# **Redox Reactions and Rate of Chemical Reactions**

Que.1. Catalysts are substances which alter the rate of chemical reactions

[Marks :(3)]

# How do positive catalysts and negative catalysts differ from each other? Explain by citing examples

**Ans.** A positive catalysts increase the rate of reaction while negative catalysts decrease the rate.

MnO<sub>2</sub> increases the rate of decomposition of hydrogen peroxide. Hence it is a positive catalyst. Phosphoric acid is a negative catalyst because it decreases the rate of decomposition of hydrogen peroxide.

Que.2. Equal volumes of sodium thio sulphate solution is taken in two boiling tubes. Heat one boiling tube for sometime. Add dilute hydrochloric acid in equal amounts in both the boiling tubes. Sulphur precipitates faster in the boiling tube which is heated. [Marks :(4)]

a) Write down the chemical equation of the above reaction.

b) Name the factor that affects the rate of reaction in this experiment.

#### c) Why does the rate of reaction increase here?

Ans. a)  $Na_2S_2O_3 + 2HCI \rightarrow 2NaCI + H_2O + SO_2 + S$ 

b) Temperature

c)When temperature increase, the number of molecules with threshold energy increases. As a result the number of effective collisions increases and thus the rate of reaction also increases.

Que.3. a) Describe an experiment to prove that rate of reaction increases with increase in temperature. [Marks :(4)]

#### b) Why does the rate of reaction increase with increase in temperature?

Ans. a) For describing the reaction between sodium thiosulphate solution and HCI

b) When temperature increases, the number of molecules with threshold energy increases. As a result the number of effective collisions increases and thus the rate of reaction also increases.

#### Que.4. .Analyse the figure and answer the question given below. [Marks :(2)]



#### In which beaker the rate of reaction is faster? Give reason

**Ans.** In the second beaker where powdered marble is taken.

Surface area of the reactant increases when marble is powdered.

Que.5. Consider the reaction [Marks :(2)]

 $Zn + 2HCI \rightarrow ZnCI_{2} + H_{2}$ 

Which of the following methods can be used to increase the rate of reaction?

- a) Decrease the temperature
- b) Concentration of HCl is increased.
- c) Powdered zinc is used.
- d) Concentration of HCI is decreased.

Ans. b and c

Que.6. Choose the oxidation reactions from the following. [Marks :(2)]

a) Zn  $\rightarrow$  Zn<sup>+2</sup> +2e<sup>-</sup>

- b) Cu<sup>2+</sup> +2e<sup>-</sup>  $\rightarrow$  Cu
- c) Mg  $\rightarrow$  Mg <sup>2+</sup>+2e<sup>-</sup>
- d) Zn²++ 2e⁻ → Zn
- **Ans.** a & c

Que.7. Zn<sup>0</sup> + Cu<sup>+2</sup>SO<sub>4</sub> <sup>-2</sup>  $\rightarrow$  Zn<sup>+2</sup>SO<sub>4</sub> <sup>-2</sup> + Cu<sup>0</sup> [Marks :(3)]

Does the chemical equation given above represent a redox reaction?

Give reason

Ans. Yes

Zn gets oxidised to ZnSO<sub>4</sub>

CuSO<sub>4</sub> gets reduced to Cu. Here oxidation and reduction take place simultaneously

Que.8. Examine the given equations and answer the following questions. [Marks :(2)]

 $Zn^0 + 2H^{+1}Cl \stackrel{\cdot 1}{\rightarrow} Zn^{+2}Cl_2 \stackrel{\cdot 1}{\rightarrow} H_2{}^0$ 

Are the statements given below correct? Justify your answer.

a) Zn gets oxidised

b) HCl is the oxidising agent.

Ans. Both statements are correct.

Oxidation number of Zn increases from 0 to + 2.Hence Zn gets oxidised.

The oxidation state of H in HCl reduces from + 1 to 0.Hence it is the oxidising agent.

