



## CHEMISTRY

### BOOKS - KUMAR PRAKASHAN KENDRA CHEMISTRY (GUJRATI ENGLISH)

## THERMODYNAMICS

#### Section A Questions 6 1 Thermodynamic Terms

1. Explain the difference between the system and surrounding.

 [Watch Video Solution](#)

2. What is system ? Explain types of system.

 [Watch Video Solution](#)

3. Explain the internal energy as a state function.



[View Text Solution](#)

4. Explain a change in internal energy on the base of work.



[View Text Solution](#)

## Section A Questions 6 2 Applications

1. Explain mechanical work.

OR

Explain pressure volume work.



[View Text Solution](#)

2. Explain free expansion.



 [View Text Solution](#)

3. Which of the following is correct for free expansion of ideal gas under isothermal condition :-

 [Watch Video Solution](#)

4. Explain : Enthalpy : state function. OR  $\Delta H = q_p$  Or Prove : "The change in enthalpy of the system in which chemical reaction occurs is equal to value of heat gain by system."

 [View Text Solution](#)

5. Explain the relation of change in heat at constant pressure and constant temperature.

 [View Text Solution](#)

6. Explain extensive property and intensive property.

 [Watch Video Solution](#)

7. Explain Heat Capacity.

 [View Text Solution](#)

8. Prove the relationship between  $C_p$  and  $C_v$  for an ideal gas.

 [View Text Solution](#)

## Section A Questions 6.3 Measurement of $\Delta U$ and $\Delta H$ Calorimetry

1. Explain the measurement of  $\Delta U$  and  $\Delta H$  by calorimetry.

 [View Text Solution](#)

2. Explain the measurement of  $\Delta U$  calorimetry

 [View Text Solution](#)

3. Explain the measurement of  $\Delta H$  calorimetry

 [View Text Solution](#)

## Section A Questions 6 4 Enthalpy Change $\Delta_r H$ Of Reaction Reaction Enthalpy

1. Explain change in enthalpy related to reaction.

 [View Text Solution](#)

2. Explain the standard enthalpy of reactions.

 [View Text Solution](#)

3. Explain enthalpy changes during phase transformations.

 [View Text Solution](#)

4. Explain standard enthalpy of formation

 [View Text Solution](#)

5. Thermochemical equations.

 [View Text Solution](#)

6. Prove Hess's law of constant heat summation.

 [View Text Solution](#)

1. Explain the standard enthalpy of combustion  $\Delta_c H^\ominus$ .

 [View Text Solution](#)

2. Explain Enthalpy of atomization ( $\Delta_a H^\ominus$ ).

 [View Text Solution](#)

3. Write the notes on diatomic molecules and polyatomic molecules.

OR

Explain the bond enthalpy.

 [View Text Solution](#)

4. Explain Enthalpy of Solution ( $\Delta_{\text{sol}} H^\ominus$ ).

 [View Text Solution](#)

5. Explain the Born-Haber Cycle.

OR

Lattice Enthalpy.



[View Text Solution](#)

6. Explain the enthalpy of dilution.



[View Text Solution](#)

## Section A Questions 6 6 Spontaneity

1. Explain entropy and spontaneity of reactions.

OR

Explain entropy and spontaneity.



[View Text Solution](#)



2. What is entropy ? Explain its spontaneity.

 [Watch Video Solution](#)

3. Describe Gibbs energy and spontaneity.

 [View Text Solution](#)

4. Describe the absolute entropy and third law of thermodynamics.

 [View Text Solution](#)

## Section A Questions 6 7 Gibbs Energy Change And Equilibrium

1. Describe about Gibbs energy change and equilibrium.

 [View Text Solution](#)

1. Express the change in internal energy of a system when

(i) No heat is absorbed by the system from the surroundings, but work ( $w$ ) is done on the system. What type of wall does the system have ?

(ii) No work is done on the system, but  $q$  amount of heat is taken out from the system and given to the surroundings. What type of wall does the system have?.

(iii)  $w$  amount of work is done by the system and  $q$  amount of heat is supplied to the system. What type of system would it be ?



[Watch Video Solution](#)

2. 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 ?



[Watch Video Solution](#)

3. Two liters of an ideal gas at a pressure of 10 atm. expands isothermally into a vacuum until its total volume is 10 liters. How much heat is absorbed and how much work is done in the expansion ?

 [View Text Solution](#)

4. Consider the same expansion, but this time against a constant external pressure of 1 atm.

 [View Text Solution](#)

5. Consider the same expansion, to a final volume of 10 liters conducted reversibly.

 [View Text Solution](#)

6. If water vapour is assumed to be a perfect gas, molar enthalpy change for vapourisation of 1 mol of water at 1 bar and 100°C is  $41 \text{ kJ mol}^{-1}$ .

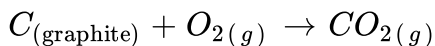
Calculate the internal energy change, when

(i) 1 mol of water is vaporised at 1 bar pressure and 100°C.

(ii) 1 mol of water is converted into ice.

 [Watch Video Solution](#)

7.1 g of graphite is burnt in a bomb calorimeter in excess of oxygen at 298 K and 1 atmospheric pressure according to the equation



During the reaction, temperature rises from 298 K to 299 K. If the heat capacity of the bomb calorimeter is 20.7 kJ/K, what is the enthalpy change for the above reaction at 298 K and 1 atm ?

 [View Text Solution](#)

8. Calculate the number of kJ of heat necessary to raise the temperature of 60.0 g of aluminium from 35°C to 55°C. Molar heat capacity of Al is 24 J mol<sup>-1</sup>K<sup>-1</sup>

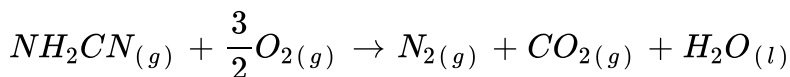
 [View Text Solution](#)

9. A swimmer coming out from a pool is covered with a film of water weighing about 18g. How much heat must be supplied to evaporate this water at 298 K ? Calculate the internal energy of vaporization at 100°C.

$$\Delta_{\text{vap}}H^{\ominus} \text{ for water at } 373 \text{ K} = 40.66 \text{ kJ mol}^{-1}$$

[View Text Solution](#)

10. The reaction of cyanamide,  $\text{NH}_2\text{CN}_{(s)}$ , with dioxygen was carried out in a bomb calorimeter, and  $\Delta U$  was found to be  $-742.7 \text{ kJ mol}^{-1}$  at 298 K. Calculate enthalpy change for the reaction at 298 K.

[View Text Solution](#)

11. The combustion of one mole of benzene takes place at 298 K and 1 atm. After combustion,  $\text{CO}_{2(g)}$  and  $\text{H}_2\text{O}_{(l)}$  are produced and 3267.0 kJ

of heat is liberated. Calculate the standard enthalpy of formation,  $\Delta_f H^\ominus$  of benzene. Standard enthalpies of formation of  $CO_2(g)$  and  $H_2O(l)$  are  $-393.5 \text{ kJ mol}^{-1}$  and  $-285.83 \text{ kJ mol}^{-1}$  respectively.

 [View Text Solution](#)

12. Calculate the enthalpy change on freezing of 1.0 mol of water at  $10.0^\circ\text{C}$  to ice at  $-10.0^\circ\text{C}$ .

$$\Delta_{\text{fus}} H = 6.03 \text{ kJ mol}^{-1} \text{ at } 0^\circ \text{C}$$

$$C_p [H_2O(l)] = 75.3 \text{ J mol}^{-1} \text{K}$$

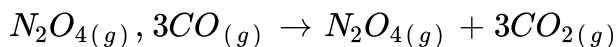
$$C_p [H_2O(s)] = 36.8 \text{ J mol}^{-1} \text{K}$$

 [View Text Solution](#)

13. Enthalpy of combustion of carbon 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 dioxygen gas.

 [View Text Solution](#)

14. Enthalpies of formation of  $CO_{(g)}$ ,  $CO_{2(g)}$ ,  $N_2O_{(g)}$  and  $N_2O_{4(g)}$  are  $-100$ ,  $-393$ ,  $81$  and  $9.7$   $\text{kJ mol}^{-1}$  respectively. Find the value of  $\Delta_r H$  for the reaction :



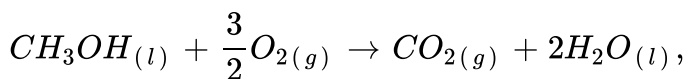
 [View Text Solution](#)

15. Given  $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ ,  $\Delta_r H^\circ = -92.4 \text{ kJ mol}^{-1}$

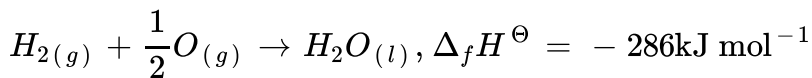
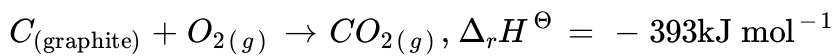
What is the standard enthalpy of formation of  $NH_3$  gas ?

 [View Text Solution](#)

16. Calculate the standard enthalpy of formation of  $CH_3OH_{(l)}$  from the following data :

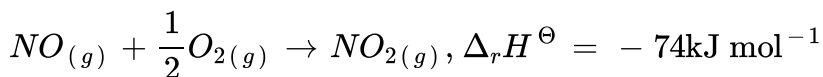
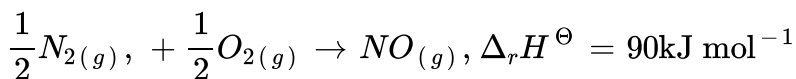


$$\Delta_r H^\ominus = -726 \text{ kJ mol}^{-1}$$



 [View Text Solution](#)

17. Comment on the thermodynamic stability of  $NO_{(g)}$ , given:

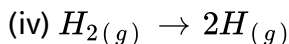


 [Watch Video Solution](#)

18. Predict in which of the following, entropy increases/decreases:

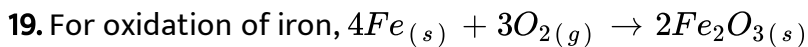
(i) A liquid crystallizes into a solid.

(ii) Temperature of a crystalline solid is raised from 0 K to 115 K.



 [View Text Solution](#)





entropy change is  $-549.4 \text{ J K}^{-1} \text{ mol}^{-1}$  at 298 K. In spite of negative entropy change of this reaction, why is the reaction spontaneous ?

$\Delta_r H^\ominus$  for this reaction is  $1648 \times 10^3 \text{ J mol}^{-1}$

 [Watch Video Solution](#)

20. Calculate the enthalpy change for the process

$CCl_4(g) + C(g) + 4CI(g)$  and calculate bond enthalpy of  $C - CI$  in

$CCl_4(g)$

$$\Delta_{\text{vap}} H^\ominus (CCl_4) = 30.5 \text{ kJ mol}^{-1}$$

$$\Delta_f H^\ominus (CCl_4) = -135.5 \text{ kJ mol}^{-1}$$

$$\Delta_a H^\ominus (C) = 715.0 \text{ kJ mol}^{-1}$$

where  $\Delta_a H^\ominus$  is enthalpy of atomisation  $\Delta_a H^\ominus (CI_2) = 242 \text{ kJ mol}^{-1}$

 [View Text Solution](#)

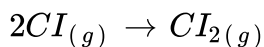
21. For an isolated system,  $\Delta U = 0$ , what will be  $\Delta S$ ?

