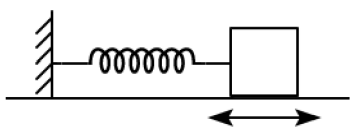


PHYSICS - SECTION A

1 A block, when suspended from a spring, causes it to extend by a length l , in equilibrium. If the block is attached to the same spring and allowed to oscillate the time period of oscillation will be:



1. $2\pi\sqrt{\frac{l}{g}}$	2. $\pi\sqrt{\frac{l}{g}}$
3. $2\sqrt{\frac{l}{g}}$	4. $2\sqrt{\frac{g}{l}}$

2 Given below are two statements:

Assertion (A):	Standing waves are formed in a string when waves of equal amplitude and frequency propagating in opposite directions superpose.
Reason (R):	This occurs as the superposing waves coming from opposite directions arrive in exactly opposite phase at equidistant points (nodes) – where their vibrations cancel; while they reinforce each other between them (antinodes).

1.	Both (A) and (R) are True and (R) is the correct explanation of (A).
2.	Both (A) and (R) are True but (R) is not the correct explanation of (A).
3.	(A) is True but (R) is False.
4.	(A) is False but (R) is True.

3 Which, of the following, represents the displacement in simple harmonic motion?

(A)	$x = A \sin^2 \omega t$
(B)	$x = A \sin \omega t + B \cos 2\omega t$
(C)	$x = A \sin^2 \omega t + B \cos 2\omega t$

1. A only
2. A and B
3. A and C
4. A, B and C

4 A simple pendulum is set oscillating in an elevator at rest, and its time period is T_0 . The elevator accelerates upward, and the new time period is measured to be T . Then:

1.	$T = T_0$
2.	$T > T_0$
3.	$T < T_0$
4.	Any of the above can be true depending on the magnitude of the elevator's acceleration

5 Two SHMs are given by: $x_1 = A \sin \omega t$ and $x_2 = B \cos \omega t$; where A, B are constants and ω is the angular frequency. These are added: $x = x_1 + x_2$
The resulting vibration will:

1.	not be SHM
2.	be SHM of frequency greater than ω
3.	be SHM of frequency ω and amplitude $(A + B)$
4.	be SHM of frequency ω , and amplitude $\sqrt{A^2 + B^2}$

6 Given below are two statements:

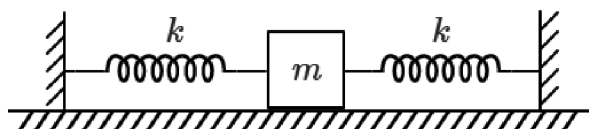
Assertion (A):	In a stationary wave there is no transfer of energy.
Reason (R):	The distance between two consecutive nodes or antinodes is $\frac{\lambda}{2}$.

1.	Both (A) and (R) are True and (R) is the correct explanation of (A).
2.	Both (A) and (R) are True but (R) is not the correct explanation of (A).
3.	(A) is True but (R) is False.
4.	Both (A) and (R) are False.

7 The kinetic energy of a block attached to a spring (spring-mass system) undergoing oscillations is maximum when the block is at:

1.	one of the extreme positions
2.	the mean position
3.	a point midway between the mean and an extreme position
4.	any of the extreme positions

- 8** A block of mass m is connected to two springs of stiffness k , as shown in the figure. The effective spring constant, when these are replaced by a single spring, is:



1.	0	2.	$2k$
3.	$\frac{k}{2}$	4.	infinity

- 9** The 4th overtone of a closed organ pipe is the same as that of the 3rd overtone of an open pipe. The ratio of the length of the closed pipe to the length of the open pipe is:

1.	8 : 9	2.	9 : 7
3.	9 : 8	4.	7 : 9

- 10** A sinusoidal waveform whose displacement is given by: $y(x, t) = (5 \text{ mm}) \sin 2\pi \left(\frac{x}{2 \text{ m}} + \frac{t}{0.01 \text{ s}} \right)$ propagates along the x -axis. The frequency of the wave is:

1.	0.01 Hz	2.	$\frac{0.01}{2\pi}$ Hz
3.	100 Hz	4.	200 Hz

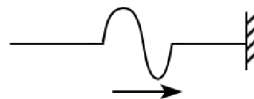
- 11** A simple pendulum undergoing small oscillations of amplitude 1 cm, has a time period of 2 s. If the amplitude of oscillation is halved, the time period will:

1.	remain unchanged
2.	increase to 4 s
3.	decrease to 1 s
4.	decrease to 0.5 s

- 12** The frequency f and the length l of a simple pendulum are related by:

- $fl = \text{constant}$
- $fl^2 = \text{constant}$
- $f^2l = \text{constant}$
- $\frac{f^2}{l} = \text{constant}$

- 13** A wave pulse travels along a taut string towards a fixed end as shown in the adjacent figures:



The reflected pulse is correctly shown by:

1.		2.	
3.		4.	

- 14** A particle is performing SHM having position $x = A \cos(30^\circ)$, and $A = 40 \text{ cm}$. If its kinetic energy at this position is 200 J, then the value of force constant is:

- 10 kN/m
- 20 kN/m
- 10000 kN/m
- 20000 kN/m

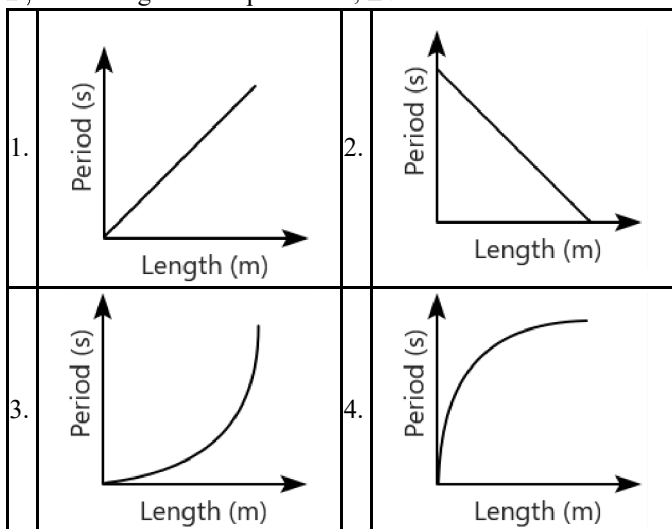
- 15** A string, under tension, and lying along the x -axis is set into transverse vibrations. The displacement at a point x is given by the function $y(x, t)$ where t represents the time:

$$y(x, t) = (3 \text{ mm}) \sin\left(\frac{\pi x}{20 \text{ cm}}\right) \cos\left\{2\pi \left(100 \text{ s}^{-1}\right) t\right\}$$

A node is formed on the string at:

1.	$x = 0$ only
2.	$x = 20 \text{ cm}$ only
3.	$x = 0, x = 20 \text{ cm}, x = 40 \text{ cm}, \dots$
4.	$x = 10 \text{ cm}, x = 30 \text{ cm}, x = 50 \text{ cm}, \dots$

16 Which of the following graphs accurately relates period, T , to the length of the pendulum, L ?



17 Select the correct statements regarding potential energy (U) in the simple harmonic motion of a particle along x -axis:

1.	$\frac{dU}{dx} < 0$ for all positions of a particle performing SHM.
2.	$\frac{dU}{dx} > 0$ for all time.
3.	Potential energy is minimum at the equilibrium position of a particle performing SHM.
4.	Potential energy increases linearly with the position as the particle moves away from the equilibrium position.

18 Two organ pipes – an open one of length L_1 and a closed one of length L_2 are set into vibration and it is observed that they resonate with each other in their fundamental modes.

Then, $\frac{L_1}{L_2}$ equals:

1. 1
2. 2
3. $\frac{1}{2}$
4. $\frac{1}{4}$

19 Which of the following equations indicates the relationship between the acceleration a and the displacement from the mean position x for a particle executing simple harmonic motion?

1. $a = +3x$
2. $a = -2x^2$
3. $a = -4x$
4. $a = -\frac{2}{x}$

20 The fundamental frequency of vibration of a wire fixed at both ends is 120 Hz. The wire can also vibrate in harmonics. The possible frequencies are:

1.	60 Hz, 40 Hz, 30 Hz, ...
2.	240 Hz, 360 Hz, 480 Hz, ...
3.	240 Hz, 300 Hz, 360 Hz, ...
4.	180 Hz, 240 Hz, 300 Hz, ...

