# B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL

## ANNUAL EXAMINATION 2026

## SUBJEST: CHEMISTRY (043)

SET -2 ANSWER KEY

Class: XI | Duration: 3 Hrs
Date:20/02/2026 | Max. Marks: 70

## 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.**

| Q. No | | Marks |
|---|---|---|
| 1 | (a) $I_2 < Br_2 < Cl_2 < F_2$ | 1 |
| 2 | (d) C > B > D > A | 1 |
| 3 | (b) Heisenberg's uncertainty principle. | 1 |
| 4 | (b) 27.27% | 1 |
| 5 | (c) All the physical processes stop at equilibrium. | 1 |
| 6 | (a) $Na^+$ | 1 |
| 7 | (c) $q = 0, \Delta T = 0, w = 0$ | 1 |
| 8 | (b) proton | 1 |
| 10 | c.For transition elements, the 3d-orbitals are filled with electrons after 3p-orbitals and before 4s-orbitals. | 1 |
| 11 | (a) 1-Chloro-2-nitro-4-methylbenze | 1 |
| 12 | (a) $Cl^+$ | 1 |
| | | |
| 13 | a | 1 |
| 14 | d | 1 |
| 15 | b | 1 |
| 16 | a | 1 |

## SECTION B

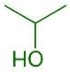
**Directions (Q.No.17-21):This section contains 5 questions . The following questions are very short answer types and carry 2 marks each.**

| | | |
|---|---|---|
| 17 | M2=1.67M<br>OR<br>C=6mol H=18mol | 2 |
| 18 | 18 Staggered more stable due to less torsional strain | 2 |
| 19 | a Explain why19 F has less negative EGE due to repulsion<br>b Be has higher IE than B because stable configuration. | 2 |
| 20 | $ClF_3$ T-shape; $XeF_4$ square planar | 2 |
| 21 | Formula Kc = $[PCl_3][Cl_2]/[PCl_5]$<br>= (1.59×1.59)/1.41 = **1.79** 1 Kc=1.79 1 | 2 |

## SECTION C

**Directions (Q. No. 22-28): This section contains 7 questions with no internal choice. The following questions are short answer type and carry 3 marks each.**

| | | |
|---|---|---|
| 22 | Moles HCl = 0.025×0.75 = 0.01875<br>Moles $CaCO_3$ = 0.01875/2 = 0.009375<br>Mass = 0.009375×100 = **0.94 g** 0.94 gram | 3 |
| 23 | (a) Principal quantum number: denotes shell & energy level.<br>b.Lowest n for d-orbital = **3**<br>c.Electrons with ms = −½ for n=4 = **16** | 3 |
| 24 | Step wise<br>$MnO_4^- + 5Fe^{2+} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$ | 3 |
| 25 | Kp = Kc(RT)^Δn<br>For $H_2 + I_2 \rightleftharpoons 2HI$, Δn = 0 → Kp = Kc | 3 |
| 26 | Na after losing $1e^-$ attains noble gas config → 2nd IE high, Mg does not. | 3 |

| | | |
|---|---|---|
| 27 | i<br><br>(ii) Ethyl benzene<br>(iii) 6 sigma and 2 pi.<br>**OR**<br>CH3 CH2CHO Propanal CH3 CO CH3 Propanone | 3 |
| 28 | **Step 1: Write formation reaction of $CH_3OH$**<br>C(s)+2H2(g)+12O2(g)→CH3OH(l)<br>C(s)+2H2(g)+21O2(g)→CH3OH(l)<br>This is the reaction whose enthalpy we need. | 3 |
| | **Step 2: Manipulate given equations**<br>Multiply equation (3) by 2:<br>2H2+O2→2H2OΔH∘=−572 kJ<br>2H2+O2→2H2OΔH∘=−572 kJ<br>Now add equation (2) and modified (3):<br>C+2H2+2O2→CO2+2H2O<br>ΔH∘=−393−572<br>= −965 kJ | |
| | **Step 3: Reverse equation (1)**<br>CO2+2H2O→CH3OH+32O2<br>2CO2+2H2O→CH3OH+23O2<br>ΔH∘=+726 kJ | |
| | **Step 4: Add Step-2 and Step-3 equations**<br>C+2H2+2O2+CO2+2H2O→CO2+2H2O+CH3OH<br>Cancel common terms $CO_2$ and $2H_2O$:<br>C+2H2+21O2→CH3OH<br>This is exactly the formation reaction. | |
| 27 | **Step 5: Calculate ΔfH°**<br>ΔfH∘=−965+726=−239 kJ mol−1 | |

