

Sample Test Paper: B.Tech

Time: 2 Hours

Maximum Marks: 360

Important Instructions

1. Test paper contains four sections with objective type multiple choice questions. **All Sections are compulsory:**
 - a) Section 1: General English (15 Questions.),
 - b) Section 2: Physics (25 Questions.),
 - c) Section 3: Chemistry (25 Questions.),
 - d) Section 4: Mathematics/Biology (25 Questions.).

Note: Students will have to attempt either Mathematics/Biology as per the eligibility of the program applied.

2. **For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores.** No marks will be awarded for un-attempted questions.
3. Use of electronic/manual calculator, log tables, cellular phones and slide rulers are not permitted.
4. Answer key for the sample paper is given at the END of the Test Paper.

Section1: General English

DIRECTION for questions 1 to 3: Read the passage carefully and choose the best answer for the questions that follow it.

Cardiac patients surrounded by banks of equipment, popping expensive pills, facing surgery and confronted by the prospect of huge medical bills have one other discomfoting thought to engage with: the treatment they are getting might not actually be helping them in the longer term.

For years, cardiac surgeon Dean Ornish was something of a priest pitted against the priesthood. Drastic changes in what patients are and how they lived their lives, he argued, would be far more effective than cutting them open on the surgical table. Now, as evidence for his proposition has become near-irrefutable, the rewards are pouring in. Author of five books, two of them best-sellers, Ornish has shown that an extremely low-fat diet, moderate exercise, stress management techniques such as yoga and meditation, quitting smoking and building more loving relationships can actually reverse heart disease. He has become something of a celebrity, with his work being featured in major magazines in the United States.

Ornish's skepticism about conventional handling of heart disease dates back to the time when he was with the legendary surgeon Michael DeBakey. In patients with coronary heart disease, the flow of blood to the heart becomes restricted. Arteries taking blood to the heart can become blocked, a phenomenon known as arteriosclerosis. Also, constricted blood cells can form clots. The end result is that the heart becomes starved for oxygen. Chest pains and full-scale heart attacks follow. Caused by a high-fat diet, nicotine, stress and other factors, coronary heart disease was for long believed to be irreversible. Surgery to bypass clogged arteries, and techniques such as angioplasty, were seen as the only options.

However, such procedures rarely solved the problem. "Bypass surgery," Ornish said in his 1990 book, 'Reversing Heart Disease', "became for me a metaphor for the inadequacy of treating a problem without also addressing the underlying causes. We would operate on patients, their chest pain would usually go away, and they were told that they were cured. Most would go home and continue to do the same things that led to the problem in the first place. They would smoke, eat a high-fat, high-cholesterol diet, manage stress poorly, and lead sedentary lives." More often than not they would end up in hospital again.

1. The author of the passage believes that
 - (a) changes in lifestyle will not help if they are not supplemented by right drugs.
 - (b) Ornish's findings, notwithstanding the conventional treatments of heart diseases, are the best.
 - (c) treatment of heart disease is best if left to experts in that field.
 - (d) findings of Ornish are nearly indisputable.

2. An apt title for the passage would be
 - (a) Diet and Disease.
 - (b) Have a Heart for your Heart.
 - (c) Lifestyle and Heart Disease.
 - (d) Benefits of Meditation.

3. In his book, 'Reversing Heart Disease', Ornish says that
 - (a) operation worsens a patient's heart disease.
 - (b) there is no point in performing an operation that anyway has no positive end result.
 - (c) without imparting adequate knowledge about the benefits of diet and exercise, a heart patient can never enjoy the benefits of his surgery.
 - (d) the predisposing causes behind a patient's heart problem should be worked upon first for longtime benefits

DIRECTION for questions 4 and 5: Each question has a sentence with two blanks followed by four pairs of words as choices. From the choices, select the pair of words that can best complete the given sentence.

4. It is difficult for a modern audience, accustomed to the _____ of film and television, to appreciate opera with its grand spectacle and _____ gestures.