 [Watch Video Solution](#)

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

 [Watch Video Solution](#)

23. For the reaction



What are the sign of  $\Delta H$  and  $\Delta S$  ?

 [Watch Video Solution](#)

24. Calculate the entropy change in surroundings when 1.00 mol of  
 $\text{H}_2\text{O}_{(l)}$  is formed under standard conditions.  
 $\Delta_f H^\ominus = -286\text{kJ mol}^{-1}$ .



Watch Video Solution

25. Calculate  $\Delta G^\ominus$  for conversion of oxygen to ozone,  $\frac{3}{2}O_{2(g)} \rightarrow O_{3(g)}$  at 298K. If  $K_p$  for this conversion is  $2.47 \times 10^{-29}$ .



Watch Video Solution

26. Find out the value of equilibrium constant for the following reaction at 298 K.



Standard Gibbs energy change,  $\Delta_r G^\ominus$  at the given temperature is  $-13.6 \text{ kJ mol}^{-1}$ .



Watch Video Solution

27. At 60°C, dinitrogen tetroxide is fifty percent dissociated. Calculate the standard free energy change at this temperature and at one atmosphere.



Watch Video Solution

 [View Text Solution](#)

28. For the reaction  $2A_{(g)} + B_{(g)} \rightarrow 2D_{(g)}$

$\Delta U^\ominus = -10.5\text{kJ}$  and  $S^\ominus = -44.1\text{JK}^{-1}$  Calculate  $\Delta G^\ominus$  for the reaction, and predict whether the reaction may occur spontaneously.

 [View Text Solution](#)

29. The equilibrium constant for a reaction is 10. What will be the value of

$\Delta G^\ominus$  ?  $R = 8.314\text{JK}^{-1}\text{mol}^{-1}$ ,  $T = 300\text{K}$

 [Watch Video Solution](#)

## Section A Try Your Self 1

1. A system receives 224 Joule heat and does work of 156 Joule. Calculate the change in internal energy.

 [Watch Video Solution](#)

2. A system receives 100 calory heat at that time 50 calory work is done by system. Calculate the change in internal energy.

 [Watch Video Solution](#)

## Section A Try Your Self 2

1. At the one bar pressure the volume of gas is 0.6 litre. If the gas receives 122 Joule of heat at 1 atmosphere pressure, the volume become . 2 liter the calculate its internal energy. (1 litre bar = 101.32 Joule)

 [View Text Solution](#)

2. Volume of 100 liter gas increases to 120 liter at constant temperature and 10 bar external pressure. Calculate the work done by the system [1 liter bar = 24.21 calory ]

 [Watch Video Solution](#)

3. At 1 bar pressure a gas having volume 0.6 lit. If this gas gained 122 Joule heat at 1 bar pressure its volume become 2 lit. Then calculate the its internal heat change. [1 lit. bar= 101.32 Joule]

 [View Text Solution](#)

4. The heat associated with combustion of liquid benzene, at constant volume is  $-3268 \text{ kilo Joule/mole}^{-1}$  calculate the change in enthalpy, when this reaction occurs at 300 K, temperature ( $R=8.314 \text{ Joule}$ )

 [View Text Solution](#)

### Section A Try Your Self 3

1. 20 calory heat is needed to increase the temperature from  $25^{\circ}\text{C}$  to  $30^{\circ}\text{C}$  of Al metal piece having 15 gram weight. Final the heat capacity, specific

heat capacity and molar heat capacity for the Al piece. (Al = 27 gram/mole)

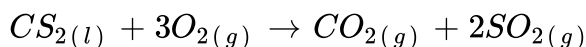
 [View Text Solution](#)

## Section A Try Your Self 4

1. Find the difference between the values of  $\Delta H$  and  $\Delta U$  for the combustion n - octane at 25°C.

 [View Text Solution](#)

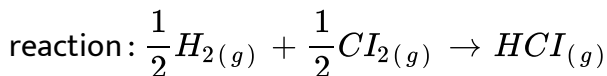
2. If the ratio of enthalpy of formation of  $CO_2$  and  $SO_2$  is 4:3 and enthalpy of formation of  $CS_2$  is 26 K.cal/mol. Find the enthalpy of formation of  $SO_{2(g)}$  on the basis of above reaction



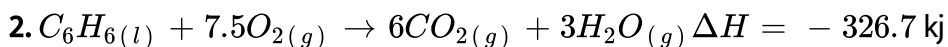
 [View Text Solution](#)

## Section A Try Your Self 5

1. The value of bond enthalpy of  $H_2$ ,  $Cl_2$  and  $HCl$  are 104, 58 and 103 kilojoule respectively. Then find the enthalpy of formation of  $HCl_{(g)}$ .



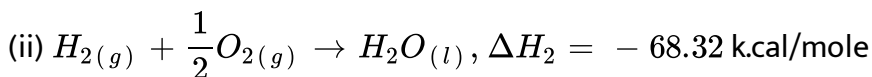
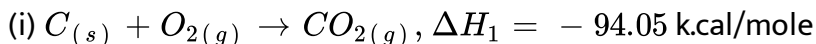
 [View Text Solution](#)



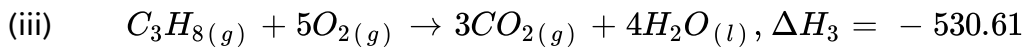
In this reaction, the standard enthalpy of formation of  $CO_2(g)$  and  $H_2O(g)$  are  $-393.5$  and  $-285.85$  kilojoule  $\text{mole}^{-1}$  respectively calculate the standard heat of formation of benzene.

 [View Text Solution](#)

3. Calculate the formation heat for propene from given equations.







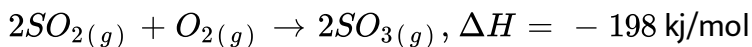
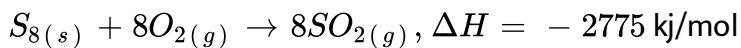
k.cal/mole

 [View Text Solution](#)

4. Formation heat of  $H_2O$  is  $-68$  k.cal/mole then, find the formation heat of  $OH^-$

 [View Text Solution](#)

5. Find the formation enthalpy of  $SO_3$  from the enthalpy of given reactions.



 [View Text Solution](#)

1. The enthalpy of vaporizations of benzene is 30. 779 KJ /mol. and its boiling point is 353 K. Find the change in entropy for the conversion of liquid benzene to its vapour at that temperature.

 [View Text Solution](#)

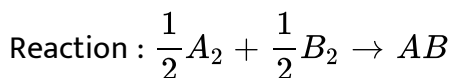
2. 3 moles of water is boiled at 373 K and is changed to vapour state having the same temperature. What will be the change in entropy of the system ? [The molecules heat of vaporizations of water is 40.668 KJ/mol]

 [View Text Solution](#)

3.  $\Delta U = -10.5$  KJ and  $\Delta S^\circ = -44.2$  J/Kelvin for the reaction  $2x_{(g)} + y_{(g)} \rightarrow 2z_{(g)}$  at 298 K temperature. Find the  $\Delta_f G^\circ$  for the reaction. Reaction will be spontaneous or not ? Why ?

 [View Text Solution](#)

4.  $AB$ ,  $A_2$  and  $B_2$  are diatomic molecule. Enthalpies of  $AB$ ,  $A_2$  and  $B_2$  are in the ratio of 1:1:0.5 the value. Enthalpy of formation of  $AB$ ,  $\Delta_f H = 100 \text{ kJ mol}^{-1}$ . Find the dissociation enthalpy of  $A_2$  ?



 [View Text Solution](#)

5. Will ice having temperature 273 K placed in a surrounding having temperature 298K will give water having temperature 273 K ? Prove this statement. The molecular enthalpy of fusing of ice is 6.025

 [View Text Solution](#)

6. Find the bond enthalpy of N - H bond in ammonia by using the change in enthalpy for the reaction given below.



Bond energy  $N \equiv N = 226$ ,  $H - H = 103 \text{ k.cal}$

 [View Text Solution](#)

## Section A Try Your Self 7

1. The equilibrium constant of the following given reaction is

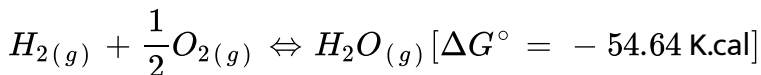
$K_p = 6.022 \times 10^{-5}$  at 298 K temperature.



Calculate the value of  $\Delta_f G^\ominus$ .

 [View Text Solution](#)

2. Find the equilibrium constant for below reaction at 25°

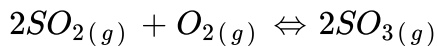


 [View Text Solution](#)

3. The equilibrium constant for the following reaction is

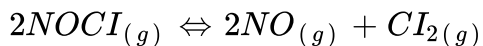
$K_p = 3.44 \times 10^{24}$  at 25° C. Calculate the value of  $\Delta G_f^\ominus(SO_2)$ . If the

value of  $\Delta G_f^\circ(SO_3)$  is  $-88.52$  Kcal/mol.



