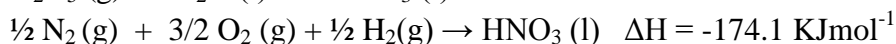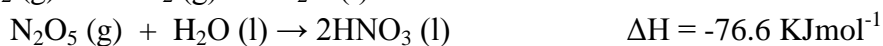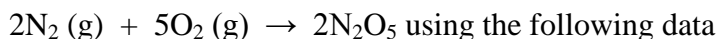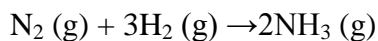|		
	INDIAN SCHOOL AL WADI AL KABIR	
Class XI	**Department of Science 2020-2021** **SUBJECT : CHEMISTRY**	**Date of completion :** **III week of June 2020**
Work sheet No.: 2 **With answers**	**Chapter: Thermodynamics**	**Note: A4 File format**
Name of the student:	**Class & Section:**	**Roll No.**

Objective type Questions (1 mark)

1. Which of the following reaction defines $\Delta_f H^0$?
   (a) $C_{diamond} + O_2 \rightarrow CO_{2_g}$
   (b) $\frac{1}{2}H_{2_g} + \frac{1}{2}F_{2_g} \rightarrow HF_g$
   (c) $N_2 + 3 H_2 \rightarrow 2NH_{3_g}$
   (d) $CO_g + \frac{1}{2}O_2 \rightarrow CO_{2_g}$

2. Predict the sign of ΔS^0 for the following reaction:
$$2H_2S_g + 3O_{2_g} \rightarrow 2H_2O_g + 2SO_{2_g}$$

3. Which of the following are state functions?
   (i)   Height of a hill
   (ii)   Distance travelled in climbing the hill

4. What is a thermodynamic state function?

5. For the reaction $2Cl(g) \rightarrow Cl_{2_g}$ What will be the sign of ΔH and ΔS?

6. State Hess 's Law for constant heat summation?

7. Define extensive properties.

8. Give the relationship between ΔH and ΔU for a reaction in gaseous state.

9. Which among the following is an intensive property?
   (a) Mass
   (b) Volume
   (c) Temperature
   (d) Specific heat

10. Which of the following represents the first law of thermodynamics?
    (a) q= ΔU – w (b) ΔH =q+w (c) ΔU = ΔH +pΔV (d) ΔU = pΔV

11. If enthalpies of formation of NH_3 (g) and H_2O (l) at 298 K and one atm pressure are -45 and1 -286 kJmol^{-1}respectively, calculate the standard enthalpy change of the following reaction.

$$NH_{3(g)} + ¾ O_{2 (g)} \rightarrow ½ N_{2(g)} + 3/2 H_2O_{(l)}$$

a. -384 kJmol^{-1}

b. -192 kJmol^{-1}

c. 384 kJmol^{-1}

d. -331 kJmol^{-1}

12. . ΔH and ΔU are related as

a. $\Delta H = \Delta U$

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

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

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

Question 12

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
(C) Assertion is correct, but reason is wrong statement.
(D) Assertion is wrong, but reason is correct statement.

13.Assertion: Enthalpy of combustion is always negative.
Reason: Combustion reaction proceeds with evolution of heat

Five marks Questions

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14. The reaction between gaseous Hydrogen and Chlorine is

$$H_{2_g} + Cl_{2_g} \rightarrow 2HCl_g; \Delta H^0{}_r = -184KJ$$

(i) What is the enthalpy of formation of HCl?

(ii) How much heat will be liberated at 298K and 1 atm for the formation of 365 g

of HCl?

15. Calculate the enthalpy of combustion of Glucose from the following data :

$$C_{(graphite)} + O_{2(g)} \longrightarrow CO_{2(g)} ; \Delta H_r^0 = -395KJ$$

$$H_{2(g)} + ½ O_{2(g)} \longrightarrow H_2O_{(l)} ; \Delta H_r^0 = -269 KJ$$

$$6C_{(graphite)} + 6 H_{2(g)} + 3O_{2(g)} \longrightarrow C_6H_{12}O_{6 (s)} ; \Delta H_r^0 = -1170 KJ$$

16. a. For a reaction, ΔH is –ve, ΔS is +ve. Is this reaction spontaneous?

b. Calculate the ΔH for the reaction

$2N_2$ (g) + $5O_2$ (g) $\rightarrow$ $2N_2O_5$ using the following data

H_2 (g) + $\frac{1}{2}$ O_2 (g) $\rightarrow$ H_2O (l) ΔH = -285.5 KJmol^{-1}

N_2O_5 (g) + H_2O (l) $\rightarrow$ $2HNO_3$ (l) ΔH = -76.6 KJmol^{-1}

$\frac{1}{2}$ N_2 (g) + $3/2$ O_2 (g) + $\frac{1}{2}$ H_2(g) $\rightarrow$ HNO_3 (l) ΔH = -174.1 KJmol^{-1}