| | | |
|---|---|---|
| | $\Delta fH^\circ(CH3OH) = -239$ kJ mol | |
| | **SECTION D** | |
| 29 | Liquid → solid :<br>**Entropy decreases**<br>Raising temp 0K to 115K:<br>**Entropy increases**<br>$\Delta S_{vap}$ (water) > ethanol due to more H-bonding<br>$2Cl(g) \rightarrow Cl_2(g)$ : $\Delta H = -ve$, $\Delta S = -ve$ | 2+1+1 |
| 30. | **I.**ii) Electrophilic substitution<br>**II.(iii)** There are 6 isomeric dichlorobenzenes.<br>**III**. Aromatic compounds have delocalized π electrons, eg: **Benzene** | |
| | **SECTION-E**<br>**Directions (Q. No. 31-33) carries 5 marks** | |
| 31 | i) Electron donating and attracting group are known as I effect It is permanent effects. | 2+3 |

Percentage of carbon in organic compound = 69%

That is, 100 g of organic compound contains 69g of carbon

∴ 0.2 g of organic compound will contain

$$= \frac{69 \times 0.2}{100} = 0.138\text{g of C}$$

Molecular mass of carbon dioxide, $CO_2$ = 44g
That is, 12 g of carbon is contained in 44 g of $CO_2$=44g
Therefore, 0.138g of carbon will be contained in

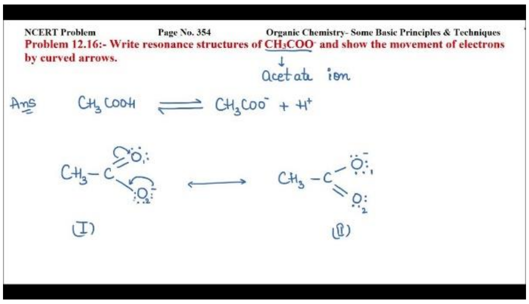
$$\frac{44 \times 0.138}{12} = 0.506\text{g of } CO_2$$

Thus, 0.506g of $CO_2$ will be produced on complete combustion of 0.2g of organic compound.
Percentage of hydrogen in organic compound is 4.8

i.e., 100g of organic compound contains 4.8g of hydrogen.

OR

(a) $H_3C$-Br



NCERT Problem Page No. 354 Organic Chemistry- Some Basic Principles & Techniques

**Problem 12.16:- Write resonance structures of $CH_3COO^-$ and show the movement of electrons by curved arrows.**

Acetate ion

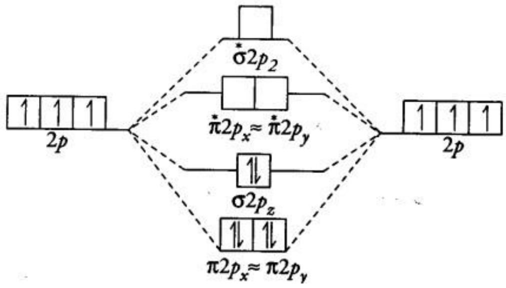
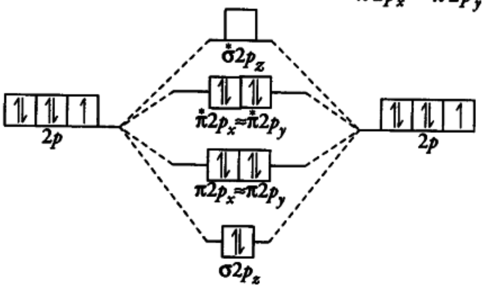
Ans $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

**Definition**: An "electron-loving" species that accepts an electron pair, often positively charged, neutral with an incomplete octet, or having a partial positive charge. They act as Lewis acids

**Definition**: A "nucleus-loving" species that donates an electron pair, typically having a negative charge or a lone pair of electrons, and acts as a Lewis base.

