Common Entrance Examination - 2018 for Admission in B. Tech/B.Pharmacy/B.Pharmacy (Ayurveda) (Physics, Chemistry & Mathematics or Biology)

Question Booklet No. :- **12678**

Duration: Three Hours

Maximum Marks: 300

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Do not open the seal of the question booklet until you are asked to do so by the invigilator.

2. OMR answer-sheet will be supplied by the Centre Superintendent for answering the questions.

3. Use blue/black ink ball pen only to darken the appropriate circle/oval in the OMR answer-sheet. No sophisticated pens are allowed.

4. Darken one circle/oval deeply for each question in the OMR answer-sheet, as faintly darkened circle might be rejected by the scanner. 🗙 Wrong ● ✓ Correct

5. This question booklet contains **32** pages including blank pages for rough work. After you are permitted to open the seal, please check all pages and report discrepancies, if any, to the invigilator on duty.

6. There are a total of 150 questions carrying 300 marks. All these questions are of objective type. Each question has only one correct answer.

7. Question1 to 50 belong to Physics, question 51 to 100 belong to Chemistry, question101 to 150 belong to Mathematics or Biology and each question carry two marks. You are advised to attempt questions from one subject, either Mathematics or Biology. However, the question belonging to Physics and Chemistry subjects are compulsory for all.

8. Rough work can be done on the question paper itself. Blank pages are provided at the end of the question booklet for rough work.

9. Do not fold the OMR answer-sheet neither put any mark here and there to avoid rejection by the scanner.

10. Write roll number carefully on the OMR answer-sheet and darken the appropriate circle/oval properly.

11. Before dealing with the question paper, fill-up the required information with blue/black ball pen correctly both in the question booklet and the OMR answer-sheet.

12. Mobile telephones are not allowed inside the examination hall.

13. The question booklet will be retained by the candidate after the entrance test is over.

14. Before the start of the examination, write your name and registration number in the space provided below using a blue/black ink ball point pen.

15. Two marks shall be awarded for each correct answers and 0.5 marks shell be deducted for each wrong answer.

PHYSICS

1. The radius of nucleus is $R = R_0 A^{1/3}$, where A is mass number. The dimensions of R_0 is

   (A) $[M L T^{-2}]$ (B) $[M^0 L T^0]$ (C) $[M^0 L^0 T^{-1}]$ (D) None of these

2. If energy of photon is $E \alpha h^a c^b \lambda^d$ where, h is Planck's constant, c = speed of light and λ = wavelength of photon. Then the value of a, b and d are

   (A) 1, 1, 1   (B) 1, −1, 1   (C) 1, 1, −1   (D) None of these

3. A particle is revolving in a circle with increasing its speed uniformly. Which of the following is constant?

   (A) Centripetal acceleration   (B) Tangential acceleration

   (C) Angular acceleration   (D) None of these

4. A 7 kg object is subjected to two forces (in newton) $\vec{F}_1 = 20\hat{i} + 30\hat{j}$ and $\vec{F}_2 = 8\hat{i} - 5\hat{j}$. The magnitude of resulting acceleration in ms^{-2} will be

   (A) 5.3   (B) 4   (C) 3.1   (D) 2

5. A particle of mass m is fixed to one end of a light rigid rod of length l and rotated in a vertical circular path about its other end. The minimum speed of the particle at its highest point must be

   (A) Zero   (B) $\sqrt{gl}$ (C) $\sqrt{1.5\,gl}$ (D) $\sqrt{2\,gl}$

6. A stone of mass 0.3 kg attached to a 1.5 m long string is whirled around in a horizontal circle at a speed of 6 meter per second (m/s). The tension in the string is

   (A) 10 N   (B) 20 N   (C) 7.2 N   (D) None

7. Calculate the net force acting on a body of mass 10 kg moving with a uniform velocity of 2 ms^{-1}

   (A) Zero   (B) 10 N   (C) 2 N   (D) 20 N

8. If $\vec{A}$ and $\vec{B}$ are two vectors, then the value of $(\vec{A} + \vec{B}) \times (\vec{A} - \vec{B})$ is

   (A) $2(\vec{B} \times \vec{A})$ (B) $-2(\vec{B} \times \vec{A})$ (C) $\vec{B} \times \vec{A}$ (D) $\vec{A} \times \vec{B}$

9. The component of vector $\vec{A} = 2\hat{i} + 3\hat{j}$ along the vector $\hat{i} + \hat{j}$ is

   (A) $\dfrac{5}{\sqrt{2}}$ (B) $10\sqrt{2}$ (C) $5\sqrt{2}$ (D) 5

[2] [B. Tech/B.Phar./B.Phar.-Ayur.]

10. The potential energy of two atoms separated by a distance x is given by $U = \dfrac{-A}{x^6}$, where A is a positive constant. What is the force exerted by one atom on another atom?

(A) $\dfrac{-7A}{x^7}$　　(B) $\dfrac{-6A}{x^7}$　　(C) $\dfrac{6A}{x^7}$　　(D) $\dfrac{5A}{x^8}$

11. Which of the following is not conserved in inelastic collision?

(A) Momentum

(B) Kinetic energy

(C) Both Momentum and Kinetic energy

(D) Neither Momentum nor Kinetic energy

12. A rod elongates by ℓ when a body of mass M is suspended from it. The work done is

(A) $Mg\ell$　　(B) $\dfrac{1}{2} Mg\ell$　　(C) $2\,Mg\ell$　　(D) Zero

13. A solid sphere rolls down two different inclined planes of the same height but of different inclinations

(A) In both cases the speeds and time of descend will be same

(B) The speeds will be same but time of descend will be different

(C) The speeds will be different but time of descend will be same

(D) Speeds and time of descend both will be different

14. A light body and a heavy body have same kinetic energy. Which one has greater linear momentum?

(A) Light Body　　　　　　　(B) Heavy Body

(C) Both have same　　　　(D) None of these

15. A small ball describes a horizontal circle on the smooth inner surface of a conical funnel. If the height of the plane of the circle above the vertex be 10 cm. What is the speed of the particle?

