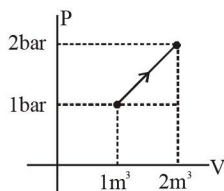


1. What is  $\Delta U$  for the process described by figure. Heat supplied during the process  $q = 200$  kJ.

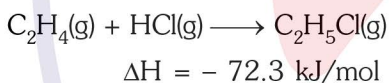


- (1) +50 kJ  
 (2) -50 kJ  
 (3) -150 kJ  
 (4) + 150 kJ
2. What is the change in internal energy when a gas is compressed from 377 ml of 177 ml under a constant pressure of 1520 torr, while at the same time being cooled by removing 124 J heat ?

[Take : (1L atm) = 100 J]

- (1) -24 J (2) - 84 J  
 (3) - 164 J (4) - 248 J
3. For a reaction,  $2X(s) + 2Y(s) \rightarrow 2C(l) + D(g)$   
 The  $q_p$  at  $27^\circ\text{C}$  is  $-28$  KCal.  $\text{mol}^{-1}$ . The  $q_v$  is -----  
 ----- K. Cal.  $\text{mol}^{-1}$  :-
- (1) - 27.4 (2) + 27.4  
 (3) - 28.6 (4) 28.6

4. Ethyl chloride ( $\text{C}_2\text{H}_5\text{Cl}$ ), is prepared by reaction of ethylene with hydrogen chloride :



What is the value of  $\Delta U$  (in kJ), if 70 g of ethylene and 73 g of HCl are allowed to react at 300 K.

- (1) -69.8 (2) -180.75  
 (3) -174.5 (4) -139.6
5. One mole of an ideal monoatomic gas expanded irreversibly in two stage expansion.  
 State-1 (8.0 bar, 4.0 litre, 300 K)  
 State-2 (2.0 bar, 16litre, 300 K)  
 State-3 (1.0 bar, 32 litre, 300 K)  
 Total heat absorbed by the gas in the process is
- (1) 116J (2) 40 J  
 (3) 4000 J (4) None of these

6. When a gas is compressed adiabatically and reversibly, the final temperature is-
- (1) Higher than the initial temperature  
 (2) Lower than the initial temperature  
 (3) The same as initial temperature  
 (4) Dependent upon the rate of compression

7. A gas ( $C_{v,m} = \frac{5}{2}R$ ) behaving ideally was allowed to expand reversibly and adiabatically from 1 litre to 32 litre. It's initial temperature was  $327^\circ\text{C}$ . The molar enthalpy change (in J/mole) for the process is :-

- (1) -1125 R (2) - 575 R  
 (3) -1575 R (4) None of these

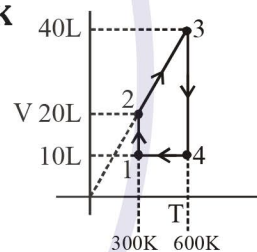
8. Two moles of an ideal gas ( $C_v = \frac{5}{2}R$ ) was compressed adiabatically against constant pressure of 2 atm. which was initially at 350 K and 1 atm pressure. The work involve in the process is equal to ?

- (1) 250 R (2) 300 R  
 (3) 400 R (4) 500 R

9. What is the net work done when 1 mole of monoatomic ideal gas undergoes in a process described by 1, 2, 3, 4 in given V-T graph

Use :  $R = 2\text{cal/mole K}$

$\ln 2 = 0.7$



- (1) -600 cal  
 (2) - 660 cal  
 (3) + 660 cal  
 (4) + 600 cal

10. The heat capacity of liquid water is  $75.6$  J/mol.K, while the enthalpy of fusion of ice is  $6.0$  kJ/mol. What is the smallest number of ice cubes at  $0^\circ\text{C}$ , each containing  $9.0$  g of water, needed to cool  $500$  g of liquid water from  $20^\circ\text{C}$  to  $0^\circ\text{C}$  ?

- (1) 1 (2) 7 (3) 14 (4) None of these

11. Change in entropy is negative for :-

- (1) Bromine ( $l$ )  $\longrightarrow$  Bromine ( $g$ )  
 (2)  $\text{C}(s) + \text{H}_2\text{O}(g) \longrightarrow \text{CO}(g) + \text{H}_2(g)$   
 (3)  $(3) \text{N}_2(g, 10 \text{ atm}, 298 \text{ K}) \longrightarrow \text{N}_2(g, 1 \text{ atm}, 298\text{K})$   
 (4)  $\text{Fe}(\text{at } 400 \text{ K}) \longrightarrow \text{Fe}(\text{at } 300 \text{ K})$

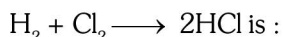
12. 5 mole of an ideal gas expand reversibly from a volume of  $8 \text{ dm}^3$  to  $80\text{dm}^3$  at a temperature of  $27^\circ\text{C}$ . The change in entropy is :-

- (1)  $41.57 \text{ JK}^{-1}$  (2)  $- 95.73 \text{ JK}^{-1}$   
 (3)  $95.73 \text{ JK}^{-1}$  (4)  $- 41.57 \text{ JK}^{-1}$

