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Sr. No.

10189

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BPH-EE-2015

SET - "Z"

A

Time : 1 $\frac{1}{4}$ Hours (75 minutes)

Max. Marks : 100

Total Questions : 130

Candidate's Name Date of Birth

Father's Name Mother's Name

Roll No.(In Figure) in words)

Date of Examination :

(Signature of the Invigilator)

(Signature of the Candidate)

CANDIDATES MUST READ THE FOLLOWING INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER & FOLLOW THEM.

1. All questions under Part-A and Part-B are compulsory. Part-C is optional. The candidates may attempt either Optional Part-C (i) OR Optional Part-C (ii). All questions carry equal one marks i.e. marks each.
2. All the candidates **MUST** return this Question booklet and the OMR Answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. The candidate **MUST NOT** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself.
4. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.
5. Use only Blue or Black ball point pen of good quality in the OMR Answer-Sheet.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOKLET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

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Part-A (Physics)

1. If momentum (P), area (A) and time (T) are taken to be fundamental quantities, then energy has the dimensional formula :

- (1) $(P^1 A^1 T^1)$
- (2) $(P^2 A^{-1} T^{1/2})$
- (3) $(P^1 A^{-1/2} T^1)$
- (4) $(P^1 A^{1/2} T^{-1})$

2. The vernier scale of a travelling microscope has 50 divisions which coincide with 49.5 main scale divisions. If each main scale division is 0.5 mm, calculate the minimum inaccuracy in the measurement of distance.

- (1) 0.001 mm
- (2) 0.05 mm
- (3) 0.005 mm
- (4) 0.002 mm

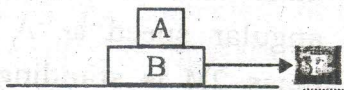
3. It is found that $|\vec{A} + \vec{B}| = |\vec{A}|$. This necessarily implies :

- (1) $\vec{B} = 0$
- (2) \vec{A}, \vec{B} are anti-parallel
- (3) \vec{A}, \vec{B} are perpendicular
- (4) $\vec{A} \cdot \vec{B} \leq 0$

4. A cricket ball of mass 150g has an initial velocity $\vec{u} = (3\vec{i} + 4\vec{j}) \text{ ms}^{-1}$ and final velocity $\vec{v} = -(3\vec{i} + 4\vec{j}) \text{ ms}^{-1}$ after being hit, the magnitude of momentum transferred during the hit is :

- (1) Zero
- (2) 0.75 Kg ms^{-1}
- (3) 1.5 Kg ms^{-1}
- (4) 140.0 Kg ms^{-1}

5. In fig. the coefficient of friction between the floor and the body B is 0.1. The coefficient of friction between body B and A is 0.2. A force F is applied as shown on B. The mass of A is $m/2$ and of B is m. The bodies will move together if F is



- (1) Zero
- (2) 0.25 mg
- (3) 1.5 mg
- (4) 1.0 mg

6. A bicyclist comes to a skidding stop in 20m. During this process, the force applied by the road on bicycle is 200N and is directly opposite to the motion. The work done by the cycle on the road is :

- (1) Zero
- (2) 4000J
- (3) -4000J
- (4) 400J

7. A body of mass 0.5 Kg travels in a straight line with velocity $v = ax^{3/2}$ where $a = 5 \text{ m}^{-1/2} \text{ s}^{-1}$. The work done by the net force during its displacement from $x = 0$ to $x = 2\text{m}$ is :

- (1) 1.5 J (2) 50 J
- (3) 10 J (4) 20 J

8. A Merry-go-round made of ring-like platform of Radius R and mass M, is revolving with angular speed ω . A person of mass 2M is standing on it. At one instant, the person jumps off the round, radially away from the centre of round (as seen from the round). The angular speed of round afterwards is :

- (1) 1.5ω (2) 2ω
- (3) ω (4) $\omega/2$

9. Satellites orbiting the earth have finite life and some time debris of satellite fall to earth. This is due to :

- (1) The solar cells and batteries in satellite run out
- (2) The laws of gravitation predict a trajectory spiraling inwards
- (3) The viscous forces causing the speed of satellite and hence height to gradually decrease
- (4) Collisions with other satellites

10. If the law of gravitation, instead of being inverse square law, becomes as inverse cube law :

- (1) Planets orbit will remain elliptical
- (2) Circular orbit of planets is not possible
- (3) Projectile motion of stone thrown by hand on the surface of the earth will be approximately parabolic
- (4) There will be no gravitation force inside a spherical shell of uniform density

