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All India Test Series (AITS)
JEE-2025

Micro Test - 01

(For XII / XII+ Students)

Time : 3 Hours	Date : 30.10.2024	Maximum Marks - 300

Syllabus :

Physics – Basic Mathematics ,Vectors,Unit and Dimension and Measrements,Kinematics,Electrostatics

Chemistry – Mole Concept, Structure of Atom

Biology – Sets,Numbers & Intervals,Fundamental of Algebra,Quadratic Equations,Function,Inverse Trigonometry Function

Name of the student : _____

Enrolment No : _____ Centre : _____

Class : _____ Test Id : _____

INSTRUCTIONS FOR CANDIDATE

1) This paper contains 75 questions based on recent NTA pattern.
2) All questions are compulsory.
3) Write your Name, Enrolment no., Date, Centre Address, Class in the space provided.
4) Use black pen to mark OMR.

MARKING SCHEME

1) This paper contains single correct & integer type questions only.
2) Only one option is correct for single correct.
3) For correct answer +4 will be awarded & -1 will be deducted for the incorrect

Centre Stamp

Invigilator sign

Student sign

USEFUL DATA

Atomic weights : H =, He = 4, Li =7, g =10 m/s ^{2}, B= 11, C=12, N= 14, O=16, F = 19, Ne = 20, Na = 23 Mg = 24, Al = 27, P = 31, S= 32, Cl= 35.5, K=39, Ca = 40 Ar = 40, Ti = 48, Cr = 52, Mn = 55, Fe = 56, Co = 59, Cu = 63.5, Zn = 65.5, Br = 80, Mo = 96, Ag = 108, I = 127, Ba = 137, U =238 g =9.8 m/s ^{2} h= 6.63×10^{-34} J/S, Na = 6.023×10^{23}, R=1.097 x 10^{7}m-1

01. An air column in open organ pipe resonates in fundamental mode due to a tuning fork. Length and radius of the pipe are measured to be $l = 95.2 \pm 0.1$ cm and $r = 4.00 \pm 0.05$ cm respectively. If speed of sound in air is known with certainty, maximum percentage error in measurement of frequency of tuning fork is

(a) 0.08 (b) 0.16 (c) 1.6 (d) 3.2

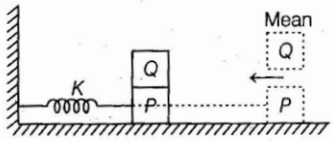
02. Magnetic field component in an EM wave is given by the following equation

$$\mathbf{B} = B_0 \cos[\omega t + 12x - 5z]\hat{n}$$

Unit vector in direction of propagation of the wave is

(a) $\frac{12\hat{i} - 5\hat{k}}{13}$ (b) $\frac{5\hat{i} - 12\hat{k}}{13}$

(c) $\frac{5\hat{k} - 12\hat{i}}{13}$ (d) $12\hat{k} - 5\hat{i}$

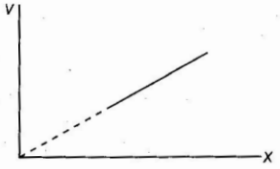
03. 

A block connected to spring of spring constant K is executing SHM with amplitude A as shown in figure. An identical block Q is gently placed on P when P is crossing its mean position. If Q ceases to slip instantly as it comes in contact with P, friction force on Q at the shown instant of maximum compression in the spring is

(a) KA (b) $\frac{KA}{\sqrt{2}}$

(c) $\frac{KA}{2}$ (d) $\frac{KA}{2\sqrt{2}}$

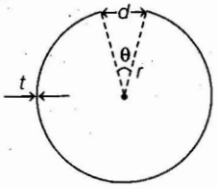
04. Velocity-position (v-x) graph for a particle moving on X-axis is as shown in figure.



If v is equal to $2v_0$ at time t equal to t_0, average acceleration of the particle between $t = t_0$ and $t = 2t_0$ is (v_0 = initial velocity)

(a) $\frac{v_0}{t_0}$ (b) $\frac{2v_0}{t_0}$ (c) $\frac{3v_0}{t_0}$ (d) $\frac{4v_0}{t_0}$

05. The figure here shows a circular metal ring of radius r with a cut/gap of dimension d. Thickness of the ring is t. On heating the ring, which of the following does not change?



(a) d (b) r (c) t (d) θ

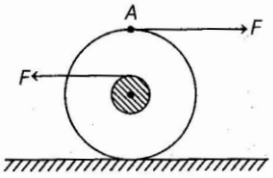
06. If air in a YDSE set-up is pumped out creating vacuum, fringe width

(a) will increase
(b) will decrease
(c) will remain unchanged
(d) may increase or decrease depending on wavelength of the source

07. To what approximate radius would earth (mass $\approx 6 \times 10^{24}$ kg) have to be compressed for it to become a black hole?

(a) 1 cm (b) 1 mm
(c) 1 μm (d) 1 pm

08. Two thin discs of mass $2m$, radius R and mass m, radius $2R$ are welded co-axially together forming a composite body as shown in figure. Two threads wound on the periphery of the two discs are pulled by equal and opposite force (F each) as shown in figure.



Assuming that friction is sufficient to prevent any slipping, initial acceleration of top point A of the body is (the body is initially at rest)

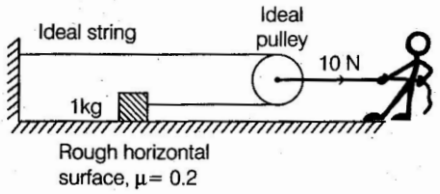
(a) $\frac{F}{3m}$ (b) $\frac{2F}{3m}$

(c) $\frac{4F}{15m}$ (d) $\frac{2F}{15m}$

09. A ball is projected from ground with kinetic energy K at angle θ with vertical. Gravitational potential energy of the ball w.r.t. ground, when it is at highest point, is

(a) K (b) $K\cos^2\theta$ (c) $K\sin^2\theta$ (d) zero

10. In the arrangement shown below, the acceleration (in m/s^2) of block with respect to pulley is (Take, $g = 10$ m/s^2)

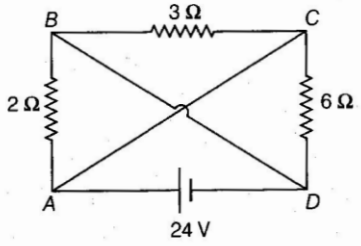


(a) 1.5 (b) 2 (c) 2.5 (d) 3

11. The magnitude of average acceleration of a particle executing SHM (with amplitude A and angular frequency ω) during its motion from mean position to extreme position is

(a) $A\omega^2$ (b) $\frac{\pi A\omega^2}{2}$ (c) $\frac{2A\omega^2}{\pi}$ (d) zero

12. Current flowing between points A and C is



(a) zero (b) 4 A (c) 8 A (d) 12 A

13. Probability of decay of a nucleus in a radioactive sample during one mean life is

(a) 37% (b) 50% (c) 63% (d) 100%

14. Average electric energy density at a point in space through which electromagnetic wave is propagating, is (where, E_0 = amplitude of electric field, B_0 = amplitude of magnetic field, μ_0 = magnetic permeability and ε_0 = electric permittivity of free space)

(a) $\frac{1}{2}\varepsilon_0 E_0^2$ (b) $\frac{1}{8}\varepsilon_0 E_0^2 + \frac{B_0^2}{8\mu_0}$

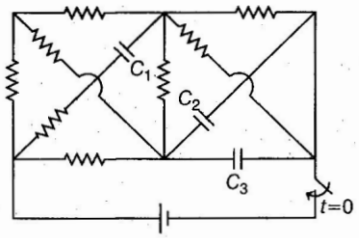
(c) $\frac{1}{4}\varepsilon_0 E_0^2 + \frac{B_0^2}{4\mu_0}$ (d) zero

15. Assuming mass of earth to be constant if density of earth's material increases by 3%, the range of a telecommunication tower on earth's surface will

(a) increase by 2% (b) decrease by 2%

(c) increase by 0.5% (d) decrease by 0.5%

16. Consider the shown network of identical resistors and capacitors C_1, C_2 and C_3 having capacitances 4C, 2C and 3C respectively. Ratio of energies stored by C_1, C_2 and C_3 in steady state is

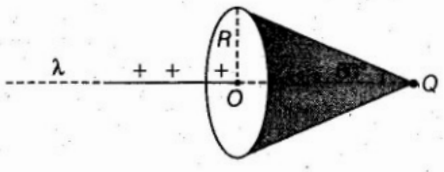


(a) 2:3:4 (b) 2:4:3 (c) 3:2:4 (d) 4:2:3

17. C-11 decays to B-11 by β^+ decay with Q-value of 0.96 MeV. β^+ particles produced in the decay combine with free electrons in the atmosphere and annihilate each other. If 1.25 μg of C-11 is present in the sample initially ($t = 0$), then energy (in MeV) produced during two half lives starting at $t = 0$, is approximately

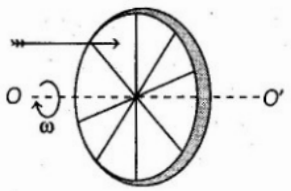
(a) 10^{15} (b) 10^{16} (c) 10^{17} (d) 10^{18}

18. The figure here shows a semi-infinite uniformly charged wire with charge density λ along axis of an imaginary cone such that its end coincides with centre O of its base. A point charge Q is placed at apex of the cone. If electric flux through the base is zero, electric flux through the curved surface is



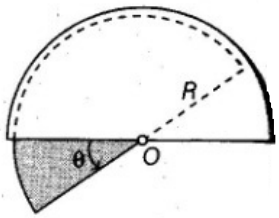
(a) $\frac{Q}{2\varepsilon_0}$ (b) $\frac{Q}{3\varepsilon_0}$ (c) $\frac{Q}{4\varepsilon_0}$ (d) $\frac{Q}{6\varepsilon_0}$

19. A wheel has eight equally spaced very thin spokes of length l. The wheel is rotating about axis OO′ as shown with angular speed ω. It is desired to pass an arrow of length same as length of one spoke without hitting any spoke. Minimum velocity of the arrow, parallel to axis of the wheel, is



(a) $\frac{\omega l}{\pi}$ (b) $\frac{2\omega l}{\pi}$ (c) $\frac{\omega l}{4\pi}$ (d) $\frac{4\omega l}{\pi}$

20. The figure shows sectional view of a parallel plate capacitor with semi-circular plates of area A and plate separation d. A semi-circularly sectioned dielectric slab completely filling the space with plates can rotate about axis perpendicular to the system and passing through O.



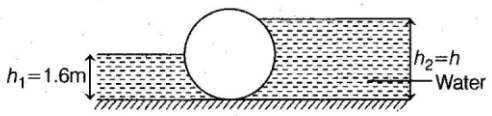
Torque required to slowly rotate the slab about O is (Given that potential difference across the capacitor is constant equal to V and dielectric constant of the slab is $K = 4\pi + 1$)

(a) $\frac{\varepsilon_0 AV^2}{d}$ (b) $\frac{2\varepsilon_0 AV^2}{d}$ (c) $\frac{3\varepsilon_0 AV^2}{d}$ (d) $\frac{4\varepsilon_0 AV^2}{d}$

INTEGER TYPE

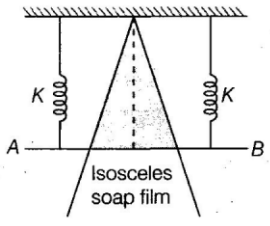
21. An ideal CO_2 sample is undergoing process given by $\rho^2 U^3$ = constant. Here, ρ is density and U is internal energy. If universal gas constant is equal to 8.31 J/mol-K, find molar specific heat (in J/mol-K) in the given process.

22. A cylinder of radius 1.6 m placed on a horizontal surface surrounded by water on one side while by a liquid of relative density 1.69 on the other side. Respective heights are as shown in the figure. Find h (in m) for the cylinder to be in equilibrium if atmospheric pressure is negligible.

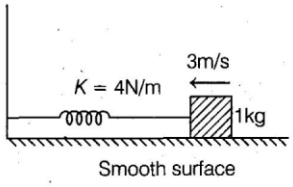


23. Ratio of nuclear radius of ^{56}Fe to that of $^{14}_{7}N$ is $x^{\frac{2}{1+x}}$. Find x.

24. A horizontal wire AB of mass m in contact with a V-shaped smooth vertical frame, is supported at rest by a soap film. Springs of spring constant K and natural length l are relaxed. If the wire AB is slightly disturbed, time period of oscillation of the wire is $\pi\sqrt{\frac{xl}{g}}$. Find x. Given that $K = \frac{mg}{l}$



25. Find work done (in J) by spring (relaxed at the instant shown) on the wall till the instant of maximum compression.



26. A sample of impure sulphide ore contains 42.34% Zn. Percentage of pure ZnS in the sample is .....
[Atomic wt. of Zn = 65.38, S = 32.06]
(a) 67.10 (b) 45.38
(c) 60.15 (d) 63.10

27. Which of the following solution represents 1 M NaCl solution?
(a) 1 L solution containing 150 g NaCl.
(b) 250 mL solution containing 58.5 g NaCl.
(c) A solution containing 5.85 mg NaCl/mL solution.
(d) 5 L solution containing 292.5 g NaCl.

28. Match the items given in Column I with those given in Column II. Choose the correct matching code from the codes given below.

	Column I		Column II
A.	0.98% H_2SO_4 (w/w) [d = 1.8 g/mL]	1.	3 M, 4 N
B.	9.8% H_3PO_4 (w/w) [d = 1.4 g/mL, α% = 100]	2.	1.4 M, 4.2 N
C.	$1.8 \times 10^{-3} \times N_A$ molecules of NH_3 in 0.5 L water	3.	0.18 M, 0.36 N
D.	250 mL 4N HCl + 250 mL 2 M H_2SO_4	4.	0.0036 M, 0.0036 N

Codes

	A	B	C	D		A	B	C	D
(a)	3	2	1	4	(b)	1	2	4	3
(c)	3	2	4	1	(d)	2	1	3	4

29. 0.4 g of a polybasic acid, AH_n requires 0.5 g of NaOH for complete neutralisation. If all hydrogen atoms of AH_n are acidic, the value of n and atomic weight of A will be respectively. [Molecular weight of AH_n = 96]
(a) 1, 95 (b) 2, 94
(c) 3, 93 (d) 4, 92

30. 1.8 g of Mg is burnt in a closed vessel which contains 0.8 g of oxygen. Which of the following statement is not correct? [Atomic weight of Mg = 24.3 g mol^{-1}]
(a) 0.05 mole of MgO is formed.
(b) 0.8 g of Mg remains unreacted.
(c) Oxygen is the limiting reactant.
(d) The extent of reaction at the completion of reaction is 0.025 mol.