 [View Text Solution](#)

4. Find the equilibrium constant for below reaction at 298 K temperature.



$[\Delta H^\circ = 18.4512$  Kcal,  $\Delta S^\circ = 29.16$  Cal]

 [View Text Solution](#)

## Section B Objective Questions

1. What is system ? Explain types of system.

 [Watch Video Solution](#)

2. When will the total heat absorbed by system during the process is completely used up in work?

 [View Text Solution](#)

3. Calculate  $\Delta S$  for ice at 275 K temperature.

 [Watch Video Solution](#)

4. If  $\Delta H < T\Delta S$  at 298K temperature, what will be the value of equilibrium constant ?

 [View Text Solution](#)

5. What is free expansion ?

 [View Text Solution](#)

6. Which of the following is an extensive property?

 [Watch Video Solution](#)

7. What is calorimetry ?

 [View Text Solution](#)

8. When will  $\Delta H = \Delta u$  for chemical reaction?

 [View Text Solution](#)

9. What is heat capacity ?

 [Watch Video Solution](#)

10. Mention the equation of entropy change for the expansion of an ideal gas in vacuum.

 [View Text Solution](#)

11. Mention the limitations of second Law of thermodynamics.

 [Watch Video Solution](#)

12. Write the symbolic equation of first law of thermodynamics.

 [Watch Video Solution](#)

13. What is standard state ?

 [Watch Video Solution](#)



14. Mention the units of specific heat capacity and molar heat capacity.

 [View Text Solution](#)

15. Which functions are needed to understand the second law of thermodynamics ?

 [View Text Solution](#)

16. Write the mathematical formula for change in entropy.

 [View Text Solution](#)

17. What is molar enthalpy of vaporization ?

 [Watch Video Solution](#)

18. What is entropy ? Explain its spontaneity.

 [Watch Video Solution](#)

19. Mention the third law of thermodynamics.

 [Watch Video Solution](#)

20. State the criteria of  $\Delta G$  for spontaneity at constant temperature and pressure.

 [Watch Video Solution](#)

21. On which factors the enthalpy of dilution is depended?

 [Watch Video Solution](#)

22. Mention the characteristics of entropy.

 [View Text Solution](#)

23. Mention the relation between free energy change in entropy and change in enthalpy.

 [View Text Solution](#)

24. What is absolute entropy ?

 [Watch Video Solution](#)

25. Write the formula of relation between equilibrium constant  $K$  and  $\Delta G^\circ$ .

 [View Text Solution](#)

26. Calculate the value of  $\Delta G$  for the system of water in atmosphere having 100 K temperature.

 [View Text Solution](#)

27. State Hess's Law of constant heat summation.

 [Watch Video Solution](#)

28. Which law of thermodynamics is known as a definition of temperature ?

 [Watch Video Solution](#)

29. Entropy increases with the increase of temperature. Why ?

 [Watch Video Solution](#)

30. Give examples of specific heat capacity.



[View Text Solution](#)

## Section C Multiple Choice Questions Mcqs Mcqs From Textual Exercise

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

- A. used to determine heat changes.
- B. whose value is independent of path.
- C. used to determine pressure volume work.
- D. whose value depends on temperature only.

**Answer: B**



[Watch Video Solution](#)

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

A.  $\Delta T = 0$

B.  $\Delta p = 0$

C.  $q = 0$

D.  $w = 0$

**Answer: C**



[Watch Video Solution](#)

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

A. unity

B. zero

C.  $< 0$

D. different for each element

**Answer: B**

 [Watch Video Solution](#)

4.  $\Delta U^\circ$  of combustion of methane is  $-X \text{ kJ mol}^{-1}$ . The value of  $\Delta H^\circ$  is :-

A.  $= \Delta U^\circ$

B.  $> \Delta U^\circ$

C.  $< \Delta U^\circ$

D.  $= 0$

**Answer: C**

 [Watch Video Solution](#)

5. The enthalpy of combustion of methane, graphite and dihydrogen at 298 K are,  $-890.3 \text{ kJ mol}^{-1}$ ,  $-393.5 \text{ kJ mol}^{-1}$ , and  $-285.8 \text{ kJ mol}^{-1}$

respectively. Enthalpy of formation of  $CH_4(g)$  will be.....

- A.  $-74.8 \text{ kJ mol}^{-1}$
- B.  $-52.27 \text{ kJ mol}^{-1}$
- C.  $+74.8 \text{ kJ mol}^{-1}$
- D.  $+52.26 \text{ kJ mol}^{-1}$

**Answer: A**



[Watch Video Solution](#)

6. A reaction,  $A + B \rightarrow C + D + q$  is found to have a positive entropy change. The reaction will be

- A. possible at high temperature.
- B. possible only at low temperature.
- C. not possible at any temperature.
- D. possible at any temperature.



**Answer: D**

 [Watch Video Solution](#)

7. Water is bounded in liquid state because of .. ..... bond of water in liquid state.

A. van-der-Walls attraction force

B. H-bond

C. Ionic bond

D. Covalent bond

**Answer: B**

 [View Text Solution](#)

8. Enthalpy for the reaction  $C + O_2 \rightarrow CO_2$  is....

A.  $+ve$

B.  $-ve$

C. zero

D. none of above

**Answer: B**

 [Watch Video Solution](#)

9. Which equation from the following is right ?

A.  $\Delta U = q - w$

B.  $w = \Delta U + q$

C.  $\Delta U = w + q$

D. none of above

**Answer: C**

 [Watch Video Solution](#)

10. Change in heat at constant volume ( $q_v$ ) = .....

A.  $\Delta U$

B.  $\Delta H$

C.  $RT$

D.  $\Delta G$

**Answer: A**



[View Text Solution](#)

11. For isothermal process .....

A.  $q = 0$  and  $\Delta E = 0$

B.  $q \neq 0$  and  $\Delta E = 0$

C.  $q = 0$  and  $\Delta E \neq 0$

D.  $q \neq 0$  and  $\Delta E \neq 0$

**Answer: B**

 [View Text Solution](#)

12. For the reaction  $2Cl_{(g)} \rightarrow Cl_{2(g)}$ , the signs of  $\Delta H$  and  $\Delta S$  respectively are

A. +, -

B. +, +

C. -, -

D. -, +

**Answer: C**

 [Watch Video Solution](#)

13. If the enthalpy of water is 386 kJ, entropy of water is ..... .

A.  $0.5kJ$

B.  $1.3kJ$

C.  $1.5kJ$

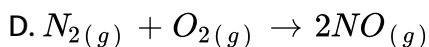
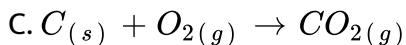
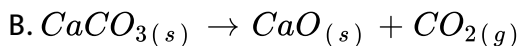
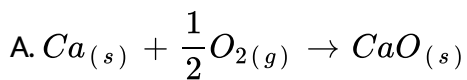
D.  $22.05kJ$

Answer: B



Watch Video Solution

14. Which of the following reaction has maximum  $\Delta S$  value?



**Answer: B**

 [View Text Solution](#)

15. Enthalpy of vaporization of water is 186.5 kJ/mol. What will be the entropy of vaporization of water ?

A. 0.5 J/K mol

B. 1.0 J/K mol

C. 1.5 J/K mol

D. 2.0 J/K mol

**Answer: A**

 [Watch Video Solution](#)

16. What is the correct from the following for the reaction

$H_2O_{(l)} \rightleftharpoons H_2O_{(g)}$  at  $100^\circ C$  and 1 atm. Pressure ?

A.  $\Delta E = 0$

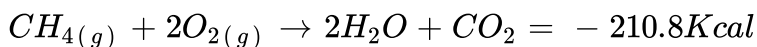
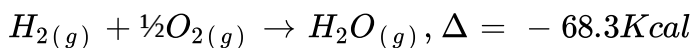
B.  $\Delta H = 0$

C.  $\Delta H = \Delta E$

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

**Answer: D**

 [Watch Video Solution](#)



what will be heat of formation of  $CH_4$  in (Kcal) ?

A. 47.3 K.Cal

B. 20.0K. Cal

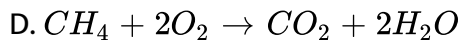
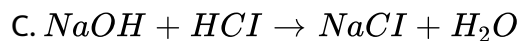
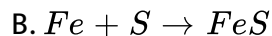
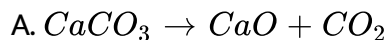
C. 45.9K. Cal

D.  $-47.3K. Cal$

**Answer: B**

 [Watch Video Solution](#)

**18.** Which of the following reaction is endothermic reaction ?



**Answer: A**

 [View Text Solution](#)

**19.** Enthalpy of formation of  $SO_2$  is 298 kJ calculate combustion enthalpy of 4 gm S.



A. + 37 kJ

B. - 37.25 kJ

C. + 298 kJ

D. 18.6 kJ

**Answer: B**

 [View Text Solution](#)

20.  $H^+ + OH^{-1} \rightarrow H_2O + 13.7 \text{ K Cal}$  calculate the enthalpy of neutralisation reaction of 1 mole  $H_2SO_4$  with base.

A. 13.7 K. Cal

B. 27.4 K. Cal

C. 6.85 K. Cal

D. 3.425 K. Cal

**Answer: B**

 [Watch Video Solution](#)

21. Fermentation reaction is .....

- A. Exothermic
- B. Endothermic
- C. Isothermic
- D. Reversible

**Answer: A**

 [Watch Video Solution](#)

22. How many moles of water is produced during combustion of 8 gm of  $CH_4$  ?

- A. 0.5
- B. 1

C. 2

D. 18

**Answer: B**

 [Watch Video Solution](#)

23. Which of the following has maximum neutralization enthalpy ?

A.  $NH_4$  and  $CH_3COOH$

B.  $NH_4OH$  and  $HCl$

C.  $KOH$  and  $CH_3COOH$

D.  $KOH$  and  $HCl$

**Answer: D**

 [View Text Solution](#)

24. Which of the following gas has maximum heat of combustion?

A. Methane

B. Ethane

C. Ethelene

D. Acetytene

**Answer: B**



[Watch Video Solution](#)

25. Calculate the heat produced during neutrilsation reaction of 36.5 gm HCl and 40 gm NaOH.

A. 13.7 K. Cal

B. 108 K. Cal

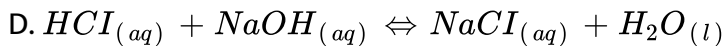
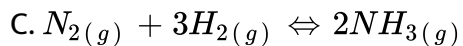
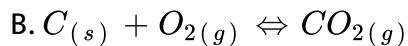
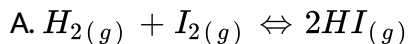
C. 713.7 K. Cal

D. 76.5 K. Cal

Answer: A

 [Watch Video Solution](#)

26. For which of the following reaction  $\Delta H \neq \Delta E$ ?



Answer: C

 [View Text Solution](#)

27. State the unit of molar entropy.

A. Joule/ Kelvin

B. KJ / kelvin mole

C. Joule/Kelvin mole

D. Calory / Kelvin

**Answer: C**

 [View Text Solution](#)

**28.** Work is not done during the expansion of ideal gas in vacuum. Why ?

A.  $q = 0$

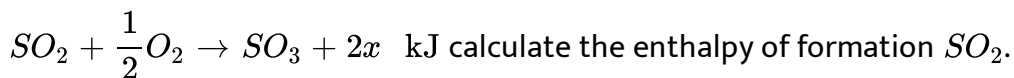
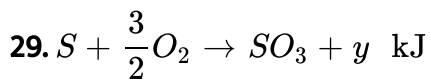
B.  $p = 0$

C.  $\Delta U = 0$

D.  $\Delta S = 0$

**Answer: B**

 [View Text Solution](#)



A.  $2x + y$

B.  $x + y$

C.  $y - 2x$

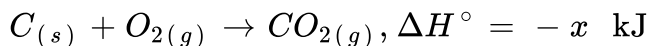
D.  $\frac{y}{2x}$

**Answer: C**



**View Text Solution**

30. Calculate the enthalpy of formation of CO from the given information.



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

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

C.  $2x - y$

D.  $y - 2x$

**Answer: B**



[View Text Solution](#)

31. If  $\Delta H > \Delta G$  for the given process, then .....

A.  $q_{\text{rev}} > 0$

B.  $q_{\text{rev}} = 0$

C.  $q_{\text{rev}} < 0$

D.  $q_{\text{rev}} \leq 0$

**Answer: A**



[View Text Solution](#)



32. If the system does not lose heat or does not receive heat, then the process is called .....

- A. Isobaric process
- B. Adiabatic process
- C. Isothermic process
- D. reversible process

**Answer: B**



[Watch Video Solution](#)

33. Value of  $\Delta G$  is -ve for ice to water system at ..... temperature.

- A. 260 K
- B. 280 K
- C. 270 K
- D. 250 K

**Answer: B**



[View Text Solution](#)

**34.** In which of the following reaction, entropy is decreasing ?

- A. Melting of ice
- B. Crystallisation of sucrose from solution
- C. Vaporisation of camphor
- D. Rusting of iron

**Answer: B**



[Watch Video Solution](#)

**35.** Conversion of graphite into diamond is .. ..... reaction.

- A. Endothermic

B. Exothermic

C. Heat conductor

D. Electric

**Answer: A**



[Watch Video Solution](#)

36. Value of  $C_v$  for mono atomic and diatomic gas are respectively .....

A.  $\frac{1}{2}R, \frac{3}{2}R$

B.  $\frac{3}{2}R, \frac{5}{2}R$

C.  $\frac{5}{2}R, \frac{7}{2}R$

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

**Answer: B**



[Watch Video Solution](#)

1. .... is correct for endothermic reaction.

