

Annual Examination 2022

Class-XI

Subject- Chemistry

Time: 3 Hours

Maximum Marks: 70

General Instructions:

Read the following instructions carefully: -

- There are 35 questions in this question paper with internal.
- SECTION A consists of 18 multiple-choice questions carrying 1 mark.
- SECTION B consists of 7 very short answer questions carrying 2 marks each.
- SECTION C consists of 5 short answer questions carrying 3 marks
- SECTION D consists of 2 case- based questions carrying 4 marks
- SECTION E consists of 3 long answer questions carrying 5 marks
- All questions are compulsory.
- Use of log tables and calculators is not allowed

SECTION-A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

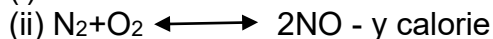
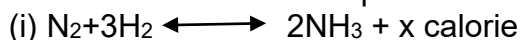
1. An oxide of metal M contain 40% by mass of oxygen. Metal M has relative atomic mass of 24. The empirical formula of oxide is:
(a) M_2O (b) M_2O_3 (c) MO (d) M_3O_4
2. The vapour densities of two gases are in the ratio 1:3. Their molecular masses are in ratio of
(a) 1:3 (b) 1:2 (c) 2:3 (d) 3:1
3. The ratio of energy of radiations of wavelengths $2000 \text{ \AA}$ and that of $4000 \text{ \AA}$ is:
(a) 2 (b) 4 (c) $1/2$ (d) $1/4$
4. Different lines in Lyman series of hydrogen spectrum lie in:
(a) UV (b) Visible (c) IR (d) Far IR
5. Which one of the following ions has the smallest radius?
(a) C^{4-} (b) S^{2-} (c) K^+ (d) Ca^{2+}
6. The outermost electronic configuration of the most electronegative element is:
(a) ns^2np^6 (b) ns^2np^4 (c) ns^2np^5 (d) ns^2np^3
7. The ion that is isoelectronic with CO is:
(a) CN^- (b) O_2^+ (c) O_2^- (d) N_2^+
8. In the formation of ethylene molecule Carbon atom make use of:
(a) sp^3 - hybridization (b) sp^3 - hybridization
(b) (c) sp^3 - hybridization (d) sp^3 - hybridization
9. The value of entropy in the universe is:
(a) Constant (b) decreasing (c) increasing (d) zero
10. Which one of the following is a state property?
(a) Heat (b) work (c) Internal energy (d) Potential energy
11. For the reaction, $N_2 + 3H_2 \longrightarrow 2NH_3$; $\Delta H = \dots$
(a) $\Delta U - 2RT$ (b) $\Delta U + 2RT$ (c) $\Delta U + RT$ (d) $U + RT$
12. 8.50 g of NH_3 is present in 250 ml volume. Its active mass is:
(a) 1.0 mol/l (b) 0.5 mol/l (c) 1.5 mol/l (d) 2 mol/l

13. For the reaction, $\text{CO(g)} + \text{Cl}_2\text{(g)} \longrightarrow \text{COCl}_2\text{(g)}$, the K_p/K_c is equal to;-
 (a) $1/RT$ (b) RT (c) $(RT)^{1/2}$ (d) 1
14. Oxidation no of S atom in $\text{Na}_2\text{S}_2\text{O}_3$ compound :
 (a) +6 (b) +4 (c) +3 (d) +2
15. Oxidation state of iodine in HIO_4 , H_3IO_5 and H_5IO_6 are respectively
 (a) +1,+3,+7 (b) +7,+7,+3 (c) +7,+7,+7 (d) +7,+5,+3
16. In hexa-1,3-dien-5-yne, the number of C-C sigma, C-C pie and C-H sigma bond respectively are
 (a) 5,4,6 (b) 6,3,5 (c) 5,3,6 (d) 6,4,5
 (e) 5,5,5
17. Given below are two statements labelled as Assertion (A) and Reason (R)
 Assertion (A): CH_3CHO and CH_2CHOH are resonance structure.
 Reason (R): Tautomers differ both in position of atoms as well as electrons.
 Select the most appropriate answer from the options given below:
 (a). Both A and R are true and R is the correct explanation of A
 (b). Both A and R are true but R is not the correct explanation of A.
 (c). A is true but R is false.
 (d). A is false but R is true.
18. Given below are two statements labelled as Assertion (A) and Reason (R)
 Assertion (A): tert-butyl carbanion is less stable than methyl carbanion.
 Reason (R): The +I effect of the CH_3 groups tends to stabilize the tert-butyl carbanion.
 Select the most appropriate answer from the options given below:
 (a). Both A and R are true and R is the correct explanation of A
 (b). Both A and R are true but R is not the correct explanation of A.
 (c). A is true but R is false.
 (d). A is false but R is true.

