

 प्रा. मोटेगावकर सरांचे RCC		 ध्येय : नाही त्या गोर्धेचे आकर्षण सेऊ आपली वेळ आणि उर्जा विनाकरण नास्ट करण्याला कर्हीही अर्थ नसतो. विनाकरण नाही त्या गोर्धेकडे गुंतून जाण्याला कर्हीही अर्थ नसतो. आपली सांगवी ऊऱ्या आणि वेळ आपले स्वान साकार करण्यासाठी खर्च करावा. आपल्या धेशाचे स्वप्न आपल्या नजेरसमोर एकदा आणावे आणि ते स्वप्न सत्यात उत्तरवाण्याचा अतोनात प्रयत्न करावा आणि त्याच्यात गुंतून जावे. नक्कीच घवघवीत यश मिळाल्याशिवाय राहणार -स्वामी विवेकानन्द	
Mark 720	Group PCB	Repeater NEET (2025-26) PCB Test	Date : 03/08/2025 Time : 3.00 Hrs
Physics - 45		Chemistry - 45	Biology - 90
Question Booklet Version 11 (Write this number on your Answer Sheet)		Roll Number	Question Booklet Sr. No.

• Today's Test Syllabus •

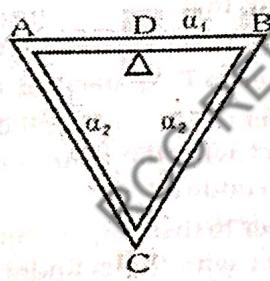
Physics : Basic Maths + Vectors + TPM + Heat Transfer + 1D + KTG

Chemistry : GOC-I + Isomerism + Atomic Structure + Peri. Table

Biology : Sexual Reproduction in F. Plant +Plant Kingdom + Biological Classification + Circulation + Breathing

SECTION 'A' PHYSICS

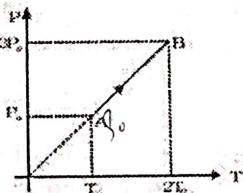
01. Three rods of equal length are joined to form an equilateral triangle ABC. D is the midpoint of AB. The coefficient of linear expansion is α_1 for AB, and α_2 for AC and BC. If the distance DC remains constant for small changes in temperature :



- 1) $\alpha_1 = \alpha_2$ 2) $\alpha_1 = 2\alpha_2$
 3) $\alpha_1 = 4\alpha_2$ 4) $\alpha_1 = \frac{1}{2}\alpha_2$

02. If water at 0°C , kept in a container with an open top, is placed in a large evacuated chamber :
- All the water will vaporize.
 - All the water will freeze.
 - Part of the water will vaporize and the rest will freeze.
 - Ice, water and water vapour will be formed and reach equilibrium at the triple point.

03. Pressure versus temperature graph of an ideal gas is shown in figure. Density of the gas at point A is ρ_0 . Density at B will be :-



- 1) $\frac{3}{4}\rho_0$ 2) $\frac{3}{2}\rho_0$
 3) $\frac{4}{3}\rho_0$ 4) $2\rho_0$

04. When unit mass of water boils to become steam at 100°C , it absorbs Q amount of heat. The densities of water and steam at 100°C are ρ_1 and ρ_2 respectively and the atmospheric pressure is P_0 . The increase in internal energy of the water is :-

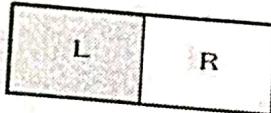
- 1) Q 2) $Q + P_0 \left(\frac{1}{\rho_1} - \frac{1}{\rho_2} \right)$
 3) $Q + P_0 \left(\frac{1}{\rho_2} - \frac{1}{\rho_1} \right)$ 4) $Q - P_0 \left(\frac{1}{\rho_1} + \frac{1}{\rho_2} \right)$

Date : 03/08/2025

05. At temperature T , N molecules of gas A each having mass m and at the same temperature $2T$, N molecules of gas B each having mass $2m$ are filled in a container. The mean square velocity of molecules of gas B is v^2 and x component of mean square velocity of molecules of gas A is w^2 . The ratio of w^2/v^2 is :

- 1) 1 2) 2
3) $1/3$ 4) $2/3$

06. A vessel is partitioned in two equal halves by a fixed diathermic separator. Two different ideal gases are filled in left (L) and right (R) halves. The rms speed of the molecules in L part is equal to the mean speed of molecules in the R part. Then the ratio of the mass of a molecule in L part to that of a molecule in R part is :



- 1) $\sqrt{\frac{3}{2}}$ 2) $\sqrt{\pi/4}$ 3) $\sqrt{2/3}$ 4) $3\pi/8$

07. Two cylinders A and B fitted with piston contain the equal amount of an ideal diatomic gas at $300K$. The piston of A is free to move, while that of B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is $30K$, then the rise in the temperature of the gas in B is :

- 1) $30K$ 2) $10K$ 3) $50K$ 4) $42K$

08. A black body emits radiation at the rate P when its temperature is T . At this temperature the wavelength at which the radiation has maximum intensity is λ_0 . If at another temperature T' the power radiated is ' P' ' and wavelength at maximum intensity is $\frac{\lambda_0}{2}$ then

- 1) $P' T' = 32 PT$
2) $P' T' = 16 PT$
3) $P' T' = 8 PT$
4) $P' T' = 4 PT$

09. A metallic sphere having radius $0.08 m$ and mass $m = 10 kg$ is heated to a temperature of $227^\circ C$ and suspended inside a box whose walls are at a temperature of $27^\circ C$. The maximum rate at which its temperature will fall is:- (Take $e = 1$, Stefan's constant

$\sigma = 5.8 \times 10^{-8} W m^{-2} K^{-4}$ and specific heat of the metal $s = 90 \text{ cal/kg/deg}$, $J = 4.2 \text{ J/Calorie}$)

- 1) $0.055^\circ C/s$ 2) $0.066^\circ C/s$
3) $0.044^\circ C/s$ 4) $0.03^\circ C/s$

10. Statement-1 : Animals curl into a ball, when they feel very cold.
and

Statement-2 : Animals by curling their body reduces the surface area.

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

- 2) Statement-1 is True, Statement-2 is True ; Statement-2 is not a correct explanation for Statement-1

- 3) Statement-1 is True, Statement-2 is False.

- 4) Statement-1 is False, Statement-2 is True

11. Two long, thin, solid cylinders are identical in size, but they are made of different substances with two different thermal conductivities. The two cylinders are connected in series between a reservoir at temperature T_{hot} and a reservoir at temperature T_{cold} . The temperature at the boundary between the two cylinders is T_b . One can conclude that :

- 1) T_b is closer to T_{hot} than it is to T_{cold} .

- 2) T_b is closer to T_{cold} than it is to T_{hot} .

- 3) T_b is closer to the temp. of the reservoir that is in contact with the cylinder with the lower thermal conductivity

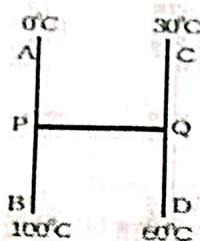
- 4) T_b is closer to the temp. of the reservoir that is in contact with the cylinder with the higher thermal conductivity.

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12. Three identical rods AB, CD and PQ are joined as shown. P and Q are mid points of AB and CD respectively. Ends A, B, C and D are maintained at 0°C , 100°C , 30°C , and 60°C respectively. The direction of heat flow in PQ is



- 1) From P to Q
- 2) From Q to P
- 3) Heat does not flow in PQ
- 4) Data not sufficient

13. Three bodies A, B and C have equal surface area and thermal emissivities in the ratio

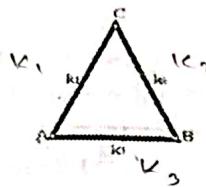
$e_A : e_B : e_C = 1 : \frac{1}{2} : \frac{1}{4}$. All the three bodies are radiating at same rate. Their wavelengths corresponding to maximum intensity are λ_A , λ_B and λ_C respectively and their temperatures are T_A , T_B and T_C on kelvin scale, then select the incorrect statement

- 1) $\sqrt{T_A T_C} = T_B$
- 2) $\sqrt{\lambda_A \lambda_C} = \lambda_B$
- 3) $\sqrt{e_A T_A} \sqrt{e_C T_C} = e_B T_B$
- 4) $\sqrt{e_A \lambda_A T_A} \sqrt{e_B \lambda_B T_B} = e_C \lambda_C T_C$

14. If the absorption coefficient and reflection coefficient of a surface of a body are 0.4 and 0.6 respectively then:-

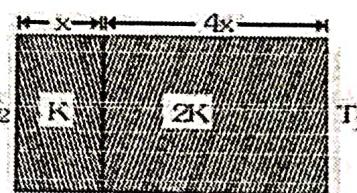
- 1) Emissive power will be 0.2
- 2) Transmission power will be 0.2
- 3) Body will be totally transparent
- 4) Body will be totally opaque.

15. Three rods of same dimensions are arranged as shown in the figure. They have thermal conductivities k_1 , k_2 & k_3 . The points A and B are maintained at different temperatures. For the heat to flow at the same rate along ACB and AB



- 1) $k_3 = 2(k_1 + k_2)$
- 2) $k_3 = \frac{k_1 k_2}{k_1 + k_2}$
- 3) $k_3 = k_1 + k_2$
- 4) $k_3 = \frac{1}{2}(k_1 + k_2)$

16. The temperature of the two outer surfaces of a composite slab, consisting of two materials having coefficients of thermal conductivity K and $2K$ and thickness x and $4x$, respectively are T_2 and T_1 ($T_2 > T_1$). The rate of heat transfer through the slab, in a steady state is $\left(\frac{A(T_2 - T_1)K}{x}\right)f$, with f equals to:-



- 1) 1
- 2) 1/2
- 3) 2/3
- 4) 1/3

17. Four moles of hydrogen, two moles of helium and one mole of water vapour form an ideal gas mixture. What is the molar specific heat at constant pressure of mixture ?

