

2020

**CHEMISTRY**  
**(Theory)**

**Full Marks : 70**

**Pass Marks : 21**

**Time : Three hours**

*All questions are compulsory.*

*Marks are indicated on the right hand margin of each question.*

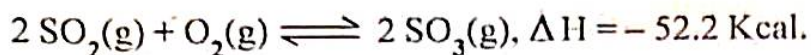
*Question from 1 to 10 are very short answer type carrying 1 mark each.*

1. State Avogadro's law. 1
2. Which one from  $O_2^-$  and  $O_2^{2-}$  may exhibit paramagnetism ? 1
3. Give the expression for work done by one mole of a gas for adiabatic expansion resulting into change of temperature from  $T_1$  to  $T_2$ . 1
4. Calculate oxidation number of Mn in  $K_2MnO_4$ . 1
5. Name the alkaline earth metal which form covalent compound. 1
6. 'A' is a solution of calcium compound, when  $CO_2$  gas is passed into the solution, it turns milky. Identify A. 1

P.T.O.



13. Formation of  $\text{SO}_3$  takes place according to the reaction



Which of the following factors favours the formation of  $\text{SO}_3$  ?

A. Increase in pressure

B. Increase in temperature

C. Increase in volume

D. Removal of Oxygen

1

14. The general formula of an ester where R represents alkyl group is

A. ROH

B. RCOOH

C. RCOOR

D. RH

1

*Question Nos. 15 – 24 are Short Answer (SA-II) types of 2 marks each.*

15. How much copper can be obtained from 100g of Copper sulphate ( $\text{CuSO}_4$ ) ?

(Atomic mass of Cu = 63.5 amu)

2

16. Give statements :

2

(a) Heisenberg's uncertainty principle

(b) Hund's rule of maximum multiplicity

17. Define ionisation enthalpy. Name the factors which influence its value. 2
18. (a) What is the basic difference in approach between Mendeleev's Periodic Law and the Modern Periodic Law? 2
- (b) Assign the position of the element having outer electronic configuration,  $ns^2np^4$  for  $n = 3$ . 2
19. Derive the relation  $PV = nRT$ , where symbols have their usual meaning. 2
20. At  $0^\circ\text{C}$ , the density of a certain oxide of a gas at 2 bar is same as that of dinitrogen at 5 bar. What is the molecular mass of the oxide? 2
21. How will you account for the acidic character of nitrous acid ( $\text{HNO}_2$ ) according to both Arrhenius theory and Bronsted - Lowry theory? 2
22. Magnesium metal burns in air to give a white ash. When this ash is treated with water, the odour of ammonia can be detected. Explain. 2
23. Giving justification, identify the electrophiles from the following : 2
- $\text{HS}^-$ ,  $\overset{+}{\text{Cl}}$ ,  $\text{C}_2\text{H}_5\text{O}^-$ ,  $\overset{+}{\text{N}}\text{O}_2$
24. An alcohol,  $\text{C}_3\text{H}_8\text{O}$  undergoes acidic dehydration to form compound A. Compound A under high temperature, pressure and in presence of catalyst polymerises to form B. Write the structural formulae of A and B. 2

Question Nos. 25 – 31 are Short Answer (SA-I) types of 3 marks each.

25. Name the element in each of the following cases : 3

(i) A bivalent anion of the element having 10 electrons.

(ii) A trivalent cation of the element having 10 electrons

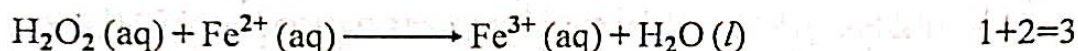
What is the relationship between the two ions called ?

26. Using VSEPR theory, predict the shape of  $\text{PCl}_5$ . 3

27. What are the general characteristics of equilibria involving physical processes ?  
(Any three points). 3

28. (a) Articles of iron are generally coated with zinc. Give reason.

(b) Balance the following redox reaction by ion-electron method



29. (a) Which isotope of hydrogen is used as a tracer in organic reactions ?

(b) Give one example of a reaction in which dihydrogen acts 1+2=3

(i) as an oxidising agent and

(ii) as a reducing agent

30. 0.3780 g of an organic chloro compound gave 0.5740 g of silver chloride in Carius estimation. Calculate the percentage of chlorine present in the compound  
[at mass of Ag = 108, Cl = 35.5] 3

31. (a) From where does ozone come in the photochemical smog ?  
(b) Why does water covered with excessive algal growth become polluted ?  
(c) A person was using water supplied by municipality. Due to shortage of water he started using underground water he experienced laxative effect. What could be the cause ? 1×3=3

*Question Nos. from 32 – 34 are essay type carrying 5 marks each.*

32. (a) Predict the sign of  $\Delta S^\circ$  for the following reaction  
$$2\text{H}_2\text{S}(\text{g}) + 3\text{O}_2(\text{g}) \longrightarrow 2\text{H}_2(\text{g}) + 2\text{SO}_2(\text{g})$$
  
(b) Calculate the entropy change in surroundings when 1.00 mol of  $\text{H}_2\text{O}(\text{l})$  is formed under standard conditions :

$$\Delta_f H^\circ = -286 \text{ kJ mol}^{-1}$$

- (c) Enthalpy of combustion of carbon to  $\text{CO}_2$  is  $-393.5 \text{ kJ mol}^{-1}$ . Calculate the heat released upon formation of 35.2 g  $\text{CO}_2$  from carbon and dioxygen gas. 1+2+2=5

33. (a) Discuss the general trends in the following properties of elements in Group 13 :

- (i) Atomic size
- (ii) Oxidation states
- (iii) Electronegative character

- (b) Explain the structure of diborane. 3+2=5

34. (a) Give an account of the following :

(i) Markovnikov's rule

(ii) Antimarkovnikov's rule

(iii) Wurtz Reaction

(b) Write the conversion of the following compounds to benzene :

(i) Ethyne

(ii) Hexane

3+2=5