21 The speed of elastic waves on a stretched string under tension is u . The tension in the string is increased by 1%. The speed of elastic waves will become (nearly):

1.	$u + \frac{u}{100}$	2.	$u - \frac{u}{100}$
3.	$u + \frac{u}{200}$	4.	$u - \frac{u}{200}$

22 If two SHMs of the same frequency and same amplitude are added but in opposite phase, then, their resultant will be:

1.	SHM of same frequency but double amplitude
2.	SHM of double frequency but same amplitude
3.	SHM of same frequency but smaller amplitude
4.	no motion, due to cancellation

23 A block connected to a spring undergoes a displacement given by: $x = (2 \text{ cm}) \sin \left\{ (5 \text{ s}^{-1})t + \frac{\pi}{6} \right\}$

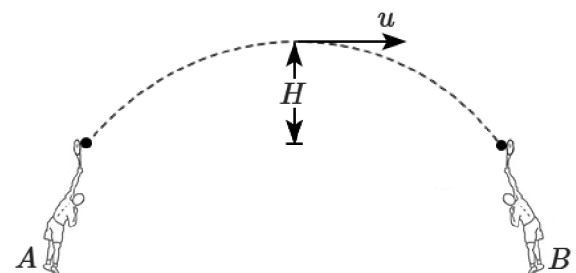
The time period of the motion is:

1. 5 s
2. 10 s
3. $\frac{5}{2\pi}$ s
4. $\frac{2\pi}{5}$ s

24 A simple pendulum of time period T is taken to the moon, where the gravitational acceleration is $\frac{1}{6}$ that on the earth. The new time period will be:

1. $6T$
2. $\sqrt{6}T$
3. $\frac{T}{6}$
4. $\frac{T}{\sqrt{6}}$

- 25** Two tennis players play a game where the ball is struck by the players, so that it rebounds and retraces its path back and forth. The players (A, B) strike the ball at the same height above the ground. The maximum height risen by the ball, after a strike, is H and its horizontal speed is u . Neglect any air resistance.



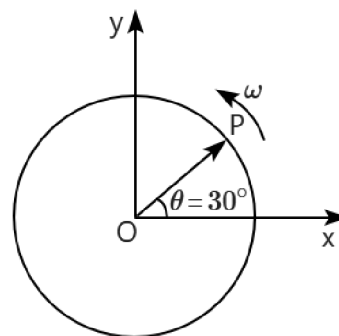
The period of the motion of the ball is:

1.	$\sqrt{\frac{2H}{g}}$	2.	$2\sqrt{\frac{2H}{g}}$
3.	$4\sqrt{\frac{2H}{g}}$	4.	$\sqrt{\frac{H}{2g}}$

- 26** A graph is plotted with the x -axis representing the position and the y -axis representing the velocity of a particle undergoing SHM along a straight line. The shape of the graph is:

1.	a straight line with a positive slope
2.	a straight line with a negative slope
3.	a circle
4.	an ellipse

- 27** The phasor of a particle performing SHM is as shown in the diagram. The SHM has an angular frequency ω and at $t = 0$ the phasor lies along OP. At any time t further, the projection of phasor along the y -axis is given by:

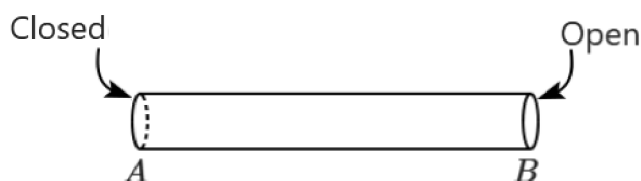


1.	$R \sin\left(\omega t + \frac{\pi}{6}\right)$	2.	$R \cos\left(\omega t + \frac{\pi}{6}\right)$
3.	$R \sin\left(\omega t - \frac{\pi}{6}\right)$	4.	$R \cos\left(\omega t - \frac{\pi}{6}\right)$

- 28** For a particle performing linear SHM, its position (x) as a function of time (t) is given by $x = A \sin(\omega t + \delta)$. If, at $t = 0$, particle is at $+\frac{A}{2}$ and is moving towards $x = +A$, then $\delta =$

1.	$\frac{\pi}{3}$ rad	2.	$\frac{\pi}{6}$ rad
3.	$\frac{\pi}{4}$ rad	4.	$\frac{5\pi}{6}$ rad

- 29** The air in an organ pipe (AB) is set into vibration as it is played. The pressure amplitude of vibration of air in the pipe is:



1.	maximum at A and at B
2.	minimum at A and at B
3.	maximum at A and minimum at B
4.	minimum at A and maximum at B

30 Which, of the following, is true for a simple pendulum undergoing small oscillations?
(neglect all dissipative forces)

1.	Kinetic energy is conserved
2.	Momentum is conserved
3.	Potential energy is conserved
4.	Total energy is conserved

31 An elastic ball rebounds vertically to a height h above the ground, the period of its motion will be:

1.	$\sqrt{\frac{2h}{g}}$	2.	$\sqrt{\frac{8h}{g}}$
3.	$\sqrt{\frac{h}{2g}}$	4.	$2\sqrt{\frac{h}{g}}$

32 Given below are two statements:

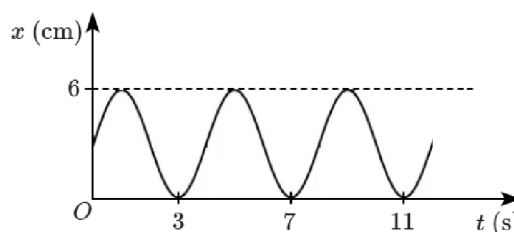
Assertion (A):	The time period of small oscillations of a simple pendulum is independent of the amplitude.
Reason (R):	The oscillatory motion of a simple pendulum is affected by the mass of the bob and the acceleration due to gravity, and so the time period depends only on these quantities.

1.	Both (A) and (R) are True and (R) is the correct explanation of (A).
2.	Both (A) and (R) are True but (R) is not the correct explanation of (A).
3.	(A) is True but (R) is False.
4.	(A) is False but (R) is True.

33 The equation of motion of a particle that starts moving at $t = 0$ s is given by $x = 5 \sin\left(\frac{\pi t}{2} + \frac{\pi}{3}\right)$ where x is in cm and time t is in second. The time, when the particle first comes to rest, is:

1.	$\frac{1}{3}$ s	2.	$\frac{7}{6}$ s
3.	$\frac{2}{3}$ s	4.	$\frac{13}{6}$ s

34 The graph represents the variation of the position of a particle (x) as a function of time (t); the variation being sinusoidal.



The mean position of the particle is at:

1. $x = 0$ cm
2. $x = 6$ cm
3. $x = 3$ cm
4. $x = 2$ cm

35 An organ pipe, open at both ends, is excited (i.e., played). The possible frequencies consist of:

1.	Odd harmonics	2.	Even harmonics
3.	All harmonics	4.	Sub-harmonics

PHYSICS - SECTION B

36 When two tuning forks with nearly equal frequencies (say: 100 Hz and 102 Hz) are sounded together,

1.	Beats of frequency 2 Hz are heard
2.	Beats of frequency 101 Hz are heard
3.	Echo of frequency 202 Hz is heard
4.	Standing waves of frequency 202 Hz are formed

37 In which of the following media is the speed of sound the highest?

1.	Air	2.	Hydrogen
3.	Water	4.	Steel

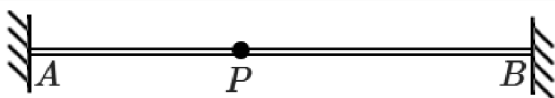
38 A sonometer wire resonates with a given tuning fork forming standing waves with five antinodes between the two bridges when a mass of 9 kg is suspended from the wire. When this mass is replaced by a mass M , the wire resonates with the same tuning fork, forming three antinodes for the same positions of the bridges. The value of M is:

1. 25 kg
2. 5 kg
3. 12.5 kg
4. $\frac{1}{25}$ kg

39 Two waves can be expressed as $x = 4 \sin\left(\omega t + kx + \frac{\pi}{3}\right)$ and $x' = 3 \cos(\omega t + kx)$. The phase difference between the two waves is:

1. $\frac{\pi}{3}$ rad
2. $\frac{\pi}{6}$ rad
3. $\frac{\pi}{2}$ rad
4. π rad

40 A string (AB) under tension has a fundamental frequency of 120 Hz. The string is set into vibration and a point P is held down by a finger so that it becomes a node (i.e., P does not vibrate): $\frac{AP}{PB} = \frac{1}{2}$. The lowest frequency for which this happens is:

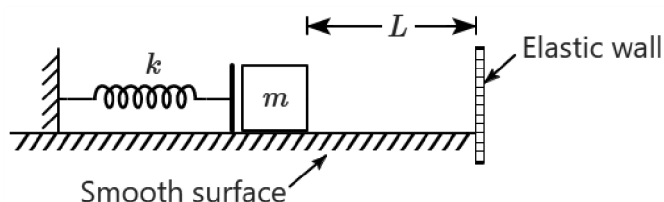


1. 120 Hz
2. 240 Hz
3. 360 Hz
4. 180 Hz

41 The first overtone of a string (A) fixed at both ends is in resonance with the second overtone of a similar string (B), also fixed at both ends. Both strings are under the same tension and have the same mass per unit length. Their respective lengths are L_A and L_B . Then:

1. $L_A = 2L_B$	2. $L_A = \frac{L_B}{2}$
3. $2L_A = 3L_B$	4. $\frac{L_A}{2} = \frac{L_B}{3}$

42 A block of mass m lies close to a spring of stiffness k , separated from a wall at a distance L on the other side. If the block is imparted a speed v towards the spring, it compresses the spring and then rebounds with the same speed v – completing a half-oscillation. Then it collides with the wall and returns.



