DPP - Daily Practice Problems

Name : Date :

Start Time : End Time :

CHEMISTRY 24

SYLLABUS : General Organic Chemistry IV: Bond fission, Reaction intermediates, Reagents, Reaction mechanism.

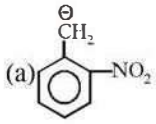
Max. Marks : 120 **Time : 60 min.**

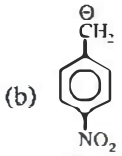
GENERAL INSTRUCTIONS

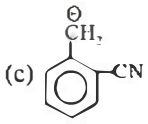
- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

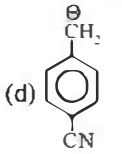
DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.

Q.1 Which one of the carbanions is most stable?

(a) 

(b) 

(c) 

(d) 

Q.2 The number of electrons present in the valency shell of carbon of $CH_3\overset{+}{C}H_2$ ion bearing +ve charge is

(a) 8 (b) 7

(c) 6 (d) 4

Q.3 Which one is the characteristic feature of a free radical?

(a) Presence of negative or positive charge

(b) Presence of unpaired electron

(c) Presence of even number of electrons

(d) Associated with high stability

Q.4 Most stable carbonium ion is :

(a) $CH_3—\overset{+}{C}H_2$ (b) $\overset{+}{C}H_2CHCl_2$

(c) $\overset{+}{C}H_2CH_2Cl$ (d) $\overset{+}{C}H_2—CH_2NO_2$

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ

Space for Rough Work

Q.5 Which of the following statements does not apply to free radical chain reaction?
(a) It may be initiated by ultraviolet rays
(b) One mole of product is obtained for each mole of free radical produced in the initiation step
(c) It is not affected by changes in polarity of solvent
(d) It is inhibited by the presence of certain reagents

Q.6 Which of the following statement is correct?
(a) Allyl carbonium ion ($CH_2=CH-\overset{+}{C}H_2$) is more stable than propyl carbonium ion
(b) Propyl carbonium ion is more stable than allyl carbonium ion
(c) Both are equally stable
(d) None of these

Q.7 Which of the following is the correct order of stability of carbocations ?
(a) benzyl > allyl > 3° > 2° (b) allyl > benzyl > 3° > 2°
(c) allyl > 3° > 2° > benzyl (d) benzyl > 3° > 2° > allyl

Q.8 Which one of the following is sec-allylic carbocation?
(a) $\overset{\oplus}{C}H_2-CH=CH_2$ (b) $CH_3-CH=CH-\overset{\oplus}{C}H_2$
(c) $C_6H_5-CH=\overset{\oplus}{C}H$ (d) $CH_3-\overset{\oplus}{C}H-CH=CH_2$

Q.9 Which among the following species is an ambident nucleophile?
(a) Ethene (b) Benzene
(c) Cyanide ion (d) Acetone

Q.10 A nucleophile is:
(a) electron-rich species
(b) electron-deficient species
(c) a Lewis acid
(d) Positively charged species

Q.11 Which is not a nucleophile ?
(a) NH_3 (b) R–O–R (c) BF_3 (d) HOH

Q.12 Most powerful leaving group in following–
(a) NH_2^- (b) OH^- (c) CH_3^- (d) F^-

Q.13 Arrange in increasing basic strength
(A) $Cl-CH_2-COOH$
(B) $Cl-CH_2-CH_2-CH_2-COOH$
(C) $Cl-CH_2CH_2COOH$
Correct answer is-
(a) (A) < (C) < (B) (b) (B) < (A) < (C)
(c) (C) < (B) < (A) (d) (A) < (B) < (C)

Q.14 Which of the following ions is most stable?
(a) $CH_3CH_2\overset{+}{C}H_2$ (b) $CH_3\overset{+}{C}HCH_2CH_3$
(c) $(CH_3)_3\overset{+}{C}$ (d) $(CH_3)_3C.\overset{+}{C}H_2$

Q.15 The most stable carbanion is-
(a) methyl carbanion (b) primarycarbanion
(c) seccondary carbanion (d) tertiarycarbanion

Q.16 Which of the following statements is wrong ?
(a) A tertiary free radical is more stable than a secondary free radical
(b) A secondary free radical is more stable than a primary free radical
(c) A tertiary carbonium ion is more stable than a secondary carbonium ion
(d) A primary carbonium ion is more stable than a secondary carbonium ion