SECTION B

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

19. Discuss the effect of temperature and pressure on the following reactions:



Or

What will be the effect of increase in temperature in the production of nitric oxide in the reaction?



20. What is the active mass of the substances?

21. What are limitation of First law of thermodynamics?

Or

Write mathematical expression of First Law of Thermodynamics.

22. Write possible resonance structure of $\text{CH}_3\text{OCH}_2^+$.

23. Elements of which group are called p-block elements and why?

24. Represent mathematically:

- (a) Energy of one quantum of light
 (b) Relation between energy and mass

25. Prove relation between molarity and molality.

SECTION C

This section contains 5 questions with internal choice in three questions. The following questions are short answer type and carry 3 marks each.

- 26.** The vapour density of a mixture containing NO_2 and N_2O_4 is 38.3 at 27°C . Calculate the moles of NO_2 in 100 g of the mixture.

Or

Hemoglobin contains 0.25% iron by mass. The molecular mass of hemoglobin is 89600. Calculate the number of iron atoms per molecule of haemoglobin.

- 27.** (a) Which of the orbitals namely 1p, 2s, 3p and 3f are not possible? Give reasons.
(b) Give the value of four quantum numbers of the last electron of sodium atom.
(c) What is the maximum number of electrons which can be accommodated on 4f?
- 28.** Discuss the position of N, P and As in the periodic table on the basis of electronic configuration.

Or

On the basis of electronic configuration, discuss the position of alkali metals in the periodic table.

- 29.** What do you understand by bonding and antibonding molecular orbitals? Write its mathematical expression.
- 30.** Write a balanced chemical equation for the following reactions:
- (i) Permanganate ion (MnO_4^-) reacts with sulphur dioxide gas in an acidic medium to produce Mn^{2+} and hydrogensulphate ion. (Balance by ion electron method)

Or

(ii) Reaction of liquid hydrazine (N_2H_4) with chlorate ion (ClO_3^-) in basic medium produces nitric oxide gas and chloride ion in a gaseous state. (Balance by oxidation number method)

SECTION D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+1+1) marks each. Read the passage carefully and answer the questions that follow.

- 31.** When covalent bond is formed between two similar atoms, for example in H_2 , O_2 , Cl_2 , N_2 or F_2 , the shared pair of electrons is equally attracted by the two atoms. As a result, electron pair is situated exactly between the two identical nuclei. The bond so formed is called nonpolar covalent bond. As a result of polarisation, the molecule possesses the dipole moment which can be defined as the product of the magnitude of the charge and the distance between the centres of positive and negative charge. It is usually designated by a Greek letter ' μ '. Mathematically, it is expressed as follows: Dipole moment (μ) = charge (Q) $\times$ distance of separation. Dipole moment is usually expressed in Debye units (D). The conversion factor is $1 \text{ D} = 3.33564 \times 10^{-30} \text{ C m}$ where C is coulomb and m is meter. Just as all the covalent bonds have some partial ionic character, the ionic bonds also have partial covalent character. The partial covalent character of ionic bonds was discussed by Fajans in terms of the following rules:

- The smaller the size of the cation and the larger the size of the anion, the greater the covalent character of an ionic bond.

