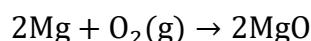


**DPP-03****SOLUTION**

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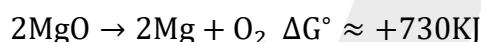
- For the given reaction,



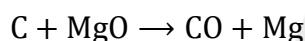
The value of free energy grows as the temperature rises. If  $dS$  is positive, then as the temperature rises,  $TdS$  gets increasingly negative. Thus, the free energy's numerical value decreases.

- The equation  $\Delta G = \Delta H - T\Delta S$  gives the free energy change accompanying a process. On increasing both temperature  $T_1$  and  $T_2$ ,  $\Delta G$  will decrease.

- $2\text{C} + \text{O}_2 \rightarrow 2\text{CO} \quad \Delta G^\circ \approx -530 \text{ KJ}$



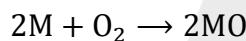
On Adding above two eq.



$$\Delta G^\circ = -530 + 730$$

$$= 230 \text{ KJ}$$

As  $\Delta G^\circ$  is positive so reaction is non spontaneous and hence carbon is not able to reduce MgO at this temperature



$$\Delta G^\circ = -730 \text{ KJ}$$

- On increasing the temperature, the Gibbs free energy will increase or decrease it will depend upon the entropy of the given reaction.

- CO is considered as best reducing agent for the reduction of  $\text{Fe}_2\text{O}_3$ . Carbon monoxide is used as a reducing agent in a blast furnace to reduce  $\text{Fe}_2\text{O}_3$  to Fe.

Carbon monoxide is used for reducing  $\text{Fe}_2\text{O}_3$  to Fe because according to Ellingham diagram, the free energy change for the formation of CO is more negative than that of  $\text{Fe}_2\text{O}_3$ .

- Lower the position in graph capable to reduce higher oxides and based on temperature variation conditions can be changed accordingly.



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7. From the above graph,  
Zn and C have intersect point at 1000°C.
8. Both oxides of zinc and carbon, i.e., ZnO & CO met at 1000°C in graph. So, at this temperature,  $\Delta G$  of the given reaction will be zero.
9. Above 1000°C, ZnO in the graph is above CO graph. So, above this temperature, the difference between the free energy of both will be negative and hence the reaction will be spontaneous.
10. Any metal will reduce oxide of other metals which lie above it in the Ellingham diagram because free energy change will become more negative and as difference increases more energy will be released and reaction will be more spontaneous.  
At 1100°C,  $ZnO + Mg \xrightarrow{\text{---}} MgO + Zn$  is spontaneous because of highly negative free energy difference .