ABC CHEMISTRY

Mr. Aniket Bhardwaj · 15+ Years Mentorship

Natural Products

Premium CSIR-NET PYQ Book

39 Previous-Year Questions · 31 with verified answers · Distractor Analysis

3-Slide Solutions | Distractor Analysis | Exam Tricks | Revision Sheets

CSIR-NET · GATE · IIT-JAM — 1 Topics · 39 Real PYQs

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Course Contents

1 Topics · 39 PYQs

1	**Natural Products – General** 39 Qs E 18 · M 18 · H 3	100%

Legend: E Easy M Medium H Hard · % = exam weightage (share of the chapter)

TOPIC 1

Natural Products – General

39 questions · Easy 18 | Medium 18 | Hard 3 · PYQ frequency: Very High

Q1

The biosynthetic precursor of abietic acid is

A. Shikimic acid

B. Mevalonic acid

C. Chorismic acid

D. Cinnamic acid

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer B Mevalonic acid

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Abietic acid is a diterpenoid resin acid (C_{20}), assembled from isoprene units derived from mevalonic acid.
- Therefore the answer is (B).

FINAL: (B) Mevalonic acid

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: B

A **Shikimic acid**

Why (B) is the key — Abietic acid is a diterpenoid resin acid (C_{20}), assembled from isoprene units derived from mevalonic acid.

C **Chorismic acid**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **Cinnamic acid**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q2

Correct characteristics of the functional groups of adenine in DNA base pair are

A N(3) is a hydrogen bond acceptor and C(6) NH_2 is a hydrogen bond donor

B N(1) is a hydrogen bond acceptor and C(6) NH_2 is a hydrogen bond donor

C Both N(3) and C(6) NH_2 are hydrogen bond acceptors

D Both N(1) and C(6)NH_2 are hydrogen bond acceptors

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer B N(1) is a hydrogen bond acceptor and C(6) NH_2 is a hydrogen bond donor

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- In the A·T Watson–Crick pair adenine's N(1) accepts a hydrogen bond from thymine N(3)–H and the C(6)-NH_2 donates one to thymine's C(4)=O.
- Therefore the answer is (B).

FINAL: (B) N(1) is a hydrogen bond acceptor and C(6) NH_2 is a hydrogen bond donor

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: B

A **N(3) is a hydrogen bond acceptor and C(6) NH_2 is a hydrogen bond donor**

Why (B) is the key — In the A·T Watson–Crick pair adenine's N(1) accepts a hydrogen bond from thymine N(3)–H and the C(6)-NH_2 donates one to thymine's C(4)=O.

C **Both N(3) and C(6) NH_2 are hydrogen bond acceptors**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **Both N(1) and C(6)NH_2 are hydrogen bond acceptors**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q3

The following natural product Enterodiol is a

A. terpene

B. steroid

C. lignan

D. alkaloid

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C lignan

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Enterodiol is a lignan, formed by the action of intestinal bacteria on lignan precursors found in plants. Explanation as extracted from the printed page; notation may be imperfect.
- Therefore the answer is (C).

FINAL: (C) lignan

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **terpene**

Why (C) is the key — Enterodiol is a lignan, formed by the action of intestinal bacteria on lignan precursors found in plants. Explanation as extracted from the printed page; notation may be imperfect.

B **steroid**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **alkaloid**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q4

The keto-hexose among the following is

A. Xylose

B. Galactose

C. Fructose

D. Mannose

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C Fructose

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Among the given options, fructose is the only one which contains a ketonic functional group, having six carbon atoms, thus called as ketohexose. CSIR JUNE 2019 Explanation as extracted from the printed page; notation may be imperfect.
- Therefore the answer is (C).

FINAL: (C) Fructose

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **Xylose**

Why (C) is the key — Among the given options, fructose is the only one which contains a ketonic functional group, having six carbon atoms, thus called as ketohexose. CSIR JUNE 2019 Explanation as extracted from the printed page; notation may be imperfect.

B **Galactose**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **Mannose**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q5

The natural product that gives signal at δ 218 ppm in its ^{13}C NMR spectrum

A. α-pinene

B. camphor

C. geraniol

D. carvone

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer B camphor

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- δ 218 ppm is a saturated ketone carbonyl: camphor. Carvone's conjugated ketone is at ≈199, geraniol and α-pinene have no C=O.
- Therefore the answer is (B).

