Date Planned : __ / __ / __	Daily Tutorial Sheet - 1	Expected Duration : 90 Min
Actual Date of Attempt : __ / __ / __	JEE Main (Archive)	Exact Duration :_____

1. For the reaction, **(2002)**

$C + O_2 \rightarrow CO_2$; $\Delta H = -393$ J , $2Zn + O_2 \rightarrow 2$ ZnO; $H = -412$ J

Which one is correct ?

(A) Carbon can reduce ZnO to Zn

(B) Oxidation of carbon is not feasible

(C) Oxidation of Zn is not feasible

(D) Zn liberates more heat than carbon during oxidation

2. The enthalpies of combustion of carbon and carbon monoxide are –393.5 and –283.5 kJ mol^{-1} respectively. The enthalpy of formation of carbon monoxide per mole is : **(2004)**

(A) $-110\,kJ$ **(B)** $676.5\,kJ$ **(C)** $-676.5\,kJ$ **(D)** $110.5\,kJ$

3. The standard enthalpy of formation ($\Delta_f H°$) at 298 K for methane, $CH_4(g)$, is –74.8 kJ mol^{-1}. The additional information required to determine the average energy for C–H bond formation would be **(2006)**

(A) The dissociation energy of hydrogen molecule, H_2

(B) The dissociation energy of H_2 and enthalpy of sublimation of carbon

(C) Latent heat of vaporization of methane

(D) The first four ionization energies of carbon and electron gain enthalpy of hydrogen

4. The enthalpy change states for the following processes are listed below : **(2006)**

$Cl_2(g) = 2Cl(g)$; $242.3\,kJ\,mol^{-1}$

$l_2(g) = 2l(g)$; $151.0\,kJ\,mol^{-1}$

$ICl(g) = I(g) + Cl(g)$; $211.3\,kJ\,mol^{-1}$

$I_2(s) = l_2(g)$; $62.76\,kJ\,mol^{-1}$

Given that the standard states for iodine and chlorine are $I_2(s)$ and $Cl_2(g)$, the standard enthalpy of formation for $ICl(g)$ is :

(A) + 244.8 kJ mol^{-1} **(B)** –14.6 kJ mol^{-1} **(C)** –16.8 kJ mol^{-1} **(D)** +16.8 kJ mol^{-1}

5. Standard entropy of X_2, Y_2 and XY_3 are 60, 40 and 50 J $K^{-1}\,mol^{-1}$, respectively. For the reaction, $1/2X_2 + 3/2Y_2 \rightarrow XY_3$, $\Delta H = -30\,kJ$, to be at equilibrium, the temperature will be **(2008)**

(A) 1250 K **(B)** 500 K **(C)** 750 K **(D)** 1000 K

6. In a fuel cell, methanol is used as fuel and oxygen gas is used as an oxidizer. The reaction is : **(2009)**

$$CH_3OH(l) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

At 298 K standard Gibbs energies of formation for $CH_3OH(l)$, $H_2O(l)$, and $CO_2(g)$ are –166.2, – 237.2, and –394.4 kJ mol^{-1}, respectively. If standard enthalpy of combustion of methanol is $-726\,kJ\,mol^{-1}$, efficiency of the fuel cell will be

(A) 80% **(B)** 87% **(C)** 90% **(D)** 97%

7. On the basis of the following thermochemical data $[\Delta_f G°H^+(aq) = 0]$ **(2009)**

$H_2O(l) \rightarrow H^+(aq) + OH^-(aq);\ \Delta H = 57.32\,kJ$

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l);\ \Delta H = -286.20\ kJ$

The value of enthalpy of formation of OH^- ion at 25°C is

(A) –22.88 kJ **(B)** –228.88kJ **(C)** +228.88kJ **(D)** –343.52kJ

8. The standard enthalpy of formation of NH_3 is –46.0 kJ mol^{-1}. If the enthalpy of formation of H_2 from its atoms is –436 kJ mol^{-1} and that of N_2 is –712 kJ mol^{-1}, the average bond enthalpy of N–H bond in NH_3 is: **(2010)**

(A) $-964\,kJ\,mol^{-1}$ **(B)** $+352\,kJ\,mol^{-1}$

(C) $+1056\,kJ\,mol^{-1}$ **(D)** $-1102\,kJ\,mol^{-1}$

9. The value of enthalpy change (ΔH) for the reaction **(2011)**

$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$ at 27°C is –1366.5 kJ mol^{-1}. The value of internal energy change for the above reaction at this temperature will be

(A) –1371.5 kJ **(B)** –1369.0 kJ **(C)** –1364.0 kJ **(D)** –1361.5 kJ

10. Consider the reaction, **(2011)**

$4NO_2(g) + O_2(g) \rightarrow 2N_2O_5(g), \Delta_r H = -111\,kJ$. If $N_2O_5(s)$ is formed instead of $N_2O_5(g)$ in the above reaction, the $\Delta_r H$ value will be

