3, 252.3, 233.0, 205.1Jmol^{-1}K^{-1}$, respectively.]

A. The reaction is exothermic at standard conditions.

B. The standard entropy is favourable for the reaction in forward direction.

C. The reaction is not spontaneous at standard condition at $25^{\circ}C$

D. Reaction becomes spontaneous at higher temperature.

Answer:

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78. which of the following statements is correct?

A. $(T_f) = (T_f)_{\text{irev}}$

B. $T_f = T_i$ for both reversible and irreversible processes.

C. $(T_f)_{\text{irrev}} > (T_f)_{rev}$

D. $T_f > T_i$ for a reversible process but $T_f = T_i$ for an irreversible process.

Answer:

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79. $H_{2(g)}+\frac{1}{2}O_2 \to H_2O_{(l)}, \Delta H_{298K} = -68.32kcal.$ Enthalpy of vapourization of water at 1 atm and $25^\circ C$ is $10.52kcal.$ The standard enthalpy of formation (in kcal) of water vapour at $25^\circ C$ is

A. 10.52

B. -78.84

C. $+57.80$

D. -57.80

Answer:

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80. Given that,$NH_{3(g)}+3Cl_{2(g)} \Leftrightarrow NCl_{3(g)}+3HCl_{(g)}, -\Delta H_1$

$N_{2(g)}+3H_{2(g)} \Leftrightarrow 2NH_{3(g)}, \Delta H_2$

$H_{2(g)}+Cl_{2(g)} \Leftrightarrow 2HCl_{(g)}, \Delta H_3$

The enthalpy of formation fo $NCl_{3(g)}$ in terms of $\Delta H_1, \Delta H_2$ and ΔH_3 is

A. $\Delta_f H = -\Delta H_i - \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$

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

C. $\Delta_f H = \Delta H_i - \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$

D. $\Delta_f H = -\Delta H_1 + \frac{\Delta H_2}{2} + \frac{3}{2}\Delta H_3$

Answer:

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81. One mole of an ideal gas at 300 K is heated at constant volume (V_1) until its temperature is doubled, then it is expanded isothermally till it reaches the original pressure. Finally, the gas is cooled at the constant pressure till system reached to the half of original volume (V_2). Determine the total work done$(V_f/2)$ in calories: [Use in $2 - 0.70, K = 2calK^{-1}mol^{-1}]$

A. 60

B. 40

C. 20

D. 10

Answer:

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82. 1 mol of an ideal gas undergoes reversible isothermal expansion from an initial volume V, to a final volume, $10V_1$ and does 10 kJ of work. The initial pressure was $1 \times 10^7 Pa.\ a)$ Calculate V_1, b) if there were 2 mol of gas, what must have been its temperature?

A. $2.21 \times 10^{-4}, 120.13K$

B. $4.34 \times 10^{-4}, 261.\ 13K$

C. $1.01 \times 10^{-4}, 60.\ 06K$

D. $3.21 \times 10^{-4}, 161.\ 13K$

Answer:

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83. The heat evolved on combustion of 1g starch $(C_6H_{10}O_5)_n$ into CO_2 and $H_2O_{(l)} is 17.49 kJg^{-1}$. Compute the enthalpy of formation of 1g starch. Given $\Delta H_f^\circ of H_2O_{(l)} = -285.85 kJmol^{-1}, \Delta H_f^\circ of CO_2 = -392.5 kJmol^{-1}$.

A. $-5.9 kJmol^{-1}$

B. $-11.81 kJmol^{-1}$

C. $-2.95 kJmol^{-1}$

D. $+11.81 kJmol^{-1}$

Answer:

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84. Given the following thermo chemical equations:

$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}, \Delta H^\circ = -113.2 kJmol^{-1}$,

$2N_2O_{2(g)} + 3O_{2(g)} \rightarrow 4NO_{2(g)}, \Delta H^\circ = 28.0 kJ mol^{-1}$ calculate ΔH° for this reaction, $N_2O_{2(g)} \rightarrow 2NO_{(g)}$

A. $-99.2 kJ mol^{-1}$

B. $+99.2 kJ mol^{-1}$

C. $+101.2 kJ mol^{-1}$

D. $-101.2 kJ mol^{-1}$

Answer:

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85. Diborane is a potential rocket fuel which undergoes combustion according to the reaction,

$B_2H_{6(g)} + 3O_{2(g)} \rightarrow B_2O_{3(s)} + 3H_2O_{(g)}$

From the following data, calculate the enthalpy change for the combustion of diborane:

$2B_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow B_2O_{3(s)}, \Delta H = -1273 kJ mol^{-1},$

$H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(l)}, \Delta H = -286 kJ mol^{-1}$

$H_2O_{(l)} \rightarrow H_2O_{(g)}, \Delta H = 44 kJmol^{-1}$,

$2B_{(s)} + 3H_{2(g)} \rightarrow B_2H_{6(s)}, \Delta H = 36 kJmol^{-1}$

A. $1273 kJmol^{-1}$

B. $-1273 kJmol^{-1}$

C. $2035 kJmol^{-1}$

D. $-2035 kJmol^{-1}$

Answer:

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86. Calculate the equilibrium constant for a reaction at 400 K given that $\Delta H^{\circ} = 308.3 kJmol^{-1}$ and $\Delta S = 0.857 kJK^{-1}mol^{-1} at 400K.$

A. 3.1959×10^4

B. 6.35×10^4

C. 9.25×10^4

D. 8.35×10^4

Answer:

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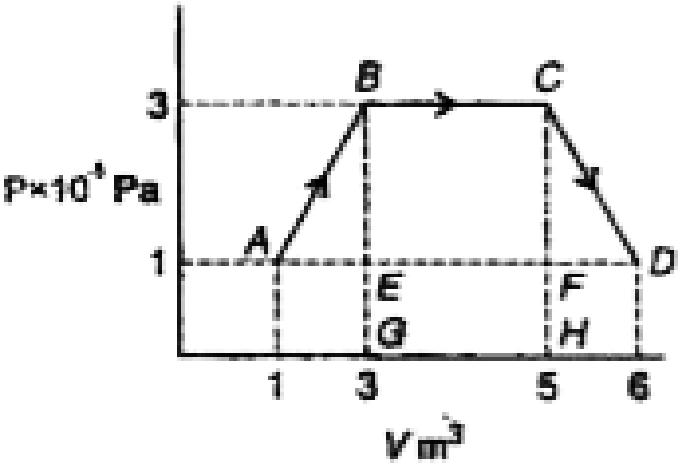
87. The net work done through a series of changes reported in figure for an ideal gas is:



A. $-600kJ$

B. $-700kJ$

C. $-1200kJ$

D. $+1200kJ$

Answer:

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

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

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

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

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

Answer:

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89. The standard heat of combustion of Al is $-837.8 kJ mol^{-1} at 25^{\circ}C$. If Al reacts with O_2 at $25^{\circ}C$, which of the following release 250 kJ of heat?

