

## CHEMISTRY

### BOOKS - V PUBLICATION

### THERMODYNAMICS

#### Question Bank

1. Choose the correct answer. A thermodynamic state function is a quantity

- i) used to determine heat changes
- ii) whose value is independent of path
- iii) used to determine pressure volume work
- iv) whose value depends on temperature only.



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

i) ' $\Delta T=0$ '

ii) ' $\Delta p=0$ '

iii) ' $q=0$ '

iv) ' $w=0$ '



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3. The enthalpies of all elements in their standard states are,

i) unity

ii) zero .

iii) 'lt0'

iv) different for each element



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4.  $\Delta U^\theta$  of combustion of methane is  $-XkJmol^{-1}$ . The value of  $\Delta H^\theta$  is

i)  $= \Delta U^\theta$

ii)  $> \Delta U^\theta$

iii)  $< \Delta U^\theta$

iv)  $= 0$



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5. a) The enthalpy of combustion of

$CH_4(g)$ ,  $C_{graphite}$  and  $H_2(g)$  at 298 K are  $-890.3 kJ mol^{-1}$ , -

$393.5 \text{ kJ mol}^{-1}$  and  $-285.8 \text{ kJ mol}^{-1}$  respectively. Calculate the enthalpy of formation of  $\text{CH}_4(g)$ .

b) Match the following:

- |                  |   |                        |
|------------------|---|------------------------|
| $W = - \Delta u$ | - | Enthalpy change        |
| $\Delta u = 0$   | - | Universal gas constant |
| $C_p - C_v$      | - | Adiabatic process      |
| $q_p$            | - | Isothermal process     |
|                  | - | Cyclic process         |

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6. A reaction, ' $\text{A} + \text{B} \rightleftharpoons \text{C} + \text{D} + q$ ' is found to have a positive entropy change. The reaction will be

- possible at high temperature
- possible only at low temperature
- not possible at any temperature
- possible at any temperature.

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7. In a process, 701 J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy for the process?

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8. The reaction of cyanamide,  $NH_2CN(s)$  with oxygen was carried out in a bomb calorimeter and  $\Delta U$  was found to be  $-742.7 kJ mol^{-1}$  at 298 K. Calculate the enthalpy change for the reaction at 298 K.

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9. Calculate the number of kJ of heat necessary to raise the temperature of 60 g of aluminium from  $35^{\circ}\text{C}$  to  $55^{\circ}\text{C}$ . Molar heat capacity of Al is  $24\text{ J mol}^{-1}\text{K}^{-1}$ .

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10. Calculate the enthalpy change on freezing of  $1.0\text{ mol}$  of water at  $10.0^{\circ}\text{C}$  to ice at  $-10.0^{\circ}\text{C}$ .  $\Delta_{fus}H = 6.03\text{ kJ mol}^{-1}$  at  $0^{\circ}\text{C}$ .

$$C_p[\text{H}_2\text{O}(l)] = 75.3\text{ J mol}^{-1}\text{K}^{-1}$$

$$C_p[\text{H}_2\text{O}(s)] = 36.8\text{ J mol}^{-1}\text{K}^{-1}$$

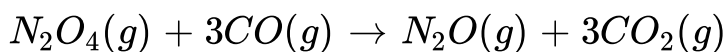
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11. Enthalpy of combustion of C to  $CO_2$  is  $-393.5 \text{ kJ mol}^{-1}$ .

Calculate the heat released upon formation of 35.2 g of  $CO_2$  from carbon and oxygen gas.

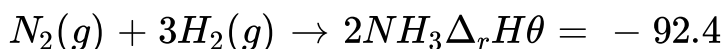
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12. Enthalpies of formation of  $CO(g)$ ,  $CO_2(g)$ ,  $N_2O(g)$  and  $N_2O_4(g)$  are  $-110$ ,  $-393.81$  and  $9.7 \text{ kJ mol}^{-1}$  respectively. Find the value of  $\Delta_r H$  from the reaction



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13. Given that

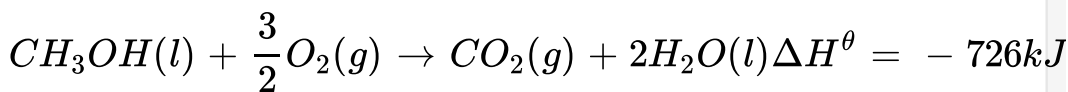


What is the standard enthalpy of formation of  $NH_3$  gas?