(a) sophistication . . . monotonous	(b) flamboyance . . . inane
(c) minutiae . . . extravagant	(d) plurality . . . subtle

5. Though his music revealed the composer's _____ and seriousness, his manner displayed his naivety and _____.

(a) sophistication . . . ingenuity	(b) levity . . . immaturity
(c) clairvoyance . . . insouciance	(d) profundity . . . ingenuousness

DIRECTION for questions 6 and 7: The following sentences test correctness and effectiveness of expression. In choosing answers, follow the requirements of standard written English; that is, pay attention to grammar, choice of words, sentence construction, and punctuation.

In each of the following sentences, part of the sentence or the entire sentence is underlined. Beneath each sentence you will find five ways of phrasing the underlined part. Choice A repeats the original; the other three are different. Choose the answer that best expresses the meaning of the original sentence.

6. Trying to keep her balance on the icy surface, the last competitor's ski-tip caught the pole and somersaulted into the soft snow.
 - (a) the last competitor's ski-tip caught the pole and somersaulted into the soft snow.
 - (b) the ski-tip of the last competitor caught the pole and somersaulted in the soft snow.
 - (c) the last competitor caught the pole with the tip of her ski, and somersaulted into the soft snow.
 - (d) the last competitor caught the pole with her ski-tip, which made her somersault into the soft snow.

7. The temperature dropped suddenly last night, which will mean that the shoots emerging from the soil will be killed by the frost.
- (a) which will mean that the shoots emerging from the soil will be killed by the frost.
 - (b) which will mean that the frost will kill the shoots emerging from the soil.
 - (c) and this will mean that the shoots emerging from the soil will be killed by the frost.
 - (d) and the resulting frost will kill the shoots that are emerging from the soil.

DIRECTION for questions 8 and 9: Each question has a word followed by four choices. From the choices, select the synonym for the given word.

8. APPREHENSIONS

- (a) Gratitude (b) Apology (c) Dread (d) Punishment

9. AMENABLE

- (a) Religious (b) Masculine (c) Proud (d) Agreeable

DIRECTION for questions 10 and 11: The sentence given in each question, when properly sequenced, form a coherent paragraph. Each sentence is labeled with a letter. Choose the most logical order of sentences from among the given choices to construct a *coherent paragraph*.

10. (A) Who can trace to its first beginnings the love of Damon for Pythias, of David for Jonathan, of Swan for Edgar?
- (B) Similarly with men.
 - (C) There is about great friendships between man and a man certain inevitability that can only be compared with the age-old association of ham and eggs.
 - (D) One simply feels that it is one of the things that must be so.
 - (E) No one can say the mutual magnetism that brought about the deathless partnership of these wholesome and palatable foodstuffs
- (a) ACBED (b) CEDBA (c) ACEBD (d) CEABD
11. (A) Events intervened, and in the late 1930s and 1940s, Germany suffered from “over-branding”.
- (B) The British used to be fascinated by the home Romanticism.
 - (C) But reunification and the federal government’s move to Berlin have prompted Germany to think again about its image.
 - (D) The first foreign package holiday was a tour of Germany organized by Thomas Cook in 1855.
 - (E) Since then, Germany has been understandably nervous about promoting itself abroad.
- (a) ACEBD (b) DECAB (c) BDAEC (d) DBAEC

21. A sphere of mass m moving with a constant velocity u hits another stationary sphere of the same mass. If e is the coefficient of restitution, then the ratio of velocities of the two spheres after collision will be

(a) $\frac{u(1+e)}{1+e}$

(b) $\frac{u(1+e)}{1-e}$

(c) $\frac{e-1}{e+1}$

(d) $\frac{e-1}{e-1}$

22. A pencil placed vertically on a table falls down. What will be the linear velocity of middle of pencil at the end of the fall if the pencil is 15 cm long?