17. (a) For the reaction,

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

ΔH = -95kJ and ΔS = -200JK^{-1}

Calculate the temperature at which Gibbs energy change is equal to zero.

b. Derive the relation $Cp – Cv = R$

Answers :

1. b

2. $\Delta S^0 = -ve$

3. (i) *Height of the hill*

4. The property which depends only on state of system not upon path is called state function e.g. P, V, T, E, H, S etc.

5. $\Delta H = = ve ; \Delta S = -ve$

6. The change of enthalpy of reaction remains same, whether the reaction is carried out in one step or several steps.

7. Properties which depends upon amount of substance called extensive properties. Volume, enthalpy, entropy

8. $\Delta H = \Delta U + \Delta n_g RT.$
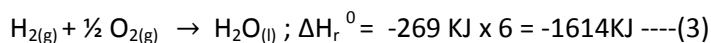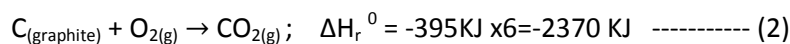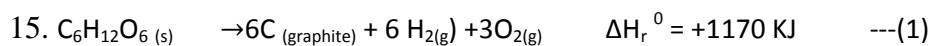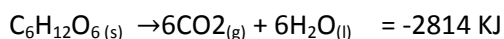
9. (c)

10. (a)

11. (a)

12. (d)

13. (a)

14. The reaction between gaseous Hydrogen and Chlorine is $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$;

$\Delta H0_r$ =184KJ

(i) -91KJ/mol (ii) 36.5g= -92KJ/mol   Therefore 365 g=-920KJ

15. $C_6H_{12}O_{6\ (s)} \rightarrow 6C_{(graphite)} + 6\ H_{2(g)} + 3O_{2(g)}$ $\Delta H_r^{\ 0} = +1170\ KJ$ ---(1)

   $C_{(graphite)} + O_{2(g)} \rightarrow CO_{2(g)}$; $\Delta H_r^{\ 0} = -395KJ\ x6 = -2370\ KJ$ ----------- (2)

   $H_{2(g)} + \frac{1}{2}\ O_{2(g)} \rightarrow H_2O_{(l)}$; $\Delta H_r^{\ 0} = -269\ KJ\ x\ 6 = -1614KJ$ ----(3)

   Adding equations 1,2 and 3

   $C_6H_{12}O_{6\ (s)} \rightarrow 6CO2_{(g)} + 6H_2O_{(l)}$ $= -2814\ KJ$

16. a. Reaction spontaneous at all temperature

    b. $4HNO_3 \rightarrow 2N_2O_5 + 2H_2O$ $\Delta H = 153.2$ kJmol-1

    $2N_2 + 6O_2 + 2H_2 \rightarrow 4HNO_3$ $\Delta H = -696.4$ kJmol-1

    $2H_2O \rightarrow 2H_2 + O_2$ $\Delta H = -571$ kJmol-1
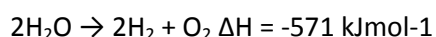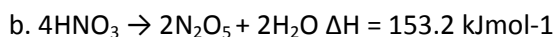
    $\Delta H = -1114.2$ kJmol-1

17. a) $\Delta G = \Delta H - T\ \Delta S$

    $\Delta H = T\ \Delta S$

    $T = -95 \times 1000\ /\ -200 = 475$ K

    b)

Heat (q) at constant volume is given as
$$q_v = C_v \Delta T = \Delta U$$
Heat (q) at constant pressure is given as
$$q_p = C_p \Delta T = \Delta H$$
But

$H = U + PV$
and $PV = RT$ [for one mole of an ideal gas]

$\therefore$ $H = U + RT$
$\therefore$ $\Delta H = \Delta U + \Delta(RT)$
or $\Delta H = \Delta U + R\Delta T$
or $\Delta H - \Delta U = R\Delta T$ ...(1)
Substituting the values of ΔH and ΔU in eq. (1), we get,

$C_p \Delta T - C_v \Delta T = R\Delta T$ or $C_p - C_v = R$ (for one mole of an ideal gas)
Thus C_p is greater than C_v by the gas constant R i.e. approximately 2 calories or 8.314 Joules.

Prepared by Ms. Jenesha Joseph

Checked by : HOD – SCIENCE