- 1) $\frac{16}{7}R$
- 2) $\frac{23}{7}R$
- 3) $\frac{19}{7}R$
- 4) $\frac{26}{7}R$

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18. Statement-1 : Snow is better insulator than ice. and

Statement-2 : Snow contain air packet and air is a bad conductor of heat.

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

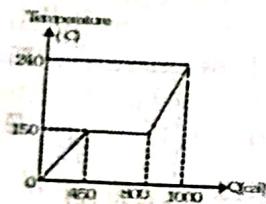
2) Statement-1 is True, Statement-2 is True ; Statement-2 is not a correct explanation for Statement-1

3) Statement-1 is True, Statement-2 is False.

4) Statement-1 is False, Statement-2 is True.

Comprehension (From Q.19 to Q.21)

A substance is in the solid form at 0°C . The amount of heat added to this substance and its temperature is plotted in the graph. The specific heat capacity of the solid substance is $0.5 \text{ cal/g}^{\circ}\text{C}$.



19. The mass of the substance is-

- 1) 6g 2) 12g
3) 3g 4) Can't be calculated

20. Latest heat capacity in melting process is-

- 1) $\frac{350}{3} \text{ cal/g}$ 2) $\frac{175}{3} \text{ cal/g}$
3) $\frac{400}{3} \text{ cal/g}$ 4) Can't say

21. Specific heat capacity in the liquid state is-

- 1) $\frac{5}{27} \text{ cal/g}^{\circ}\text{C}$ 2) $\frac{5}{27} \text{ cal/gK}$
3) $\frac{10}{27} \text{ cal/g}^{\circ}\text{C}$ 4) Can't say

22. A point moves with uniform acceleration and v_1 , v_2 and v_3 denote the average velocities in three successive intervals of time t_1 , t_2 and t_3 . Which of the following relations is correct

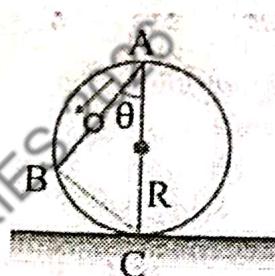
1) $v_1 - v_2 : v_2 - v_3 = t_1 - t_2 : t_2 + t_3$

2) $v_1 - v_2 : v_2 - v_3 = t_1 + t_2 : t_2 + t_3$

3) $v_1 - v_2 : v_2 - v_3 = t_1 - t_2 : t_1 - t_3$

4) $v_1 - v_2 : v_2 - v_3 = t_1 - t_2 : t_2 - t_3$

23. A frictionless wire AB is fixed on a sphere of radius R. A very small spherical ball slips on this wire. The time taken by this ball to slip from A to B is :



1) $\frac{2\sqrt{gR}}{g \cos \theta}$

2) $2\sqrt{gR} \frac{\cos \theta}{g}$

3) $2\sqrt{\frac{R}{g}}$

4) $\frac{gR}{\sqrt{g \cos \theta}}$

24. A particle had a speed of 18 m/s at a certain time, and 2.4 s later its speed was 30 m/s in the opposite direction. The average acceleration of the particle in the duration is :

- 1) 20 m/s^2 in the direction of initial velocity
2) 20 m/s^2 in the direction opposite to the initial velocity
3) 5 m/s^2 in the direction of initial velocity
4) 5 m/s^2 in the direction opposite to the initial velocity.

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25. A stone is thrown vertically upward. On its way up it passes point A with speed of v , and point B, 3 m higher than A, with speed $v/2$. The maximum height reached by stone above point B is

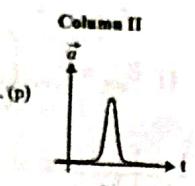
- 1) 1 m
- 2) 2 m
- 3) 3 m
- 4) 5 m

26. Column I gives some physical situation and Column II, the graphical representation. Match the columns.

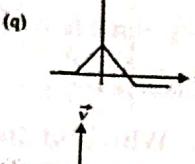
Column I

- A. A ball hits the wall and return back and then stops. (p)

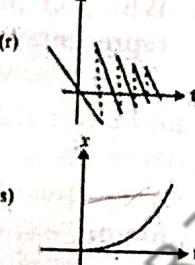
Column II



- B. A ball thrown upward and rebound again and again with an inelastic collision (q)



- C. A cricket ball hits by a bat. (r)



- D. A particle start moving with constant acceleration. (s)



- 1) A \rightarrow p ; B \rightarrow r ; C \rightarrow q ; D \rightarrow s
- 2) A \rightarrow q ; B \rightarrow p ; C \rightarrow r ; D \rightarrow s
- 3) A \rightarrow r ; B \rightarrow q ; C \rightarrow p ; D \rightarrow s
- 4) A \rightarrow s ; B \rightarrow r ; C \rightarrow q ; D \rightarrow p

27. A body is projected vertically upwards. If t_1 and t_2 be the times at which it is at height h above the projection while ascending and descending respectively, then h is

- 1) $\frac{1}{2}gt_1t_2$ 2) gt_1t_2 3) $2gt_1t_2$ 4) $2hg$

28. Two balls are dropped to the ground from different heights. One ball is dropped 2s after the other but they both strike the ground at the same time. If the first ball takes 5s to reach the ground, then the difference in initial heights is ($g = 10 \text{ ms}^{-2}$)

- 1) 20 m
- 2) 80 m
- 3) 170 m
- 4) 40 m

29. Assertion : The difference of two vectors A and B can be treated as the sum of two vectors.

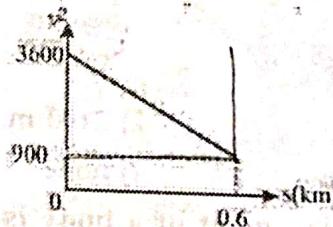
Reason : Subtraction of vectors can be defined in terms of addition of vectors.

- 1) If both assertion and reason are true and reason is the correct explanation of assertion.
- 2) If both assertion and reason are true but reason is not the correct explanation of assertion.
- 3) If assertion is true but reason is false.
- 4) If both assertion and reason are false.

30. Starting from rest, acceleration of a particle is $a = 2(t - 1)$. The velocity of the particle at $t = 5\text{s}$ is

- 1) 15 m/s
- 2) 25 m/s
- 3) 5 m/s
- 4) none of these

31. A graph between the square of the velocity of a particle and the distance moved is shown in the figure. The acceleration of the particle in kilometer per hour squared is



- 1) 2250
- 2) 22.5
- 3) - 2250
- 4) 225

Spare For Rough Work

32. A car moves on a straight track from station A to the station B, with an acceleration $a = (b - cx)$, where b and c are constants and x is the distance from station A. The maximum velocity between the two stations is

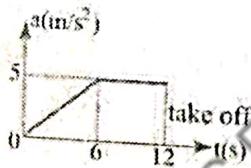
- 1) b/\sqrt{c} 2) b/c
 3) c/\sqrt{a} 4) \sqrt{b}/c

33. Balls are thrown vertically upward in such a way that the next ball is thrown when the previous one is at the maximum height. If the maximum height is 4.9 m, the number of balls thrown per minute will be

34. A parachutist after bailing out falls 50 m without friction. When parachute opens, it decelerates at 2 m/s^2 . He reaches the ground with a speed of 3 m/s. At what height, did he bail out

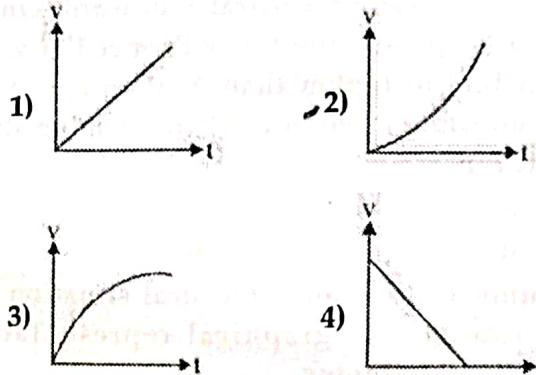
 - 1) 111 m
 - 2) 293 m
 - 3) 182 m
 - 4) 91 m

35. An experiment on the take-off performance of an aeroplane shown that the acceleration varies as shown in the figure, and that 12 s to take-off from a rest position. The distance along the runway covered by the aeroplane is



- 1) 210 m
3) 21000 m
2) 2100 m
4) none

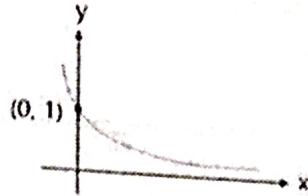
36. The displacement of a body is given to be proportional to the cube of time elapsed. The velocity-time graph of motion of the body is :



37. If $B_{axis} = B_{center} \left(\frac{R^3}{(R^2 + x^2)^{3/2}} \right)$, find $\frac{B_{axis}}{B_{center}}$ if $x \ll R$

- 1) $\left[1 - \frac{3}{2} \frac{x^2}{R^2} \right]$
 - 2) $\left[1 + \frac{3}{2} \frac{x^2}{R^2} \right]$
 - 3) $\left[1 + \frac{3}{2} \frac{x}{R} \right]$
 - 4) $\left[1 - \frac{3}{2} \frac{x}{R} \right]$

38. Which of the following equation is the best representation of the given graphs?



- 1) $x = \frac{1}{y}$ 2) $y = e^{-x}$
 3) $y = e^x$ 4) $y = \log x$

39. If vectors \mathbf{A} and \mathbf{B} be respectively equal to $3\hat{i} - 4\hat{j} + 5\hat{k}$ and $2\hat{i} + 3\hat{j} - 4\hat{k}$. The unit vector parallel to $\mathbf{A} + \mathbf{B}$ is $\frac{1}{\sqrt{5}}(5\hat{i} - \hat{j} + \hat{k})$. Find the

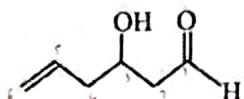
- 1) 1 2) 3 3) 4 4) 2

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SECTION 'B' CHEMISTRY

46. What is the correct IUPAC name of the following compounds ?

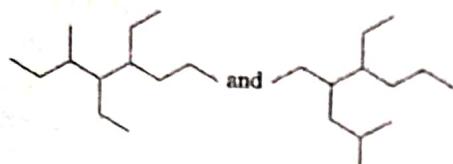


- 1) 4-Hydroxyhex-1-en-6-ol
 - 2) 1-oxohex-5-en-3-ol
 - 3) 3-Hydroxyhex-5-enal
 - 4) 6-oxohex-1-en-4-ol