31. 3 moles of ethane is mixed with 60 g of it and after sometimes 2.4×10^{24} molecules of the gas is removed. The left over gas is combusted with excess of oxygen [$N_A = 6.023 \times 10^{23}$ mol^{-1}, density of water = 1 g/mL].
Based on the above experiment, three statements can be made which need justification in accordance to the experiment.
I. 2 moles of C_2H_6 was left for combustion.
II. Volume of CO_2 produced at STP after combustion is 44.8 L.
III. Volume of water produced is 54 mL.
Which of the above statement(s) is (are) correct?
(a) Only I (b) II and III
(c) I, II and III (d) I and III

32. H_3PO_4 is a tribasic acid and it on reaction with NaOH, forms an acidic salt, NaH_2PO_4. What volume of 1 M NaOH solution should be added to 12 g of NaH_2PO_4 to convert it completely into Na_3PO_4?
[Atomic wt. of Na = 23, H = 1, P = 31, O = 16]
(a) 100 mL (b) 150 mL
(c) 200 mL (d) 250 mL

33. An automobile of mass 500 kg is moving with a speed of 50 ± 0.001 km/h. Which of the following will be the correct one regarding the uncertainty in position of the car and its interpretation?
(a) 3.798×10^{-34} m and negligible
(b) 3.798×10^{-34} m and not negligible
(c) 1.512×10^{-2} m and not negligible
(d) 4.151×10^{-40} m and negligible

34. How fast should an electron have to move in order to eject an electron of neon, which has first ionisation energy equal to 2080 kJ mol^{-1}?
(a) 2.754×10^{6} ms^{-1}
(b) 3.021×10^{7} ms^{-1}
(c) 1.265×10^{8} ms^{-1}
(d) 4.012×10^{5} ms^{-1}

35. In an experiment to measure the quantum efficiency of photosynthesis in green plants, it was found that 8 quanta of red light at 6850 Å were needed to evolve 1 molecule of O_2. The average energy storage in the photosynthesis process is 112 kcal/mol O_2 evolved. Energy conversion efficiency of the photosynthesis process is
(a) 85% (b) 61.8% (c) 33.5% (d) 100%

36. If λ_0 is threshold wavelength for photoelectronic emission, λ is the wavelength of light falling on the surface of metal, and m is the mass of electron, then de-Broglie wavelength of the emitted electron is

(a) $\left[\frac{h(\lambda\lambda_0)}{2mc(\lambda_0-\lambda)}\right]^{1/2}$ (b) $\left[\frac{h(\lambda_0-\lambda)}{2mc\lambda\lambda_0}\right]^{1/2}$

(c) $\left[\frac{h(\lambda-\lambda_0)}{2mc\lambda\lambda_0}\right]^{1/2}$ (d) $\left[\frac{(h\lambda\lambda_0)}{2mc}\right]^{1/2}$

37. Given below are two statements.

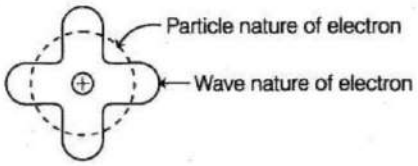
Statement I An ideal black body emits and absorbs radiation of all frequencies.

Statement II Frequency of black body radiation is directly proportional to the temperature of the black body.

In the light of the above statements, choose the most appropriate answer from the options given below.

(a) Both statement I and statement II are correct.
(b) Both statement I and statement II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

38. In hydrogen atom, the electronic motion can be shown as,



39. The number of revolutions made by the electron in the given orbit is

(a) $6.5\times10^{15}\ s^{-1}$ (b) $2\times10^{14}\ s^{-1}$

(c) $2\times10^{13}\ s^{-1}$ (d) $1.0\times10^{14}\ s^{-1}$

40. The distance of closest approach of an α-particle fired towards a nucleus with momentum p is r. What will be the distance of closest approach when the momentum of the α-particle is $2p$?

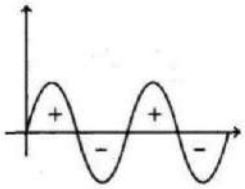
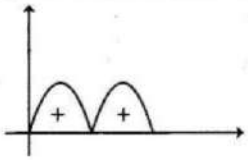
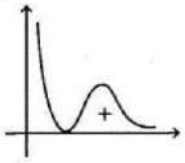
(a) $2r$ (b) $4r$

(c) $\frac{r}{2}$ (d) $\frac{r}{4}$

41. The de-Broglie wavelength made by the electron present in the third orbit of He^+ ion is

(a) 3.32 Å (b) 1.66 Å (c) 1.11 Å (d) 4.98 Å

42. Match radial distribution curves given in Column I with the presentations of the respective curves given in Column II. Select the answer from the codes given below.

Column I		Column II [r = distance from the nucleus]
A.		1. $R^2(r)$ vs r
B.		2. $R(r)$ vs r
C.		3. ψ^2 vs r for 2s

Codes

	A	B	C		A	B	C
(a)	1	2	3	(b)	2	3	1
(c)	2	1	3	(d)	3	2	1

43. Which is a possible set of quantum numbers for a valence unpaired electron in ground state atom of phosphorus (atomic no. $Z=15$)?

(a) $n=2, l=1, m=0, s=+\frac{1}{2}$ (b) $n=3, l=2, m=0, s=+\frac{1}{2}$

(c) $n=3, l=0, m=0, s=+\frac{1}{2}$ (d) $n=3, l=1, m=+1, s=+\frac{1}{2}$

44. Quantum numbers of some electrons are given as

I. $n=4, s=-\frac{1}{2}$ II. $n=3, l=0$ III. $n=2, l=1$

IV. $n=2, m=0$

How many electrons in an atom may have these quantum numbers ?

	I	II	III	IV		I	II	III	IV
(a)	16	2	6	6	(b)	32	18	8	8
(c)	16	6	8	6	(d)	16	2	6	4

45. 0.70 g of a sample of $(NH_4)_2SO_4$ was boiled with 100 mL of 0.2 N NaOH solution till all the $NH_3(g)$ evolved and get dissolved in solution itself. The remaining solution was diluted to 250 mL. 25 mL of this solution was neutralised using 10 mL of 0.1 N H_2SO_4 solution. The percentage purity of the sample is

(a) 94.3 (b) 50.8

(c) 47.4 (d) 79.8

Integer Type

46. When the Baeyer process is used for recovering aluminium from siliceous ore, some aluminium is always lost because of the formation of an unworkable mud having the following average formula : $3Na_2O \cdot 3Al_2O_3 \cdot 5SiO_2 \cdot 5H_2O$. A certain ore contained 13% (by weight) kaolin ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$; molar mass = 258 g mol^{-1}) and 87% gibbsite ($Al_2O_3 \cdot 3H_2$; molar mass = 156 g mol^{-1}). The percentage of the total aluminium in this ore that is recoverable in the Baeyer process is ..... [Atomic mass of aluminium = 27 g mol^{-1}]

47. A litre of milk weighs 1.032 kg. The butterfat it contains to the extent of 4% by volume has a density of 865 kg/m^3. The density (in kg/m^3) of the fat-free "skimmed" milk will be .....

48. A sample of polystyrene prepared by heating styrene ($C_6H_5 — CH = CH_2$) with tribromobenzoyl peroxide in absence of air has the formula, $Br_3C_6H_3(C_8H_8)_n$ which contains 10.46% of bromine by mass. The value of n is ..... [Atomic mass of bromine = 80 g mol^{-1}]

49. The empirical formula of a commercial ion-exchange resin is $C_8H_7SO_3Na$. The resin can be used to soften hard water according to the reaction,

$$Ca^{2+} + 2C_8H_7SO_3Na \longrightarrow (C_8H_7SO_3)_2Ca\downarrow + 2Na^+$$

The maximum uptake of Ca^{2+} by the resin is found to be $x \times 10^{-3}$ mol/g resin. The value of x is .....

50. The wavelength of a beam of light is 24 μm. The energy (in J) of one of its photon with a multiple of value, 10^{-21} will be .....

51. Which of the following is **not** correct for relation R on the set of real numbers ?
(a) $(x, y) \in R \Leftrightarrow 0 < |x| - |y| \le 1$ is neither transitive nor symmetric.
(b) $(x, y) \in R \Leftrightarrow 0 < |x - y| \le 1$ is symmetric and transitive.
(c) $(x, y) \in R \Leftrightarrow |x| - |y| \le 1$ is reflexive but not symmetric.
(d) $(x, y) \in R \Leftrightarrow |x - y| \le 1$ is reflexive and symmetric.

52. The function $f: N \to N$ defined by $f(x) = x - 5\left[\frac{x}{5}\right]$, where N is set of natural numbers and $[x]$ denotes the greatest integer less than or equal to x, is :
(a) one-one and onto. (b) one-one but not onto.
(c) onto but not one-one. (d) neither one-one nor onto.

53. The value of $\cot\left(\sum_{n=1}^{50} \tan^{-1}\left(\frac{1}{1+n+n^2}\right)\right)$ is

(a) $\frac{26}{25}$ (b) $\frac{25}{26}$ (c) $\frac{50}{51}$ (d) $\frac{52}{51}$

54. If $(\sin^{-1} x)^2 - (\cos^{-1} x)^2 = a$; $0 < x < 1$, $a \neq 0$, then the value of $2x^2 - 1$ is :

(a) $\cos\left(\frac{4a}{\pi}\right)$ (b) $\sin\left(\frac{2a}{\pi}\right)$

(c) $\sin\left(\frac{2a}{\pi}\right)$ (d) $\sin\left(\frac{4a}{\pi}\right)$

55. The value of $\tan^{-1}\left[\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right]$, $|x| < \frac{1}{2}, x \neq 0$, is equal to

(a) $\frac{\pi}{4} + \frac{1}{2}\cos^{-1} x^2$ (b) $\frac{\pi}{4} + \cos^{-1} x^2$

(c) $\frac{\pi}{4} - \frac{1}{2}\cos^{-1} x^2$ (d) $\frac{\pi}{4} - \cos^{-1} x^2$

56. All the pairs (x, y) that satisfy the inequality $2^{\sqrt{\sin^2 x - 2\sin x + 5}} \cdot \frac{1}{4^{\sin^2 y}} \le 1$ also satisfy the equation:

(a) $2|\sin x| = 3\sin y$ (b) $2\sin x = \sin y$
(c) $\sin x = 2\sin y$ (d) $\sin x = |\sin y|$

57. Let $S = \{x \in R : x \ge 0$ and $2|\sqrt{x} - 3| + \sqrt{x}(\sqrt{x} - 6) + 6 = 0\}$. Then S:
(a) contains exactly one element.
(b) contains exactly two elements.
(c) contains exactly four elements.
(d) is an empty set.

58. Let S be the set of all triangles in the xy-plane, each having one vertex at the origin and the other two vertices lie on coordinate axes with integral coordinates. If each triangle in S has area 50 sq. units, then the number of elements in the set S is:
(a) 9 (b) 18 (c) 36 (d) 32

59. The sum of the digits in the unit's place of all the 4-digit numbers formed by using the numbers 3, 4, 5 and 6, without repetition, is:
(a) 432 (b) 108 (c) 36 (d) 18

60. A scientific committee is to be formed from 6 Indians and 8 foreigners, which includes at least 2 Indians and double the number of foreigners as Indians. Then the number of ways, the committee can be formed, is :
(a) 1625 (b) 575 **(c) 560** **(d) 1050**

61. If in a regular polygon the number of diagonals is 54, then the number of sides of this polygon is

(a) 12 (b) 6 (c) 10 (d) 9

62. If $a > 0$ and $z = \frac{(1+i)^2}{a-i}$, has magnitude $\sqrt{\frac{2}{5}}$, then $\bar{z}$ is equal to :

(a) $-\frac{1}{5} - \frac{3}{5}i$ (b) $-\frac{3}{5} - \frac{1}{5}i$

(c) $\frac{1}{5} - \frac{3}{5}i$ (d) $-\frac{1}{5} + \frac{3}{5}i$

63. The area of the polygon, whose vertices are the non-real roots of the equation $\bar{z} = iz^2$ is :

(a) $\frac{3\sqrt{3}}{4}$ (b) $\frac{3\sqrt{3}}{2}$ (c) $\frac{3}{2}$ (d) $\frac{3}{4}$

64. If $\mathrm{Re}\left(\frac{z-1}{2z+i}\right) = 1$, where $z = x + iy$, then the point (x, y) lies on a:

(a) circle whose centre is at $\left(-\frac{1}{2}, -\frac{3}{2}\right)$.

(b) straight line whose slope is $-\frac{2}{3}$.

(c) straight line whose slope is $\frac{3}{2}$.

(d) circle whose diameter is $\frac{\sqrt{5}}{2}$.

