



Organic Chemistry — JEE (Advanced) Pattern Sample Test

FREE SAMPLE TEST · CHEMISTRY · PATTERN OF JEE (ADVANCED) PAPER 1

DURATION	MAXIMUM MARKS	QUESTIONS	NAME / ROLL NO.
60 minutes	60	17 (4 + 3 + 6 + 4)	

GENERAL INSTRUCTIONS

1. This question paper has FOUR sections. All questions are compulsory.
2. Read the marking scheme of each section carefully: wrong answers in Sections 1, 2 and 4 carry negative marks.
3. Use of a calculator, log tables or any other aid is not allowed.
4. The answer key and worked solutions are at the end of this booklet. Attempt the paper in 60 minutes before you look at them.

SECTION 1 (Q1–4) — +3 / 0 / –1

1. This section contains FOUR (04) questions.
2. Each question has FOUR options. ONLY ONE of these four options is the correct answer.
3. Full Marks: +3 if ONLY the correct option is chosen; Zero Marks: 0 if none of the options is chosen; Negative Marks: –1 in all other cases.

SECTION 2 (Q5–7) — +4 / partial / –2

1. This section contains THREE (03) questions.
2. Each question has FOUR options. ONE OR MORE THAN ONE of these four option(s) is(are) correct answer(s).
3. Full Marks: +4 ONLY if (all) the correct option(s) is(are) chosen; Partial Marks: +3 if all the four options are correct but ONLY three options are chosen; +2 if three or more options are correct but ONLY two options are chosen, both of which are correct; +1 if two or more options are correct but ONLY one option is chosen and it is a correct option; Zero Marks: 0 if unanswered; Negative Marks: –2 in all other cases.

SECTION 3 (Q8–13) — +4 / 0

1. This section contains SIX (06) questions.
2. The answer to each question is a NON-NEGATIVE INTEGER.
3. Full Marks: +4 ONLY if the correct integer is entered; Zero Marks: 0 in all other cases.

SECTION 4 (Q14–17) — +3 / 0 / –1

1. This section contains FOUR (04) Matching List Sets.
2. Each set has ONE Multiple Choice Question. Each set has TWO lists: List-I and List-II. List-I has Four entries (P), (Q), (R) and (S) and List-II has Five entries (1), (2), (3), (4) and (5).
3. FOUR options are given in each Multiple Choice Question based on List-I and List-II and ONLY ONE of these four options satisfies the condition asked in the Multiple Choice Question.
4. Full Marks: +3 ONLY if the option corresponding to the correct combination is chosen; Zero Marks: 0 if none of the options is chosen; Negative Marks: –1 in all other cases.

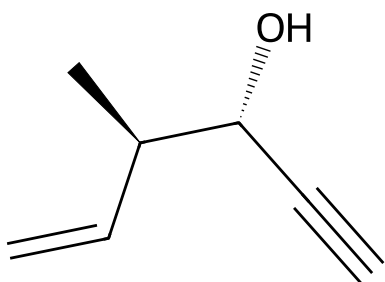
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Chapters covered: General Organic Chemistry · Isomerism · Hydrocarbons · Haloalkanes and Haloarenes · Alcohols, Phenols and Ethers · Aldehydes, Ketones and Carboxylic Acids · Aromatic Compounds and Named Reactions

SECTION 1 (Q1–4) · Single correct · +3 / 0 / -1

Each question has FOUR options. ONLY ONE of these four options is the correct answer.

1. The configurations at C-3 and C-4 of the compound shown, 4-methylhex-5-en-1-yn-3-ol ($\text{HC}\equiv\text{C}-\text{CH}(\text{OH})-\text{CH}(\text{CH}_3)-\text{CH}=\text{CH}_2$), are



- (A) 3R, 4R
 - (B) 3S, 4R
 - (C) 3R, 4S
 - (D) 3S, 4S
2. The correct order of acid strength is
- (A) $\text{HCOOH} > \text{ClCH}_2\text{COOH} > \text{C}_6\text{H}_5\text{COOH} > \text{CH}_3\text{COOH}$
 - (B) $\text{ClCH}_2\text{COOH} > \text{C}_6\text{H}_5\text{COOH} > \text{HCOOH} > \text{CH}_3\text{COOH}$
 - (C) $\text{ClCH}_2\text{COOH} > \text{HCOOH} > \text{CH}_3\text{COOH} > \text{C}_6\text{H}_5\text{COOH}$
 - (D) $\text{ClCH}_2\text{COOH} > \text{HCOOH} > \text{C}_6\text{H}_5\text{COOH} > \text{CH}_3\text{COOH}$
3. The major product of the reaction of 3,3-dimethylbutan-2-ol with concentrated HCl is
- (A) 2-chloro-2,3-dimethylbutane
 - (B) 2-chloro-3,3-dimethylbutane
 - (C) 1-chloro-2,3-dimethylbutane
 - (D) 2,3-dimethylbut-2-ene
4. 2-Bromo-2-methylbutane is heated with potassium tert-butoxide in tert-butanol. The major product is
- (A) 2-methylbut-2-ene
 - (B) 3-methylbut-1-ene
 - (C) 2-methylbut-1-ene
 - (D) 2-methylbutan-2-ol

