Adda247
PUBLICATIONS

ODISHA LTR
TGT SCIENCE CBZ

Main Written Exam

15 MTB SOLUTION BOOKLET

FREE OMR SHEET

INCLUDES
- Chemistry
- Botany
- Zoology
- Pedagogy & Evaluation

ODISHA STAFF SELECTION COMMISSION
Leave Training Reserve (LTR) Teacher | TGT SCIENCE CBZ | Main Written Exam

[Total No. of Question – 150]　　　**TEST BOOKLET NO. 01**　　　[Maximum Marks – 150]

SUBJECTS | (a) Chemistry (40 MCQS | 40 Marks) | (b) Botany(45 MCQs | 45 Marks)
| (c) Zoology (45 MCQS | 45 Marks) | (d) Pedagogy & Evaluation (20 MCQs | 20 Marks)

Chemistry

1. Which of these is least likely to act as a Lewis base?
(a) NH_3
(b) BH_3
(c) $R-O-H$
(d) R_2O

2. The equilibrium constant for the aromatization reaction of acetylene is 8. The aromatization reaction is given below

$$3C_2H_2 \xrightarrow[\text{tube}]{\text{Red hot}} C_6H_6$$
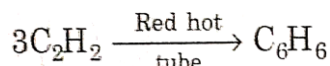
If the equilibrium concentration of acetylene is found to be 0.5 then the equilibrium concentration of benzene (C_6H_6) is
(a) 0.5 mol L^{-1}
(b) 1 mol L^{-1}
(c) 0.25 mol L^{-1}
(d) 2 mol L^{-1}

3. Enzymes increases the rate of reaction
(a) by increasing activation energy
(b) by decreasing activation energy
(c) by taking part in the reaction
(d) by altering concentration of the reaction

4. How many chiral centres are present in 2-methyl butane?
(a) 0
(b) 1
(c) 2
(d) 3

5. The acid derivative having maximum reactivity towards nucleophilic addition is
(a) CH_3CONH_2
(b) $(CH_3CO)_2O$
(c) CH_3COCl
(d) CH_3COOR

6. Which of the following molecules possesses linear geometry?
(a) XeF_2
(b) XeF_4
(c) $XeOF_4$
(d) XeF_6

7. The hybridisation of central atoms in case of diamond and carborundum respectively are
(a) sp^2, sp^3
(b) sp^3, sp^2
(c) sp^2, sp
(d) sp^3, sp^3

8. Consider the following reaction sequence

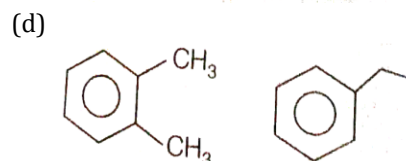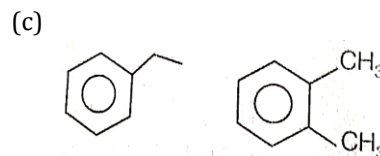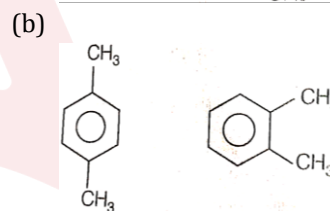$$CH_3Br \xrightarrow[C_2H_5OC_2H_5]{Mg} X \xrightarrow[H^+]{Y} (CH_3)_3C-OH$$
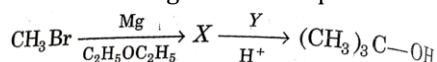
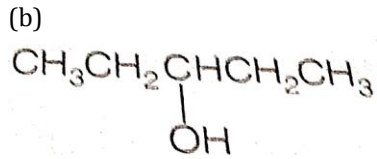What is Y in the above reaction sequence?
(a) $CH_3 CHO$
(b)

(c)