65. If for positive integers $r > 1$, $n > 2$, the coefficients of the $(3r)^{th}$ and $(r+2)^{th}$ powers of x in the expansion of $(1+x)^{2n}$ are equal, then n is equal to :

(a) $2r+1$ (b) $2r-1$ (c) $3r$ (d) $r+1$

66. Let $\bigcup_{i=1}^{50} X_i = \bigcup_{i=1}^{n} Y_i = T$, where each X_i contains 10 elements and each Y_i contains 5 elements. If each element of the set T is an element of exactly 20 of sets X_i's and exactly 6 of sets Y_i's, then n is equal to
(a) 15 (b) 50 (c) 45 (d) 30

67. In a class of 140 students numbered 1 to 140, all even numbered students opted Mathematics course, those whose number is divisible by 3 opted Physics course and those whose number is divisible by 5 opted Chemistry course. Then the number of students who did not opt for any of the three courses is:
(a) 102 (b) 42 (c) 1 (d) 38

68. For $\alpha \in N$, consider a relation R on N given by $R = \{(x, y) : 3x + \alpha y \text{ is a multiple of } 7\}$. The relation R is an equivalence relation if and only if:
(a) $\alpha = 14$
(b) α is a multiple of 4
(c) 4 is the remainder when α is divided by 10
(d) 4 is the remainder when α is divided by 7

69. Let R_1 and R_2 be two relations defined on $\mathbb{R}$ by a R_1 $b \Leftrightarrow ab \geq 0$ and $a R_2 b \Leftrightarrow a \geq b$, then
(a) R_1 is an equivalence relation but not R_2
(b) R_2 is an equivalence relation but not R_1
(c) both R_1 and R_2 are equivalence relations
(d) neither R_1 nor R_2 is an equivalence relation

70. Let $\mathbb{Z}$ be the set of all integers,
$A = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : (x-2)^2 + y^2 \leq 4\}$,
$B = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : x^2 + y^2 \leq 4\}$ and
$C = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : (x-2)^2 + (y-2)^2 \leq 4\}$
If the total number of relation from $A \cap B$ to $A \cap C$ is 2^p, then the value of p is :
(a) 16 (b) 25 (c) 49 (d) 9

INTEGER TYPE

71. Let f(x) be a quadratic polynomial with leading coefficient 1 such that $f(0) = p$, $p \neq 0$ and $f(1) = \frac{1}{3}$. If the equation $f(x) = 0$ and $fofofof(x) = 0$ have a common real root, then $f(-3)$ is equal to _____

72. Let $z = a + ib$, $b \neq 0$ be complex numbers satisfying $z^2 = \bar{z}.2^{1-|z|}$. Then the least value of $n \in N$, such that $z^n = (z+1)^n$, is equal to ____.

73. The number of elements in the set $\{n \in \{1, 2, 3, ..., 100\} (11)^n > (10)^n + (9)^n\}$ is _____.

74. The number of real roots of the equation $\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{4}$ is :

75. Given that the inverse trigonometric function take principal values only. Then, the number of real values of x which satisfy $\sin^{-1}\left(\frac{3x}{5}\right) + \sin^{-1}\left(\frac{4x}{5}\right) = \sin^{-1} x$ is equal to:

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Chemistry - Mole Concept, Structure of Atom

Biology - Diversity in Living organisms : The Living world, Biological Classification, Plant Kingdom, Animal Kingdom, Structural Organisation in Animals-Frog

Name of the student : _____

Enrolment No : _____ Centre : _____

Class : _____ Test Id : _____

INSTRUCTIONS FOR CANDIDATE

1) This paper contains 200 questions.
2) All questions are compulsory in section A and attempt any 10 questions from section B.
3) Write your Name, Enrolment no., Date, Centre Address, Class in the space provided.
4) Use black pen to mark OMR.

MARKING SCHEME

1) This paper contains single correct questions only.
2) Only one option is correct for single correct.
3) For correct answer +4 will be awarded & -1 will be deducted for the incorrect

Centre Stamp

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Student sign

USEFUL DATA

Atomic weights : H =, He = 4, Li =7, g =10 m/s ^{2}, B= 11, C=12, N= 14, O=16, F = 19, Ne = 20, Na = 23 Mg = 24, Al = 27, P = 31, S= 32, Cl= 35.5, K=39, Ca = 40 Ar = 40, Ti = 48, Cr = 52, Mn = 55, Fe = 56, Co = 59, Cu = 63.5, Zn = 65.5, Br = 80, Mo = 96, Ag = 108, I = 127, Ba = 137, U =238 g =9.8 m/s ^{2} h= 6.63×10^{-34} J/S, Na = 6.023×10^{23}, R=1.097 x 10^{7}m-1

PHYSICS

SECTION - A

1. If area (A), velocity (v) and density (ρ) are taken as fundamental units, then correct dimensional formula of force is represented by

(a) $Av\rho$ (b) $Av\rho^2$

(c) $Av^2\rho$ (d) $\frac{Av}{\rho}$

2. Force F and density ρ are related as $F = \frac{\alpha}{\beta + \sqrt{\rho}}$, then dimensional formula of α and β, respectively is

(a) $[M^{\frac{1}{2}}L^{\frac{1}{2}}T^{-2}]$ & $[M^{\frac{1}{2}}L^{\frac{3}{2}}]$

(b) $[M^{\frac{3}{2}}L^{-\frac{1}{2}}T^{-2}]$ & $[M^{\frac{1}{2}}L^{-\frac{3}{2}}]$

(c) $[M^{\frac{3}{2}}L^{-\frac{1}{2}}T^{-1}]$ & $[M^{\frac{1}{2}}L^{-\frac{3}{2}}]$

(d) Cannot be calculated

3. **Assertion (A)** In vander Waals' equation of state, $\left(p + \frac{a}{V^2}\right)(V - b) =$ a constant; Unit of ab is N-m^7.

Reason (R) We can add, subtract, multiply or divide physical quantities having same dimensions.

Choose most appropriate answer from options given below

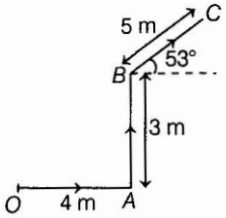
(a) Both A and R are true but R is not the correct explanation of A.

(b) A is true but R is false.

(c) A is false but R is true.

(d) Both A and R are true and R is the correct explanation of A.

4. A particle starts motion from point O. It follows the path $O \to A \to B \to C$ as shown in the figure. The displacement of the particle from point O to point C is



(a) 10 m (b) 12 m

(c) $7\sqrt{2}$ m (d) None of these

5. **Assertion (A)** Path of a projectile seen from another projectile is parabolic, if both are thrown at different angles of projection.

Reason (R) Relative acceleration of first projectile with respect to second projectile is zero.

Choose most appropriate answer from options given below

(a) Both A and R are true but R is not the correct explanation of A.

(b) A is true but R is false.

(c) A is false but R is true.

(d) Both A and R are true and R is the correct explanation of A.

6. Let speed of light (c), gravitational constant (G) and Planck's constant (h) are taken as fundamental quantities in a system of units.

Now, match physical quantities in Column I with its dimensions in Column II.

	Column I		Column II
A.	Density	P.	$[c^{\frac{1}{2}}G^{-\frac{1}{2}}h^{\frac{1}{2}}]$
B.	Mass	Q.	$[c^{-\frac{5}{2}}G^{\frac{1}{2}}h^{\frac{1}{2}}]$
C.	Time	R.	$[c^{-\frac{3}{2}}G^{\frac{1}{2}}h^{\frac{1}{2}}]$
D.	Length	S.	$[c^5G^{-2}h^{-1}]$

Choose the correct answer from options given below

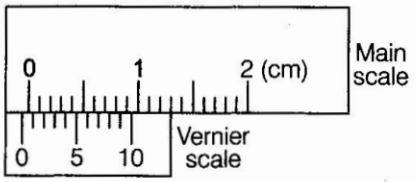
(a) A → P, B → Q, C → R, D → S

(b) A → S, B → R, C → Q, D → P

(c) A → S, B → P, C → Q, D → R

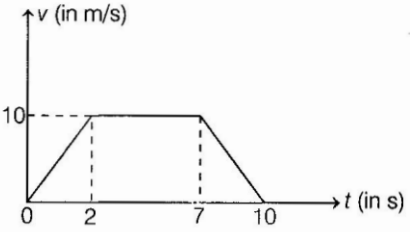
(d) A → S, B → Q, C → P, D → R

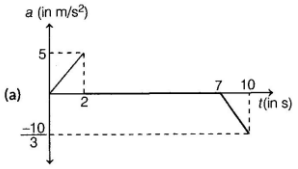
7. In the following figure, vernier and main scale of vernier calliper has been shown. If each main scale division is of 1 mm and 4th division of vernier scale coincides with a main scale division, then the zero correction is

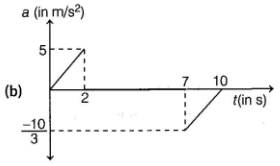


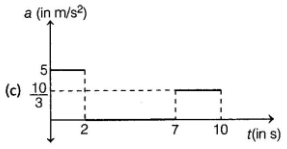
(a) 0.6 mm (b) – 0.6 mm (c) + 0.4 mm (d) – 0.4 mm

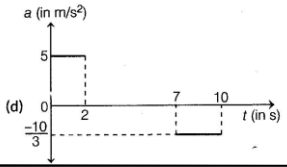
8. The velocity-time graph of a car moving on a straight road is shown below in the following figure. The correct representation of acceleration-time graph of motion of car is











9. A car is being driven at 40 m/s on a level road is suddenly put into neutral gear and allowed to coast, the velocity decreases as $v = \frac{400}{10+t}$ m/s, where t is in second. The acceleration of car at the instant when its speed is 5 m/s, is

(a) $-\frac{1}{16}$ m/s^2

(b) $-\frac{1}{8}$ m/s^2

(c) $-\frac{1}{4}$ m/s^2

(d) $-\frac{1}{20}$ m/s^2

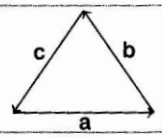
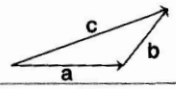
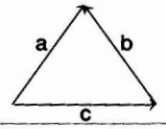
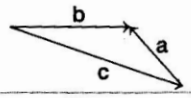
10. The number of significant digits in 20.000 and 6.23×10^1 are, respectively

(a) 2, 3 (b) 5, 3
(c) 2, 4 (d) 1, 3

11. A student measures two quantities as $A = (1.0 \pm 0.2)$ m and $B = (2.0 \pm 0.2)$m. The correct value of $(AB)^{1/2}$ is

(a) (1.4 ± 0.4) m (b) (1.41 ± 0.15)m
(c) (1.4 ± 0.3) m (d) (1.4 ± 0.2)m

12. Match the vector equation in Column II with vector diagram in Column I.

Column I		Column II	
A.		(i)	$\mathbf{a} - (\mathbf{b} + \mathbf{c}) = 0$
B.		(ii)	$\mathbf{b} - \mathbf{c} = \mathbf{a}$
C.		(iii)	$\mathbf{a} + \mathbf{b} = -\mathbf{c}$
D.		(iv)	$\mathbf{a} + \mathbf{b} = \mathbf{c}$

Choose the correct answer from the options given below

	A	B	C	D		A	B	C	D
(a)	(i)	(iii)	(ii)	(iv)	(b)	(iii)	(iv)	(i)	(ii)
(c)	(iv)	(i)	(iii)	(ii)	(d)	(iii)	(ii)	(iv)	(i)

13. Position of a particle moving in space is given by

$$\mathbf{r} = 6t\hat{\mathbf{i}} - 2t^2\hat{\mathbf{j}} + 4\hat{\mathbf{k}}$$

Ratio of magnitudes of velocity and acceleration at $t = 2$s is

(a) $\frac{5}{2}$ (b) $\frac{2}{7}$
(c) $\frac{3}{5}$ (d) $\frac{7}{9}$

14. The initial and final temperatures of water as recorded by a student are $(30.4 \pm 0.2)°C$ and $(51.5 \pm 0.4)°C$. The rise in temperature is

(a) $(21.1 \pm 0.2)°C$ (b) $(21.1 \pm 0.6)°C$
(c) $(19.9 \pm 0.6)°C$ (d) $(19.9 \pm 0.8)°C$

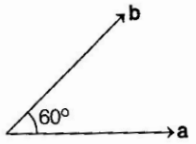
15. A man can cross the 400 m wide river in least possible time of 80 s. If he wants to reach exactly opposite point to starting point, then at what angle from the direction of flow in river he should swim?
(Take, river flow velocity = 3 m/s)

(a) 37°
(b) 53°
(c) 127°
(d) 143°

16. A car travelling due North at the speed of $20\sqrt{2}$ m/s turn towards right (without changing speed) by 90° in 2 s. Acceleration of car is

(a) 10 ms^{-2} due N-E
(b) 10 ms^{-2} due N-W
(c) 10 ms^{-2} due S-W
(d) 10 ms^{-2} due S-E

17. Resultant of two vectors **a** and **b** (shown) is of magnitude $\sqrt{7}b$. The value of b/a is



(a) 1/2 (b) 1 (c) 2 (d) 3

18. A ball is projected from a point O with some velocity at an angle 60° with the horizontal. A target is placed at point B $(10\sqrt{3}$ m, 15 m). With what velocity, the ball must be projected so that it can hit the target? Take point of projection as origin and $g = 10$ m/s^2.

(a) 20 m/s (b) 10 m/s (c) $10\sqrt{2}$ m/s (d) $10\sqrt{3}$ m/s

19. If $\mathbf{a} = 3\hat{\mathbf{i}} + 4\hat{\mathbf{j}}$ and $\mathbf{b} = 7\hat{\mathbf{i}} + 24\hat{\mathbf{j}}$, then vector having the same magnitude as **b** and direction opposite to **a** is $x\hat{\mathbf{i}} + y\hat{\mathbf{j}}$, then value of $\frac{x+y}{5}$ is

(a) 7 (b) 14
(c) –7 (d) –4

20. **Statement I** Vector addition of two vectors is always greater than their vector subtraction.
Statement II Magnitude of resultant of two vectors may be less than the magnitude of either vector.
In light of above statements, choose the most appropriate answer from the options given below :

(a) Both Statement I and Statement II are incorrect.
(b) Statement I is correct and Statement II is incorrect.
(c) Statement I is incorrect and Statement II is correct.
(d) Both Statement I and Statement II are correct.

