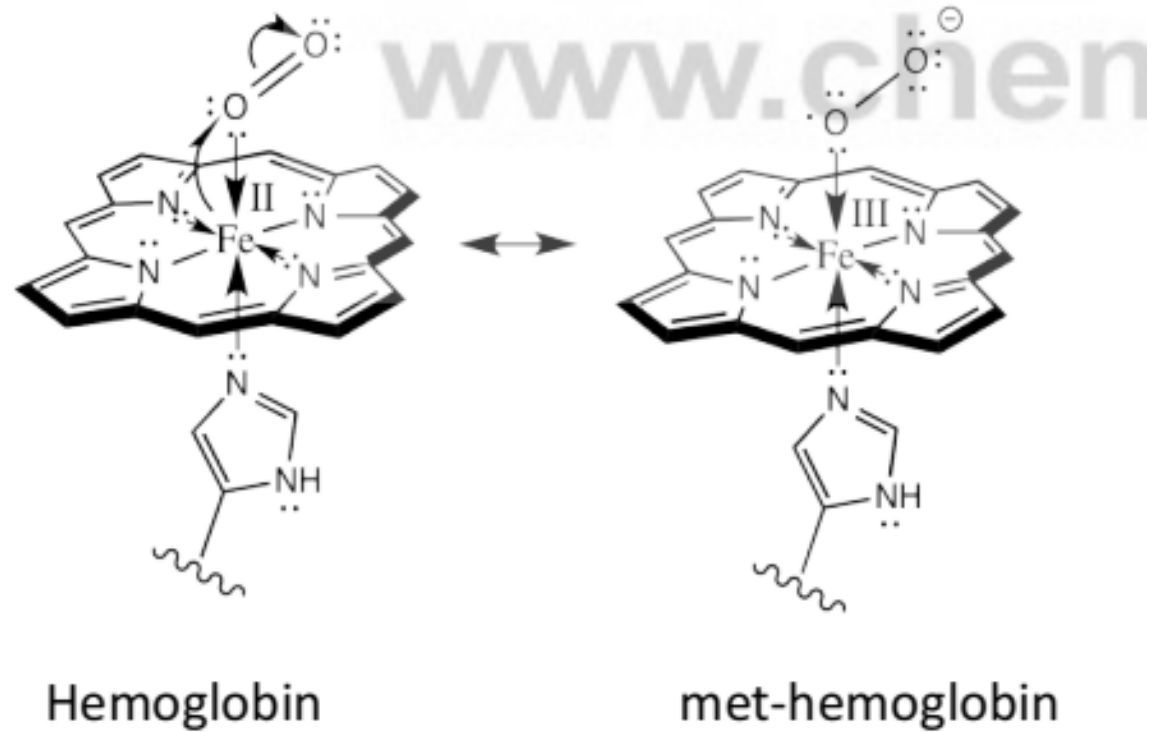


1. What is the oxidation state of **Fe** in Met-hemoglobin

- A) +3
- B) +2
- C) 0
- D) +4

**Ans: A**



Also, predict the no. of unpaired electron present in **Fe** Centre in Met-hemoglobin.

2. The cooperative binding of  $O_2$  in hemoglobin is due to
- (a) a decrease in size of iron followed by changes in the protein conformation
  - (b) an increase in size of iron followed by changes in the protein conformation
  - (c) a decrease in size of iron that is NOT accompanied by the protein conformational changes
  - (d) an increase in size of iron that is NOT accompanied by the protein conformational changes

**NOTE: transitions from the T (tense) state to the R (relaxed) state the primary molecule that moves out hemoglobin tetramer is 2,3-bisphosphoglycerate (2,3-BPG).**

**Correct answer is (a)**

The movement of iron atom and imidazole side chain of histidine toward the porphyrin plane results in breaking of some of the salt bridges. The breaking of these salt bridges reduces the strain in hemoglobin molecule. Therefore, the oxyform of hemoglobin is called relaxed state (i.e., R state). The T form of deoxyhemoglobin discourages the addition of first dioxygen molecule.

The bonding of one dioxygen molecule to a subunit of hemoglobin reduces the steric hindrance in the other subunits (due to breaking of salt bridges) and therefore encourages the third as well as fourth subunits. This is called cooperative mechanism

3. During the binding of  $O_2$  to myoglobin (consider 'heme' in xy-plane), the molecular orbital of  $O_2$  and atomic orbital of Fe involved in the formation of the  $\sigma$ -bond is