FINAL: (B) camphor

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: B

A **α-pinene**

Why (B) is the key — δ 218 ppm is a saturated ketone carbonyl: camphor. Carvone's conjugated ketone is at ≈199, geraniol and α-pinene have no C=O.

C **geraniol**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **carvone**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q6

Among the following, the amino acid which is basic in nature is:

A. Tyrosine

B. Asparagine

C. Leucine

D. Arginine

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer D Arginine

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- More number of NH2 groups, more basic, the amino acid hence more basic is arginine. CSIR DEC 2012 Explanation as extracted from the printed page; notation may be imperfect.
- Therefore the answer is (D).

FINAL: (D) Arginine

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: D

A **Tyrosine**

Why (D) is the key — More number of NH2 groups, more basic, the amino acid hence more basic is arginine. CSIR DEC 2012 Explanation as extracted from the printed page; notation may be imperfect.

B **Asparagine**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

C **Leucine**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q7

Number of isoprene units present in lupeol is

A. two

B. four

C. six

D. eight

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C six

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- The terpene Lupeol contains 30 carbons, dividing by 5 (since each isoprene unit has 5 carbon) we get 6. Explanation as extracted from the printed page; notation may be imperfect.
- Therefore the answer is (C).

FINAL: (C) six

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **two**

Why (C) is the key — The terpene Lupeol contains 30 carbons, dividing by 5 (since each isoprene unit has 5 carbon) we get 6. Explanation as extracted from the printed page; notation may be imperfect.

B **four**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **eight**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q8

The biosynthetic precursor for the steroids is (a) secologanin (b) shikimic acid (c) mevalonic acid

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

SELF-PRACTICE answer on record: (C) — options were not printed in the source.

Q9

Among the following, the natural product that is a steroid and contains an α,β-unsaturated ketone is

A. estrone

B. prostaglandin

C. cortisone

D. morphine

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C cortisone

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Cortisone is a C21 steroid (pregnane skeleton) with a Δ^4-3-keto group — an α,β-unsaturated ketone in ring A. Estrone is a phenolic steroid, prostaglandins are C20 fatty-acid derivatives, morphine is an alkaloid.
- Therefore the answer is (C).

FINAL: (C) cortisone

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **estrone**

Why (C) is the key — Cortisone is a C21 steroid (pregnane skeleton) with a Δ^4-3-keto group — an α,β-unsaturated ketone in ring A. Estrone is a phenolic steroid, prostaglandins are C20 fatty-acid derivatives, morphine is an alkaloid.

B **prostaglandin**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **morphine**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q10 **D-Glucose and D-fructose interconvert into each other in aqueous alkaline solution. Suggest a mechanism for the interconversion. (Numerical answer type — write the value.)**

ANSWER: Lobry de Bruyn–van Ekenstein rearrangement via the 1,2-enediol

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
Base removes the C2–H of glucose to give the C1–C2 enediolate (1,2-enediol); reprotonation at C1 gives back glucose or mannose (C2 epimers), while tautomerisation to the C2 carbonyl gives fructose. All three interconvert through the same enediol.

Q11

Proteins are biopolymers. The monomer units present in them are

A carbohydrates

B amino acids

C fatty acids

D alkenes

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer B amino acids

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Proteins are polyamides formed by condensation of α-amino acids (peptide bonds).
- Therefore the answer is (B).

FINAL: (B) amino acids

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: B

A **carbohydrates**

Why (B) is the key — Proteins are polyamides formed by condensation of α-amino acids (peptide bonds).

C **fatty acids**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **alkenes**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q12

The pK_a values for the three ionizable groups X, Y and Z of glutamic acid are 4.3, 9.7 and 2.2 respectively. The isoelectric point for the amino acid is

A. 7.00

B. 3.25

C. 4.95

D. 5.95

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer B 3.25

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- For an acidic amino acid pI is the mean of the two carboxyl pK_a values: (2.2 + 4.3)/2 = 3.25.
- Therefore the answer is (B).

FINAL: (B) 3.25

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: B

A **7.00**

Why (B) is the key — For an acidic amino acid pI is the mean of the two carboxyl pK_a values: (2.2 + 4.3)/2 = 3.25.