21. Just after firing, a bullet is found to be moving at an angle of 37° to the horizontal. Its acceleration is 10 m/s^2 downwards. The component of its acceleration in the direction of its velocity is

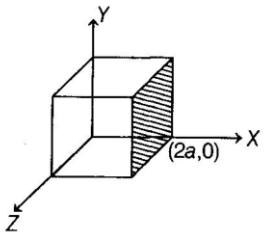
(a) – 8 m/s^2 (b) +8 m/s^2
(c) – 6 m/s^2 (d) Need value of **v**

22. Which of the following statement is incorrect?
(a) Physics is the study of nature and natural phenomena.
(b) Physics and technology are not related to each other.
(c) Electrodynamics deals with electric and magnetic phenomena associated with charged and magnetic bodies.
(d) The most significant area to which physics has and will contribute is the development of alternative energy resources.

23. The electric field due to an electric dipole r distance away along the axis is **E**. The electric field at distance $2r$ along the perpendicular bisector is
(a) $\frac{-\mathbf{E}}{4}$ (b) $\frac{\mathbf{E}}{4}$
(c) $\frac{\mathbf{E}}{8}$ (d) $\frac{\mathbf{E}}{16}$

24. Which of the following statement is correct?
(a) Technology gives rise to new physics.
(b) Wireless communication followed the discovery of basic laws of electricity and magnetism.
(c) Bohr had dismissed the possibility of tapping energy from atoms.
(d) Both (a) and (b)

25. A cube is placed in an electric field, $\mathbf{E} = \frac{E_0 x}{a}\hat{\mathbf{i}}$. The electric flux passing through the shaded surface of a cube is



(a) $2E_0a^2$ (b) $4E_0a^2$ (c) $8E_0a^2$ (d) zero

26. Match the Column I (domains) with Column II (relation) and select the correct answer from the codes given below.

	Column I		Column II
A.	Mechanics	1.	electric and magnetic fields
B.	Electrodynamics	2.	macroscopic equilibrium
C.	Thermodynamics	3.	minute scales of atoms and nuclei
D.	Microscopic	4.	Newton's law of motion

	A	B	C	D		A	B	C	D
(a)	4	2	3	1	(b)	4	1	2	3
(c)	1	2	4	3	(d)	2	3	1	4

27. Match the Column I (physical quantities) with Column II (scale) and select the correct answer from the codes given below.

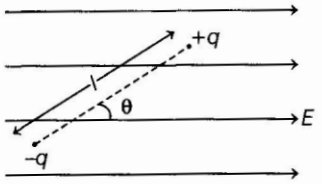
	Column I		Column II
A.	Size of electron or proton	1.	10^{-30} kg
B.	Mass of an electron	2.	10^{-14} m
C.	Extent of universe	3.	10^{26} m
D.	Mass of observable universe	4.	10^{55} kg

28. Match the Column I (force) with Column II (relative strength) and select the correct answer from the codes given below.

	Column I		Column II
A.	Gravitational force	1.	10^{-13}
B.	Weak nuclear force	2.	1
C.	Electromagnetic force	3.	10^{-2}
D.	Strong nuclear force	4.	10^{-39}

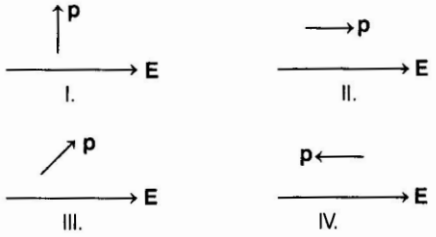
	A	B	C	D		A	B	C	D
(a)	4	1	3	2	(b)	4	1	2	3
(c)	1	3	2	4	(d)	4	2	3	1

29. An electric dipole of length l has been placed in a uniform electric field E making an angle θ as shown in the following figure. The potential energy of the system is



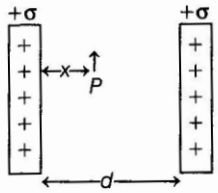
(a) $-pE\cos\theta$ (b) $-pE\sin\theta$
(c) $+pE\cos\theta$ (d) $-pE\cos\theta - \frac{kq^2}{l}$

30. The diagram given below, show four possible orientations of an electric dipole **p** in a uniform electric field **E**.



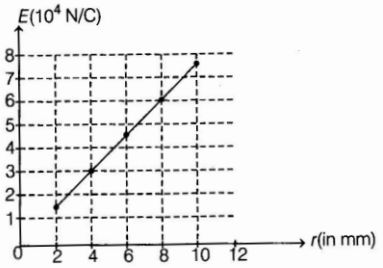
The correct order of magnitude of torque on the dipole, is
(a) $\tau_{IV} > \tau_I > \tau_{III} > \tau_{II}$ (b) $\tau_I > \tau_{III} > \tau_{IV} > \tau_{II}$
(c) $\tau_I > \tau_{III} > \tau_{II} = \tau_{IV}$ (d) $\tau_{II} > \tau_{III} > \tau_I > \tau_{IV}$

31. Two infinite long conducting charged sheets are placed parallel to each other and perpendicular to the plane of paper as shown in the following figure. The electric field at point P will



(a) depend only on x and σ (b) depend on x, σ, and d
(c) depend only on σ (d) not depend on x, σ and d

32. The variation of electric field due to a uniformly charged insulating sphere having volume charge density ρ and radius R at distance r from centre has been shown below. The value of ρ is



(a) 3.54×10^{-18} C / m^3 (b) 18×10^{-18} C / m^3
(c) 2×10^{-4} C / m^3 (d) 2×10^{-6} C / m^3

33. An electric dipole of dipole moment **p** is placed in its stable equilibrium position in uniform electric field **E**, the work done in rotating it to its unstable equilibrium position very slowly
(a) zero (b) pE
(c) $2pE$ (d) $-2pE$

34. The potential function of an electrostatic field is given by $V = 3x^2 + (y^3 - 1)$. Then, which of the following statements is correct?
(a) There exist only one point at which potential is zero.
(b) There exist no such point at which electric field is zero.
(c) The direction of electric field does not change through out the points of space.
(d) The charge $2\sqrt{2}$ μC experiences a force of 24 μN at point $(1\text{ m}, \sqrt{2}\text{ m})$.

35. Two point charges 9 μC and 16 μC are placed 1 m apart in vacuum. The electric potential between the two charges is minimum at a distance of
(a) $\frac{2}{7}$ m from 9 μC
(b) $\frac{3}{7}$ m from 9 μC
(c) $\frac{4}{7}$ m from 9 μC
(d) minimum potential point doesn't exist.

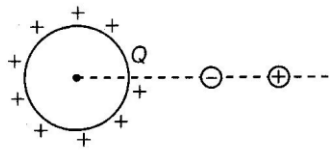
SECTION - B

36. A point P lies at a distance of 4.1×10^{-9} m from the centre of a dipole of dipole moment 4.8×10^{-30} Cm. Match items of Column I with the items of Column II.

	Column I		Column II
A.	Point along axis of dipole nearer to positive charge	P.	-1.8×10^{-3} V
B.	Point is 45° above the axis but nearer to positive charge	Q.	1.8×10^{-3} V
C.	Point is 45° above axis but nearer to negative charge	R.	2.6×10^{-3} V

Choose the correct answer from the options given below:
(a) A → R, B → Q, C → P
(b) A → P, B → Q, C → R
(c) A → R, B → P, C → Q
(d) A → Q, B → P, C → R

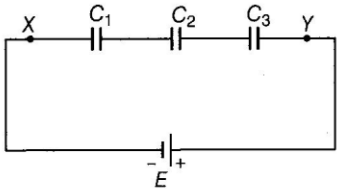
37. A small dipole (dipole moment **p**) is placed at a distance x ($x > r$) from a charged sphere having a charge Q and of radius r.

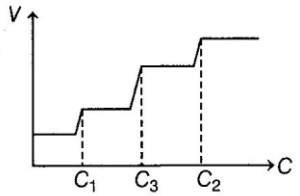


Force on the dipole is ($K = 1/4\,\pi\varepsilon_0$)
(a) $\frac{2KQp}{x^3}$ (b) $\frac{KQp}{x^3}$ (c) $\frac{4KQp}{3x^3}$ (d) $\frac{KQp}{2x^3}$

38. For a thin spherical shell of radius R having a surface charge density σ, which of these statement is correct?
(a) Field at a distance r from the centre $r > R$ is given by $E = \frac{\sigma}{\varepsilon_0}$.
(b) Field at a distance r from the centre $r < R$ given by $E = \frac{kq}{r^2}$, where $q = \sigma\,(4\pi R^2)$.
(c) Field at a distance r from the centre $r > R$ is given by $E = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{r^2}$, where $q = \sigma \cdot 4\pi R^2$.
(d) Field at surface of shell is given by $E = \frac{\sigma}{2\varepsilon_0}$.

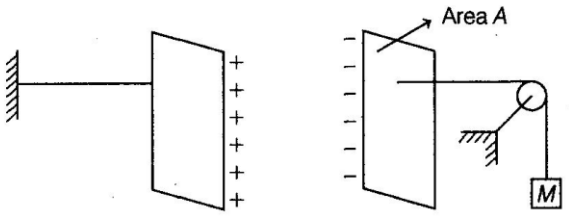
39. Three capacitors of capacitance C_1, C_2 and C_3 are connected in series with a battery of emf E as shown below. The graph of electric potential V from point X to point Y has been also shown in figure. The correct relation is





(a) $C_1 > C_2 > C_3$ (b) $C_2 > C_3 > C_1$
(c) $C_3 > C_2 > C_1$ (d) $C_1 > C_3 > C_2$

40. If a block of mass M is required to keep the right side charged plate of parallel plate capacitor stationary as shown in figure, then the electric field between the plates is



(a) $\sqrt{\frac{2Mg}{A\varepsilon_0}}$ (b) $\sqrt{\frac{Mg}{A\varepsilon_0}}$

(c) $\sqrt{\frac{Mg}{2A\varepsilon_0}}$ (d) Data insufficient

41. Two statements are given below.

Statement I Gauss' law is true for any closed surface, irrespective of its shape and size.

Statement II Gauss' law is based on the inverse square dependence on distance contained in the Coulomb's law.

In light of above statements choose the most appropriate answer from the options given below :

(a) Both Statement I and Statement II are incorrect.

(b) Statement I is correct and Statement II is incorrect.

(c) Statement I is incorrect and Statement II is correct.

(d) Both Statement I and Statement II are correct.

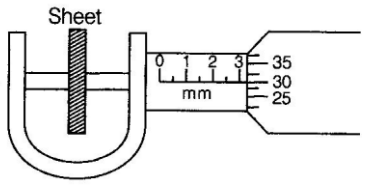
42. In an experiment, four quantities a, b, c and d are measured with percentage errors of 2%, 3%, 1% and 0.5%, respectively.

A quantity x is defined as $x = \frac{a\sqrt{b}}{c^{3/2}d^4}$. The maximum percentage error in the measurement of x will be

(a) 5% (b) 6%

(c) 7% (d) 9%

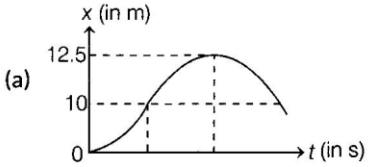
43. While measuring the thickness of a thin sheet, by using a micrometer, screw gauge and the readings of scale has been shown. So, the thickness of the sheet will be

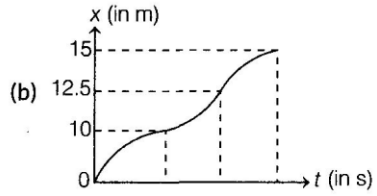


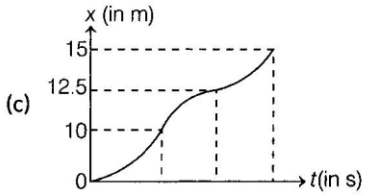
(a) 3.29 mm (b) 3.30 mm

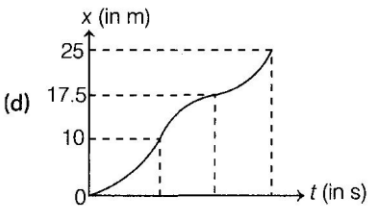
(c) 3.36 mm (d) 3.41 mm

44. A ball is released from a height of 10 m. After some time, it strikes to the ground and rebounds with a speed of 7 m/s. The graph between distance travelled by ball and time taken when it is about to strike the ground again is (Take, $g = 9.8\ m/s^2$)

(a)


(b)


(c)


(d)


45. A particle moves over a circular path of radius $r = 10$ m with a constant speed of 10 ms^{-1}. Particle turns over path by 60°. Match Column I with Column II.

	Column I		Column II
A.	Magnitude of displacement	P.	$\frac{10}{3}\pi$
B.	Change in speed	Q.	10
C.	Change in velocity	R.	zero
D.	Distance covered	S.	Non-zero

Choose the correct answer from the options given below:

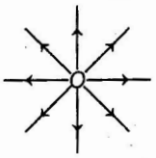
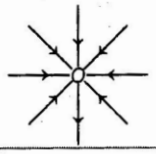
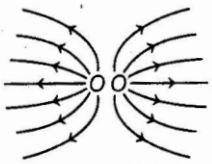
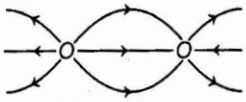
	A	B	C	D		A	B	C	D
(a)	P	Q	R	S	(b)	Q	P	R	S
(c)	Q, S	R	Q, S	P, S	(d)	Q	R	Q	P

46. A particle is moving uniformly in a circular path of radius r. When it moves through an angular displacement θ, the magnitude of the corresponding linear displacement will be

(a) $2r\cos(\theta/2)$ (b) $2r\cot(\theta/2)$

(c) $2r\tan(\theta/2)$ (d) $2r\sin(\theta/2)$

47. Match the Column I (electric lines of force) with Column II (types of charge) and select the correct answer from the codes given below.

Column I		Column II
A.		1. A pair of equal and opposite charges
B.		2. A pair of positive charges
C.		3. A single positive charge
D.		4. A single negative charge

	A	B	C	D
(a)	1	2	3	4
(b)	3	2	1	4
(c)	3	4	1	2
(d)	3	4	2	1

48. Match the Column I (type of body) with Column II (electric field) and select the correct answer from the codes given below.