47. How many structural isomers are possible with the molecular formula C_8H_{10} ?

- 1) 3 2) 4
3) 5 4) 6

48. Given compound shows which type of isomerism?



- 1) Chain isomerism
 - 2) Positional isomerism
 - 3) Functional group isomerism
 - 4) Metamerism

49. Which of the following statements regarding ethanoic acid and methyl methanoate are correct?

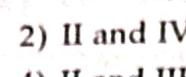
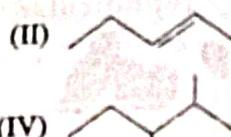
- I. They are functional group isomers with molecular formula $C_2H_4O_2$.
II. They belong to same homologous series
III. They have different chemical properties
1) I and II 2) I and III
3) II and III 4) I, II and III

50. Which of the following compounds are structural isomers of $C_5H_{10}O$?
 H. Propyl ethanoate

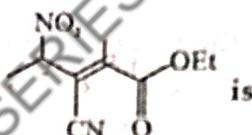
- I. 2-methyl butanal II. Propyl ethanoate
 III. Pentanal

1) I and II 2) I and III
 3) II and III 4) I, II and III

51. Select pair of chain isomers from the following

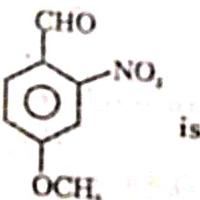


52. The IUPAC name of compound



- 1) 2-cyano-3-nitro-2-methylpent-2-enoate
 - 2) Ethyl-3-cyano-2-methyl-4-nitropent-2-enoate
 - 3) 4-cyano-3-nitro-2-methylpent-2-enoate
 - 4) All of these

53. The correct IUPAC name of the compound



- 1) 2-Formyl-5-methoxynitrobenzene
 - 2) 4-Formyl-3-nitroanisole
 - 3) 4-Methoxy-2-nitrobenzenecarbaldehyde
 - 4) 4-Methoxy-6-nitrobenzaldehyde

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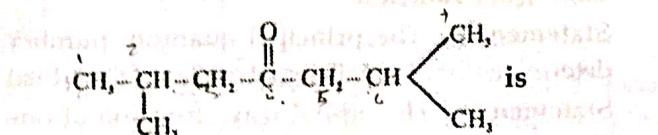
54. Which of the following does not show geometrical isomerism

- 1) $\text{CH}_3\text{-CH=CH-CH}_3$
 - 2) $\text{CH}_3\text{-CH}_2\text{-CH=CH}_2$
 - 3) $\text{CH}_3\text{-C(Cl)=CH-CH}_3$
 - 4) $\text{ClHC=CH-CH}_2\text{-CH}_3$

55. Maleic acid and fumaric acids are

- 1) Tautomers
 - 2) Chain isomers
 - 3) Geometrical isomers
 - 4) Functional isomers

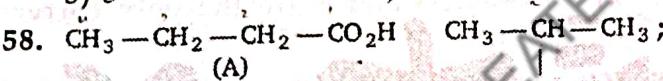
56. The IUPAC name of the given structure :



- 1) 2,4-Dimethyl-3-hexanone
 - 2) 2,6-Dimethyl-4-heptanone
 - 3) 2,6-Dimethyl-5-heptanone
 - 4) 2,6-Dimethyl-4-hexanone

57. The number of structural isomers for C_6H_{14} is

- 1) 6 2) 4
• 3) 3 4) 5



(A) and (B) are

- 1) Chain isomers
 - 2) Positional isomers
 - 3) Functional isomers
 - 4) Metamers

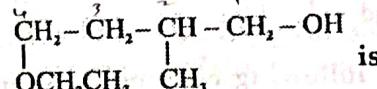
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59. Which of the following pairs represent isomer?

- 1) $\text{CH}_3\text{-CH}_3$, $\text{CH}_3\text{-CH}_2\text{-CH}_3$
 - 2) $\text{H}_2\text{C} = \text{CH-OH}$, $\text{CH}_3\text{-O-CH}_3$
 - 3) $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$, $\text{CH}_3\text{-CH}(\text{CH}_3)\text{-CH}_3$

- 4) All of these

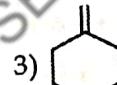
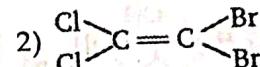
60. The correct IUPAC name for the compound



- 1) 1-ethoxy-3-methylbutan-4-ol
 - 2) 1-ethoxy-3-methylbutan-1-ol
 - 3) 4-ethoxy-2-methylbutan-1-ol
 - 4) 1-ethyloxy-3-methylbutan-1-ol

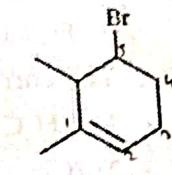
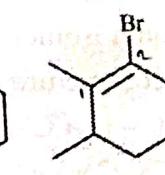
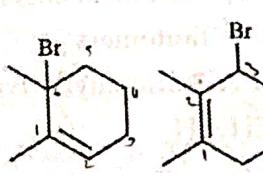
61. Which of the following compound show cis and trans isomerism ?

- $$1) \text{ClCH} = \text{CHCl}$$



- 4)  A cyclohexene ring with a double bond between the first and second carbons. The second carbon is bonded to a methyl group (CH_3) and an ethyl group (CH_2CH_3).

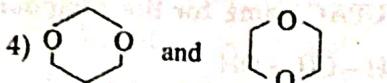
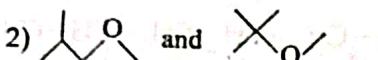
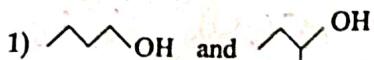
62. What is the sum of positions assigned to bromine while numbering the Parent Chain in the below compounds ?



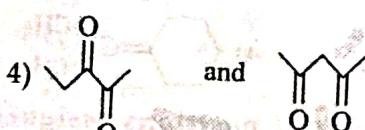
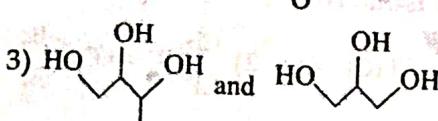
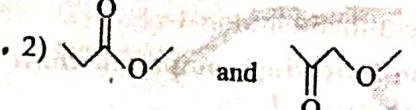
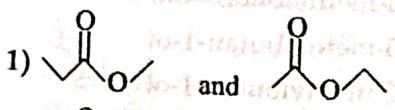
- 1) 13 2) 14
3) 15 •4) 16

QUESTION BOOKLET VERSION : 11

63. Which of the following pairs of compounds are not position isomers ?



64. Which of the following pairs of compounds are functional isomers?



65. 2-butyne and 1, 3-butadiene are

- 1) Chain isomer 2) Position isomers
 - 3) Functional isomer 4) Tautomers

66. The correct structure of 3, 3-dimethylbutane:

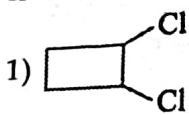
- 1) $\text{CH}_3\text{CH}_2 - \text{C} \equiv \text{C} - \text{CH}_2\text{CH}_3$

2) $(\text{CH}_3)_3\text{C} - \text{C} \equiv \text{CH}$

3) $\text{CH}_3 - \text{C} \equiv \text{CCH}(\text{CH}_3)_2$

4) $\begin{matrix} \text{CH}_3 & & \text{C} = \text{C} & - \text{CH}_3 \\ & | & & | \\ & \text{CH}_3 & & \text{CH}_3 \end{matrix}$

67. Which of the following will form geometrical isomers?



- 3)  • 4) All of these

68. Which of the following options is correct regarding True (T) or False (F) nature of the statements.

Statement 1 : Angular momentum quantum number determines the three dimensional shape of the orbital. \checkmark

Statement 2 : No two orbitals can have exactly same wave function. T

Statement 3 : The principal quantum number determines the orientation and energy of the orbital.

Statement 4 : The orbital wave function of one electron species which obeys Pauli's exclusion principle will be dependent on the four quantum numbers

- 1) Statement 2 and statement-4 are the only correct statements
 - 2) statement-3 is the only incorrect statement
 - 3) statement-1 and 2 are the only correct statements
 - 4) statement-3 and 4 are the only correct statements

69. Ratio of wavelength of series limit of Paschen and Brackett series for a single electronic species is

- 1) $\frac{4}{9}$ 2) $\frac{12}{7}$
3) $\frac{9}{16}$ 4) $\frac{16}{25}$

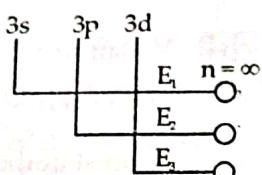
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QUESTION BOOKLET VERSION : 11

70. Which orbital is represented by the complete wave function, ψ_{420} ?

- 1) 4s
- 2) 4p
- 3) 4d
- 4) 4f

71. For H-atom, the energy required for the removal of electron from various sub-shells is given as under



The order of the energies would be :

- 1) $E_1 > E_2 > E_3$
- 2) $E_3 > E_2 > E_1$
- 3) $E_1 = E_2 = E_3$
- 4) $E_2 > E_1 > E_3$

72. If a radiation of energy 8 eV falls on a metal surface then calculate the no of ejected electrons and the kinetic energy of electron if work function of the metal is 3 eV.

Work function = minimum energy required to remove 1 electron.

- 1) 2, 4 eV
- 2) 1, 6 eV
- 3) 4, 0 eV
- 4) 1, 5 eV

73. Uncertainty in the position of an electron (mass = 9.1×10^{-31} kg) moving with a velocity 300 ms^{-1} , accurate upto 0.001 %, will be ($\hbar = 6.63 \times 10^{-34} \text{ Js}$)

- 1) $19.2 \times 10^{-2} \text{ m}$
- 2) $5.76 \times 10^{-2} \text{ m}$
- 3) 1.92 cm
- 4) $3.84 \times 10^{-2} \text{ m}$

74. A gas of mono atomic hydrogen is excited by an energy of 13.056 eV/atom. Calculate sum of no of spectral lines are formed in Lyman, Balmer series respectively.