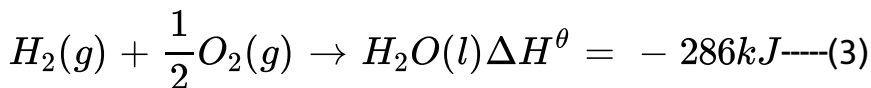
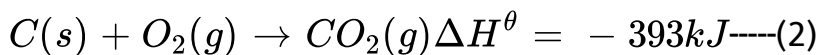
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14. Calculate the standard enthalpy of formation of  $CH_3OH$

(l) from the following data



----(1)



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15. Calculate the enthalpy change for the process ' $CCl_4(g)$

rarr  $C(g) + 4 Cl(g)$ ' and calculate bond enthalpy of 'C-Cl' in

' $CCl_4(g)$ '



'Delta\_(vap) H^0 (C C l\_4)=30.5 kJ mol ^(-1)' 'Delta\_f H^0(C C l\_4)=(-1)35.5 kJ mol^(-1)'

'Delta\_n H^0(C)=715.0 kJ mol^(-1)', where 'Delta\_n H^0' is enthalpy of atomisation, 'Delta\_n H^ (Cl\_2)=242 kJ mol^(-1)'

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

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17. For the reaction  $2A+B \rightarrow C$  at 298 K,  $\Delta H = 400kJmol^{-1}$  and  $\Delta S = 0.2kJk^{-1}mol^{-1}$ . At what temperature will be reaction become spontaneous considering  $\Delta H$  and  $\Delta S$  to be constant over the temperature range.

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18. For the reaction,  $2\text{Cl}(g) \rightarrow \text{Cl}_2(g)$  what are the signs of  $\Delta H$  and  $\Delta S$ ?

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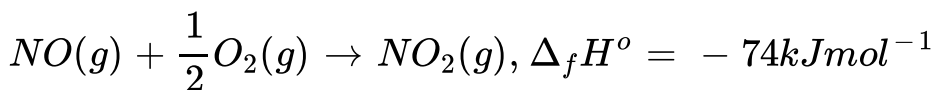
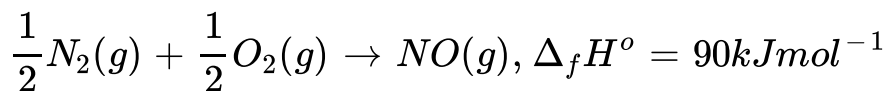
19. For the reaction  $2\text{A}(g)+\text{B}(g) \rightarrow 2\text{D}(g)$ ,  $\Delta U^\theta=-10.5 \text{ kJ}$  and  $\Delta S^\theta = -44.1 \text{ Jk}^{-1}$  Calculate  $\Delta G^\theta$  for the reaction and predict whether the reaction may occur spontaneously.

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20. The equilibrium constant for a reaction is 10. What will be the value of  $\Delta G^\theta$  at 300 K

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**21.** Comment on the thermodynamic stability of  $\text{NO}(g)$  and  $\text{NO}_2(g)$  given :

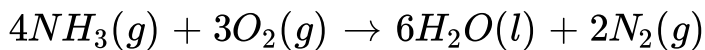


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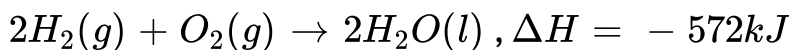
**22.** Calculate the entropy change in surrounding when 1.0 mol of  $\text{H}_2\text{O}(l)$  is formed under standard conditions. Given  $\Delta_f H^\circ = -286\text{kJmol}^{-1}$ .

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**23.** The following thermochemical equations represent combustion of ammonia and hydrogen:



$$\Delta H = -1516kJ$$



Calculate enthalpy of formation of ammonia.

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**24.** Acetic acid and hydrochloric acid react with KOH solution.

The enthalpy of neutralization of acetic acid is  $-55.8kJmol^{-1}$  while that of hydrochloric acid is  $-57.3kJ' mol^{-1}$ . Why?

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25. Take a specific example to show that  $\Delta S(\text{total})$  is a criterion for spontaneity of a change.



