BUDHA DAL PUBLIC SCHOOL, PATIALA
Final Examination (21 March 2024)
Class XI (Science)
Subject - Chemistry
(Set - A)

Time: 3hrs.

M.M. 70

General Instructions:
1. There are 33 questions in this question paper with internal choice.
2. Section A consists of 16 multiple-choice questions carrying 1 mark each.
3. Section B consists of 5 short answer questions carrying 2 marks each.
4. Section C consists of 7 short answer questions carrying 3 marks each.
5. Section D consists of 2 case-based questions carrying 4 marks each.
6. Section E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

Section - A

Q1. What is the mass percent of carbon in carbon dioxide?
a) 0.034%   b) 27.27%   c) 3.4%   d) 28.7%

Q2. The empirical formula and molecular mass of compound are CH_2O and 180 g respectively. What will be the molecular formula of the compound?
a) $C_9H_{18}O_9$ b) CH_2O c) $C_6H_{12}O_6$ d) $C_2H_4O_2$

Q3. Two atoms are said to be isobars if

a) they have same atomic number but different mass number

b) they have same number of electrons but different number of neutrons

c) they have same number of neutrons but different number of electrons

d) sum of the number of protons and neutrons is same but the number of protons in different

Q4. Which of the following is responsible to rule out the existence of definite paths or trajectories of electrons?

a) Pauli's exclusion principle

b) Heisenberg's uncertainty principle

c) Hund's rule of maximum multiplicity

d) Aufbau principle

Q5. Which of the following is the correct order of size of the given species

A) $I > I^- > I^+$ B) $I^+ > I^- > I$ C) $I > I^+ > I^-$ D) $I^- > I > I^+$

Q6. The statement that is not correct for periodic classification of elements is :
a) The properties of elements are periodic function of their atomic numbers.
b) Non metallic elements are less in number than metallic elements.
c) For transition elements, the 3d-orbitals are filled with electrons after 3p-orbitals and before 4s-orbitals.
d) The first ionization enthalpies of elements generally increase with increase in atomic number as we go along a period

Q7. In which of the following substances will hydrogen bond be strongest?
a) HCl   b) H_2O c) HI   d) H_2S

Q8. We know that the relationship between K_c and K_p is

$$K_p = K_c (RT)^{\Delta n}$$

What would be the value of Δn for the reaction

$$NH_4CL (s) \rightleftharpoons NH_3 (g) + HCL (g)$$
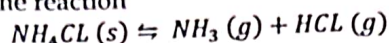
a) 1   b) 0.5   c) 1.5   d) 2

Q9. During complete combustion of one mole of butane, 2658kJ of heat is released. The thermochemical reaction for above change is

a) $2C_4H_{10}(g) + 13\, O_2(g) \rightarrow 8CO_2(g) + 10\, H_2O\ (l)\ \Delta_cH = -2658.0\ kJ\ mol^{-1}$

b) $C_4H_{10}(g) + \frac{13}{2}\, O_2(g) \rightarrow 4CO_2(g) + 5\, H_2O\ (l)\ \Delta_cH = -1329.0\ kJ\ mol^{-1}$

c) $C_4H_{10}(g) + \frac{13}{2}\, O_2(g) \rightarrow 4CO_2(g) + 5\, H_2O\ (l)\ \Delta_cH = -2658.0\ kJ\ mol^{-1}$

d) $C_4H_{10}(g) + \frac{13}{2}\, O_2(g) \rightarrow 4CO_2^{\cdot}(g) + 5\, H_2O\ (l)\ \Delta_cH = +2658.0\ kJ\ mol^{-1}$

Q10. Which of the following is not an example of redox reaction?

a) $CuO + H_2 \rightarrow Cu + H_2O$

b) $Fe_2O_3 + 3\, CO \rightarrow 2\, Fe + 3\, CO_2$

c) $2K + F_2 \rightarrow 2\, KF$

d) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2\, HCl$

Q11. The IUPAC name for

$$CH_3 - \overset{O}{\overset{\|}{C}} - CH_2 - CH_2 - \overset{O}{\overset{\|}{C}} - OH$$
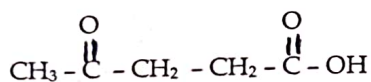
Is ......

a) 1 – hydroxypentane – 1, 4 – dione

b) 1, 4 – dioxopntanol

c) 1 – carboxybutan – 3 – one

d) 4 – oxopentanoic acid

Q12. The increasing order of reduction of alkyl halides with zinc and dilute HCl is

a) R – Cl < R – I < R – Br

b) R – Cl < R – Br < R – I

c) R – I < R – Br < R – Cl

d) R – Br < R – I < R – Cl

The questions (Q.No. 13 – 16) given below consist of Assertion and Reason. Use the following key of select the correct answer.

a) Assertion and Reason both are correct and reason is correct explanation for assertion.
b) Assertion and Reason both are are correct but reason is not correct explanation for assertion.
c) Assertion is correct but Reason is incorrect.
d) Assertion is incorrect but Reason is correct.