(A) 2 m/s　　　　　　　　　(B) 4 m/s

(C) 16 m/s　　　　　　　　(D) 1 m/s

16. In the earth-moon system. If T_1 and T_2 are period of revolution of earth and moon respectively about the centre of mass of the system, then

(A) $T_1 > T_2$　　(B) $T_1 = T_2$　　(C) $T_1 < T_2$　　(D) Insufficient data

17. If a planet revolves around the sun in a circular orbit of radius "a" with a period of revolution T, the (K being a positive constant)

(A) $T = Ka^{2/3}$　　(B) $T = Ka^{3/2}$　　(C) $T = Ka^2$　　(D) $T = Ka^3$

[3] [B. Tech/B.Phar./B.Phar.-Ayur.]

18. The time period of a satellite of earth is 5 hours. If the separation between the earth and the satellite is increased to 4 times the previous value the new time period will become

    (A) 10 hours   (B) 80 hours   (C) 40 hours   (D) 20 hours

19. A person will get more quantity of matter in kg – wt at

    (A) poles

    (B) at latitude of 60°

    (C) equator

    (D) satellite

20. Suppose there is a hole in a copper plate. Upon heating the plate, diameter of the hole would

    (A) always increase

    (B) always decrease

    (C) remains the same

    (D) None of the above

21. Find the depth at which an air bubble of radius 0.7 mm will remain in equilibrium in water. Given surface tension of water = 7.0×10^{-2} Nm^{-1}. Take g = 10 ms^{-2}

    (A) 2 cm   (B) 4 cm

    (C) 10 cm   (D) 12 cm

22. When temperature is increased the frequency of organ pipe

    (A) increases

    (B) decreases

    (C) remains same

    (D) Nothing can be said

23. When a sound wave travels from water to air it,

    (A) bends towards normal

    (B) bends away from normal

    (C) may bend in any direction

    (D) data insufficient

24. A particle executes simple harmonic motion with a frequency f. The frequency with which the potential energy oscillates is

    (A) f   (B) $\dfrac{f}{2}$ (C) 2f   (D) Zero

[4] [B. Tech/B.Phar./B.Phar.-Ayur.]

25. A column of water 60 cm high supports a 32 cm column of an unknown liquid. What is density of the liquid?

(A) 1.875×10^{-3} kg m^{-3}

(B) 3.54×10^{4} kg m^{-3}

(C) 1.875×10^{3} kg m^{-3}

(D) 8×10^{5} kg m^{-3}

26. If a charge q is placed at corner of a cube then flux passes through the cube is

(A) $\dfrac{q}{\epsilon_0}$

(B) $\dfrac{q}{24\,\epsilon_0}$

(C) $\dfrac{q}{48\,\epsilon_0}$

(D) $\dfrac{q}{16\,\epsilon_0}$

27. If charge density varies as $\rho \alpha r^n$ where r is distance from axes of cylinder then electric field inside the cylinder varies as

(A) r^n

(B) r^{-n}

(C) r^{n+1}

(D) r^2

28. Find the energy of a conducting sphere having radius R and total charge q

(A) $\dfrac{q^2}{4\pi\,\epsilon_0 R}$

(B) $\dfrac{q^2}{2\pi\,\epsilon_0 R}$

(C) $\dfrac{6}{5}\dfrac{q^2}{8\pi\,\epsilon_0 R}$

(D) $\dfrac{q^2}{8\pi\,\epsilon_0 R}$

29. Poisson's equation is given by

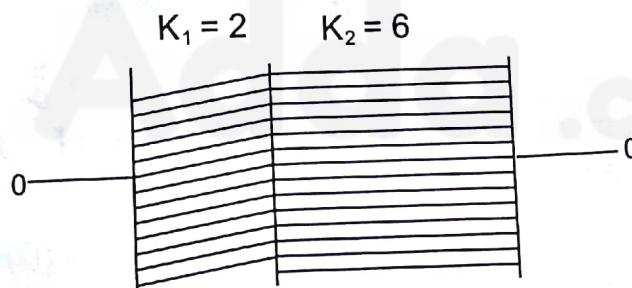(A) $\vec{\nabla}\cdot\vec{E} = \dfrac{\rho}{\epsilon_0}$

(B) $\vec{E} = -\nabla V$

(C) $\nabla^2 V = 0$

(D) $\nabla^2 V = \dfrac{-\rho}{\epsilon_0}$

30. A parallel plate capacitor has two layers of dielectrics as shown in figure. This capacitor is connected across a battery. Then the ratio of potential difference across the dielectric layer is

$K_1 = 2$ $K_2 = 6$

(A) $\dfrac{4}{3}$

(B) $\dfrac{1}{2}$

(C) $\dfrac{1}{3}$

(D) $\dfrac{3}{2}$

31. The susceptibility of a magnetism at 300 K is 1.2×10^{-5}. The temperature at which susceptibility increases to 1.8×10^{-5} is

(A) 150 K

(B) 200 K

(C) 250 K

(D) 20 K

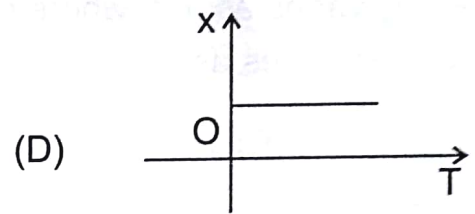32. Susceptibility of ferromagnetic substance is
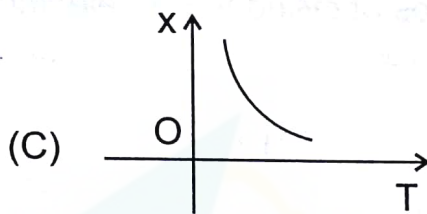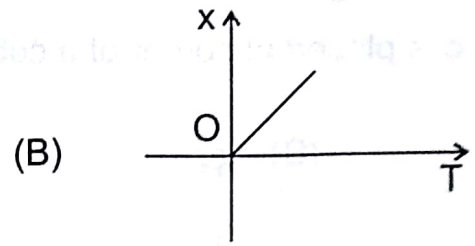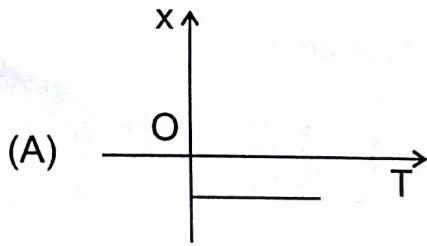
(A) > 1

(B) < 1

(C) Zero

(D) 1

[5] [B. Tech/B.Phar./B.Phar.-Ayur.]