(d)
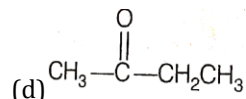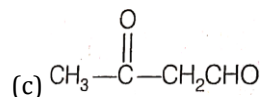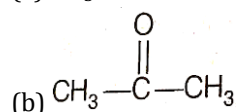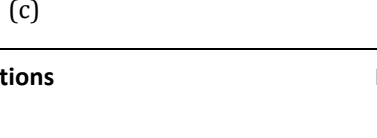
9. Compound X having the molecular formula C_8H_{10} forms two isomers Y and Z. Isomer Y when subjected to oxidation gives benzoic acid and isomer Z when subjected to oxidation followed by dehydration gives phthalic anhydride. The structures of the two isomers respectively are
(a)

(b)

(c)

(d)
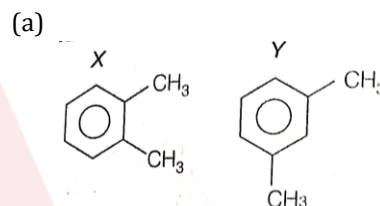
10. Which of the following pairs have identical values of e/m?
(a) A proton and a neutron
(b) A proton and a deuterium
(c) Deuterium and an α − particle
(d) An electron and γ - rays

11. The diamagnetic molecule among the following is
(a) O_2
(b) N_2
(c) N^-_2
(d) O^-_2

12. Which of the following does not react with aqueous solution of $KMnO_4$, acidified with H_2SO_4?
(a) SO_2
(b) Fe^{2+}
(c) NO_2^-
(d) NO_3^-

13. $HClO_4 + P_2O_5 \rightarrow$ (A) and (B) A and B are
(a) $HClO_3, H_3PO_4$
(b) Cl_2O_6, HPO_3
(c) ClO_2, H_2PO_4
(d) Cl_2O_7, HPO_3

14. Which of the following does not depend upon the concentration of reactants?
(a) zero order reaction
(b) first order reaction
(c) second order reaction
(d) third order reaction

15. If time for the completion of 75% of a reaction is 40 min, then 50% of the reaction was completed in
(a) 16 min
(b) 25 min
(c) 18 min
(d) 20 min

16. Which of the following is not correctly matched?
(a) ClO_3^- - sp^2 hybridised
(b) SO_3 - sp^2 hybridised
(c) NH_3 - sp^3 hybridised
(d) PCl_5 - sp^3d hybridised

17. The actinoids showing +7 oxidation state are
(a) U, Np
(b) Pu, Am
(c) Np, Pu
(d) Am, Cm

18. Basic strength is maximum for
(a) $C_6H_5NH_2$
(b) $C_6H_4(NO_2) NH_2$
(c) $C_6H_5NHCH_3$
(d) $C_6H_5CH_2NHC_2H_5$

19. Which of the following statement is incorrect for o-nitrophenol?
(a) it contains intermolecular H-bonding
(b) its boiling point is lower than that of p-nitrophenol
(c) its boiling point is lower than that of m-nitrophenol
(d) its vapour pressure is higher as compared to p-nitrophenol

20. Mark the correct statement.
(a) For a chemical reaction to be feasible, G should be zero
(b) Entropy is a measure of order of a system
(c) For a chemical reaction to be feasible, G increases
(d) The total energy of an isolated system is constant

21. K_{sp} for $Mg (OH)_2$ is 0.4×10^{-11}, then the pH value of the solution is
(a) 5
(b) 8.5
(c) 10.3
(d) 12

22. Freezing point is minimum for
(a) 0.1 M $Al_2(SO_4)_3$
(b) 0.1 M $BaCl_2$
(c) 0.1 M Urea
(d) 0.1 M $NaCl$

23. Which of the following does not present in the form of minerals?
(a) SO_4^{2-}
(b) S^{2-}
(c) NO_3^-
(d) Cl^-

24. The species which acts as a Lewis but not a Bronsted acid is
(a) NH_2^-
(b) O^{2-}
(c) BF_3
(d) OH^-

25. Which of the following species does not exist?
(a) BF_3
(b) $B(OH)_6^{3-}$
(c) Al_2Cl_6
(d) $AlCl_3$

26. The number of peroxide bonds in perxenate ion $[XeO_6]^{4-}$ is
(a) 0
(b) 2
(c) 3
(d) 1

27. Anodising can be done by electrolysing dilute sulphuric acid with Al as anode. This result in
(a) the formation of protective oxide layer
(b) the formation of $Al_2(SO_4)_3$ and SO_2 gas
(c) the formation of AlH_3 and SO_2 gas
(d) the formation of Al (HSO_3) and H_2 gas