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26. What is meant by entropy driven reaction?



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27. Give reason for the following: It is preferable to determine a change in enthalpy than change in internal energy.



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28. Ice is lighter than water, but entropy of ice is less than that of water. Explain.

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29. Construct a reaction between carboxy haemoglobin with oxygen from the following equations.

Haemoglobin +  $O_2$  (aq)  $\rightarrow$  Oxyhaemoglobin,

$$\Delta H_1 = -23.1k \frac{J}{m} ol \rightarrow (1)$$

Haemoglobin +  $CO$  (aq)  $\rightarrow$  Carboxyhaemoglobin,  $\Delta$

$$H_2 = , -32.4k \frac{J}{m} ol \rightarrow (2)$$

a. Using the value of  $\Delta$  from your equation, account for the extreme toxicity of carbon monoxide.

b. What are the sources of carbon monoxide in the

atmosphere. How can you rectify the adverse effects of  $CO$  in atmosphere?

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**30.** A twisted angle of a wrenched knee requires immediate first aid. Temperature must be lowered -to shrink, the broken blood vessels around the sprain and minimize the internal bleeding. Athlete uses a "cold pack" for this purpose. It is a plastic bag containing solid ammonium nitrate that is separated from water. When bag is squeezed the partition between ammonium nitrate and water is broken. Now analyse the situation and' why it is used as a 'cold pack'?

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**31.** Why some reactions are exothermic while some others are endothermic?

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**32.** In the following changes, state whether order has increased or decreased and consequently the direction of change of entropy of the system?

i) Steam  $\rightarrow$  water

ii)  $H_2O(l) \rightarrow H_2O(s)$

iii) Normal egg  $\rightarrow$  hard boiled egg.

iv) Dry ice (solid carbon dioxide)  $\rightarrow CO_2(g)$ .

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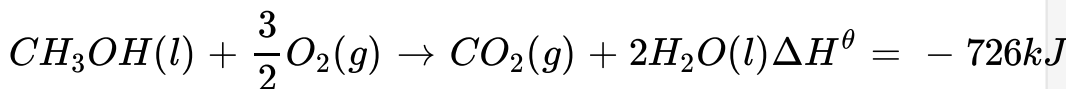
**33.** Select the odd one out from the following sets?

- i) Temperature, pressure, mass, density (Intensive property)
- ii) Human body, Earth, Water in a closer vessel (types of system)
- iii) Internal energy, work, enthalpy, entropy (State function)

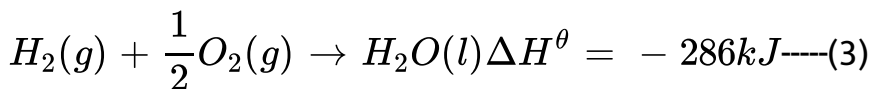
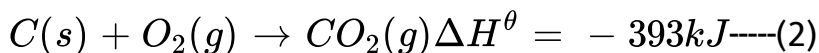
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**34.** Calculate the standard enthalpy of formation of  $CH_3OH$

(l) from the following data



----(1)



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**35.** Why most of the exothermic processes (reactions) are spontaneous?

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**36.** Which of following are open, close or nearly isolated systems? i) Human beings, ii). the earth. iii) can of tomato soup iv) ice cube tray filled with water v) coffee in'a thermoflask vi) helium-filled balloon. .

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**37.** Which of the following are state functions?

a. Height of a hill.

b. Distance travelled in climbing the hill.



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**38.** What kind of system, is the coffee held in a cup?



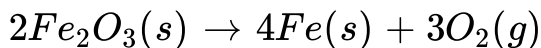
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**39.** The standard' enthalpy'of formation of diamond is not taken as zero, whereas that for graphite is take as zero. Give reason.



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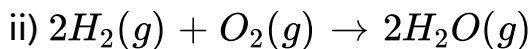
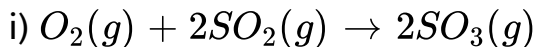
40. The enthalpy change for the reaction is  $1650\text{kJ}$ .



What is the enthalpy of formation of  $\text{Fe}_2\text{O}_3(s)$  .

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41. Predict the sign of entropy change in the following reactions.