33. Torque on a magnetic dipole in a uniform magnetic field $\vec{B}$ is

(A) Zero   (B) $\vec{M} \times \vec{B}$ (C) $\vec{p} \times \vec{E}$ (D) $\vec{r} \times \vec{F}$

34. Plot of diamagnetic susceptibility (x) versus temperature (T) is given by

(A)   (B)

(C)   (D)

35. Relation between magnetic field and magnetic vector potential ($\vec{A}$) is given by

(A) $\vec{B} = \nabla \times \vec{A}$ (B) $\vec{A} = \nabla \times \vec{B}$ (C) $\vec{B} = \vec{A} \times \vec{\nabla}$ (D) $\nabla \times \vec{B} = 0$

36. Critical angle of light passing from glass to air is least for

(A) red   (B) green   (C) yellow   (D) violet

37. The refractive index of water is $\frac{4}{3}$. The speed of light in water is 1.33

(A) 1.50×10^8 m/s   (B) 1.78×10^8 m/s

(C) 2.25×10^8 m/s   (D) 2.67×10^8 m/s

38. In Young's double slit experiment, the intensity of the maxima is I. If the width of each is doubled the intensity of the maxima will be

(A) $\frac{I}{2}$ (B) I   (C) 2 I   (D) 4 I

39. Monochromatic light is refracted from air into glass of refractive index μ. The ratio of wavelengths of the incident and refracted waves is

(A) 1 : 1   (B) 1 : μ (C) μ : 1   (D) μ^2 : 1

40. In a given process on an ideal gas, dW = 0 and dQ < 0. Then for the gas

(A) the temperature will decrease

(B) the volume will increase

(C) the pressure will remain constant

(D) the temperature will increase

[6] [B. Tech/B.Phar./B.Phar.-Ayur.]

41. The root mean square speed of hydrogen molecules at a certain temperature is v. If the temperature is doubled and the hydrogen gas dissociates into atomic hydrogen, the root mean square speed (rms) will become

(A) $\dfrac{v}{4}$

(B) $\dfrac{v}{2}$

(C) $1\,v$

(D) $4\,v$

42. In an isochoric process, if heat is supplied to gas the pressure will

(A) Increase

(B) Decrease

(C) Remains same

(D) Varies exponentially

43. L, C, and R respectively represent inductance, capacitance and resistance which one of the following combination has the dimensions of frequency?

(A) $\dfrac{1}{RC}$

(B) $\dfrac{1}{LC}$

(C) $\dfrac{L}{R}$

(D) $\dfrac{C}{L}$

44. An X-ray tube is operated at 20 kV. The cut off wavelength is

(A) 0.89 Å

(B) 0.75 Å

(C) 0.62 Å

(D) None of these

45. The frequency of K_α line of a source of atomic number z is proportional to

(A) z^2

(B) $(z-1)^2$

(C) $\dfrac{1}{z}$

(D) z

46. The avalanche break occurs at

(A) higher reverse voltage

(B) lower reverse voltage

(C) lower forward voltage

(D) higher forward voltage

47. How many NAND gate are required to make an OR gate using NAND gate?

(A) 2

(B) 1

(C) 4

(D) 3

48. How does the effective power radiated by an antenna vary with wavelength?

(A) $\rho\alpha\left(\dfrac{1}{\lambda}\right)^4$

(B) $\rho\alpha\,\lambda^2$

(C) $\rho\alpha\left(\dfrac{1}{\lambda}\right)^3$

(D) $\rho\alpha\left(\dfrac{1}{\lambda}\right)^2$

49. Dioptre is the unit of

(A) Power of lens

(B) focal length

(C) Ionosphere

(D) None

50. Name the device which will convert DC into AC is

(A) Rectifier

(B) Amplifier

(C) Oscillator

(D) Condenser

[7] [B. Tech/B.Phar./B.Phar.-Ayur.]

CHEMISTRY

51. The Avogadro number or a mole represents:

    (A) 6.02×10^{23} ions

    (B) 6.02×10^{23} atoms

    (C) 6.02×10^{23} molecules

    (D) 6.02×10^{23} entities

52. Which of the following is incorrect regarding Rutherford's atomic model?

    (A) Atom contains nucleus

    (B) Size of nucleus is very small in comparison to that of atom

    (C) Nucleus contains about 90% mass of the atom

    (D) Electrons revolve around the nucleus with uniform speed.

53. The triad of the nuclei that is isotonic:

    (A) $_6C^{14}, _7N^{14}, _9F^{19}$

    (B) $_6C^{14}, _7N^{15}, _9F^{17}$

    (C) $_6C^{14}, _7N^{14}, _9F^{17}$

    (D) $_6C^{12}, _7N^{14}, _9F^{19}$

54. A fcc crystal contains how many atoms in each unit cell?

    (A) 4

    (B) 6

    (C) 2

    (D) 5

55. The molarity of 720g of pure water is:

    (A) 40 M

    (B) 4 M

    (C) 55.5 M

    (D) None

56. The curve showing the variation of adsorption with pressure at constant temperature, is called:

    (A) Adsorption isobar

    (B) An isostere

    (C) Adsorption isotherm

    (D) All of the above

57. The standard reduction potential of Pb and Zn electrodes are – 0.126V and – 0.763V respectively. The cell equation will be:

    (A) $Pb^{2+} + Zn \longrightarrow Pb + Zn^{2+}$

    (B) $Pb^{4+} + 2Zn \longrightarrow Pb + 2Zn^{2+}$

    (C) $Zn^{2+} + Pb \longrightarrow Zn + Pb^{2+}$

    (D) None

58. The ion which does not have configuration of argon (Ar) is:

(A) I^-

(B) K^+

(C) Cl^-

(D) Ca^{2+}

59. The one that exist as dimer is:

(A) Aluminium iodide

(B) Magnesium chloride

(C) Aluminium chloride

(D) Aluminium bromide

60. Dichromate ions in alkaline medium exist as:

(A) CrO_4^{2-}

(B) CrO_3

(C) Cr^{3+}

(D) Cr^{4-}

61. $CH_3 MgI$ is an organometallic compound due to:

(A) Mg–I bond

(B) C–I bond

(C) C–Mg bond

(D) C–H bond

62. Which of the following is paramagnetic?

(A) $K_4 [Fe(CN)_6]$

(B) $K_3 [Fe(CN)_6]$

(C) $Ni (CO)_4$

(D) $[Co(NH_3)_6] Cl_3$

63. Ozone does not act as:

(A) Reducing agent

(B) Oxidizing agent

(C) Acid

(D) Bleaching agent

64. The shape of XeF_4 is:

(A) Tetrahedral

(B) Square Planar

(C) Octahedral

(D) Trigonal Planar

65. The gas most difficult to liquefy is:

(A) He

(B) Ne

(C) Xe

(D) Ar

66. The IUPAC name of following compound is:

CH$_3$CH CH$_2$CH$_3$
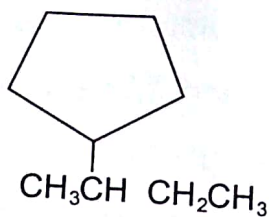
(A) 2 — Cyclopentyl butane

(B) 2 — Phenyl butane
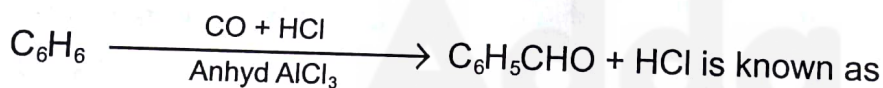
(C) 1 — Butyl Cyclohexane

(D) 3 — Cyclopentyl butane

67. Anthracene is purified by:

(A) Filtration

(B) Crystallization

(C) Distillation

(D) Sublimation

68. Lindlar's Catalyst is:

(A) Pd + BaSO$_4$

(B) Pb + CaCO$_3$

(C) Al$_2$O$_3$ + V$_2$O$_3$

(D) Al$_2$O$_3$ + AlCl$_3$

69. The reaction

$$C_6H_6 \xrightarrow[\text{Anhyd AlCl}_3]{\text{CO + HCl}} C_6H_5CHO + HCl \text{ is known as}$$

(A) Gattermann — Koch reaction

(B) Friedel Craft reaction

(C) Sandmeyer reaction

(D) None

70. Tetrafluorothene is the monomer of:

(A) Orlon

(B) Polystyrene

(C) Teflon

(D) PAN
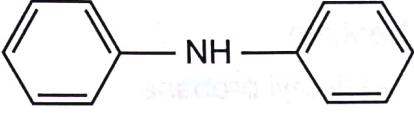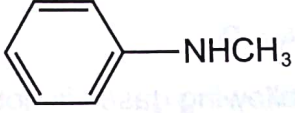
71. For a first order reaction A $\longrightarrow$ B, the reaction rate at reactant concentration of 0.01 M is found to be 2.0 × 10^{-5} mol L^{-1} S^{-1}. The half life period of reaction is:

(A) 30 s

(B) 220 s

(C) 300 s

(D) 347 s

[10] [B. Tech/B.Phar./B.Phar.-Ayur.]

$(mol\ L^{-1})^{n-1} s^{-1}$

72. The value of rate constant of a pseudo first order reaction:

(A) Depends on the concentration of reactants present in the small amount

(B) Depends on the concentration of reactants present in excess

(C) Is independent of concentration of reactants

(D) Depends only on temperature

73. At the equilibrium position in the process of adsorption:

(A) $\Delta H > 0$

(B) $\Delta H = T\Delta S$

(C) $\Delta H > T\Delta S$

(D) $\Delta H < T\Delta S$

74. Heating pyrites to remove sulphur is called:

(A) Smelting

(B) Calcination

(C) Liquation

(D) Roasting

75. Complete the reaction

$XeF_4 + O_2F_2 \longrightarrow ? + ?$

(A) $XeF_6 + O_2$

(B) $XeF_4 + 2O_2$

(C) $XeO_3 + 2F$

(D) $XeF_2 + O_2$

76. The chemical formula of laughing gas is:

(A) N_2O

(B) $2NO$

(C) N_2O_3

(D) None

77. A brown ring is formed in the ring test for NO_3^- ion. It is due to the formation of:

(A) $[Fe(H_2O)_5NO]^{2+}$

(B) $FeSO_4 \cdot NO_2$

(C) $[Fe(H_2O)_4(NO)_2]^{2+}$

(D) $FeSO_4 H NO_3$

78. There are 14 elements in actinoid series, which of the following elements does not belong to this series?

(A) U

(B) Np

(C) Tm

(D) Fm

[11] [B. Tech/B.Phar./B.Phar.-Ayur.]

79. Which shows the maximum magnetic moment?

   (A) V^{3+}

   (B) Cr^{3+}

   (C) Fe^{3+}

   (D) Co^{3+}

80. Which of the following compounds have peroxo linkage?

   (A) H_2SO_3

   (B) H_2SO_5

   (C) $H_2S_2O_7$

   (D) $H_2S_2O_8$

81. For the hydrides of nitrogen family, in going down the group:

   (A) Stability decreases

   (B) Reducing activity decreases

   (C) Bond angle HEH increases

   (D) Boiling point increases

82. Which of the following ions will exhibit colour in aqueous solution?

   (A) La^{3+} (Z=57)

   (B) Ti^{3+} (Z=22)

   (C) Lu^{3+} (Z=71)

   (D) Sc^{3+} (Z=21)

83. Which of the following species is not expected to be a ligand?

   (A) NO

   (B) NH_4^+

   (C) $NH_2CH_2CH_2NH_2$

   (D) CO

84. Which of the given options are correct for $[Fe(CN)_6]^{3-}$ complex?

   (A) d^2sp^2 Hybridization

   (B) sp^3d^2 Hybridization

   (C) Paramagnetic

   (D) Diamagnetic

85. For a reaction, A + B ⟶ C + D, doubling the concentration of both the reactants increases the reaction rate by 8 times and doubling the only B simply doubles the reaction rate. The rate law is given as:

   (A) $r = K [A]^{1/2} [B]^{1/2}$

   (B) $r = [A] [B]^2$

   (C) $r = K [A]^2 [B]$

   (D) $r = K [A] [B]$

86. Metabolic activities of cells are controlled by:

   (A) Proteins   (B) DNA   (C) RNA   (D) Fats

[12] [B. Tech/B.Phar./B.Phar.-Ayur.]

