St. Paul's Cathedral Mission College

Department of Chemistry

Internal Assessment Test-2025; Semester-4 (CCF); Full Marks: 50; Time: 1 hour

Name: College Roll No.:   University Roll No.

Attempt all the questions: Each question carry one mark unless otherwise stated

1.   Double Salt among the following is

   (a) $CuSO_4.Cu(OH)_2$ (b) $NaKSO_4$ (c) $KAl(SO_4)_2.12H_2O$ (d) $4KCN. Fe(CN)_2$

2.   Linkage isomerism is shown by the ligand

   (a) bidentate   (b) flexidentate   (c) chelating   (d) ambidentate.

3.   Chelate effect is mainly due to the effect

   (a) Enthalpy   (b) Entropy   (c) Activation Energy   (d) Internal Energy.

4. $[Co(NH_3)_5Br]SO_4$ shows the isomerism

   (a) Ionic   (b) hydrate   (c) linkage   (d) coordination

5.   Solvent system theory is applicable for the solvent

   (a) H_2O (b) liquid NH_3 (c) liquid SO_2 (d) all of the above.

6.   Conjugate base of OH^- is:

   (a) H_2O (b) O^{2-} (c) H_3O^+ (d) none of the above.

7.   According to Lux Flood concept B_2O_3 is

   (a) Acidic   (b) Basic   (c) Amphoteric   (d) Neutral in nature.

8.   Among Fe^{2+}, Pb^{2+}, Cu^{2+} and Cu^+ borderline acid combination(s) is/are

   (a) Pb^{2+}, Cu^+ (b) Fe^{2+}, Cu^{2+} (c) Pb^{2+}, Cu^{2+} (d) Fe^{2+}, Cu^+

9. $^{208}_{82}Pb$ is the end product of all naturally occurring radioactive series because

   (a) it has magic number of n and p (b) magic number of n (c) magic number of p (d) none of these.

10.   The most common projectile for fission reaction is

   (a) slow neutron   (b) fast neutron   (c) α-particle   (d) both (a) and (b).

11.   Asymmetric fission is explainable from

   (a) Segre chart   (b) Harkin's rule   (c) Bohr yield curve   (d) none of these.

12.   Control rod is used in

   (a) spallation   (b) fission   (c) fusion   (d) all of these.

13. The heaviest stable nuclide is

(a) $^{236}_{92}U$ (b) $^{208}_{82}Pb$ (c) $^{209}_{83}Bi$ (b) none of these.

14. Nuclear fusion is observed for

(a) lighter nuclides   (b) medium nuclides   (c) heavier nuclides   (d) all of these.

15. Which of the following compounds show maximum hydrogen bonding?

(a) HF   (b) NH_3 (c) H_2O (d) None of these.

16. KCl is soluble in water due to the following interaction

(a) hydrogen bonding   (b) ion-ion   (c) ion-dipole   (d) ion-induced dipole.

17. Which one of the followings is the most stable species?

(a) H_2 (b) H_2^+ (c) H_2^- (d) HeH^+

18. Which one of the followings has the shortest bond length?

(a) O_2^{2-} (b) O_2^- (c) O_2 (d) O_2^+

19. Which one of the followings is a two-electron paramagnetic species?

(a) B_2 (b) C_2 (C) N_2 (d) F_2

20. 2s-2p mixing does not occur in

(a) Li_2 (b) C_2 (c) N_2 (d) F_2

21. The unequal raising and lowering of ABMO and BMO respectively for H_2^+ ion occurs due to

(a) normalization constant neglected   (b) orthogonalization concept considered   (c) in phase and out of phase overlap considered concurrently   (d) overlap integral neglected

22. The probability of finding the electron density in BMO is greater than that of ABMO. Based on this, pick out the correct stament from below

(a) the normalization constant in ABMO is greater than BMO   (b) BMO contains greater number of modes than ABMO   (c) phasing out of BMO is more frequent than ABMO   (d) the BMOs are higher in energy than their corresponding ABMOs

23. Which one of the following is false?

(a) Electrons in the MOs move independently   (b) The nuclear movement is kept freezed during the construction of MOs   (c) Pauli and Hund's rules are followed   (d) The degenerate levels should be selectively occupied by the electrons.