11. A rigid bar of mass M is supported symmetrically by three wires of equal length l , middle wire is of iron (having Young's modulus of elasticity, Y_{iron}) and side wires are of copper (having Young's modulus of elasticity, Y_{copper}). The ratio of their diameters, if each is to have same tension, is equal to :

- (1) $Y_{\text{iron}}/Y_{\text{copper}}$
- (2) $Y_{\text{iron}}^2/Y_{\text{copper}}^{1/2}$
- (3) $(Y_{\text{copper}}/Y_{\text{iron}})^{1/2}$
- (4) $(Y_{\text{copper}}/Y_{\text{iron}})^{-1/2}$

12. A steel rod ($Y = 2.0 \times 10^{11} \text{ NM}^{-2}$); ($\alpha = 10^{-50} \text{ C}^{-1}$) of length 2.0m and area of cross-section 1 cm^2 is heated from 0°C to 473K , without being allowed to extend or bend. What is the tension produced in the rod ?

- (1) $4 \times 10^4 \text{ N}$ (2) $40 \times 10^4 \text{ N}$
- (3) $0.4 \times 10^4 \text{ N}$ (4) $2 \times 10^4 \text{ N}$

13. The surface tension and vapour pressure of water at 37.40°C $7.28 \times 10^{-2} \text{ Nm}^{-1}$ and $2.33 \times 10^3 \text{ Pa}$, respectively. What is the radius of the smallest spherical water droplet which can form without evaporation at the given temperature ?

- (1) $6.0 \times 10^{-5} \text{ m}$ (2) $6.25 \times 10^{-5} \text{ m}$
- (3) $6.5 \times 10^{-4} \text{ m}$ (4) $1.25 \times 10^{-5} \text{ m}$

14. Steam line flow is more likely for the liquids with :

- (1) High density and high viscosity
- (2) Low density and low viscosity
- (3) Low density and high viscosity
- (4) High density and low viscosity

15. A sphere, a cube and a thin circular plate, all of same material and same mass are initially heated to same high temperature :

- (1) Plate will cool fastest and cube the slowest
- (2) Plate will cool fastest and sphere the slowest
- (3) Sphere will cool fastest and cube the lowest
- (4) Cube will cool fastest and plate the lowest

16. If the coefficient of performance of a refrigerator is 5 and operates at the room temperature (27°C), find the temperature inside the refrigerator :

- (1) 31°C
- (2) -23°C
- (3) 0°C
- (4) 32°C

17. A gas mixture consist of 2.0 moles of oxygen and 4.0 mole of neon at temperature T . Calculate the total internal energy of the system. (Neglecting all the vibrational modes).
- (1) $6RT$ (2) $5RT$
 (3) $11RT$ (4) $12RT$
18. Find the displacement (x) of a simple harmonic oscillator (with amplitude r) at which its potential energy is half of the maximum energy of the oscillator.
- (1) $\pm r/2^{1/2}$ (2) $-r/2$
 (3) $r/2^{-1/2}$ (4) $\pm r/2^{3/2}$
19. Equation of plane progressive wave is $y = 0.6 \sin 2\pi (t - x/2)$. On the reflection from denser medium its amplitude becomes $2/3$ of the amplitude of incident wave. The equation of reflected wave is :
- (1) $y = 0.6 \sin 2\pi (t + x/2)$
 (2) $y = -0.4 \sin 2\pi (t + x/2)$
 (3) $y = -0.6 \cos 2\pi (t - x/2)$
 (4) $y = 0.4 \sin 2\pi (t + x/2)$
20. A hollow metal sphere of radius 5 cm is charged such that the potential on its surface is 10V. The potential at the centre of sphere is :
- (1) 0 V (2) 10 V
 (3) Same as at point 5 cm away from the surface
 (4) Same as at point 25 cm away from the surface
21. A condenser of capacitance $2\mu\text{F}$ has been charged to 200V. It is now discharged through a resistance, the heat produced in the wire is :
- (1) 400 J
 (2) 0.02 J
 (3) 0.04 J
 (4) 20 J
22. A cell sends a current I through a resistance R_1 for time t . The same cell sends the same current through another resistance R_2 for time t . If the amount of heat developed in both the cases is same, then the internal resistance of the cell is :
- (1) $(R_1 + R_2)/2$
 (2) $(R_1 - R_2)/2$
 (3) $(R_1 R_2)^{1/2}$
 (4) $(R_1 R_2/2)^{1/2}$
23. A conductor circular loop of radius r carries a constant current I . It is placed in a uniform magnetic field $B \rightarrow$ such that $B \rightarrow$ is perpendicular to the plane of loop. The magnetic force acting on the loop is :
- (1) Blr
 (2) $2\pi IrB$
 (3) zero
 (4) πIrB