87. Caprolactum polymerizes to give:
    (A) Nylon – 6
    (B) Buna – 5
    (C) Glyptal
    (D) Teflon

88. A drug that is antipyretic as well as analgesic is:
    (A) Chloropromazine hydrochloride
    (B) Paracetamol
    (C) Chloroquine
    (D) Penicillin

89. Maximum pKb value is of

    (A) $(CH_3CH_2)_2NH$

    (B) (diphenylamine: phenyl—NH—phenyl)

    (C) $(CH_3)_2NH$

    (D) (phenyl—NHCH₃, N-methylaniline)

90. Vinegar is dilute aqueous solution of
    (A) Ethanoic acid
    (B) Benzoic acid
    (C) Citric acid
    (D) Oxalic acid

91. The IUPAC name of $CH_3COCH_2CH_2CH_3$ is:
    (A) Methyl- n- propyl ketone
    (B) 2- Pentanone
    (C) 3- Pentanone
    (D) n- Propyl- methyl ketone

92. The major product obtained on interaction of phenol with NaOH and CO_2 is:
    (A) Benzoic acid
    (B) Salicylaldehyde
    (C) Salicylic acid
    (D) Phthalic acid

93. For the following:
    a. I^- b. Cl^- c. Br^-
    The increasing order of nucleophilicity would be
    (A) $Cl^- < Br^- < I^-$
    (B) $I^- < Cl^- < Br^-$
    (C) $Br^- < Cl^- < F^-$
    (D) $I^- < Br^- < Cl^-$

[13] [B. Tech/B.Phar./B.Phar.-Ayur.]

94. How many chiral compounds are possible on monochlorination of 2 – methyl butane?

(A) 2

(B) 4

(C) 6

(D) 8

95. Among the halides of the elements of group 13, one which is most acidic is:

(A) BF_3

(B) $AlCl_3$

(C) BCl_3

(D) BBr_3

96. Arrange the following in decreasing order of their boiling points:

A. n- Butane

B. 2- Methyl butane

C. n- Pentane

D. 2,2 – Diethyl propane

(A) A > B > C > D

(B) B < C > D < A

(C) D > C > A > D

(D) C > B > D > A

97. Which of the following gases is not a green house gas?

(A) CO

(B) O_3

(C) CH_4

(D) H_2O vapours

98. The IUPAC name for the compound:

$$CH_3—\underset{\overset{|}{\underset{4}{C}}}{\overset{\overset{CH_3}{|}}{}}=\underset{3}{CH}—\underset{2}{COOH} \text{ is}$$

(A) 2- Methyl but -2- enoic acid

(B) 3- Methyl but -3- enoic acid

(C) 3- Methyl but -2- enoic acid

(D) 2- Methyl but -3- enoic acid

99. When Zeolite which is hydrated sodium aluminum silicate is treated with hard water, the sodium ions are exchanged with which of the following ions?

(A) H^+

(B) Mg^{2+}

(C) Cu^{2+}

(D) SO_4^{-2}

100. The alkali metals are low melting. Which of the following alkali metals is expected to melt if the room temperature rises to 30°C?

(A) Na

(B) K

(C) Rb

(D) Cs

MATHEMATICS

101. Let $A = \{x : x \in \mathbb{R}, x > 4\}$ and $B = \{x : x \in \mathbb{R}, x < 5\}$. Then $A \cap B$ equals to

(A) $(4,5]$

(B) $(4,5)$

(C) $[4,5)$

(D) $[4,5]$

102. If R is a relation on a finite set having n elements, then the number of relations on A is

(A) 2^n

(B) 2^{n^2}

(C) n^2

(D) n^n

103. The range of the function $f(x) = \dfrac{x}{|x|}$ is

(A) $\mathbb{R} \setminus 0$

(B) $\mathbb{R} \setminus \{-1, 1\}$

(C) $\{-1, 1)$

(D) none of these

104. If $f : [-2, 2] \to \mathbb{R}$ is defined by $f(x) = \begin{cases} -1, & \text{for } -2 \le x \le 0 \\ x - 1, & \text{for } 0 \le x \le 2 \end{cases}$, then the set $\{x \in [-2, 2] : x \le 0$ and $f(|x|) = x\}$ equals to

(A) $\{-1\}$

(B) $\{0\}$

(C) $\left\{\dfrac{-1}{2}\right\}$

(D) ϕ

105. If $\dfrac{1 - ix}{1 + ix} = a + ib$, then $a^2 + b^2$ equals

(A) 1

(B) -1

(C) 0

(D) none of these

106. The value of $(1 + i)^4 + (1 - i)^4$ is

(A) 8

(B) 4

(C) -8

(D) -4

107. If α, β are the roots of the equation $x^2 + px + q = 0$, then $-\dfrac{1}{\alpha}, -\dfrac{1}{\beta}$ are the roots of the equation

(A) $x^2 - px + q = 0$

(B) $x^2 + px + q = 0$

(C) $qx^2 + px + 1 = 0$

(D) $qx^2 - px + 1 = 0$

[15] [B. Tech/B.Phar./B.Phar.-Ayur.]

108. The number of solutions of $x^2 + |x-1| = 1$ are

(A) 0

(B) 1

(C) 2

(D) 3

109. If $^{k+5}P_{k+1} = \dfrac{11(k-1)}{2} \cdot {}^{k+3}P_k$, then the values of k are

(A) 7 and 11

(B) 6 and 7

(C) 2 and 11

(D) 2 and 6

110. $^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_4 + {}^5C_5$ is equal to

(A) 30

(B) 31

(C) 32

(D) 33

111. A student was asked to prove statement P(n) by induction. He proved P(k + 1) whenever P(k) is true for all k > 5 and also P(5) is true, on the basis of this he could co that P(n) is true

(A) For all $n \in \mathbb{N}$

(B) For all n > 5

(C) For all n ≥ 5

(D) For all n ≤ 5

112. The coefficient of $\dfrac{1}{x}$ in the expansion of $(1+x)^n \left\{1 + \dfrac{1}{x}\right\}^n$ is

(A) $\dfrac{n!}{\{(n-1)!(n+1)!\}}$

(B) $\dfrac{(2n)!}{\{(n-1)!(n+1)!\}}$

(C) $\dfrac{(2n)!}{\{(2n-1)!(2n+1)!\}}$

(D) none of these

113. $\lim_{x \to 0} \dfrac{(1 - \cos 2x)\sin 5x}{x^2 \sin 3x}$ equals

(A) $\dfrac{10}{3}$

(B) $\dfrac{3}{10}$

(C) $\dfrac{6}{5}$

(D) $\dfrac{5}{6}$

114. $\int_1^{\sqrt{3}} \dfrac{1}{1+x^2} dx$ is equal to

(A) $\dfrac{\pi}{12}$

(B) $\dfrac{\pi}{6}$

(C) $\dfrac{\pi}{4}$

(D) $\dfrac{\pi}{3}$

115. $\int_0^1 \dfrac{d}{dx}\left\{\sin^{-1}\dfrac{2x}{1+x^2}\right\}dx$ is equal to