- The greater the charge on the cation, the Greater the covalent character of the ionic bond.
- For cations of the same size and charge, The one, with electronic configuration $(n-1)d^0ns^0$, typical of transition metals, is More polarising than the one with a noble Gas configuration, $ns^2 np^6$, typical of alkali and alkaline earth metal cations.

Sidgwick and Powell in 1940, proposed a simple theory Based on the repulsive interactions of the Electron pairs in the valence shell of the atoms. It was further developed and redefined by Nyholm and Gillespie (1957).

1) Dipole moment is usually expressed in?

2) 1 D is equal to?

3) Valence bond theory was introduced by?

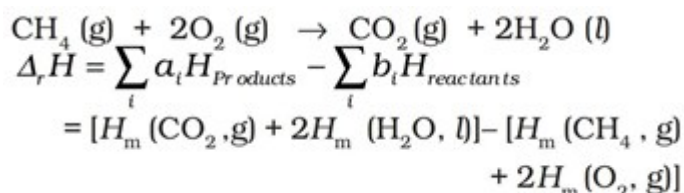
4) Pair is situated exactly between the two Identical nuclei the bond so formed is called covalent bond.

32. In a chemical reaction, reactants are converted into products and is represented by, Reactants $\rightarrow$ Products The enthalpy change accompanying a reaction is called the reaction enthalpy. The enthalpy change of a chemical reaction, is given by the symbol $\Delta_r H$.

$\Delta_r H = (\text{sum of enthalpies of products}) - (\text{sum of enthalpies of reactants})$

$$= \sum_i a_i H_{\text{products}} - \sum_i b_i H_{\text{reactants}}$$

Here symbol $\sum$ (sigma) is used for summation and a_i and b_i are the stoichiometric coefficients of the products and reactants respectively in the balanced chemical equation. For example, for the reaction



where H_m is the molar enthalpy. Enthalpy change is a very useful quantity. Knowledge of this quantity is required when one needs to plan the heating or cooling required to maintain an industrial chemical reaction at constant temperature. It is also required to calculate temperature dependence of equilibrium constant.

Standard Enthalpy of Reactions Enthalpy of a reaction depends on the conditions under which a reaction is carried out. It is, therefore, necessary that we must specify some standard conditions. The standard enthalpy of reaction is the enthalpy change for a reaction when all the participating substances are in their standard states. The standard state of a substance at a specified temperature is its pure form at 1 bar. For example, the standard state of liquid ethanol at 298 K is pure liquid ethanol at 1 bar; standard state of solid iron at 500 K is pure iron at 1 bar. Usually data are taken at 298 K. Standard conditions are denoted by adding the superscript 0 to the symbol ΔH , e.g., ΔH°

Enthalpy Changes during Phase Transformations Phase transformations also involve energy changes. Ice, for example, requires heat for melting. Normally this melting takes place at constant pressure (atmospheric pressure) and during phase change, temperature remains constant (at 273 K).



- 1) The enthalpy change of a chemical reaction, is given by the symbol ...
- 2) The molar enthalpy is denoted by
- 3) ... is enthalpy of fusion in standard state.
- 4) Solid CO_2 or 'dry ice' sublimes at..

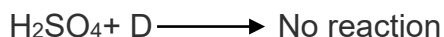
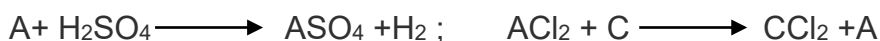
SECTION E

The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

33. Define oxidation number. How it is differ from valency ? Write general rules of assigning oxidation numbers to various atoms in ions and molecules.

Or

Arrange A,B,C,D,E and H in order of increasing electrode potential in the electrochemical series if



34. How are free radicals, carbocations and carboanions produced? Discuss their relative stabilities.

Or

Describe the various type of structural isomerism with atleast 2 examples.

35. What are K_p and K_c for gaseous reversible reactions? Derive relationship between, $K_p = K_c(RT)^{\Delta n}$. Under what condition $K_p = K_c$?

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