24. A magnetic needle is placed in a non uniform magnetic field. It experiences :

- (1) A force and a torque
- (2) A force but not a torque
- (3) A torque but not a force
- (4) Neither a force nor a torque

25. A series LCR circuit has a material frequency of 200Hz. The current flowing will be maximum when the frequency of applied e.m.f. is :

- (1) 200 Hz
- (2) 100 Hz
- (3) 50 Hz
- (4) 400 Hz

26. When an electric motor is run at 120V, 10A current flows through it and the induced back e.m.f. is 115V. What will be the current flowing in the coil at the time of switch off ?

- (1) 230 A
- (2) 10 A
- (3) 240 A
- (4) Zero

27. The electro-magnetic waves do not transport :

- (1) Charge
- (2) Energy
- (3) Momentum
- (4) Information

28. The Young's double slit experiment is performed with blue and with green light of wavelengths 4360 Å and 5460 Å respectively. If x is the distance of 4th maxima from the centre one, then :

- (1) x (blue) = x (green)
- (2) x (blue) > x (green)
- (3) x (blue) < x (green)
- (4) x (blue)/ x (green)=5460/4360

29. A convex lens of focal length 40 cm is in contact with a concave lens of focal length 25 cm. The power of the combination is :

- (1) - 1.5 D
- (2) - 6.5 D
- (3) + 6.5 D
- (4) + 6.67 D

30. An electron of mass 'm' and charge 'q' is accelerated from rest in a uniform electric field of strength 'E'. The velocity acquired by it as it travels a distance 'l' is :

- (1) $(E \times q/m \times l)^{1/2}$
- (2) $(2E \times q \times l/m)^{1/2}$
- (3) $(2E \times q/m \times l)^{1/2}$
- (4) $(E \times m/q \times l)^{1/2}$

31. A proton and an α -particle have equal De-Broglie wavelengths. Calculate the ratio of kinetic energy of proton to that of α -particle :

- (1) 4:1
- (2) 2:1
- (3) 1:1
- (4) 1:2

32. If 80% of a given radioactive sample is left undecayed after 10 days, what percentage of the original sample will decay in 30 days.

- (1) 50%
- (2) 51.2%
- (3) 36.1%
- (4) 40.2%

33. In a half wave rectifier, if the input frequency is 50Hz, the frequency of the pulsating d.c. is :

- (1) 50 Hz
- (2) Zero
- (3) 25 Hz
- (4) 100 Hz

34. What should be the minimum energy band gap of material used as LED ?

- (1) 1.2 eV
- (2) 1.8 eV
- (3) 0.8 eV
- (4) 2.2 eV

35. Two carrier waves have frequencies ν_0 and $3\nu_0$. What is the ratio of the lengths of dipole antenna required for the two carrier waves :

- (1) 3:1
- (2) 4:1
- (3) 2:1
- (4) 1:4

Part-B (Chemistry)

36. The value of ΔE when the system absorbs 1000 KJ of heat and does 650 KJ of work on surrounding is :

- (1) 350 KJ
- (2) -350 KJ
- (3) 1650 KJ
- (4) -1650 KJ

37. The decomposition of N_2O into N_2 and O in the presence of Gracious argon follows second order kinetics with $R = (5 \times 10^{-4} \text{ L mol}^{-1} \text{ S}^{-1}) e^{-2900(K)/T}$

Hence the E_a (Energy of Activation) is :

- (1) $5.0 \times 10^4 \text{ KCal}$
- (2) 2900 KCal
- (3) 58 KCal
- (4) -2900 KCal

38. $H_2O(l) \xrightleftharpoons{1 \text{ atm}} H_2O(g)$
 $\Delta H_{\text{vap}} = 10 \text{ KCal mol}^{-1}$

If pressure is increased

- (1) Steam is liquified
- (2) BP of H_2O is elevated
- (3) Both (1) and (2)
- (4) None of these

39. In HCP structure, the packing fraction is :

- (1) 0.68
- (2) 0.74
- (3) 0.50
- (4) 0.54

40. The vapour pressure of a pure liquid A is 40 mmHg at 310 k. The vapour pressure of this liquid in a solution with liquid B is 32 mmHg. Mole fraction of A in the solution, if it obeys Raoult's law is :