(Given, ΔH of sublimation for N_2O_5 is 54 kJ mol^{-1})

(A) –165 kJ **(B)** +54 kJ **(C)** +219 kJ **(D)** –219 kJ

11. For the 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 kJ mol^{-1} at 25°C. Assuming ideality, the enthalpy of combustion, $\Delta_C H$ for the reaction will be **(2014)**

$[R = 8.314\,JK^{-1}\,mol^{-1}]$

(A) $-1366.95\,kJmol^{-1}$ **(B)** $-1361.95\,kJmol^{-1}$

(C) $-1460.50\,kJmol^{-1}$ **(D)** $-1350.50\,kJ\,mol^{-1}$

12. The combustion of benzene (ℓ) gives $CO_2(g)$ and $H_2O(\ell)$. Given that heat of combustion of benzene at constant volume is $-3263.9\,kJ\,mol^{-1}$ at 25°C, heat of combustion (in $kJ\,mol^{-1}$) of benzene at constant pressure will be : $(R = 8.314\,JK^{-1}\,mol^{-1})$ **(2018)**

(A) 3260 **(B)** –3267.6 **(C)** 4152.6 **(D)** –452.46

13. For which of the following reactions, ΔH is equal to ΔU ? **(2018)**

(A) $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$ **(B)** $2HI(g) \longrightarrow H_2(g) + I_2(g)$

(C) $2NO_2(g) \longrightarrow N_2O_4(g)$ **(D)** $2SO_2 + O_2(g) \longrightarrow 2SO_3(g)$

14. Given : **(2018)**

(i) $2Fe_2O_3(s) \longrightarrow 4Fe(s) + 3O_2(g);\ \Delta_rG^\circ = +1487.0\ kJ\ mol^{-1}$

(ii) $2CO(g) + O_2(g) \longrightarrow 2CO_2(g);\ \Delta_rG^\circ = -514.4\ kJ\ mol^{-1}$

Free energy change, Δ_rG° for the reaction

$2Fe_2O_3(s) + 6CO(g) \longrightarrow 4Fe(s) + 6CO_2(g)$ will be :

(A) $-112.4\ kJ\ mol^{-1}$ **(B)** $-56.2\ kJ\ mol^{-1}$ **(C)** $-168.2\ kJ\ mol^{-1}$ **(D)** $-208.0\ kJ\ mol^{-1}$

15. For which of the following processes, ΔS is negative ? **(2018)**

(A) $H_2(g) \longrightarrow 2H(g)$ **(B)** $N_2(g, 1\ atm) \longrightarrow N_2(g, 5\ atm)$

(C) C(diamond) $\longrightarrow$ C(graphite) **(D)** $N_2(g, 273\ K) \longrightarrow N_2(g, 300\ K)$

16. Given : **(2019)**

(i) $C(\text{graphite}) + O_2(g) \rightarrow CO(g);\ \Delta_rH^\circ = x\ kJ\ mol^{-1}$

(ii) $C(\text{graphite}) + \frac{1}{2}O_2(g) \rightarrow CO_2(g);\ \Delta_rH^\circ = y\ kJ\ mol^{-1}$

(iii) $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g);\ \Delta_rH^\circ = z\ kJ\ mol^{-1}$

Based on the above thermochemical equations, find out which one of the following algebraic relationships is correct ?

(A) $z = x + y$ **(B)** $y = 2z - x$ **(C)** $x = y - z$ **(D)** $x = y + z$

17. The difference between ΔH and $\Delta U (\Delta H - \Delta U)$, , when the combustion of one mole of heptane(l) is carried out at a temperature T, is equal to : **(2019)**

(A) $-4RT$ **(B)** $4RT$ **(C)** $-3RT$ **(D)** $3RT$

18. Enthalpy of sublimation of iodine is 24 cal g^{-1} at 200°C. If specific heat of I_2(s) and I_2(vap) are 0.055 and $0.031 cal\ g^{-1}K^{-1}$ respectively, then enthalpy of sublimation of iodine at 250°C in cal g^{-1} is :

(A) 5.7 **(B)** 22.8 **(C)** 11.4 **(D)** 2.85 **(2019)**

19. The standard heat of formation $(\Delta_fH^\circ_{298})$ of ethane (in kJ/mol), if the heat of combustion of ethane, hydrogen and graphite are $-1560, -393.5$ and $-286\ kJ/mol$, respectively is _____. **(2020)**

20. If enthalpy of atomisation for $Br_2(\ell)$ is $x\ kJ/mol$ and bond enthalpy for Br_2 is $y\ kJ/mol$, the relation between them : **(2020)**

(A) does not exist **(B)** is $x = y$ **(C)** is $x > y$ **(D)** is $x < y$