A. The reaction of 0.624 mol ofAl

B. The formation of 0.624 mol of Al_2O_3

C. The reaction of 0.312 mol of Al

D. The formation of 0.150 mol ofAl_2O_3

Answer:

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90.

$$H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(l)}, BE(H-H) = x_1, BE(O=O) = x_2, BE($$

Latent heat of vaporisation of water liquid into water vapour $= x_4$, then heat of formation of liquid water is

A. $x_1 + \frac{x_2}{2} - x_3 + x_4$

B. $2x_3 - x_1 - \frac{x_2}{2} - x_4$

C. $x_1 + \frac{x_2}{2} - 2x_3 - x_4$

D. $x_1 + \frac{x_2}{2} - 2x_3 + x_4$

Answer:

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91. A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of $37.0^{\circ} C$. As it does so, it absorbs 208 J of heat. The values of q and w for the process will be: (R=8.314 J/mol K) (In 7.5=2.01)

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

B. $q = +208J, w = +208J$

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

D. $q = -208J, w = -208J$

Answer:

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92. If for an ideal gas, the ratio of pressure and volume is constant and is equal to 1atmL^{-1}, the molar heat capacity at constant pressure would be

A. $(3/2)R$

B. $2R$

C. $(5/2)R$

D. zero

Answer:

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93. Two cylinders Aand B fitted with pistons contain equal amounts of an ideal gas (diatomic) at 300 K. Thie piston of A is free to move, while that of B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30 K, then the rise in temperature of the gas in B is

A. 30 K

B. 18 K

C. 50 K

D. 42 K

Answer:

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94. 4 kg of ice at $-20^\circ C$ is mixed with 10 kg of water at $20^\circ C$ in an insulating vessel having a negligible heat capacity. Calculate the final mass of water remaining in the container, Given : Specific heat capacities of water and ice are $4.184 kJK^{-1}kg^{-1}$ and $2.092 kJK^{-1}kg^{-1}$, respectively. Molar enthalpy of fusion of ice is $334.7 kJkg^{-1}$.

A. 8 kg

B. 10 kg

C. 12 kg

D. 14 kg

Answer:

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95. If $\Delta_f H^\circ(CO, g) = -110.5 kJmol^{-1}$ and $\Delta_f H^\circ(CO_2, g) = -393.5 kJmol^{-1}$ the mass ofoxygen consumed in the reaction C (graphite) $+O_2(g) \rightarrow$ mixture of $CO(g) + CO_2(g)$ for which $\Delta H = -313.8 kJmol^{-1}$ will be about

A. $24.0g$

B. $25.5g$

C. $27.5g$

D. $29.0g$

Answer:

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96. The enthalpy of combustion of $H_2(g)$ at 298 K to give $H_2O(g) is - 249 kJ mol^{-1}$ and bond enthalpies of H-H and $O=O$ are $433 kJ mol^{-1}$ and $492 kJ mol^{-1}$ respectively. The bond enthalpy of O-H is

A. $464 kJ mol^{-1}$

B. $-464 kJ mol^{-1}$

C. $232 kJ mol^{-1}$

D. $-232 kJ mol^{-1}$

Answer:

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97. If bond enthalpies of $(C-H)=413kJmol^{-1}, (C-C)=347.7kJmol^{-1}$, and $(C=C)=615.1kJmol^{-1}, \Delta_{C}H$ (C, graphite) $=718kJmol^{-1}$ and $\Delta_f H(H,g)=218kJmol^{-1}$, the enthalpy of formation of gaseous isoprene will be about $(CH_2=C(CH_3)CH=CH_2)$

A. $206.4kJmol^{-1}$

B. $-206.4kJmol^{-1}$

C. $103.2kJmol^{-1}$

D. $44kJmol^{-1}$

Answer:

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98. If $\Delta_f G^\circ(H_2O, l) = -237.19 kJ mol^{-1}$ and $\Delta_f G^\circ(H_2O. g) = -228.59 kJ mol^{-1}$, the vapour pressure of water at 298 K would be about

A. 0.01 atm

B. 0.02 atm

C. 0.03 atm

D. 0.05 atm

Answer:

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99. 36 mL of pure water takes 100 sec to evaporate from a vessel and heater connected to an electric source which delivers 806 watt. The $\Delta H_{\text{vaporization}} of H_2O$ is: 40.3 kJ/mol, 43,2 kJ/mol, 4.03 kJ/mol, 4.32 kJ/mol

A. 40.3 kJ/mol

B. 43.2 kJ/mol

C. 4.03 kJ/mol

D. 4.32 kJ/mol

Answer:

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100. Consider the reaction at $300K, C_6H_6(l) + \frac{15}{2}O_2(g) \rightarrow 6CO_2(g) + 3H_2O(l), \Delta H = -3271kJ$

What is ΔU for the combustion of 1.5 mole of benzene at $27^\circ C$?

A. $-3667.25kJ$

B. $-4900.88kJ$

C. $-4806.5kJ$

D. $-3274.75kJ$

Answer:

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101. A rigid and insulated tank of $3m^3$ volume is divided into two compartments. One compartment of volume of $2m^3$ contains an ideal gas at 0.8314 MPa and 400 K and while the second compartment of volume $1m^3$ contains the same gas at 8.314 MPa and 500 K. If the partition between the two compartments is ruptured, the final temperature of the gas is:

A. 420 K

B. 450 K

C. 480 K

D. 500 K

Answer:

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102. The enthalpy of neutralization of a weak monoprotic acid (HA) in 1 M solution with a strong base is -55.95 kJ/mol. If the unionized acid is required 1.4 kJ/mol heat for it's complete ionization and enthalpy of neutralization of the strong monobasic acid with a strong monoacidic base is -57.3 kJ/mol. What is the % ionization of the weak acid in molar solution?