- (1) 0.8
- (2) 0.5
- (3) 0.2
- (4) 0.4

41. H_2 , D_2 , T_2 do not differ in :

- (1) Freezing point
- (2) Boiling point
- (3) Critical temperature
- (4) Bond energy





42. IUPAC name of $K_4[Fe(CN)_6]$ is :

- (1) Potassium hexacyano iron (II)
- (2) Potassium iron (II) hexacyano
- (3) Tetra potassium iron (II) hexacyano
- (4) Potassium hexacyanoferrate (II)

43. 100 ml of 1M HCl is mixed with 50 ml of 2M HCl. Hence, $[H_3O^+]$ is :

- (1) 1.00 M
- (2) 1.50 M
- (3) 1.33 M
- (4) 3.00 M

44. Bicycle [2, 2, 2] is :

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

45. The reactive intermediate in Riemer-Tiemann reaction is :

- (1) Formyl anion
- (2) Formyl carbocation
- (3) Dichloromethyl carbocation
- (4) Dichlorocarbene

46. Benzene is generated from :

- (1) Chlorobenzene in presence of sodamide in liquid NH_3
- (2) Benzene with sodium in liquid NH_3
- (3) Benzene in liquid NH_3
- (4) Action of Heat on benzoic acid

47. Which one of the following reaction involves a hydride shift in its reaction mechanism ?

- (1) Claisen condensation
- (2) Blackmann rearrangement
- (3) Cannizzaro reaction
- (4) Benzylic acid rearrangement

48. α , β -unsaturated carbonyl compounds undergo a ring closure reaction with conjugated dienes. This is also known as :

- (1) Perkin reaction
- (2) Sandmeyer reaction
- (3) Wittig reaction
- (4) Diels-Alder reaction

49. The false statement of osmium tetroxide reagent is :

- (1) OsO_4 is commonly known as Osmic acid
- (2) OsO_4 reagent always attacks on less hindered side of Olefinic bond
- (3) OsO_4 is most often used for anti-hydroxylation of alkenes
- (4) OsO_4 reagent can be used for regio-selectivity

50. Sucrose is a disaccharide consisting of :

- (1) Glucose and Glucose
- (2) Glucose and Galactose
- (3) Glucose and Fructose
- (4) Glucose and Mannose

51. A nucleoside on hydrolysis gives :

- (1) An aldopentose and orthophosphoric acid
- (2) An adopentose and heterocyclic base
- (3) An aldopentose, heterocyclic base and orthophosphoric acid
- (4) A heterocyclic base and orthophosphoric acid

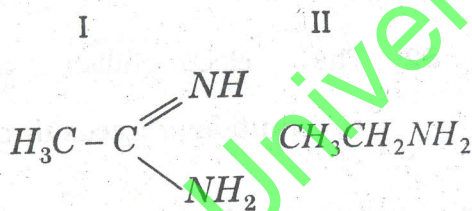
52. The electrophilic aromatic substitution proceeds through a :

- (1) Free radical
- (2) Sigma complex
- (3) Benzene
- (4) Carbene

53. Most stable carbocation form from $(\text{CH}_3)_3\text{C-Br}$, $(\text{C}_6\text{H}_5)_3\text{C-Br}$, $(\text{C}_6\text{H}_5)\text{CHBr}$ and $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$ would be :

- (1) $\text{C}_6\text{H}_5\overset{\oplus}{\text{C}}\text{H}_2$
- (2) $(\text{CH}_3)_3\overset{\oplus}{\text{C}}$
- (3) $(\text{C}_6\text{H}_5)_3\overset{\oplus}{\text{C}}$
- (4) $(\text{C}_6\text{H}_5)_2\overset{\oplus}{\text{C}}\text{H}$

54. The correct order of basic ties of the following compound is :



- (1) II > I > III > IV
- (2) I > III > II > IV
- (3) III > I > II > IV
- (4) I > II > III > IV

55. Consider the following reagent :

- (I) Br_2 water
- (II) Tollen's reagent
- (III) Fehling solution

Which can be used to make distinction between an aldose and a ketose :

- (1) I, II, III
- (2) II, III
- (3) I only
- (4) II only

56. Co-ordination number of calcium is six in :

- (1) $[\text{Ca}(\text{EDTA})]^{2-}$
- (2) CaC_2O_4
- (3) $[\text{Ca}(\text{C}_2\text{O}_4)_2]^{2-}$
- (4) $\text{CaSO}_4 \cdot 4\text{H}_2\text{O}$

57. $[\text{Ni}(\text{CN})_4]^{2-}$ and $[\text{Ni}(\text{CO})_4]$ have :