C **4.95**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **5.95**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q13 **contain a Statement with a Reason and an Assertion. For each question, choose the correct answer from the following four choices. Statement: D-Glucose and D-mannose give the same phenylosazone. Reason: Osazone formation results in a loss of the stereocentre at C_2 but does not affect other stereocenters. Assertion: D-Glucose and D-mannose are enantiomers.**

A. Both Reason and Assertion are correct

B. Both Reason and Assertion are wrong

C. Reason is correct but Assertion is wrong

D. Reason is wrong but Assertion is correct

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C Reason is correct but Assertion is wrong

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Osazone formation involves C1 and C2, destroying the C2 stereocentre, so the C2 epimers glucose and mannose give the same osazone (Reason correct). Glucose and mannose are epimers/diastereomers, not enantiomers (Assertion wrong).
- Therefore the answer is (C).

FINAL: (C) Reason is correct but Assertion is wrong

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A — **Both Reason and Assertion are correct**

Why (C) is the key — Osazone formation involves C1 and C2, destroying the C2 stereocentre, so the C2 epimers glucose and mannose give the same osazone (Reason correct). Glucose and mannose are epimers/diastereomers, not enantiomers (Assertion wrong).

B — **Both Reason and Assertion are wrong**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D — **Reason is wrong but Assertion is correct**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q14

Select the correct pair of statements: (I) Complementary strands run antiparallel in a double stranded DNA. (II) The triplet codons, represented by the genetic code, are expressed by ribonucleic acids. (III) t-RNA carries the genetic information to the site of DNA replication. (IV) A nucleoside contains a ribose or deoxyribose and phosphate constituents only.

A. I and II

B. II and III

C. III and IV

D. I and IV

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer A I and II

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- I true (antiparallel strands). II true (codons are read on mRNA). III false — tRNA carries amino acids to the ribosome, mRNA carries the information. IV false — a nucleoside is base + sugar with no phosphate.
- Therefore the answer is (A).

FINAL: (A) I and II

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: A

B **II and III**

Why (A) is the key — I true (antiparallel strands). II true (codons are read on mRNA). III false — tRNA carries amino acids to the ribosome, mRNA carries the information. IV false — a nucleoside is base + sugar with no phosphate.

C **III and IV**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **I and IV**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q15

Sucrose is converted to a mixture of glucose and fructose in a pseudo first order process under alkaline condi tions. The reaction has a half life of 28.4 min . The time required for the reduction of a 8.0 mM sample of sucrose to 1.0 mM is

A. 56.8 min

B. 170.4 min

C. 85.2 min

D. 227.2 min

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C 85.2 min

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- 8 mM → 1 mM is three halvings (8 → 4 → 2 → 1): 3 × 28.4 = 85.2 min.
- Therefore the answer is (C).

FINAL: (C) 85.2 min

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **56.8 min**

Why (C) is the key — 8 mM → 1 mM is three halvings (8 → 4 → 2 → 1): 3 × 28.4 = 85.2 min.

B **170.4 min**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **227.2 min**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q16

Treatment of the pentapeptide Gly-Arg-Phe-Ala-Ala, in separate experiments, with the enzymes Trypsin, Chemotrypsin and Carboxypeptidase A respectively, gives :

(A) Gly-Arg + Phe-Ala-Ala; Gly-Arg-Phe+Ala-Ala; Gly-Arg-Phe-Ala+Ala

(B) Gly-Arg-Phe+Ala-Ala; Gly-Arg-Phe+Ala-Ala; Gly-Arg-Phe-Ala+Ala

(C) Gly-Arg+Phe-Ala-Ala; Gly-Arg-Phe-Ala+Ala; Gly-Arg-Phe+Ala-Ala

(D) Gly-Arg + Phe-Ala-Ala; Gly-Arg-Phe+Ala-Ala; Gly+ Arg-Phe-Ala + Ala

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer A Gly-Arg + Phe-Ala-Ala; Gly-Arg-Phe+Ala-Ala; Gly-Arg-Phe-Ala+Ala

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Trypsin cuts after Arg (Gly-Arg + Phe-Ala-Ala), chymotrypsin after Phe (Gly-Arg-Phe + Ala-Ala), carboxypeptidase A releases the C-terminal Ala (a).
- Therefore the answer is (A).