**13.** If  $\Delta H_{\text{vapourisation}}$  of substance X(l) (molar mass : 30 g/mol) is 300 J/g at its boiling point 300 K, then molar entropy change for reversible condensation process is :-

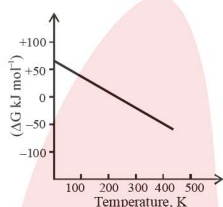
- (1) 30 J/mol.K                      (2) -300 J/mol.K  
(3) -30 J/mol.K                      (4) None of these

**14.** If  $S^{\circ}$  for  $H_2$ ,  $Cl_2$  and  $HCl$  are 0.13, 0.22 and 0.19  $KJ K^{-1} mol^{-1}$  respectively. The total change in standard entropy for the reaction,



- (1) 30  $JK^{-1} mol^{-1}$                       (2) 40  $JK^{-1} mol^{-1}$   
(3) 60  $JK^{-1} mol^{-1}$                       (4) 20  $JK^{-1} mol^{-1}$

**15.** What can be concluded about the values of  $\Delta H$  and  $\Delta S$  from this graph?



- (1)  $\Delta H > 0, \Delta S > 0$   
(2)  $\Delta H > 0, \Delta S < 0$   
(3)  $\Delta H < 0, \Delta S > 0$   
(4)  $\Delta H < 0, \Delta S < 0$

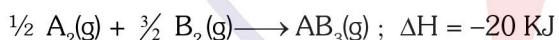
**16.** What is the free energy change ( $\Delta G$ ) when 1.0 mole of water at 100°C and 1 atm pressure is converted into steam at 100°C and 1 atm pressure ?

- (1) 80 cal                                      (2) 540 cal  
(3) 620 cal                                      (4) zero

**17.** For a reaction at 25°C enthalpy change ( $\Delta H$ ) and entropy change ( $\Delta S$ ) are  $-11.7 \times 10^3 J mol^{-1}$  and  $-105 J mol^{-1} K^{-1}$  respectively. The reaction is :

- (1) Spontaneous                              (2) Non spontaneous  
(3) At equilibrium                              (4) Can't say anything

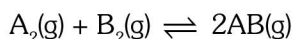
**18.** For hypothetical reversible reaction,



if standard entropies of  $A_2$ ,  $B_2$  and  $AB_3$  are 60, 40 and 50  $JK^{-1} mole^{-1}$  respectively. The above reaction will be in equilibrium at the temperature :-

- (1) 400 K                                      (2) 500 K  
(3) 250 K                                      (4) 200 K

**19.** For the hypothetical reaction ,



$\Delta_r G$  and  $\Delta_r S$  are 20 kJ/mole and  $-20 JK^{-1} mol^{-1}$  respectively at 200 K.

If  $\Delta_r C_p$  is 20  $JK^{-1} mol^{-1}$  then  $\Delta_r H$  at 400 K is :-

- (1) 20 kJ/mole                              (2) 7.98 kJ/mole  
(3) 28 kJ/mole                              (4) None of these

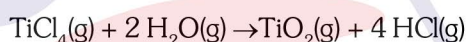
**20.** The value of  $\Delta G_f^{\circ}$  of gaseous mercury is 31 KJ/mole. At what total external pressure mercury start boiling at 25°C. [ $R = 8.3 J/K mole$ ]

- (1)  $10^{-5.44}$                                       (2)  $10^{-12.5}$   
(3)  $10^{-6.52}$                                       (4)  $10^{-3.12}$

**21.** Which of the following equations represents a reaction that provides the heat of formation of  $CH_3Cl$ ?

- (1)  $C(s) + HCl(g) + H_2(g) \rightarrow CH_3Cl(g)$   
(2)  $C(s) + 3/2 H_2(g) + 1/2 Cl_2(g) \rightarrow CH_3Cl(g)$   
(3)  $C(s) + 3 H(g) + Cl(g) \rightarrow CH_3Cl(g)$   
(4)  $CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$

**22.** Use the given standard enthalpies of formation to determine the heat of reaction of the following reaction:



$$\Delta H_f^{\circ} TiCl_4(g) = -763.2 kJ/mole$$

$$\Delta H_f^{\circ} TiO_2(g) = -944.7 kJ/mole$$

$$\Delta H_f^{\circ} H_2O(g) = -241.8 kJ/mole$$

$$\Delta H_f^{\circ} HCl(g) = -92.3 kJ/mole$$

- (1) - 278.1                                      (2) + 369.2  
(3) + 67.1                                      (4) - 67.1

**23.**  $2NO_2(g) \rightarrow N_2O_4(g)$

$$\Delta U_f^{\circ} [N_2O_4(g)] = 2kcal/ mole$$

and  $\Delta U_{\text{reaction}}^{\circ} = -16 kcal /mol$  then calculate  $\Delta H_{\text{formation}}^{\circ}$  of  $NO_2$  at 727°C

- (1) 9 kcal /mol                                      (2) 4.5 kcal /mol  
(3) 8 kcal /mol                                      (4) 10 kcal /mol

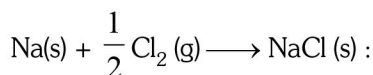
**24.** The reaction  $CH_4(g) + Cl_2(g) \longrightarrow CH_3Cl(g) + HCl(g)$  has  $\Delta H = -25 kCal$ .