- (1) Sp^3 hybridized Ni in both cases
- (2) Sp^3 and Sp^2d hybridized Ni
- (3) dsp^2 and sp^3 hybridized Ni
- (4) dsp^2 in both cases

58. The crystal field splitting energy for octahedral (Δ_o) and tetrahedral (Δ_t) complexes is related as :

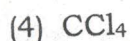
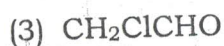
(1) $\Delta_t = -\frac{4}{9} \Delta_o$

(2) $\Delta_t = \frac{1}{2} \Delta_o$

(3) $\Delta_o = -2 \Delta_t$

(4) $\Delta_o = -\frac{4}{9} \Delta_t$

59. $\text{CH}_3\text{CH}_2\text{OH}$ on reaction with bleaching powder forms :



60. For the cell :

$\text{Hg}/\text{Hg}_2\text{Cl}_2/\text{Cl}^- (0.1\text{M})//\text{Cl}^- (0.01\text{M})/\text{Pt}(\text{Cl}_2)$. E_{cell}° is 1.10 V.

Hence, E_{cell} is

(1) 1.1591 V

(2) -1.1591 V

(3) 1.0409 V

(4) -1.0409 V

61. Which of the following statements regarding orthoboric acid is false ?

(1) It acts as a weak monobasic acid

(2) It is soluble in hot water

(3) It has a planar structure

(4) It acts as a tribasic acid

62. Principal cause of ozone depletion :

(1) Presence of fluoro-carbons

(2) Acid rain

(3) Photochemical smog

(4) Green house effect

63. Acid strength of oxoacids of chlorine is in order :

(1) $\text{HOCl} < \text{HO}_2\text{Cl} < \text{HClO}_3 < \text{HClO}_4$

(2) $\text{HClO}_4 < \text{HClO}_3 < \text{HClO}_2 < \text{HOCl}$

(3) $\text{HClO}_3 < \text{HClO}_4 < \text{HClO}_2 < \text{HOCl}$

(4) $\text{HClO}_2 < \text{HClO}_3 < \text{HOCl} < \text{HClO}_4$

64. Which of the following is copolymer ?

- (1) $-CH_2 - \overset{\overset{CH_3}{|}}{C} - COOCH_3$
- (2) $-(CH_2 - CH - (C_6H_5))_n$
- (3) $-(CH_2CH = CH - CH_2 - \underset{\underset{C_6H_5}{|}}{CH} - CH_2)_n$
- (4) $-(CH_2 - \underset{\underset{Cl}{|}}{CH})_n$

65. Which statement is correct :

- (1) Starch is a polymer of α -glucose
- (2) Amylase is a component of cellulose
- (3) Proteins are composed of only one type of amino acids
- (4) In cyclic structure of Fructose, there are four carbon and one oxygen atom

66. In Nessler's reagent for the detection of NH_3 , the active species is :

- (1) Hg_2Cl_2
- (2) Hg^{2+}
- (3) Hg_2I_2
- (4) HgI_4^{2-}

67. The basic character of transition metal monoxides follow the order :

- (1) $VO > CrO > TiO > FeO$
- (2) $CrO > VO > FeO > TiO$
- (3) $TiO > FeO > VO > CrO$
- (4) $TiO > VO > CrO > FeO$

68. Which of the following has $p\pi-d\pi$ bonding ?

- (1) NO_3^- (2) SO_3^{2-}
- (3) BO_3^{3-} (4) CO_3^{2-}

69. Which of the following is planar :

- (1) XeO_4 (2) $XeOF_3$
- (3) XeO_2F_2 (4) XeF_4

70. Select the correct statements :

- (1) Solubility of alkali hydroxides is in order $LiOH > NaOH > KOH > RbOH$
- (2) Solubility of alkali carbonates is in order $Li_2CO_3 > Na_2CO_3 > K_2CO_3 > Rb_2CO_3$
- (3) Both are correct
- (4) None is correct

Part-C {Opt(i)} (Mathematics)

71. If X and Y are two sets such that $X \cup Y$ has 50 elements, X has 28 elements and Y has 32 elements, how many elements does $X \cap Y$ has :