SECTION 2 (Q5–7) · One or more correct · +4 / partial / -2

Each question has FOUR options. ONE OR MORE THAN ONE of these four option(s) is(are) correct answer(s).

5. Which of the following statements is/are correct?
- (A) 2,3-Dibromobutane has three stereoisomers.
 - (B) Pentane-2,3,4-triol has four stereoisomers, two of which are meso.
 - (C) 1,2-Dimethylcyclohexane has three stereoisomers.
 - (D) Hepta-2,4-diene has three geometrical isomers.

6. Which of the following statements is/are correct?

- (A) Hydroboration–oxidation of 1-methylcyclohexene gives trans-2-methylcyclohexan-1-ol (as a racemate).
- (B) Propene with HBr in the presence of a peroxide gives 1-bromopropane.
- (C) Ozonolysis of 2-methylbut-2-ene followed by $\text{Zn}/\text{H}_2\text{O}$ gives two molecules of acetone.
- (D) Bromine adds to cis-but-2-ene to give meso-2,3-dibromobutane.

7. Which of the following statements is/are correct?

- (A) Acetaldehyde undergoes the Cannizzaro reaction with concentrated NaOH.
- (B) Phenol with CHCl_3 and aqueous NaOH, followed by acidification, gives mainly salicylaldehyde.
- (C) Benzenediazonium chloride with CuCN gives benzonitrile.
- (D) Propan-2-ol, ethanol and acetophenone give a positive iodoform test, but propan-1-ol does not.

SECTION 3 (Q8–13) · Non-negative integer · +4 / 0

The answer to each question is a NON-NEGATIVE INTEGER.

8. Find the degree of unsaturation (double bond equivalent) of a compound with molecular formula $\text{C}_{12}\text{H}_{13}\text{NO}_2\text{Cl}_2$.

Answer: _____

9. Find the total number of monochlorination products, including stereoisomers, formed when methylcyclohexane reacts with Cl_2 in the presence of light.

Answer: _____

10. 3-Bromo-3-methylhexane undergoes dehydrobromination with alcoholic KOH. Considering every β -hydrogen and no rearrangement, find the total number of alkenes, including stereoisomers, that can be formed.

Answer: _____

11. Find the total number of stereoisomers of hepta-2,5-dien-4-ol, $\text{CH}_3\text{--CH=CH--CH(OH)--CH=CH--CH}_3$.

Answer: _____

12. Find the number of structurally isomeric esters (stereoisomers not counted separately) with the molecular formula $\text{C}_5\text{H}_{10}\text{O}_2$.

Answer: _____

13. How many of the following are aromatic? pyrrole; furan; pyridine; azulene; cyclopenta-1,3-diene; cyclopentadienyl anion; cyclopentadienyl cation; tropylium ion; cycloheptatriene; cyclopropenyl cation; cyclobutadiene; cyclooctatetraene

Answer: _____

SECTION 4 (Q14–17) · Matching lists · +3 / 0 / –1

Each set has ONE Multiple Choice Question. Each set has TWO lists: List-I and List-II. List-I has Four entries (P), (Q), (R) and (S) and List-II has Five entries (1), (2), (3), (4) and (5).

14. Match each reaction in List-I with its main organic product in List-II.

List-I	List-II
(P) Sodium phenoxide with CO_2 at 400 K and 4–7 atm, then H_3O^+ (Kolbe–Schmitt)	(1) Ethylbenzene
(Q) Toluene with CrO_2Cl_2 in CS_2 , then H_3O^+ (Étard)	(2) Salicylic acid
(R) Acetamide with Br_2 and aqueous NaOH (Hofmann bromamide)	(3) Benzaldehyde
(S) Acetophenone with Zn-Hg and conc. HCl (Clemmensen)	(4) Methylamine
	(5) Benzoic acid

