1. Which of the following alkyl halides will undergo SN1 reaction most readily?

A. CH3Cl
B. (CH3)3CCl
C. CH3CH2Cl
D. CH3CHClCH3

Answer: B. (CH3)3CCl
Explanation: Tertiary alkyl halides form stable carbocations → SN1 occurs easily.

2. Which of the following is the best leaving group?

A. F^-
B. Cl^-
C. Br^-
D. I^-

Answer: D. I^-
Explanation: I^- is the most stable anion → best leaving group.

3. The major product of the reaction between C2H5Br and alcoholic KOH is:

A. C2H6
B. C2H5OH
C. C2H4
D. CH3CHO

Answer: C. C2H4
Explanation: Alcoholic KOH causes elimination (dehydrohalogenation) → alkene forms.

4. Which compound reacts fastest with AgNO3 in ethanol?

A. CH3Cl
B. CH3CH2Cl
C. (CH3)3CCl
D. C6H5CH2Cl

Answer: C. (CH3)3CCl

Explanation: Tertiary carbocation forms fastest → SN1 mechanism → faster reaction with AgNO3.

5. Which is most reactive in nucleophilic substitution?

A. CH3Cl
B. CH3CH2Cl
C. CH2=CHCl
D. C6H5Cl

Answer: B. CH3CH2Cl
Explanation: C6H5Cl and CH2=CHCl are resonance-stabilized → less reactive; CH3CH2Cl is primary alkyl halide → SN2.

6. Which of the following is an aryl halide?

A. C2H5Cl
B. CH3CH2Br
C. C6H5Cl
D. CH3Cl

Answer: C. C6H5Cl
Explanation: Aryl halides have halogen directly bonded to aromatic ring.

7. Which of the following statements is true regarding aryl halides?

A. They easily undergo nucleophilic substitution
B. They form carbocation easily
C. They are less reactive due to resonance
D. They are unstable

Answer: C. They are less reactive due to resonance
Explanation: Resonance between ring and halogen lone pairs → C–X bond gets partial double bond character → less reactive.

8. Which of the following does not give white precipitate with AgNO3?

A. CH3CH2Br

B. CH3CH2Cl
C. CH3CH2I
D. C6H5Cl

Answer: D. C6H5Cl
Explanation: Aryl halides do not easily ionize → no reaction with AgNO3.

9. Which product is formed when chlorobenzene reacts with NaOH at high temperature and pressure?

A. Phenol
B. Benzene
C. Aniline
D. Benzaldehyde

Answer: A. Phenol
Explanation: Nucleophilic substitution at high temperature → –OH replaces –Cl.

10. Which reagent can be used to convert an alcohol to an alkyl halide?

A. NaOH
B. KMnO4
C. SOCl2
D. H2O2

Answer: C. SOCl2
Explanation: SOCl2 is used for halogenation of alcohols → R–OH → R–Cl.

11. Which compound undergoes SN2 substitution reaction most rapidly?

A. CH3CH2Cl
B. CH3CHClCH3
C. (CH3)3CCl
D. C6H5CH2Cl

Answer: A. CH3CH2Cl
Explanation: Primary alkyl halide → less steric hindrance → SN2 favored.

12. Which of the following does not undergo SN1 reaction?

A. (CH3)3CBr
B. C6H5CH2Br
C. CH3CH2Br
D. (CH3)2CHBr

Answer: C. CH3CH2Br
Explanation: Primary halides do not form stable carbocation → do not undergo SN1.

13. On heating with Na in dry ether, alkyl halides give:

A. Alcohol
B. Alkyne
C. Alkane
D. Alkene

Answer: C. Alkane
Explanation: Wurtz reaction → coupling of alkyl halides → alkane.

14. Which compound shows optical activity?

A. CH3CHBrCH3
B. CH3CH2CH2Br
C. CH3CHBrCH2CH3
D. CH3CH(Br)CH3

Answer: C. CH3CHBrCH2CH3
Explanation: Contains a chiral center → optical activity.

15. Which of the following is most reactive towards SN2 reaction?

A. CH3CH2Cl
B. (CH3)2CHCl
C. (CH3)3CCl
D. C6H5CH2Cl

Answer: A. CH3CH2Cl

Explanation: SN2 reaction favored by less hindered primary halides.

16. Which of the following halides can form two types of products in an SN1 reaction due to rearrangement?

A. CH3CH2Br
B. (CH3)3CBr
C. CH3CH(Br)CH2CH3
D. CH3CH2CH2Br

Answer: C. CH3CH(Br)CH2CH3
Explanation: Secondary carbocation undergoes hydride shift → gives rearranged product.