- (1) 4
- (2) 5
- (3) 6
- (4) 10

72. Domain of the function

$$f(x) = \frac{x^2 + 3x + 5}{x^2 - 5x + 4} \text{ is :}$$

- (1) R
- (2) $R - \{1\}$
- (3) $R - \{4\}$
- (4) $R - \{1, 4\}$

73. For every positive integer n, $7^n - 3^n$ is divisible by :

- (1) 4
- (2) 7
- (3) 3
- (4) 5

74. If $x + iy = \frac{a+ib}{a-ib}$ then $x^2 + y^2 = :$

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

75. The solution set of $4x + 3 < 6x + 7$ is :

- (1) $(2, \infty)$
- (2) $(-2, \infty)$
- (3) $(0, \infty)$
- (4) $(-\infty, 0)$

76. If $n_{C9} = n_{C8}$, then n_{C17} is :

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

77. If a, b, c are in G.P. and $a^{1/x} = b^{1/y} = c^{1/z}$, then x, y, z are :

- (1) in G.P.
- (2) in A.P.
- (3) Not in A.P.
- (4) None of these

78. In the expansion of $(x + 2y)^9$, the coefficient of x^6y^3 is :

- (1) 42
- (2) 336
- (3) 672
- (4) 168

79. The distance between the parallel lines $3x - 4y + 7 = 0$ and $3x - 4y + 5 = 0$ is :

(1) $\frac{1}{5}$

(2) $\frac{2}{5}$

(3) $\frac{3}{5}$

(4) $\frac{4}{5}$

80. The derivative of $f(x) = 1 + x + x^2 + x^3 + \dots x^{50}$ at $x = 1$ is :

(1) 75

(2) 275

(3) 1275

(4) 175

81. The variance of 20 observations is 5. If each observation is multiplied by 2, the new variance of the resulting observation is :

(1) 20

(2) 10

(3) 5

(4) 25

82. A committee of two persons is selected from two men and two women. The probability that the committee will have two men is :

(1) $\frac{2}{3}$

(2) $\frac{1}{6}$

(3) $\frac{1}{3}$

(4) 1

83. Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined as $f(x) = x^4$. Choose the correct answer :

(1) f is one-one onto

(2) f is many-one onto

(3) f is one-one but not onto

(4) f is neither one-one nor onto

84. $\tan^{-1} \frac{1}{2} + \tan^{-1} \frac{2}{11}$ is equal to :

(1) $\tan^{-1} \frac{1}{4}$

(2) $\tan^{-1} \frac{1}{11}$

(3) $\tan^{-1} \frac{3}{4}$

(4) $\tan^{-1} \frac{1}{2}$

85. If A, B are symmetric matrices of the same order, then $AB - BA$ is a :

- (1) Skew symmetric matrix
- (2) Symmetric matrix
- (3) Zero matrix
- (4) Identity matrix

86. If

$$\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix},$$

then x is equal to :

- (1) 6
- (2) ± 6
- (3) -6
- (4) 0

87. Derivative of $\sin^2 x$ w.r.t $e^{\cos x}$ is :

- (1) $-\frac{2 \cos x}{e^{\cos x}}$
- (2) $\frac{2 \cos x}{e^{\cos x}}$
- (3) $\frac{\cos x}{e^{\cos x}}$
- (4) $-\frac{\cos x}{e^{\cos x}}$

88. The slope of the tangent to the curve $y = x^3 - x$ at $x = 2$ is :

- (1) 1
- (2) 2
- (3) 7
- (4) 11

89. $\int x^2 e^{x^3} dx$ equals :

- (1) $\frac{1}{2} e^{x^3} + c$
- (2) $\frac{1}{2} e^{x^3} + c$
- (3) $\frac{1}{3} e^{x^2} + c$
- (4) $\frac{1}{3} e^{x^2} + c$

90. $\int_0^1 \frac{\tan^{-1} x}{1+x^2} dx$ equals :

- (1) $\frac{\pi^2}{4}$
- (2) $\frac{\pi^2}{32}$
- (3) $\frac{\pi^2}{16}$
- (4) $\frac{\pi^2}{8}$

91. The integrating factor of the differential equation

$$x \frac{dy}{dx} - y = 2x^2 \text{ is}$$

(1) x

(2) $\frac{1}{x}$

(3) e^{-x}

(4) e^{-y}

92. Let A be a non-singular square matrix of order 3×3 . Then $|\text{adj } A|$ is equal to :

(1) $|A|$

(2) $|A|^2$

(3) $|A|^3$

(4) $3|A|$

93. The approximate change in the volume of a cube of side x metres caused by increasing the side by 3% is :

(1) $0.06 x^3 \text{m}^3$

(2) $0.6 x^3 \text{m}^3$

(3) $0.09 x^3 \text{m}^3$

(4) $0.9 x^3 \text{m}^3$

94. The general solution of the differential equation $\frac{dy}{dx} = e^{x+y}$ is :

(1) $e^x + e^{-y} = c$

(2) $e^x + e^y = c$

(3) $e^{-x} + e^y = c$

(4) $e^{-x} + e^{-y} = c$

95. Direction cosines of the vector $i + 2j - k$ are :

(1) $\left(\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{-2}{\sqrt{6}}\right)$