- 1) 7
- 2) 10
- 3) 9
- 4) 11

75. Statement I : Emitted radiations will fall in visible range when an electron jumps from higher level to $n = 2$ in Li^{+2} ion.

Statement II : Balmer series radiations belong to visible range in all H-atoms.

- 1) Both Statement I and Statement II are correct
- 2) Both Statement I and Statement II are incorrect
- 3) Statement I is correct but Statement II is incorrect
- 4) Statement I is incorrect but Statement II is correct

76. Match the orbitals the number of nodes/ quantum numbers present in them.

Column I	Column II
A 2p orbital	p Number of spherical nodes = 0
B 3d orbital	q Number of nodal plane = 0
C 2s orbital	r Orbital angular momentum number = 0
D 4f orbital	s Azimuthal quantum number = 0

- 1) A-p, B-q, C-r, D-r, s
- 2) A-q, B-s, C-p,t, D-r
- 3) A-r,t, B-p, C-s, D-q
- 4) A-p, B-p, C-q,r,s, D-p

77. Assertion (A) : Black body is in thermal equilibrium with it self.

Reason (R) : It radiate same amount of energy per unit area as it absorbs from its surrounding in any given time.

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

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QUESTION BOOKLET VERSION : 11

78. Arrange the following orbitals in decreasing order of energy?

A. $n = 3, l = 0, m = 0$ B. $n = 4, l = 0, m = 0$
 C. $n = 3, l = 1, m = 0$ D. $n = 3, l = 2, m = 1$

The correct option for the order is :

1) B > D > C > A 2) D > B > C > A
 3) A > C > B > D 4) D > B > A > C

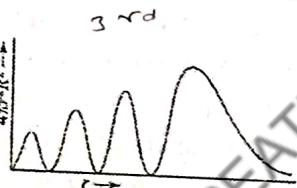
79. Which of the following statement concerning probability density (Ψ^2) and radial distribution function ($4\pi r^2 \Psi^2$) for an s-orbital of H-like species is incorrect?

 - I) Ψ^2 is minimum at nucleus but $4\pi r^2 \Psi^2$ is maximum at nucleus
 - II) Ψ^2 is maximum at nucleus but $4\pi r^2 \Psi^2$ is minimum at nucleus
 - III) Both Ψ^2 and $4\pi r^2 \Psi^2$ are maximum at nucleus.
 - IV) Both Ψ^2 and $4\pi r^2 \Psi^2$ are minimum at nucleus.

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

80. For an orbital if ψ^2 is maximum at nucleus having following radial distribution curve then orbital is.

- 1) 3p
 - 2) 4s
 - 3) 5p
 - 4) 6d



81. Which of the following is the incorrect match for the position of element in periodic table ?
-1) [A-12] B-1

- 1) $[Ar]3d^5\ 4s^1 \rightarrow$ 4th period, 6th group
 - 2) $[Kr]4d^{10}\ 5s^1 \rightarrow$ 5th period, 12th group
 - 3) $[Rn]6d^2\ 7s^2 \rightarrow$ 7th period, 3rd group
 - 4) $[Xe]4f^4\ 5d^2\ 6s^2 \rightarrow$ 6th period, 4th group

82. Which among the following is correct of s_B in normal state?

- 1)  : Against Hund's rule

2)  : Against aufbau principle as well as Hund's rule

3)  : Violation of Pauli's exclusion principle and not Hund's rule

4)  : against aufbau principle

83. Orbital angular momentum of 3s and 3p are:

- 1) $\frac{h}{2\pi}, \frac{h}{2\pi}$ 2) $\frac{h}{\sqrt{2}\pi}, \frac{h}{\sqrt{2}\pi}$
 3) $0, \frac{\sqrt{2}h}{\pi}$ 4) $0, \frac{h}{\sqrt{2}\pi}$

84. Which of the following pair of elements belong to the same period?

- 1) Mg and Sb
3) ~~Na~~ and Ca • 2) Ca and Zn
 • 4) Ca and Cl

85. Modern periodic law is based on

- 1) Atomic mass
 - 2) Atomic number
 - 3) Atomic density
 - 4) Atomic radius

36. What are the lanthanides and actinides?

- 1) Inner-transition elements
 - 2) Noble gases
 - 3) Normal elements
 - 4) Transition elements

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35

3

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3P

3 d

6-2-1

③ -

QUESTION BOOKLET VERSION : 11

87. Which of the following pairs contain metalloid elements in the periodic table ?

 - 1) Na and K
 - 2) F and Cl
 - 3) Ca and Mg
 - 4) As and Si

88. The law of triads is not applicable to

 - 1) Fe, Co, Ni
 - 2) Ru, Rh, Pd
 - 3) Os, Ir, Pt
 - 4) All of these

89. The element with atomic number 19 is

 - 1) Halogen
 - 2) Chalcogen
 - 3) Noble gas
 - 4) An alkali metal

90. Which of the following statements is/are correct about the modern periodic table ?

 - 1) It has '8' vertical columns known as groups
 - 2) It has '7' horizontal rows known as periods
 - 3) It has '18' vertical columns known as groups
 - 4) Both (2) and (3)

QUESTION BOOKLET VERSION :11

SECTION 'C' BIOLOGY

91. Assertion : Chemosynthetic autotrophic bacteria oxidise various inorganic substances.

Reason : Energy released during oxidation is used in ATP production.

- 1) If both assertion and reason are true and reason is the correct explanation of assertion
 - 2) If both assertion and reason are true but reason is not the correct explanation of assertion
 - 3) If assertion is true but reason is false
 - 4) If assertion is false but reason is true

92. Statement I : Heterocysts are specialised cells in filamentous blue-green algae that fix atmospheric nitrogen.

Statement II : Cyanobacteria play a great role in recycling nutrients like nitrogen, phosphorous and iron.

- 1) Both statements I and II are correct.
 - 2) Statement I is correct but statement II is incorrect.
 - 3) Statement I is incorrect but statement II is correct.
 - 4) Both statements I and II are incorrect.

93. Which of the following options incorrectly distinguishes the kingdoms Monera and Protista?

	Monera	Protista
1)	Includes unicellular prokaryotes	Includes multicellular eukaryotes
2)	Membrane bound cell organelles are absent	Membrane bound cell organelles are present
3)	Cell wall when present, made up of peptidoglycans.	Cell wall if present, contains cellulose
4)	Flagella are present in some organisms	Flagella and cilia are present in some members

94. During unfavourable conditions which of the following behaviours is seen in slime moulds?

- 1) They appear as an aggregated form which may grow and spread over.
 - 2) They form fruiting bodies bearing spores at the tips.
 - 3) They behave like heterotrophs by predating on other smaller organisms.
 - 4) They turn into parasitic mode to get nutrition under unfavourable condition.

95. In the following table, one example and one specific characteristic of the group is given. Select the correct option

Group	Example	Characteristics
i) Phycomycetes	Albugo	Septate
ii) Phycomycetes	Mucor	Mycelium aseptate and coenocytic
iii) Ascomycetes	Penicillium	Aseptate, branched
iv) Basidiomycetes	Agaricus	Mycelium branched and septate

- 1) i and iii only .2) ii and iv only
3) ii and iii only 4) i and iv only

96. All eukaryotic unicellular organisms belong to

- 1) Monera 2) Protista
3) Fungi 4) Bacteria.

97. An association between roots of higher plants and fungi is called

- 1) lichen 2) fern 5
3) mycorrhiza 4) BGA.

- 98.** With respect to the fungal sexual cycle, choose the correct sequence of events.

- 1) Karyogamy, plasmogamy and meiosis
 - 2) Meiosis, plasmogamy and karyogamy
 - 3) Plasmogamy, karyogamy and meiosis
 - 4) Meiosis, karyogamy and plasmogamy

99. Members of Phycomycetes are found in

 - i) aquatic habitats
 - ii) on decaying wood
 - iii) moist and damp places
 - iv) as obligate parasites on plants.

Choose 6

Choose from the following options.

- 1) None of the above 2) (i) and (iv)
3) (ii) and (iii) 4) All of the above

100. Statement I : All the unicellular eukaryotic organisms are placed in Kingdom Protista.
Statement II : Yeast is a unicellular organism that is placed in Kingdom Fungi.

1) Both are correct
2) Both are wrong
3) Statement I is correct
4) Statement II is correct
5) None of the above

- 1) Both statements I and II are correct.
2) Statement I is correct but statement II is incorrect.
3) Statement I is incorrect but statement II is correct.
4) Both statements I and II are incorrect.

QUESTION BOOKLET VERSION : 11

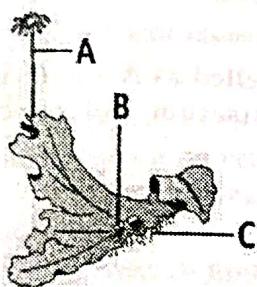
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- 101. Statement I : Insectivorous plants are partially heterotrophic .**

Statement II : Kingdom Animalia has autotrophic mode of nutrition by absorption of food.

 - 1) Both statements I and II are correct.
 - 2) Statement I is correct but statement II is incorrect.
 - 3) Statement I is incorrect but statement II is correct.
 - 4) Both statements I and II are incorrect.

102. Select the option that correctly identifies A, B and C in the given figure of female thallus of *Marchantia*.



- 1) A - Antheridiophore, B - Gemma cup, C - Rhizoids
 - 2) A - Antheridiophore, B - Rhizoids, C - Gemma cup
 - 3) A - Archegoniophore, B - Gemma cup, C - Rhizoids
 - 4) A - Archegoniophore, B - Rhizoids, C - Gemma cup

103. Plant classification as proposed by Carolus Linnaeus was artificial because it was based on

- 1) only a few morphological characters
 - 2) all the possible characters
 - 3) anatomical characters which are adaptive in nature
 - 4) physiological and morphological characters.

104. _____ classification systems were based on evolutionary relationships between various organisms.