The period of the complete motion is:

1. $2\pi\sqrt{\frac{m}{k}} + \frac{L}{v}$	2. $\pi\sqrt{\frac{m}{k}} + \frac{L}{v}$
3. $2\pi\sqrt{\frac{m}{k}} + \frac{2L}{v}$	4. $\pi\sqrt{\frac{m}{k}} + \frac{2L}{v}$

43 The sound of thunder is heard 3 s after the flash of lightning is observed. The speed of sound in air is nearly 330 m/s. The distance of the lightning strike is nearly: (assume speed of light is infinite)

1. 500 m
2. 1 km
3. 2 km
4. 1.5 km

44 When a travelling wave is reflected off a fixed end, the reflected wave has:

1. the same frequency
2. a lower frequency
3. a higher frequency
4. a higher and a lower frequency

45 Two sound waves of the same frequency arrive at point P, one with amplitude 0.3 Pa, and the other with amplitude 0.5 Pa. Which of the following gives the range of possible amplitudes for sound at point P?

1. 0 – 0.5 Pa	2. 0.2 – 0.5 Pa
3. 0.2 – 0.8 Pa	4. 0.3 – 0.8 Pa

46 Match the types of motion in List-I with their corresponding examples in List-II.

List-I	List-II
(a) motion with constant speed	(i) SHM
(b) motion with constant acceleration	(ii) uniform circular motion
(c) oscillatory motion	(iii) projectile motion
(d) random motion	(iv) molecular motion in gas

Codes:

1.	a - (iv), b - (ii), c - (iii), d - (i)
2.	a - (i), b - (iii), c - (ii), d - (iv)
3.	a - (ii), b - (iii), c - (i), d - (iv)
4.	a - (ii), b - (iii), c - (iv), d - (i)

47 A guitar string and an open organ pipe are set into vibration and they are observed to be in resonance. At resonance,

1.	the frequencies of the mechanical vibrations on the respective instruments are equal
2.	the wavelengths of the mechanical vibrations on the respective instruments are equal
3.	both the frequencies and wavelengths of the mechanical vibrations on the respective instruments are equal
4.	either the frequencies or the wavelengths of the mechanical vibrations on the respective instruments are equal

48 A sinusoidal waveform whose displacement is given

$$\text{by: } y(x, t) = (5 \text{ mm}) \sin 2\pi \left(\frac{x}{2 \text{ m}} + \frac{t}{0.01 \text{ s}} \right)$$

propagates along the x -axis.

Which, of the following statement, is true?

1.	The wave propagates along the positive x -axis with a speed of 500 mm/s
2.	The wave propagates along the negative x -axis with a speed of 500 mm/s
3.	The wave propagates, along the positive x -axis with a speed of 200 m/s
4.	The wave propagates along the negative x -axis with a speed of 200 m/s

49 A stone is dropped from the top of a hillock and the sound of it striking the ground is heard 4.25 s later. The speed of sound in air is 320 m/s and the value of g is 10 m/s^2 . The time, required by the stone to reach the bottom, is:

- 4 s
- 2.125 s
- 0.25 s
- 2 s

50 Let the wave number of a sound wave be n and the wavelength of the wave be λ . The dimension of the product $n\lambda$ is:

1.	L	2.	L^2
3.	LT^{-1}	4.	dimensionless

CHEMISTRY - SECTION A

51 The correct order of C-C bond lengths of the following molecules are:

- $\text{C}_2\text{H}_6 > \text{C}_2\text{H}_4 > \text{C}_6\text{H}_6 > \text{C}_2\text{H}_2$
- $\text{C}_2\text{H}_2 < \text{C}_2\text{H}_4 < \text{C}_6\text{H}_6 < \text{C}_2\text{H}_6$
- $\text{C}_2\text{H}_6 > \text{C}_2\text{H}_2 > \text{C}_6\text{H}_6 > \text{C}_2\text{H}_4$
- $\text{C}_2\text{H}_4 > \text{C}_2\text{H}_6 > \text{C}_2\text{H}_2 > \text{C}_6\text{H}_6$

52 Consider the following statements about the electromeric effect in organic compounds:

a:	It is a temporary effect.
b:	Alkenes and alkynes show this effect.
c:	This effect operates in presence of an attacking reagent only.

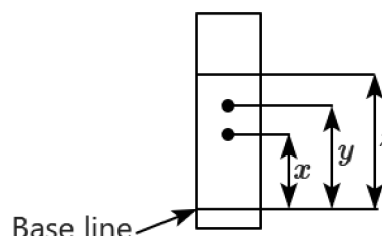
The correct statements are:

- (a) and (b) only
- (b) and (c) only
- (a), (b) and (c)
- (a) and (c) only

53 The compound for which the heat of hydrogenation is the smallest, among the following, is:

- But-1-ene
- 2,3-Dimethylbut-2-ene
- But-2-ene
- Pent-2-ene

54 Given below is the developed chromatogram of a mixture of pigments



R_f values for x and y , respectively, can be expressed as:

- $\frac{x}{z}, \frac{y}{z}$
- $\frac{x}{y}, \frac{y}{z}$
- xz, yz
- $\frac{z}{x}, \frac{z}{y}$

55 Match the following:

List-1 (Compound)	List-2 (Composition)
A. Baeyer's reagent	i. Pd/BaSO_4 / Quinoline
B. Lindlar's catalyst	ii. Ammoniacal silver nitrate
C. Tollen's reagent	iii. Alkaline potassium permanganate
D. Wurtz reaction	iv. Na, dry ether
	v. Br_2 in CCl_4

The correct match is:

	A	B	C	D
1.	iii	i	iv	ii
2.	ii	i	v	iv
3.	v	ii	i	iii
4.	iii	i	ii	iv

56 The electron pair in the π - bond of an alkene has:

1.	33% p character and are at a lower energy level than the electron pair in the σ - bond.
2.	50% p character and are at a higher energy level than the electron pair in the σ - bond.
3.	100% p character and are at a lower energy level than the electron pair in the σ - bond.
4.	100% p character and are at a higher energy level than the electron pair in the σ - bond.

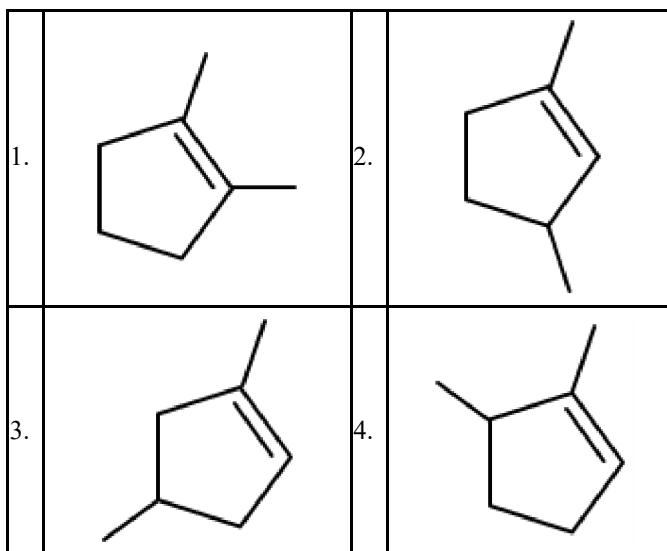
57 The number of sp^2 hybrid orbitals in a molecule of benzene are:

1. 24
2. 6
3. 18
4. 12

58 The incorrect statement, among the following, is:

1.	Free radicals, carbonium ions, or carbanions are reaction intermediates.
2.	The reaction between methane and chlorine in the presence of sunlight proceeds via free radicals.
3.	The electronegative atom in the carbon chain produces the +I effect.
4.	Homolytic fission of C-C bonds gives free radicals.

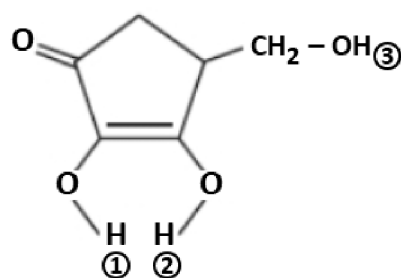
59 A compound X undergoes ozonolysis to yield 5-oxo-2-methylhexanal.
The structure of X is:



60 The type of isomerism shown by CH_3CONH_2 and HCONHCH_3 is:

1. Position isomerism
2. Chain isomerism
3. Tautomerism
4. Functional isomerism

61



The correct order of the rate of expulsion of hydrogen as H^+ in the above figure is:

1. $1 > 2 > 3$
2. $2 > 3 > 1$
3. $2 > 1 > 3$
4. $3 > 2 > 1$

62 The total number of isomers for $\text{C}_4\text{H}_{10}\text{O}$ are (including stereoisomers):

1. 4
2. 5
3. 7
4. 8

63 The oxidation state of Mo in Ammonium phosphomolybdate is:

- +5
- +4
- +6
- +3

64

A.	$(C_6H_5)_3\dot{C}$
B.	$(CH_3)_2\dot{C}H$
C.	$(C_6H_5)_2\dot{C}CH_3$
D.	$C_6H_5\dot{C}(CH_3)_2$

For the free radical given above, correct option for decreasing order of stability is:

- $A > C > D > B$
- $A > B > C > D$
- $B > A > C > D$
- $B > D > A > C$

65 Match column I with column II and mark the appropriate choice:

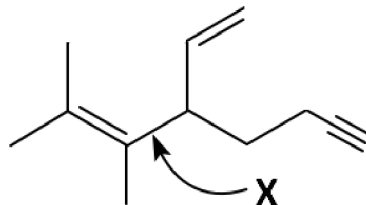
	Column I		Column II
(A)	Alkyl halide + Sodium in presence of dry ether	(i)	Sulphonation
(B)	Arene + Acid halide in presence of $AlCl_3$	(ii)	Wurtz reaction
(C)	Arene + Fuming sulphuric acid	(iii)	Catalytic hydrogenation
(D)	Arene + Hydrogen in presence of Ni	(iv)	Friedel-Crafts reaction

- (A) \rightarrow (i), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (iv)
- (A) \rightarrow (iv), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (i)
- (A) \rightarrow (iii), (B) \rightarrow (i), (C) \rightarrow (iv), (D) \rightarrow (ii)
- (A) \rightarrow (ii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (iii)

66 The correct statement regarding the comparison of staggered and eclipsed conformations of ethane is:

1.	The eclipsed conformation of ethane is more stable than staggered conformation because eclipsed conformation has no torsional strain
2.	The eclipsed conformation of ethane is more stable than staggered conformation even though the eclipsed conformation has a torsional strain
3.	The staggered conformation of ethane is more stable than the eclipsed conformation because staggered conformation has no torsional strain
4.	The staggered conformation of ethane is less stable than eclipsed conformation because staggered conformation has torsional strain

67 Bond X in the image given below is formed by the overlapping of:



- sp and sp^3 orbitals
- sp and sp^2 orbitals
- sp^2 and sp^3 orbitals
- None of the above

68 p-nitrophenol and o-nitrophenol are separated by:

- Distillation
- Steam distillation
- Crystallisation
- Fractional crystallisation

69

Statement I:	$HCOOH$ is more acidic than C_6H_5COOH .
Statement II:	CH_3COOH is less acidic than C_6H_5COOH .

1.	Statement I is correct and Statement II is incorrect.
2.	Statement I is incorrect and Statement II is incorrect.
3.	Statement I is correct and Statement II is correct.
4.	Statement I is incorrect and Statement II is correct.

70 Sum of number of α -hydrogens in the following two compounds is :

(i)	(ii)

- 13
- 14
- 15
- 16

71 The enolic form of an acetone contains:

1. 9 sigma bonds, 1 pi bond, and 2 lone pairs of electrons
2. 8 sigma bonds, 2 pi bonds, and 2 lone pairs of electrons
3. 10 sigma bonds, 1 pi bond, and 1 lone pair of electrons
4. 9 sigma bonds, 2 pi bonds, and 1 lone pair of electrons

72 Given below are two statements:

Statement I:	Friedel Crafts acylation of benzene is done using acetic anhydride in the presence of anhydrous $AlCl_3$.
Statement II:	Friedel Crafts acylation is an example of an electrophilic substitution reaction.

In light of the above statements, choose the correct answer from the options given below:

1.	Only Statement I is correct.
2.	Only Statement II is correct.
3.	Both Statements I and II are correct.
4.	Both Statement I and II are false.

73 Consider the following statements:

a:	n-Hexane on heating in the presence of anhydrous aluminium chloride and hydrogen chloride gas isomerises to branched chain alkanes.
b:	2-Methylpropane is oxidised to 2-Methylpropan-2-ol by potassium permanganate.
c:	Methane reacts with steam at 1273 K in the presence of nickel catalyst to form carbon dioxide and dihydrogen.

The correct statements are:

1. (a) and (b) only
2. (b) and (c) only
3. (a) and (c) only
4. (a), (b) and (c)

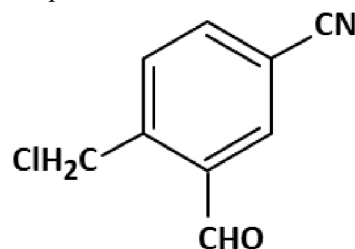
74 Consider the following reactions.

(i)	$CH_4 + O_2 \xrightarrow[\Delta]{MoO_3} A(\text{major})$
(ii)	$(CH_3)_3CH \xrightarrow{KMnO_4} B(\text{major})$

Major products (A) and (B), respectively, are:

1. Methanol and acetone
2. Methanal and Acetaldehyde
3. Methanal and 2-Methylpropan-2-ol
4. Methanol and 2-Methylpropan-2-ol

75 The number of sigma and pi bonds, respectively, in the given organic compound are:



1. 15 sigma and 6 pi bonds
2. 18 sigma and 6 pi bonds
3. 18 sigma and 3 pi bonds
4. 15 sigma and 3 pi bonds

76 The correct order of nucleophilicity, among the following, is:

1. $NH_2^- > NH_3$
2. $H_2O > OH^-$
3. $F^- < I^-$
4. $Ph-O^- > OH^-$

77 The minimum number of carbon atoms in an alkane having four primary carbon atoms are:

1. 4
2. 8
3. 5
4. 6

78 The compound with the highest enolic content, among the following, is:

1.		2.	
3.		4.	

79 The pair of structures that does not represent isomers is:

1.		2.	
3.		4.	

80 The strongest ortho/para directing group is:

1. $-\text{NH}_2$
2. $-\text{CH}_3$
3. $-\text{Cl}$
4. $-\text{C}_2\text{H}_5$

81 Identify number of compounds, among the following, that have the same degree of unsaturation:

- (A) $\text{CH}_3 - \text{CH} = \text{CH} - \text{C} \equiv \text{N}$
- (B) $\text{CH}_3 - \text{N} = \text{CH} - \text{C} \equiv \text{CH}$
- (C) $\text{CH} \equiv \text{C} - \text{NH} - \text{CH} = \text{CH}_2$
- (D) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{C} \equiv \text{N}$

1. 2
2. 3
3. 0
4. 4

82 The number of chiral carbons in each of the following compounds is, respectively,:

(I).		(II).	
(III).		(IV).	

1. 0, 2, 2, 4
2. 2, 2, 0, 4
3. 1, 2, 2, 4
4. 2, 2, 2, 4

83 Which of the organic compounds will give blood red colour in the Lassaigne test?

1.	$\text{C}_6\text{H}_5\text{NH}_2$	2.	$\text{H}_2\text{N} - \overset{\text{S}}{\underset{\parallel}{\text{C}}} - \text{NH}_2$
3.	$\text{H}_2\text{N} - \overset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{NH}_2$	4.	None of these

84 Given the following compounds:

- (a) Heptane
- (b) Butane
- (c) 2-Methylbutane
- (d) 2-Methylpropane
- (e) Hexane

For the compounds given above, the correct option capturing decreasing order of boiling points is:

1. (a) > (c) > (e) > (d) > (b)	2. (c) > (d) > (a) > (e) > (b)
3. (a) > (e) > (b) > (c) > (d)	4. (a) > (e) > (c) > (b) > (d)

85

Assertion (A):	A free radical is a paramagnetic species.
Reason (R):	A free radical is formed by the homolytic fission of a covalent bond.

1.	Both (A) and (R) are true, and (R) is the correct explanation of (A).
2.	Both (A) and (R) are true, but (R) is not the correct explanation of (A).
3.	(A) is true, but (R) is false.
4.	Both (A) and (R) are false.

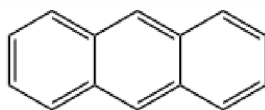
CHEMISTRY - SECTION B

86

Assertion (A):	$\text{CH}_3 - \text{C} \equiv \text{CH}$ is more polar than $\text{CH}_3 - \text{CH} = \text{CH}_2$.
Reason (R):	sp hybridised carbon is more electro-negative than sp^2 hybridised carbon.

1.	Both (A) and (R) are True and (R) is the correct explanation of (A).
2.	Both (A) and (R) are True but (R) is not the correct explanation of (A).
3.	(A) is True but (R) is False.
4.	Both (A) and (R) are False.

87 Anthracene is an aromatic compound that is described by the following characteristics:



Anthracene

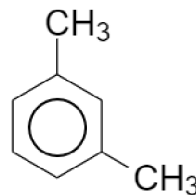
I.	Cyclic
II.	Planar
III.	Satisfies Huckel's rule
IV.	Has an even number of π electrons

1.	I and II only	2.	II, III, and IV only
3.	I, III, and IV only	4.	I, II, III, and IV

88 The reaction of ethene with Baeyer's reagent generates:

1.	Ethane	2.	Ethene
3.	Diethyl ether	4.	Ethylene glycol

89 The product(s) that are formed when the given compound is treated with Br_2 in the presence of FeBr_3 are:

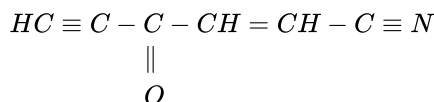


1.		2.	and
3.	and 	4.	and

90 Lewis acid(s) that can be used during the ethylation of benzene is/are:

1. FeCl_3
2. SnCl_4
3. BF_3
4. All of the above

91 The number of acetylenic bonds in the given compound is/are :



1. 2
2. 3
3. 1
4. 4

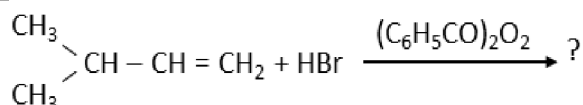
92 Which compound, from the following, has the highest dipole moment?