A.  $\Delta H < 0$

B.  $\Delta H > 0$

C.  $\Delta H = 0$

D.  $\Delta H < < 0$

**Answer: B**



[Watch Video Solution](#)

2. Change in entropy for the expansion of 1 mole ideal gas in vacuum is

.....

A. 1 Joule

B. 2 Joule

C. 10 Joule

D. Zero

**Answer: D**

 [View Text Solution](#)

3. .... is net state function.

A. Work

B. Enthalpy

C. Internal energy

D. Entropy

**Answer: A**

 [View Text Solution](#)

4. For the spontaneous reactions .....

A.  $\Delta H = -ve, \Delta S = +ve$

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

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

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

**Answer: A**



[View Text Solution](#)

5. Standard enthalpy of ..... is not zero.

A. graphite

B.  $Na_{(s)}$

C.  $N_{2(l)}$

D. Rhombic sulphur

**Answer: C**



**View Text Solution**

**6. For adiabatic change .....**

A.  $\Delta U \neq w_{ad}$

B.  $\Delta U > w_{ad}$

C.  $\Delta U = w_{ad}$

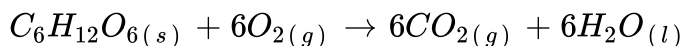
D.  $\Delta U < w_{ad}$

**Answer: C**



**Watch Video Solution**

**7. Choose the correct option for the reaction given below.**



A.  $\Delta H < \Delta U$

B.  $\Delta H > \Delta U$

C.  $\Delta H = \Delta U$

D.  $\Delta H \leq \Delta U$

Answer: C

 [View Text Solution](#)

8. Find the  $\Delta H$  for the reaction given below.



A.  $\Delta U - RT$

B.  $\Delta U + 2RT$

C.  $\Delta U + RT$

D.  $\Delta U - 2RT$

Answer: C



 [View Text Solution](#)

9. The instrument measuring heat changes at constant pressure .....

- A. pH meter
- B. calorie meter
- C. galvano meter
- D. hydro meter

**Answer: B**

 [View Text Solution](#)

10. From below, ..... is not intensive property.

- A. Heat capacity
- B. Density
- C. Mass

D. Volume

**Answer: B**



**Watch Video Solution**

## Section C Multiple Choice Questions Mcqs Mcqs Asked In Competitive Exam

1. .... is correct for endothermic reaction.

A. Zero

B.  $-ve$

C.  $+ve$

D. B and C both

**Answer: C**



**Watch Video Solution**

2. Which of the following has maximum neutralization enthalpy ?

A.  $NH_4$  and  $CH_3COOH$

B.  $NH_4OH$  and  $HCl$

C.  $NaOH$  and  $CH_3COOH$

D.  $NaOH$  and  $HCl$

**Answer: D**

 [View Text Solution](#)

3. Combustion enthalpy of carbon, Hydrogen and Methane at  $25^\circ C$  temperature are  $395.5 \text{ KJ mol}^{-1}$ ,  $-284.8 \text{ kJ mol}^{-1}$  and  $-890.4 \text{ kJ mol}^{-1}$  respectively. Calculate the standard enthalpy of formation of methane for the same temperature.

A.  $890.4 \text{ KJ mol}^{-1}$

B.  $-298.8 \text{ KJ mol}^{-1}$

C.  $-74.7 \text{ KJ mol}^{-1}$

D.  $-107.7 \text{ KJ mol}^{-1}$

**Answer: C**



[Watch Video Solution](#)

4. Change in entropy for one mole water from liquid form to vapour at 373 K is ..... Joule/ Kelvin. ( $\Delta H_{\text{vap}} = 2.257 \text{ KJ/gm}$ )

A. 105.9

B. 107.9

C. 108.9

D. 109.9

**Answer: C**



[Watch Video Solution](#)

5. Which of the following is an extensive property?

A. mass

B. volume

C.  $\frac{\text{mass}}{\text{volume}}$

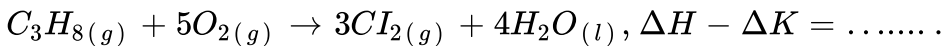
D. Enthalpy

Answer: C



Watch Video Solution

6. For the reaction



A.  $RT$

B.  $-3RT$

C.  $3RT$

D.  $-RT$

**Answer: B**



[View Text Solution](#)

7. .... has given  $\Delta G = \Delta H - T\Delta S$ .

A. Faraday

B. Kirchof

C. Einstein

D. Gibbs

**Answer: D**



[Watch Video Solution](#)

8. Change in entropy during adsorption of gas on the solid substance is..... .

A. Increasing

B. decreasing

C. constant

D. infinite

**Answer: B**

 [Watch Video Solution](#)

9. When 1 mole Zn powder is reacted with 1 mole sulphuric acid in bomb calorimeter (closed isolated system),.....

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**

 [Watch Video Solution](#)

10. Change in enthalpy during neutralization reaction of one mole HCl with dilute KOH at 298 K is ..... KJ

A. 68

B. 56

C. 50

D. 65

**Answer: B**

 [View Text Solution](#)

11. If  $K < 1$ ,  $\Delta G^\circ = \dots\dots\dots$

A. +ve

B. -ve



C. Zero

D. 1

**Answer: A**

 [View Text Solution](#)

12. Which of the following statement is correct for the spontaneous reaction ?

A. Entropy of the system is always increased.

B. Free energy of the system is always increased.

C. Total entropy change is always negative.

D. Total entropy change is always positive

**Answer: D**

 [Watch Video Solution](#)

13.  $723 \text{ KJ mol}^{-1}$  heat is released when 1 mole methanol combustions in present of  $O_2$ . What amount of heat is enlisted of one mole of  $O_2$  is used?

- A. 241 kj
- B. 723 kj
- C. 482 kj
- D. 924 KJ

**Answer: C**



[Watch Video Solution](#)

14. Hess.s Law of integrate enthalpy is related to..... ,

- A. change in enthalpy of reaction.
- B. rate of reaction.
- C. equilibriums constant.

D. effect of pressure on the volume of gas.

**Answer: A**

 [Watch Video Solution](#)

15. For a reaction  $\Delta H = 3 \text{ KJ}$  and  $\Delta S = 10 \text{ J/Kelvin}$  at what temperature the reaction will be spontaneous ?

A.  $300\text{K}$

B.  $200\text{K}$

C.  $273\text{K}$

D.  $373\text{K}$

**Answer: D**

 [Watch Video Solution](#)

16. Which one of the following is related to thermodynamic equilibrium ?

- A. All of above
- B. Thermal equilibrium
- C. equilibriums. of pressure
- D. Chemical equilibrium

**Answer: B**



[View Text Solution](#)

17. Which one of the following is the isobaric process ?

- A.  $\Delta H = 0$
- B.  $\Delta E = 0$
- C.  $\Delta P = 0$
- D.  $\Delta Q = 0$

**Answer: C**

 [Watch Video Solution](#)

**18.** For the spontaneous reaction at each temperature ..... .

A.  $\Delta G - ve$ ,  $\Delta H + ve$  and  $\Delta S + ve$

B.  $\Delta G + ve$ ,  $\Delta H - ve$  and  $\Delta S + ve$

C.  $\Delta G - ve$ ,  $\Delta H - ve$  and  $\Delta S - ve$

D.  $\Delta G - ve$ ,  $\Delta H - ve$  and  $\Delta S + ve$

**Answer: D**

 [Watch Video Solution](#)

**19.** Combustion enthalpy of carbon is  $-x$  kJ, Enthalpy of formation of water is  $-y$  kJ and combustion enthalpy of methane is  $-z$  kJ calculate the enthalpy of formation of methane.

A.  $(-x - y + z) \text{ kJ}$

B.  $(-z + 2y - x) \text{ kJ}$

C.  $(-x - 2y + z) \text{ kJ}$

D.  $(-x - 2y - z) \text{ kJ}$

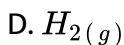
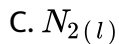
**Answer: C**

 [Watch Video Solution](#)

**20. Which one of the following has maximum entropy ?**



B. Diamond



**Answer: D**

 [Watch Video Solution](#)

21. An exothermic reaction is spontaneous reaction ..... is correct from the following.

A.  $\Delta G > 0$

B.  $\Delta S < 0$

C.  $\Delta S > 0$

D.  $\Delta H < 0$

**Answer: C**



[View Text Solution](#)

22. What will be the value of  $\Delta G$  for the ice at  $8^{\circ}\text{C}$  temperature ?

A. zero

B.  $+ve$

C.  $-ve$

D. one

**Answer: C**



[View Text Solution](#)

23. Ice cube is melting at the room temperature this reaction belongs to which law of ?

A. Zero<sup>th</sup> Law

B. Third Law

C. First Law

D. Second Law

**Answer: C**



[View Text Solution](#)



24. Combustion enthalpies of methane and ethane are  $-210\text{k. cal mol}^{-1}$  and  $-368\text{k. cal mol}^{-1}$ . Combustion enthalpy of Decane is .....

- A.  $-158\text{k. cal}$
- B.  $-1632\text{k. cal}$
- C.  $-1700\text{k. cal}$
- D. given data is not complete

**Answer: B**

 [Watch Video Solution](#)

25. For the gaseous reaction, at 300 K temperature, value of  $\Delta H - \Delta U = -4.98\text{ KJ}$ , Then  $\Delta n_{(g)} = \dots$

- A. 1
- B. 2

C.  $-2$

D.  $0$

**Answer: C**

 [Watch Video Solution](#)

26. For the reaction  $298\text{ K } A_{(g)} + B_{(g)} \rightarrow C_{(g)}$  at  $298\text{ K}$ ,  $\Delta U = -5\text{ cal}$  and  $\Delta S = -10\text{ cal K}^{-1}$ .  $\Delta G = \dots\dots$  "cal".