FINAL: (A) Gly-Arg + Phe-Ala-Ala; Gly-Arg-Phe+Ala-Ala; Gly-Arg-Phe-Ala+Ala

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: A

B **Gly-Arg-Phe+Ala-Ala; Gly-Arg-Phe+Ala-Ala; Gly-Arg-Phe-Ala+Ala**

Why (A) is the key — Trypsin cuts after Arg (Gly-Arg + Phe-Ala-Ala), chymotrypsin after Phe (Gly-Arg-Phe + Ala-Ala), carboxypeptidase A releases the C-terminal Ala (a).

C **Gly-Arg+Phe-Ala-Ala; Gly-Arg-Phe-Ala+Ala; Gly-Arg-Phe+Ala-Ala**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **Gly-Arg + Phe-Ala-Ala; Gly-Arg-Phe+Ala-Ala; Gly+ Arg-Phe-Ala + Ala**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q17

Cyanogen bromide (CNBr) specifically hydrolyses the peptide bond formed by the C-side of

A. methionine

B. glycine

C. proline

D. serine

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer A methionine

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- CNBr cleaves specifically at the C-terminal side of methionine, converting Met to a homoserine lactone.
- Therefore the answer is (A).

FINAL: (A) methionine

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: A

B **glycine**
Why (A) is the key — CNBr cleaves specifically at the C-terminal side of methionine, converting Met to a homoserine lactone.

C **proline**
Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **serine**
Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q18

The decreasing order of isoelectric point for the following α-amino acids is Lysine (I), Alanine (II), Glutamic acid (III)

A. I > II > III

B. II > I > III

C. III > I > II

D. I > III > II

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
'5 carbons at a time'.

Correct Answer A I > II > III

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- pI: lysine (basic side chain) ≈ 9.7 > alanine (neutral) ≈ 6.0 > glutamic acid (acidic) ≈ 3.2.
- Therefore the answer is (A).

FINAL: (A) I > II > III

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: A

B **II > I > III**

Why (A) is the key — pI: lysine (basic side chain) ≈ 9.7 > alanine (neutral) ≈ 6.0 > glutamic acid (acidic) ≈ 3.2.

C **III > I > II**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **I > III > II**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q19

The sequence of an mRNA molecule produced from a DNA template strand with the composition 5'-AGCTACACT-3' is

A. 5'–AGUGUAGCU–3'

B. 5'–UCGAUGUGA–3'

C. 5'–AGTGTAGCT–3'

D. 5'–TCGATGTGA–3'

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer A 5'–AGUGUAGCU–3'

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- mRNA is complementary and antiparallel to the template, with U for T. Template 5′-AGCTACACT-3′ → mRNA 3′-UCGAUGUGA-5′ = 5′-AGUGUAGCU-3′. Options (c)/(d) contain T and cannot be RNA. (Bank key (c) — corrected.)
- Therefore the answer is (A).

FINAL: (A) 5'–AGUGUAGCU–3'

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: A

B **5'–UCGAUGUGA–3'**

Why (A) is the key — mRNA is complementary and antiparallel to the template, with U for T. Template 5′-AGCTACACT-3′ → mRNA 3′-UCGAUGUGA-5′ = 5′-AGUGUAGCU-3′. Options (c)/(d) contain T and cannot be RNA. (Bank key (c) — corrected.)

C **5'–AGTGTAGCT–3'**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **5'–TCGATGTGA–3'**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q20

Number of thymine residues in a 5000 kb DNA containing 23% guanine residues is:

A. 2.70×10^6

B. 2.70×10^7

C. 1.35×10^6

D. 1.35×10^7

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C 1.35 × 10^6

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Chargaff: G = C = 23 %, so A = T = 27 %. Taking the 5000 kb DNA as 5×10^6 nucleotides: T = $0.27 \times 5\times10^6 = 1.35\times10^6$ (bank key). If 5000 kb is counted as 5×10^6 base pairs (10^7 nucleotides) the answer doubles to 2.7×10^6.
- Therefore the answer is (C).

FINAL: (C) 1.35 × 10^6

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **2.70×10^6**

Why (C) is the key — Chargaff: G = C = 23 %, so A = T = 27 %. Taking the 5000 kb DNA as 5×10^6 nucleotides: T = $0.27 \times 5\times10^6 = 1.35\times10^6$ (bank key). If 5000 kb is counted as 5×10^6 base pairs (10^7 nucleotides) the answer doubles to 2.7×10^6.