- 1) Natural
 - 2) Artificial
 - 3) Phylogenetic
 - 4) Both 1) and 2)

105. In *Pinus*, male strobilus bears a large number of
1) anthers 2) stamens
3) microsporophylls 4) megasporophylls.

- 106.** Read the following statements regarding bryophytes and select the correct option.

- i) Bryophytes lack true roots, stem and leaves.
 - ii) The main plant body is haploid.
 - iii) Sex-organs are unicellular.
 - iv) Fertilisation produces zygote inside the water.

• 1) Statements (i) and (ii) only are correct.

2) Statements (ii) and (iii) only are correct.

3) Statements (iii) and (iv) only are correct.

4) All statements are correct.

107. Match column I with column II and select the correct option from the codes given below.

Column I	Column II
a. Lichen	i) Colonial
b. Volvox	ii) Symbiotic association
c. Ulothrix	iii) Filamentous
d. Kelps	iv) Massive plant body
1) a-(ii), b-(iii), c-(i), d-(iv)	
2) a-(ii), b-(i), c-(iii), d-(iv)	
3) a-(i), b-(ii), c-(iv), d-(iii)	
4) a-(i), b-(iv), c-(ii), d-(iii)	

108. The heterosporous pteridophytes are

- 1) Lycopodium and Pteris
 - 2) Selaginella and Psilotum
 - 3) Selaginella and Salvinia
 - 4) Dryopteris and Adiantum.

109. Select the mismatched pair.

- 1) Cycas — Unbranched stem
 - 2) Pinus — Agar production
 - 3) Cedrus — Branched stem
 - 4) Sequoia — Tallest tree

110. Mycorrhizal roots of are associated with some fungal symbionts.

- 1) Pinus
 - 2) Cedrus
 - 3) Cycas
 - 4) Ginkgo

111. Heterospory is found in some members of and all members of

- 1) Bryophyta, Pteridophyta
 - 2) Pteridophyta, Bryophyta
 - 3) Bryophyta, Gymnospermae
 - 4) Pteridophyta, Gymnospermae

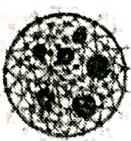
QUESTION BOOKLET VERSION : 11

112. Statement I : The gymnosperm cone is the spiral arrangement of sporophyll along the axis

Statement II : The cones bearing megasporophylls with megasporangia are called male strobili

- 1) Both statements I and II are correct
- 2) Statement I is correct but statement II is incorrect
- 3) Statement I is incorrect but statement II is correct
- 4) Both statements I and II are incorrect

113. The algae shown in the given figures belong to the Class



- 1) Chlorophyceae
- 2) Phaeophyceae
- 3) Rhodophyceae
- 4) Cyanophyceae

114 Statement I : The cells of the sporophyte undergo reduction division to produce haploid spores in pteridophytes.

Statement II: Angiosperms are divided into two classes : dicotyledons and monocotyledons.

- 1) Both statements I and II are correct
- 2) Statement I is correct but statement II is incorrect
- 3) Statement I is incorrect but statement II is correct
- 4) Both statements I and II are incorrect

115. Match column I with column II and select the correct option from the codes given below.

Column I

Column II

- | | |
|--------------|---------------------------|
| a. Food | i) Brown algae |
| b. Agar | ii) Porphyra, Laminaria |
| c. Algin | iii) Gelidium, Gracilaria |
| d. Carrageen | iv) Red algae |
- 1) a-(ii), b-(iii), c-(i), d-(iv)
 2) a-(ii), b-(iii), c-(iv), d-(i)
 3) a-(iii), b-(ii), c-(iv), d-(i)
 4) a-(iii), b-(ii), c-(i), d-(iv)

116. 1000 pollen grains were found in each pollen sac of a typical angiospermic anther. Can you calculate how many meiotic divisions would have occurred in the microspore mother cells of the anther?

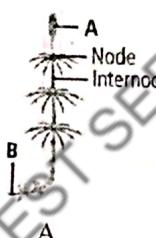
- 1) 100
- 2) 250
- 3) 1000
- 4) 500

117. Assertion: Geitonogamy is functionally cross-pollination involving pollinating agent but genetically it is similar to autogamy since the pollen grains come from another plant.

Reason: Geitonogamy is the only type of pollination during which pollination brings genetically different types of pollen grains to the stigma.

- 1) if both assertion and reason are true and the reason is the correct explanation of the assertion
- 2) If both assertion and reason are true, but reason is not the correct explanation of the assertion
- 3) If assertion is true, but reason is false
- 4) If both assertion and reason are false

118. Identify the parts labelled as A and B in the given figure of Equisetum and select the correct option.



B

- | | |
|----------------|------------|
| 1) Strobilus | 1) Rhizome |
| 2) Sporophylls | 2) Tuber |
| 3) Sporangia | 3) Rhizome |
| 4) Sporophyte | 4) Tuber |

119. Match the following columns and choose the correct option

Column I

Column II

- | | |
|--------------|--|
| a. Epicotyl | i. Cylindrical portion below the level of cotyledons |
| b. Hypocotyl | ii. Above the level of cotyledons |
| c. Radicle | iii. Root tip |
| d. Plumule | iv. Stem tip |
- 1) a-ii, b-i, c-iii, d-iv
 2) a-i, b-ii, c-iii, d-iv
 3) a-ii, b-i, c-iv, d-iii
 4) a-i, b-ii, c-iv, d-iii

120. Statement I: Pollen grains of some plants remain viable for months.

Statement II: Double fertilisation is absent where pollen is shed at 2-celled stage.

- 1) Only statement I is correct
- 2) Only statement II is correct
- 3) Both statements I and II are correct
- 4) Both statements I and II are incorrect

121. Assertion: To compensate the uncertainties and associated loss of pollen grains during pollination by abiotic agents, the flowers produce enormous amount of pollens as compared to the number of ovules available for pollination.

Reason: Pollen grains coming in contact with the stigma is a chance factor in both wind and water pollination.

- 1) if both assertion and reason are true and the reason is the correct explanation of the assertion
- 2) If both assertion and reason are true, but reason is not the correct explanation of the assertion
- 3) If assertion is true, but reason is false
- 4) If both assertion and reason are false

122. Statement I: In the most common type of endosperm development, the PEN undergoes successive nuclear divisions to give rise to free nuclei.

Statement II: Embryo develops at the chalazal end of the embryo sac where zygote is situated.

- 1) Only statement I is correct
- 2) Only statement II is correct
- 3) Both statements I and II are correct
- 4) Both statements I and II are incorrect

123. In flowering plants, what is the correct sequence of events that takes place in the integumented ovule?

- a. Embryo sac formation
 - b. Megasporogenesis
 - c. Endosperm formation
 - d. Fertilisation
 - e. Embryogenesis
- 1) a → b → c → d → e
 - 2) b → a → d → c → e
 - 3) b → a → e → c → d
 - 4) b → a → c → d → e

124. The correct sequence of parts in an ovule starting from the innermost circle will be

- 1) Egg, embryo sac, nucellus, integument
- 2) Egg, integument, embryo sac, nucellus
- 3) Egg, nucellus embryo sac, integument
- 4) Embryo sac, nucellus, integument, egg.

125. Statement I: Pollen grains of a large number of species can be stored for years in liquid nitrogen (-196°C).

Statement II: Arising from the placenta are the megasporangia, commonly called ovules.

- 1) Only statement I is correct
- 2) Only statement II is correct
- 3) Both statements I and II are correct
- 4) Both statements I and II are incorrect

126. Match the columns and choose the correct combination.

Column I

- a. Funicle
- b. Integuments
- c. Chalaza
- d. Hilum
- e. Micropyle

- 1) a-ii, b-iii, c-v, d-iv, e-i
- 2) a-i, b-iii, c-ii, d-iv, e-v
- 3) a-ii, b-iii, c-i, d-iv, e-v
- 4) a-iii, b-iv, c-v, d-i, e-ii

Column II

- i. Small opening of ovule
- ii. Stalk of ovule
- iii. Protective envelopes
- iv. Protective envelopes
- v. Basal part of ovule

127. Statement I: The egg apparatus consists of two synergids and one egg cell.

Statement II: The male and female gametes in flowering plants are produced in the pollen grains and embryo sac respectively.

- 1) Only statement I is correct
- 2) Only statement II is correct
- 3) Both statements I and II are correct
- 4) Both statements I and II are incorrect

128. An angiospermic male plant having 24 chromosomes in its pollen mother cell is crossed with a female plant bearing 24 chromosomes in its root cells. The number of chromosomes in embryo and endosperm formed from this cross will most likely be

- 1) 24 and 48
- 2) 24 and 24
- 3) 48 and 72
- 4) 24 and 36

129. Match the column I with column II and select the correct option using the codes given below

	Column I	Column II
a	Pistils fused together	i. Gametogenesis
b	Formation of gametes	ii. Pistillate
c	Hyphae of higher ascomycetes	iii. Syncarpous
d	Unisexual female flower	iv. Dikaryotic

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

QUESTION BOOKLET VERSION : 11

130. Match the following columns and choose the correct option.

Column I	Column II
1. Endosperm	a. Grasses
2. Perisperm	b. State of inactivity
3. Dormancy	c. Persistent nucellus
4. Scutellum	d. Reserve food materials

1) 1 - c, 2 - d, 3 - b, 4 - a
 2) 1 - d, 2 - c, 3 - a, 4 - b
 3) 1 - c, 2 - d, 3 - a, 4 - b
 4) 1 - d, 2 - c, 3 - b, 4 - a

131. Which among the following statements are correct for a typical female gametophyte of a flowering plant?

- A) It is located inside the integument but outside the nucellus.
 - B) It is 8 - nucleate and 7 - celled at maturity.
 - C) It has an egg apparatus situated at the chalaza end.
 - D) It is free nuclear during the development.

1) A and C 2) B and C
3) B and D 4) A and D

132. Read the following statements about pollination.

- I. Majority of aquatic plants are pollinated by insect or wind.

II. It is believed, particularly for some bryophytes and pteridophytes, that their distribution is limited because of the need for water for the transport of male gametes for fertilisation.