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42. Justify the following statements: b. The entropy of a substance increases on going from liquid to vapour state at

any temperature:



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**43.** Under what conditions will the reaction occur, if

i) both ' $\Delta H$ ' and ' $\Delta S$ ' are positive

ii) both ' $\Delta H$ ' and ' $\Delta S$ ' are negative



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**44.** Match the following:

'(##VPU\_HSS\_CHE\_XI\_C06\_E02\_024\_Q01##)'



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45. Is the bond energy of the two OH bonds in water molecule equal why? How is the O-H bond energy of water reported?

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46. Thermodynamics deals with macroscopic properties.

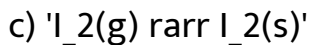
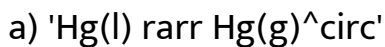
a) What is the difference between extensive and intensive properties?

b) Classify the following properties into extensive and intensive.

Pressure, Mass, Volume, Temperature, Density, Heat capacity, Viscosity, Surface tension, Internal energy, Molar heat capacity, Refractive index, Enthalpy, Specific heat capacity.

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**47.** Predict the sign of entropy change for each of the following changes of state



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**48.** Predict the entropy change (positive/negative) in the following:

i) A liquid substance crystallizes into a solid.

ii) Temperature of a crystal is increased.

iii) ' $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{O}_2(\text{g})$ '

iv) ' $\text{N}_2(\text{g})(1 \text{ atm}) \rightarrow \text{N}_2(\text{g})(0.5 \text{ atm})$ '



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**49.** State first law of Thermodynamics. Heat ( $q$ ) and work done ( $w$ ) individually are not state functions but their sum is always a state function. Explain. Why?



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**50.** For the process to occur under adiabatic conditions, the correct condition is:

i) ' $\Delta T=0$ '

ii) ' $\Delta p=0$ '



iii)  $q=0$

iv)  $w=0$

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**51.** An exothermic reaction is  $X \rightleftharpoons Y$  is spontaneous in the back direction. What is the sign of  $\Delta G$  for the forward direction?

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**52.** A gas absorbs 120 J of heat and expands against the external pressure of 1.10 atm from a volume of 0.5 L to 2.0 L. What is the change in internal energy. (1 L atm = 101.3 J)

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**53.** The heat of combustion of methane at constant volume measured in a bomb calorimeter at 298K is found to be  $-885389 \text{ J mol}^{-1}$ , Calculate the value of heat of combustion at constant pressure.



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**54.** Calculate the enthalpy change on freezing of '1.0 mol' of water at ' $10.0^\circ \text{C}$ ' to ice at ' $-10.0^\circ \text{C}$ '.  $\Delta_{\text{fus}} H = 6.03 \text{ kJ mol}^{-1}$  at ' $0^\circ \text{C}$ '.

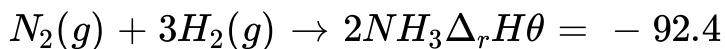
$$C_p[\text{H}_2\text{O}(l)] = 75.3 \text{ J mol}^{-1} \text{ K}^{-1}$$

$$C_p[\text{H}_2\text{O}(s)] = 36.8 \text{ J mol}^{-1} \text{ K}^{-1}$$



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55. Given that



What is the standard enthalpy of formation of  $NH_3$  gas?

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56. The enthalpies of combustion of ' $CH_4$ ' and ' $C_6H_6$ ' are '-890.3' and '-1559.7  $\text{kJmol}^{-1}$ ' respectively. Which of the two has greater efficiency of fuel per gram?

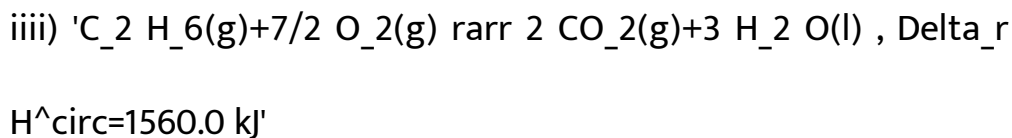
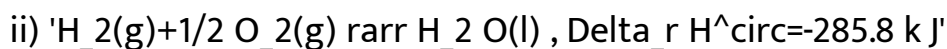
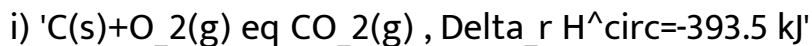
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57. When '1 g' of liquid naphthalene ' $(C_{10}H_8)$ ' solidifies, '149 J' of heat is evolved. Calculate the heat of fusion of naphthalene.