1.		2.	
3.		4.	

93 The reaction, among the following, that cannot produce ethane is:

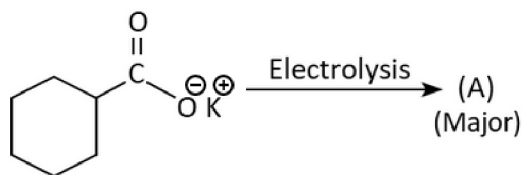
1. $CH_3 - Cl \xrightarrow[\text{dry ether}]{Na}$
2. $CH_3 - COOH \xrightarrow[\text{lime}]{\text{Soda}}$
3. $CH_3 - COOK \xrightarrow{\text{electrolysis}}$
4. $CH_3 - CH_2 - O - CH_2 - CH_3 \xrightarrow[HI]{\text{Red P}}$

94 The major product of the following chemical reaction is:



1.	
2.	
3.	
4.	

95



The major product (A) in the above reaction is:

1.		2.	
3.		4.	

96 The most stable bond, based on the data given below, is formed between:

Bond	Energy (kJ/mol)
$C_2H_5 - Cl$	339
$C_2H_5 - CH_3$	356
$H_2C = CH - Cl$	352
$H_2C = CH - CH_3$	385
$C_6H_5 - Cl$	360
$C_6H_5 - CH_3$	389

1. A saturated alkyl group and a halogen.
2. A saturated alkyl group and a methyl group.
3. An unsaturated alkyl group and a halogen.
4. An unsaturated alkyl group and a methyl group.

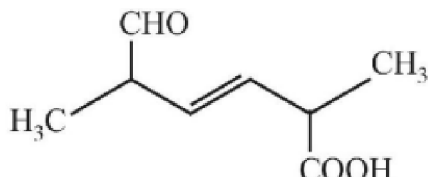
97 The least resonance-stabilized molecule among the following is:

1.		2.	
3.		4.	

98 The electrophile used in the sulphonation of benzene is:

1. $^+\text{SO}_3\text{H}$
2. SO_3
3. SO_2
4. $^+\text{SO}_3$

99 The IUPAC name for the following compound is :



1. 2, 5-Dimethyl-5-carboxy-hex-3-enal
2. 2, 5-Dimethyl-6-carboxy-hex-3-enal
3. 2, 5-Dimethyl-6-oxo-hex-3-enoic acid
4. 6-Formyl-2-methyl-hex-3-enoic acid

100 The product obtained when Al_4C_3 reacts with D_2O is:

1.	$\begin{array}{c} \text{O} \\ \\ \text{CD}_3 - \text{C} - \text{CD}_3 \end{array}$
2.	$\text{CD}_3 - \text{C} = \text{CD}$
3.	C_2D_4
4.	CD_4

begin

BIOLOGY I - SECTION A

101 Consider the given two statements:

Statement I:	Eukaryotes have a membrane bound nucleus, prokaryotes do not. Prokaryotes may have non-membrane organelles, eukaryotes do not.
Statement II:	In 1839, Theodore Schwann, a British Zoologist, studied different types of animal cells and reported that cells had a thin outer layer which is today known as the 'plasma membrane'.

1. **Statement I** is correct; **Statement II** is correct
2. **Statement I** is incorrect; **Statement II** is correct
3. **Statement I** is correct; **Statement II** is incorrect
4. **Statement I** is incorrect; **Statement II** is incorrect

102 Consider the given two statements:

Statement I:	The outer nuclear membrane usually remains continuous with the endoplasmic reticulum and also bears ribosomes on it.
Statement II:	Nuclear pores are the passages through which movement of RNA from nucleus to the cytoplasm and protein molecules from the cytoplasm to the nucleus takes place.

1. **Statement I** is correct; **Statement II** is correct
2. **Statement I** is correct; **Statement II** is incorrect
3. **Statement I** is incorrect; **Statement II** is correct
4. **Statement I** is incorrect; **Statement II** is incorrect

103 Plant and animal cells are different. Identify the correct difference:

I:	Plant cells possess cell walls, plastids and a large central vacuole which are absent in animal cells.
II:	Animal cells have centrioles which are absent in almost all plant cells.

1. Only **I** is correct
2. Only **II** is correct
3. Both **I** and **II** are correct
4. Both **I** and **II** are incorrect

104 Reserve material in prokaryotic cells is stored in the cytoplasm in the form of:

1.	inclusion bodies	2.	carboxysomes
3.	magnetosomes	4.	chromatophores

105 The nucleus was discovered by:

1. Robert Hooke
2. Robert Brown
3. Anton Von Leeuwenhoek
4. Purkinje

106 Identify the incorrect statement:

1.	Centrosome is an organelle usually containing two cylindrical structures called centrioles.
2.	Both the centrioles in a centrosome lie parallel to each other in which each has an organisation like the cartwheel.
3.	Centrioles are made up of nine evenly spaced peripheral fibrils of tubulin protein where each of the peripheral fibril is a triplet.
4.	The central part of the proximal region of the centriole is also proteinaceous and called the hub.

107 Mesosome in bacterial cells is not involved in:

1. cell wall formation
2. DNA replication and distribution to daughter cell
3. respiration
4. photosynthesis

108 How many of the given statements regarding cell wall are true?

I:	A non-living rigid structure called the cell wall forms an outer covering for the plasma membrane of fungi and plants.
II:	Cell wall not only gives shape to the cell and protects the cell from mechanical damage and infection, it also helps in cell-to-cell interaction and provides barrier to undesirable macromolecules.
III:	Algae have cell wall, made of cellulose, galactans, mannans and minerals like calcium carbonate, while in other plants it consists of cellulose, hemicellulose, pectins and proteins.
IV:	The cell wall of a young plant cell, the primary wall is capable of growth.
V:	The secondary wall is formed on the outer (towards middle lamella) side of the cell.

1. 2
2. 3
3. 4
4. 5

109 Resistance to an antibiotic is the character conferred to bacterial cell by:

1. Peptidoglycan cell wall
2. Main chromosomal DNA
3. Plasmid DNA
4. Satellite DNA

110 Consider the given two statements:

Statement I:	In 1838, Matthias Schleiden, a German botanist, examined a large number of plants and observed that the presence of cell wall is a unique character of the plant cells.
Statement II:	In 1839, Theodore Schwann, a British Zoologist, studied different types of animal cells and reported that cells had a thin outer layer which is today known as the 'plasma membrane'.

1. **Statement I** is correct; **Statement II** is correct
2. **Statement I** is correct; **Statement II** is incorrect
3. **Statement I** is incorrect; **Statement II** is correct
4. **Statement I** is incorrect; **Statement II** is incorrect

111 The endomembrane system of a typical eukaryotic cell includes all the following except:

1. Lysosomes	2. Golgi Apparatus
3. Vacuole	4. Mitochondria

112 Sodium ions will be transported to the outside of the cell and potassium ions to the inside of the cell by:

1. simple diffusion	2. facilitated diffusion
3. osmosis	4. active transport

113 An elaborate network of filamentous proteinaceous structures consisting of microtubules, microfilaments and intermediate filaments present in the cytoplasm of eukaryotic cells is collectively referred to as the:

1. cytoskeleton	2. MTOC
3. Contractile elements	4. vimentin

114 Consider the given two statements:

Assertion (A):	In eukaryotic cells, there is an extensive compartmentalisation of cytoplasm.
Reason (R):	Eukaryotic cells possess an organised nucleus with a nuclear envelope.

1.	Both (A) and (R) are True and (R) correctly explains the (A).
2.	Both (A) and (R) are True but (R) does not correctly explain the (A).
3.	(A) is True; (R) is False
4.	Both (A) and (R) are False

115 What type of plastids store oils and fats in plant cells?

1. Chromoplasts	2. Amyloplasts
3. Elaioplasts	4. Aleuroplasts

116 Ribosomes are the site of protein synthesis. Identify the correct statement:

I:	Several ribosomes may attach to a single mRNA and form a chain called polyribosomes or polysome.
II:	The ribosomes of a polysome translate the mRNA into different proteins.

1. Only I	2. Only II
3. Both I and II	4. Neither I nor II

117 Animal cells contain a non-membrane bound organelle which helps in cell division. This organelle is called:

1. Golgi apparatus	2. Mesosome
3. Centrosome	4. Centromere

118 Regarding the genetic material in prokaryotes:

I: The main chromosomal DNA is linear

II: Plasmid DNA is circular

1. Only **I** is correct
2. Only **II** is correct
3. Both **I** and **II** are correct
4. Both **I** and **II** are incorrect

119 Out of the four basic shapes:

1.	Spherical bacteria are called as Coccus and Rod shaped bacteria are called as Bacillus
2.	Spherical bacteria are called as Bacillus and Rod shaped bacteria are called as Coccus
3.	Spherical bacteria are called as Spirillum and Rod shaped bacteria are called as Vibrios
4.	Comma shaped bacteria are called as Vibrios and Spherical bacteria are called as Spirillum

120 That cells divide and new cells are formed from pre-existing cells (Omnis cellula-e cellula) was first explained by:

1.	Louis Pasteur	2.	Robert Koch
3.	Rudolph Virchow	4.	Francesco Redi

121 How many of the given statements are true?

I:	ER divides the intracellular space into two distinct compartments, i.e., luminal (inside ER) and extra luminal (cytoplasm) compartments.
II:	RER is frequently observed in the cells actively involved in protein synthesis and secretion.
III:	RER are extensive and continuous with the outer membrane of the nucleus.
IV:	The smooth endoplasmic reticulum is the major site for synthesis of lipid.
V:	In animal cells, lipid-like steroidal hormones are synthesised in SER.