(a) 1.05 m/s

(b) 2.1 m/s

(c) 3 m/s

(d) 0.5 m/s

23. A billiard ball is hit by a cue at a height h above the centre. It acquires a linear velocity v_0 . Mass of the ball is m and radius is r . The angular velocity ω_0 acquired by the ball is

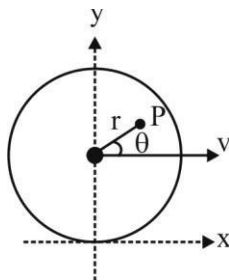
(a) $\frac{2v_0 h}{5r^2}$

(b) $\frac{5v_0 h}{2r^2}$

(c) $\frac{2v_0 r^2}{5h}$

(d) $\frac{5v_0 r^2}{2h}$

24. A disc of radius R rolls without slipping at speed v along positive x -axis. Velocity of point P at the instant shown in figure is



(a) $V_P = v + \frac{vr \sin \theta}{R} i - \frac{vr \cos \theta}{R} j$

(b) $V_P = v + \frac{vr \sin \theta}{R} i + \frac{vr \cos \theta}{R} j$

(c) $V_P = \frac{vr \sin \theta}{R} i + \frac{vr \cos \theta}{R} j$

(d) $V_P = \frac{vr \sin \theta}{R} i - \frac{vr \cos \theta}{R} j$

P *R* *R*

P *R* *R*

25. Two particles of mass m and M are initially at rest and infinitely separated from each other. Due to mutual interaction they approach each other. Their relative velocity of approach at a distance of separation d between them is

(a) 

(b) 

(c) 

(d) 

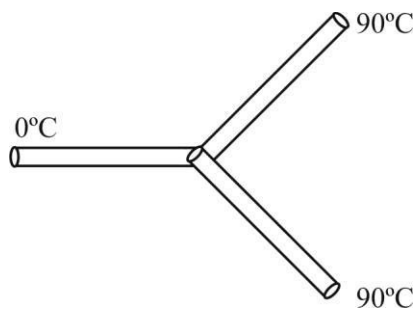
26. A cylinder of mass m and density \times hanging from a string is lowered into a vessel of cross-sectional area s containing a liquid of density $?$ ($< \times$) until it is fully immersed. The increase in pressure at the bottom of the vessel is

(a) $\frac{m \times}{? s}$ (b) $\frac{mg}{s}$ (c) $\frac{m}{\times s} ? g$ (d) zero

27. The frequency of a sonometer wire is f . When the weights producing the tensions are completely immersed in water the frequency becomes $f/2$ and on immersing the weights in a certain liquid the frequency becomes $f/3$. The specific gravity of the liquid is

(a) $\frac{4}{3}$ (b) $\frac{1}{6}$ (c) $\frac{15}{12}$ (d) $\frac{32}{27}$

28. Three rods made of the same material and having the same cross-section have been joined as shown in the figure. Each rod is of the same length. The left and right ends are kept at 0°C and 90°C respectively. The temperature of junction of the three rods will be



(a) 45°C (b) 60°C (c) 30°C (d) 20°C

29. The mean density of sea water is \times , and bulk modulus is B . The change in density of sea water in going from the surface of water to a depth of h is

(a) $\frac{B \times}{2}$ (b) $B \times gh$ (c) $\frac{\times^2}{gh}$ (d) $\frac{\times}{gh}$

gh

B

B

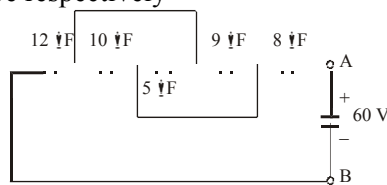
30. A uniform cylinder of length L and mass M having cross-sectional area A is suspended with its vertical length, from a fixed point by a massless spring, such that it is half-submerged in a liquid of density d at equilibrium position. When the cylinder is given a small downward push and released, it starts oscillating vertically with a small amplitude. If the force constant of the spring is K , the frequency of oscillation of the cylinder is

- (a) $\frac{1}{2\pi} \sqrt{\frac{K + Adg}{M}}$ (b) $\frac{1}{2\pi} \sqrt{\frac{K + dgL}{M}}$
- (c) $\frac{1}{2\pi} \sqrt{\frac{K + Adg}{M}}$ (d) $\frac{1}{2\pi} \sqrt{\frac{K + Adg}{Adg}}$