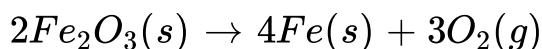
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**58.** Calculate the enthalpy of formation of ethane from the following data:



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**59.** The enthalpy change for the reaction is  $1650 \text{ kJ}$ .



What is the enthalpy of formation of  $\text{Fe}_2\text{O}_3(s)$ .



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**60.** Calculate the entropy change in surrounding when 1.0 mol of  $H_2O(l)$  is formed under standard conditions. Given  $\Delta_f H^\circ = -286 \text{ kJ mol}^{-1}$ .

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**61.** For the melting of ice at  $25^\circ \text{C}$  :



the enthalpy of fusion is  $6.97 \text{ kJ mol}^{-1}$ , and entropy of fusion is  $25.4 \text{ J mol}^{-1} \text{ K}^{-1}$ . Calculate the free energy change and predict whether melting of ice is spontaneous or not at this temperature.

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**62.** The equilibrium constant for a reaction is 10. What will be the value of  $\Delta G^\theta$  at 300 K

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**63.** The enthalpy change for the conversion of liquid water to steam is '40.8 k J' at '100<sup>°</sup> C'. Calculate 'Delta S' for the process.

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**64.** Calculate the change in the internal energy of a system which absorbs '500 J' of heat, and does work equivalent to '200 J' on the surroundings.

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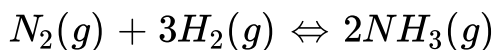
**65.** Ethanol boils at  $78.4^{\circ}\text{C}$ . The enthalpy of vaporisation of ethanol is  $42.4\text{ kJ mol}^{-1}$ . Calculate the entropy of vaporisation of ethanol.

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**66.** The following data are available for the melting of  $\text{KCl}$ .  $\Delta_{\text{fus}} H = 7.25\text{ kJ mol}^{-1}$  and  $\Delta_{\text{fus}} S = 0.007\text{ kJ K}^{-1}\text{ mol}^{-1}$ . Calculate the melting point of  $\text{KCl}$ .

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**67.** For reaction,



which of the following is valid?  $\Delta H = \Delta U$ ,  $\Delta H > \Delta U$ ,

$\Delta H < \Delta U$ , None of the above

A.  $\Delta H = \Delta U$

B.  $\Delta H > \Delta U$

C.  $\Delta H < \Delta U$

D. None of the above

**Answer: C**



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**68.** Which of the following represents the first law of thermodynamics? (1)  $\Delta U = q + w$  (2)  $\Delta H = q + W$ , (3)  $\Delta U = H + p\Delta V$  (4)

$\Delta U = p\Delta V$



A.  $q = \Delta U - W'$

B.  $\Delta H = q + W'$

C.  $\Delta U = \Delta H + p \Delta V'$

D.  $\Delta U = p \Delta V'$

**Answer: A**



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**69.** The heat of solution depends upon : nature of solute, nature of solvent, concentration of solution, all the above

A. nature of solute

B. nature of solvent

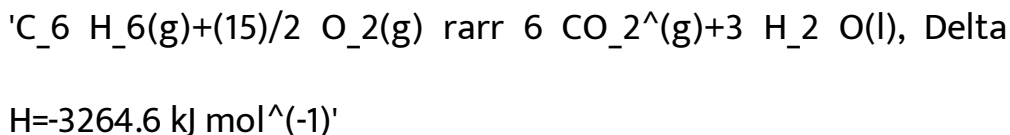
C. concentration of solution

D. all the above

**Answer: D**

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**70.** The heat evolved in the combustion of benzene is given by the equation:



The heat energy change when '39 g' of ' $\text{C}_6\text{H}_6$ ' are burnt in an open container will be:

A. '+816.15 kJ mol<sup>-1</sup>'

B. +1632.3 kJ mol<sup>-1</sup>'

C. (-1)632.2 kJ mol<sup>-1</sup>'

D. '-2448.45 kJ mol<sup>(-1)</sup>'

**Answer: C**



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**71.** Which of the following equations represents enthalpy of formation of 'H<sub>2</sub>O' ?