17. Which is the correct increasing order of reactivity in SN2 reaction?

A. CH3Cl < CH3CH2Cl < (CH3)3CCl
B. (CH3)3CCl < CH3CH2Cl < CH3Cl
C. (CH3)3CCl < CH3Cl < CH3CH2Cl
D. CH3CH2Cl < CH3Cl < (CH3)3CCl

Answer: C. (CH3)3CCl < CH3Cl < CH3CH2Cl
Explanation: SN2 is faster for less hindered → tertiary < methyl < primary.

18. Which is not a correct method to prepare alkyl halides?

A. Alcohol + SOCl2
B. Alkene + HX
C. Alkane + HCl (in presence of sunlight)
D. Alcohol + HNO3

Answer: D. Alcohol + HNO3
Explanation: HNO3 does not convert alcohol to alkyl halide.

19. Which of the following is an example of electrophilic substitution reaction?

A. C2H5Br + NaOH → C2H5OH
B. C6H5Cl + Cl2/AlCl3 → C6H4Cl2
C. CH3CH2Cl + KOH → CH2=CH2

D. $C_6H_5Br + Mg \rightarrow C_6H_5MgBr$

Answer: B. $C_6H_5Cl + Cl_2/AlCl_3 \rightarrow C_6H_4Cl_2$
Explanation: Aromatic halogenation → electrophilic substitution.

20. When 2-bromobutane is treated with alcoholic KOH, the major product is:

A. Butanol
B. Butene (Z)
C. Butene (E)
D. 2-butene (E and Z mixture)

Answer: D. 2-butene (E and Z mixture)
Explanation: Elimination (E2) gives mixture of stereoisomers.

21. Which of the following shows both +I and –I effect?

A. $–CH_3$
B. –Cl
C. $–NO_2$
D. –OH

Answer: B. –Cl
Explanation: –Cl shows –I due to electronegativity, +M due to lone pair → dual character.

22. Which one is incorrect about SN1 reaction?

A. Follows first-order kinetics
B. Rate depends only on substrate
C. Carbocation intermediate forms
D. Inversion of configuration always occurs

Answer: D. Inversion of configuration always occurs
Explanation: SN1 gives racemization, not complete inversion.

23. In the Wurtz reaction, coupling of CH_3Br and C_2H_5Br gives:

A. CH3CH3 and C2H5C2H5
B. CH3CH2CH3
C. CH3CH2CH2CH3
D. Mixture of CH3CH3, C2H5C2H5, and CH3C2H5

Answer: D. Mixture of CH3CH3, C2H5C2H5, and CH3C2H5
Explanation: Cross Wurtz reaction gives all possible combinations.

24. Chlorobenzene is less reactive than alkyl halides due to:

A. Inductive effect
B. Resonance stabilization
C. Electronegativity
D. Steric hindrance

Answer: B. Resonance stabilization
Explanation: Lone pair on Cl delocalized → less reactive C–Cl bond.

25. Which of the following gives white ppt with AgNO3 solution instantly?

A. CH3CH2Br
B. CH3CH2Cl
C. C6H5Cl
D. CH3CH2I

Answer: D. CH3CH2I
Explanation: I^- is best leaving group → reacts instantly.

26. In aryl halides, nucleophilic substitution is difficult due to:

A. Low electron density on ring
B. Resonance giving partial double bond character
C. High bond dissociation energy
D. All of the above

Answer: D. All of the above
Explanation: All factors contribute to resistance to nucleophilic substitution.

27. Which reaction is used for the synthesis of alkyl fluorides?

A. Finkelstein reaction
B. Sandmeyer reaction
C. Swarts reaction
D. Reimer–Tiemann reaction

Answer: C. Swarts reaction
Explanation: Swarts reaction replaces halogen with fluorine using SbF3.

28. C2H5Br + Mg/ether → ?

A. C2H6
B. C2H5MgBr
C. C2H5OH
D. CH3CH=CH2

Answer: B. C2H5MgBr
Explanation: Grignard reagent forms.

29. Which of the following is not formed in the reaction of CH3CH2Cl with aq. KOH?

A. CH3CH2OH
B. CH2=CH2
C. C2H6
D. None of these

Answer: C. C2H6
Explanation: Alkane is not formed with aqueous KOH.