A. 1%

B. 3.57%

C. 7%

D. 10%

Answer:

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Level Ii Assertion Reason Type

1. Assertion : Heat of neutralisation of HNO_3, and NaOH is almost same as that of HCl and KOH.

Reason : Both HNO_3, and HCl are strong acids and NaOH and KOH are strong bases. : if both (A) and (R) are correct and (R) is the correct explanation of(A)., If both (A) and (R) are correct, but (R) is not the correct explanation of(A)., If(A) is correct, but (R) is incorrect., If both (A) and (R) are incorrect.

A. and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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2. Assertion : Anexothermic process which is non spontaneous at high temperature may become spontaneous at low temperature.

Reason : Spontaneous process is an irreversible process and may be reversed by some external agency.

A. A and (R) are correct and (R) is the correct explanation of(A).

B. both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. (A) is correct, but (R) is incorrect.

D. both (A) and (R) are incorrect.

Answer: B

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3. Assertion : There is no change in internal energy in a cyclic process.

Reason : Internal energy is a state function.

A. and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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4. Assertion : During an adiabatic process, heat energy is not exchanged between system and its surroundings.

Reason : The temperature of a gas increases when it undergoes an adiabatic expansion.

A. A and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. (A) is correct, but (R) is incorrect.

D. both (A) and (R) are incorrect.

Answer: C

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5. Assertion : For an isothermal reversible process $Q = -W i.e.$ work done by the system equals the heat absorbed by the system.

Reason : Enthalpy change (ΔH) is zero for isothermal process. : If both (A) and (R) are correct and (R) is the correct explanation of(A)., If both (A) and (R) are correct, but (R) is not the correct explanation of(A)., If(A) is correct, but (R) is incorrect., If both (A) and (R) are incorrect.

A. and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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6. 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. A and (R) are correct and (R) is the correct explanation of(A).

B. both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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7. Assertion : Decrease in free energy causes spontaneous reaction.

Reason : Spontaneous reactions are invariably exothermic.

A. A and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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8. Assertion : The enthalpy of both graphite and diamond is taken to be zero, being elementary substances.

Reason : The enthalpy of formation of an elementary substance in any state is taken as zero. : If both (A) and (R) are correct and (R) is the correct explanation of(A)., If both (A) and (R) are correct, but (R) is not the correct explanation of(A)., If(A) is correct, but (R) is incorrect., If both (A) and (R) are incorrect.

A. and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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9. Assertion : When a gas at high pressure expands against vacuum, the work done is maximum.

Reason : Work done in expansion depends upon the pressure inside the gas and increase in volume.

A. A and (R) are correct and (R) is the correct explanation of(A).

B. both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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10. Assertion : A process for which $\Delta_{\text{Ssystem}} > 0$ as well as $\Delta H > 0$, passes from non-spontaneous to spontaneous state as temperature is increased.

Reason : At higher temperature $T\Delta S$ exceeds ΔH.

A. and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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11. Assertion : There is no reaction known for which ΔG is positive, yet it is spontaneous.

Reason : For photochemical reaction, ΔG is negative,

A. and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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12. Assertion : For every chemical reaction at equilibrium, standard Gibbs energy of the reaction is zero.

Reason : At constant temperature and pressure, chemical reactions are spontaneous in the direction of the decreasing Gibbs energy.

A. and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is incorrect, but (R) is correct.

D. If both (A) and (R) are incorrect.

Answer: D

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13. Assertion : The enthalpy of formation of gaseous oxygen molecules at 298, K and under a pressure of one bar is zero.

Reason : The entropy of formation of gaseous oxygen molecule under the same conditions is zero.

A. A and (R) are correct and (R) is the correct explanation of(A).

B. both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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14. Assertion : Molar entropy ofvaporisation of water is different from ethanol.

Reason : Water is more polar than ethanol.

A. and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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15. Assertion : If both ΔH° and ΔS° are positive then reaction will be spontaneous at high temperature.

Reason : All processes with positive entropy change are spontaneous.

A. and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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16. Assertion : There is exchange in internal energy in a cyclic process.

Reason : Cyclic process is the one in which the system returns to its initial state after a number of reactions.

A. If both (A) and (R) are correct and (R) is the correct explanation of(A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is incorrect, but (R) is correct.

D. If both (A) and (R) are incorrect.

Answer: A

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17. Assertion : There is a natural asymmetry between converting work to heat and converting heat to work.

Reason : No process is possible in which the sole result is the absorption of heat from a reservoir and its complete conversion into work.

A. A and (R) are correct and (R) is the correct explanation of(A).

B. both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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18. Assertion : A reaction which is spontaneous and accompanied by decrease of randomness must be exothermic.

Reason : All exothermic reactions are accompanied by decrease of randomness.

A. A and (R) are correct and (R) is the correct explanation of(A).

B. both (A) and (R) are correct, but (R) is not the correct explanation of(A).

C. If(A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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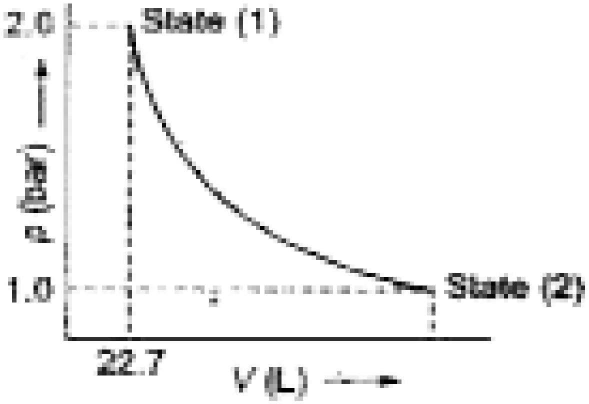
Level Iii

1. 1.0 mole of a monoatomic ideal gas is expanded from state (1) to state (2) as shown in the figure. Calculate ti work done for the expansion of gas from state (1) to state (2) at 298 K