A.  $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$ ,  $\Delta H = -ve$

B.  $2\text{H}_2\text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$ ,  $\Delta H = +ve$

C.  $\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$ ,  $\Delta H = +ve$

D.  $2\text{H}_2\text{O}(\text{g}) \rightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$ ,  $\Delta H = +ve$

**Answer: C**



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72. The enthalpy of neutralisation of 'NaOH' with 'HCl' is '57.1 kJ' while with 'CH<sub>3</sub>COOH', it is '-55 kJ' This happens because

- A. acetic acid is an organic acid
- B. acetic acid is little soluble in water
- C. acetic acid is a weak acid and requires lesser sodium hydroxide for neutralisation
- D. some heat, is required to ionise acetic acid completely

**Answer: D**



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73. Calorific values of food and fuel are determined by :

- A. Bunsen's calorimeter
- B. Bomb calorimeter
- C. Backmann's thermomètre
- D. None of these

**Answer: B**



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74. Enthalpy of a reaction is given as:

- A.  $H=U+p V'$
- B.  $H=U-p V'$
- C.  $\Delta H=\Delta U+p \Delta V'$
- D.  $\Delta H=\Delta U-p \Delta V'$

**Answer: A**



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**75.** The heat of neutralisation of a strong acid by a strong base :

A. is nearly '57.1 kJ'

B. is greater than '57.1 kJ'

C. is less than '57.1 kJ'

D. depends upon the nature of the acid and base

**Answer: A**



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76. The heat content of 'Y' is greater than that of 'X', the reaction  $X \rightarrow Y$  is :

- A. spontaneous
- B. exothermic
- C. endothermic
- D. instantaneous

**Answer: C**



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77. The heat change for the reaction :

$C(s) + 2S(s) \rightarrow CS_2(l)$  is '102.4 kJ.' It represents

- A. heat of formation

B. heat of combustion

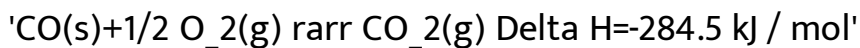
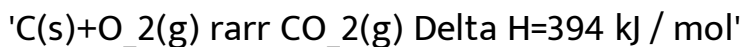
C. heat of solution

D. heat of fusion

**Answer: A**

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**78.** The equations representing the combustion of carbon and carbon monoxide are:



the heat of formation of 1 mol of 'CO(g)' is

A. '-109.5 kJ / mol'

B. '+109.5 kJ / mol'



C. '+180.0 kJ / mol'

D. +100 kJ / mol'

**Answer: A**

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**79.** Delta H' for the the combustion of a compound is :

A. positive

B. zero

C. negative

D. may be positive or negative

**Answer: C**

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80. Molar heat capacity of ethanol is  $110.4JK$ . Its specific heat capacity is:- 2.4, 55.2,  $5.078KJ$ , 110.4

A. 2.4

B. 55.2

C. 5.078KJ

D. 110.4

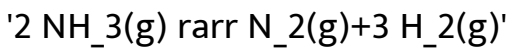
**Answer: A**



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81. Enthalpy of formation of ammonia is  $-46.0 kJ mol^{-1}$ .

The enthalpy change for the reaction:



- A.  $46.0 \text{ kJ mol}^{-1}$
- B.  $-23.0 \text{ kJ mol}^{-1}$
- C.  $+92.0 \text{ kJ mol}^{-1}$
- D.  $-92.0 \text{ kJ mol}^{-1}$

**Answer: C**



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**82.** For an ideal gas, ' $C_p$ ' and ' $C_v$ ' are related as

- A.  $C_p - C_v = R$
- B.  $(C_p)/(C_v)$
- C.  $C_p + C_v = R$

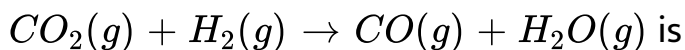
$$D. C_v - C_p = R'$$

Answer: A



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83. The  $\Delta_r H^0$  for  $CO_2(g)$ ,  $CO(g)$  and  $H_2O$  are  $-393.5$ ,  $-110.5$  and  $-241.8 kJ mol^{-1}$  respectively. The standard enthalpy change in (kJ) for the reaction:



A. 524.1

B. 41.2

C. -262.5

D. -41.2

**Answer: B**



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**84.** Equal volumes of one molar 'HCl' and ' $H_2SO_4$ ' are neutralised (separately) by dilute NaOH solution and 'x' kcal and 'y' kcal of heats are liberated. Which of the following is true?