24. NH_4HF_2 is added in Fe^{3+}/Fe^{2+} titration against $K_2Cr_2O_7$ solution because of

(a) to provide the source of H^+ ions   (b) to balance the acidity of the mixture

(c) to keep the indicator potential at the intermediate stage of the oxidant and the reductant, as well as to provide a colourless background   (d) all of these

25. The major product of the following reaction is: $2 CH_3CHO \xrightarrow{Al(OEt)_3}$?

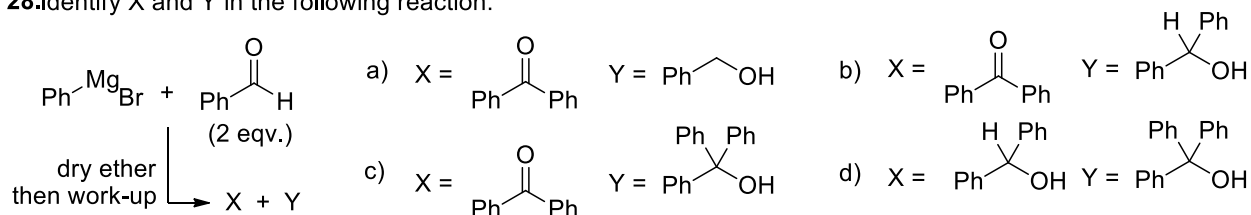a) $CH_3CH(OH)CH_2CHO$ b) $CH_3CO_2CH_2CH_3$ c) $CH_3CH_2CO_2CH_3$ d) $CH_3CH(OH)CH_2CHO$

26. Benzaldehyde reacts with excess of ethyl alcohol in presence of catalytic, dry HCl to give:

a) $PhCH(OH)OEt$ b) $PhCH(Cl)OEt$ c) $PhCH(OEt)_2$ d) $PhCH(Cl)OH$

27. Which of the following compounds does not undergo Cannizzaro reaction?

a) CH_3CHO b) $PhCHO$ c) $HCHO$ d) $(CH_3)_3CCHO$

28. Identify X and Y in the following reaction:

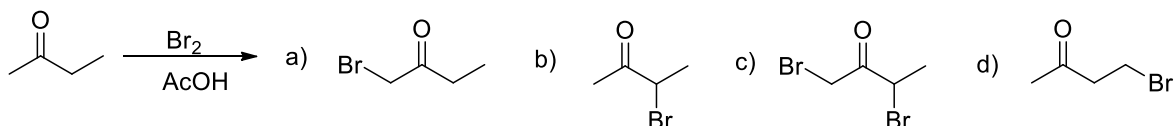**29.** Which of the following reactions is unsuitable for the synthesis of the aldehyde (X)?

a)   + BuMgBr   b) HCO_2Et + BuMgBr

X =

c)   + BuMgBr   d)   + BuMgBr
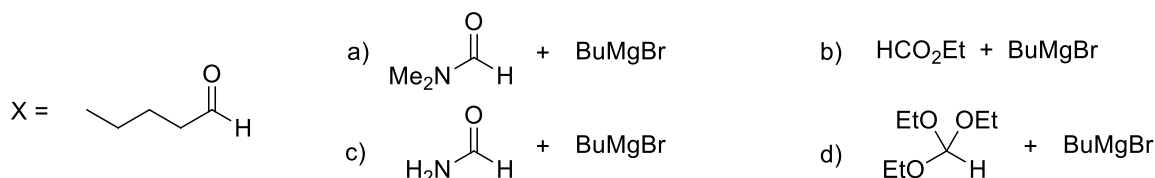
30. Identify the mechanism most likely to operates when methyl mesitoate is hydrolysed to mesitoic acid & MeOH.

a) $A_{Ac}2$ b) $A_{Ac}1$ c) $B_{Ac}2$ d) $B_{Ac}1$

31. The correct order of relative rate of hydrolysis of methyl 4-nitrobenzoate (I), methyl 4-methoxybenzoate (II), and methyl benzoate (III) in aqueous alkali is:

a) III < II < I   b) I < III < II
c) III < I < II   d) II < III < I

32. The major product in the following reaction is:

$\xrightarrow[AcOH]{Br_2}$ a)   b)   c)   d)

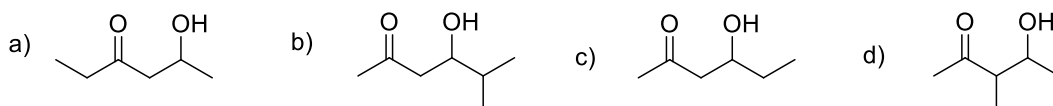**33.** Which of the following conditions is wrong with kinetic-enolate formation?

a)   favoured by strong, hindered base   b)   favoured in low temperature
c)   favoured by short reaction time   d)   favoured by the addition of base to ketone

