

### 1. Which of the following are Lewis acids?

- (a)  $\text{PH}_3$  and  $\text{BCl}_3$
- (b)  $\text{AlCl}_3$  and  $\text{SiCl}_4$
- (c)  $\text{PH}_3$  and  $\text{SiCl}_4$
- (d)  $\text{BCl}_3$  and  $\text{AlCl}_3$

#### Solution:

The compound which can accept a pair of electrons is known as Lewis acid.  $\text{BCl}_3$  and  $\text{AlCl}_3$  have vacant orbitals and their octet is not complete. Hence these can accept electron pairs and behave as Lewis acids.

Hence option (d) is the answer.

### 2. Species acting as both Bronsted acid and base is

- (a)  $(\text{HSO}_4)^-$
- (b)  $\text{Na}_2\text{CO}_3$
- (c)  $\text{NH}_3$
- (d)  $\text{OH}^-$

#### Solution:

A Bronsted acid is a substance that can donate a proton to any other substance and a Bronsted base is a substance that can accept a proton from any other substance.  $(\text{HSO}_4)^-$  can donate and accept a proton.

Hence option (a) is the answer.

### 3. What is the conjugate base of $\text{OH}^-$ ?

- (a)  $\text{O}_2$
- (b)  $\text{H}_2\text{O}$
- (c)  $\text{O}^-$
- (d)  $\text{O}^{2-}$

#### Solution:

When acid gives  $\text{H}^+$  then the remaining of its part is called the conjugate base.

The conjugate base of  $\text{OH}^-$  is  $\text{O}^{2-}$ .

Hence option (d) is the answer.

### 4. Which one of the following substances has the highest proton affinity?

- (a)  $\text{H}_2\text{S}$
- (b)  $\text{NH}_3$
- (c)  $\text{PH}_3$
- (d)  $\text{H}_2\text{O}$

#### Solution:

The stability of the conjugate acid will give us the compound with the highest proton affinity.

Here ammonia has the highest proton affinity.

Hence option (b) is the answer.

**5. When rain is accompanied by a thunderstorm, the collected rainwater will have a pH value**

- (a) slightly lower than that of rainwater without a thunderstorm
- (b) slightly higher than that when the thunderstorm is not there
- (c) uninfluenced by the occurrence of a thunderstorm
- (d) which depends on the amount of dust in the air.

**Solution:**

The temperature increases due to the thunderstorm. As temperature increases,  $[H^+]$  also increases, and thus pH decreases.

Hence option (a) is the answer.

**6. For the reaction,  $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ ,  $\Delta H = -57.2 \text{ kJ mol}^{-1}$  and  $K_c = 1.7 \times 10^{16}$  Which of the following statements is incorrect?**

- (a) The equilibrium will shift in the forward direction as the pressure increases.
- (b) The addition of inert gas at constant volume will not affect the equilibrium constant.
- (c) The equilibrium constant is large, suggestive of reaction going to completion and so no catalyst is required.
- (d) The equilibrium constant decreases as the temperature increases.

**Solution:**

The large value of  $K_c$  suggests that the reaction should go almost to completion. The oxidation of  $SO_2$  to  $SO_3$  is very slow. So the rate of reaction is increased by adding a catalyst. Statement c is wrong.

Hence option (c) is the answer.