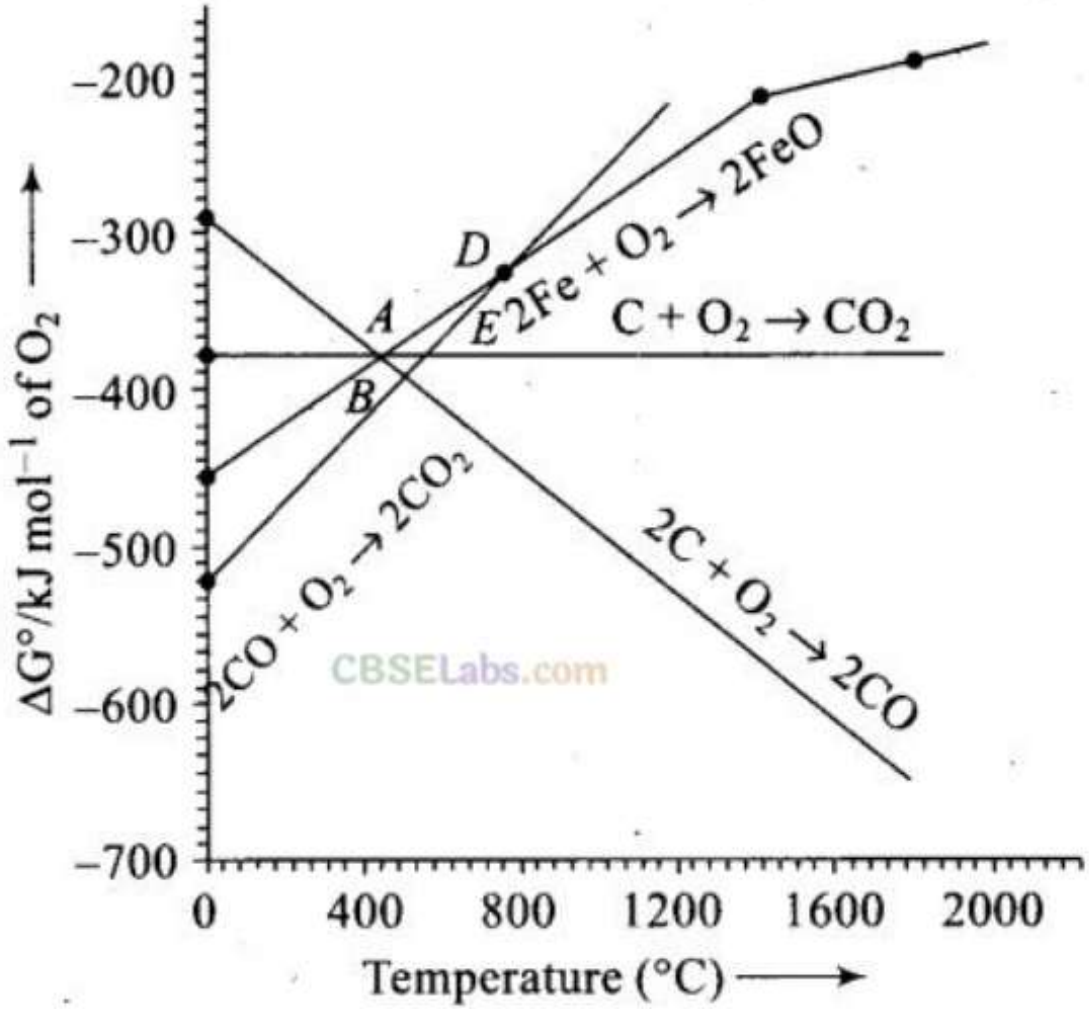

Question 11. Choose the correct option of temperature at which carbon reduces FeO to iron and produces CO.

(a) Below temperature at point A

(b) Approximately at the temperature corresponding to point A

(c) Above temperature at point A but below temperature at point D

(d) Above temperature at point A

Solution:

(d) $FeO + C \rightarrow Fe + CO$

It can be seen as a couple of two simpler reactions:

$$FeO \rightarrow Fe + \frac{1}{2}O_2 \ (\Delta G^{\circ}_{FeO,Fe})$$

$$C + \frac{1}{2}O_2 \rightarrow CO \ (\Delta G^{\circ}_{C,CO})$$

Total Gibb's energy change becomes

$$\Delta G^{\circ}_{(C,CO)} + \Delta G^{\circ}_{(FeO,Fe)} \ \Delta_r G^{\circ}$$

In ΔG° versus T plot, the plot Fe to FeO goes upward and the plot for C to CO goes downwards.

At temperature above point A, the C to CO line comes below Fe to FeO and $\Delta G^{\circ}_{(C,CO)} < \Delta G^{\circ}_{(Fe,FeO)}$.

So in this range, C will reduce FeO to Fe and itself be oxidized to CO.