- (A) $\text{P} \rightarrow 2, \text{Q} \rightarrow 5, \text{R} \rightarrow 4, \text{S} \rightarrow 1$
(B) $\text{P} \rightarrow 5, \text{Q} \rightarrow 3, \text{R} \rightarrow 4, \text{S} \rightarrow 1$
(C) $\text{P} \rightarrow 2, \text{Q} \rightarrow 3, \text{R} \rightarrow 4, \text{S} \rightarrow 1$
(D) $\text{P} \rightarrow 2, \text{Q} \rightarrow 3, \text{R} \rightarrow 1, \text{S} \rightarrow 4$

15. Match each compound in List-I with its total number of stereoisomers in List-II.

List-I	List-II
(P) 2-Bromo-3-chlorobutane	(1) 2
(Q) 1,3-Dimethylcyclobutane	(2) 16
(R) Hexa-2,4-diene	(3) 4
(S) 2,3,4,5,6-Pentahydroxyhexanal (open-chain aldohexose)	(4) 3
	(5) 8

- (A) $\text{P} \rightarrow 3, \text{Q} \rightarrow 1, \text{R} \rightarrow 4, \text{S} \rightarrow 2$
(B) $\text{P} \rightarrow 4, \text{Q} \rightarrow 1, \text{R} \rightarrow 3, \text{S} \rightarrow 2$
(C) $\text{P} \rightarrow 3, \text{Q} \rightarrow 3, \text{R} \rightarrow 4, \text{S} \rightarrow 2$
(D) $\text{P} \rightarrow 3, \text{Q} \rightarrow 1, \text{R} \rightarrow 4, \text{S} \rightarrow 5$

16. Match each conversion in List-I with the reagents in List-II that achieve it as the major outcome.

List-I	List-II
(P) Benzene $\rightarrow$ acetophenone	(1) H_2O , dil. H_2SO_4 , HgSO_4
(Q) Propene $\rightarrow$ propan-1-ol	(2) CH_3COCl , anhydrous AlCl_3
(R) 3,3-Dimethylbut-1-ene $\rightarrow$ 3,3-dimethylbutan-2-ol	(3) $\text{BH}_3 \cdot \text{THF}$; then H_2O_2 , NaOH
(S) But-1-yne $\rightarrow$ butan-2-one	(4) $\text{Hg}(\text{OAc})_2$, H_2O ; then NaBH_4
	(5) NBS , $h\nu$

- (A) $\text{P} \rightarrow 2, \text{Q} \rightarrow 4, \text{R} \rightarrow 3, \text{S} \rightarrow 1$
(B) $\text{P} \rightarrow 2, \text{Q} \rightarrow 3, \text{R} \rightarrow 1, \text{S} \rightarrow 4$
(C) $\text{P} \rightarrow 1, \text{Q} \rightarrow 3, \text{R} \rightarrow 4, \text{S} \rightarrow 2$
(D) $\text{P} \rightarrow 2, \text{Q} \rightarrow 3, \text{R} \rightarrow 4, \text{S} \rightarrow 1$

17. Match each alkane in List-I with the total number of monochlorination products, including stereoisomers, in List-II.

List-I	List-II
(P) 2-Methylbutane	(1) 8
(Q) 2,2-Dimethylbutane	(2) 4
(R) 3-Methylpentane	(3) 10
(S) Methylcyclopentane	(4) 6
	(5) 5

- (A) P $\rightarrow$ 4, Q $\rightarrow$ 5, R $\rightarrow$ 1, S $\rightarrow$ 3
(B) P $\rightarrow$ 4, Q $\rightarrow$ 2, R $\rightarrow$ 1, S $\rightarrow$ 3
(C) P $\rightarrow$ 2, Q $\rightarrow$ 4, R $\rightarrow$ 1, S $\rightarrow$ 3
(D) P $\rightarrow$ 4, Q $\rightarrow$ 2, R $\rightarrow$ 3, S $\rightarrow$ 1

END OF THE QUESTION PAPER

ANSWER KEY

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
B	D	A	C	A, B, C	A, B	B, C, D	6	12

Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17
5	4	9	7	C	A	D	B

WORKED SOLUTIONS

Q1. Answer B. C-3 carries OH, C≡CH, C-4 and H. OH is first. Between the ethynyl carbon and C-4: the triple bond is counted as (C, C, C) by duplicating atoms, while C-4 is (C, C, H), so C≡CH ranks second and C-4 third. C-4 carries C-3 (O, C, H), CH=CH₂ (C, C, H), CH₃ and H, in that order. With H pointing away from the viewer, 1 → 2 → 3 runs anticlockwise at C-3 (S) and clockwise at C-4 (R): 3S, 4R. Ranking vinyl above ethynyl (by counting hydrogens instead of duplicated atoms) reverses C-3.