Column I		Column II
A.	Infinite plane sheet of charge	1. 0
B.	Infinite plane sheet of uniform thickness	2. $\frac{\sigma}{2\varepsilon_0}$
C.	Non-conducting charged solid sphere at its surface	3. $\frac{R\rho}{3\varepsilon_0}$
D.	Conducting charged solid sphere at its centre	4. $\frac{\sigma}{\varepsilon_0}$

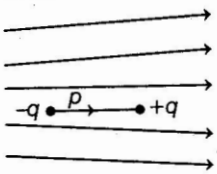
	A	B	C	D
(a)	2	4	3	1
(b)	3	2	1	4
(c)	1	4	2	3
(d)	2	1	4	3

49. Match the Column I (charge) with Column II (property) and select the correct answer from the codes given below.

Column I		Column II
A.	Like charges	1. Of two types
B.	Unlike charges	2. Repel each other
C.	Charge can be	3. Attract each other
D.	Charges are	4. Neutralised, if they are equal and opposite

	A	B	C	D
(a)	1	2	3	4
(b)	2	1	3	4
(c)	4	1	3	2
(d)	2	3	4	1

50. Figure shows electric field lines in which an electric dipole p is placed as shown. Which of the following statements is correct?



(a) The dipole will not experience any force.
(b) The dipole will experience a force towards right.
(c) The dipole will experience a force towards left.
(d) The dipole will experience a force upwards.

CHEMISTRY

SECTION-A

51. A mixture of SO_2 and gas X (molar mass 80 g mol^{-1}) in the molar ratio $a : b$ has average molar mass 69.33 g mol^{-1}.
If they are mixed in the ratio of $b : a$, then average molar mass would be
(a) 40.00 (b) 69.33 (c) 32.00 (d) 74.67

52. Penicillin N is an antibacterial agent contains 8.92% sulphur by mass. What is the value of the molar mass of penicillin N?
(a) 256 g mol^{-1} (b) 360 g mol^{-1} (c) 390 g mol^{-1} (d) 760 g mol^{-1}

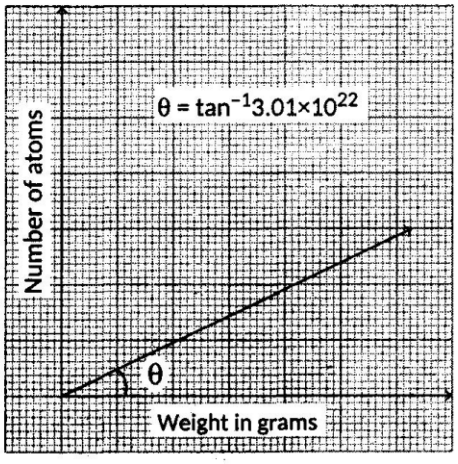
53. A metal sulphate is isomorphous with $CaSO_4 \cdot 2H_2O$ and contains 10% S. Atomic weight of the metal is (Ca = 40).
(a) 108 (b) 188 (c) 94 (d) 208

54. 0.1596 g mol M_2O_3 is reduced to metal M by 0.006 g of hydrogen. The atomic mass of metal M is
(a) 15.58 (b) 5.58 (c) 155.8 (d) 55.8

55. The vapour density of a gas is 11.2. The volume occupied by 1 g of the gas at STP is
(a) 1.0 L (b) 11.2 L (c) 22.4 L (d) None of these

56. 0.015 mole of an acid HXO_2 has mass 1.695 g. Thus, atomic mass of X is
(a) 35.5 (b) 80 (c) 127 (d) 19

57. For a given element, number of atoms (along y-axis) contained in different amount in gram (along x-axis) have been plotted. Thus, atomic weight of the element in g/mol is



(a) 10 (b) 20 (c) 30 (d) 40

58. How many H-atoms are contained in 1.50 g of glucose?
(a) 3.0×10^{22} (b) 1.20×10^{23} (c) 2.40×10^{23} (d) 6.02×10^{22}

59. The number of oxygen atoms in 1.58 g of $KMnO_4$ is

(a) 6.02×10^{21} (b) 2.4×10^{22} (c) 1.4×10^{22} (d) 3.0×10^{20}

60. Number of neutrons present in 1.4 mg of $^{14}_{6}C$ is

(a) 4.214×10^{20} (b) 3.612×10^{20} (c) 8.428×10^{20} (d) 4.816×10^{20}

61. For $CuSO_4 \cdot 5H_2O$, which is the correct mole relationship?

(a) $9 \times$ mole of Cu = mole of O (b) $5 \times$ mole of Cu = mole of O

(c) $9 \times$ mole of Cu = mole of O_2 (d) Mole of Cu = $9 \times$ mole of O

62. In rhombic sulphur, S-atoms are joined into S_8 molecules with density 2.07 g/cm^3. Number of S_8 molecules in a crystal of 0.568 mm^3 is

(a) 1.336×10^{21} (b) 2.212×10^{22} (c) 2.765×10^{21} (d) 2.765×10^{18}

63. A sample of ammonium phosphate $(NH_4)_3PO_4$ contains 3.18 moles of hydrogen atoms. The number of moles of oxygen atoms in the sample is

(a) 0.265 (b) 0.795 (c) 1.060 (d) 3.180

64. Consider following solution of HCl.

	A	*B*	*C*	Mixture of *A*, *B* and *C*
Molarity	0.07 M	0.12 M	0.15 M	0.10 M
Volume	V_1	V_2	V_3	100 mL

Thus, V_1, V_2 and V_3 respectively (in mL) are given $(V_1 + V_2) = 75$ mL

(a) 50, 25, 25 (b) 15, 60, 25 (c) 45, 30, 25 (d) 55, 20, 25

65. A solution containing 12.0% NaOH by mass has a density of 1.131 g/mL. What volume of this solution contains 5.00 moles of NaOH?

(a) 0.0240 L (b) 1.67 L (c) 1.47 L (d) 1.00 L

66. Normality of 0.3 M H_3PO_3 solution based on the following reaction is

$$H_3PO_3 + 2OH^- \longrightarrow HPO_3^{2-} + 2H_2O$$

(a) 0.3N (b) 0.6 N (c) 0.1N (d) 0.15 N

67. Photoelectric emission is observed from a surface for frequencies ν_1 and ν_2 of incident $(\nu_1 > \nu_2)$. If the maximum KE of photoelectron in two cases are in the ratio 2 : 1, then threshold frequency ν_0 is given by

(a) $\frac{\nu_1 - \nu_2}{2}$ (b) $\frac{2\nu_1 - \nu_2}{(2-1)}$ (c) $\frac{2\nu_2 - \nu_1}{(2-1)}$ (d) $\nu_2 - \nu_1$

68. Minimum wavelength of light necessary to overcome the work function Cs metal (work function of Cs = 2.14 eV)

(a) 58.1 nm (b) 581 Å (c) 581 nm (d) 581 pm

69. The difference between the incident energy and threshold energy for an electron in a photoelectric effect experiment is 5 eV. The de-Broglie wavelength of the electron is

(a) $\frac{6.6 \times 10^{-9}}{\sqrt{1456}}$ m (b) $\frac{6.6 \times 10^{-9}}{\sqrt{145.6}}$ m (c) $\frac{6.6 \times 10^{-9}}{\sqrt{1664}}$ m (d) $\frac{6.6 \times 10^{-9}}{\sqrt{166.4}}$ m

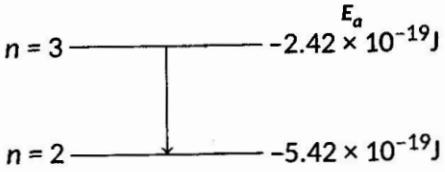
70. The work function of a metal is 4.0 eV. If the metal is irradiated with radiation of wavelength 200 nm, then the maximum kinetic energy of the photoelectrons would be about.

(a) 6.4×10^{-19} J (b) 3.5×10^{-19} J (c) 1.0×10^{-18} J (d) 2.0×10^{-19} J

71. Photoelectric emission is observed from a surface for frequencies ν_1 and ν_2 of the incident radiation ($\nu_1 > \nu_2$). If the maximum kinetic energies of the photoelectrons in two cases are in ratio 1 : K, then the threshold frequency ν_0 is given by

(a) $\frac{\nu_2 - \nu_1}{K - 1}$ (b) $\frac{K\nu_1 - \nu_2}{K - 1}$ (c) $\frac{K\nu_2 - \nu_1}{K - 1}$ (d) $\frac{\nu_2 - \nu_1}{K}$

72. The energies of the electron in the given orbits are



Wavelength of the emitted light, when electron drops from third orbit to second orbit is

(a) 440 nm (b) 210 nm (c) 663 nm (d) None is correct

73. An electrons in H-atom in its ground state absorbs 1.5 times as much energy as the minimum required for its escape from the atom

$$H(g) \longrightarrow H^+(g) + e^-;\ \Delta H = 13.6 \text{ eV atom}^{-1}$$

Thus, kinetic energy gives to the emitted electron is

(a) − 21.4 eV (b) 20.4 eV (c) 35 eV (d) 21.4 eV

74. The energy of electron in the first Bohr's orbit of H-atom is − 83.6 eV. What will be its potential energy in n = 4th orbit?

(a) − 13.6 eV (b) − 3.4 eV (c) − 0.85 eV (d) − 1.70 eV

75. A hydrogen-atom sample in the ground state is excited by monochromatic light radiation of wavelength λ Å. The resulting spectrum consists of maximum 15 different lines. What is λ? ($R_H = 109677 \text{ cm}^{-1}$)

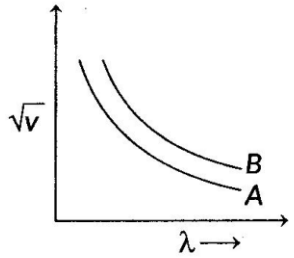
(a) 937.3 Å (b) 1025 Å (c) 1236 Å (d) None of these

76. For a hydrogen ion, kinetic energy of electron in its third excited state is found to be 54.4 eV. Then series limit $\left(\frac{1}{\lambda}\right)$ for Balmer series, for this ion, is

(a) $1.09678 \times 16 \text{ cm}^{-1}$ (b) $109678 \times 16 \text{ cm}^{-1}$

(c) $109678 \times 4 \text{ cm}^{-1}$ (d) $109678 \times 64 \text{ cm}^{-1}$

77. $\sqrt{v}$ on two particles A and B are plotted against de-Broglie wavelengths, where v is the potential on the particles. Which of the following relation is correct about the mass of particles?



(a) $m_A = m_B$ (b) $m_A > m_B$ (c) $m_A < m_B$ (d) $m_A \leq m_B$

78. A small particle of mass m moves in such a way that $PE = -\frac{1}{2}mkr^2$, where k is a constant and r is the distance of the particle from origin. Assuming Bohr's model of quantisation of angular moment and circular orbit, r is directly proportional to

(a) n^2 (b) n (c) $\sqrt{n}$ (d) None of these

79. The wave number of electromagnetic radiation emitted during transition from n_2 level of n_1 level of Li^{2+} ion such that $n_1 + n_2 = 4$ and $(n_1 - n_2) = 2$, is

(a) $\frac{7}{2}R_H$ (b) $4\bar{R}_H$ (c) $8\bar{R}_H$ (d) $\frac{8}{9}\bar{R}_H$

80. The position of proton is measured with an accuracy of $\pm 10^{-11}$ m. If the speed of proton is equal to speed of light (3×10^8 m/s). What is the uncertainty of proton after 1s?
($h = 6.626 \times 10^{-34}$)

(a) 300 m (b) 0.30 Å (c) 3.15×10^3 m (d) None of these

81. The total spin resulting from d^7-configuration is

(a) 3/2 (b) 1/2 (c) 2 (d) 1

82. Out of the following electrons with given sets of quantum number, electron with lowest energy is

	n	l	m_l	m_s
(a)	3	2	1	$+\frac{1}{2}$
(c)	4	1	0	$-\frac{1}{2}$

	n	l	m_l	m_s
(a)	4	2	−1	$+\frac{1}{2}$
(d)	5	0	0	$+\frac{1}{2}$

83. Which set of quantum numbers is not consistent with the quantum mechanical theory?

(a) $n = 2, l = 1, m = 1, s = 1/2$ (b) $n = 4, l = 3, m = 2, s = -1/2$
(c) $n = 3, l = 2, m = 3, s = +1/2$ (d) $n = 4, l = 3, m = 3, s = +1/2$

84. Electron from Cs surface with threshold frequency ν_0 shows emission of photo-electrons when radiated with frequency ν. Thus, wavelength of the emitted photoelectron is

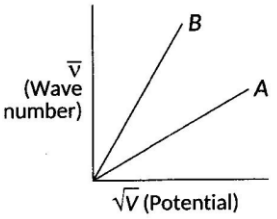
(a) $\sqrt{\frac{h}{2m\Delta\nu}}$ (b) $\sqrt{\frac{2m\Delta\nu}{h}}$ (c) $\sqrt{\frac{2m}{h\Delta\nu}}$ (d) $\left(\frac{h}{2m\Delta\nu}\right)^2$

85. In the element with atomic number 20, number of electrons with $(l + m) = 0$, is

(a) 20 (b) 13 (c) 12 (d) 7

SECTION - B

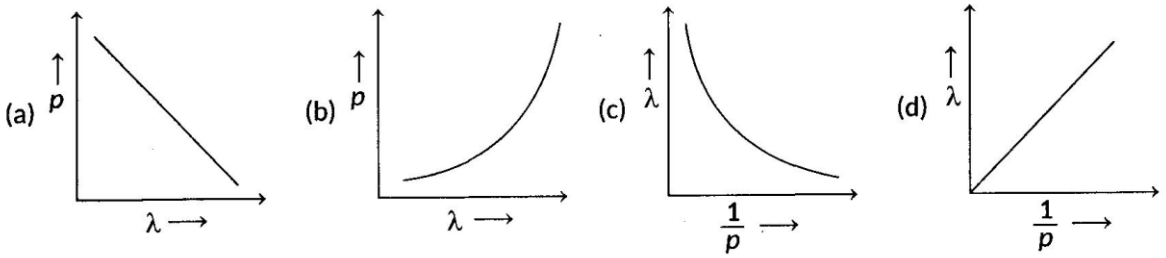
86. Following represents a graph between $\bar{\nu}$ (wave-number) and $\sqrt{V}$ (V is the potential applied to two sub-atomic particles A and B)