A.  $x=y$

B.  $x=0.5y$

C.  $x=1/(2y)$

D. None

**Answer: B**



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85. If the dissociation energies of ' $\text{CH}_4$ ' and ' $\text{C}_2\text{H}_6$ ' are 360 and '620 kcal/ mol' respectively, then the bond energy of 'C -C' bond is

- A. 80KCal
- B. 180KCal
- C. 980KCal
- D. 90KCal

**Answer: D**



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86. Standard molar enthalpy of formation of ' $\text{CO}_2$ ', is equal to

A. Zero

B. standard molar enthalpy of combustion

C. the sum of standard molar enthalpies of formation of  
'CO' and 'O<sub>2</sub>'

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

**Answer: D**



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**87.** The enthalpy change in freezing 1g of water ( $\Delta_{fusion}H = 6.0 \text{ kJ mol}^{-1}$ ) will be:-  $-6000.0 \text{ J}$ ,  $-333 \text{ J}$ ,  $333.33 \text{ J}$ ,  $60.0 \text{ J}$

A.  $-6000.0 \text{ J}$

B. - 333 J'

C. 333.33J' '

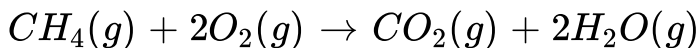
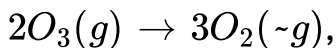
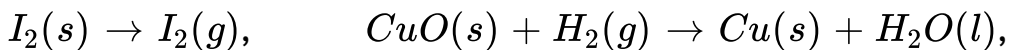
D. 60.0 J'

**Answer: D**



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**88.** For which of the reactions,  $\Delta S$  is not positive :



A.  $I_2(s) \rightarrow I_2(g)$ '

B.  $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(l)$ '





**Answer: B**

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**89.** In which of the following cases, reaction is spontaneous at all temperatures? (a)  $\Delta H > 0, \Delta S > 0$  (b)  $\Delta H < 0, \Delta S > 0$  (c)  $\Delta H < 0, \Delta S < 0$  (d)  $\Delta H < 0, \Delta S = 0$

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

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

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

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

**Answer: B**



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**90.** When a solid melts, there is:

- A. no increase in enthalpy.
- B. increase in enthalpy
- C. decrease in enthalpy
- D. decrease in entropy

**Answer: B**



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91. The relation ' $\Delta G = \Delta H - T \Delta S$ ' was given by

A. Boltzman

B. Faraday

C. Gibbs'Helmholtz

D. Thomson

**Answer: C**



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92. If equilibrium constant for a reaction is 'K', then standard free energy change is :

A. ' $\Delta G^{\circ} = -RT \log K$ '

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

C.  $(\Delta G^{\circ})/(RT) = -\log K'$

D.  $(\Delta G^{\circ})/(RT) = -2.303 \log K'$

**Answer: D**



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**93.** In a reversible process the total change in entropy is  $\Delta S$  (universe) is

A.  $\Delta S = Tq_{\text{rev}}$

B.  $\Delta S = (\Delta H)/T$

C.  $\Delta S = (q_{\text{rev}})/T$

D.  $\Delta S + TDH$

**Answer: C**



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**94.** Free energy,  $G$  may be defined as: (a) $G=U-T$  (b) $G=U+TS$   
(c) $G=H-TS$  (d) $G=U+H-TS$

A.  $G=U-T'$

B.  $G=U+TS'$

C.  $G=H-TS'$

D.  $G=U+H-TS'$

**Answer: C**



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95. The spontaneity of a process is expressed in terms of a change in Gibbs energy.

- a) What is meant by a change in Gibbs energy of a system?
- b) How is it related to the enthalpy and entropy of a system?
- c) How is it useful in predicting the feasibility of a process?

A.  $\Delta G = \Delta H - T \Delta S'$

B.  $\Delta G = T \Delta S - \Delta H'$

C.  $\Delta G^{\circ} = (\Delta H - \Delta S) / T'$

D.  $\Delta G = \Delta H + T \Delta S'$

**Answer: A**



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