A. $-1717.46J$

B. $+1717.46J$

C. $-1908.2J$

D. $+1908.2J$

Answer:

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2. 18.0.g water completely vaporises at 100°C and 1 bar pressure and the enthalpy change in the process 40.79 kJ moll. What will be the enthalpy change for vaporising two moles of water under the same condition

A. $81.58kJ, 81.58kJ$

B. $40.\ 79.\ kJ, 40.\ 79kJ$

C. $40.79kJ, 81.58kJ$

D. $81.58kJ, 40.\ 79kJ$

Answer:

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3. A cylinder of gas is assumed to contain 11.2 kg ofbutane (C_4H_{10}). If a normal family needs 20000 kJ of energ per day, the cylinder will last in (Given that ΔH for combustion of butane is –2658 kJ)

A. 20 days

B. 25 days

C. 23 days

D. 24 days

Answer:

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4. The specific heat of silver is 0.0565 cal$/g^{\circ}C$. Assuming no heat loss, the final temperature, when 100 g of Ag at $40.0^{\circ}C$ is immersed in 60.0 g of water at $10.0^{\circ}C$,

A. 10.15

B. 12.58

C. 40.00

D. 19.16

Answer:

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5. A sample containing 2.000 mol of helium gas originally at 298.15 K and 1.000 bar is cooled to its norm boiling temperature of 4K, condensed to a liquid and then cooled further to 2 K, where it undergoes anoth phase transition to a second liquid form, called liquid helium II. Abeam of laser light suddenly vapourizes th liquid phase, and the helium is brought to a temperature of 298.15 K and a pressure of 0.500 bar. The entropy change for the above process is:

A. $11.5JK^{-1}$

B. $-11.\,5JK^{-1}$

C. $23JK^{-1}$

D. $-23JK^{-1}$

Answer:

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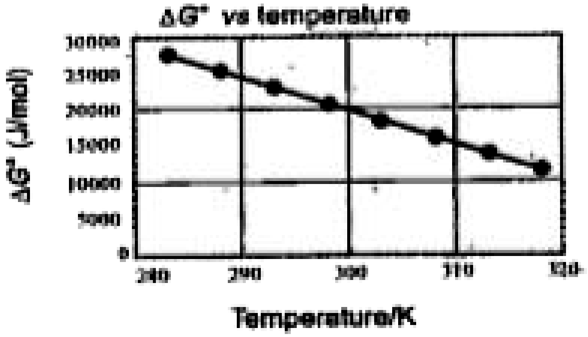
6. For the reaction of ammonium carbonate to produce carbon dioxide and ammonia, an experiment was devised and the results were plotted as in the following diagram:



Which one of the following is consistent with these results?

A. $\Delta H^\circ = -455kJmol^{-1}, \Delta S^\circ = 156Jmol^{-1}K^{-1}$

B. $\Delta H^\circ = 156 \times 103mol^{-1}, \Delta S^\circ = 0455Jmol^{-1}K^{-1}$

C. $\Delta H^\circ = 170kJmol^{-1}, \Delta S^\circ = 500Jmol^{-1}K^{-1}$

D. $\Delta H^\circ = 156 \times 103kJmol^{-1}, \Delta S^\circ = 455kJmol^{-1}K^{-1}$

Answer:

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7. A piston is cleverly designed so that it extracts the maximum amount of work out of a chemical reaction, by matching P_{estera} to the P_{istema} at all times. This 8cm diameter piston initially holds back 1 mol of gas occupying 1 L, and comes to rest after being pushed out a further 2 L at $25^{\circ} C$. After exactly half of the work has been done, the piston has travelled out a total of .

A. $10.0cm$

B. $11.2cm$

C. $16.5cm$

D. $20.0cm$

Answer:

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8. A reaction from unknown reactants $(R): R \rightarrow P$ is spontaneous at $37^{\circ} C$ and goes to completion. If the molar entropy of the products (P) is measured to be 460 J/mol K, and 71.3 kJ of heat was given off in the process to the surroundings when I mol reacted, then the molar entropy of the reactants has to be

A. at least-230 J/mol K

B. at the most 690 J/mol.K

C. at the most 230 J/mol K

D. at least 690 J/mol K

Answer:

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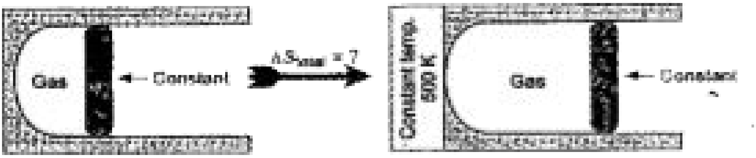
9. 3 moles of an ideal gas ($C_{v,m}$ =3/2 R) are initially in an insulated piston-fitted cylinder at a constant pressure. The volume of the gas is initially 40 L. The cylinder is then placed in contact with a constant temperature bath at 500 K. Bringing the bath in contact with the cylinder causes 6.236 kJ of heat to transfer into the cylinder and causes the gas to expand. Find

ΔS_{TOTAL} for this process.



A. $28JK^{-1}$

B. $36JK^{-1}$

C. $54JK^{-1}$

D. $14JK^{-1}$

Answer:

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10. The spontaneity means, having the potential to proceed without the assistance of external agency. The processes which occur spontaneously are

A. flow of heat from colder to warmer body

B. gas in a container contracting into one corner

C. gas expanding to fill the available volume

D. burning carbon in oxygen to give carbon dioxide

Answer:

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11. A sample containing 1.0 mole of an ideal gas is expanded isothermally and reversibly to ten times of its original volume, in two separate experiments. The expansion is carried out at 300 K and at 600 K respectively. Choose the correct option.

A. Work done at 600 K is 20 times the work done at 300 K

B. Work done at 300 K is twice the work done at 600 K

C. Work done at 600 K is twice the work done at 300K

D. $\Delta E = 0$ in both cases

Answer:

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12. Which of the following are intensive properties?

A. Heat capacity

B. Refractive index

C. Specific volume

D. Entropy

Answer:

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13. Which of the following statements are correct?