A.  $2612$

B.  $2379$

C.  $261.2$

D.  $-2612$

**Answer: B**

 [View Text Solution](#)

27. According to the first law of thermodynamics, which of the following shows change in state function ?

A.  $q_{\text{rev}}$

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

C.  $q_{\text{rev}} / w_{\text{rev}}$

D.  $w_{\text{rev}}$

**Answer:**



[View Text Solution](#)

28. Standard entropies of  $x_2$ ,  $y_2$  and  $xy_3$  are 60, 40 and 50 J/K mol<sup>-1</sup> respectively for the reaction  $\frac{1}{2}x_2 + \frac{3}{2}y_2 \rightarrow xy_3$ ,  $\Delta H = -30\text{kJ}$  to be at equilibrium the temperature should be.

A. 500 K

B. 750 K

C. 1000 K

D. 1250 K

**Answer: B**



[Watch Video Solution](#)

29. When water freezed to ice, entropy ..... .

A. Increases

B. Decreases

C. Constant

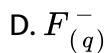
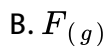
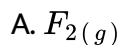
D. Zero

**Answer: B**



[Watch Video Solution](#)

30. Standard enthalpy of formation is zero for ..... from following



Answer: A



[View Text Solution](#)

31. Thermodynamically stable form of C is .....

A. Graphite

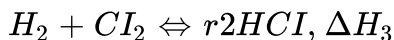
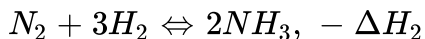
B. Diamond

C. Fullerenl

D. Cock

Answer: A

 View Text Solution



Calculate the enthalpy of formation of  $\text{NCl}_3$

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

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

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

D. none of above

Answer: D

 View Text Solution

33. Work done is ..... when 3 moles of ideal gas is expand in vacuum.

A. +ve

B. -ve

C. zero

D. can not decide

**Answer: C**



[View Text Solution](#)

34. Which of the following is an extensive property?

A. Molar conductivity

B. Electro motive force

C. Resistance

D. Heat capacity

**Answer: A**



[Watch Video Solution](#)

**35.** Calculate the work, when 1 mole ideal gas defuse to 1 atm from 10 atm at 300. K temperature.

A. 5744.1 J

B. 6257.2 J

C. 4938.8 J

D. 4138.8 J

**Answer: A**



[Watch Video Solution](#)

**36.** At 300 K one mole ideal gas is expand freely to 100 liter from 10 liter. If

$\Delta U = 0$ , then  $\Delta H = \dots\dots\dots$



- A. 20 kJ
- B. 200 KJ
- C. – 200 KJ
- D. 0

**Answer: D**

 [View Text Solution](#)

37. Dissociation enthalpy of diatomic molecules  $XY$ ,  $X_2$  and  $Y_2$  are too in the ratio of 1:1:0.5 the value. Enthalpy of formation of  $XY$ .  $\Delta_f H = -200 \text{ kJ mol}^{-1}$ . Find the dissociation enthalpy of  $X_2$  ?

- A.  $200 \text{ kJ mol}^{-1}$
- B.  $300 \text{ kJ mol}^{-1}$
- C.  $400 \text{ kJ mol}^{-1}$
- D.  $800 \text{ kJ mol}^{-1}$

Answer: D

 [Watch Video Solution](#)

38. Which of the following is not correct ?

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

B. 
$$w_{\text{rev.}} = -nRT \ln \frac{V_f}{V_i}$$

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

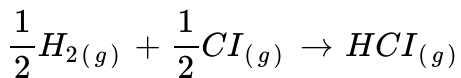
D. 
$$K = e^{-\Delta G^\circ / RT}$$

Answer: C

 [View Text Solution](#)

39. Standard enthalpy of formation of  $H_{2(g)}$ ,  $Cl_{2(g)}$  and  $HCl_{(g)}$  are 218, 121.68 and  $-92.31$  KJ/mole respectively. Calculate the change in

standard enthalpy for the reaction



A. + 431.99 kJ

B. - 262.14 kJ

C. - 431.99 kJ

D. + 247.37 kJ

**Answer: B**



[Watch Video Solution](#)

40. .... is done, when 50 gm of Fe is reacted with HCl in open vessel at 25°C temperature.

A. zero

B. - 2.2 kJ

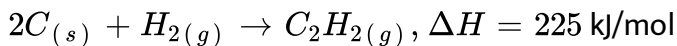
C. 2.2 kJ

D. 0.22 kJ

**Answer: B**

 [View Text Solution](#)

41. Bond enthalpy of C - H bond is 350 kJ/mol. Calculate the bond enthalpy of  $C \equiv C$  bond in  $C_2H_2$ .



A. 1165 kJ/mol

B. 837 kJ/mol

C. 865 kJ/mol

D. 815 kJ/mol

**Answer: D**

 [Watch Video Solution](#)

42. Same volume of two monoatomic gases A and B is mixed at same temperature. .... Is  $\frac{C_p}{C_v} = \dots\dots\dots$

A. 0.83

B. 1.67

C. 3.3

D. 3.30

**Answer: B**



[Watch Video Solution](#)

43. Statements and reasons are given. Choose the correct option from the following. (Q.43, 44, 45)

Statement : Enthalpy of formation of gaseous oxygen molecule is zero at 1 atm pressure and 298 K.

Reason : Enthalpy of formation of oxygen molecule is zero for the same situation.

- A. Statement and reason both are correct and correct explanation of statement is given by reason.
- B. Statement and reason both are correct but correct explanation of statement is not given by reason.
- C. Statement is correct but reason is wrong.
- D. Statement and reason both are wrong.

**Answer: C**



[View Text Solution](#)

**44.** Statements and reasons are given. Choose the correct option from the following. (Q.43, 44, 45)

Statement : Chlorine gas become solid at absolute zero temperature but

its entropy will be zero.

Reason : Chlorine has strong small and its difficult to correct it into solid.

- A. Statement and reason both are correct and correct explanation of statement is given by reason.
- B. Statement and reason both are correct but correct explanation of statement is not given by reason.
- C. Statement is correct but reason is wrong.
- D. Statement and reason both are wrong.

**Answer: B**



[View Text Solution](#)

45. Statements and reasons are given. Choose the correct option form the following. (Q.43, 44, 45)

Statement : Absorbed energy becomes zero when ideal gas is expand in

vacuum. in isothermic process.

Reason : Volume occupied by molecules is zero.

- A. Statement and reason both are correct and correct explanation of statement is given by reason.
- B. Statement and reason both are correct but correct explanation of statement is not given by reason.
- C. Statement is correct but reason is wrong.
- D. Statement and reason both are wrong.

**Answer: C**

 [View Text Solution](#)

### Section C Multiple Choice Questions Mcqs Mcqs Asked In Jee Neet Aiee

1. Given that bond energies of H - H and Cl -Cl are  $430\text{kJ/mol}^{-1}$  and  $240\text{kJ/mol}^{-1}$  respectively and  $\Delta H_f$  for *HCl* is



–  $90\text{kJ/mol}^{-1}$ , bond enthalpy of HCl is

A.  $380\text{ kJ/mol}$

B.  $425\text{ kJ/mol}$

C.  $245\text{ kJ/mol}$

D.  $290\text{ kJ/mol}$

**Answer: B**



[View Text Solution](#)

2. Which of the following is not a state functions?

A. (i) and (iv)

B. (ii), (iii) and (iv)

C. (i), (ii) and (iii)

D. (ii) and (iii)

**Answer: D**



Watch Video Solution

3. For the gas phase reaction,



Which of the following conditions are correct ?

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

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

C.  $\Delta h < 0$  and  $\Delta S < 0$

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

Answer: B



Watch Video Solution

4. Bond dissociation enthalpy of  $H_2$ ,  $Cl_2$  and  $HCl$  are 434, 242 and 431 kJ mol<sup>-1</sup> respectively. Enthalpy of formation of HCl is

A.  $93\text{kJ mol}^{-1}$

B.  $-245\text{kJ mol}^{-1}$

C.  $-93\text{kJ mol}^{-1}$

D.  $245\text{kJ mol}^{-1}$

**Answer: C**

 [View Text Solution](#)

5. The values of  $\Delta H$  and  $\Delta S$  for the reaction,  
 $C_{(\text{graphite})} + CO_{2(g)} \rightarrow 2CO_{(g)}$  are  $170\text{kJ}$  and  $170\text{JK}^{-1}$ , respectively.

This reaction will be spontaneous at

A. 910 K

B. 1110 K

C. 510 K

D. 710 K

**Answer: B**

 [Watch Video Solution](#)

6. Standard entropies of  $x_2$ ,  $y_2$  and  $xy_3$  are 60, 40 and  $50\text{J/K mol}^{-1}$  respectively for the reaction  $\frac{1}{2}x_2 + \frac{3}{2}y_2 \rightarrow xy_3$ ,  $\Delta H = -30\text{kJ}$  to be at equilibrium the temperature should be.

- A. 750 K
- B. 1000 K
- C. 1250 K
- D. 500 K

**Answer: A**

 [Watch Video Solution](#)

7. For vapourisation of water at 1 atm, values of  $\Delta H$  &  $\Delta S$  are  $40.6 \text{ KJ mol}^{-1}$  and  $108 \text{ JK}^{-1} \text{ mol}^{-1}$ , respectively will be. The temperature when  $\Delta G$  for this transition zero is :-

A. 293.4 K

B. 273.4 K

C. 393.4 K

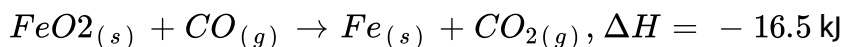
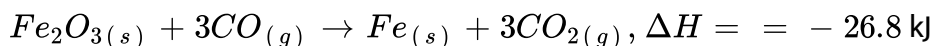
D. 373.4 K

**Answer: D**

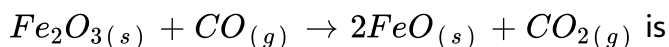


[Watch Video Solution](#)

8. The following two reactions are known :



The value  $\Delta H$  for the following reaction



- A. + 6.2 kJ
- B. + 10.3 kJ
- C. - 43.3 kJ
- D. - 10.3 kJ

**Answer: A**

 [Watch Video Solution](#)

9. If the enthalpy change for the transition of liquid water to steam is 30 kJ/mol<sup>-1</sup> at 27°C, the entropy change for the process would be :

- A. 10 J mol<sup>-1</sup>K<sup>-1</sup>
- B. 1.0 J mol<sup>-1</sup>K<sup>-1</sup>
- C. 0.1 J mol<sup>-1</sup>K<sup>-1</sup>
- D. 100 J mol<sup>-1</sup>K<sup>-1</sup>

**Answer: D**

10. For complete combustion of ethanol,  $C_2H_5OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(l)}$ , the amount of heat produced as measured in bomb calorimeter is  $1364.47\text{kJ mol}^{-1}$  at  $25^\circ\text{C}$ . Assuming ideality the Enthalpy of combustion,  $\Delta_C H$ , for the reaction will be :

$$\left( R = 8.314\text{kJ mol}^{-1} \right)$$

A.  $-1460.50\text{kJ mol}^{-1}$

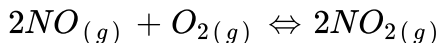
B.  $-1350.50\text{kJ mol}^{-1}$

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

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

**Answer: C**

11. The following reaction is performed at 298 K.



The standard free energy of formation of  $NO_{(g)}$  is 86.6 kJ/mol at 298 K.