III. Water pollinated flowers are large often featuring stigma to easily trap air-borne pollen grains.

IV. In Castor and Orchids, seeds are albuminous.

V. Orobanche and Striga are parasitic plants.

Which of the given statements are correct?

1) I, II and IV
2) I, II and V
3) II, III and V
4) III and IV

133. Choose the wrong statement.

- True statement**

 - 1) In angiosperms, a single microsporogenesis involves one meiosis and two mitosis
 - 2) Each pollen grain produces two male gametes both in gymnosperm and angiosperm
 - 3) Megagametogenesis is the process of formation of ovum
 - 4) All of the above

134. Assertion (A) : Exine of a pollen grain is made up of sporopollenin which is resistant to high temperature, strong acid or alkali as well as enzymatic degradation.

Reason (R) : Sporopollenin is absent in the region of germpores.

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

135. Match the following columns and choose the correct option.

Column I	Column II
1. Yucca	a Water
2. Grasses	b. Moth
3. Water hyacinth	c. Wind
4. Vallisneria	d. Insects
1) 1 - b, 2 - a, 3 - d, 4 - c	
2) 1 - b, 2 - d, 3 - a, 4 - c	
3) 1 - b, 2 - c, 3 - d, 4 - a	
4) 1 - d, 2 - c, 3 - a, 4 - b	

SECTION 'C' Biology

136. Match List I with list II correctly –

List I	Correctly –	List II
(Types of leucocytes/WBCs)		(Their% of total WBC)
a. Neutrophils		i. 20-25
b. Basophils .		ii. 2-3
c. Monocytes .		iii. 6.8
d. Eosinophils		iv. 0.5-1
e. Lymphocytes		v. 60-65
1) a-v, b-iv, c-iii, d-i, e-ii		
2) a-i, b-ii, c-iii, d-v, e-iv		
•3) a-v, b-iv, c-iii, d-ii, e-i		
4) a-ii, b-iv, c-i, d-iii, e-i		

137. What is the correct order?

- The correct order of these events

 1. Conversion of fibrinogen to fibrin
 2. Clot retraction and leakage of serum
 3. Thromboplastin formation
 4. Conversion of prothrombin to thrombin

1) 3, 2, 1, 4 2) 3, 4, 1, 2
3) 3, 4, 2, 1 4) 4, 1, 3, 2

- Q3.** 138. Identify the respiratory organ with its correct matching of example:

- 1) Tracheal tubes - Insects
 - 2) Cuticle - Reptiles
 - 3) Gills - Earthworm
 - 4) Book lungs - Aquatic art

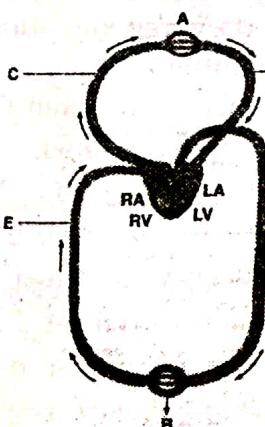
139. All of the following statement are correct about WBCs except –

- 1) They are nucleate and least constancy in shape
 - 2) They are lesser in number (6000 – 8000 per mm³ blood)
 - 3) They are generally short lived
 - 4) They help in blood clotting

140. Match the following and select the correct option :

- | | |
|----------------------------|----------------------------|
| a) Hypertension | (i) Acute chest pain |
| b) Coronary artery disease | (ii) High blood pressure |
| c) Cardiac arrest | (iii) Atherosclerosis |
| d) Angina pectoris | (iv) Stop beat |
| 1) a-ii, b-i, c-iv, d-iii | •2) a-ii, b-iii, c-iv, d-i |
| 3) a-iii, b-ii, c-iv, d-i | 4) a-ii, b-iv, c-i, d-iii |

141. Schematic plan of blood circulation in human is given below. Correctly identify labelling A to F



- 1) A— Body parts, B— Lungs, C— Pulmonary artery,
D— Pulmonary vein, E— Vena cava, F— Dorsal aorta
 - 2) A— Lungs, B— Body parts, C— Pulmonary vein, D—
Pulmonary artery, E— Vena cava, F— Dorsal aorta
 - 3) A— Lungs, B— Body parts, C— Pulmonary artery,
D— Pulmonary vein, E— Vena cava, F— Dorsal aorta
 - 4) A— Lungs, B— Body parts, C— Pulmonary artery,
D— Pulmonary vein, E— Dorsal aorta, F— Vena cava

142) Assertion – Nitroglycerin relieve chest pain caused by narrowing of the cardiac arteries.

Reason – The chest pain results from inadequate blood flow in coronary arteries. Vasodilation promoted by nitric oxide from nitroglycerin increases blood flow, providing the heart muscle with additional oxygen and thus relieving the pain.

- 1) Both assertion and reason are true and reason is correct explanation of assertion.
 - 2) Both assertion and reason are true and reason is not correct explanation of assertion.
 - 3) Assertion is true but reason is false.
 - 4) Both assertion and reason are false.

- 143.** Assertion - After exercising regularly for several months, our resting heart rate decreases, but our cardiac output at rest is unchanged.

Reason- The heart, like any other muscle, becomes stronger through regular exercise. The stronger heart would have a lesser stroke volume, which would allow for the decrease in heart rate.

- 1) Both assertion and reason are true and reason is correct explanation of assertion.
 - 2) Both assertion and reason are true and reason is not correct explanation of assertion.
 - 3) Assertion is true but reason is false.
 - 4) Both assertion and reason are false.

- 144. Assertion-** The heart of a normally developing human foetus has a hole between the left and right atria. In some cases, this hole does not close completely before birth. If the hole weren't surgically corrected, the O₂ content would be abnormally low.

Reason- In this case, some oxygen depleted blood returned to the right atrium from the systemic circuit would mix with the oxygen rich blood in the left atrium.

- 1) Both assertion and reason are true and reason is correct explanation of assertion.
 - 2) Both assertion and reason are true and reason is not correct explanation of assertion.
 - 3) Assertion is true but reason is false.
 - 4) Both assertion and reason are false.

QUESTION BOOKLET VERSION : 11

- 145. Which of following statements is wrong about lymph.**

- I. Lymph is colourful as it has haemoglobin but no RBC
 - II. The fluid present in lymphatic system is called lymph
 - III. It contains specialized lymphocytes which are responsible for immunity of the body
 - IV. Lymph is an important carrier for nutrients and hormones
 - V. Fats are absorbed through lymph in the lacteals present in the intestinal villi

- 1) Only I
 - 2) III and IV
 - 3) II and III
 - 4) Only IV

- 147.** Read the following five statements (A to E) and select the option with all correct statements:

- A) Respiratory rhythm is maintained by the respiratory centre in the midbrain.

B) RBCs contain a very high concentration of the enzyme, carbonic anhydrase which helps in CO_2 transport.

C) The movement of air into and out of the lungs is carried out by creating a pressure gradient between the lungs and the atmosphere.

D) Oxygen (O_2) is utilised by the organisms to indirectly breakdown nutrient molecules like glucose and to derive energy for performing various activities.

Exchange of O_2 and CO_2 at the alveoli and tissues occur by facilitated transport.

- 1) (A), (C) and (D) 2) (A), (D) and (E)
 • 3) (B), (C) and (D) 4) (B), (C) and (E)

148. Select the correct matching in the following pairs:

- pairs:**

 - 1) Vital capacity — Total volume of air accommodated in the lungs at the end of a forced inspiration.
 - 2) Tidal volume — Volume of air inspired or expired during a normal respiration.
 - 3) Residual volume — Total volume of air a person can inspire after a normal expiration.
 - 4) Expiratory capacity — The maximum volume of air a person can breathe in after a forced expiration.

- 149.** Pick out the wrong statement.

- A. On an average, a healthy human breathes 12-16 times/minute.

B. Each haemoglobin molecule can carry a maximum of four molecules of O₂.

C. The lungs are situated in the abdominal chamber which is anatomically an air-tight chamber.

1) A and B • 2) B and C

3) C only 4) B only

5) A only

- 150.** Match the accessory excretory organs in column I with products given in column II and select the correct option :

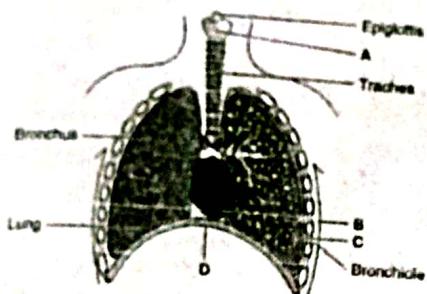
Column I	Column II
a) Vital Capacity (VC)	i. 500 mL
b) Tidal Volume (TV)	ii. 1100 mL
c) Residual Volume (RV)	iii. 4800 mL
d) Expiratory Reserve Volume (ERV)	iv. 1200 mL
• 1) a-iii, b-i, c-iv, d-ii	2) a-iv, b-ii, c-i, d-iii
3) a-ii, b-iv, c-i, d-iii	4) a-iii, b-i, c-ii, d-iv

151. Select the correct statement with respect to mechanism of breathing in humans :

- Q. In humans :**

 - 1) Inspiration can occur if the pressure within the lungs (intra-pulmonary pressure) is more than the atmospheric pressure.
 - 2) Inspiration is an active process as it requires expenditure of energy for muscle contraction.
 - 3) An increase in pulmonary volume increases the intra-pulmonary pressure
 - 4) During inspiration, the diaphragm becomes dome-shaped.

152. The figure shows a diagrammatic view of human respiratory system with labels A, B, C and D. Select the option which gives correct identification and main function and/or characteristic.

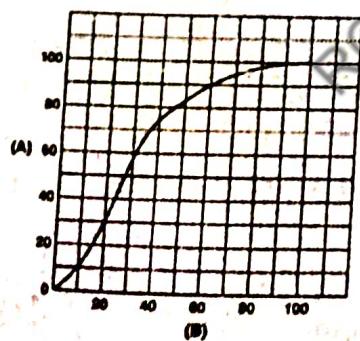


- 1) B - Alveoli - stores the resident air in the lungs.
- 2) C - Pleural fluid - acts as a lubricant, holds two pleura together.
- 3) D - Lower end of lungs - diaphragm pulls it down during Expiration.
- 4) A - Larynx - purify the inspiratory air.