A. Absolute value of enthalpy cannot be determined

B. Absolute value of internal energy cannot be determined

C. Absolute value of entropy can be determined

D. Internal energy, enthalpy, and entropy are intensive properties

Answer:

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14. For which process does $\Delta U = 0$ holds true?

A. Cyclic process

B. Isothermal expansion

C. Isochoric process

D. Adiabatic process

Answer:

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15. Which is not correct relationship between $\Delta G^{\ominus}$ and equilibrium constant K_P.

A. $K_P = -RT \log \Delta G^{\ominus}$

B. $K_P = \left[\frac{e}{RT}\right]^{\Delta G^{\circ}}$

C. $K_P = -\frac{\Delta G^{\ominus}}{RT}$

D. $K_P = c^{-\Delta G^{\ominus} / RT}$

Answer:

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16. 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:

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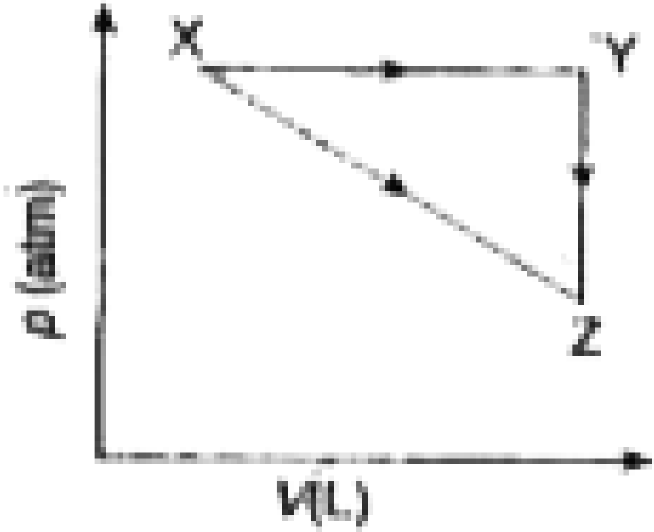
17. For an ideal gas, consider onlyp-V work in going from an initial state X to the final state Z. The final state can be reached by either of the two paths shown in the below figure. Which of the following choices ar correct? [Take ΔS as change in entropy and was work done.]



A. $\Delta S_{x \to z} = \Delta S_{x \to y} + \Delta S_{y \to z}$

B. $W_{x \to z} = W_{x \to y} + W_{y \to z}$

C. $W_{x \to y \to z} = W_{x \to y}$

D. $\Delta S_{x \to y \to z} = \Delta S_{x \to y}$

Answer:

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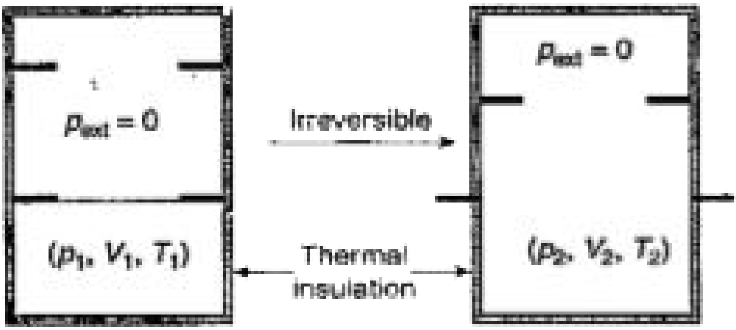
18. An ideal gas in a thermally insulated vessel at internal pressure $= p_1$, volume $= V_1$, and absolute temp $= T_1$, expands irreversibly against zero external pressure, as shown in the below diagram. The final internal pressure volume and absolute temperature of the gas are $p_2, V_2,$ and T_2, respectively. For this expansion,



A. `q=0

B. $T_2 = T_1$

C. $p_2V_2 = p_1V_1$

D. $p_2V_2^{\gamma} = p_1V_1^{\gamma}$

Answer:

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19. For the $C(s) + H_2O(g) \rightarrow CO(g) + H_2(g)$ reaction, $\Delta H^{\circ} = +131kJ, \Delta S^{\circ} = +134JK^{-1}$ Mark out the correct statement(s).

A. Reaction is spontaneous even at room temperature

B. Reaction is not spontaneous at room temperature.

C. Reaction is spontaneous above $705^{\circ}C$.

D. Reaction is non spontaneous above $705^{\circ}C$.

Answer:

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20. Which of the following statement(s) is/are correct?

A. The system of constant entropy and constant volume will attain the equilibrium in a state of minimum energy.

B. The entropy of the universe is increasing.

C. The process would be spontaneous when $(\Delta S)_{U,V} < 0, (\Delta U)_{S,V} > 0$

D. The process would be spontaneous when $(\Delta S)_{U,V} > 0, (\Delta U)_{S,V} < 0$

Answer:

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21. Which of the following sets show the intensive properties?

A. Temperature and pressure.

B. Viscosity and surface tension

C. Refractive index and specific heat

D. Volume and heat capacity

Answer:

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22. Which of the following are endothermic processes?

A. Combustion of glucose

B. Decomposition of water

C. Dehydrogenation of ethane to ethene

D. Conversion of graphite to'diamond

Answer:

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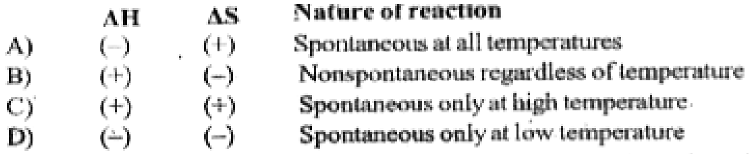
23. Which of the options given below are correct?



	ΔH	ΔS	Nature of reaction
A)	(–)	(+)	Spontaneous at all temperatures
B)	(+)	(–)	Nonspontaneous regardless of temperature
C)	(+)	(+)	Spontaneous only at high temperature
D)	(–)	(–)	Spontaneous only at low temperature

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24. Enthalpy change equals internal energy change for a chemical reaction when

A. All the reactants and products are in solution

B. Reaction is carried out in a closed vessel

C. Number of moles of gaseous reactants and that of products is equal

D. Reaction is carried out at constant pressure

Answer:

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25. The enthalpy of fusion of ice is 6.02 kJ mol^{-1}. The heat capacity of water is $4.18Jg^{-1}C^{4}$. What is the smallest number of ice cubes at $0^{\circ}C$, each containing one mole of water, that are needed to cool 500g of liquid water from$20^{\circ}C$to $0^{\circ}C$?