Q13. Assertion : Combustion of 16 g of methane gives 18 g of water.
Reason : In the combustion of methane, water is one of the products.

Q14. Assertion : Boron has a smaller first ionization enthalpy than beryllium.
Reason : The penetration of a 2s electron to the nucleus is more than the 2p electron, hence 2p electron is more shielded by the inner core of electrons than the 2s electrons.

Q15. Assertion : Though the central atom of both NH_3 and H_2O molecules are sp³ hybridised, yet H–N–H bond angle is greater than that of H–O–H.
Reason : This is because nitrogen atom has one lone pair and oxygen atom has two lone pairs

Q16. Assertion : C – C bond in ethyne is shorter that C – C bonds in ethene.

Reason : Carbon atom is ethene is sp hybridized while it is sp^2 in ethyne.

Section - B

Q17. Calculate the wavelength, frequency of a light wave whose period is 2×10^{-10} sec.

Q18. Which our of N and Oxygen, has higher first ionization enthalpy and why?

Q19. For given equilibrium reaction $aA + bB \rightleftharpoons cC + dD$

Derive the relationship $Kp = Kc(RT)^{\Delta ng}$

Q20. Define disperpotionation reaction with one example.

Q21. Justify that given reaction is redox in nature $Mg\ (s) + Cl_2(g) \rightarrow Mg\ Cl_2\ (s)$

OR

Balance the following redox reaction by ion – electron method :

$MnO_4^-(aqu) + I^-(aqu) \rightarrow MnO_2 + I_2(s)$ (in basic medium)
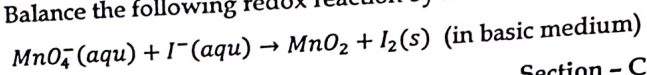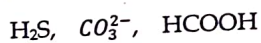
Section – C

Q22. In a reaction $A + B_2 \rightarrow AB_2$

Identify the limiting reagent in the following reaction mixtures

    a) 300 atoms of A + 200 molecules of B

    b) 100 atoms of A + 100 molecules of B

    c) 5 mol A + 2.5 mol B

Q23. Draw the Lewis dot structures for the following molecules/ ions:
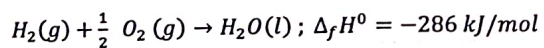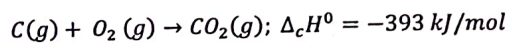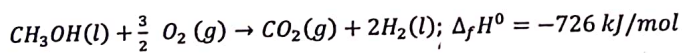
H_2S, CO_3^{2-}, HCOOH

Q24. Describe the hybridisation in case of PCl_5. Why are the axial bonds longer as compared to equatorial bonds?

OR

Draw the molecular orbital energy level diagram for O_2 molecule. Write its molecular electronic configuration. Also calculate its bond order.

Q25. Calculate the standard enthalpy of formation of CH_3OH (l) from the following data :

$CH_3OH(l) + \frac{3}{2} O_2\ (g) \rightarrow CO_2(g) + 2H_2(l); \Delta_f H^0 = -726\ kJ/mol$

$C(g) + O_2\ (g) \rightarrow CO_2(g); \Delta_c H^0 = -393\ kJ/mol$

$H_2(g) + \frac{1}{2} O_2\ (g) \rightarrow H_2O(l) ; \Delta_f H^0 = -286\ kJ/mol$

Q26. What are electrophiles and nucleophiles? Explain with examples.

Q27. Write the structural formula of

    a) o – Ethylanisole

    b) p – Nitroaniline

    c) 2, 3 – Dibromo – 1 – phenylpentane

Q28. Propanal and pentan – 3 – one are the ozonolysis products of an alkene? What is the structural formula of the alkene? Write reaction.