(b) + I effect and hyperconjugation effect.

| | | |
|---|---|---|
| 32 | (a) Explain sp $sp^2$ and $sp^3$ hybridisation with suitable example<br>**sp Hybridization**<br>- **Definition**: One 's' orbital and one 'p' orbital intermix to form two identical sp hybrid orbitals.<br>- **Geometry**: Linear (straight line).<br>- **Bond Angle**: 180°.<br>- **Example**: Acetylene (C2H2<br>$C2H2$Each carbon atom uses its two sp orbitals to form sigma (<br>σsigma<br>$\sigma$) bonds (one with H, one with the other C), while its two unhybridized 'p' orbitals form pi (<br>$\pi$) bonds, resulting in a triple bond (C≡C).<br>**$sp^2$ Hybridization**<br>- **Definition**: One 's' orbital and two 'p' orbitals intermix to form three identical $sp^2$ hybrid orbitals.<br>- **Geometry**: Trigonal Planar (flat triangle).<br>- **Bond Angle**: 120°.<br>- **Example**: Ethene (<br>C2H4<br>$C2H4$). Each carbon uses three $sp^2$ orbitals for sigma bonds (two with H, one with the other C), and the remaining unhybridized 'p' orbital forms a pi (<br>bond, creating a double bond (C=C).<br>**$sp^3$ Hybridization**<br>- **Definition**: One 's' orbital and three 'p' orbitals intermix to form four identical $sp^3$ hybrid orbitals.<br>- **Geometry**: Tetrahedral (four corners of a tetrahedron).<br>- **Bond Angle**: ~109.5°.<br>- **Example**: Methane<br>C2H6Carbon uses all four $sp^3$ orbitals to form single sigma (<br>σ) bonds with four atoms (e.g., H atoms in methane) | 5 |

| | | |
|---|---|---|
| | **OR**<br>Formation of $N_2$ molecule<br>$_7N = 1s^2, 2s^2, 2p_x^1, 2p_y^1, 2p_z^1$<br>$N_2 = \sigma 1s^2, \overset{*}{\sigma} 1s^2, \sigma 2s^2, \overset{*}{\sigma} 2s^2, \pi 2p_x^2 \approx \pi 2p_y^2, \sigma 2p_z^2$<br> $\overset{*}{\sigma}2p_2$<br>2p<br>$\overset{*}{\pi}2p_x \approx \overset{*}{\pi}2p_y$<br>2p<br>$\sigma 2p_z$<br>$\pi 2p_x \approx \pi 2p_y$<br>Formation of $F_2$ molecule $_9F = 1s^2, 2s^2, 2p_x^2, 2p_y^2, 2p_z^1$<br>$F_2 = \sigma 1s^2, \overset{*}{\sigma} 1s^2, \sigma 2s^2, \overset{*}{\sigma} 2s^2, \sigma 2p_z^2, \pi 2p_x^2 \approx \pi 2p_y^2, \overset{*}{\pi} 2p_x^2 \approx \overset{*}{\pi} 2p_y^2$<br> $\overset{*}{\sigma}2p_z$<br>2p<br>$\overset{*}{\pi}2p_x \approx \overset{*}{\pi}2p_y$<br>2p<br>$\pi 2p_x \approx \pi 2p_y$<br>$\sigma 2p_z$<br>**© Nb-Na/2 = 0** | |
| 33 | (i) **No two electrons in a single atom can have an identical set of all four quantum numbers**<br>(ii) Write the electronic configurations of the following ions:<br>(a) 1s2 2s22p6 (b) 1s2 2s2 2p6 3s23p6 3d6 | |