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26. Temperature of one mole of helium gas is increased by $1^{\circ}C$. Hence, the increase in its internal energy will be

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27. 4.48 Lofan ideal gas at S.T.P requires 12 calories to raise its temperature by $15^{\circ}C$ at constant volume. The C_p of the gas is:

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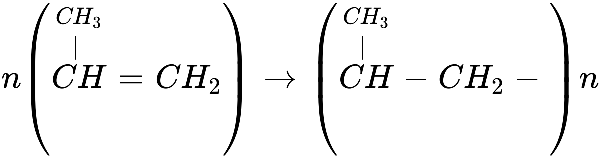
28. The polymerisation of propene to linear polypropene is represented by the reaction



$$n\left(\overset{\overset{CH_3}{|}}{C}H = CH_2\right) \rightarrow \left(\overset{\overset{CH_3}{|}}{C}H - CH_2 - \right) n$$

where n has large integral value, the average enthalpies of bond dissociation for(C=C) and(C-C) at 298K are +590 and $+331 kJmol^{-1}$, respectively. The enthalpy of polymerisation is $-360 kJmol^{-1}$. Find the value of n.

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29. The lattice energy of solid KCl is 181 kcal mol^{-1} and the enthalpy of solution of KCl in H_2O is 1.0 kcal mol^{-1}. If the hydration enthalpies of $K^{\ominus}$ and $Cl^{\ominus}$ ions are in the ratio of 2:1 then the enthalpy of hydration of $K^{\oplus}$ is-20x K cal mol^{-1}. Find the value of x.

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30. A heated iron block at $127^\circ C$ loses 300 J. of heat to the surroundings which are at a temperature of 27°. In this process the total change in entropy for system and surroundings is $\frac{1}{x} JK^{-1}$. Find the value of x.

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31. What work is to be done on 2 mole of a perfect gas at $27^\circ C$ if it is.compressed reversibly and isothermally from a pressure of $1.01x10Nm \rightarrow$ 5.05 x10^6 Nm^-2?

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32. The heat of neutralisation of oxalic acid is -25.4 kcal mol^{-1} using strong base, NaOH. Hence, the enthalpy change of the process, $H_2C_2O4 \Leftrightarrow 2H^+ + C_2O_4^{2-}$ is

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33. 100 mole of an ideal gas at 8.21 atm is heated to show a linear graph between log V (V in litres) and log-T (T in kelvin). The slope of the line is :

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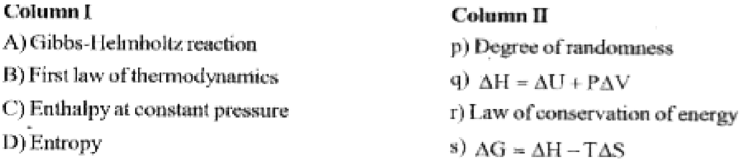
34. match the following



Column I	Column II
A) Gibbs-Helmholtz reaction	p) Degree of randomness
B) First law of thermodynamics	q) $\Delta H = \Delta U + P\Delta V$
C) Enthalpy at constant pressure	r) Law of conservation of energy
D) Entropy	s) $\Delta G = \Delta H - T\Delta S$

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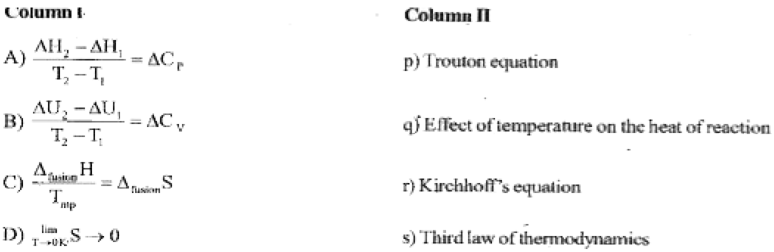
35.



Column I	Column II
A) $\frac{\Delta H_2 - \Delta H_1}{T_2 - T_1} = \Delta C_P$	p) Trouton equation
B) $\frac{\Delta U_2 - \Delta U_1}{T_2 - T_1} = \Delta C_V$	q) Effect of temperature on the heat of reaction
C) $\frac{\Delta_{fusion} H}{T_{mp}} = \Delta_{fusion} S$	r) Kirchhoff's equation
D) $\lim_{T \to 0K} S \to 0$	s) Third law of thermodynamics

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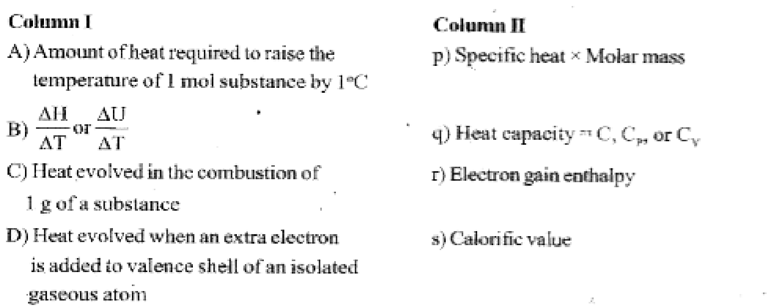
36. match the following



Column I	Column II
A) Amount of heat required to raise the temperature of 1 mol substance by 1°C	p) Specific heat × Molar mass
B) $\frac{\Delta H}{\Delta T}$ or $\frac{\Delta U}{\Delta T}$	q) Heat capacity = C, C_p, or C_V
C) Heat evolved in the combustion of 1 g of a substance	r) Electron gain enthalpy
D) Heat evolved when an extra electron is added to valence shell of an isolated gaseous atom	s) Calorific value

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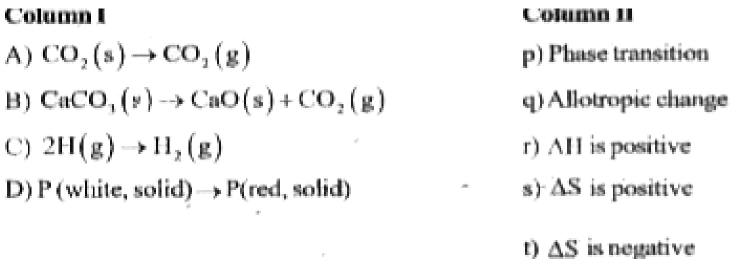
37. Match the transformations in Column I with appropriate options in Column II