Q29. Read the following passage and answer the questions that follow:

The first law of thermodynamics has the limitation that it cannot predict the spontaneity of a process, i.e., a process can take place (by itself or on initiation) or cannot take place. The net driving force is the resultant of tendency for minimum energy and tendency for maximum randomness. Randomness is expressed in terms of the thermodynamic quantity called 'entropy (S)'. Entropy change during a process depends upon physical state of reactants and products, volume change, temperature and number of gaseous molecules before and after the process. Entropy change also occurs during fusion, vaporisation and sublimation and can be calculated from heat of transition and transition temperature. Total entropy change (ΔS total) is the sum of the entropy change of the system (ΔS system) and entropy change of the surroundings (ΔS surroundings). This helps to predict whether the process is spontaneous, non-spontaneous or in equilibrium. It is found that all spontaneous processes are thermodynamically irreversible and are accompanied by increase of entropy. This is the statement of the second law of thermo- dynamics. Suitable expressions can be used to calculate the entropy change of an ideal, gas with changes of pressure, volume and temperature (P, V and T). Similarly, third law of thermodynamics deals with entropies of crystalline substances.

Based on the above paragraph, answer the following questions:

a) What is entropy?

b) State the second law of Thermodynamics.

c) What is Gibb's Helmholtz equation? Explain terms used.

OR

Write down the expression for the standard free energy change in terms of equilibrium constant. State meaning of the symbols used.

Q30. Read the given passage and answer the questions that follow:

In the cyclic structure of benzene, we find that each carbon atom is further linked to only three atoms viz., two carbon atoms and one hydrogen atom by sigma (σ) bonds, for which it requires only three half filled valence shell orbitals. Therefore, it is only sp_2 hybridised. Two of these sp_2 hybrid orbitals overlap with those of two neightbouring carbon atoms, while the third overlaps with 1s half filled orbital of a hydrogen atom in each case, giving the formation of six carbon-carbon sigma (σ) bonds and six carbon-hydrogen sigma (σ) bonds in one plane. This gives the formation of a regular hexagon of six carbon atoms. After this, each carbon atom is left with one unhybeidised half filled p-orbitals ($2p_z$) which is unused. These unused half filled orbitals then overlap sideways with one another giving the formation of two sets of pi (π)-bongs. The resultant π –molecular orbital cloud embracing all the six carbon atoms. This results into two π –electron clouds, one above and the other below the plane of the carbon atoms.
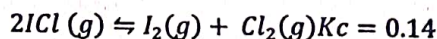
a) What is the hybridization state of each carbon of benzyl? benzene?

b) Draw orbital structure of benzene.

c) What will be product formed when Benzene is reacted with Cl_2 in the presence of $AlCl_3$.

OR

Write Friedel craft alkylation reaction of Benzene.

Q31. a) An electron is in one of the 3d orbitals. Give the possible values of n, l and m for this electron.

b) Calculate the wave number for the longest wavelength transition in the Balmer series of atomic hydrogen.
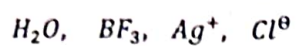
Q32. a) What is the equilibrium concentration of each of the substance in the equilibrium when the intial concentration of ICl was 0.78 M.

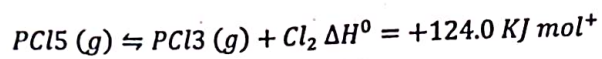$$2ICl\ (g) \rightleftharpoons I_2(g) + Cl_2(g) \quad Kc = 0.14$$

b) The concentration of hydrogen ion in a simple of soft drink is $3.8 \times 10^{-3} M$. What is its pH? Given log 3.8 = 0.58

<div align="center">OR</div>

a) Classify the following into Lewis acids and Lewis bases giving reasons.

$H_2O, \quad BF_3, \quad Ag^+, \quad Cl^\ominus$

b) For a given reaction

$$PCl5\ (g) \leftrightharpoons PCl3\ (g) + Cl_2 \quad \Delta H^0 = +124.0\ KJ\ mol^+$$

What would be the effect on Kc if

i)   Move PCl5 is added $\rightarrow$ PCl5

ii)   Pressure is increased

iii)   Temperature is increased

Q33.   a)   What is Ozonolysis? Give the name of the alkene which on ozonolysis given propanone.

b)   Write not on (i) Markovnikov's Rule   (ii) Wurtz reaction

<div align="center">OR</div>

a)   Draw Newmen's projection formulae of Ethane. Out of staggered and Ecilpsed which is more stable and why?

b)   How Ethene can be prepared from   (a) Ethanol   (b) Ethyl Iodide

BUDHA DAL PUBLIC SCHOOL, PATIALA
Final Examination (6 March 2024)
Class XI (Science)
Subject - Chemistry
(Set - B)

M.M. 70

Time: 3hrs.