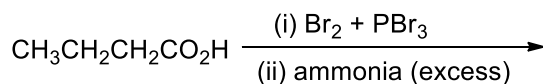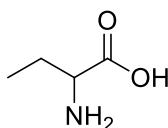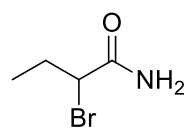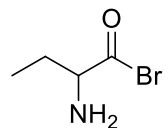**34.** The major product in the following reaction is:

$\xrightarrow{NaOEt / EtOH}$ a)   b)   c)   d)
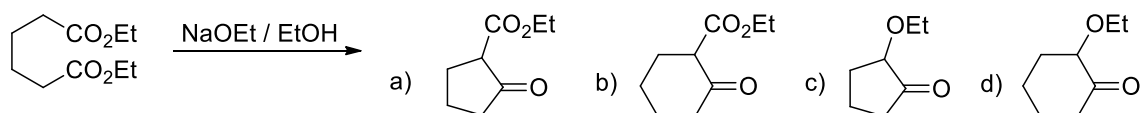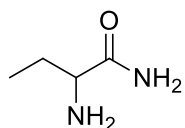
35. Product (P) in the following reaction is: $\xrightarrow[\text{(iii) } H_3O^{\oplus}]{\text{(i) LDA, THF, -78 °C; (ii) } CH_3CHO}$ (P)

a)   b)   c)   d)

3

36. Product (P) in the following reaction is: $CH_3CH_2CH_2CO_2H$ $\xrightarrow[\text{(ii) ammonia (excess)}]{\text{(i) Br}_2\text{ + PBr}_3}$

a) [structure: chain with O, OH, NH_2]

b) [structure: chain with O, NH_2, Br]

c) [structure: chain with O, Br, NH_2]

d) [structure: chain with O, NH_2, NH_2]
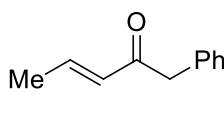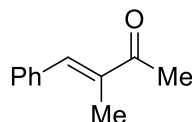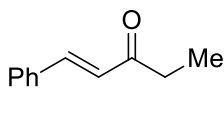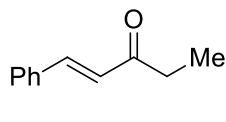
37. Reaction between benzaldehyde and butanone gives (A) in base. (A) is:

a) Me—⌐=⌐—(C=O)—Ph

b) Ph—CH=C(Me)—(C=O)—Me

c) Ph—⌐=⌐—(C=O)—Me

d) Ph—⌐=⌐—(C=O)—Me

38. The van't Hoff factor and the apparent degree of dissociation of a 0.2 molal aqueous solution of $NaNO_3$ which freezes at -0.675 °C are [Given k_f = 1.86 K Kg mole^{-1}]

   a) 1; 0.6
   b) 1.815; 0.815
   c) 0.8; 0.6
   d) 1.415; 0.415

[3]

39. A mixture of quinoline and water (immiscible pair) boils at 98.9 °C under a pressure of 740 mm of Hg. The distillate contains 78 g quinoline and 100 g water. The vapour pressure of quinoline at 98.9 °C is 8 mm of Hg. So what will be the molar mass of quinoline?

   a) 130.5 g
   b) 125.5 g
   c) 128.5 g
   d) 135.5 g

[2]

40. The excess pressure inside a soap bubble (γ = 0.03 N/m) of radius 2 mm is

   a) 40 N/m^2
   b) 50 N/m
   c) 60 N/m^2
   d) 20 N/m

[2]

41. The viscosity of a fluid in motion is 1 Poise. What will be it's viscosity (in Poise) when the fluid is at rest?

   a) 0
   b) 0.5
   c) 1
   d) 2

[2]

42. For an ideal solution the thermodynamic requirement is

   a) $\Delta H_{mix} = 0$, $\Delta S_{mix} = 0$.
   b) $\Delta G_{mix} = 0$, $\Delta S_{mix} = 0$.
   c) $\Delta G_{mix} = 0$, $\Delta V_{mix} = 0$.
   d) $\Delta H_{mix} = 0$, $\Delta V_{mix} = 0$.

[1]

43. What is the significance of the triple point in a phase diagram?

    a) It represents the highest temperature in the system.
    b) It is the point where all phases coexist in equilibrium.
    c) It marks the lowest pressure at which a gas phase can exist.
    d) It is unrelated to the equilibrium conditions.

    [1]

44. How many degrees of freedom are there at the triple point in a one-component system?
    a) 3
    b) 2
    c) 0
    d) 1

    [1]

45. For a face centered cubic lattice, the miller indices for the first Bragg's (smallest Bragg angle):
    a) 002
    b) 111
    c) 001
    d) 110

    [1]