153. Select the wrong statement regarding the transport of CO_2 in the blood:

- 1) Nearly 20 – 25 per cent of CO_2 is transported by RBCs.
- 2) 70 per cent of CO_2 is carried by blood as bicarbonate.
- 3) Transport CO_2 by blood is much easier than that of O_2 due high solubility of CO_2 .
- 4) CO_2 is carried by haemoglobin as carboxy-haemoglobin (about 20 – 25 per cent).

154. Which of the following is true about the graph given below:



- 1) The curve is sigmoid in shape.
- 2) A - axis represents partial pressure of O_2 in mmHg.
- 3) B - axis represents % saturation of Hb with O_2 .
- 4) The graph is called carbon dioxide dissociation curve.

155. Which is the correct sequence of air passages in man?

- 1) External Nostril → Nasal passage → Internal nostril → Pharynx → Larynx → Trachea → Bronchi → Bronchioles → Alveoli
- 2) Nose → Larynx → Pharynx → Bronchioles → Bronchi → Alveoli
- 3) Nose → Pharynx → Trachea → Larynx → Bronchi → Bronchioles → Alveoli
- 4) Nose → Larynx → Bronchi → Pharynx → Trachea → Bronchioles → Alveoli

156. Which of the following options is wrong about the larynx (sound box)?

- 1) It is a bony box
- 2) Glottis is the opening into the larynx
- 3) During swallowing of food glottis is covered by epiglottis to prevent food entry into the larynx
- 4) All

157. I. It is double layered and covers the lungs
II. Fluid between the layers reduces friction on lung-surface
III. Outer layer is in contact with thoracic wall
IV. Inner layer is in contact with lungs
The above features refer to –

- 1) Pericardium 2) Peritoneum
- 3) Pleura 4) None

158. Respiration involves following steps –

- I) Diffusion of gases O_2 and CO_2 across alveolar membrane
- II) Transport of gases by blood
- III) Utilization of O_2 by cell for catabolic reactions and resultant release of CO_2
- IV) Pulmonary ventilation by which atmospheric air is drawn in and CO_2 rich alveolar air is released out
- V) Diffusion of O_2 and CO_2 between blood and tissues.

The correct sequence of steps is –

- 1) I) → II) → III) → IV) → V)
- 2) V) → IV) → III) → II) → I)
- 3) IV) → I) → II) → V) → III)
- 4) III) → II) → V) → I) → IV)

QUESTION BOOKLET VERSION : 11

159. Inspiration occurs when there is a negative pressure in the lungs with respect to atmospheric pressure. This negative pressure is achieved when -

- 1) Intrapulmonary pressure is less than the atmospheric pressure
- 2) Intra pulmonary pressure is greater than the atmospheric pressure
- 3) Intrapulmonary pressure is equal to the atmospheric pressure
- 4) Intrapleural pressure becomes more than the intra-alveolar pressure

160. Match the following -

Column A	Column B
1. Tidal Volume	C. 2500-3000 mL of air
2. Inspiratory reserve volume	B. 1000 mL of air
3. Expiratory reserve volume	C. 500 mL of air
4. Residual volume	D. 3400-4800 mL of air
5. Vital Capacity	E. 1200 mL of air

- 1) 1 - C, 2 - D, 3 - B, 4 - A, 5 - E
- 2) 1 - C, 2 - A, 3 - B, 4 - E, 5 - D
- 3) 1 - C, 2 - A, 3 - D, 4 - E, 5 - B
- 4) 1 - E, 2 - A, 3 - B, 4 - E, 5 - D

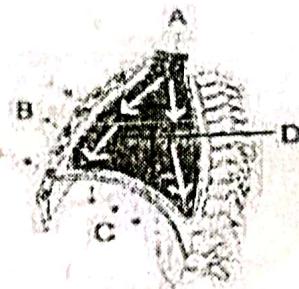
161. Which of the following sequences is correct to initiate inspiration?

- I. The contraction of external intercostal muscles raises the ribs and sternum
 - II. Volume of thorax increases in the dorso-ventral axis
 - III. Intrapulmonary pressure decreases
 - IV. Diaphragm contraction
 - V. Air rushes into lungs
 - VI. Volume of thorax increases in the antero-posterior axis
- 1) I, II, IV, V, III, VI 2) I, II, III, IV, V
 - 3) I, II, IV, VI, III, V 4) VI, I, II, III, V

162. Which of the following sequences is correct to initiate expiration?

- I. Relaxation of external intercostal muscles and return of diaphragm and sternum to their normal position
 - II. Air expelled from lungs
 - III. Volume of thorax decreases
 - IV. Intrapulmonary pressure increases
- 1) I, III, IV, II 2) II, IV, III, I
 - 3) IV, III, II, I 4) I, II, III, IV

163. Following illustration depicts the mechanism of breathing. In which of the following option all the parts A, B, C and D are correctly labelled?



- 1) A-Air entering into lungs; B-Ribs and sternum raised; C-Diaphragm contracted; D-Volume of thorax raised
- 2) A - Air expelled from lungs; B - Ribs and sternum return to original position; C - Diaphragm relaxed; D - Volume of thorax decreased
- 3) A-Air expelled from lungs; B- Ribs and sternum raised; C - Diaphragm relaxed; D - Volume of thorax decreased
- 4) A-Air expelled from lungs; B- Ribs and sternum raised; C-Diaphragm contracted; D- Volume of thorax decreased

164. Arrange the following in order of increasing volume -

1. Tidal volume
2. Residual volume
3. Expiratory reserve volume
4. Vital capacity

- 1) 1 < 2 < 3 < 4 2) 1 < 4 < 3 < 2
- 3) 1 < 3 < 2 < 4 4) 1 < 4 < 2 < 3

165. Different respiratory volumes are given below-

- I. Tidal Volume= 500 ml
 - II. Residual Volume= 1000 ml
 - III. Inspiratory Reserve Volume= 2500 ml
 - IV. Expiratory Reserve Volume = 1000 ml
- The functional residual capacity (FRC) is-
- 1) 3500 ml 2) 2000 ml
 - 3) 600 ml 4) 3000 ml

QUESTION BOOKLET VERSION : 11

166. Which of the following statements about the partial pressure of CO₂ is true?
- It is higher in alveoli than in pulmonary artery
 - It is higher in the systemic arteries than in tissues
 - It is higher in systemic veins than in systemic arteries
 - It is higher in the pulmonary veins than in pulmonary arteries
167. Partial pressures (in mmHg) of O₂ in atmospheric air, alveoli deoxygenated blood, oxygenated blood and tissues are-
- 40, 95, 40, 104, 159
 - 104, 40, 40, 95, 159
 - 159, 104, 40, 95, 40
 - 195, 104, 95, 40, 40
168. Partial pressure (in mm Hg) of CO₂ in atmospheric air, alveoli, deoxygenated blood, oxygenated blood and tissues are-
- 0.3, 40, 45, 40, 45
 - 40, 45, 40, 45, 0.3
 - 40, 40, 45, 45, 0.3
 - 0.3, 45, 45, 40, 40
169. Blood carries the CO₂ in 3 forms. The correct percentages of CO₂ in these forms are-
- | | As carbaminohaemoglobin in RBC | As bicarbonates | Dissolved form in plasma |
|----|--------------------------------|-----------------|--------------------------|
| 1) | 20-25% | 70% | 7% |
| 2) | 70% | 20-25% | 7% |
| 3) | 20-25% | 7% | 70% |
| 4) | 7% | 20-25% | 70% |
170. Which of the following statements is wrong?
- O₂ binds with haemoglobin in a reversible manner to form oxyhaemoglobin.
 - Every 100 mL of oxygenated blood can deliver around 5 ml of O₂ to the tissue
 - Occupational respiratory disorder are characterised by fibrosis (proliferation of fibrous tissues)
 - None
171. What will be the pO₂ and pCO₂ in the atmospheric air compared to those in the alveolar?
- pO₂ lesser, pCO₂ higher
 - pO₂ higher, pCO₂ lesser
 - pO₂ higher, pCO₂ higher
 - pO₂ lesser, pCO₂ lesser
172. Which of the following situations would result in the greatest degree of O₂ saturation for haemoglobin, assuming pO₂ remains constant -
- Increased CO₂ levels, decreased temperature
 - Increased CO₂ levels, increased temperature
 - Decreased CO₂ levels, decreased temperature
 - Decreased CO₂ levels, increased temperature
173. All of the following favour the dissociation of oxyhaemoglobin to deliver O₂ to tissues except-
- pO₂ ↑
 - pCO₂ ↑ OR H⁺ ↑
 - Temperature ↑
 - pO₂ ↓
174. Which of the following statements is false?
- pO₂ is the major factor which affects the binding of CO₂ with haemoglobin
 - pCO₂ is low and pO₂ is high as in the tissues, more binding of CO₂ with Hb occurs
 - RBC contains a very high conc. of carbonic anhydrase and minute quantities of the same in the plasma
 - Every 100 mL of deoxygenated blood delivers approximately 4 mL of CO₂ to the alveoli.
175. How does an increase in the CO₂ concentration in the blood affect the pH of CSF?
- pH ↑
 - pH ↓
 - pH remains same.
 - pH may increase or decrease.
176. Assertion - A drop in the blood pH causes an increase in heart rate.
- Reason- Increased Heart Rate increases the rate at which CO₂ is delivered to the lungs, where CO₂ is removed.
- Both assertion and reason are true and reason is correct explanation of assertion.
 - Both assertion and reason are true and reason is not correct explanation of assertion.
 - Assertion is true but reason is false.
 - Both assertion and reason are false

QUESTION BOOKLET VERSION : 11

177. All of the following factors play role in the regulation of respiratory rhythm except –

- 1) CO₂
 - 2) H⁺ conc.
 - 3) O₂
 - 4) None of the above is correct

178. Receptors associated with aortic arch and carotid artery can recognise changes in _____ and _____ conc. and send necessary signal to _____ for remedial action.