Q.17 The species $CH_3\overset{+}{C}HCH_3$ is less stable than-
(a) $(CH_3)_3C^+$ (b) $CH_3CH_2\overset{+}{C}H_2$
(c) $CH_3\overset{+}{C}H_2$ (d) CH_3^+

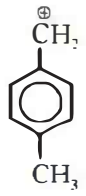
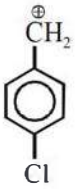
Q.18 Consider the following carbocations-
(A) $CH_3-\overset{\oplus}{C}H_2$ (B) $CH_2=\overset{\oplus}{C}H$
(C) $CH_2=CH-\overset{\oplus}{C}H_2$ (D) $C_6H_5-\overset{\oplus}{C}H_2$
Stability of these carbocations in decreasing order is -
(a) D > C > A > B (b) D > C > B > A
(c) C > D > B > A (d) C > D > A > B

Q.19 Which free radical is the most stable?
(a) $C_6H_5-\dot{C}H_2$ (b) $CH_2=CH-\dot{C}H_2$
(c) $CH_3-\dot{C}H-CH_3$ (d) $CH_3-\underset{CH_3}{\overset{\dot{}}{C}}-CH_3$

RESPONSE GRID					
5. ⓐⓑⓒⓓ	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ
10. ⓐⓑⓒⓓ	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ
15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ

Space for Rough Work

Q.20 Which carbocation is the most stable?

(a)  (b)  (c)  (d) 

Q.21 Which of the following is most stable carbocation?

(a) $CH_3-{}^{+}CH_2$

(b) $CH_3-{}^{+}CH-CH_3$

(c) $CH_3-\overset{+}{\underset{CH_3}{\overset{|}{C}}}-CH_3$

(d) $(CH_3-CH_2)_3\overset{+}{C}$

DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :

(a) 1, 2 and 3 are correct **(b)** 1 and 2 are correct

(c) 2 and 4 are correct **(d)** 1 and 3 are correct

Q.22 Which of the following compounds are arranged in order of decreasing reactivity towards electrophilic substitution ?

(1) Fluorobenzene > chlorobenzene > bromobenzene

(2) Phenol > *n*-propylbenzene > benzoic acid

(3) Chlorotoluene > para-nitrotoluene > 2-chloro-4-nitrotoluene

(4) Benzoic acid > phenol > *n*-propylbenzene

Q.23 Which of the following statements is characteristic of free radical chain reaction ?

(1) It gives major product derived from most stable free radical

(2) It proceeds in three main steps like initiation, propagation and termination

(3) It may be initiated by U.V. light

(4) It is usually sensitive to change in solvent polarity

Q.24 Which of the following statements pertaining of an S_N2 reaction are true ?

(1) The rate of reaction is independent of the concentration of the nucleophile

(2) The nucleophile attacks the C–atom on the side of the molecule opposite to the group being displaced

(3) Favoured by mild and low concentration of nucleophiles

(4) The reaction proceeds with simultaneous bond formation and bond rupture/cleavage

DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :

In the S_N1 reaction of (S)-2-bromobutane with water, two substitution products are formed, one has the same relative configuration as the reactant and the other has the inverted configuration. This is because in such reactions, the leaving group departs before the nucleophile attacks.

In most of S_N1 reactions, the racemic product is non-50 : 50 mixture, i.e. partial racemization takes place, the inverted product is more than 50%. The formation of different composition of the product is due to following steps involved in S_N1 reactions.

$$\underset{\substack{\text{Undissociated}\\\text{molecule}\\\text{I}}}{R-X} \longrightarrow \underset{\substack{\text{Intimate}\\\text{ion pair}\\\text{II}}}{R^+X^-} \longrightarrow \underset{\substack{\text{Solvent–separated}\\\text{ion pair}\\\text{III}}}{R^+\text{solvent } X^-} \longrightarrow \underset{\substack{\text{Dissociated}\\\text{ions}\\\text{IV}}}{R^+ \quad X^-}$$

Q.25 Which type of intermediate is formed in the reaction of (S)-2-bromobutane with water?

(a) sp^3 hybridised (b) sp^2 hybridised

(c) sp hybridised (d) a transition state

Q.26 50 : 50 racemic mixture is due to attack of the nucleophile on which intermediate species of the reaction?