**(i)** To calculate the energy of a photon whose fr
quency

$$(\upsilon) = 3 \times 10^{15}\ \text{Hz}$$
$$= 3 \times 10^{15}\ \text{cs}^{-1}$$
$$(1\ \text{Hz} = 1\ \text{cycle sec}^{-1}$$
$$E = h\upsilon$$

where h = Planck's constant

$$= 6.6 \times 14^{-34}\ \text{Js}$$
$$E = 6.6 \times 10^{-34} \times 3 \times 10^{15}$$
$$= 1.98 \times 10^{-18}\ \text{J}$$

**(ii)** $$E = h\upsilon = h\frac{c}{\lambda} \qquad \left[\because \upsilon = \frac{c}{\lambda}\right.$$

$$= \frac{6.6 \times 10^{-34}\ \text{Js} \times 3 \times 10^{8}\ \text{ms}^{-1}}{0.50 \times 10^{-10}\ \text{m}}$$

$$= 3.98 \times 10^{-15}\ \text{J.}$$

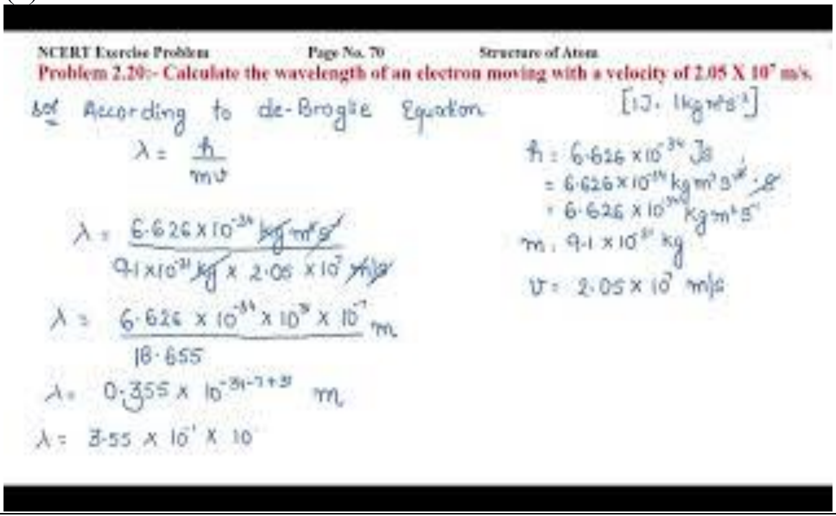
**OR**

(a)

Hund's Rule of Maximum Multiplicity states that electrons will singly occupy degenerate (same-energy) orbitals with parallel spins before any pairing occurs, leading to the lowest energy state with the maximum number of unpaired electrons and highest spin multiplicity (2S+1) for a given electron configuration, like in p, d, or f subshells. This means electrons fill each orbital in a subshell with one electron

b. (i) 29(ii) 1s2 2s2 2p6 3s23p6 3d10 4s1

(c)



NCERT Exercise Problem Page No. 70 Structure of Atom

Problem 2.20:- Calculate the wavelength of an electron moving with a velocity of 2.05 X 10⁷ m/s.

Sol According to de-Broglie Equation

$\lambda = \frac{h}{mv}$

$\lambda = \frac{6.626 \times 10^{-34}\ \cancel{kg}\ m^2 \cancel{s^{-1}}}{9.1 \times 10^{-31}\ \cancel{kg} \times 2.05 \times 10^{7}\ \cancel{m/s}}$

$\lambda = \frac{6.626 \times 10^{-34} \times 10^{31} \times 10^{-7}}{18.655}\ m$

$\lambda = 0.355 \times 10^{-34-7+31}\ m$

$\lambda = 3.55 \times 10^{-1} \times 10$

$[1J = 1kg\ m^2 s^{-2}]$

$h = 6.626 \times 10^{-34}\ Js$

$= 6.626 \times 10^{-34}\ kg\ m^2 s^{-2} \cdot s$

$= 6.626 \times 10^{-34}\ kg\ m^2 s^{-1}$

$m = 9.1 \times 10^{-31}\ kg$

$v = 2.05 \times 10^{7}\ m/s$