- 1) O₂, CO₂, Pneumothorax
 - 2) CO₂, H⁺, rhythm centre
 - 3) CO₂, H⁺, apneustic centre
 - 4) O₂, H⁺, Pneumothorax

179. Why do human beings have difficulty breathing at high elevations?

- 1) O₂ makes up higher percentage of air there
 - 2) The temperature is lower there
 - 3) The barometric pressure is higher there
 - 4) pO₂ is lower there

180. If an injury tore a small hole in the membrane surrounding lungs, what effect on lung function would you expect?

- ✓ 1) Pneumothorax with lung collapse
 - 2) Pneumothorax without lung collapse
 - 3) Silicosis with lung collapse
 - 4) Silicosis without lung collapse

SECTION A: PHYSICS

01. Sol.(3)

$$DC^2 = L_z^2 - \frac{L_1^2}{4} \Rightarrow 0 = 2L_z \Delta L_z - \frac{2L_z \Delta L_1}{4}$$

$$\Rightarrow 0 = 2L_1(a_1 L_2 \theta) - \frac{2L_1(a_1 L_1 \theta)}{\lambda} \Rightarrow a_1 = 4a_2$$

02.

D. A.

A part of liquid will evaporate immediately sucking latent heat from the bulk of liquid. Hence a part of

٢١٣

30L (4)

$$\text{Ideal gas equation } P = \frac{\rho}{M} \cdot RT \quad \text{for state A}$$

$$P_0 = \frac{\rho_0}{V} R T_0 \quad \text{For state B}$$

$$M = \frac{\rho}{M} R T_0 \Rightarrow \rho = \frac{3}{2} \rho_0$$

2

16. Sol. (1) For black body

$$\lambda_1 T = \frac{h}{2} T \Rightarrow T = 2T$$

$$\frac{P}{P'} = \frac{\epsilon A T^4}{\epsilon A T'^4} = \frac{1}{16} \Rightarrow P' = 16P = 16\pi R^2 T^4 = 16\pi RT^4$$

17. Sol. (2) From Stefan's law of cooling :

$$e\sigma A(T^4 - T_0^4) = m s \left(-\frac{dT}{dt} \right)$$

$$\Rightarrow 1 \cdot 5.8 \cdot 10^{-8} \pi (0.05)^2 (500^4 - 300^4)$$

$$= 10 \cdot 90 \cdot 4.2 \left(-\frac{dT}{dt} \right) \Rightarrow \left(-\frac{dT}{dt} \right) = 0.067 \text{ C/s}$$

18. Sol. (1) 19. Sol. (1) 20. Sol. (2) 21. Sol. (3) 22.

19. Sol. (1) 20. Sol. (2) 21. Sol. (3) 22.

23. Sol. (2)

For same rate of heat transfer the body having higher conductivity will have lower temperature difference. If cylinder with higher conductivity is connected with hot reservoir first then the function temperature T_{12} will be closer to hot reservoir temperature.

24. Sol. (1) $T_P = 50^\circ\text{C}$, $T_0 = 45^\circ\text{C}$
Heat will flow from P to Q

25. Sol. (4) For same power of radiation

$$P_A = P_c \Rightarrow e_A \sigma A T_A^4 = e_c \sigma A T_c^4 \Rightarrow e_A \sigma A T_A^4 = e_c \sigma A T_c^4$$

$$\& \lambda_A T_A = \lambda_c T_c \Rightarrow e_A T_A^3 = e_c T_c^3 \Rightarrow 1 : \frac{1}{2} : \frac{1}{4}$$

$$\Rightarrow \sqrt{T_A T_c} = T_A \sigma \sqrt{e_A T_A} \sqrt{e_c T_c} = e_A T_A \& \sqrt{e_c T_c} = \sqrt{\lambda_A}$$

26. Sol. (4) Conceptual

27. Sol. (2)

$$\dot{Q} = \frac{T_A - T_B}{L} = \frac{T_A - T_B}{\frac{L}{k} + \frac{k}{\rho c}} \Rightarrow k = \frac{k}{\frac{L}{\rho c}}$$

$$\begin{aligned} -30 &= 18 + a \times 2.4 \\ \therefore a &= -20 \text{ m/s}^2. \end{aligned}$$

$$\left(\frac{v}{2}\right)^2 = v^2 - 2g \times 3$$

If h is the further height, then

$$0 = \left(\frac{v}{2}\right)^2 - 2gh$$

$$\therefore h = \frac{v^2}{8g} = \frac{8g}{8g} = 1 \text{ m.}$$

$$\begin{aligned} \text{Also } h &= ut^2 - \frac{1}{2}gt^2 \\ \text{After simplifying above equations, we get} \\ h &= \frac{1}{2}gt_1t_2. \end{aligned}$$

$$\begin{aligned} s_1 &= \frac{1}{2}gt_1^2 = \frac{10}{2} \times (5)^2 = 125 \text{ m} \\ s_2 &= \frac{1}{2}gt_2^2 = \frac{10}{2} \times (3)^2 = 45 \text{ m} \\ \therefore s_1 - s_2 &= 125 - 45 = 80 \text{ m} \end{aligned}$$

Let two vectors be \vec{A} and \vec{B} . Difference of vectors \vec{A} and \vec{B} can be taken as the sum of two vectors \vec{A} and $-\vec{B}$ i.e., $\vec{A} - \vec{B} = \vec{A} + (-\vec{B})$

$$\begin{aligned} \frac{dv}{dt} &= 2(t-1) \\ \text{or } \int_0^v dv &= \int_0^t 2(t-1) dt \\ \text{or } v &= 2 \left[\left(\frac{t^2}{2} - t \right) \right]_0^t = 2 \left(\frac{t^2}{2} - t \right) = 15 \text{ m/s.} \end{aligned}$$

$$\begin{aligned} \text{We have } v^2 &= u^2 + 2as \\ \text{or } 900 &= 3600 + 2a \times 0.6 \\ \therefore a &= -2250. \end{aligned}$$

$$\vec{A} + \vec{B} = \vec{S} - \vec{j} + \vec{k}$$

$$\text{The unit vector of } \vec{A} + \vec{B} = \frac{\vec{S} - \vec{j} + \vec{k}}{\sqrt{25+1+1}} = \frac{\vec{s} - \vec{j} + \vec{k}}{\sqrt{27}}$$

The time taken by stone to reach the highest point
0 = 9.8 - $g t_1$
 $t_1 = \frac{9.8}{g} = 1.15$

The time taken to pass through the point of projection = $2s$.
If it is the time to reach the ground, then

$$\begin{aligned} 39.2 &= -9.8t + \frac{1}{2}gt^2 \\ \text{After solving, we get, } t &= 4s. \\ \text{Velocity before striking the ground,} \\ v^2 &= u^2 + 2gh \end{aligned}$$

$$= (-9.8)^2 + 2 \times 9.8 \times 39.2$$

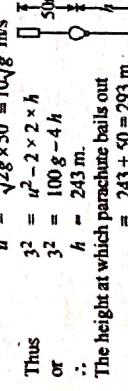
$$v = 29.4 \text{ m/s.}$$

$$\begin{aligned} \cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma &= 1 \\ \text{or } \cos^2 60^\circ + \cos^2 60^\circ + \cos^2 45^\circ &= 1 \\ \text{or } \frac{1}{4} + \frac{1}{4} + \cos^2 \gamma &= 1 \\ \text{or } \cos^2 \gamma &= 1 - \frac{1}{2} = \frac{1}{2} \\ \text{or } \cos \gamma &= \frac{1}{\sqrt{2}} \Rightarrow \gamma = 45^\circ \quad \therefore n = 4 \end{aligned}$$

$$\begin{aligned} \text{If } a \text{ and } b \text{ are perpendicular, } ab &= 0 \\ \text{or } 2x - 3 + 1 &= 0 \\ \therefore x &= 1 \end{aligned}$$

$$\begin{aligned} \text{Given, } \vec{A} = a\hat{i} \text{ and } \vec{B} = a(\cos \alpha \hat{i} + \sin \alpha \hat{j}) \\ (\vec{A} + \vec{B}) = (a + a \cos \alpha)\hat{i} + a \sin \alpha \hat{j} \\ \text{and } (\vec{A} + \vec{B}) = (a - a \cos \alpha)\hat{i} - a \sin \alpha \hat{j} \\ |(\vec{A} + \vec{B})| = \sqrt{(a + a \cos \alpha)^2 + (a \sin \alpha)^2} \\ |(\vec{A} - \vec{B})| = \sqrt{(a - a \cos \alpha)^2 + (a \sin \alpha)^2} \end{aligned}$$

$$\begin{aligned} \text{Which gives } \vec{A} + \vec{B} &= 2a \cos \frac{\alpha}{2} \hat{i} \\ \vec{A} - \vec{B} &= 2a \sin \frac{\alpha}{2} \hat{j} \\ \text{So } 2a \cos \frac{\alpha}{2} &= \sqrt{3} \left(2a \sin \frac{\alpha}{2} \right) \\ \tan \frac{\alpha}{2} &= \frac{1}{\sqrt{3}} \\ \frac{\alpha}{2} &= \frac{\pi}{6} \Rightarrow \alpha = \frac{\pi}{3} \\ \text{or } \frac{\pi}{6} &= \frac{\pi}{3} \Rightarrow t = 2.00 \text{ sec} \end{aligned}$$



$$\begin{aligned} \text{Velocity of the parachute after falling 50 m} \\ u &= \sqrt{2g \times 50} = 10\sqrt{g} \text{ m/s} \\ \text{Thus } 32 &= u^2 - 2 \times g \times h \\ \text{or } 32 &= 100g - 4h \\ \therefore h &= 24.3 \text{ m.} \\ \text{The height at which parachute falls out} \\ &= 24.3 + 50 = 29.3 \text{ m.} \end{aligned}$$

Comprehension (From Q43 to Q45)
From the top of a multi-storeyed building, 39.2 m tall, a boy projects a stone vertically upwards with an initial velocity of 9.8 m/s such that it finally drops to the ground.

It represents a parabola between v and t .