What is the standard free energy of formation of  $NO_{2(g)}$  at 298 K ?

$$(K_p = 1.6 \times 10^{12})$$

A.  $R(298)\ln(1.6 \times 10^{12}) - 86600$

B.  $86600 + R(298)\ln(1.6 \times 10^{12})$

C.  $86600 - \frac{\ln(1.6 \times 10^{12})}{R(298)}$

D.  $0.5[2 \times 86600 - R(298)\ln(1.6 \times 10^{12})]$

**Answer: D**



[View Text Solution](#)

12. The standard Gibbs energy change at 300 K for the reaction

$2A \rightleftharpoons B + C$  is 2494.2 J. At a given time, the composition of the reaction



mixture is  $[A] = \frac{1}{2}$ ,  $[B] = 2$  and  $[C] = \frac{1}{2}$ . The reaction proceeds in the

:  $[R = 8.314\text{J/K/mol}, e = 2.718]$

A. forward direction because  $Q > K_C$

B. reverse direction because  $Q > K_C$

C. forward direction because  $Q < K_C$

D. reverse direction because  $Q < K_C$

**Answer: B**



**Watch Video Solution**

**13.** Which of the following statements is correct for a reversible process in a state of equilibrium ?

A.  $\Delta G = - 2.303RT \log K$

B.  $\Delta G = 2.30 RT \log K$

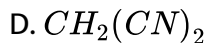
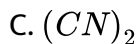
C.  $\Delta G^\circ = - 2.30 RT \log K$

$$D. \Delta G^\circ = 2.30 RT \log K$$

**Answer: C**

 [Watch Video Solution](#)

14. Which of the following species contains equal number of  $\sigma$  – and  $\pi$  – bonds?



**Answer: B**

 [Watch Video Solution](#)

15. The heat of combustion of carbon to  $CO_2$  is  $-393.5\text{kJ/mol}$ . The heat released upon formation of  $35.2\text{ g}$  of  $CO_2$  from carbon and oxygen gas is

:

A.  $-630\text{kJ}$

B.  $-3.15\text{kJ}$

C.  $-315\text{KJ}$

D.  $+315\text{kJ}$

**Answer: D**



[View Text Solution](#)

16. For the spontaneous reaction at each temperature .....

A.  $\Delta H > 0$  and  $\Delta S < 0$

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

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

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

Answer: B::D



Watch Video Solution

17. For a sample of perfect gas when its pressure is changed isothermally from  $P_i$  to  $P_f$  the entropy change is given by

A.  $\Delta S = nRT \ln \left( \frac{P_f}{P_i} \right)$

B.  $\Delta S = RT \ln \left( \frac{P_i}{P_f} \right)$

C.  $\Delta S = nR \ln \left( \frac{P_f}{P_i} \right)$

D.  $\Delta S = nR \ln \left( \frac{P_i}{P_f} \right)$

Answer: D



Watch Video Solution

18. If the  $E_{\text{cell}}^{\circ}$  for a given reaction has a negative value, which of the following gives the correct relationships for the values of  $\Delta G^{\circ}$  and  $K_{eq}$ ?

A.  $\Delta G^{\circ} < 0, K_{eq} > 1$

B.  $\Delta G^{\circ} < 0, K_{eq} < 1$

C.  $\Delta G^{\circ} > 0, K_{eq} < 1$

D.  $\Delta G^{\circ} > 0, K_{eq} > 1$

**Answer: C**



[View Text Solution](#)

19. If  $\Delta H = 35.5 \text{ kJ/mol}$  and  $\Delta S = 83.6 \text{ J/mol K}$ . At what temperature the reaction will be spontaneous?

A.  $T > 425K$

B. Each temperature

C.  $T < 298 \text{ K}$

D.  $T < 425 \text{ K}$

**Answer: A**

 [Watch Video Solution](#)

## Section C Multiple Choice Questions Mcqs Mcqs Asked In Board Exam

1. Which of the following reaction is incorrect according to thermodynamics ?

A.  $\Delta G^\circ = -nFE^\circ$

B.  $\Delta H = \Delta E + P\Delta V$

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

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

**Answer: D**

 [View Text Solution](#)

2. What will be value of  $\Delta G^\circ$  for ice at 298 K temperature?

A.  $-ve$

B. 0

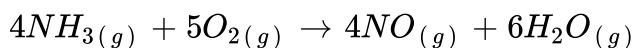
C. none of these

D.  $+ve$

**Answer: A**

 [View Text Solution](#)

3. Which of the following option is correct for the given equation ?



A.  $\Delta H = \Delta U$

B.  $\Delta H < \Delta U$

C.  $\Delta U > \Delta U$

D.  $\Delta H \neq \Delta U$

**Answer: C**

 [View Text Solution](#)

4. If the change in entropy at 353 K is  $0.087 \text{ kJ mol}^{-1}$  for benzene. Then calculate the heat of vapourisation.

A.  $-6.96 \text{ kJ mol}^{-1}$

B.  $6.96 \text{ kJ mol}^{-1}$

C.  $-30.711 \text{ kJ mol}^{-1}$

D.  $30.711 \text{ kJ mol}^{-1}$

**Answer: D**

 [View Text Solution](#)



5. The change in free energy during working of pencil cell is  $-1372.58$  cal.

Calculate the equilibrium constant of the cell under standard condition

$$\left( R = 2 \text{ cal mol}^{-1} \text{ K}^{-1} \right)$$

A.  $1.00 \times 10^5$

B.  $1.00 \times 10^2$

C.  $1.00 \times 10^{10}$

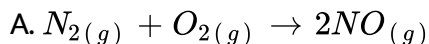
D.  $1.00 \times 10^1$

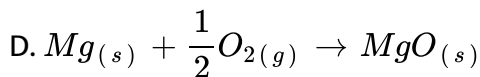
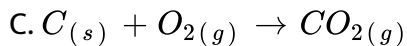
**Answer: B**



[View Text Solution](#)

6. For which reaction  $\Delta S$  can be maximum if it is occurring at constant volume ?





**Answer: B**

 [View Text Solution](#)

7. There is change in volume of an ideal gas when pressure is changed at constant temperature. The change in free energy associated with this can be calculated by which of the following equation ?

$$A. \Delta G = RT \ln \frac{P_2}{P_1}$$

$$B. \Delta G = -2.303RT \log \frac{P_2}{P_1}$$

$$C. \Delta G = nRT \ln \frac{V_2}{V_1}$$

$$D. \Delta G = nRT \ln \frac{P_2}{P_1}$$

**Answer: D**

 [View Text Solution](#)

8. A system receives 100 calory heat at that time 50 calory work is done by system. Calculate the change in internal energy.

A. – 150 Joule

B. 50 Joule

C. – 50 Joule

D. 150 Joule

**Answer: B**



[Watch Video Solution](#)

9. In which phenomenon Entropy decreases ?

A. Melting of ice

B. Crystallisation of salt

C. Evaporation of liquid

## D. Diffusion

**Answer: B**



[View Text Solution](#)

10. If substance is completely pure crystalline at 273 K, which of the following state function will be zero at 273 K ?

A. Free energy

B. Entropy

C. Enthalpy

D. All the given

**Answer: B**



[Watch Video Solution](#)

11. Which of the following is an extensive property?

- A. Boiling point
- B. Elevation in boiling point
- C. Density
- D. Fluidity

**Answer: B**



[Watch Video Solution](#)

12. For a reaction value of  $K_c$  is  $7.105 \times 10^{-5}$ , what will be the change in free energy ?

- A.  $\Delta G > 0$
- B.  $\Delta G < 0$
- C.  $\Delta G = 0$
- D.  $\Delta G = 1$

**Answer: A**

 [View Text Solution](#)

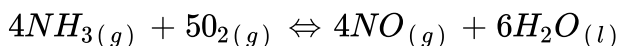
13. Joule  $K^{-1}gm^{-1}$  is the unit of ....

- A. Entropy
- B. Enthalpy
- C. Specific heat capacity
- D. All the given

**Answer: C**

 [View Text Solution](#)

14. For the given equation



Select the correct option for change in Enthalpy.

A.  $\Delta U + RT$

B.  $\Delta U + 5RT$

C.  $\Delta U - RT$

D.  $\Delta U - 5RT$

**Answer: D**

 [Watch Video Solution](#)

15. By mixing aqueous solutions of silver nitrate and ammonium chloride in a test tube, white precipitates are formed. In this process, test tube is .....

A. universe

B. surrounding

C. borderline of the system

D. system

**Answer: C**

 [View Text Solution](#)

16. What will be the value of  $K$  and  $\Delta G^\circ$  for the process of transformation of ice into water at room temperature ?

A.  $K = 1$ ,  $\Delta G^\circ$  Zero

B.  $K < 1$ ,  $\Delta G^\circ$  positive

C.  $K > 1$ ,  $\Delta G^\circ$  positive

D.  $K > 1$ ,  $\Delta G^\circ$  negative

**Answer: D**

 [View Text Solution](#)

17. Which law of thermodynamics gives information about exact entropy of a substance ?



A. Zeroth Law

B. Second Law

C. Third Law

D. First Law

**Answer: B**



[View Text Solution](#)

**18.** The level of thermal energy in a substance is known as ..... .

A. Entropy

B. Temperature

C. Heat energy

D. Quantity of Heat

**Answer: B**



[View Text Solution](#)

19. Which of the following statements is correct for absolute entropy of a substance ?

A. It is shown as  $S^\circ$ .

B. It is the entropy of 1 mole of substance at constant temperature and standard state.

C. Its unit is Joule Kelvin Mole<sup>-1</sup>.

D. It is the entropy of 1 mole of substance.

**Answer: B**



[View Text Solution](#)

20. Water always flows from higher level to lower level on its own. Which of the following statement is correct for this phenomena ?