Thus, relative masses of A and B can be

(a) $\frac{m_A}{m_B} = 1$ (b) $\frac{m_A}{m_B} > 1$ (c) $\frac{m_A}{m_B} < 1$ (d) cannot be predicted

87. Which of the following graphs correctly represents the variation of particles momentum with de-Broglie wavelength?



88. The mass of photon having wavelength 1 nm is

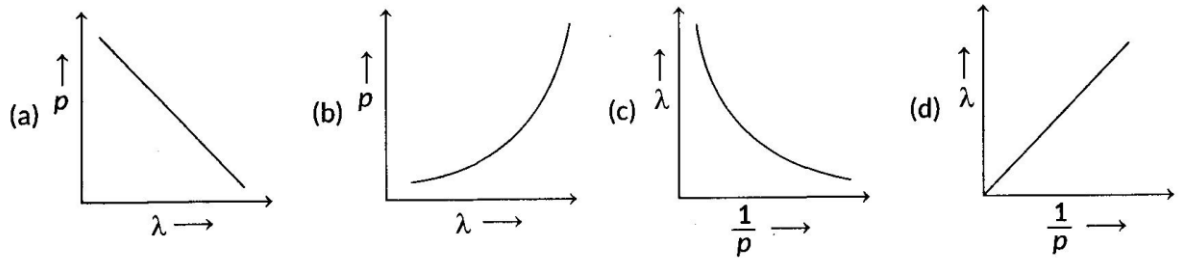
(a) 2.21×10^{-35} kg (b) 2.21×10^{-33} g

(c) 2.21×10^{-33} kg (d) 2.21×10^{-26} g

89. The wavelength associated with an electron moving with a velocity of 10^{10} cm/s is

(a) 0.0772 Å (b) 772 Å (c) 772 nm (d) 0.772 nm

90. Which of the following graphs correctly represents the variation of particles momentum with de-Broglie wavelength?



91. An electron is moving with a kinetic energy of 4.55×10^{-25} J. What will be the de-Broglie wavelength for this electron?

(a) 5.28×10^{-7} m (b) 7.28×10^{-7} m (c) 2×10^{-10} m (d) 3×10^{-5} m

92. Uncertainty in position of an electron moving with a velocity of 3×10^{2} ms^{-1} accurate upto 0.001% will be

(a) 0.0193 m (b) 0.0384 m (c) 0.0576 m (d) 0.0768 m

93. **Statement I** The radial wave function (ψ) for 1*s*-atomic orbital is always greater than zero.
Statement II The radial part of wave function (ψ) never vanishes in the limit of finite value of distance (r) from nucleus.

94. **Statement I** An orbital cannot have more than two electrons.
Statement II The two electrons in an orbital create opposite magnetic field.

95. **Assertion (A)** Nuclide $^{30}_{13}Al$ is less stable than $^{40}_{20}Ca$.
Reason (R) Nuclide having odd number of protons and neutrons are generally unstable.

96. **Assertion (A)** In Rutherford's gold foil experiment, very few α-particles are reflected back.
Reason (R) Nucleus present inside the atom is heavy.

97. **Statement I** A 8.0 g N_2H_4 ($M = 32$) has more atoms than 6.0 g H_2O.
Statement II N_2H_4 has more atoms per molecule than water.

98. **Statement I** Molar volume of a gas is 22.4 L at STP.
Statement II 22.4 L of $O_2(g)$ contains 6.022×10^{23} CO_2 molecules at STP.

99. **Statement I** The configuration of B-atom cannot be $1s^2 2s^3$.
Statement II Hund's rule demands that the configuration should display maximum multiplicity.

100. **Statement I** For $n = 3$, l may be 0, 1 and 2, and m may be 0, ± 1 and 0, ± 1 and ± 2.
Statement II For each value of n, there are 0 to $(n - 1)$ possible values of l for each value of l, there are 0 to $\pm l$ values of m.

BOTANY

SECTION-A

101. What are the essential basis of modern taxonomic studies?
(A) External and internal structure
(B) Structure of cell
(C) Developmental process and ecological information
(D) All of these

102. The word 'Systematics' is derived from the latin word 'systema', what it means?
(A) System present in plants and animals.
(B) Systems used to make physiological study.
(C) Systematic arrangement of organisms.
(D) Systems written in any book.

103. Five kingdom system of classification suggested by R.H. Whittaker is not based on .
(a) presence or absence of a well defined nucleus
(b) mode of reproduction
(c) mode of nutrition
(d) complexity of body organisation.

104. Phylogenetic system of classification is based on
(a) morphological features
(b) chemical constituents
(c) floral characters
(d) evolutionary relationships.

105. **Which one of the following is common to multicellular fungi, filamentous algae and protonema of mosses?**
(a) Diplontic life cycle
(b) Members of kingdom planate
(c) Mode of nutrition
(d) Multiplication by fragmentation

106. **Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature?**
(a) Biological names can be written in any language.
(b) The first word in a biological name represents the genus name and the second is a specific epithet.
(c) The names are written in Latin and are italicized.
(d) When written by hand, the names are to be underlined.

107. In the names *Mangifera indica*, *Solanum tuberosum* and *Panthera leo*, the words *indica*, *tuberosum* and *leo* represent
(A) Generic name
(B) Generic epithet
(C) Specific name
(D) Specific epithet

108. Which one of the following aspects is an exclusive characteristic of living things?
(A) Isolated metabolic reactions occurs *in vitro*.
(B) Increase in mass from inside only.
(C) Perceptions of events happening in the environment and their memory.
(D) Increase in mass by accumulation of material both on surface as well as internally.

109. Match Column – I with Column – II for housefly classification and select the correct option using the codes given below:

Column – I	Column – II
(a) Family	(1) Diptera
(b) Order	(2) Arthropoda
(c) Class	(3) Muscidae
(d) Phylum	(4) Insecta

(A) (a) : 3, (b) : 2, (c) : 4, (d) : 1
(B) (a) : 4, (b) : 3, (c) : 2, (d) : 1
(C) (a) : 4, (b) : 2, (c) : 1, (d) : 3
(D) (a) : 3, (b) : 1, (c) : 4, (d) : 2

110. **Infectious proteins are present in**
(a) *Gemini viruses* **(b) *Prions***
(c) Viroids **(d) Satellite viruses**

111. Organisms called Methanogens are most abundant in a
(a) Cattle yard
(b) Polluted stream
(c) Hot spring
(d) Sulphur rock

112. Maximum nutritional diversity is found in the group
(a) Fungi (b) Animalia
(c) Monera (d) Plantae

113. Which statement is wrong for viruses?
(a) All are parasites.
(b) All of them have helical symmetry.
(c) They have ability to synthesize nucleic acids and proteins.
(d) Antibiotics have no effect on them.

114. A location with luxuriant growth of lichen on the trees indicated that the
(a) Tress are very healthy
(b) Trees are heavily infested
(c) Location is highly polluted
(d) Location is not polluted

115. Archaebacteria differs from other bacteria in having a
(A) Different cell wall structure
(B) Different cellular organization
(C) Parasitic nature
(D) All of these

116. Nitrogen fixing cyanobacteria are
(A) *Rhizobium, Nostoc*
(B) *Rhizobium, Anabaena*
(C) *Nostoc, Anabaena*
(D) *Anabaena, Azolla*

117. The vast majority of bacteria are
(A) Symbiotic (B) Autotrophic
(C) Heterotrophic (D) Nitrogen fixing

118. Which one of the following prokaryotes lack cell wall?
(A) Virus (B) Cyanobacteria
(C) Mycoplasma (D) Protozoa

119. According to five kingdom classification protista includes
(A) Chrysophytes, Dinoflagellates, Protozoans
(B) Diatoms, Euglenoids, Virus
(C) Dinoflagellates, Protozoans, Red algae
(D) Chrysophytes, Bryophytes, Protozoans, Slime mold

120. An alga, very rich in protein, is
(a) *Chlorella* (b) *Nostoc*
(c) *Spirogyra* (d) *Ulothrix*.

121. *Ulothrix* can be described as a
(a) filamentous alga lacking flagellated reproductive stages
(b) membranous alga producing zoospores
(c) filamentous alga with flagellated reproductive stages
(d) non-motile colonial alga lacking zoospores.

122. A student observed an algae with chlorophyll *a*, *b* and phycoerythrin, it should belong to
(a) Phaeophyta (b) Rhodophyta
(c) Chlorophyta (d) Bacillariophyta.

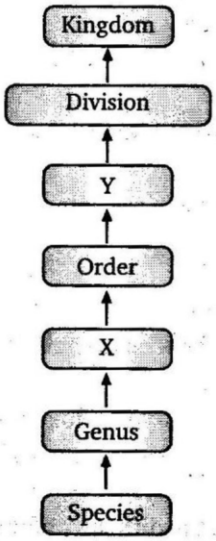
123. Which one of the following shows isogamy with non-flagellated gametes?
(a) *Sargassum* (b) *Ectocarpus*
(c) *Ulothrix* (d) *Spirogyra*

124. Which one of the following statements is wrong?
(a) Algae increase the level of dissolved oxygen in the immediate environment.
(b) Algin is obtained from red algae, and carrageenan from brown algae.
(c) Agar-agar is obtained from *Gelidium* and *Gracilaria*.
(d) *Laminaria* and *Sargassum* are used as food.

125. Protonema occurs in the life cycle of
(a) *Riccia* (b) *Funaria*
(c) *Anthoceros* (d) *Spirogya*.

126. Which of the following is a defining characteristic o living organisms?
(a) Growth
(b) Ability to make sound
(c) Reproduction
(d) Response to external stimuli

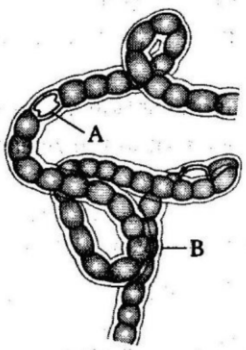
127. Observe the gradation of taxonomic categories and identify the missing categories according to the statements given below ;



(i) X is a group of related species
(ii) Y is a group related divisions
(iii) X is a group of related genera
(iv) Y is a group of related kingdoms
(v) Y is a group of related orders
The correct options are :
(a) (ii) and (iv)
(b) (i) and (ii)
(c) (i), (ii), (iv) and (v)
(d) (iii) and (v)

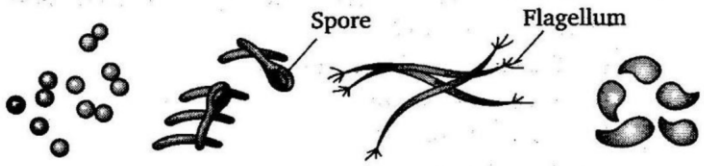
128. As we go from species to kingdom in a taxonomic hierarchy, the number of common characteristics :
(a) Will decrease
(b) Will increase
(c) Remain same
(d) May increase or decrease

129. Identify the organism, the structure marked as *A* and *B*:



(a) *Spirogyra*, heterocyst and mucilage sheath
(b) *Nostoc*, heterocyst and mucilage sheath
(c) *Nostoc*, mucilage sheath and heterocyst
(d) *Spirogyra*, mucilage sheath and heterocyst

130. Identify the four categories of bacteria marked as *A, B, C* and *D* based on their shapes :



(a) A = Spirilla, B = Cocci, C = Vibrio, D = Bacilli
(b) A = Bacilli, B = Cocci, C = Vibrio, D = Spirilla
(c) A = Vibrio, B = Bacilli, C = Cocci, D = Spirilla
(d) A = Cocci, B = Bacilli, C = Spirilla, D = Vibrio

131. Chemosynthetic autotrophic bacteria :
(a) Oxidize various inorganic substances such as nitrates and ammonia and use the released energy for their ATP production
(b) Play a great role in recycling nutrients like nitrogen, phosphorus, iron and sulphur
(c) Both (a) and (b)
(d) Can evolve oxygen during photosynthesis

132. Read the following statements w.r.t. diatoms:
(i) In diatoms, the cell walls from two thin overlapping shells which fit together as in a soap box
(ii) The walls are embedded with silica and thus the walls are indestructible
(iii) The fossilized diatoms are called diatomaceous earth
(iv) Diatoms are not the main producers in the oceans
(v) Diatomaceous earth is used in polishing, filtration of oil and syrups

How many of the above statements is/are incorrect?
(a) One (b) Four
(c) Three (d) Two

133. Which of the following is incorrect w.r.t. Dinoflagellates?
(a) They appear yellow, green, brown, blue or red depending on the main pigments present in their cells
(b) The cell wall has stiff cellulosic plates on the outer surface
(c) Most of them have single flagellum
(d) These also secrete a type of toxin

134. Match the column :

Column-I		Column-II	
A.	Amoeboid protozoans	(i)	*Paramoecium*
B.	Flagellated protozoans	(ii)	*Plasmodium*
C.	Ciliated protozoans	(iii)	*Entamoeba*
D.	Sporozoans	(iv)	*Trypanosoma*

(a) A = (ii), B = (iv), C = (iii), D = (i)
(b) A = (i), B = (ii), C = (iii), D = (iv)
(c) A = (iii), B = (iv), C = (i), D = (ii)
(d) A = (iii), B = (iv), C = (ii), D = (i)

135. Match the columns :

Column-I		Column-II	
A.	*Plasmodium*	(i)	Diatoms
B.	Mixotrophic nutrition	(ii)	Euglenoids
C.	Red tide	(iii)	Dinoflagellates
D.	Oceanic chief producers	(iv)	Slime moulds

(a) A = (iv), B = (ii), C = (iii), D = (i)
(b) A = (i), B = (iv), C = (iii), D = (ii)
(c) A = (i), B = (ii), C = (iii), D = (iv)
(d) A = (iv), B = (iii), C = (i), D = (ii)

SECTION-B

Read the following statements w.r.t. the class Ascomycetes of fungi :
(i) These are commonly called sac fungi
(ii) These are mostly multicellular
(iii) They are saprotrophic, decomposers, parasitic or coprophilous
(iv) Their mycelium is aseptate
(v) Conidia produced by them are endogenous

136. **A:** Viruses are obligate parasites.
R: Viruses cannot propagate outside the host cell

137. **A:** Viroids are different from viruses.
R: Viroids lack capsid but viruses possess capsid.