B **2.70×10^7**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **1.35×10^7**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q21

A disaccharide that will not given Benedict's test and will not form osazone is

A. maltose

B. lactose

C. cellobiose

D. sucrose

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer D sucrose

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Sucrose (Glc α1→β2 Fru) has no free anomeric carbon: non-reducing and no osazone (d).
- Therefore the answer is (D).

FINAL: (D) sucrose

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: D

A **maltose**

Why (D) is the key — Sucrose (Glc α1→β2 Fru) has no free anomeric carbon: non-reducing and no osazone (d).

B **lactose**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

C **cellobiose**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q22

The compound given below is a (Hirsutene)

A. sesterterpene

B. monoterpene

C. sesquiterpene

D. triterpene

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C sesquiterpene

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Hirsutene is a C15 (three isoprene units) tricyclic → sesquiterpene.
- Therefore the answer is (C).

FINAL: (C) sesquiterpene

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **sesterterpene**

Why (C) is the key — Hirsutene is a C15 (three isoprene units) tricyclic → sesquiterpene.

B **monoterpene**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **triterpene**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q23 A tetrapeptide, made up of natural amino acids, has alanine as the N-terminal residue which is coupled to a chiral amino acid. Upon complete hydrolysis, the tetrapeptide gives glycine, alanine, phenylalanine and leucine. The number of possible sequences of the tetrapeptide is ___. GATE 2020 (Numerical answer type — write the value.)

ANSWER: 4

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
Position 1 = Ala. Position 2 must be chiral, i.e. Phe or Leu (not Gly): 2 choices; the remaining two residues fill positions 3–4 in 2! = 2 ways → 2 × 2 = 4 sequences.

Q24

A correct example of a nucleotide is:

A. DNA

B. adenosine monophosphate (AMP)

C. RNA

D. uridine

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer B adenosine monophosphate (AMP)

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Nucleotide = base + sugar + phosphate: AMP. Uridine is a nucleoside (no phosphate); DNA/RNA are polynucleotides.
- Therefore the answer is (B).

FINAL: (B) adenosine monophosphate (AMP)

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: B

A **DNA**

Why (B) is the key — Nucleotide = base + sugar + phosphate: AMP. Uridine is a nucleoside (no phosphate); DNA/RNA are polynucleotides.

C **RNA**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **uridine**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q25

The complementary strand of DNA for the following single stranded DNA sequence, 5′–A–T–C–A–T–G–C–3′ is

A. 5′–A–T–C–A–T–G–C–3′

B. 5′–T–A–G–T–A–C–G–3′

C. 5′–G–C–A–T–G–A–T–3′

D. 5′–C–G–T–A–C–T–A–3′

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C 5′–G–C–A–T–G–A–T–3′

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Complement of 5′-ATCATGC-3′ read antiparallel is 3′-TAGTACG-5′, which written 5′→3′ is 5′-GCATGAT-3′.
- Therefore the answer is (C).

FINAL: (C) 5′–G–C–A–T–G–A–T–3′

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **5′–A–T–C–A–T–G–C–3′**

Why (C) is the key — Complement of 5′-ATCATGC-3′ read antiparallel is 3′-TAGTACG-5′, which written 5′→3′ is 5′-GCATGAT-3′.

B **5′–T–A–G–T–A–C–G–3′**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **5′–C–G–T–A–C–T–A–3′**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q26

Calculate the isoelectric point (p.I.) of lysine, given the pK_a of α.NH_3 is 8.95, pK_a of side chain NH_3 is 10.53 and pK_a of α.COOH is 2.18. (Numerical answer type — write the value.)

ANSWER: 9.74

QUESTION INSIGHTS

ESTIMATED TIME
3–5 min

DIFFICULTY
Hard

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★★

EXPECTED LEVEL
Part C (high merit)

MEMORY HOOK
Lysine (basic): pI = average of the two amino pK_a values = (8.95 + 10.53)/2 = 9.74.

Q27

The correct relationship within each pair of the natural products is:

A. Camphor - terpene; insulin - protein; nicotine - alkaloids; streptomycin - carbohydrate

B. Camphor - terpene; insulin - carbohydrate; nicotine - alkaloid; streptomycin - lipid

C. Camphor-alkaloid; insulin-protein; nicotine-terpene; streptomycin-carbohydrate

D. Camphor - carbohydrate; insulin - protein; nicotine - alkaloid; streptomycin - terpene

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer A Camphor - terpene; insulin - protein; nicotine - alkaloids; streptomycin - carbohydrate

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Camphor – terpene; insulin – protein; nicotine – alkaloid; streptomycin – (amino)carbohydrate (a).
- Therefore the answer is (A).