30. Which of the following compounds will undergo nucleophilic substitution most easily?

A. C6H5Cl
B. C6H5CH2Cl
C. CH3Cl
D. CH3CH2Cl

Answer: B. C6H5CH2Cl
Explanation: Benzylic carbocation is resonance stabilized → reacts easily.

31. The IUPAC name of the compound CH3–CH(Cl)–CH2–CH3 is:

A. 1-chlorobutane
B. 2-chlorobutane
C. 3-chlorobutane
D. sec-butyl chloride

Answer: B. 2-chlorobutane
Explanation: Chlorine is on the second carbon → 2-chlorobutane.

32. Which of the following will show fastest SN1 reaction?

A. CH3CH2Br
B. CH3CH(Br)CH3
C. (CH3)3CBr
D. C6H5CH2Br

Answer: C. (CH3)3CBr
Explanation: Tertiary carbocation is most stable → fastest SN1.

33. When chloroform is exposed to air and sunlight, it forms:

A. Phosgene
B. Chlorine
C. Hydrogen chloride
D. Dichloromethane

Answer: A. Phosgene
Explanation: CHCl3 oxidizes to COCl2 (phosgene), which is toxic.

34. C–X bond strength decreases in the order:

A. C–F > C–Cl > C–Br > C–I
B. C–I > C–Br > C–Cl > C–F

C. C–Cl > C–F > C–I > C–Br
D. C–Br > C–Cl > C–F > C–I

Answer: A. C–F > C–Cl > C–Br > C–I
Explanation: Bond strength decreases with increasing atomic size.

35. Which halide does not give white ppt with $AgNO_3$ in ethanol at room temperature?

A. CH3CH2I
B. CH3CH2Br
C. CH3CH2Cl
D. CH3CH2F

Answer: D. CH3CH2F
Explanation: Fluoride ion is not easily precipitated.

36. Which reagent is used in Finkelstein reaction?

A. NaBr in acetone
B. NaI in acetone
C. AgNO3
D. SOCl2

Answer: B. NaI in acetone
Explanation: Finkelstein reaction is halogen exchange via SN2.

37. The hybridisation of carbon in C–Cl bond of CH3Cl is:

A. sp
B. sp^2
C. sp^3
D. sp^3d

Answer: C. sp^3
Explanation: CH3Cl → tetrahedral → sp^3.

38. Which compound reacts fastest with alcoholic KOH?

A. CH3CH2Cl
B. CH3CH2CH2Cl
C. (CH3)3CCl
D. CH3CHClCH3

Answer: C. (CH3)3CCl
Explanation: E2 reaction → tertiary halide gives fastest elimination.

39. Which product is obtained from chlorobenzene by reaction with NaOH at high temperature and pressure?

A. Benzene
B. Phenol
C. Aniline
D. Toluene

Answer: B. Phenol
Explanation: Nucleophilic substitution → Cl replaced by OH.

40. Which of the following is most reactive in SN2 reaction?

A. CH3Cl
B. C2H5Cl
C. (CH3)2CHCl
D. (CH3)3CCl

Answer: A. CH3Cl
Explanation: Methyl halide has least steric hindrance → fastest SN2.

41. A compound C2H5Cl is treated with alcoholic KOH. The expected major product is:

A. C2H6
B. C2H4
C. CH3CH2OH
D. CH3CHO

Answer: B. C2H4
Explanation: Elimination (E2) → forms ethene.

42. In the nitration of chlorobenzene, the major product is:

A. m-chloronitrobenzene
B. o-chloronitrobenzene
C. p-chloronitrobenzene
D. Equal mixture of ortho and para

Answer: D. Equal mixture of ortho and para
Explanation: Cl is ortho-para directing → both products form.

43. Which halide cannot be prepared using Lucas reagent (ZnCl2 + HCl)?

A. 3° alcohol
B. 2° alcohol
C. 1° alcohol
D. Allyl alcohol

Answer: C. 1° alcohol
Explanation: Lucas test is slow for 1° alcohol due to unstable carbocation.

44. What is the product when C6H5Br is treated with Mg in dry ether?

A. C6H5MgBr
B. C6H5OH
C. C6H6
D. C6H5Cl

Answer: A. C6H5MgBr
Explanation: Grignard reagent formation.

45. The compound CH3–CH(OH)–CH2–Cl on reaction with NaOH (aq) gives:

A. CH3–CHOH–CH2OH
B. CH3–CH=CH2
C. CH3–COOH
D. CH3–CH2–CH2OH

Answer: A. CH3–CHOH–CH2OH
Explanation: Nucleophilic substitution → Cl replaced by OH.