1. 2
2. 3
3. 4
4. 5

122 The correct description of prokaryotic ribosomes will be:

1.	They are about 15 nm by 20 nm in size and are made of two subunits - 50S and 30S units which when present together form 70S prokaryotic ribosomes.
2.	They are about 15 nm by 20 nm in size and are made of two subunits - 40S and 30S units which when present together form 70S prokaryotic ribosomes.
3.	They are about 20 nm by 25 nm in size and are made of two subunits - 60S and 40S units which when present together form 80S prokaryotic ribosomes.
4.	They are about 25 nm by 50 nm in size and are made of two subunits - 50S and 20S units which when present together form 70S prokaryotic ribosomes.

123 Which organelle must be specifically stained with a vital dye such as Janus green so that it can be seen under a microscope?

1.	SER	2.	Mitochondria
3.	Chloroplasts	4.	Vacuoles

124 The middle lamella is a layer of the cell wall complex in plant cells and is composed mainly of:

1.	Sodium alginate	2.	Magnesium silicate
3.	calcium pectate	4.	Aluminium hydroxide

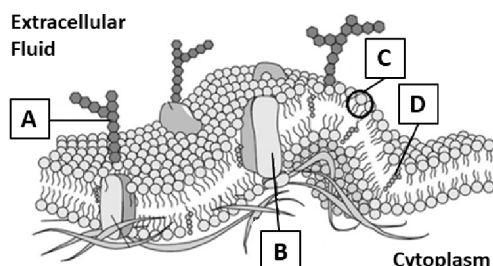
125 What is not true regarding the detailed structure of a typical cell membrane?

1.	The cell membrane is mainly composed of lipids and proteins.
2.	The major lipids are phospholipids that are arranged in a bilayer.
3.	The lipids are arranged within the membrane with the polar head towards the inner sides and the hydrophobic tails towards the outer part.
4.	In addition to phospholipids, membrane also contains cholesterol.

126 Tonoplast is:

1. the internal membrane in chloroplast
2. membrane of vacuole
3. membrane of lysosomes
4. membrane of glyoxysomes

127 Which alphabet represents carbohydrate in the given figure?



1. A
2. B
3. C
4. D

128 Unicellular organisms are capable of

I:	independent existence
II:	division
III:	performing the essential functions of life

1. Only **I** and **II** are correct
2. Only **I** and **III** are correct
3. Only **II** and **III** are correct
4. **I**, **II** and **III** are correct

129 Regarding prokaryotes:

I:	All prokaryotes have a cell wall surrounding the cell membrane except in mycoplasma.
II:	All prokaryotes have a cell membrane except in mycoplasma.

1. Only **I** is correct
2. Only **II** is correct
3. Both **I** and **II** are correct
4. Both **I** and **II** are incorrect

130 In human beings, the membrane of the erythrocyte has approximately:

1.	52 per cent protein and 40 per cent lipids.
2.	40 per cent protein and 52 per cent lipids.
3.	50 per cent protein and 40 per cent lipids.
4.	60 per cent protein and 40 per cent lipids.

131 Bacterial cells, if motile, will move with the help of:

1.	Cilia	2.	Flagella
3.	Myocytes	4.	Pseudopodia

132 Consider the two statements:

Statement I:	Besides flagella, Pili and Fimbriae are also surface structures of the bacteria but do not play a role in motility.
Statement II:	Pili and fimbriae help attach the bacteria to rocks in streams and also to the host tissues.

1.	Statement I is correct; Statement II is correct
2.	Statement I is correct; Statement II is incorrect
3.	Statement I is incorrect; Statement II is correct
4.	Statement I is incorrect; Statement II is incorrect

133 Read carefully: Select the location with respect to a eukaryotic cell where ribosomes are not expected to be found?

1. in the cytoplasm
2. within the chloroplasts (in plants)
3. within the mitochondria
4. within the rough ER.

134 Acid hydrolases in a eukaryotic cell are located within:

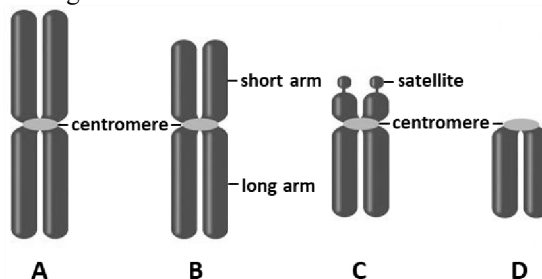
1.	Peroxisomes	2.	Glyoxysomes
3.	Lysosomes	4.	Carboxysomes

135 A peroxisome is a membrane-bound organelle found in the cytoplasm of virtually all eukaryotic cells and contains several oxidases and catalases. Why type of structure is the peroxisome?

1.	Inclusion body	2.	FTS-Z elements
3.	Microbody	4.	Lysosomes

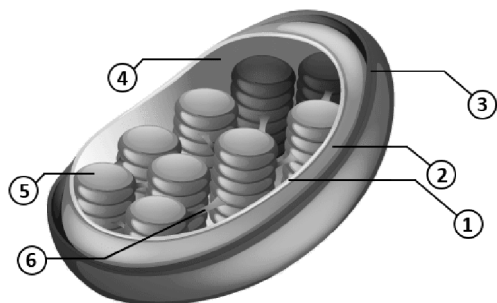
BIOLOGY I - SECTION B

136 Which alphabet represents telocentric chromosomes in the given figure?



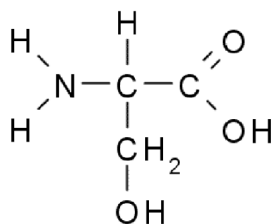
1. A
2. B
3. C
4. D

137 Which number represents the site for carbon fixation in the given figure?



1. 2
2. 4
3. 5
4. 3

138 Identify the amino acid (shown in the molecule given below):

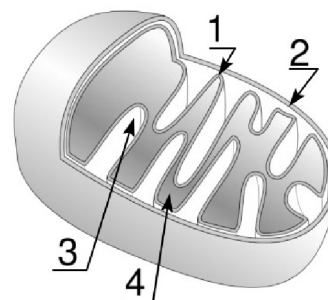


1.	Glycine	2.	Serine
3.	Alanine	4.	Methionine

139 Which of the following is a zwitter ion?

1.	$\begin{array}{c} \text{H} \\ \\ \text{R} - \text{C} - \text{COOH} \\ \\ \text{NH}_2 \end{array}$	2.	$\begin{array}{c} \text{H} \\ \\ \text{R} - \text{C} - \text{COOH} \\ \\ \text{NH}_3^+ \end{array}$
3.	$\begin{array}{c} \text{H} \\ \\ \text{R} - \text{C} - \text{COO}^- \\ \\ \text{NH}_2 \end{array}$	4.	$\begin{array}{c} \text{H} \\ \\ \text{R} - \text{C} - \text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$

140 Which number represents the site for Kreb's cycle in the given figure?



1. 1
2. 2
3. 3
4. 4

141 Identify the incorrect statement:

1.	Each protein is a polymer of amino acids.
2.	A protein is a heteropolymer and not a homopolymer.
3.	Essential amino acids can be synthesized in our body.
4.	Collagen is the most abundant protein in animal world.

142 Which of the following components of the acid insoluble fraction of a cell is not a macromolecule?

1.	proteins	2.	nucleic acids
3.	polysaccharides	4.	lipids

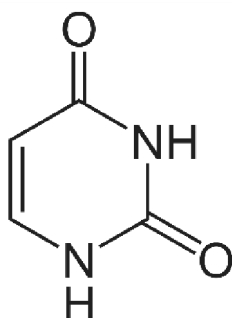
143 Which element makes up the maximum % weight of the human body?