1.  $\pi^*$  and  $d_{z^2}$

2.  $\pi^*$  and  $d_{xz}$

3.  $\pi$  and  $d_{xz}$

4.  $\pi$  and  $d_{z^2}$

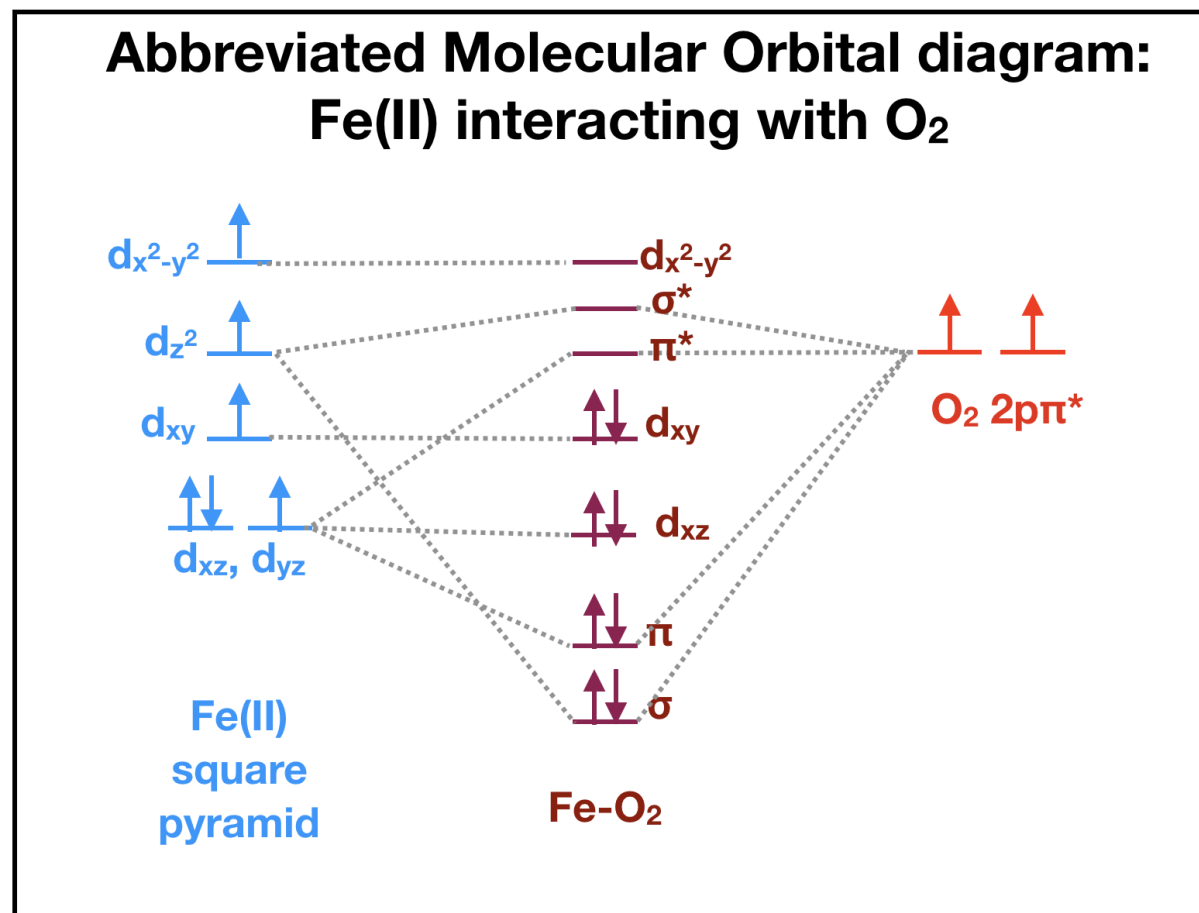
**Ans: 1**

### 3. The red colour of oxy-hemoglobin is mainly due to

- (a) d-d transition
- (b) metal to ligand charge transfer transition
- (c) Ligand to metal charge transfer transition
- (d) intraligand  $\pi$  to  $\pi^*$  transition

**Ans: d**

The binding of oxygen to the iron in the heme group causes a shift in the electronic structure, making the  $\pi \rightarrow \pi^*$  transition more prominent and causing the observed change in color from the purplish color of deoxy-hemoglobin to the bright red of oxy-hemoglobin.

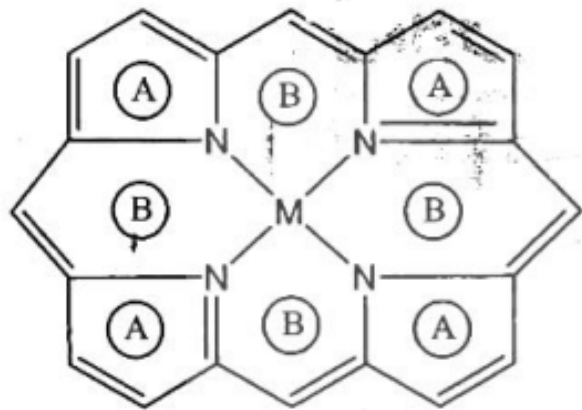


**Correct combination of number and size of rings present in a metal ion-porphine complex (including metal ion bearing chelate rings) is**

- (a) four 5-membered and four 6-membered**
- (b) two 5-membered and six 6-membered**
- (c) six 5-membered and two 6-membered**
- (d) five 5-membered and three 6-membered**

**Correct option is (a)**

Structure of m-porphyrine complex can be shown as

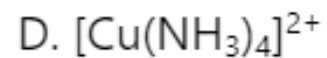
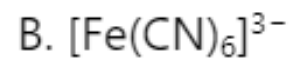
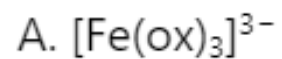


Here, (A) represents = five membered ring

(B) represents = six membered ring.

Thus, these are four 5-membered ring and four-6-membered ring.

Complex(es) which has/have unpaired electron(s) that is equal to that of iron center in oxymyoglobin is/are



(Given: ox = oxalato)

Correct answer is

1. A and B

2. B and D

**Ans: 2**

3. C only

4. C and D

**2. During the binding of  $O_2$  to myoglobin (consider 'heme' in x-y plane), the molecular orbital of  $O_2$  and the atomic orbital of Fe involved in  $\sigma$ -bond formation is**

A)  $\pi$  and  $d_z^2$

B)  $\pi^*$  and  $d_z^2$

**ANS: (B)**

C)  $\sigma$  and  $d_z^2$

D)  $\sigma^*$  and  $d_z^2$

**3. In the transformation of oxy-haemoglobin to deoxy-haemoglobin**

A)  $Fe^{3+}$  in the low spin changes to  $Fe^{2+}$  in the high spin state

B)  $Fe^{3+}$  in the low spin changes to  $Fe^{2+}$  in the low spin state

**ANS: (A)**

C)  $Fe^{2+}$  in the high spin changes to  $Fe^{3+}$  in the low spin state

D)  $Fe^{3+}$  in the low spin remains to  $Fe^{3+}$  in the high spin state