(2) $\left(\frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}\right)$

(3) $\left(\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{-1}{\sqrt{6}}\right)$

(4) $\left(\frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{-1}{\sqrt{6}}\right)$

96. Angle between the vectors

$$\vec{a} = i + j - k \text{ and } \vec{b} = i - j + k \text{ is}$$

(1) $\text{Cos}^{-1}\left(\frac{-1}{3}\right)$

(2) $\text{Cos}^{-1}\left(\frac{1}{3}\right)$

(3) $\text{Sin}^{-1}\left(\frac{1}{3}\right)$

(4) $\text{Sin}^{-1}\left(-\frac{1}{3}\right)$

97. The distance of the plane $2x - 3y + 4z - 6 = 0$ from the origin is :

(1) $\frac{6}{\sqrt{29}}$

(2) $\frac{1}{\sqrt{29}}$

(3) $\frac{2}{\sqrt{29}}$

(4) $\frac{3}{\sqrt{29}}$

98. The angle between the two planes $2x + y - 2z = 5$ and $3x - 6y - 2z = 7$ is :

(1) $\cos^{-1}\left(\frac{4}{21}\right)$

(2) $\cos^{-1}\left(\frac{1}{21}\right)$

(3) $\cos^{-1}\left(\frac{-4}{21}\right)$

(4) $\cos^{-1}\left(-\frac{1}{21}\right)$

99. If

$$P(A) = \frac{7}{13}, \quad P(B) = \frac{9}{13} \quad \text{and}$$

$$P(A \cap B) = \frac{4}{13}, \quad \text{then } P(A|B)$$

is :

(1) $\frac{4}{9}$

(2) $\frac{2}{9}$

(3) $\frac{7}{9}$

(4) $\frac{5}{9}$

100. The probability of obtaining an even prime number on each die, when a pair of dice is rolled is :

(1) 0

(2) $\frac{1}{3}$

(3) $\frac{1}{12}$

(4) $\frac{1}{36}$

Part-D {Opt(ii)} (Biology)

101. Lack of nuclear membrane is a characteristic feature of :
- (1) Protista
 - (2) Fungi
 - (3) Monera
 - (4) Planta
102. An example of phototrophic autotroph is :
- (1) *Vibrio* sp.
 - (2) *Bacillus* sp.
 - (3) *Archae* sp.
 - (4) *Spirullina* sp.
103. Virioids were discovered by :
- (1) T.O. Diener
 - (2) B. McClintock
 - (3) M.W. Beijerinck
 - (4) R. Gallo
104. Oogamous fusion evolves :
- (1) Fusion of two non-motile gametes
 - (2) Fusion of two motile gametes
 - (3) Fusion of a large motile and a small non-motile gamete
 - (4) Fusion of a small motile and a large non-motile gamete
105. Rhodophyceae is characterised by :
- (1) Chlorophyll a + b
 - (2) Chlorophyll a + c
 - (3) Chlorophyll a + d
 - (4) Chlorophyll a + b along with flagella
106. A diploblastic organism has :
- (1) Mesoderm and ectoderm
 - (2) Endoderm and mesoderm
 - (3) Endoderm and Ectoderm
 - (4) Ectoderm, mesoderm and mesoglea
107. Aceolomate is a feature of :
- (1) Platyhelminthes
 - (2) Annelida
 - (3) Ponifera
 - (4) Coelanterata
108. Ostia and Osculum are found in :
- (1) Earthworm
 - (2) Cockroaches
 - (3) Sponges
 - (4) Butterflies

109. Taeniasis and Cysticercosis are caused by :

- (1) Bacteria
- (2) Platyhelminthes
- (3) Annelids
- (4) Aschelminthes

110. Negatively geotropic roots that help in respiration are :

- (1) Prop roots
- (2) Stilt roots
- (3) Tendrils
- (4) Pneumatophores

111. Formation of ovule on inner ovary wall is :

- (1) Axile
- (2) Marginal
- (3) Parietal
- (4) Basal

112. Glycoproteins and glycolipids are formed on :

- (1) Lysosomes
- (2) ER
- (3) Golgi bodies
- (4) Vacuoles

113. 70 S ribosomes are found in :