(A) 0   (B) π (C) $\dfrac{\pi}{2}$ (D) $\dfrac{\pi}{4}$

116. $\int_1^3 \dfrac{3x+1}{x^2+9}dx$ equals

(A) $\dfrac{\pi}{12} + \log(2\sqrt{2})$

(B) $\dfrac{\pi}{2} + \log(2\sqrt{2})$

(C) $\dfrac{\pi}{6} + \log(2\sqrt{2})$

(D) $\dfrac{\pi}{3} + \log(2\sqrt{2})$

117. The probability of the student getting I, II and III division in an examination are $\dfrac{1}{10}, \dfrac{3}{5}$ and $\dfrac{1}{5}$ respectively. The probability that students fails in the examination is

(A) $\dfrac{197}{200}$

(B) $\dfrac{27}{100}$

(C) $\dfrac{83}{100}$

(D) none of these

118. From a set of 100 cards numbered 1 to 100, one card is drawn at random. The probability that the number obtained on the card is divisible by 6 or 8 but not by 24 is

(A) $\dfrac{6}{25}$

(B) $\dfrac{1}{4}$

(C) $\dfrac{1}{6}$

(D) $\dfrac{2}{5}$

119. If two events are independent then

(A) they must be mutually exclusive

(B) the sum of third probability must be equal to 1

(C) (A) and (B) both are correct

(D) none of the above is correct

120. If A = [a$_{ij}$] is a square matrix of even order such that $a_{ij}= i^2 - j^2$, then

(A) A is a skew-symmetric matrix and $|A| = 0$

(B) A is a symmetric matrix and $|A|$ is a square

(C) A is a symmetric matrix and $|A| = 0$

(D) none of these

121. Let A be a m × n (m < n) matrix with rank m. Then

(A) for every b ∈ $\mathbb{R}^m$ Ax = b has a unique solution

(B) for every b ∈ $\mathbb{R}^m$ Ax = b has a solution but it is not unique

(C) there exists b ∈ $\mathbb{R}^m$ for which Ax = b has no solution

(D) none of these

122. The number of all possible matrices of order 3 x 3 with each entry 0 or 1 is

(A) 27

(B) 18

(C) 81

(D) 512

123. The relation R defined on the set A = {1,2,3,4,5} by R = {(a, b) : $a^2 - b^2$ divides 16}

(A) {(1,1),(2,1),(3,1),(4,1),(2,3)}

(B) {(2,2),(3,2),(4,2),(2,4)}

(C) {(3,3),(4,3),(5,4),(3,4)}

(D) none of these

124. The relation R in $\mathbb{N} \times \mathbb{N}$ such that (a, b) R(c, d) ⇔ a + d = b + c is

(A) reflexive but not symmetric

(B) reflexive and transitive but not symmetric

(C) an equivalence relation

(D) none of these

125. The maximum number of equivalence relations on the set A = {1, 2,3} is

(A) 1

(B) 2

(C) 3

(D) 5

126. The value of $\lim_{n \to 0} \left\{ \dfrac{1 + 2 + 3 + 4 + 5 + ... n}{n + 2} - \dfrac{n}{2} \right\}$ is

(A) $\dfrac{1}{2}$

(B) 1

(C) – 1

(D) $-\dfrac{1}{2}$

127. If n is a positive integer and A = $\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then A^n is equal to

(A) $\begin{bmatrix} \cos n\theta & -\sin n\theta \\ \sin n\theta & \cos n\theta \end{bmatrix}$

(B) $\begin{bmatrix} \cos n\theta & \sin n\theta \\ \sin n\theta & -\cos n\theta \end{bmatrix}$

(C) $\begin{bmatrix} \cos n\theta & \sin n\theta \\ -\sin n\theta & \cos n\theta \end{bmatrix}$

(D) none of these

128. If $a > 0$ and discriminant of $ax^2 + 2bx + c$ is negative, then

$$A = \begin{vmatrix} a & b & ax + b \\ b & c & bx + c \\ ax + b & bx + c & 0 \end{vmatrix}$$

is

(A) positive

(B) $(ac - b^2)(ax^2 + 2bx + c)$

(C) negative

(D) 0

129. The value of the determinant $\begin{vmatrix} a - b & b + c & a \\ b - a & c + a & b \\ c - a & a + b & c \end{vmatrix}$ is

(A) $a^3 + b^3 + c^3$

(B) $3bc$

(C) $a^3 + b^3 + c^3 - 3ab$

(D) none of these

130. The mean deviation of the series $a, a + d, a + 2d, a + 3d, a + 4d, \ldots a + 2n$ from its mean is

(A) $\dfrac{(n + 1)d}{2n + 1}$

(B) $\dfrac{nd}{2n + 1}$

(C) $\dfrac{n(n + 1)d}{2n + 1}$

(D) $\dfrac{(2n + 1)d}{n(n + 1)}$

131. If the standard deviation of a variable X is σ, then the standard deviation of variable $\dfrac{aX + b}{c}$ is

(A) $a\sigma$

(B) $\dfrac{a}{c}\sigma$

(C) $\left|\dfrac{a}{c}\sigma\right|$

(D) $\dfrac{a\sigma + b}{c}$

132. Let $x_1, x_2, \ldots, x_n$ be n observations. Let $y_i = ax_i + b$ for $i = 1, 2, 3, \ldots, n$ where a, b are constants. If the mean of x_i's is 48 and their standard deviation is 12, the mean of y_i's is 55 and standard deviation of y_i's is 15, then the values of a, b are

(A) $a = 1.25, b = -5$

(B) $a = -1.25, b = 5$

(C) $a = 2.5, b = -5$

(D) $a = 2.55, b = -5$

133. The function $f(x) = \dfrac{x^3 + x^2 - 16x + 20}{x - 2}$ is not defined for $x = 2$. In order to make $f(x)$ continuous at $x = 2$, $f(2)$ should be defined as