General Instructions:
1. There are 33 questions in this question paper with internal choice.
2. Section A consists of 16 multiple-choice questions carrying 1 mark each.
3. Section B consists of 5 short answer questions carrying 2 marks each.
4. Section C consists of 7 short answer questions carrying 3 marks each.
5. Section D consists of 2 case-based questions carrying 4 marks each.
6. Section E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

Section - A

Q1. Which of the following terms are unitless?
a) Molality   b) Molarity   c) Mole fraction   d) Mass percent

Q2. One mole of CO_2 contains
a) 6.02×10^{23} atoms of C   b) 6.026×10^{23} atoms of O
c) 18.1×10^{23} molecules of CO_2 d) 3 g atoms of CO_2

Q3. Number of angular nodes for 4d orbital is ………
a) 4   b) 3   c) 2   d) 1

Q4. In which of the following pairs, the ions are isoelectronic?
a) Na^+, Mg^{2+} b) Al^3, O^- c) Na^+, O^{2-} d) N^{3-}, Cl^-

Q5. The order of screening effect of electrons of s, p, d and f orbitals of a given shell of an atom on its outer shell electrons is:
A) $s > p > d > f$ B) $f > d > p > s$ C) $p > d > s > f$ D) $f > p > s > d$

Q6. Which of the following have no unit?
a) Electronegativity
b) Electron gain enthalpy
c) Ionsiation enthalpy
d) None of the above

Q7. Which of the following species contains three bond pairs and one lone pair around the central atom?
a) H_2O b) BF_3 c) NH_2^- d) PCl_3

Q8. Which of the following are Lewis acids?
a) PH_3 and BCl_3 b) $AlCl_3$ and $SiCl_4$ c) PH_3 and $SiCl_4$ d) BCl_3 and $AlCl_3$

Q9. A metal ion M^{3+} loses 3 electrons, its oxidation number will be
a) +3   b) +6   c) 0   d) -3

Q10. Which of the following is not correct?
a) ΔG is zero for a reversible reaction
b) ΔG is positive for a spontaneous reaction
c) ΔG is negative for a spontaneous reaction
d) ΔG is positive for a non-spontaneous reaction

Q11. In which of the following, functional group isomerism is not possible?
a) Alcohols   b) Aldehydes   c) Alkyl halides   d) Cyanides

B-1

Q12. The increasing order of reduction of alkyl halides with zinc and dilute HCl is

    a) $R-Cl < R-I < R-Br$

    b) $R-Cl < R-Br < R-I$

    c) $R-I < R-Br < R-Cl$

    d) $R-Br < R-I < R-Cl$

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    a) Assertion and Reason both are correct and reason is correct explanation for assertion.

    b) Assertion and Reason both are correct but reason is not correct explanation for assertion.

    c) Assertion is correct but Reason is incorrect.

    d) Assertion is incorrect but Reason is correct.

Q13. Assertion : The empirical mass of ethane is half of its molecular mass.

Reason : The empirical formula represents the simplest whole number ratio of various atoms present in a compound.

Q14. Assertion : Boron has a smaller first ionization enthalpy than beryllium.

Reason : The penetration of a 2s electron to the nucleus is more than the 2p electron, hence 2p electron is more shielded by the inner core of electrons than the 2s electrons.

Q15. Assertion : BF_3 molecule is planar but NF_3 is pyramidal.

Reason : N atom is smaller than B.

Q16. Assertion : Boiling points of cis-isomers are higher than those of trans-isomers.

Reason : Dipole moments of cis-isomers are higher than those of trans-isomers.

Section - B

Q17. Calculate the wavelength, frequency of a light wave whose period is 2×10^{-10} sec.

Q18. Which our of N and Oxygen, has higher first ionization enthalpy and why?

Q19. For given equilibrium reaction $aA + bB \leftrightharpoons cC + dD$

Derive the relationship $Kp = Kc(RT)^{\Delta ng}$

Q20. Define disperpotionation reaction with one example.

Q21. Justify that given reaction is redox in nature $Mg\ (s) + Cl_2(g) \rightarrow Mg\ Cl_2\ (s)$

<div align="center">OR</div>

Balance the following redox reaction by ion – electron method :

$MnO_4^-(aqu) + I^-(aqu) \rightarrow MnO_2 + I_2(s)$ (in basic medium)

Section – C

Q22.   a) Calculate the number of atoms in each of the following :

        i)   52 moles of He   (Atomic mass of He = 4U)   ii) 52 gm of He

    b) How many significant figures are present in 500.0 ?