FINAL: (A) Camphor - terpene; insulin - protein; nicotine - alkaloids; streptomycin - carbohydrate

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: A

B **Camphor - terpene; insulin - carbohydrate; nicotine - alkaloid; streptomycin - lipid**

Why (A) is the key — Camphor – terpene; insulin – protein; nicotine – alkaloid; streptomycin – (amino)carbohydrate (a).

C **Camphor-alkaloid; insulin-protein; nicotine-terpene; streptomycin-carbohydrate**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **Camphor - carbohydrate; insulin - protein; nicotine - alkaloid; streptomycin - terpene**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q28

The complementary DNA sequence of the given DNA 5'-G-A-A-T-T-C-3' is:

A. 5'-C-T-T-A-A-G-3'

B. 5'-C-U-U-A-A-G-3'

C. 3'-C-T-T-A-A-G-5'

D. 3'-G-A-A-T-T-C-5'

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C 3'-C-T-T-A-A-G-5'

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Complement of 5′-GAATTC-3′ is 3′-CTTAAG-5′ (the EcoRI palindrome; equivalently 5′-GAATTC-3′). Option (b) contains U.
- Therefore the answer is (C).

FINAL: (C) 3'-C-T-T-A-A-G-5'

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **5'-C-T-T-A-A-G-3'**

Why (C) is the key — Complement of 5′-GAATTC-3′ is 3′-CTTAAG-5′ (the EcoRI palindrome; equivalently 5′-GAATTC-3′). Option (b) contains U.

B **5'-C-U-U-A-A-G-3'**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **3'-G-A-A-T-T-C-5'**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q29

Which one of the following statements is Correct?

A. Naturally occuring DNA has β-configuration

B. Nucleic acids are derived from proteins

C. Proteins store genetic information

D. Vitamins generally act as enzymes

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer A Naturally occuring DNA has β-configuration

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Natural DNA is mostly the right-handed B form; nucleic acids are not derived from proteins, proteins do not store genetic information and vitamins act as cofactors (a).
- Therefore the answer is (A).

FINAL: (A) Naturally occuring DNA has β-configuration

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: A

B **Nucleic acids are derived from proteins**

Why (A) is the key — Natural DNA is mostly the right-handed B form; nucleic acids are not derived from proteins, proteins do not store genetic information and vitamins act as cofactors (a).

C **Proteins store genetic information**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **Vitamins generally act as enzymes**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q30

Tollen's test will be negative for:

A. Glucose

B. Mannose

C. Sucrose

D. Galactose

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C Sucrose

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Sucrose's anomeric carbons are both locked in the glycosidic bond (acetal/ketal), so it cannot open to an aldehyde — a non-reducing sugar; glucose, mannose and galactose are reducing.
- Therefore the answer is (C).

FINAL: (C) Sucrose

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **Glucose**

Why (C) is the key — Sucrose's anomeric carbons are both locked in the glycosidic bond (acetal/ketal), so it cannot open to an aldehyde — a non-reducing sugar; glucose, mannose and galactose are reducing.

B **Mannose**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **Galactose**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q31

Specific rotations of freshly prepared aqueous solutions of I and II are +112 and +18.7, respectively. On standing the optical rotation of aqueous solution of I slowly decreases to give a final value of +52.7 due to equilibrium with II. Under this state of equilibrium, what is the ratio II : I?

A. 0.57

B. 1.00

C. 1.75

D. 5.9

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C 1.75

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Let x = fraction of I: 112x + 18.7(1 − x) = 52.7 → 93.3x = 34 → x = 0.364. II : I = 0.636/0.364 = 1.75 (mutarotation of α-/β-D-glucose).
- Therefore the answer is (C).

FINAL: (C) 1.75

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **0.57**

Why (C) is the key — Let x = fraction of I: 112x + 18.7(1 − x) = 52.7 → 93.3x = 34 → x = 0.364. II : I = 0.636/0.364 = 1.75 (mutarotation of α-/β-D-glucose).

B **1.00**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **5.9**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q32 The pK_a values of lysine are 2.18, 8.95 and 10.79. The isoelectric point of lysine is ___ IIT JAM 2016
(Numerical answer type — write the value.)