   (A) 0
   (B) 1
   (C) 2
   (D) 3

134. If $f(x) = 3x - 5$, then $f^{-1}(x)$

   (A) is given by $\dfrac{1}{3x - 5}$

   (B) is given by $\dfrac{x + 5}{3}$

   (C) does not exist because f is not into

   (D) does not exist because f is not onto

135. The function $f(x) = \dfrac{4 - x^2}{4x - x^3}$ is

   (A) discontinuous at only one point
   (B) discontinuous exactly at two point
   (C) discontinuous exactly at three point
   (D) none of these

136. The function $f(x) = \sin^{-1}(\cos x)$ is

   (A) discontinuous at $x = 0$
   (B) continuous at $x = 0$
   (C) differentiable at $x = 0$
   (D) none of these

137. Let

$$f(x) = \begin{cases} ax^2 + 1, & x > 1 \\ x + \dfrac{1}{2} & x \le 1 \end{cases}$$

   Then $f(x)$ is derivable at $x = 1$, if

   (A) $a = 2$
   (B) $a = 1$
   (C) $a = 0$
   (D) $a = \dfrac{1}{2}$

138. The set of points where the function $f(x)$ given by $f(x) = |x - 3|\cos x$ is differentiable are

   (A) $\mathbb{R}$
   (B) $\mathbb{R} \setminus \{3\}$
   (C) $(0, \infty)$
   (D) none of these

[20] [B. Tech/B.Phar./B.Phar.-Ayur.]

139. The general solution of the differential equation $e^x dy + (ye^x + 2x)dx = 0$ is

    (A) $xe^y + x^2 = c$

    (B) $xe^y + y^2 = c$

    (C) $ye^x + x^2 = c$

    (D) $ye^y + x^2 = c$

140. The integrating factor of the differential equation

    $$(1 - y^2)\frac{dx}{dy} + yx = ay \; (-1 < y < 1)$$

    is

    (A) $\dfrac{1}{y^2 - 1}$

    (B) $\dfrac{1}{\sqrt{y^2 - 1}}$

    (C) $\dfrac{1}{1 - y^2}$

    (D) $\dfrac{1}{\sqrt{1 - y^2}}$

141. Which of the following is a homogeneous differential equation?

    (A) $(4x + 6y + 5)dy - (3y + 2x + 4)dx = 0$

    (B) $xydx - (x^3 + y^3)dy = 0$

    (C) $(x^3 + 2y^2)dx + 2xydy = 0$

    (D) $y^2dx + (x^2 - xy - y^2)dy = 0$

142. If p and q are the order and degree of the differential equation

    $$y\frac{dy}{dx} + x^3 \frac{d^2y}{dx^2} + xy = \cos x,$$

    (A) $p < q$

    (B) $p = q$

    (C) $p > q$

    (D) none of these

143. Integration factor of the differential equation $\cos x \dfrac{dy}{dx} + y \sin x = 1$ is

    (A) $\cos x$

    (B) $\tan x$

    (C) $\sec x$

    (D) $\sin x$

[21] [B. Tech/B.Phar./B.Phar.-Ayur.]

144. In a regular hexagon ABCDEF, $\vec{AB} = \vec{a}$, $\vec{BC} = \vec{b}$ and $\vec{CD} = \vec{c}$, then $\vec{AE}$ equals

  (A) $\vec{a} + \vec{b} + \vec{c}$

  (B) $2\vec{a} + \vec{b} + \vec{c}$

  (C) $\vec{b} + \vec{c}$

  (D) $\vec{a} + 2\vec{b} + 2\vec{c}$

145. The vector $\cos\alpha\cos\beta\,\hat{i} + \cos\alpha\sin\beta\,\hat{j} + \sin\alpha\,\hat{k}$ is a

  (A) null vector

  (B) unit vector

  (C) constant vector

  (D) none of these

146. If $\vec{a}$ and $\vec{b}$ be two unit vectors and θ is the angle between them, then $\vec{a} + \vec{b}$ is a unit vector if θ equals

  (A) $\dfrac{\pi}{4}$ (B) $\dfrac{\pi}{3}$ (C) $\dfrac{\pi}{2}$ (D) $\dfrac{2\pi}{3}$

147. If $\sin\theta = \sin\alpha$, then the angle θ and α are related by

  (A) $\theta = n\pi \pm \alpha$

  (B) $\theta = 2n\pi \pm \{-1\}^n\,\alpha$

  (C) $\theta = n\pi \pm (-1)^n\,\theta$

  (D) $\theta = (2n+1)\pi + \alpha$

148. The poles of the straight line $ax + y - 28 = 0$ with respect to the circle $2x^2 + 2y^2 - 3x + 5y - 7 = 0$ is

  (A) $(3, 1)$ (B) $(1, 3)$

  (C) $(3, -1)$ (D) $(-3, 1)$

149. $(\vec{a} + 2\vec{b} - \vec{c}) \cdot \{(\vec{a} - \vec{b}) \times (\vec{a} - \vec{b} - \vec{c})\}$ is equal to

  (A) $[\vec{a}\ \vec{b}\ \vec{c}]$ (B) $2[\vec{a}\ \vec{b}\ \vec{c}]$

  (C) $3[\vec{a}\ \vec{b}\ \vec{c}]$ (D) 0

150. The points $(-a, -b)$, $(0, 0)$ and (a^2, ab) are

  (A) collinear

  (B) vertices of a rectangle

  (C) vertices of a parallogram

  (D) none of these

[22] [B. Tech/B. Phar./B. Phar.-Ayur.]

BIOLOGY

101. Most unusual protist phyla is
   (A) coflagellates
   (C) choanoflagellates
   (B) dinoflagellates
   (D) paraflagellates

102. Algae have cell wall made up of
   (A) Hemicellulose, pectins and proteins
   (B) Cellulose, galactans and mannans
   (C) Cellulose, hemicellulose and pectins
   (D) Pectins, cellulose and proteins

103. Which of the following is the amphibian of the plant kingdom?
   (A) Pteridophytes
   (C) Gymnosperms
   (B) Bryophytes
   (D) Angiosperms

104. Which of the following is not a single flower?
   (A) China rose
   (C) sunflower
   (B) Petunia
   (D) holy hope

105. Canal system is present in phylum:
   (A) Porifera
   (C) Echinodermata
   (B) Cnidaria
   (D) Protozoa

106. The water of coconut is
   (A) Liquid mesocarp
   (B) Liquid endocarp
   (C) Degenerated liquid endosperm
   (D) Liquid nucellus

107. Root develops from which part of the germinating seed?
   (B) Radicle
   (A) Cotyledons
   (D) Plumule
   (C) Pericarp