28. Cannizaro reaction is given by
(a) CH_3CHO
(b) C_6H_5CHO
(c) CH_3COOH_3
(d) $C_6H_5COCH_3$

29. What is the product of the reaction of $C_6H_5OC_2H_5$ with HI?
(a) $C_6H_5OH + C_2H_5I$
(b) $C_2H_5OH + C_6H_5I$
(c) $C_2H_5.I$ only
(d) $C_6H_5OH + C_6H_5I$

30. The correct decreasing order of priority for the functional groups of organic compounds in the IUPAC system of nomenclature is
(a) COOH, SO_3H, $CONH_2$, CHO
(b) SO_3H, COOH, $CONH_2$, CHO
(c) CHO, COOH, SO_3H, $CONH_2$
(d) $CONH_2$, CHO, SO_3H, COOH

31. When an acid cell is charged, then
(a) voltage of cell increases
(b) resistance of cell increases
(c) electrolyte of cell dilutes
(d) all of the above

32. Which of the following exhibit only optical isomerism?
(a)

(b)

$CH_3CH_2CHCH_2CH_3$
        |
       OH

(c)

1. **(b):** BH$_3$, being electron deficient, have a tendency of gaining, not losing electrons, so it behaves like a Lewis acid, not like a Lewis base.
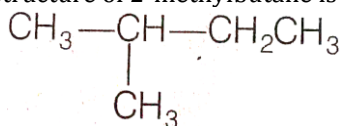
2. **(b):** For the given reaction, Kc = $\frac{[C6H6]}{\{C2H2\}3}$

   $8 = \frac{[C6H6]}{(0.5)3}$

   [C$_6$H$_6$] = $8 \times (0.5)^3 = 1$

3. **(b):** Enzymes act as catalysts, thus they increase the rate of a biochemical reaction by providing an alternate pathway of lower activation energy.

4. **(a):** The structure of 2-methylbutane is

   Thus, it contains no chiral centre i.e., the carbon, all the four valencies of which are satisfied by four different groups.

5. **(c):** Cl being an electron withdrawing group decreases the electron density at carbonyl carbon and makes the C = O bond more polar and hence more reactive towards nucleophilic addition reactions.

6. **(a):** $XeF_2 \Rightarrow$ 2bp + 4/p Thus, geometry linear
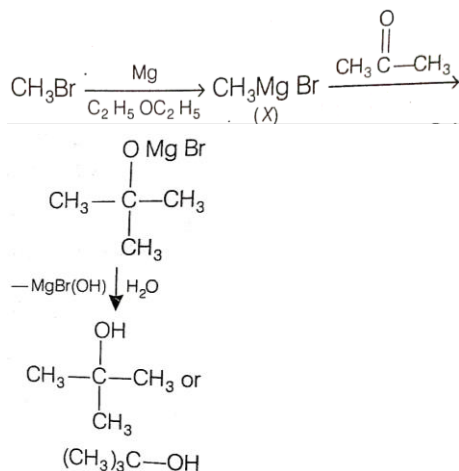 $XeF_4 \Rightarrow$ 4bp + 2/p square planar
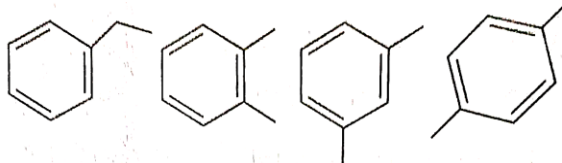 $XeOF_4 \Rightarrow$ 5bp + 1/p square pyramid
   $XeF_6 \Rightarrow$ 6bp + 1/p distorted octahedral

7. **(d):** In diamond and carborundum (SiC) both the central atoms are sp^3 hybridised.
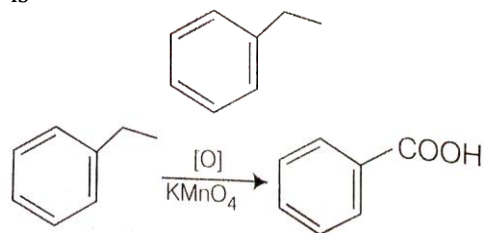
8. **(b):**