138. Read the following statements :
(i) Agar-agar is used to grow microbes and in the preparations of ice-creams and jellies
(ii) *Chlorella* and *Spirulina* are unicellular algae, rich in proteins and are used as food supplements by space travellers
(iii) *Porphyra*, *Laminaria* and *Sargassum* are poisonous
(iv) Algae are photosynthetic
(v) *Spirogyra* is a filamentous fungi

How many of the above statements are incorrect ?
(a) Five (b) Three
(c) Four (d) Two

139. Read the following statements about green algae :
(i) Vegetative reproduction usually takes place by fragmentation or by formation of different types of spores
(ii) Zoospore formation is rare
(iii) Sexual reproduction can be isogamous, anisogamous or oogamous
(iv) Asexual reproduction can occur by flagellated zoospores produced in zoosporangia
(v) *Chlamydomonas, Chara, Spirogyra, Volvox* and *Ulothrix* belong to green algae

How many of the above statements are correct ?
(a) Four (b) Two
(c) Three (d) One

140. Identify X, Y and Z in the table given below :

Classes	Major pigments	Stored food	Flagella
Chlorophyceae	Chlorophyll-*a* and *b*	Y	2-8, equal, apical
Phaeophyceae	X	Mannitol Laminarin	2, unequal, lateral
Rhodophyceae	Chlorophyll-*a* and *d*	Fluoridean starch	Z

(a) X = Fucoxanthin, Y = Starch, Z = 2-8 flagella
(b) X = Phycobilins, Y = Mannitol, Z = Flagella absent
(c) X = Chlorophyll-*e*, Y = Laminarin, Z = 2-flagella
(d) X = Chlorophyll-*a* and *c*, Y = Starch, Z = Flagella absent

141. Which of the following is incorrect w.r.t. bryophytes?
(a) They play an important role in plant succession on bare rocks/soil
(b) They usually occur in shaded, dry and xeric areas
(c) They possess gamete formation
(d) All are incorrect

142. Match the column :

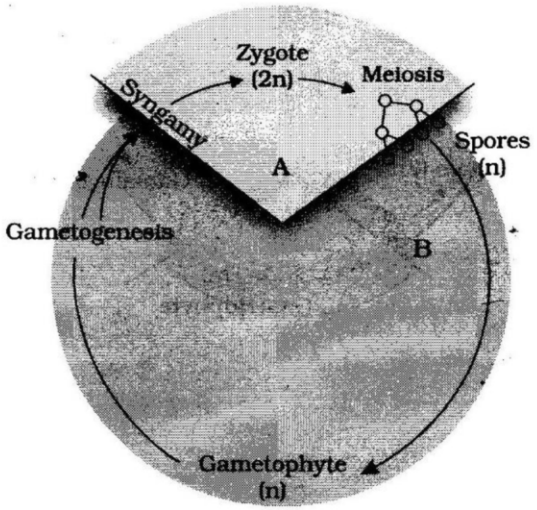
Column-I	Column-II
A. Psilopsida	(i) *Dryopteris*, *Pteris* and *Adiantum*
B. Lycopsida	(ii) *Equisetum*
C. Sphenopsida	(iii) *Selaginella* and *Lycopodium*
D. Pteropsida	(iv) *Psilotum*

(a) A = (i), B = (iv), C = (iii), D = (ii)
(b) A = (ii), B = (iv), C = (iii), D = (i)
(c) A = (i), B = (ii), C = (iii), D = (iv)
(d) A = (iv), B = (iii), C = (ii), D = (i)

143. Read the following statements w.r.t. gymnosperms :
(i) The cones bearing megasporophylls with ovules or megasporangia are called megasporangiate or female strobili
(ii) The male or female cones or strobili may be borne on the same tree (*e.g.*, *Pinus*)
(iii) In *Cycas*, male cones and megasporophylls are borne on different trees
(iv) One of the cells of nucellus differentiates into megaspore mother cell
(v) Ovule is a specialised megasporangium which is integumented, indehiscent and permanently stores the megaspores

How many of the above statements are correct ?
(a) Three (b) Five
(c) Four (d) Two

144. Identify the life cycle pattern :



(a) Haplo-diplontic (b) Haplontic
(c) Diplontic (d) Diplohaplontic

145. Phylogenetic system of classification is based on
(a) morphological features
(b) chemical constituents
(c) floral characters
(d) evolutionary relationships.

146. Which one of the following statements is wrong?
(a) Algae increase the level of dissolved oxygen in the immediate environment.
(b) Algin is obtained from red algae, and carrageenan from brown algae.
(c) Agar-agar is obtained from *Gelidium* and *Gracilaria*.
(d) *Laminaria* and *Sargassum* are used as food.

147. Which one of the following shows isogamy with non-flagellated gametes?
(a) *Sargassum* (b) *Ectocarpus*
(c) *Ulothrix* (d) *Spirogyra*

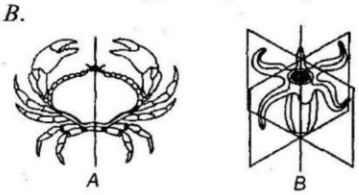
148. A student observed an algae with chlorophyll *a*, *b* and phycoerythrin, it should belong to
(a) Phaeophyta (b) Rhodophyta
(c) Chlorophyta (d) Bacillariophyta.

149. *Ulothrix* can be described as a
(a) filamentous alga lacking flagellated reproductive stages
(b) membranous alga producing zoospores
(c) filamentous alga with flagellated reproductive stages
(d) non-motile colonial alga lacking zoospores.

150. An alga, very rich in protein, is
(a) *Chlorella* (b) *Nostoc*
(c) *Spirogyra* (d) *Ulothrix*.

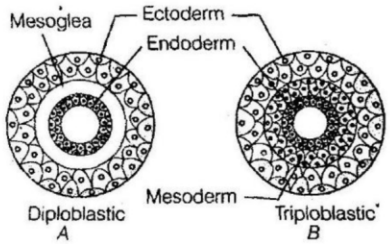
SECTION-A

151. Choose the correct type of symmetry for the animals, *A* and *B*.



(a) Bilateral, Asymmetrical, respectively
(b) Bilateral, Radial, respectively
(c) Radial, Bilateral, respectively
(d) Radial, Radial, respectively

152. The diagram below shows the diploblastic and triploblastic germ layers in the animals. Identify the correct option in which they are found.

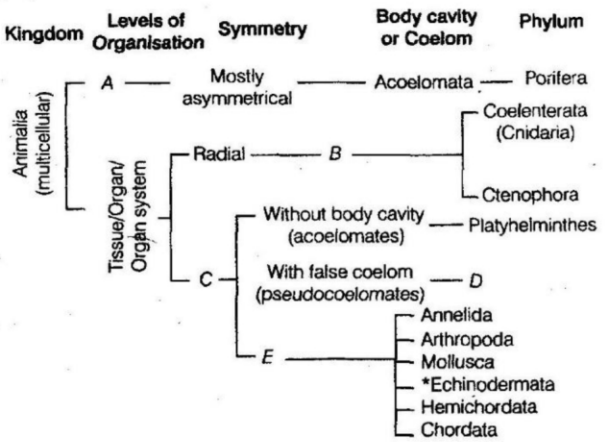


(a) A–Molluscs, B–Chordates
(b) A–Annelida, B–Porifera
(c) A–Coelenterates, B–Platyhelminthes
(d) A–Porifera, B–Cnidaria

153. The pseudocoelomate animals are included in the plylum
(a) Porifera (b) Annelida
(c) Aschelminthes (d) Mollusca

154. Male and female cockroaches can be distinguished externally through:
(a) Anal styles in male
(b) Anal cerci in female
(c) Anal style and antennae in female
(d) Both (b) and (c)

155. Study the flow chart given below and identify the missing parts *A, B, C, D, E.*



	A	B	C	D	E
(a)	Cellular	Acoelomata	Bilateral	Aschelminthes	Coelomates
(b)	Cellular	Coelomata	Radial	Aves	Pseudocoelomates
(c)	Cellular	Acoelomata	Radial	Mammalia	Pseudocoelomates
(d)	Cellular	Coelomata	Radial	Aschelminthes	Coelomates

156. In case of poriferans, the spongocoel is lined with flagellated cells called
(a) ostia
(b) oscula
(c) choanocytes
(d) mesenchymal cells

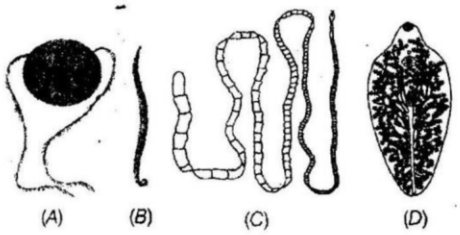
157. In most simple type of canal system of Porifera, water flows through which one of the following ways?
(a) Ostia → Spongocoel → Osculum → Exterior
(b) Spongocoel → Ostia → Osculum → Exterior
(c) Osculum → Spongocoel → Ostia → Exterior
(d) Osculum → Ostia → Spongocoel → Exterior

158. Which of the following is not true regarding phylum–Coelenterata?
(a) They are diploblastic animals
(b) They have cellular level of organisation
(c) They have nematocyte cells present on the tentacles
(d) The gastrovascular opening is called the hypostome

159. Medusa is the sexually reproductive structure of
(a) *Hydra* (b) *Obelia*
(c) Sea anemone (d) None of these

160. Flame cells are present in
(a) Aschelminthes (b) Platyhelminthes
(c) Annelida (d) Cephalochordata

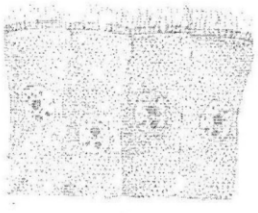
161. Identify the correct option specifying the names of the animals *A, B, C* and *D*.



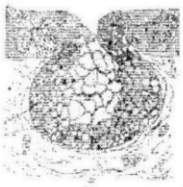
	A	B	C	D
(a)	*Pleurobrachia*	Tapeworm	*Taenia*	*Aurelia*
(b)	*Fasciola*	Tapeworm	Liver fluke	*Aurelia*
(c)	*Pleurobrachia*	Roundworm	*Taenia*	*Liver fluke*
(d)	*Fasciola*	Roundworm	Liver fluke	*Adamsia*

162. Which one of the following statements is totally wrong about the occurrence of notochord, while the other three are correct?
(a) It is present only in larval tail in ascidian.
(b) It is replaced by a vertebral column in adult frog.
(c) It is absent throughout life in humans from the very beginning.
(d) It is present throughout life in Amphioxus.

163. A student was given a sample of two tissues. He observed the tissues under the microscope and draws their figures as 1 and 2 given below.



1



2

Identify the tissues 1 and 2.

(a) 1: Columnar cells bearing cilia
2: Unicellular glandular epithelium

(b) 1: Cuboidal cells bearing cilia
2: Multicellular glandular epithelium

(c) 1: Compound cells bearing cilia
2: Unicellular glandular epithelium

(d) 1: Columnar cells bearing cilia
2: Multicellular glandular epithelium

164. Read the following statements :

(i) In open type circulatory system the blood is pumped out of the heart and the cells and tissues are directly bathed in it

(ii) Radially symmetrical animals are mostly cylindrical and central axis is longitudinal in their body

(iii) Cephalization is considered an evolutionary trend which eventually produces a head region with sensory organs

(iv) The great majority (~99%) of animals are radially symmetric

(v) The phylum Echinodermata is unique among animals in having bilateral symmetry in the larval stage but radial symmetry at the adult stage

Which of the above statements are correct ?

(a) (iii), (iv), (v) (b) (i), (ii), (iii), (v)
(c) (i), (ii), (iii) (d) (iii), (v)

165. Read the following statements :

(i) True coelom is a body cavity which arises as a cavity in the embryonic mesoderm

(ii) Digestive cavity is found in acoelomates, pseudocoelomates as well as coelomates

(iii) The body cavity of arthropods and non-cephalopod molluscs is called haemocoel.

(iv) Aschelminthes possess true body cavity

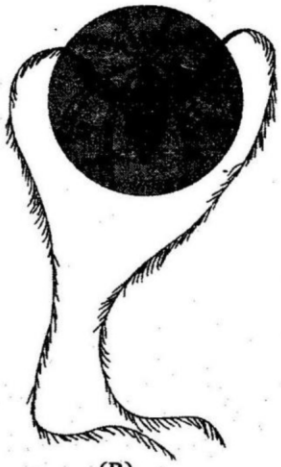
(v) There is no cavity between the body wall and gut in Echinoderms

Which of the above statements are correct ?

(a) (i), (iii) (b) (i), (ii), (iii)
(c) (iv), (v) (d) (i), (iv), (v)

166. Identify the organisms A, B and C :

(A)



(B)

(C)

Options	A	B	C
(a)	*Pleurobrachia*	*Adamsia*	*Aurelia*
(b)	*Aurelia*	*Adamsia*	*Pleurobrachia*
(c)	*Pleurobrachia*	*Aurelia*	*Adamsia*
(d)	*Aurelia*	*Pleurobrachia*	*Adamsia*

167. Read the following statements w.r.t. cnidarians :

(i) Cnidarians exhibit tissue level of organisation and are triploblastic

(ii) Digestion is extracellular and intracellular

(iii) Corals secrete calcium bicarbonate to form a soft skeleton commonly

(iv) Corals may harbour some photosynthetic dinoflagellates for taking nutrition

(v) They possess a central gastro-vascular cavity with a single opening, mouth on hypostome.

Which of the above statements are correct ?