Q2. Answer D. pK_a values: ClCH₂COOH 2.86 (−I effect of Cl), HCOOH 3.75 (no electron-donating alkyl group), C₆H₅COOH 4.20 (the sp² ring carbon is mildly electron-withdrawing), CH₃COOH 4.76 (+I effect of CH₃). Lower pK_a means stronger acid, so ClCH₂COOH > HCOOH > C₆H₅COOH > CH₃COOH. The usual slip is to put benzoic acid below acetic acid by treating the phenyl group as electron-releasing.

Q3. Answer A. SN1: protonation and loss of water give a secondary carbocation at C-2, next to a quaternary carbon. A 1,2-methyl shift from C-3 turns it into a tertiary carbocation (now at the carbon that carried the methyl groups), which Cl[−] captures: (CH₃)₂CCl-CH(CH₃)₂, 2-chloro-2,3-dimethylbutane. 2-Chloro-3,3-dimethylbutane would need the unrearranged cation; the alkene is an elimination product, minor with Cl[−] in conc. HCl.

Q4. Answer C. A bulky strong base gives E2 elimination and removes the most accessible β-hydrogen, from the CH₃ group rather than the CH₂: the less substituted (Hofmann) alkene, 2-methylbut-1-ene, is major. With a small base such as EtO[−] the more substituted (Saytzeff) 2-methylbut-2-ene would be major. 3-Methylbut-1-ene cannot form at all (its double bond is not next to C-2), and tert-butoxide is far too hindered to substitute at a tertiary carbon.

Q5. Answer A, B, C. (A) Two like stereocentres: (R,R) and (S,S) enantiomers plus one meso form — true. (B) C-2 and C-4 are stereocentres and C-3 is pseudo-asymmetric: (2R,4R) and (2S,4S) are enantiomers, while (2R,4S) gives two meso forms (3r and 3s) — four in all, two meso — true. (C) cis is meso, trans is a pair of enantiomers — true. (D) Both double bonds are stereogenic and the ends differ (CH₃ against C₂H₅), so EE, EZ, ZE and ZZ are all different: four geometrical isomers — false. (Three would be right for the symmetrical hexa-2,4-diene.)

Q6. Answer A, B. (A) BH₃ adds syn and anti-Markovnikov, and oxidation keeps the configuration: H and OH end up on the same face, so the CH₃ and OH are trans — true. (B) Anti-Markovnikov radical addition (peroxide effect) — true. (C) (CH₃)₂C=CH-CH₃ splits into acetone and acetaldehyde, not two acetones — false. (D) Br₂ adds anti; anti addition to the cis alkene gives the racemic (±)-2,3-dibromobutane. The meso form comes from trans-but-2-ene — false.

Q7. Answer B, C, D. (A) False: acetaldehyde has α-hydrogens and undergoes aldol condensation instead; Cannizzaro needs an aldehyde without α-H. (B) True: Reimer-Tiemann formylation, via dichlorocarbene, goes mainly ortho. (C) True: Sandmeyer reaction. (D) True: the test needs CH₃CO− or CH₃CH(OH)− (which I₂/NaOH oxidises to CH₃CO−). Ethanol is CH₃CH₂OH = CH₃CH(OH)−H, propan-2-ol is CH₃CH(OH)CH₃ and acetophenone is CH₃COC₆H₅; propan-1-ol has neither group.

Q8. Answer 6. DBE = C − (H + X)/2 + N/2 + 1, with oxygen ignored and halogens counted like H: 12 − (13 + 2)/2 + 1/2 + 1 = 12 − 7.5 + 0.5 + 1 = 6.

Q9. Answer 12. Five kinds of hydrogen. On C-1: 1-chloro-1-methylcyclohexane, achiral (1). On the CH₃: (chloromethyl)cyclohexane (1). On C-2: two stereocentres, cis and trans, each chiral: 4. On C-3: likewise 4. On C-4: cis and

trans, but a mirror plane runs through C-1 and C-4, so both are achiral: 2. Total $1 + 1 + 4 + 4 + 2 = 12$.

Q10. Answer 5. C-3 carries CH_3 , C_2H_5 (C-2 side) and C_3H_7 (C-4 side), so there are three kinds of β -hydrogen. Toward C-2: 3-methylhex-2-ene, E and Z (2). Toward C-4: 3-methylhex-3-ene, E and Z (2). From the CH_3 : 2-ethylpent-1-ene (1). Total 5.