Column I	Column II
A) $CO_2(s) \rightarrow CO_2(g)$	p) Phase transition
B) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$	q) Allotropic change
C) $2H(g) \rightarrow H_2(g)$	r) ΔH is positive
D) P (white, solid) → P(red, solid)	s) ΔS is positive
	t) ΔS is negative

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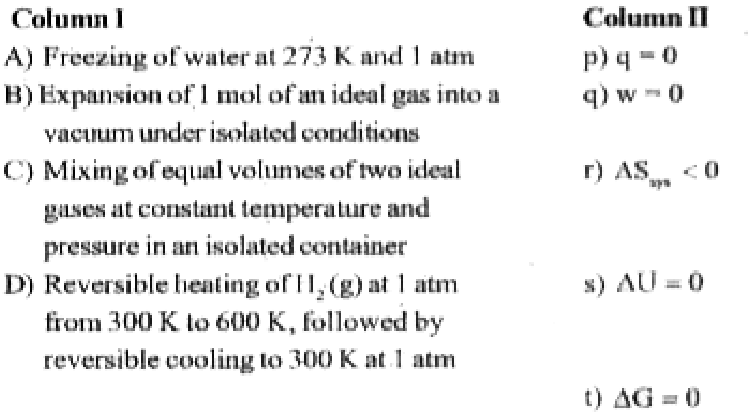
38. Match the thermodynamic processes given under Column I with expressions given in Column II



Column I	Column II
A) Freezing of water at 273 K and 1 atm	p) $q = 0$
B) Expansion of 1 mol of an ideal gas into a vacuum under isolated conditions	q) $w = 0$
C) Mixing of equal volumes of two ideal gases at constant temperature and pressure in an isolated container	r) $\Delta S_{sys} < 0$
D) Reversible heating of $H_2(g)$ at 1 atm from 300 K to 600 K, followed by reversible cooling to 300 K at 1 atm	s) $\Delta U = 0$
	t) $\Delta G = 0$

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39. Statement 1 : The solubility of most salts in water increases with rise of temperature.

Statement 2 : For most of the ionic compounds. $\Delta_{sol}H^\circ$ is positive and the dissociation process is endothermic.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is True.

Answer:

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40. Statement 1 : An exothermic process which is non spontaneous at high temperature may become spontaneous at low temperature,

Statement 2 : Spontaneous process is an irreversible process and may be reversed by some external agency.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is True.

Answer:

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41. Statement 1 : For an isothermal reversible process Q=-Wi.e. work done by the system equals the heat absorbed by the system.

Statement 2: Enthalpy change (ΔH) is zero for isothermal process.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is True.

Answer:

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42. Statement 1 : When hydrogen gas at high pressure and room temperature expands adiabatically into a region of low pressure, there is a decrease in temperature.

Statement 2 : Hydrogen gas at room temperature is above its inversion temperature.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 and 2 are False.

Answer:

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43. Statement 1 : If both ΔH° and ΔS° are positive, then reaction will be spontaneous at high temperatur

Statement 2: All processes with positive entropy change respontaneous.

A. Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is True.

Answer:

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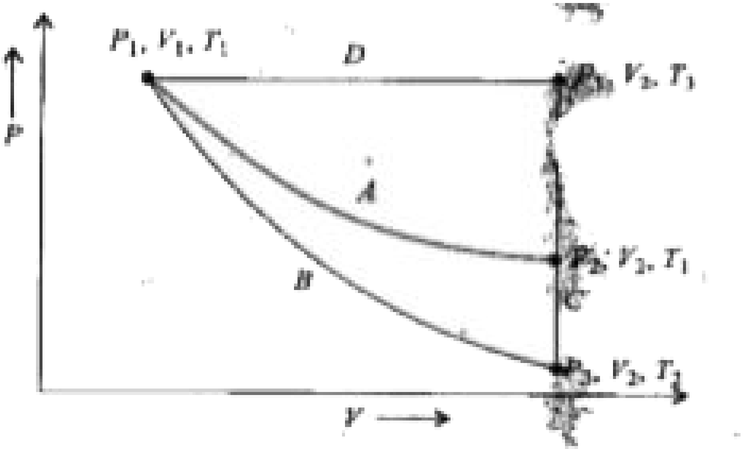
44. For an ideal gas, an illustration of three different paths A, (B +C) and (D+E) from an initial state P_1, V_1, T_1 to a final state P_2, V_2, T_1 is shown in the given



Path A represents a reversible isothermal expansion from $P_1, V_1,$ to P_2, V_2 Path (B +C) represents a reversible adiabatic expansion (B) from P_1, V_1, T_1 to P_3, V_2, T_2 followed by reversible heating the gas at constant volume (C) from P_3, V_2, T_2 to P_2, V_2, T_1. Path (D+E) represents a reversible expansion at constant pressure P_1 from P_1, V_1, T_1 to P_1, V_2, T_3 followed by a reversible cooling at constant volume $V_2(E)$ frm V_1, V_2T_3 toP_2, V_2, T_1.

What is $q_{rav},$ for path (A) ?

