Daily Tutorial Sheet-1	Level-1

1.(B) The reactions in which products have lesser energy than reactants, then energy is released in the reaction and such reactions are known as exothermic reactions e.g.

$$N_2 + 3H_2 \longrightarrow 2NH_3 + 90\,kJ$$

In this equation energy is released, so, it is an example of exothermic reaction.

2.(A) Bond breaking process or decomposition process are endothermic process.

3.(C) Macroscopic properties which determine the state of a system are referred as state functions. The change in the state properties depends only upon the initial and final state of the system. All thermodynamics functions are state functions except work and heat.

4.(C) The properties of the system whose value depends upon the amount of substance present in the system is called extensive property. Gibb's free energy is an extensive property.

5.(C) Internal energy, enthalpy and entropy are state functions but work and heat are path functions.

6.(A) For exothermic reaction, $\Delta H = (-)$ for endothermic reaction, $\Delta H = (+)$.

7.(A) For an endothermic reactions ΔH is positive because in endothermic reaction heat is always absorbed.

8.(A) The heat of formation of CO is calculated by using Hess's law. According to it, the total heat change occurring during a chemical reaction is independent of path.

$$2CO(g) + O_2(g) \longrightarrow 2CO_2(g)\ ; \qquad \Delta H = -135.2 \text{ kcal}$$

I. $$CO_2(g) \longrightarrow CO(g) + \frac{1}{2}O_2(g); \qquad \Delta H = \frac{135.2}{2} \text{ kcal}$$

II. $$C(s) + O_2(g) \longrightarrow CO_2(g); \qquad \Delta H = -94 \text{ kcal}$$

Required equation : $$C(s) + \frac{1}{2}O_2(g) \longrightarrow CO(g); \qquad \Delta H = ?$$

Add Eqs. (I) and (II) $$C(s) + \frac{1}{2}O_2(g) \longrightarrow CO(g); \qquad \Delta H = -26.4 \text{ kcal}$$

9.(B) Every system having some quantity of matter, is associated with a definite amount of energy. This energy is known as internal energy. It is sum of many type of energies, such as translation energy, rotational energy, vibrational energy, electronic energy and bonding energy of the molecule.

$$E = E_{trans} + E_{rot} + E_{vib} + E_{bonding} + E_{electronic}$$

10.(B) $C(s) + O_2(g) \longrightarrow CO_2(g)\ ; \Delta H = r$

$$CO(g) + \frac{1}{2}O_2(g) \longrightarrow CO_2(g);\ \Delta H = s$$

$$C(s) + \frac{1}{2}O_2(g) \longrightarrow CO(g);\ \Delta H = ?$$

Subtract Eq. (ii) from Eq. (i)

$$C(s) + O_2(g) \longrightarrow CO_2(g);\ \Delta H = r$$

$$CO(s) + \frac{1}{2}O_2(g) \longrightarrow CO_2(g); \qquad \Delta H = s$$

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$$C(s) + \frac{1}{2}O_2(g) \longrightarrow CO(g); \qquad \Delta H = r - s$$

11.(B) Hess's law is based upon law of conservation of energy i.e., first law of thermodynamics.

12.(C) The first law of thermodynamics can be expressed as: $\Delta E = q + W$; $q = \Delta E - W$

13.(A) According to Hess's law that the total heat change (ΔH) accompanying a chemical reaction is the same whether the reaction takes place in one or more steps. It means that heat of a reaction depends only on the initial reactants and final products and not on intermediate products that may be formed.

Now, $\Delta H = \Delta H_1 + \Delta H_2 + \Delta H_3$

Enthalpy change in a reaction is always constant and independent of the path followed.

14.(B) ΔH_f° of elements in their standard state is taken to be zero. Cl_2 is gas, Br_2 is liquid and I_2 is solid at room temperature.

15.(A) $NaOH + HCl \longrightarrow NaCl + H_2O$

20 mL 100 mL

0.5 M 0.1 M

10 m moles 10 m moles

0.01 moles 0.01 moles

Applying unitary method

0.01 mole of acid and base release $= x\,kJ$

1 mole of acid and base release $= \frac{x}{0.01} kJ/mol = -100\,x\,kJ/mol$

–ve sign shows energy is released