- (1) Nucleus
- (2) Cytoplasm
- (3) Mitochondria
- (4) Ribosomes

114. Insulin is an example of :

- (1) Protein that acts as hormone
- (2) Enzyme
- (3) Protein for glucose transport
- (4) Alkaloids for sugar breakdown

115. Anabolic pathways are characterised by :

- (1) Liberation of energy
- (2) Consumption of energy
- (3) Breakdown of proteins
- (4) Breakdown of sugar for ATP generation

116. H_2CO_3 production by combining CO_2 and H_2O is catalysed by :

- (1) Carbonic anhydrase
- (2) Glycogen synthase
- (3) Insulin
- (4) Hydrolase

117. Relationship between enzyme activity and temperature is depicted by :
- (1) Parabolic curve
 - (2) Hyperbolic curve
 - (3) Linear graph
 - (4) Sigmoidal curve
118. Anaerobic respiration of one glucose molecule leads to net production of :
- (1) 40 ATP
 - (2) 36 ATP
 - (3) 38 ATP
 - (4) 34 ATP
119. The first step of CO_2 fixation occurs in :
- (1) Calvin Cycle
 - (2) Anaerobic respiration
 - (3) Lactic acid formulation
 - (4) Glycolysis
120. Ability of an organism to form different kind of structures under different life cycle phase or environment is called :
- (1) Elasticity
 - (2) Plasmatic growth
 - (3) Plasticity
 - (4) Maturation
121. Bakane disease is associated with discovery of :
- (1) Cytokinin
 - (2) Auxin
 - (3) Ethylene
 - (4) Gibberellin
122. Which of these are auxins :
- (1) 1 BA and 2, 4-D
 - (2) BAP
 - (3) TDZ
 - (4) Zeatin
123. Crypts of Lieberkuhn are found in :
- (1) Pancreas
 - (2) Kidney
 - (3) Intestine
 - (4) Larynx

124. Salivary amylase acts at a pH of :

- (1) 6.8
- (2) 4.5
- (3) 8.5
- (4) 11.0

125. Tidal volume of air during normal respiration is :

- (1) 5000 ml
- (2) 1000 ml
- (3) 500 ml
- (4) 100 ml

126. Blood clotting involves :

- (1) Fibrins only
- (2) Fibrins and thrombins
- (3) Eosinophils and platelets
- (4) Eosinophils and neutrophils

127. Wings of butterfly and birds are examples of :

- (1) Convergent evolution
- (2) Divergent evolution
- (3) Allopatry
- (4) Sympatry

128. The class of antibodies produced as a response to allergens :

- (1) IgM
- (2) IgE
- (3) IgG
- (4) IgA

129. IUCN report of 2004 records :

- (1) Nearly 1.5 million species on earth
- (2) Nearly 1.5 million species on earth
- (3) Nearly 20 million plant and animal species on earth
- (4) Nearly 2 million animal species on earth

130. The most species rich taxonomic group is :

- (1) Viruses
- (2) Birds
- (3) Insects
- (4) Plants

ANSWER - KEY

Part-a

1	2	3	4	5	6	7	8	9	10
4	3	2	3	2	1	2	3	3	3
11	12	13	14	15	16	17	18	19	20
4	1	2	3	2	2	2	1	2	2
21	22	23	24	25	26	27	28	29	30
3	3	3	1	1	1	1	3	1	2
31	32	33	34	35					
1	2	1	2	1					

Part-b

36	37	38	39	40	41	42	43	44	45
a	c	c	b	a	d	d	c	d	d
46	47	48	49	50	51	52	53	54	55
a	c	d	c	c	b	b	c	b	c
56	57	58	59	60	61	62	63	64	65
a	c	a	a	a	d	a	a	c	a
66	67	68	69	70					
d	d	b	d	d					

ANSWER – KEY**Part-c**

71	72	73	74	75	76	77	78	79	80
4	4	1	4	2	1	2	3	2	3
81	82	83	84	85	86	87	88	89	90
1	2	4	3	1	2	1	4	3	2
91	92	93	94	95	96	97	98	99	100
2	2	3	1	4	1	1	1	1	4

Part-c (Option-II)

101	102	103	104	105	106	107	108	109	110
C	d	A	D	C	D	A	C	B	D
111	112	113	114	115	116	117	118	119	120
C	C	C	A	B	A	B	B	A	C
121	122	123	124	125	126	127	128	129	130
D	A	C	A	C	B	A	B	A	C

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