Q23. Draw Molecular Orbital Energy level diagram of N_2 molecule. Find its Bond order and predict Magnetic behaviour (paramagnetic/ Dia magnetic)

Q24. Describe hybridization state and also draw geometry of following molecules

    (a) H_2O (b) PCl5

<div align="center">OR</div>

Define resonance. Draw resonating structures of CO_3^{-2} ion

<div align="right">B-2</div>

Q25: For a reaction $2A(g) + B(g) \rightarrow 2D(g)$ $\Delta U^0 = -10.5\ KJ$ and $\Delta S^0 = -44.1 \times 10^{-3} JK^{-1}$ Calculate ΔG^0 for the reaction and predict whether the reaction may occur spontaneously.

Q26. What is carbocations? State the types of carbocation and discuss its stability.

Q27. Write the structural formula of
   a) 2 – hydroxy butanal
   b) 2 – Oxo pentanoic acid
   c) 3 – Methylcyclohexyne

Q28. Define Huckel's rule of Aromatic compound. State whether these organic compounds are aromatic/ non-aromatic

(i)   (ii)   (iii)

Section – D

Q29. Read the following passage and answer the questions that follow:

The first law of thermodynamics has the limitation that it cannot predict the spontaneity of a process, i.e., a process can take place (by itself or on initiation) or cannot take place. The net driving force is the resultant of tendency for minimum energy and tendency for maximum randomness. Randomness is expressed in terms of the thermodynamic quantity called 'entropy (S)'. Entropy change during a process depends upon physical state of reactants and products, volume change, temperature and number of gaseous molecules before and after the process. Entropy change also occurs during fusion, vaprorisation and sublimation and can be calculated from heat of transition and transition temperature. Total entropy change (ΔS total) is the sum of the entropy change of the system (ΔS system) and entropy change of the surroundings (ΔS surroundings). This helps to predict whether the process is spontaneous, non-spontaneous or in equilibrium. It is found that all spontaneous processes are thermodynamically irreversible and are accompanied by increase of entropy. This is the statement of the second law of thermo- dynamics. Suitable expressions can be used to calculate the entropy change of an ideal, gas with changes of pressure, volume and temperature (P, V and T). Similarly, third law of thermodynamics deals with entropies of crystalline substances.

Based on the above paragraph, answer the following questions:

   a) The enthalpies of all the elements in their standard state are

      (i)   Unity   (ii) Zero   (iii) <0   (iv) None of these

   b) What is the order of Entropy of solid, liquid and gaseous state?

   c) Which quantity out of ΔG or ΔG^0 will be zero at equilibrium?

                          OR

      State First Law of Thermodynamics.

Q30. Read the given passage and answer the questions that follow:

In the cyclic structure of benzene, we find that each carbon atom is further linked to only three atoms viz., two carbon atoms and one hydrogen atom by sigma (σ) bonds, for which it requires only three half filled valence shell orbitals. Therefore, it is only sp_2 hybridised. Two of these sp_2 hybrid orbitals overlap with those of two neightbouring carbon atoms, while the third overlaps with 1s half filled orbital of a hydrogen atom in each case, giving the formation of six carbon-carbon sigma (σ) bonds and six carbon-hydrogen sigma (σ) bonds in one plane. This gives the formation of a regular hexagon of six carbon atoms. After this, each carbon atom is left with one unhybeidised half filled p-orbitals ($2p_z$) which is unused. These unused half filled orbitals then overlap sideways with one another giving the formation of two sets of pi (π)-bongs. The resultant π –molecular orbital cloud embracing all the six carbon atoms. This results into two π –electron clouds, one above and the other below the plane of the carbon atoms.

B-3

a) What is the hybridization state of each carbon of benzyl?

b) Draw orbital structure of benzene.

c) What will be product formed when Benzene is reacted with Cl_2 in the presence of $AlCl_3$.

OR

Write Friedel craft alkylation reaction of Benzene.

Q31.

a) Define photoelectric effect. Write photoelectric equation with meaning of each term used.

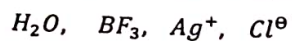b) An electron is in 3p orbital. Give possible value of n, l and m for this election.

Q32.

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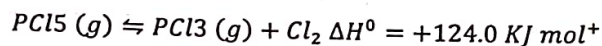
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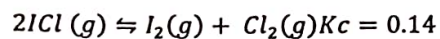
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Q33.

a) What is Ozonolysis? Give the name of the alkene which on ozonolysis given propanone.

b) Write not on (i) Markovnikov's Rule (ii) Wurtz reaction

OR

a) Draw Newmen's projection formulae of Ethane. Out of staggered and Ecilpsed which is more stable and why?

b) How Ethene can be prepared from (a) Ethanol (b) Ethyl Iodide

B-4