Q11. Answer 4. Each double bond is E or Z. (E,E) and (Z,Z): C-4 carries two identical propenyl groups, so it is not a stereocentre — one isomer each. (E,Z): C-4 now carries an E-propenyl and a Z-propenyl group, which are different, so C-4 is a stereocentre and there are two enantiomers. Total $1 + 1 + 2 = 4$. Multiplying $2 \times 2 \times 2 = 8$ is the trap.

Q12. Answer 9. $\text{R}-\text{COO}-\text{R}'$ with four carbons shared between R and R'. $\text{HCOO}-$ with a butyl group (n-, iso-, sec-, tert-): 4. $\text{CH}_3\text{COO}-$ with propyl or isopropyl: 2. $\text{C}_2\text{H}_5\text{COO}-\text{C}_2\text{H}_5$: 1. $\text{C}_3\text{H}_7\text{COO}-\text{CH}_3$ with n- or iso-propyl: 2. Total 9.

Q13. Answer 7. Aromatic (cyclic, planar, fully conjugated, $4n + 2 \pi$ electrons): pyrrole (6), furan (6), pyridine (6), azulene (10), cyclopentadienyl anion (6), tropylium ion (6), cyclopropenyl cation (2): 7. Not aromatic: cyclopenta-1,3-diene and cycloheptatriene (an $\text{sp}^3 \text{CH}_2$ breaks the conjugation), cyclooctatetraene (non-planar tub), cyclobutadiene and the cyclopentadienyl cation ($4n \pi$ electrons, antiaromatic).

Q14. Answer C. (P) The phenoxide attacks CO_2 at the ortho position: salicylic acid (P $\rightarrow$ 2). (Q) The Étard complex stops at the aldehyde: benzaldehyde, not benzoic acid (Q $\rightarrow$ 3). (R) The amide loses its carbonyl carbon as CO_3^{2-} : $\text{CH}_3\text{CONH}_2 \rightarrow \text{CH}_3\text{NH}_2$, one carbon fewer (R $\rightarrow$ 4). (S) Clemmensen reduces $\text{C}=\text{O}$ to CH_2 : $\text{C}_6\text{H}_5\text{COCH}_3 \rightarrow \text{C}_6\text{H}_5\text{CH}_2\text{CH}_3$ (S $\rightarrow$ 1).

Q15. Answer A. (P) Two different stereocentres: $2^2 = 4$ (P $\rightarrow$ 3). (Q) cis and trans; a mirror plane through C-1 and C-3 makes both achiral: 2, not 4 (Q $\rightarrow$ 1). (R) The molecule is symmetrical, so E,Z and Z,E are the same: EE, ZZ, EZ = 3 (R $\rightarrow$ 4). (S) Four different stereocentres (C-2 to C-5): $2^4 = 16$, the D- and L-aldoheptoses (S $\rightarrow$ 2).

Q16. Answer D. (P) Friedel–Crafts acylation (P $\rightarrow$ 2). (Q) Hydroboration–oxidation adds water anti-Markovnikov (Q $\rightarrow$ 3). (R) Markovnikov addition without rearrangement needs oxymercuration–demercuration: there is no free carbocation, so no methyl shift; acid-catalysed hydration would rearrange to 2,3-dimethylbutan-2-ol (R $\rightarrow$ 4). (S) Hg^{2+} -catalysed hydration of the alkyne gives the enol of the Markovnikov product, which tautomerises to the methyl ketone (S $\rightarrow$ 1).

Q17. Answer B. (P) 1-chloro-2-methylbutane (chiral, 2), 2-chloro-2-methylbutane (1), 2-chloro-3-methylbutane (chiral, 2), 1-chloro-3-methylbutane (1): 6 (P $\rightarrow$ 4). (Q) 1-chloro-2,2-dimethylbutane (1), 3-chloro-2,2-dimethylbutane (chiral, 2), 1-chloro-3,3-dimethylbutane (1): 4 (Q $\rightarrow$ 2). (R) 1-chloro-3-methylpentane (chiral, 2), 2-chloro-3-methylpentane (two stereocentres, 4), 3-chloro-3-methylpentane (1), 1-chloro-2-ethylbutane (1): 8 (R $\rightarrow$ 1). (S) On C-1 (1), on CH_3 (1), on C-2 cis/trans each chiral (4), on C-3 likewise (4): 10 (S $\rightarrow$ 3).

All questions are original and © Master Testing Agency. Free to download and use for personal practice; not for resale. Counting and structure answers (stereoisomers, monochlorination and elimination products, R/S labels, aromaticity, isomer counts) were recomputed independently with RDKit from the structures themselves; reactions were checked by atom bookkeeping where possible, and descriptive answers follow standard reference data.