Bond	Bond Enthalpy kCal
$\epsilon_{C-Cl}$	84
$\epsilon_{H-Cl}$	103
$\epsilon_{C-H}$	x
$\epsilon_{Cl-Cl}$	y
$x : y = 9 : 5$	

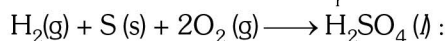
From the given data, what is the bond enthalpy of  $Cl-Cl$  bond

- (1) 70 kCal                                      (2) 80 kCal  
(3) 67.75 kCal                                      (4) 57.75 kCal

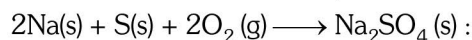
**25.** The enthalpy changes of the following reactions at 27°C are



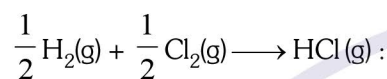
$$\Delta_r H = -411 \text{ kJ/mol}$$



$$\Delta_r H = -811 \text{ kJ/mol}$$

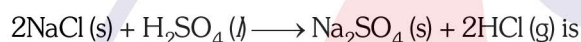


$$\Delta_r H = -1382 \text{ kJ/mol}$$



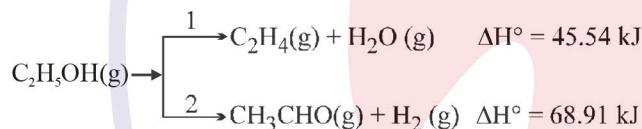
$$\Delta_r H = -92 \text{ kJ/mol};$$

from these data, the heat change of reaction at constant volume (in kJ/mol) at 27°C for the process (R = 8.3 J/K-mol)



- (1) 67 (2) 62.02  
(3) 71.98 (4) None

**26.** Ethanol can undergoes decomposition to form two sets of products



if the molar ratio of C<sub>2</sub>H<sub>4</sub> to CH<sub>3</sub>CHO is 8 : 1 in a set of product gases, then the enthalpy involved in the decomposition of 1 mole of ethano/is :

- (1) 65.98 kJ (2) 48.137 kJ  
(3) 48.46 kJ (4) 57.22 kJ

**27.**  $\Delta H_f^\circ$  of water is - 285.8 kJ mol<sup>-1</sup>. If enthalpy of neutralisation of monoacid strong base is -57.3 kJ mol<sup>-1</sup>,  $\Delta H_f^\circ$  of OH<sup>-</sup> ion will be

- (1) - 228.5 kJ mol<sup>-1</sup> (2) 228.5 kJ mol<sup>-1</sup>  
(3) 114.25 kJ mol<sup>-1</sup> (4) -114.25 kJ mol<sup>-1</sup>

**28.** The molar heat capacities at constant pressure (assume constant with respect to temperature) of A, B and C are in ratio of **1.5 : 3.0 : 2.0** . If enthalpy change for the exothermic reaction A + 2B → 3C at 300 K is - 10 kJ/mol & C<sub>p,m</sub>(2) is 300 J/mol then enthalpy change at 310 K is

- (1) - 8.5 kJ/mol (2) 8.5 kJ/mol  
(3) - 11.5 kJ/mol (4) none of these

**29.** Reactions involving gold have been of particular interest to a chemist . Consider the following reactions,



$$\Delta H = - 28 \text{ kCal}$$



$$\Delta H = - 36.8 \text{ kCal}$$

In an experiment there was an absorption of 0.44 kCal when one mole of HAuBr<sub>4</sub> was mixed with 4 moles of HCl . What is the percentage conversion of HAuBr<sub>4</sub> into HAuCl<sub>4</sub> ?

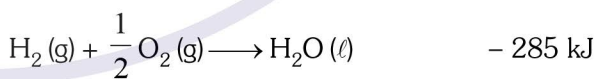
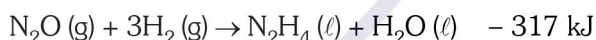
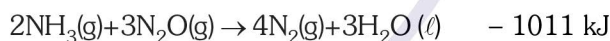
- (1) 0.5 % (2) 0.6 %  
(3) 5 % (4) 50 %

**30.** Hydrazine, a component of rocket fuel, undergoes combustion to yield N<sub>2</sub> and H<sub>2</sub>O.



What is the enthalpy change of combustion of N<sub>2</sub>H<sub>4</sub> (kJ/mole)

**Given Reaction** **ΔH/kJ**



- (1) - 620.5 (2) - 622.75  
(3) 1167.5 (4) + 622.75

**ANSWER KEY**

**Exercise-1**

<b>Que.</b>	1	2	3	4	5	6	7	8	9	10
<b>Ans.</b>	1	2	3	4	3	1	3	4	3	3
<b>Que.</b>	11	12	13	14	15	16	17	18	19	20
<b>Ans.</b>	4	3	3	1	1	4	2	2	1	1
<b>Que.</b>	21	22	23	24	25	26	27	28	29	30
<b>Ans.</b>	2	4	3	4	2	2	1	3	3	1