Que.9. Fe + 2HCl  $\rightarrow$  FeCl<sub>2</sub> + H<sub>2</sub>

[Marks :(3)]

a) Find the oxidation state of Fe in FeCl<sub>2</sub>

# b) Identify the oxidising agent and reducing agent in the given equation.

**Ans.** a) +2

b) oxidising agent HCI/H<sup>+</sup>

reducing agent Fe

Que.10. 2 Na +  $CI_2 \rightarrow 2NaCI$ 

[Marks :(4)]

# Analyse the equation and fill up the table given below

The oxidised atom	
Equation of oxidation	Na → Na <sup>+</sup> +1e <sup>-</sup>
Reduced atom	
Equation of reduction	Cl+ 1e <sup>-</sup> → Cl <sup>-</sup>
Oxidising agent	
Reducing agent	

Ans.

The oxidised atom	Na
Equation of oxidation	$Na \rightarrow Na^+ + 1e^-$
Reduced atom	CI
Equation of reduction	Cl+ 1e <sup>-</sup> → Cl <sup>-</sup>
Oxidising agent	

Reducing agent Na
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Que.11. Balance the following chemical equations. [Marks :(4)]

a) Mg +  $O_2 \rightarrow MgO$ 

b) Na + O<sub>2</sub>  $\rightarrow$  Na<sub>2</sub>O

c) Mg(OH)<sub>2</sub> + H<sub>2</sub>SO<sub>4</sub>  $\rightarrow$  MgSO<sub>4</sub> +H<sub>2</sub>O

d) KClO<sub>3</sub>  $\rightarrow$  KCl + O<sub>2</sub>

Ans. a) 2Mg +  $O_2 \rightarrow 2MgO$ 

b)  $4Na + O_2 \rightarrow 2Na_2O$ 

c) Mg(OH)<sub>2</sub> + H<sub>2</sub>SO<sub>4</sub>  $\rightarrow$  MgSO<sub>4</sub>+2H<sub>2</sub>O

d)  $2KCIO_3 \rightarrow 2KCI+ 3O_2$ 

Que.12. The chemical equation given below represents the reaction between<br/>hydrogen and oxygen producing water.[Marks :(2)]

 $H_2 + O_2 \rightarrow H_2O$ 

Is the given equation balanced? Give reason.

**Ans.** No. The total number of atoms of each element in the molecules present in the reactant side and that in the product side are not equal.

Que.13. From the statements given below, find the wrong one. Rewrite it correctly. [Marks :(2)]

a) In a chemical reaction mass is neither created nor destroyed.

b) The total mass of the products will be greater than the total mass of the reactants.

c) In a chemical reaction, the total number of atoms of each element in the reactant side and that in the product side are equal.

Ans. Wrong statement is (b).

The total mass of the products will be equal to the total mass of the reactants.

# Que.14. A few chemicals are given . [Marks :(4)]

NaCl, AgNO<sub>3</sub>, Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>, BaCl<sub>2</sub>, HCl

a. Choose the suitable chemicals from the box and plan an experiment to prove that temperature influences the rate of reaction

b. What is your observation?

### c. Which is the substance formed as a result of the reaction taking place?

Ans. a. Na<sub>2</sub> S<sub>2</sub>O<sub>3</sub>, HCl

For planning the experiment properly

b. In the test tube which is heated, a white/ light yellow precipitate is formed quickly.

c. Sulphur

# Que.15. Name the catalyst which reduces the rate of decomposition of hydrogen peroxide? [Marks :(1)]

Ans. Phosphoric acid

Que.16. Take two test tubes A and B. Take equal volumes of sodium thiosulphate solution in both test tubes. Heat test tube A. Add equal volumes of dilute hydrochloric acid in both test tubes. [Marks :(4)]

a. In which test tube the reaction is faster?

b. Which is the factor that affects rate of reaction here?.

## c. Explain why the rate of reaction is faster in this test tube

Ans. a. In test tube A

#### b. Temperature

c. When temperature increases, the number of molecules with threshold energy increases. As a result the number of effective collisions increases and thus the rate of reaction also increases.

Que.17. Using the materials given below ,write down the procedure of the experiment to prove the influence of temperature on rate of reaction? Write down the observation of the experiment. [Marks :(3)]

(Sodium thiosulphate, dilute hydrochloric acid, boiling tubes, beaker ,spirit lamp)

Ans. For writing the procedure (2)

For writing the observation (1)

# Que.18. Take 5ml hydrogen peroxide $(H_2O_2)$ solution in a test tube. Add some MnO<sub>2</sub> into it.. [Marks :(3)]

# a. Which is the gas evolved ?How will you identify it?

# b. What is the function of MnO2 in this reaction?

**Ans.** a.)  $Oxygen(O_2)$  Introduce a glowing match stick into the test tube. Flaring up of the glowing match stick shows the presence of oxygen.

b) MnO<sub>2</sub> increases the rate of reaction. Hence it acts as a positive catalyst.