1.	carbon	2.	hydrogen
3.	nitrogen	4.	oxygen

144 Which of the secondary metabolites is an important anti-cancer drug?

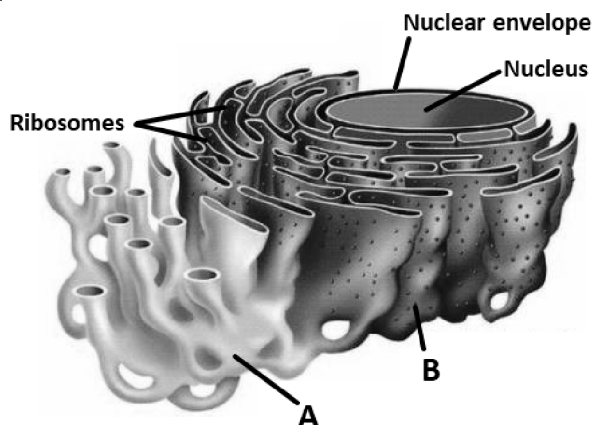
1.	Ricin	2.	Abrin
3.	Vincristine	4.	Atropine

145 Identify the molecule shown in the figure:



1.	Uracil	2.	Thymine
3.	Cytosine	4.	Guanine

146 What are A and B in the given figure?



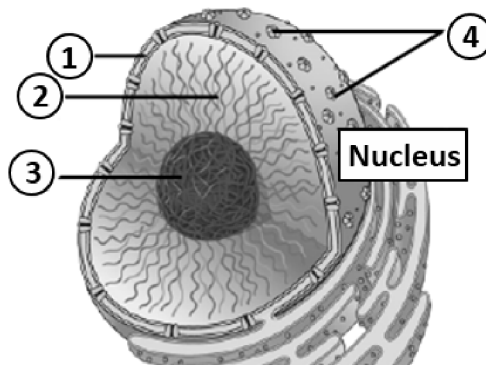
	A	B
1.	SER	RER
2.	RER	SER
3.	RER	Golgi apparatus
4.	SER	Golgi apparatus

147 State whether the given statements are true or false:

Statement I:	Palmitic acid has 16 carbons including carboxyl carbon.
Statement II:	Arachidonic acid has 20 carbon atoms including the carboxyl carbon.
Statement III:	Adenosine, guanosine, thymidine, uridine and cytidine are nucleosides.
Statement IV:	Nucleic acids like DNA and RNA consist of nucleotides only.

	Statement I	Statement II	Statement III	Statement IV
1.	T	T	T	T
2.	T	T	F	F
3.	F	F	T	T
4.	F	F	F	F

148 Which number represents the site of ribosome biogenesis in the given figure?



1. 1
2. 2
3. 3
4. 4

149 All the following are aromatic amino acids except:

1.	tyrosine	2.	phenylalanine
3.	tryptophan	4.	threonine

150 If we represent the chemical composition of living tissue from abundance point of view, the most abundant chemical in living organisms is:

1.	Water	2.	Carbohydrates
3.	Proteins	4.	Lipids

BIOLOGY II - SECTION A

151 Anaphase stage of mitosis is characterised which of the following key events?

Statement I:	Centromeres split and chromatids separate.
Statement II:	Chromatids move to opposite poles.

- | | |
|----|---|
| 1. | Statement I is correct and Statement II is incorrect. |
| 2. | Statement I is incorrect and Statement II is incorrect. |
| 3. | Statement I is correct and Statement II is correct. |
| 4. | Statement I is incorrect and Statement II is correct. |

152 In a polypeptide or a protein, amino acids are linked by a peptide bond which is formed:

I:	when the carboxyl (-COOH) group of one amino acid reacts with the amino (-NH ₂) group of the next amino acid
II:	with the elimination of a water moiety (the process is called dehydration)

1. Only **I**
2. Only **II**
3. Both **I** and **II**
4. Neither **I** nor **II**

153 What will not be true for the S Phase of the interphase in the cell cycle?

- | | |
|----|--|
| 1. | It marks the period during which DNA synthesis or replication takes place. |
| 2. | During this time, the amount of DNA per cell doubles. |
| 3. | If the initial amount of DNA is denoted as 2C then it increases to 4C. |
| 4. | There is an increase in the chromosome number. |

154 The famous Watson-Crick model of DNA helix describes its:

1.	Primary structure	2.	Secondary structure
3.	Tertiary structure	4.	Quaternary structure

155 Which of the following will not be correct for the steps of the catalytic cycle of an enzyme action?

- | | |
|----|---|
| 1. | First, the substrate binds to the active site of the enzyme, fitting into the active site. |
| 2. | The binding of the substrate induces the enzyme to alter its shape, fitting more tightly around the substrate. |
| 3. | The active site of the enzyme, now in close proximity of the substrate, breaks the chemical bonds of the substrate and the new enzyme- product complex is formed. |
| 4. | The enzyme gets consumed in the reaction while releasing the product. |

156 In the absence of an enzyme, the reaction catalysed by this enzyme:

1. will not take place
2. is very slow
3. produces some other product
4. gets faster

157 Inhibition of succinic dehydrogenase by malonate is a n example of:

1. Competitive inhibition
2. Non-competitive inhibition
3. Un-competitive inhibition
4. Allosteric feedback inhibition

158 Consider the given two statements:

Assertion (A):	High temperature destroys enzymatic activity.
Reason (R):	Enzymes generally function in a narrow range of temperatures.

- | | |
|----|--|
| 1. | Both (A) and (R) are True and (R) correctly explains the (A) . |
| 2. | Both (A) and (R) are True but the (R) does not correctly explain the (A) . |
| 3. | (A) is True; (R) is False |
| 4. | Both (A) and (R) are False |

159 Identify the correct statements:

a:	Plant cell walls are made of cellulose.
b:	Fungal cell walls are made of chitin.
c:	True bacterial cell walls are made of lipopolysaccharides.
d:	Archaeal cell walls are made of sporopollenin.

1. Only **a** and **b**
2. Only **a** and **c**
3. Only **b** and **c**
4. Only **c** and **d**

160 Co-enzymes:

I:	are organic compounds associated permanently with the apoenzyme.
II:	serve as co-factors in a number of different enzyme catalyzed reactions.
III:	have, many of them, vitamins as their essential chemical components.

1. Only **I** and **II** are correct
2. Only **I** and **III** are correct
3. Only **II** and **III** are correct
4. **I, II** and **III** are correct

161 Enzymes that catalyse removal of groups from substrates by mechanisms other than hydrolysis leaving double bonds are classified as:

1. Lyases	2. Ligases
3. Transferases	4. Oxidoreductases

162 The direction of a phosphodiester bond [in a polynucleotide chain] is:

1. 5' – 3'	2. 3' – 5'
3. 1' – 3'	4. 3' – 1'

163 In plant cells:

I:	during the S phase, DNA replication begins in the nucleus.
II:	during the S phase, the centriole duplicates in the cytoplasm.
III:	during the G ₂ phase, proteins are synthesised in preparation for mitosis
IV:	cell growth stops during S phase and G ₂ phase.

1. **I** is correct; **II**, **III** & **IV** are incorrect
2. **I** & **IV** are correct; **II** & **III** are incorrect
3. **I** & **III** are correct; **II** and **IV** are incorrect
4. All the statements: **I**, **II**, **III** & **IV** are correct.

164 Kinetochore:

I:	are small disc-shaped structures at the surface of the centromeres.
II:	serve as the sites of attachment of spindle fibres to the chromosomes.
III:	are same as centromeres.

1. **I** is correct; **II** & **III** are incorrect
2. **I** & **II** are correct; **III** is incorrect
3. **I**, **II** & **III** are correct
4. **I**, **II** & **III** are not correct.

165 Adult human haemoglobin consists of:

- I:** 4 subunits.
II: 4 types of subunits.
1. Only **I** is correct
 2. Only **II** is correct
 3. Both **I** and **II** are correct
 4. Both **I** and **II** are incorrect

166 Onion root tip cell has 16 chromosomes. This cell will have 16 chromosomes:

- I:** at G₁ phase
II: after S phase
III: after M phase
1. **I** is correct; **II** & **III** are incorrect
 2. **I** & **II** are correct; **III** is incorrect
 3. **I**, **II** & **III** are correct
 4. **I**, **II** & **III** are not correct

167 Haem:

I:	is the prosthetic group in peroxidase and catalase
II:	is not a part of the active site of the peroxidase and catalase

1. Only **I** is correct
2. Only **II** is correct
3. Both **I** and **II** are correct
4. Both **I** and **II** are incorrect

168 In an enzyme catalysed biochemical reaction, the formation of enzyme-substrate complex is:

1. optional and transient
2. obligatory and transient
3. obligatory and permanent
4. needed only in anabolic reactions

169 Cells at the end of prophase, when viewed under the microscope, show:

1. Golgi complexes
2. endoplasmic reticulum
3. nuclear envelope
4. chromosomes

170 Almost all enzymes are proteins but a few may be:

1. nucleic acids	2. carbohydrates
3. lipids	4. metal ions

171 Some cells in adult animals do not appear to exhibit division. A typical example of such a cell will be:

1. Skin epithelial cell	2. Neuron
3. Fibroblast	4. Phagocytes

172 Which end of the glycogen molecule is the reducing end?

1. The left
2. The right
3. The right and the left both
4. Neither the right nor the left

173 Consider the given two statements:

Assertion (A):	Plants continue to grow all their lives.
Reason (R):	All cells in a plant divide all the time.

1.	Both (A) and (R) are True and (R) is the correct explanation of (A).
2.	Both (A) and (R) are True but (R) is not the correct explanation of (A).
3.	(A) is True but (R) is False.
4.	(A) is False but (R) is True.

174 All the following events take place during the telophase stage of mitosis except:

1.	Chromosomes cluster at opposite spindle poles and their identity is lost as discrete elements.
2.	Nuclear envelope develops around the chromosome clusters at each pole forming two daughter nuclei.
3.	Nucleolus, Golgi complex and ER re-form.
4.	Microtubules get organised into spindle fibres.

175 A typical eukaryotic cell cycle is illustrated by human cells in culture. These cells divide once in:

1. about 90 minutes.
2. approximately every 24 hours.
3. nearly one week.
4. 120 days on an average.