(a) (i), (iii) (b) (i), (ii), (iii)
(c) (ii), (iv), (v) (d) (iii), (iv)

168. Match the column :

Column-I	Column-II
A. *Gorgonia*	(i) Sea pen
B. *Adamsia*	(ii) Sea fan
C. *Physalia*	(iii) Sea anemone
D. *Pennatula*	(iv) Portuguese man-of-war

(a) A = (i), B = (iv), C = (iii), D = (ii)
(b) A = (i), B = (iii), C = (ii), D = (iv)
(c) A = (ii), B = (iii), C = (iv), D = (i)
(d) A = (ii), B = (iv), C = (iii), D = (i)

169. *Meandrina is :*

(a) Brain coral (b) Sea fan
(c) Sea anemone (d) Sea pen

170. **Read the following statements w.r.t. cnidarians :**

(i) **Some cnidarians exists only in polyp forms like *Adamsia* and *Hydra***

(ii) **In cnidarians showing metagenesis, polyps undergo asexual reproduction (budding) to give out medusae**

(iii) **In cnidarians showing metagenesis, medusae produce sperm and ova for sexual reproduction to form polyps**

(iv) **Some cnidarians exist as medusa as the dominant form where polyp may be absent or reduced like *Aurelia* or jelly fish**

(v) ***Obelia* exhibit alternation of generation, *i.e.*, metagenesis**

Which of the above statements are correct ?

(a) (i), (ii), (v) (b) (i), (ii), (iii), (iv), (v)

(c) (ii), (iii), (iv) (d) (i), (iii), (iv), (v)

171. In Annelids :

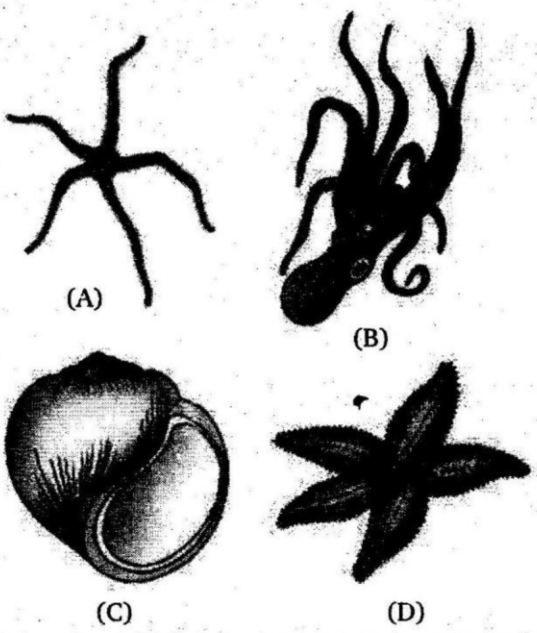
(a) Neural system consists of paired ganglia connected by lateral nerves to a double ventral nerve cord

(b) Reproduction occur both asexually and sexually

(c) Like *Nereis, Pheretima* and *Hirudinaria* have monoecious condition

(d) Aquatic forms are completely absent

69. Identify A, B, C and D alongwith their phyla :



Options	A	B	C	D
(a)	*Ophiura* Mollusca	*Octopus*, Mollusca	*Pila*, Echino-dermata	*Asterias*, Echino-dermata
(b)	*Ophiura*, Echinoder-mata	*Octopus*, Mollusca	*Pila*, Mollusca	*Asterias*, Echino-dermata
(c)	*Ophiura*, Echinoder-mata	*Octopus*, Echino-dermata	*Pila*, Mollusca	*Asterias*, Mollusca
(d)	*Ophiura*, Mollusca	*Octopus*, Echino-dermata	*Pila*, Echino-dermata	*Asterias*, Mollusca

172. All of the following are the exclusive feature of arthropods, except :

(a) Chitinous exoskeleton

(b) Jointed appendages

(c) Presence of respiratory system

(d) Presence of wings

173. **Match the column :**

Column-I	Column-II
A. *Pila*	(i) Devil fish
B. *Octopus*	(ii) Pearl oyster
C. *Pinctada*	(iii) Sea-hare
D. *Aplysia*	(iv) Apple snail

(a) A = (ii), B = (iii), C = (i), D = (iv)

(b) A = (iv), B = (i), C = (iii), D = (ii)

(c) A = (ii), B = (i), C = (iii), D = (iv)

(d) A = (iv), B = (i), C = (ii), D = (iii)

174. **Read the following statements w.r.t. molluscs :**

(i) **A soft and spongy layer of skin forming a thin delicate covering over the visceral hump is called mantle or pallium**

(ii) ***Octopus* possess the calcareous shell secreted by mantle**

(iii) **Molluscs can have gills or lungs**

(iv) **Ganglia is absent**

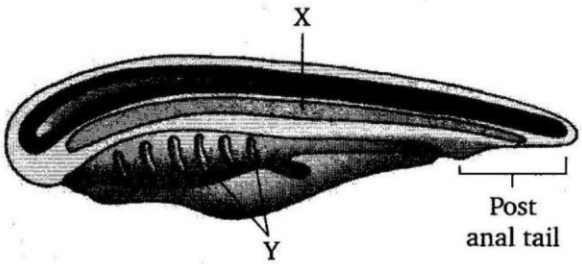
(v) **Direct development occurs in *Octopus, Sepia* and *Loligo***

Which of the above statements are incorrect ?

(a) (ii), (iv) (b) (i), (iii), (v)

(c) (i), (iii) (d) (iii), (iv)

Identify the correct statement w.r.t. structures marked X and Y in the diagram given below :



(Chordate characters)

(a) Both X and Y are present throughout the life in Urochordates

(b) Both X and Y takes part in circulation of water for respiration

(c) In vertebrates X is replaced by a cartilaginous or bony vertebral column in adults and Y occur only in embryonic stages in higher chordates

(d) X may be present in few non-chordates but Y is completely absent in them

175. **A:** The phylum Aschelminthes represent pseudocoelomates
R: In Aschelminthes, mesoderm is present as scattered pouches in between ectoderm and endoderm

176. **A:** All the vertebrates are chordates but all the chordates are not vertebrates.
R: All the vertebrates are characterised by the presence of a notochord, a dorsal hollow nerve cord and paired pharyngeal gill slits at some stages of the life cycle.

177. Which of the following is incorrect ?
(a) The epithelium of proximal convoluted tubule (PCT) of nephron in the kidney lacks microvilli
(b) The cells of columnar epithelium have their nuclei located at the base
(c) Ciliated epithelium functions to move particles or mucus in a specific direction over the epithelium
(d) The squamous epithelium can form a diffusion boundary

178. In which of the following tissues, the cells are compactly packed with little intercellular matrix?
(a) Nervous tissue
(b) Connective tissue
(c) Muscular tissue
(d) Epithelial tissue

179. Inner surface of hollow organs like bronchioles and fallopian tubes have :
(a) Ciliated epithelium
(b) Compound epithelium
(c) Cuboidal epithelium
(d) Squamous epithelium

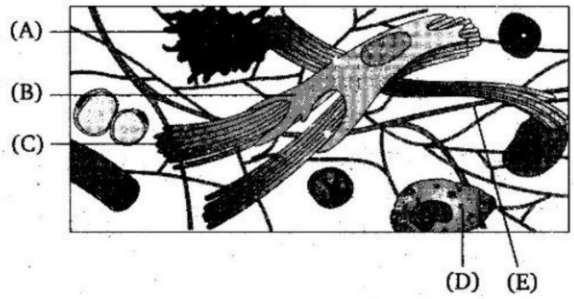
180. Match the column :

Column-I		Column-II	
A.	Brush border epithelium	(i)	Moist surface of buccal cavity
B.	Compound epithelium	(ii)	Proximal convoluted tubule (PCT)
C.	Simple cuboidal epithelium	(iii)	Wall of blood vessels
D.	Simple squamous epithelium	(iv)	Germinal epithelium

(a) A = (i), B = (ii), C = (iii), D = (iv)
(b) A = (iv), B = (iii), C = (i), D = (ii)
(c) A = (iii), B = (ii), C = (i), D = (iv)
(d) A = (ii), B = (i), C = (iv), D = (iii)

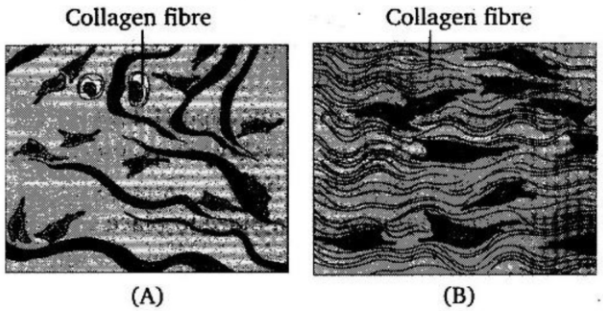
181. Blood is best classified as connective tissue because :
(a) Its cells are separated from each other by an extracellular matrix
(b) It contains more than one type of cells
(c) It is contained in vessels that connect different parts of an organisms body
(d) Its cells can move from place to place

182. Identify A, B, C, D and E in the areolar tissue given below :



Options	A	B	C	D	E
(a)	Macro-phage	Fibro-blast	Yellow fibres	Mast cell	Collagen fibres
(b)	Mast cell	Yellow fibres	Macro-phage	Collagen fibres	Fibroblast
(c)	Fibro-blast	Macro-phage	Mast cell	Collagen fibre	Mast cell
(d)	Macro-phage	Fibro-blast	Collagen fibres	Mast cell	Yellow fibres

183. Choose the correct information about the tissues **A** and **B** diagrammatically shown below :



(a) A = Dense regular connective tissue
B = Dense irregular connective tissue
(b) A = This tissue is present in the skin
B = Tendons and ligaments are examples of this tissue
(c) A = Dense irregular connective tissue
B = Dense irregular connective tissue
(d) A = Tendons and ligaments are examples of this tissue
B = This tissue is present in the skin

184. Ligament is :
(a) Modified white fibrous tissue
(b) Modified yellow elastic fibrous tissue
(c) Inelastic fibrous tissue
(d) Modified yellow inelastic fibrous tissue

185. Nephridia of earthworm :
(a) Are respiratory structures
(b) Always open into gut
(c) Starts out as funnel that collects excess fluid from coelomic chamber
(d) Are absent in 4th, 5th and 6th segments

SECTION-A

Read the following statements for frog :

(i) They possess both neural and endocrine system for control and coordination

(ii) They possess a central nervous system (Brain and spinal cord) and a peripheral nervous system (carnial and spinal nerves)

(iii) They lack an autonomic nervous system

(iv) They possess 10 pairs of cranial nerves arising from the brain

(v) Stomach contains oxyntic glands, gastric glands, hepatic caecae, calciferous glands as well as collaterial glands

186. Conglobate organ w.r.t. male reproductive system is found in :

(a) Frog (b) Earthworm

(c) Cockroach (d) Lizzard

187. **A:** Cockroaches show sexual dimorphism.

R: Malpighian tubules in cockroaches removes excretory material from haemolymph.

188. **A:** Goblet cells are found in alimentary canal.

R: Goblet cells secrete mucus.

189. Consider the following four statements (A-D) related to the common frog *Rana tigrina*, and select the correct option stating which ones are true (T) and which ones are false (F) :

(A) On dry land is would die to lack of O_2 if its mouth is forcibly kept closed for a few days

(B) It has four-chambercd heart

(C) On dry land it turns uricotelic from ureotelic

(D) Its life-history is carried out in pond water

	(A)	(B)	(C)	(D)
(a)	F	T	T	F
(b)	T	F	F	T
(c)	T	T	F	F
(d)	F	F	T	T

190. Uretres act as urinogenital ducts in:

(a) Frog's males

(b) Human males

(c) Human females

(d) Frog's both males and females

191. Which one of the following statements about certain given animals is correct?

(a) Roundworms (Aschelminthes) are pseudo-coelomates.

(b) Molluscs are acoelomates.

(c) Insects are pseudocoelomates.

(d) Flatworms (Platyhelminthes) are coelomates.

192. The animals with bilateral symmetry in young stage and radial pentamerous symmetry in the adult stage, belong to the Phylum

(a) Annelida (b) Mollusca

(c) Cnidaria (d) Echinodermata.

193. Coelom is found between

(a) body wall and ectoderm

(b) ectoderm and endoderm

(c) mesoderm and body wall (endoderm)

(d) mesoderm and ectoderm.

194. Bilaterally symmetrical and acoelomate animals are exemplified by

(a) ctenophora (b) platyhelminthes

(c) aschelminthes (d) annelida.

195. Which of the following statements are true for the Phylum Chordata?

(A) In Urochordata, notochord extends from head to tail and it is present throughout their life.

(B) In Vertebrata, notochord is present during the embryonic period only.

(C) Central nervous system is dorsal and hollow.

(D) Chordata is divided into 3 subphyla : Hemichordata, Tunicata and Cephalochordata.

(a) (D) and (C) (b) (C) and (A)

(c) (A) and (B) (d) (B) and (C)

196. Match the following organisms with respective characteristics.

(A) *Pila* (i) Flame cells

(B) *Bombyx* (ii) Comb plates

(C) *Pleurobrachia* (iii) Radula

(D) *Taenia* (iv) Malpighian tubules

Select the correct option from the following.

	(A)	(B)	(C)	(D)
(a)	(iii)	(ii)	(iv)	(i)
(b)	(iii)	(ii)	(i)	(iv)
(c)	(iii)	(iv)	(ii)	(i)
(d)	(ii)	(iv)	(iii)	(i)

197. Identify the vertebrate group of animals characterised by crop and gizzard in its digestive system.

(a) Amphibia (b) Reptilia

(c) Aves (d) Osteichthyes

198. Important characteristic that hemichordates share with chordates is

(a) ventral tubular nerve cord

(b) pharynx with gill slits

(c) pharynx without gill slits

(d) absence of notochord.

199. Which one of the following characteristics is not shared by birds and mammals?

(a) Viviparity
(b) Warm bloodednature
(c) Ossified endoskeleton
(d) Breathing using lungs

200. Which of the following characteristic features always holds true for the corresponding group of animals?

(a) Possess a mouth with an upper and a lower jaw	Chordata
(b) 3–chambered heart with one incompletely divided ventricle	Reptilia
(c) Cartilaginous endoskeleton	Chondrichthyes
(d) Viviparous	Mammalia

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