9. **(c):** The possible isomers of the molecule with molecular formula C$_8$H$_{10}$ are

Since, Y on oxidation gives only benzoic acid, it means that it contains only one side chain. Thus, Y is

Since, Z contains side chain at two places, so its oxidation product contains two -COOH groups. Further, formation of phthalic anhydride suggests that both the -COOH groups are present at adjacent positions. Thus, Z is
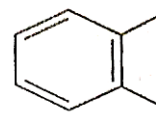
10. **(c):** $\frac{\frac{e}{m_d}}{\frac{2e}{m_\alpha}} = \frac{4m_d}{4m_d} = 1$. Thus, deuterium and an α-particle have identical value of e/m.

11. **(b):** Molecules having no unpaired electrons are diamagnetic in nature.
    N$_2$(14) = $\sigma1s^2$, $\overset{*}{\sigma}1s^2$, $\sigma2s^2$, $\overset{*}{\sigma}2s^2$, $\pi2p_x^2 \approx \pi2p^2y$, $\sigma2p_z^2$
    No unpaired electron is present, so it is a diamagnetic species.

12. **(d):** In acidic medium, KMnO$_4$ acts as a good oxidising agent but it cannot oxidise No$_3^-$ ion, as in it N is present in its highest oxidation state (+5), so further increase in oxidation number is not possible.
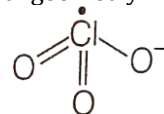
13. **(d):** 2HClO$_4$ + P$_2$O$_5 \rightarrow$ Cl$_2$O$_7$ + 2HPO$_3$

14. **(a):** In case of zero order reaction, rate of reaction does not depend upon the concentration of reactants.

15. **(d):** t$_{75\%}$ = 2 × t$_{50\%}$
    t$_{50\%}$ = $\frac{t75\%}{2} = \frac{40}{2}$ = 20 min

16. **(a):** $CIO_3^- \Rightarrow$ 3bp + 1/p $\Rightarrow$ sp^3 hybridized
    = pyramidal geometry

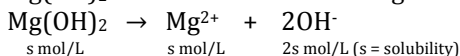17. **(c):** Np and Pu in NpO$^+_3$ and PuO$_3^+$ oxocations show +7 oxidation state which are not so stable.

18. **(d):** More the number of electron releasing R groups attached directly with N-atom, more is the basic

strength. Thus, $C_6H_5CH_2NHC_2H_5$ has maximum basic strength.

19. **(a):** o-nitrophenol contains intramolecular H-bonding. All other given statements are true.

20. **(d):** For a chemical reaction to be feasible, ΔG should be < 0, i.e., negative.
Further entropy is the measure of randomness of a system.

21. **(c):** $Mg(OH)_2$ dissolved in the following manner.
$$Mg(OH)_2 \; \rightarrow \; Mg^{2+} \; + \; 2OH^-$$
$\quad$ s mol/L $\qquad$ s mol/L $\qquad$ 2s mol/L (s = solubility)
$K_{sp} = [Mg^{2+}] \, [OH^-]^2$
$= (s) \, (2s)^2 = 4s^3$
$4s^3 = 0.4 \times 10^{-11}$
$s^3 = 10^{-12}$
$s = 10^{-4}$
Since 1 mol Mg $(OH)_2$ provides 2 moles of $[OH^-]$, so $[OH^-] = 2 \times 10^{-4}$
$pOH = -\log[OH^-] = -\log(2 \times 10^{-4}) = 3.7$
$pH = 14 - pOH = 14 - 3.7 = 10.3$

22. **(a):** Depression in freezing point is a colligative property i.e., depends upon the number of particles. Thus, as the number of particles increases, freezing point decreases.
Thus 0.1 M $Al_2(SO_4)_3$ shows minimum freezing point.

23. **(c):** Since nitrates of almost all salts are soluble in water, so they are never present as minerals.