A. Free energy increases

B. Entropy decreases

C. Free energy decreases

D. Entropy increases

**Answer: C**

 [View Text Solution](#)

21. If the values of  $\Delta_f H^\circ$  for  $H_2O_2$  and  $H_2O$  are  $-188$  and  $-286 \text{ kJ mol}^{-1}$ , then the value of  $\Delta H^\circ = \dots$  kJ/mol for the following reaction -  $2H_2O_{2(l)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$

A.  $-494$

B.  $-196$

C.  $-98$

D.  $+196$

**Answer: B**



[Watch Video Solution](#)

22. What will be the work done by the system when one mole of an ideal gas expands in vacuum ?

- A. Zero
- B. 1 Joule
- C. 2 Joule
- D. 3 Joule

**Answer: A**



[View Text Solution](#)

23. During adiabatic process, the system .....

- A. gains energy
- B. loses energy

C. loses mass

D. neither gains nor loses energy

**Answer: D**



[View Text Solution](#)

**24.** Which of the following has standard Enthalpy value not equal to zero

?

A. Rhombic Sulphur

B. Graphite

C.  $O_2(l)$

D.  $Na(s)$

**Answer: C**



[View Text Solution](#)

25. The reaction  $A \rightarrow B$  is impossible, if..... .

A.  $\Delta H$  positive,  $\Delta S$  positive but  $\Delta H < T\Delta S$

B.  $\Delta H$  positive,  $\Delta S$  negative but  $\Delta H > T\Delta S$

C.  $\Delta H$  negative,  $\Delta S$  positive.

D.  $\Delta H$  positive,  $\Delta S$  negative,  $\Delta G = \Delta H - T\Delta S$

Answer: B::D



[View Text Solution](#)

26. Heat of vaporization of benzene is  $7350 \text{ cal } K^{-1}\text{mol}^{-1}$ . Calculate the change in entropy for converting 1 mole gaseous benzene to liquid benzene at  $77^\circ \text{ C}$ .

A. 21 calorie  $K^{-1}\text{mol}^{-1}$

B.  $-21 \text{ calorie } K^{-1}\text{mol}^{-1}$

C.  $-21 \text{ calorie } K^{-1}$

D.  $21\text{calorieK}^{-1}$

**Answer: B**

 [Watch Video Solution](#)

## Section D Solutions Of Ncert Exemplar Problems Multiple Choice Questions Mcqs

1. Thermodynamics is not concerned about

- A. change in energy involved in a chemical reaction.
- B. the extent to which a chemical reaction proceeds.
- C. the rate at which a reaction proceeds.
- D. the feasibility of a chemical reaction.

**Answer: C**

 [Watch Video Solution](#)

2. 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 thermos flask or any other closed insulated vessel is an example of a closed system.

**Answer: C**



[Watch Video Solution](#)

3. The state of a gas can be described by quoting the relationship between



- A. pressure, volume, temperature
- B. temperature, amount, pressure
- C. amount, volume, temperature
- D. pressure, volume, temperature, amount

**Answer: D**

 [Watch Video Solution](#)

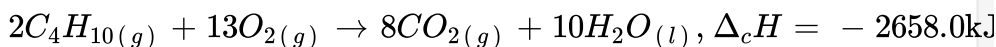
4. The volume of gas is reduced to half from its original volume. The specific heat will be

- A. reduce to half
- B. be doubled
- C. remain constant
- D. increase four times

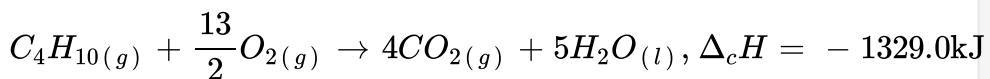
**Answer: C**

5. During complete combustion of one mole of butane, 2658 kJ of heat is released. The thermochemical reaction for above change is

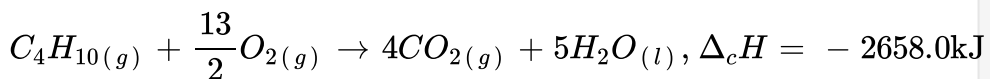
A.



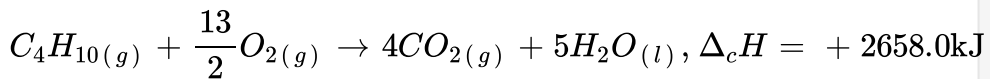
B.



C.



D.



Answer: C

6.  $\Delta_C U^\ominus$  of formation of  $CH_4(g)$  at certain temperature is  $-393\text{kJ mol}^{-1}$ . The value of  $\Delta_f H^\ominus$  is

A. zero

B.  $< \Delta_f U^\ominus$

C.  $> \Delta_f U^\ominus$

D. equal to  $\Delta_f U^\ominus$

**Answer: B**



[View Text Solution](#)

7. In an adiabatic process, no transfer of heat takes place between the 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: C**



[View Text Solution](#)

8. The pressure-volume work for an ideal gas can be calculated by using the expression  $W = - \int_{V_i}^{V_f} P_{ex} dV$ . The work can also be calculated from the pV- plot by using the area under the curve within the specified limits. When an ideal gas is compressed (A) reversibly or (B) irreversibly from volume  $V_i$  to  $V_f$ . choose the correct option.

A.  $W$  (reversible) =  $W$  (irreversible)

B.  $W$  (reversible) lt  $W$  (irreversible)

C.  $W$  (reversible) gt  $W$  (irreversible)

D.  $W$  (reversible) =  $W$  (irreversible) +  $P_{ex} \cdot \Delta V$

**Answer: B**

 [View Text Solution](#)

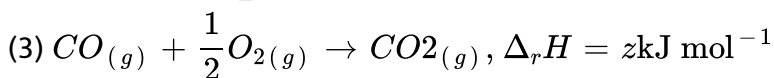
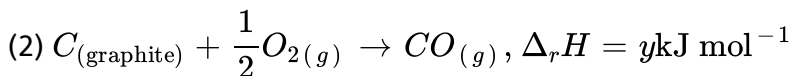
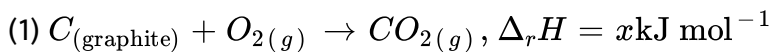
9. The entropy change can be calculated by using the expression  $\Delta S = \frac{q_{\text{rev}}}{T}$ . When water freezes in a glass beaker, choose the correct statement amongst the following :

- A.  $\Delta S$  (system) decreases but  $\Delta S$  (surroundings) remains the same.
- B.  $\Delta S$  (system) increases but  $\Delta S$  (surroundings) decreases.
- C.  $\Delta S$  (system) decreases but  $\Delta S$  (surroundings) increases.
- D.  $\Delta S$  (system) decreases and  $\Delta S$  (surroundings) also decreases.

**Answer: C**

 [Watch Video Solution](#)

10. On the basis of thermochemical equations (1), (2) and (3), find out which of the algebraic relationships given in options (A) to (D) is correct.



A.  $z = x + y$

B.  $x = y - z$

C.  $x = y + z$

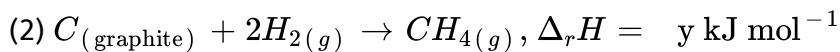
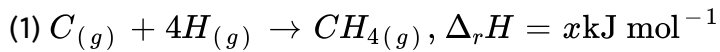
D.  $y = 2x - z$

**Answer: C**



**Watch Video Solution**

11. Consider the reactions given below. On the basis of these reactions find out which of the algebraic relations given in options (A) to (D) is correct?



A.  $x = y$

B.  $x = 2y$

C.  $x > y$

D.  $x < y$

**Answer: C**



**View Text Solution**

**12.** The enthalpies of elements in their standard states are taken as zero.

The enthalpy of formation of a compound

A. is always negative

B. is always positive

C. may be positive or negative

D. is never negative

**Answer: C**



**Watch Video Solution**

**13.** Enthalpy of sublimation of a substance is equal to

A. enthalpy of fusion+ enthalpy of vaporisation

B. enthalpy of fusion

C. enthalpy of vaporisation

D. twice the enthalpy of vaporisation

**Answer: A**



**Watch Video Solution**

**14.** Which of the following is not correct ?



- A.  $\Delta G$  is zero for a reversible reaction
- B.  $\Delta G$  is positive for a spontaneous reaction
- C.  $\Delta G$  is negative for a spontaneous reaction
- D.  $\Delta G$  is positive for a non-spontaneous reaction

**Answer: B**

 [Watch Video Solution](#)

## Section D Solutions Of Ncert Exemplar Problems Mcqs More Than One Options

1. Thermodynamics mainly deals with

- A. interrelation of various forms of energy and their transformation from one form to another.
- B. energy changes in the processes which depend only on initial and final states of the microscopic systems containing a few molecules.

- C. how and at what rate these energy transformations are carried out.
- D. the system in equilibrium state or moving from one equilibrium state to another equilibrium state.

**Answer: A::D**

 [Watch Video Solution](#)

2. In an exothermic reaction, heat is evolved, and system loses heat to the surrounding. For such system

- A.  $q_p$  will be negative
- B.  $\Delta_r H$  will be negative
- C.  $q_p$  will be positive
- D.  $\Delta_r H$  will be positive

**Answer: A::B**

 [Watch Video Solution](#)

3. 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: C::D**

 [Watch Video Solution](#)

4. For an ideal gas, the work of reversible expansion under isothermal condition can be calculated by using the expression  $W = nRT \ln \frac{V_f}{V_i}$ . A sample containing 1.0 mol 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.

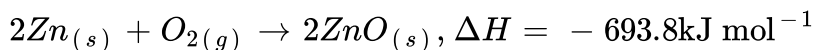
- A. Work done at 600 K is 20 times the work done at 300 K.
- B. Work done at 300 K is twice the work done at 600 K.
- C. Work done at 600 K is twice the work done at 300 K.
- D.  $\Delta U = 0$  in both cases.

**Answer: C::D**



[View Text Solution](#)

5. Consider the following reaction between zinc and oxygen and choose the correct options out of the options given below :



- A. The enthalpy of two moles of ZnO is less than the total enthalpy of two moles of Zn and one mole of oxygen by 693.8 kJ.

- B. The enthalpy of two moles of ZnO is more than the total enthalpy of two moles of Zn and one mole of oxygen by 693.8 kJ.
- C.  $693.8 \text{ kJ mol}^{-1}$  energy is evolved in the reaction.
- D.  $693.9 \text{ kJ mol}^{-1}$  energy is absorbed in the reaction.

**Answer: A::C**

 [View Text Solution](#)

## Section D Solutions Of Ncert Exemplar Problems Short Answer Type Questions

1. 18.0 g of water completely vaporises at  $100^\circ\text{C}$  and 1 bar pressure and the enthalpy change in the process is  $40.79 \text{ kJ mol}^{-1}$ . What will be the enthalpy change for vapourising two moles of water under the same conditions ? What is the standard enthalpy of vapourisation for water ?

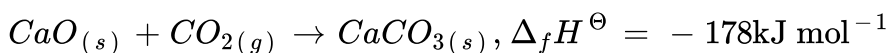
 [Watch Video Solution](#)

2. One mole of acetone requires less heat to vaporise than 1 mol of water.

Which of the two liquids has higher enthalpy of vaporisation ?