A. $P(V_2 - V_1)$

B. $-nRT_1 \ln \frac{V_2}{V_1}$

C. $-nR \ln \frac{V_2}{V_1}$

D. $nRT_1 \ln \frac{V_2}{V_1}$

Answer:

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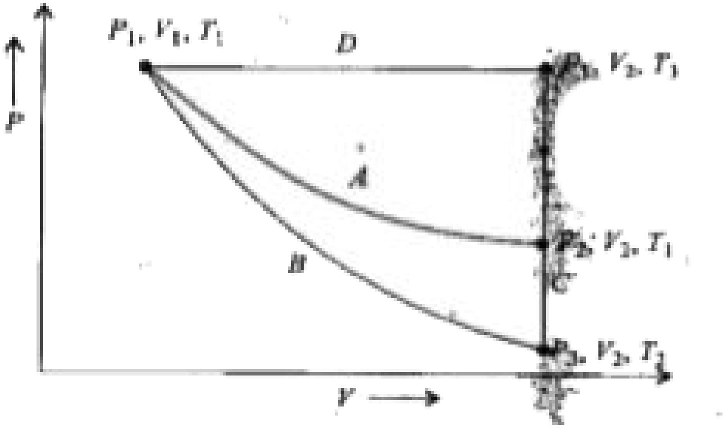
45. For an ideal gas, an illustration of three different paths A, (B +C) and (D+E) from an initial state P_1, V_1, T_1 to a final state P_2, V_2, T_1 is shown in the given



Path A represents a reversible isothermal expansion from $P_1, V_1,$ to P_2, V_2 Path (B +C) represents a reversible adiabatic expansion (B) from

P_1, V_1, T_1 to P_3, V_2, T_2 followed by reversible heating the gas at constant volume (C) from P_3, V_2, T_2 to P_2, V_2, T_1. Path (D+E) represents a reversible expansion at constant pressure P_1 from P_1, V_1, T_1 to P_1, V_2, T_3 followed by a reversible cooling at constant volume $V_2(E)$ frm V_1, V_2T_3 to P_2, V_2, T_1.

What is ΔS for path A ?

A. $nR\ln\frac{V_2}{V_1}$

B. $P(V_2 - V_1)$

C. $-P(V_1 - V_1)$

D. $nR(V_2 - V_1)$

Answer:

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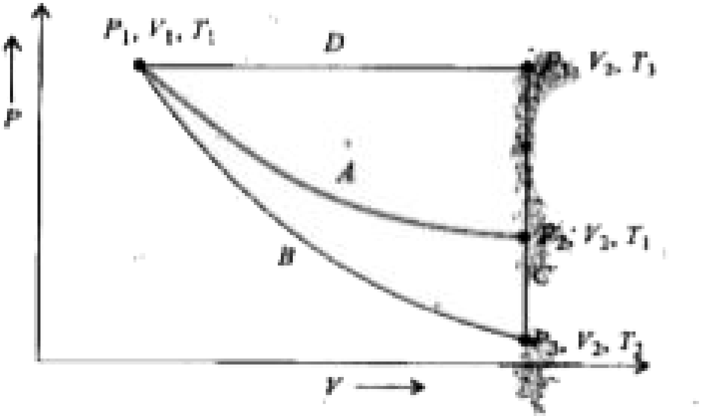
46. For an ideal gas, an illustration of three different paths A, (B +C) and (D+E) from an initial state P_1, V_1, T_1 to a final state P_2, V_2, T_1 is shown in the given



Path A represents a reversible isothermal expansion from $P_1, V_1,$ to P_2, V_2 Path (B +C) represents a reversible adiabatic expansion (B) from P_1, V_1, T_1 to P_3, V_2, T_2 followed by reversible heating the gas at constant volume (C) from P_3, V_2, T_2 to P_2, V_2, T_1. Path (D+E) represents a reversible expansion at constant pressure P_1 from P_1, V_1, T_1 to P_1, V_2, T_3 followed by a reversible cooling at constant volume $V_2(E)$ frm $V_1, V_2 T_3$ toP_2, V_2, T_1.

What is ΔS for path A ?

A. $-P(V_2 - V_1)$

B. $-nR \ln \frac{V_2}{V_1}$

C. $+P(V_2 - V_1)$

D. $nR \ln \frac{V_2}{V_1}$

Answer:

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47. Free energy, G=- TS, is a state funtion that indicates whether a reaction is spontaneous or non-spontaneous if you think of TS as the part of the system's energy that is discordered already, then (H-TS) is the part of system's energy that is still orderd and therefore free to cause spontaneous change by becoming disorder Also, $\Delta G = \Delta H - T\Delta S$

Form the second law of thermodyamics, a reaction is spontaneous if $\Delta_{\text{total}} S$ is + ve, nonspontaneous if $\Delta_{\text{total}} S$ is negative and at equilibrium if $\Delta_{lot} S$ is zero. Since, $-T\Delta S = \Delta C$ and since ΔG and ΔS have oposite single we can restate the themodynmaic creation for the spontaneity of a reaction oout at constant temperature and pressure.

If $\Delta G < 0,$ the reaction is spontaneous. $If \Delta G > 0,$ the reaction is non-spontaneous.

If $\Delta G = 0,$ the reaction is at equilibrium.

A particular reaction has a negative value for the free enregy charge. Then at ordinary temmperature

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

B. It has a large (+ve) value for enthalpy change

C. It has a small (+ve) value for enthalpy change

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

Answer:

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48. Which of the following is trur for the reaction ?

$H_2O(1) \Leftrightarrow H_2O(g)at100^{\circ}C$ and 1 atmosphere

A. $\Delta S = 0$

B. $\Delta U = \Delta H$

C. $\Delta H = 0$

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

Answer:

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49. One mol of ice is converted to liquid at 273 $K : H_2O(s)$ and $H_2O(l)$ have entropies 38.20 and $60.30 Jmol^{-1}K^{-1}$. Enthalpy change in the conversion will be

A. $59.59 Jmol^{-1}$

B. $593.96 Jmol^{-1}$

C. $5959.6 Jmol^{-1}$

D. $59596 Jmol^{-1}$

Answer:

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50. In which of the following cases ΔH and ΔU are not equal to each other?

A. The reaction involves no gaseous reactant and product

B. The number of mole of gaseous reactants and gaseous products are not equal to each other

C. The number of mole of gaseous reactants and gaseous products are equal to each other

D. The process is carried out in closed vessel

Answer:

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51. The latent heat of vaporization of liquid at 500 K and 1 atmospheric pressure is 10.0 kcal/mol. What will be. the change in internal energy of 3 mole of the liquid at the same temperature and pressure?

A. $27.0kcal$

B. $13.0kcal$

C. $-27.0kcal$

D. $-13.0kcal$

Answer:

Watch Video Solution

52.

One mole of a gas is allowed to expand freely in vacuum at 300 K. The work done during the process is :

A. 300J

B. 300 kJ

C. zero

D. $-300J$

Answer:

Watch Video Solution