30 MCQs – Organic Heterocyclic Synthesis

Q1. Which of the following reactants are used in the Paal–Knorr synthesis of pyrroles?

A. 1,4-dicarbonyl compound + primary amine or ammonia

B. 1,2-dicarbonyl compound + secondary amine

C. Aldehyde + alcohol

D. Ketone + Grignard reagent

Q2. Which product is formed when hydrogen sulfide replaces ammonia in the Paal–Knorr reaction?

A. Pyrrole

B. Furan

C. Thiophene

D. Pyridine

Q3. Which condition is required to form furan from a 1,4-dicarbonyl compound?

A. Strong base

B. Dilute aqueous acid

C. UV light

D. High pressure

Q4. The Paal–Knorr synthesis mainly produces which type of rings?

A. 3-membered rings

B. 4-membered rings

C. 5-membered heterocycles

D. 7-membered rings

Q5. Which reactants are used in the synthesis of pyrazines?

A. 1,2-diamine +α-dicarbonyl compound

B. 1,4-diamine + aldehyde

C. Ketone + alcohol

D. Ester + amine

Q6. What is the intermediate product before oxidation in pyrazine synthesis?

A. Pyridine

B. Dihydropyrazine

C. Imidazole

D. Quinoline

Q7. What is the role of mild oxidation in pyrazine synthesis?

A. Forms alcohol

B. Produces aromatic pyrazine

C. Reduces carbonyl group

D. Breaks the ring

Q8. Which reactants are used to form pyrimidines from β-dicarbonyl compounds?

A. β-dicarbonyl + 1,1-diamino compound

B. Aldehyde + alcohol

C. Ketone + ether

D. Ester + alkene

Q9. Which compound is commonly used as a diamino reagent in pyrimidine synthesis?

A. Urea

B. Benzene

C. Methane

D. Ethanol

Q10. Which reaction synthesizes imidazole from 1,2-diaminobenzene?

A. Wittig reaction

B. Phillips synthesis

C. Knorr synthesis

D. Heck reaction

Q11. Which reactant is required in the Phillips synthesis?

A. Carboxylic acid

B. Alkene

C. Alcohol

D. Halide

Q12. The Traube purine synthesis involves which reactants?

A. Diaminopyrimidine + carboxylic acid

B. Ketone + amine

C. Ester + alcohol

D. Alkene + halide

Q13. What type of reaction is involved in aldol condensation?

A. Nucleophilic substitution

B. Electrophilic addition

C. Carbonyl–carbonyl condensation

D. Radical reaction

Q14. What is the product of aldol condensation before dehydration?

A. Alkene

B. Beta-hydroxy aldehyde or ketone

C. Alcohol

D. Ester

Q15. What is formed after dehydration of aldol product?

A. Saturated alcohol

B. α,β-unsaturated carbonyl compound
C. Amide
D. Ether

Q16. Which reactants are used in Knorr pyrrole synthesis?

A. α-amino ketone + β-ketoester
B. Ketone + alcohol
C. Alkene + amine
D. Ester + acid

Q17. What type of reaction is involved in Knorr synthesis?

A. Aldol-type condensation
B. Radical substitution
C. Oxidation
D. Reduction

Q18. What is the final product of Knorr pyrrole synthesis?

A. Pyridine
B. Pyrrole
C. Furan
D. Imidazole

Q19. Which reactants are used in Feist–Benary synthesis?

A. α-haloketone + ketoester
B. Ketone + amine
C. Ester + alcohol
D. Aldehyde + halide

Q20. What type of reaction occurs in Feist–Benary synthesis?

A. Radical substitution
B. Aldol-type condensation + halogen displacement
C. Oxidation
D. Hydrolysis

Q21. Which reactants are used in pyridine synthesis shown in the file?

A. 1,3-diketone + malonic acid derivative
B. Ketone + alcohol
C. Aldehyde + amine
D. Ester + alkene

Q22. What drives the formation of pyridine in this synthesis?

A. Reduction
B. Dehydration (loss of water)
C. Hydrogenation

D. Polymerization

Q23. Which reaction forms quinoline using acid catalysis?

A. Combes synthesis

B. Wittig reaction

C. Heck reaction

D. Knorr synthesis

Q24. What is required for Combes synthesis?

A. Basic medium

B. Acid catalysis

C. UV radiation

D. Metal catalyst

Q25. Which reaction synthesizes isoquinoline?

A. Wittig reaction

B. Bischler–Napieralski reaction

C. Aldol condensation

D. Heck reaction

Q26. Which reagents are used in Bischler–Napieralski reaction?

A. Lewis acids (POC■, P■O■)

B. NaOH

C. H■ gas

D. KMnO■

Q27. What is the intermediate in Bischler–Napieralski reaction?

A. Alcohol

B. Hydroxy intermediate

C. Ether

D. Ester

Q28. Which reactants are used in Wittig reaction?

A. Aldehyde or ketone + phosphonium ylide

B. Alkene + acid

C. Alcohol + amine

D. Ester + halide

Q29. What is the product of Wittig reaction?

A. Alcohol

B. Alkene

C. Amine

D. Ester

Q30. What is the driving force in alkene metathesis?

A. Formation of alcohol
B. Formation and removal of small alkene (e.g., ethylene)
C. Reduction
D. Oxidation

Model Answers

1. A
2. C
3. B
4. C
5. A
6. B
7. B
8. A
9. A
10. B
11. A
12. A
13. C
14. B
15. B
16. A
17. A
18. B
19. A
20. B
21. A
22. B
23. A
24. B
25. B
26. A
27. B
28. A
29. B
30. B