Que.19. Which one of the following does not affect the rate of reaction?

[Marks :(1)]

(temperature, pressure, colour of reactants, concentration)

Ans. colour of reactants

Que.20. Take 5ml of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) solution in a test tube. Add some manganese dioxide (MnO<sub>2</sub>) into it. [Marks :(3)]

- a. Which is the gas evolved ?
- b. What is the function of MnO<sub>2</sub> in this reaction?
- c. Which are the substances remaining in the test tube when the reaction is over?

**Ans.** a. O<sub>2</sub>

- b. Positive catalyst
- c. H<sub>2</sub>O and MnO<sub>2</sub>

#### Que.21.



Analyse the figure given above and answer the following questions. [Marks :(4)]

a. Identify the gas formed in this reaction?

b. In which beaker the rate of reaction is faster? Give reason

# c. Suggest any other method to increase the rate of collision?

#### **Ans.** a. CO<sub>2</sub>

b. Second beaker. Powdered calcium carbonate is used here. Hence surface area of reactant increases.

c. Concentration of HCl is increased/temperature is increased.

Que.22. Analyse the given reaction and answer the following questions.

[Marks :(3)]

 $CaCO_3 + 2HCI \rightarrow CaCl_2 + H_2O + -----X ------$ 

a. Which is the product X formed here ?

b. Suggest any two methods to increase the amount of products in the given reaction

**Ans.** a. CO<sub>2</sub>

- b. i. Use powdered CaCO<sub>3</sub> .
  - ii. Increase the concentration of HCI or Increce the temperature

## Que.23. Analyse the figure given below and answer the following questions. [Marks :(3)]



a. In which test tube is the rate of reaction faster?

b. Which is the factor that influences the rate of reaction in this case?

c. Write down the balanced chemical equation of the reaction taking place here.

Ans. a. Test tube 1

b. concentration of reactants

c. Mg + 2HCl 
$$\rightarrow$$
 MgCl<sub>2</sub> + H<sub>2</sub>

[Marks :(4)]

Analyse the given equation and answer the following questions.

- a. Which element gets oxidised?
- b. Which element /ion gets reduced?
- c. Which is the oxidising agent?
- d. Which is the reducing agent?

Ans. a. Zn

b. Element /ion get reduced Cu /Cu2+

c. Oxidising agent Cu(SO<sub>4</sub>)<sub>2</sub>/Cu<sup>2+</sup>

d. Reducing agent Zn

#### Que.25. Examine the given reaction

[Marks :(2)]

 $Fe + 2HCI \rightarrow FeCl_2 + H_2$ 

### Does this reaction represent a redox reaction? Justify your answer

Ans. Yes.

Fe changes to Fe<sup>2+</sup> ion by the removal of 2 electrons.

 $Fe \rightarrow Fe^{2+} + 2e^{-}$  (oxidation)

H<sup>+</sup> ions change to H<sub>2</sub>. by accepting electrons

 $2H^+ + 2e^- \rightarrow H_2$  (reduction)

The given reaction represents a redox reaction because both oxidation and reduction take place simultaneously.

## Que.26. Choose oxidation reactions from the following and write them.

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[Marks :(2)]
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i)  $Zn \rightarrow Zn^{2+} + 2e^{-}$ ii)  $F + 1e^{-} \rightarrow F^{-}$ iii)  $Cl + 1e^{-} \rightarrow Cl^{-}$ iv)  $Mg \rightarrow Mg^{2+} + 2e^{-}$ Ans. i)  $Zn \rightarrow Zn^{2+} + 2e^{-}$ iv)  $Mg \rightarrow Mg^{2+} + 2e^{-}$ 