ANSWER: 9.87

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
Lysine: pI = (pK_a α-NH_3^+ + pK_a ε-NH_3^+)/2 = (8.95 + 10.79)/2 = 9.87.

Q33

The most basic amino acid among the following is

A. tyrosine

B. methionine

C. arginine

D. glutamine

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer C arginine

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Arginine's guanidinium side chain ($pK_a \approx 12.5$) is the most basic group among amino acids.
- Therefore the answer is (C).

FINAL: (C) arginine

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: C

A **tyrosine**

Why (C) is the key — Arginine's guanidinium side chain ($pK_a \approx 12.5$) is the most basic group among amino acids.

B **methionine**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **glutamine**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q34

Among the following the correct statement(s) is/are

A. Guanine is a purine nucleobase

B. Glycine and proline are achiral amino acids

C. DNA contains glycosidic bonds and pentose sugars

D. Sucrose is a non-reducing sugar

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer A Guanine is a purine nucleobase

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Guanine is a purine ✓; DNA has N-glycosidic bonds and 2-deoxyribose ✓; sucrose is non-reducing ✓. Glycine is achiral but proline is chiral, so (b) is false.
- Therefore the answer is (A).

FINAL: (A) Guanine is a purine nucleobase

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: A

B **Glycine and proline are achiral amino acids**

Why (A) is the key — Guanine is a purine ✓; DNA has N-glycosidic bonds and 2-deoxyribose ✓; sucrose is non-reducing ✓. Glycine is achiral but proline is chiral, so (b) is false.

C **DNA contains glycosidic bonds and pentose sugars**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **Sucrose is a non-reducing sugar**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q35 The maximum number of dipeptides that could be obtained by reaction of phenylalanine with leucine is ___
(Numerical answer type — write the value.)

ANSWER: 4

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
Phe-Phe, Leu-Leu, Phe-Leu and Leu-Phe (sequence matters) → 4 dipeptides.

Q36

The C-2 epimer of D-glucose is

A. D-Mannose

B. D-Fructose

C. D-Galactose

D. D-Gulose

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer A D-Mannose

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- D-Mannose differs from D-glucose only in the configuration at C2 (C2 epimer); galactose is the C4 epimer; fructose is a ketose.
- Therefore the answer is (A).

FINAL: (A) D-Mannose

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: A

B **D-Fructose**

Why (A) is the key — D-Mannose differs from D-glucose only in the configuration at C2 (C2 epimer); galactose is the C4 epimer; fructose is a ketose.

C **D-Galactose**

Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **D-Gulose**

Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q37

The complementary strand for the following single strand of DNA is 5' ← mathrmA-T-G-C-T → 3' (a) 3' ← mathrmT-A-C-G-A → 5' (b) 3' ← mathrmA-T-G-C-T → 5'

SELF-PRACTICE answer on record: (A) — options were not printed in the source.

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
'5 carbons at a time'.

Q38

The nucleobase NOT found DNA is

A. Thymine

B. Uracil

C. Guanine

D. Adenine

QUESTION INSIGHTS

ESTIMATED TIME
1–1.5 min

DIFFICULTY
Easy

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★☆☆

EXPECTED LEVEL
Part B

MEMORY HOOK
'5 carbons at a time'.

Correct Answer B Uracil

CONCEPT

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

LOGIC / WORKING

- Uracil occurs in RNA; DNA uses thymine in its place.
- Therefore the answer is (B).

FINAL: (B) Uracil

SHORTCUT / EXAM TRICK

Count carbons ÷ 5 → terpene class; N-atom + basic + plant origin → alkaloid.

COMMON MISTAKE

Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

EXAM TIP

Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MEMORY TRICK

'5 carbons at a time'.

Why the Other Options Are Wrong

Correct answer: B

A **Thymine**
Why (B) is the key — Uracil occurs in RNA; DNA uses thymine in its place.

C **Guanine**
Ruled out: Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).

D **Adenine**
Ruled out: Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

Q39

The functional group (s) in reducing sugar that tests positive with Tollen's reagent is (are)

A. Aldehyde

B. Ketone

C. Acetal

D. Hemi-acetal

ANSWER: (a) and (d)

QUESTION INSIGHTS

ESTIMATED TIME
2–3 min

DIFFICULTY
Medium

CONCEPT TESTED
Natural Products – General

PYQ FREQUENCY
Very High · 10 papers

REVISION PRIORITY
★★★★☆

EXPECTED LEVEL
Part B / Part C

MEMORY HOOK
The free hemiacetal (anomeric OH) opens to the aldehyde, which is oxidised by Tollens' reagent. A full acetal (glycoside) cannot open and is non-reducing.