176 Which metal ions is required as a co-factor for the proteolytic enzyme carboxypeptidase?

1.	Magnesium	2.	Zinc
3.	Copper	4.	Iron

177 Consider the given two statements:

Assertion (A):	Mitosis is also called as equational division.
Reason (R):	The number of chromosomes in the parent cells undergoing mitosis and progeny cells is the same.

1.	Both (A) and (R) are True and (R) is the correct explanation of (A).
2.	Both (A) and (R) are True but (R) is not the correct explanation of (A).
3.	(A) is True but (R) is False.
4.	(A) is False but (R) is True.

178 Nucleic Acids:

I:	are polynucleotides.
II:	are constituents of the true macromolecular fraction of any living tissue or cell.

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

179 The number of correct statements from the given statements regarding cell division in human somatic cells will be:

I:	The M Phase represents the phase when the actual cell division or mitosis occurs.
II:	The interphase represents the phase between two successive M phases.
III:	The interphase lasts more than 95% of the duration of cell cycle.
IV:	During interphase, the cell is metabolically not active.

1. 1
2. 2
3. 3
4. 4

180 Regarding the primary structure of a protein:

I:	The sequence of amino acids i.e., the positional information in a protein is called the primary structure of a protein.
II:	A protein is imagined as a line, the left end represented by the first amino acid and the right end represented by the last amino acid.
III:	The first amino acid is also called as C-terminal amino acid and the last amino acid is called the N-terminal amino acid.

1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II and III are correct

181 Consider the given two statements:

Assertion (A):	Metaphase is the stage at which morphology of chromosomes is most easily studied.
Reason (R) :	At metaphase, condensation of chromosomes is completed.

1.	Both (A) and (R) are True and (R) is the correct explanation of (A).
2.	Both (A) and (R) are True but (R) is not the correct explanation of (A).
3.	(A) is True but (R) is False.
4.	(A) is False but (R) is True.

182 Consider the two statements:

Statement I:	Whether it is an exothermic or spontaneous reaction or an endothermic or energy requiring reaction, the 'S' has to go through a much higher energy state or transition state.
Statement II:	Enzymes eventually bring down this energy barrier of activation energy making the transition of 'S' to 'P' more easy.

1. **Statement I** is correct; **Statement II** is correct
2. **Statement I** is correct; **Statement II** is incorrect
3. **Statement I** is incorrect; **Statement II** is correct
4. **Statement I** is incorrect; **Statement II** is incorrect

183 Consider the given two statements:

Assertion (A):	With the increase in substrate concentration, the velocity of the enzymatic reaction rises at first and the reaction ultimately reaches a maximum velocity (V_{max}) which is not exceeded by any further rise in concentration of the substrate.
Reason (R)	The enzyme molecules are fewer than the substrate molecules.

1. Both (A) and (R) are True and (R) correctly explains the (A).
2. Both (A) and (R) are True but (R) does not correctly explain the (A).
3. (A) is True; (R) is False
4. Both (A) and (R) are False

184 Identify the incorrect statement regarding prophase stage of mitosis:

1. It follows the G_2 phases of interphase.
2. It is marked by the initiation of condensation of chromosomal material.
3. The centrosome undergoes duplication during this phase in animal cells.
4. By the end of this phase, chromosomes are seen to be composed of two chromatids attached together at the centromere.

185 Consider the given two statements:

Statement I:	In male honeybees, haploid cells divide by mitosis.
Statement II:	Higher plants show mitotic divisions only in diploid cells.

1. **Statement I** is correct and **Statement II** is incorrect.
2. **Statement I** is incorrect and **Statement II** is incorrect.
3. **Statement I** is correct and **Statement II** is correct.
4. **Statement I** is incorrect and **Statement II** is correct.

BIOLOGY II - SECTION B

186 Regarding crossing over:

I:	Crossing over is the exchange of genetic material between two homologous chromosomes.
II:	Crossing over is also an enzyme-mediated process and the enzyme involved is called recombinase.
III:	Crossing over leads to recombination of genetic material on the two chromosomes.

1. **I** is correct; **II** & **III** are incorrect
2. **I** & **II** are correct; **III** is incorrect
3. **I**, **II** & **III** are correct
4. **I**, **II** & **III** are not correct.

187 Which stage of prophase I of meiosis is characterised by the dissolution of the synaptonemal complex and the tendency of the recombined homologous chromosomes of the bivalents to separate from each other except at the sites of crossovers?

1. Zygotene	2. Pachytene
3. Diplotene	4. Diakinesis

188 What is incorrect regarding the second stage of prophase I?

1. It is called Zygotene.
2. Chromosomes start pairing together and this process of association is called synapsis.
3. Such paired chromosomes are called heterologous chromosomes.
4. Chromosome synapsis is accompanied by the formation of complex structure called synaptonemal complex.

189 The correct chronological sequence [earliest to last] of stages of prophase I of meiosis I will be:

1. Leptotene, Pachytene, Zygotene, Diplotene and Diakinesis.
2. Leptotene, Zygotene, Pachytene, Diakinesis and Diplotene.
3. Zygotene, Leptotene, Pachytene, Diplotene and Diakinesis.
4. Leptotene, Zygotene, Pachytene, Diplotene and Diakinesis.

190 Identify the incorrect statement regarding mitosis:

1.	Mitosis usually results in the production of haploid daughter cells with variable genetic complement.
2.	The growth of multicellular organisms is due to mitosis.
3.	Mitosis restores the nucleo-cytoplasmic ratio.
4.	Mitosis replaces lost cells in multicellular organisms.

191 In meiosis, the splitting of the centromere of each chromosome takes place during:

1.	Metaphase I	2.	Metaphase II
3.	Anaphase I	4.	Anaphase II

192 During which stage of prophase I of meiosis I, the four chromatids of each of the bivalent chromosomes become distinct and clearly appear as tetrads?

1.	Leptotene	2.	Zygotene
3.	Pachytene	4.	Diplotene

193 Identify the incorrect statement regarding diakinesis of prophase I of meiosis I:

1.	It is the final stage of meiotic prophase I.
2.	It is marked by terminalisation of chiasmata.
3.	During this phase, the meiotic spindle is assembled to prepare the homologous chromosomes for separation.
4.	By the end of diakinesis, the nucleolus reappears and the nuclear envelope also reappears.

194 During prophase I of meiosis I, recombination between homologous chromosomes is completed:

1. in the Zygotene
2. in the beginning of the Pachytene
3. by the end of Pachytene
4. in the beginning of the Diplotene

195 How many of the given statements are correct?

I:	In an animal cell, cytokinesis is achieved by the appearance of a furrow in the plasma membrane.
II:	In plant cells, wall formation starts in the centre of the cell and grows outward to meet the existing lateral walls.
III:	At the time of cytoplasmic division, organelles like mitochondria and plastids get distributed between the two daughter cells.

1.	0	2.	1
3.	2	4.	3

196 All the following are key features of meiosis except:

1.	Meiosis involves two sequential cycles of nuclear and cell division called meiosis I and meiosis II but only a single cycle of DNA replication.
2.	Meiosis I is initiated after the parental chromosomes have replicated to produce identical sister chromatids at the S phase.
3.	Meiosis involves pairing of homologous chromosomes and recombination between non-sister chromatids of homologous chromosomes.
4.	Four haploid cells are formed at the end of meiosis I.

197 Regarding anaphase I:

Statement I:	The homologous chromosomes separate, while sister chromatids remain associated at their centromeres.
Statement II:	It is the basis of segregation.

1.	Statement I is correct and Statement II is incorrect.
2.	Statement I is incorrect and Statement II is incorrect.
3.	Statement I is correct and Statement II is correct.
4.	Statement I is incorrect and Statement II is correct.

198 In telophase I:

Statement I:	The nuclear membrane and nucleolus reappear.
Statement II:	The chromosomes reach the extremely extended state of the interphase nucleus.

1.	Statement I is correct and Statement II is incorrect.
2.	Statement I is incorrect and Statement II is incorrect.
3.	Statement I is correct and Statement II is correct.
4.	Statement I is incorrect and Statement II is correct.

199 Consider the given two statements:

Assertion (A):	Meiosis is the mechanism by which conservation of specific chromosome number of each species is achieved across generations in sexually reproducing organisms.
Reason (R):	Meiosis results in reduction of chromosome number by half in gametes.

1.	Both (A) and (R) are True and (R) is the correct explanation of (A).
2.	Both (A) and (R) are True but (R) is not the correct explanation of (A).
3.	(A) is True but (R) is False.
4.	(A) is False but (R) is True.

200 Consider the given two statements:

Statement I:	At Metaphase I the chromosomes align at the equator and the microtubules from opposite poles of the spindle get attached to the kinetochores of sister chromatids.
Statement II:	At metaphase II the bivalent chromosomes align on the equatorial plate and microtubules from the opposite poles of the spindle attach to the kinetochore of homologous chromosomes.

1.	Statement I is correct and Statement II is incorrect.
2.	Statement I is incorrect and Statement II is incorrect.
3.	Statement I is correct and Statement II is correct.
4.	Statement I is incorrect and Statement II is correct.

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