(a) I (b) II

(c) III (d) IV

Q.27 The non-50 : 50 racemic mixture during S_N reaction of an alkyl halide is due to attack of the nucleophile on species

(a) I (b) II

(c) III (d) Both II or III

RESPONSE GRID					
	20. ⓐⓑⓒⓓ	**21.** ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ	**23.** ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ
	25. ⓐⓑⓒⓓ	**26.** ⓐⓑⓒⓓ	**27.** ⓐⓑⓒⓓ		

Space for Rough Work

DIRECTIONS (Q. 28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement - 1 is False, Statement-2 is True.

(d) Statement -1 is True, Statement-2 is False.

Q.28 Statement -1: Aryl halides undergo nucleophilic substitution with ease.
Statement -2: The carbon-halogen bond in aryl halides has partial double bond character.

Q.29 Statement -1: Phenol is more reactive than benzene towards electrophilic substitution reactions.
Statement-2: In the case of phenol, the intermediate carbocation is more resonance stabilized.

Q.30 Statement -1: Heterolytic fission involves the breaking of a covalent bond in such a way that the two electrons of the shared pair are carried away by one of the atoms.
Statement -2: Heterolytic fission occurs readily in polar covalent bonds.

RESPONSE GRID	28. ⓐ ⓑ ⓒ ⓓ	29. ⓐ ⓑ ⓒ ⓓ	30. ⓐ ⓑ ⓒ ⓓ

DAILY PRACTICE PROBLEM SHEET 24 - CHEMISTRY			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	40	Qualifying Score	64
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

24

(1) **(a)** Strongly electron-attracting group ($-NO_2$) present in *o*-position disperses negative charge of carbanion most effectively, thus, it increases stability.

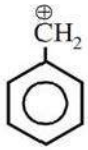
(2) **(c)** Carbocations consist of 3 bond pairs in outermost orbit.

(3) **(b)** Presence of odd electrons.

(4) **(a)** + I group stabilises carbocation.

(5) **(c)** It is not affected by changes in polarity of solvent.

(6) **(a)** Allyl carbocation is resonance stabilised.

(7) **(a)** 

$CH_2 = CH - \overset{+}{C}H_2$

4-R.S 2-R.S

3° is more stable than 2°

(8) **(d)** +ve charge containing carbon joined with two other carbons.

(9) **(c)** Cyanide ion is an ambident nucleophile.

(10) **(a)** A nucleophile is electron-rich species.

(11) **(c)** BF_3 is electron deficient.

(12) **(d)** Weak bases are always better leaving groups.

(13) **(a)** $Cl-CH_2-COOH < Cl-CH_2CH_2COOH < Cl-CH_2-CH_2-CH_2-COOH$

(14) **(c)** Ter. carbocation is most stable.

(15) **(a)** + I group decreases the stability of carbanion.

(16) **(d)** Order of stability of carbonium ions and free radicals is 3°>2°>1°

(17) **(a)** Order of stability of carbonium ions and free radicals is 3°>2°>1°

(18) **(a)**

(19) **(a)** More resonance in (a).

(20) **(b)** + M effect of OH is highest, which decreases magnitude of charge, thus stability increases.

(21) **(c)** Because $CH_3-\overset{+}{\underset{\displaystyle CH_3}{\underset{|}{C}}}-CH_3$ has '9' α– Hatoms which is maximum in all four examples.

(22) **(a)** **(23)** **(a)** **(24)** **(c)**

(25) **(b)** Since the leaving group (Br) is departing before the attack of the nucleophile, the intermediate formed must be carbocation which is sp^2 hybridised.

(26) **(d)** When the nucleophile attacks the completely dissociated carbocation (IV), there is no steric hindrance on either side of the carbocation with the result a 50 : 50 racemic mixture is obtained.

(27) **(d)** When the nucleophile attacks the carbocation of either the intimate ion pair (II) or the solvent-separated ion pair (III), the leaving group will partially block the approach of the nucleophile to that side of the carbocation; with the result a non-50: 50 racemic mixture is obtained in which inverted configuration is in greater amount.

(28) **(c)** Statement -1 is false because aryl halides do not undergo nucleophilic substitution under ordinary conditions. This is due to resonance, because of which the carbon–chlorine bond acquires partial double bond character, hence it becomes shorter and stronger and thus cannot be replaced by nucleophiles.

(29) **(a)** Due to +M effect of $-\ddot{O}H$, its intermediate carbocation is more stable than the one in benzene.

(30) **(b)** Heterolytic fission occurs when the two atoms differ considerably in their electronegativities and shared pair of electrons is carried by more electronegative atom.