108. Amitosis is the usual process of cell division
   (A) Meristematic cells
   (B) Prokaryotic cells
   (C) Eukaryotic cells
   (D) Spore mother cells

109. Which of the following organelle is known as traffic police of the cell?

(A) Golgi body
(B) Mitochondria
(C) Endoplasmic reticulum
(D) Nucleus

110. Which of the following organelle is involved in xenobiotic detoxification?

(A) Golgi
(B) Lysosome
(C) SER
(D) RER

111. The percentage of light absorbed by chlorophyll from total absorption is

(A) 12%
(B) 83%
(C) 96%
(D) 4%

112. Which of the following bacterium brings about denitrification?

(A) Pseudomonas
(B) Rhizobium
(C) Azotobacter
(D) Nitrobacter

113. First step in seed germination is

(A) passing through gut of an animal
(B) exploding along sutures
(C) absorption of water
(D) taking in of O_2

114. In tissue culture, low cytokinin to auxin ratio causes

(A) Root differentiation
(B) Shoot differentiation
(C) Both (A) and (B)
(D) None of these

115. Which of the following is the non pathogenic bacteria of colon?

(A) Escherichia coli
(B) Balantidium coli
(C) Entamoeba histolytica
(D) Enterobius vermicularis

116. The process common to aerobic and anaerobic respiration is ....

(A) Oxidation
(B) Glycolysis
(C) Kreb's cycle
(D) Electron transport chain

[24] [B. Tech/B.Phar./B.Phar.-Ayur.]

117. The number of ATP molecules produced during aerobic and anaerobic respiration are .... and .... respectively.

(A) 2 and 38

(C) 38 and 0

(B) 0 and 2

(D) 38 and 2

118. Dup'sound is produced during closure of

(A) Semilunar valves

(B) Bicuspid valve

(C) Tricuspid valve

(D) Both (B) and (C)

119. The advanced feature of human evolution are

(A) Orthognathus face

(B) Bipedal gait

(C) High cranial capacity

(D) All of the above

120. The end product of ornithine cycle is

(A) Ammonia

(C) Uric acid

(B) Urea

(D) CO_2

121. Which of the following types of synovial joints is the most freely movable?

(A) Ball and Socket

(C) Saddle

(B) Hinge

(D) Gliding

122. Muscles get fatigue due to accumulation of

(A) Lactic acid

(C) Phosphate molecules

(B) ATP

(D) Carbondioxide

123. Blind spot does not contain

(A) Rods

(C) Both rods and cones

(B) Cones

(D) None of the above

124. Cretinism results due to

(A) excess of adrenaline

(B) lesser thyroxin

(C) excess insulin

(D) lesser keratin

125. Haploid microspores produced in pollen sacs are called

    (A) ovary   (B) anther

    (C) stamen   (D) carpel

126. Large amount of ovum is due to

    (A) large sized nucleus

    (B) Large amount of liquid in the cytoplasm

    (C) Large number of cells

    (D) Large amount of reserve food

127. The secondary oocyte is

    (A) Haploid   (B) Diploid

    (C) Monosomic   (D) Polyspermic

128. In modern synthetic theory, the unit of evolution is:

    (A) Genus   (B) species

    (C) population   (D) individual

129. The cradle of human evolution is

    (A) South Africa   (B) North America

    (C) India   (D) Germany

130. The first civilized ancestor of modern man is

    (A) Java ape man   (B) Neanderthal man

    (C) Heidelburg man   (D) Cro-magnon man

131. The term 'survival of the fittest' was contributed by

    (A) Darwin   (B) Wallace

    (C) Spencer   (D) Lamarck

132. Homologous organs are

    (A) similar in structure and function

    (B) similar in origin and different in functions

    (C) Dissimilar in origin and similar in functions

    (D) dissimilar in origin and functions

133. A pond is a

    (A) man made ecosystem   (B) natural ecosystem

    (C) biome   (D) macro ecosystem

134. Food derived by killing other organism

(A) parasitism

(B) protocooperation

(C) predation

(D) amensalism

135. Which is known as marsh gas?

(A) H_2S

(B) CO

(C) SO_2

(D) CH_4

136. The algal bloom due to the addition of washed off fertilizers in aquatic reservoir is known as

(A) Biomagnification

(B) biobloom

(C) Eutrophication

(D) Nutrification

137. Filariasis is transmitted by

(A) Mosquito

(B) Sand fly

(C) Bed bug

(D) Tse tse fly

138. Honey bees are used for

(A) sericulture

(B) apiculture

(C) Silviculture

(D) Tissue culture

139. The types of nucleotides present in DNA

(A) 1

(B) 2

(C) 3

(D) 4

140. The term genetic code was given by

(A) George Gamow

(B) Nirenburg

(C) Methai

(D) Kornburg

141. The transgenic animals are those which have

(A) foreign DNA in some of their cells

(B) foreign DNA in all of their cells

(C) foreign RNA in some of their cells

(D) Both (A) and (C)

142. When the genotype of an organism is improved by the addition of foreign genes. The process is known as

(A) Biotechnology

(B) Genetic engineering

(C) Genetic drift

(D) Genetic diversity

143. Which enzyme is known as a molecular glue of the cell?
    (A) Lipases
    (B) Ligases
    (C) Plumerase
    (D) Exopeptidase

144. Which of the following is a heterocrine gland?
    (A) Adrenal
    (B) Pituitary
    (C) Pancreas
    (D) Penial

145. The longest cell of human body is
    (A) Skeletal muscle
    (B) Nerve cell
    (C) Smooth muscle fibre
    (D) Glial cell

146. Functional unit of striated muscle is
    (A) I band
    (B) Z line
    (C) Myofilament
    (D) Sarcomere

147. Human ear ossicle are
    (A) incus and stapes
    (B) stapes
    (C) incus, malleus and stapes
    (D) incus and malleus

148. The development of fruit without fertilization is known as
    (A) Parthgenesis
    (B) Parthenocarpy
    (C) Apomixis
    (D) Apogamy

149. Edible part of mango is
    (A) Receptacle
    (B) Epicarp
    (C) Mesocarp
    (D) Endocarp

150. C_4 cycle is also known as
    (A) E.M.P. pathway
    (B) T.C.A. Cycle
    (C) Hatch and slack cycle
    (D) Pentose phosphate pathway

[28] [B. Tech/B.Phar./B.Phar.-Ayur.]