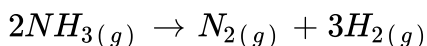
 [Watch Video Solution](#)

3. Standard molar enthalpy of formation,  $\Delta_f H^\ominus$  is just a special case of enthalpy of reaction,  $\Delta_r H^\ominus$ . Is the  $\Delta_r H^\ominus$  for the following reaction same as  $\Delta_f H^\ominus$ ? Give reason for your answer.



 [View Text Solution](#)

4. The value of  $\Delta_f H^\ominus$  for  $\text{NH}_3$  is  $-91.8 \text{kJ mol}^{-1}$ . Calculate enthalpy change for the following reaction:



 [Watch Video Solution](#)

5. Enthalpy is an extensive property. In general, if enthalpy of an overall reaction  $A \rightarrow B$  along one route is  $\Delta_r H$  and  $\Delta_r H_1, \Delta_r H_2, \Delta_r H_3, \dots$  represent enthalpies of intermediate reactions leading to product B. What will be the relation between  $\Delta_r H$  for overall reaction and  $\Delta_r H_1, \Delta_r H_2, \dots$  etc. for intermediate reactions.

 [View Text Solution](#)

6. The enthalpy of atomisation for the reaction  $CH_4(g) \rightarrow C(g) + 4H(g)$  is  $1665 \text{ kJ mol}^{-1}$ . What is the bond energy of  $C - H$  bond?

 [Watch Video Solution](#)

7. Use the following data to calculate  $\Delta_{\text{lattice}} H^\ominus$  for  $NaBr$ .  $\Delta_{\text{sub}} H^\ominus$  for sodium metal =  $108.4 \text{ kJ mol}^{-1}$ , ionization enthalpy of sodium =  $496 \text{ kJ mol}^{-1}$ , electron gain enthalpy of bromine =  $-325 \text{ kJ mol}^{-1}$ , bond dissociation enthalpy of bromine =  $192 \text{ kJ mol}^{-1}$   $\Delta_f H^\ominus$  for  $NaBr(s) = -360.1 \text{ kJ mol}^{-1}$ .



[View Text Solution](#)

8. Given that  $\Delta H = 0$  for mixing of two gases. Explain whether the diffusion of these gases into each other in a closed container is a spontaneous process or not ?



[Watch Video Solution](#)

9. Heat has randomising influence on a system and temperature is the measure of average chaotic motion of particles in the system. Write the mathematical relation which relates these three parameters.



[Watch Video Solution](#)

10. Increase in enthalpy of the surroundings is equal to decrease in enthalpy of the system. Will the temperature of system and surroundings be the same when they are in thermal equilibrium ?



[View Text Solution](#)



 [View Text Solution](#)

11. At 298 K,  $K_p$  for the reaction  $NO_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$  is 0.98. Predict whether the reaction is spontaneous or not.

 [Watch Video Solution](#)

12. A sample of 1.0 mol of a monoatomic ideal gas is taken through a cyclic process of expansion and compression as shown in Fig. What will be the value of  $\Delta H$  for the cycle as a whole ?



 [View Text Solution](#)

13. The standard molar entropy of  $H_2O_{(l)}$  is  $70 \text{ JK}^{-1}\text{mol}^{-1}$ . Will the standard molar entropy of  $H_2O_{(s)}$  be more, or less than  $70 \text{ JK}^{-1}\text{mol}^{-1}$  ?

 [Watch Video Solution](#)

14. Which of the following is not a state functions?

 [Watch Video Solution](#)

15. The molar enthalpy of vapourisation of acetone is less than that of water. Why ?

 [Watch Video Solution](#)

16. Which quantity out of  $\Delta_r G$  and  $\Delta_r G^\ominus$  will be zero at equilibrium ?

 [Watch Video Solution](#)

17. Predict the change in internal energy for an isolated system at constant volume.

 [Watch Video Solution](#)

18. Although heat is a path function but heat absorbed by the system under certain specific conditions is independent of path. What are those conditions ? Explain.

 [View Text Solution](#)

19. Expansion of a gas in vacuum is called free expansion. Calculate the work done and the change in internal energy when 1 litre of ideal gas expands isothermally into vacuum until its total volume is 5 litre ?

 [View Text Solution](#)

20. Heat capacity ( $C_p$ ) is an extensive property but specific heat ( $c$ ) is an intensive property. What will be the relation between  $C_p$  and  $c$  for 1 mol of water?

 [Watch Video Solution](#)

21. The difference between  $C_p$  and  $C_v$  can be can be  $H = U + pV$ .

Calculate the difference  $C_p$  and  $C_v$  for 10 moles of an ideal gas.

 [Watch Video Solution](#)

22. If the combustion of 1 g of graphite produces -20.7 kJ of heat, what will be molar enthalpy change? Give the significance of sign also.

 [Watch Video Solution](#)

23. The net enthalpy change of a reaction is the amount of energy required to break all the bonds in reactant molecules minus amount of energy required to form all the bonds in the product molecules. What will be the enthalpy change for the following reaction.

$H_{2(g)} + Br_{2(g)} \rightarrow 2HBr_{(g)}$ . Given that Bond energy of  $H_2$ ,  $Br_2$  and  $HBr$  is  $435 \text{ kJ mol}^{-1}$ ,  $192 \text{ kJ mol}^{-1}$  and  $368 \text{ kJ mol}^{-1}$  respectively.

 [Watch Video Solution](#)

24. The enthalpy of vaporisation of  $\text{CCl}_4$  is  $30.5 \text{ kJ mol}^{-1}$ . Calculate the heat required for the vaporisation of 284 g of  $\text{CCl}_4$  at constant pressure. (Molar mass of  $\text{CCl}_4 = 154 \text{ g mol}^{-1}$ ).

▶ View Text Solution

25. The enthalpy of reaction for the reaction :  $2\text{H}_{(g)} + \text{O}_{2(g)} \rightarrow 2\text{H}_2\text{O}_{(l)}$  is  $\Delta_r H_e^\ominus = -572 \text{ kJ mol}^{-1}$ . What will be the standard enthalpy of formation of  $\text{H}_2\text{O}_{(l)}$ ?

▶ View Text Solution

26. What will be the work done on an ideal gas enclosed in a cylinder, when it is compressed by a constant external pressure,  $P_{\text{ext}}$  in a single step as shown in Fig. Explain graphically.





[View Text Solution](#)

27. How will you calculate work done on an ideal gas in a compression, when change in pressure is carried out in infinite steps ?



[View Text Solution](#)

28. Represent the potential energy / enthalpy change in the following processes graphically.

(a) Throwing a stone from the ground to roof.

(b)  $\frac{1}{2}H_{2(g)} + \frac{1}{2}Cl_{2(g)} \rightleftharpoons HCl_{(g)} \Delta_r H^\ominus = -92.32 \text{ kJ mol}^{-1}$  In which of the processes potential energy/ enthalpy change is contributing factor to the spontaneity ?



[View Text Solution](#)

29. Enthalpy diagram for a particular reaction is given in Fig. Is it possible to decide spontaneity of a reaction from given diagram. Explain.



 [View Text Solution](#)

**30.** 1.0 mol of a monoatomic ideal gas is expanded from state (1) to state (2) as shown in Fig. 6.4. Calculate the work done for the expansion of gas from state (1) to state (2) at 298 K.



 [View Text Solution](#)

**31.** An ideal gas is allowed to expand against a constant pressure of 2 bar from 10 L to 50 L in one step. Calculate the amount of work done by the gas. If the same expansion were carried out reversibly, will the work done be higher or lower than the earlier case ? (Given that 1 L bar = 100 J)

 [Watch Video Solution](#)

1. Match the following :



[View Text Solution](#)

2. Match the following processes with entropy change :



[View Text Solution](#)

3. Match the following parameters with description for spontaneity :



[View Text Solution](#)



4. Match the following :



 [View Text Solution](#)

## Section D Solutions Of Ncert Exemplar Problems Assertion And Reason

1. In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

Assertion (A): Combustion of all organic compounds is an exothermic reaction.

Reason (R) : The enthalpies of all elements in their standard state are zero.

- A. Both A and R are true and R is the correct explanation of A.
- B. Both A and R are true but R is not the correct explanation of A.
- C. A is true but R is false.

D. A is false but R is true.

**Answer: B**

 [Watch Video Solution](#)

2. In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

Assertion (A) : Spontaneous process is an irreversible process and may be reversed by some external agency.

Reason (R) : Decrease in enthalpy is a contributory factor for spontaneity.

- A. Both A and R are true and R is the correct explanation of A.
- B. Both A and R are true but R is not the correct explanation of A.
- C. A is true but R is false.
- D. A is false but R is true.

**Answer: B**



[Watch Video Solution](#)

3. In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

Assertion (A) : A liquid crystallizes into a solid and is accompanied by decrease in entropy.

Reason (R) : In crystals, molecules organise in an ordered manner.

- A. Both A and R are true and R is the correct explanation of A.
- B. Both A and R are true but R is not the correct explanation of A.
- C. A is true but R is false.
- D. A is false but R is true.

**Answer: A**



[Watch Video Solution](#)

## Section D Solutions Of Ncert Exemplar Problems Long Answer Type Questions

1. Derive the relationship between  $\Delta H$  and  $\Delta U$  for an ideal gas. Explain each term involved in the equation.

 [View Text Solution](#)

2. Extensive properties depend on the quantity of matter but intensive properties do not. Explain whether the following properties are extensive or intensive.

Mass, internal energy, pressure, heat capacity, molar heat capacity, density, mole fraction, specific heat, temperature and molarity.

 [View Text Solution](#)

3. The lattice enthalpy of an ionic compound is the enthalpy when one mole of an ionic compound present in its gaseous state, dissociates into

its ions. It is impossible to determine it directly by experiment. Suggest and explain an indirect method to measure lattice enthalpy of  $\text{NaCl}_{(s)}$ .

 [View Text Solution](#)

4.  $\Delta G$  is net energy available to do useful work and is thus a measure of "free energy". Show mathematically that  $\Delta G$  is a measure of free energy. Find the unit of  $\Delta G$ . If a reaction has positive enthalpy change and positive entropy change, under what condition will the reaction be spontaneous ?

 [View Text Solution](#)

5. Graphically show the total work done in an expansion when the state of an ideal gas is changed reversibly and isothermally from  $(p_i, V_i)$  to  $(P_f, V_f)$ . With the help of a pV plot compare the work done in the above case with that carried out against a constant external pressure  $p_f$ .

 [Watch Video Solution](#)

Question Paper From Module Section A Answer The Following Questions In Very Short

1. Which is not state function ?

 [Watch Video Solution](#)

2. What type of the value will be of  $\Delta G$  for ice poured in open vessel at 260 K temperature ?

 [Watch Video Solution](#)

3. What is the change in entropy for crystalline solid while it turns into liquid ?

 [Watch Video Solution](#)