TOPIC REVISION

Natural Products – General

39 PYQs · Last-minute revision

TOPIC SUMMARY

Classes and biosynthesis: terpenoids (C_5 isoprene; mevalonate/MEP), steroids (cyclopentanoperhydrophenanthrene; cholesterol, hormones), alkaloids (N-containing; morphine, quinine, nicotine, atropine), carbohydrates (Fischer/Haworth, mutarotation, glycosides), amino acids/peptides (sequencing, Edman), nucleic acids, flavonoids/polyketides (acetate pathway).

IMPORTANT FORMULA SHEET

- Isoprene rule: C_{10} mono-, C_{15} sesqui-, C_{20} di-, C_{30} tri- (squalene), C_{40} tetra-terpenes
- Steroid skeleton: 17 C, rings A/B/C/D
- Edman degradation: PTH-amino acid per cycle
- Mutarotation: α-D-glucose +112° ⇌ β +19° → +52.7°

FREQUENTLY ASKED CONCEPTS

- Classify a natural product
- Number of isoprene units
- Biogenetic pathway (mevalonate, shikimate, acetate)
- Reactions of glucose (osazone, oxidation)
- Peptide sequencing logic

COMMON MISTAKES & QUICK NOTES

Watch out:
Assuming all terpenes follow head-to-tail joining (squalene and carotenoids are tail-to-tail at the centre).
Shikimate pathway → aromatic amino acids → alkaloids and flavonoid B-ring.

MOST-REPEATED PYQs & EXPECTED IN EXAM

PYQs in this topic: Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 …

Expect 4 question(s) next session on Natural Products – General.

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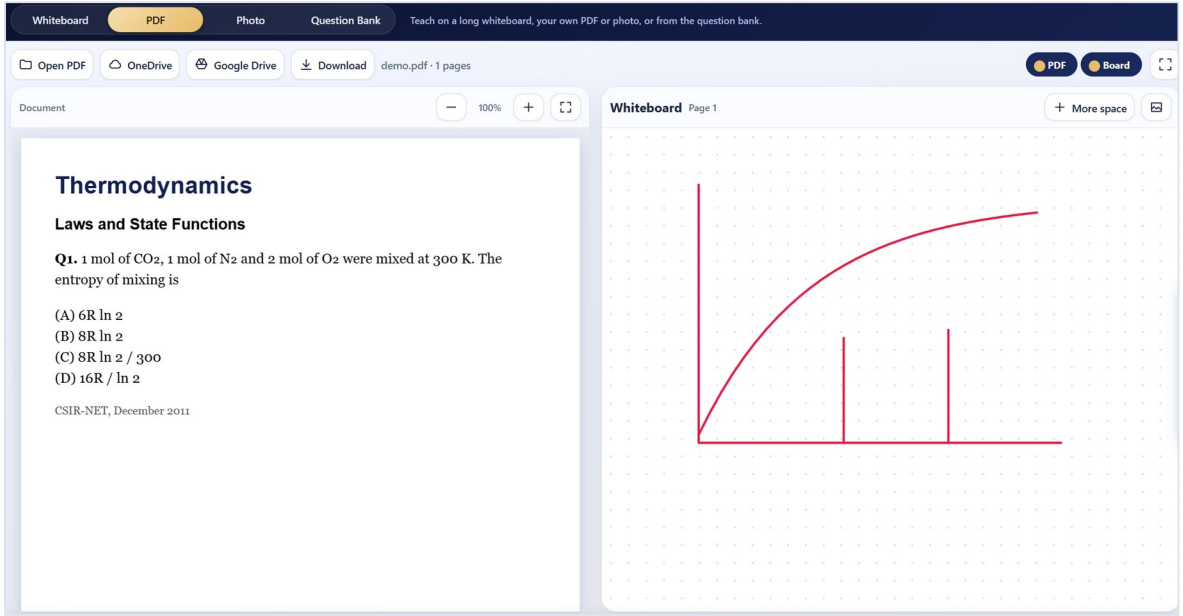
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