Que.27. Unbalanced and incomplete chemical equations are given. Fill up the gaps by selecting from the formulae of the molecules given in brackets. Also balance the given equations. [Marks :(6)]

a)  $Zn + 2HCI \rightarrow --a-- + H_2$ b)  $2Mg + --b-- \rightarrow 2MgO$ c)  $4AI + 3O_2 \rightarrow ----C----$ (hint:  $O_2$ ,  $ZnCI_2$ ,  $AI_2O_3$ ) Ans. a.  $Zn + 2HCI \rightarrow ZnCI_2 + H_2$ b.  $2Mg + O_2 \rightarrow 2MgO$ c. $4AI + 3O_2 \rightarrow 2AI_2O_3$  Que.28. Hydrogen peroxide decomposes to give oxygen. [Marks :(4)]

A student wrote the chemical equation of this reaction as follows.

 $H_2O_2 {\rightarrow} H_2O + O$ 

a) Which are the reactants and products in this reaction? .

b) Are the molecular formulae of reactants and products written here correct ? If not rewrite them correctly.

c) write the balanced chemical equation for this reaction.

**Ans.** a. Reactant – hydrogen peroxide

Products- water, oxygen

b. Molecular formula of oxygen given in this equation is wrong. The correct molecular formula of oxygen is  $O_2$ .

 $c. \ 2H_2O_2 \rightarrow \ 2H_2O \textbf{+} O_2$ 

Que.29. NaCl + AgNO<sub>3</sub>→ NaNO<sub>3</sub> + AgCl

[Marks :(3)]

When 58.5g NaCl reacts completely with 170g AgNO $_3$ , 85g NaNO $_3$  is formed. Calculate the mass of AgCl formed in this reaction? Justify your answer.

AIIS. 143.39	
Total mass of the reactants= 58.5g + 170g = 228.5g	
total mass of the products = 228.5g	
Mass of AgCl = 228.5g - 85g =143.5g	
Que.30. Find the relation and fill up suitably	[Marks :(1)]
Atomic theory : John Dalton	
Law of conservation of mass:	
Ans. Lavoisier	
Que.31. Mg <sup>0</sup> + 2H <sup>+1</sup> Cl <sup>-1</sup> $\rightarrow$ Mg <sup>+2</sup> Cl <sup>-1</sup> + H <sup>2</sup> <sup>0</sup>	[Marks :(4)]
Que.31. Mg <sup>0</sup> + 2H <sup>+1</sup> Cl <sup>-1</sup> $\rightarrow$ Mg <sup>+2</sup> Cl <sub>2</sub> <sup>-1</sup> + H <sub>2</sub> <sup>0</sup> Analyse the given chemical equation and answer	[Marks :(4)] the following questions.
Que.31. $Mg^0 + 2H^{+1}CI^{-1} \rightarrow Mg^{+2}CI_2^{-1} + H_2^0$ Analyse the given chemical equation and answer a) Which atom/ ion gets oxidised?	[Marks :(4)] the following questions.
Que.31. $Mg^0 + 2H^{+1}CI^{-1} \rightarrow Mg^{+2}CI_2^{-1} + H_2^0$ Analyse the given chemical equation and answer a) Which atom/ ion gets oxidised? b) Which atom/ ion gets reduced?	[Marks :(4)] the following questions.
Que.31. $Mg^0 + 2H^{+1}CI^{-1} \rightarrow Mg^{+2}CI_2^{-1} + H_2^0$ Analyse the given chemical equation and answer a) Which atom/ ion gets oxidised? b) Which atom/ ion gets reduced? c) Which is the oxidising agent ?	[Marks :(4)] the following questions.
Que.31. $Mg^0 + 2H^{+1}CI^{-1} \rightarrow Mg^{+2}CI_2^{-1} + H_2^0$ Analyse the given chemical equation and answer a) Which atom/ ion gets oxidised? b) Which atom/ ion gets reduced? c) Which is the oxidising agent ? d) Identify the reducing agent?	[Marks :(4)] the following questions.
Que.31. $Mg^0 + 2H^{+1}CI^{-1} \rightarrow Mg^{+2}CI_2^{-1} + H_2^0$ Analyse the given chemical equation and answer a) Which atom/ ion gets oxidised? b) Which atom/ ion gets reduced? c) Which is the oxidising agent ? d) Identify the reducing agent? Ans. a) Mg	[Marks :(4)] the following questions.

c) HCl d) Mg