24. **(c):** BF_3 being electron deficient acts as a Lewis acid but it is not a Bronsted acid because of the absence of H atoms.

25. **(b):** B, because of the absence of d-orbitals, cannot extend its covalency beyond 4 and hence, $B(OH)^{3-}_6$ does not exist.
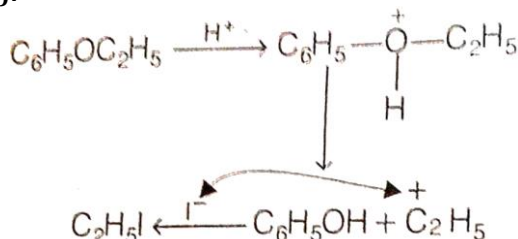
26. **(a):** Structure of $[XeO_6]^{4-}$ is
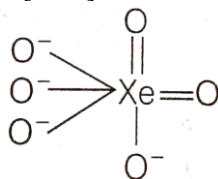
Thus, it does not contain any peroxide bond.

27. **(a):** Anodising of Al results in the formation of a protective layer over Al surface.

28. **(b):** Cannizaro reaction is given by only those aldehydes which do not contain any α – H atom.
Among the given only C_6H_5CHO (benzaldehyde) has no α – H atom. So, it will give Cannizaro reaction.
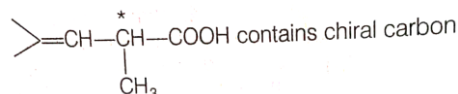
29. **(a):**

Thus, the products are C_2H_5I and C_6H_5OH.

30. **(a):** The correct decreasing order of priority in IUPAC system of nomenclature is
$-COOH, -SO_3H, -CONH_2, -CHO$

31. **(a):** Charging results in increase voltage.

32. **(c):**

atom but has no such double bond to which different groups are attached. Hence, it will exhibit only optical isomerism.

33. **(a):** Zn being less reactive than Mg cannot replace Mg from its salts.

34. **(a):** For the reaction,
$MnO^-_4 + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$
$-E_3 = \dfrac{-1.51 \times 5 + 2 \times 1.23}{3} = 1.70$ V

35. **(a):** Van der Waals' equation is $\left(p + \dfrac{an^2}{V^2}\right)(V - nb) = nRT$
For 1 mol, n = 1
$\left(p + \dfrac{a}{V^2}\right)(V - b) = RT$
or $\qquad p = \dfrac{RT}{(V-b)} - \dfrac{a}{V^2}$

36. **(c):** $\Delta G° = -RT \ln K$
$\ln k = -\dfrac{\Delta G°}{RT}$
$k = e^{-\Delta G°}/RT$

37. **(c):** For, $2HI \rightleftharpoons H_2 + I_2$
$\Delta n_g = 2 - 2 = 0$
$K_p = K_c \, (RT)^{\Delta n_g} = K_c$

38. **(b):** A less electronegative atom is more nucleophilic. Thus, nucleophilicity is highest for CH^-_3 among the given.

39. **(c):** $Hg_2(NO_3)_2$ ionises as
$Hg_2 \, (NO_3)_2 \rightarrow \underbrace{Hg_2^{2} + 2NO_3^-}_{3 \; ions}$
So, van't Hoff factor, i = 3

40. **(c):** Chloromycetin is the antibiotic that is effective for treating pneumonia, bronchitis etc.

41. **(d):** Cellulose is a structural polysaccharide formed of a long chain of - glucose units (6000 -10,000). They are straight, unbranched and linear. Adjacent glucose molecules are joined by $\beta 1 \rightarrow 4$ linkages.
Pectin is a mucopolysaccharide found in the cell wall. It is made up of galactose, galacturonic acid and arabinose.
Lignin is a heterogeneous phenyl propane polymer formed by condensation of coumarin, coniferyl and sinapyl alcohol.

42. **(c):** Parenchyma is made up of isodiametric, thin-walled cells having intercellular space. The main function of parenchyma is the storage of food.
In hydrophytes, the parenchyma develops air spaces and such parenchyma with air cavities is known as aerenchyma, which helps in floating or buoyancy.