31. An open pipe of length λ is sounded together with another open organ pipe of length $\lambda + x$ in their fundamental tones. Speed of sound in air is v . The beat frequency heard will be ($x \ll \lambda$)

- (a) $\frac{vx}{4\lambda^2}$ (b) $\frac{v^2}{2x}$
- (c) $\frac{vx}{2\lambda^2}$ (d) $\frac{vx^2}{2\lambda^2}$

32. Five capacitors are connected as shown. The equivalent capacitance between terminals A and B and charge on $5 \mu\text{F}$ capacitor will be respectively



- (a) $8 \mu\text{F}, 100 \mu\text{C}$ (b) $4 \mu\text{F}, 50 \mu\text{C}$
- (c) $12 \mu\text{F}, 150 \mu\text{C}$ (d) $16 \mu\text{F}, 200 \mu\text{C}$

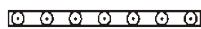
33. A charge Q is distributed over two concentric hollow spheres of radii R and $2R$ such that the surface densities are equal. The potential at the common centre is

- (a) $\frac{2}{3} \cdot \frac{Q}{4\pi R^2}$ (b) $\frac{3}{4} \cdot \frac{Q}{4\pi R^2}$
- (c) $\frac{2}{3} \cdot \frac{Q}{4\pi R^2}$ (d) $\frac{3}{5} \cdot \frac{Q}{4\pi R^2}$

34. A particle of charge q and mass m starts moving from the origin under the action of an electric field $\vec{E} = E_0 \hat{i}$ and magnetic field $\vec{B} = B_0 \hat{j}$ with a velocity $\vec{v} = v_0 \hat{k}$. The speed of the particle will become $\frac{\sqrt{5}}{2} v_0$ after a time

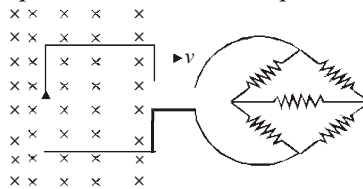
- (a) $\frac{mv_0}{qE}$ (b) $\frac{\sqrt{qmv_0}}{2qE}$
 (c) $\frac{mv_0}{2qE}$ (d) $\frac{mv_0}{3qE}$

35. A large metal sheet carries an electric current along its surface. Current per unit length is $\frac{1}{2} \text{ A}$. Magnetic field induction near the metal sheet is



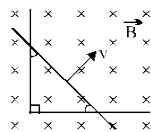
- (a) $\frac{1}{2} \mu_0$ (b) $\frac{1}{2} \mu_0$
 (c) $\frac{1}{2} \mu_0$ (d) $\frac{1}{2} \mu_0$

36. A square metal loop of side 20 cm and resistance 2 ohm is moved with a constant velocity partly inside a uniform magnetic field of 5 Wb/m^2 , directed into the paper, as shown in the figure. The loop is connected to a network of five resistors each of value R . If a steady current of 0.1 A flows in the loop, and the speed of the loop is 1 m/s, then R is equal to



- (a) 2 Ω (b) 3 Ω
 (c) 8 Ω (d) 9 Ω

37. A conductor is bent in L-shape and another conductor is sliding with constant velocity v directed perpendicular to its length as shown in the figure. The sliding conductor always makes equal angle with the two arms of the bent conductor. If resistance per unit length of each conductor is r then current in the loop formed by conductors is



- (a) $\frac{\sqrt{2}BV}{(\sqrt{2}+1)r}$ (b) $\frac{\sqrt{2}BV}{(\sqrt{2}-2)r}$
 (c) $\frac{BV}{(\sqrt{2}+2)r}$ (d) $\frac{BV}{(\sqrt{2}-1)r}$

38. In an ac circuit $V = 100 \sin(100t)$ volt and $I = 100 \sin(100t + \pi/3)$ mA. The power dissipated in the circuit is
- (a) 10^4 W (b) 10 W
(c) 2.5 W (d) 5 W
39. A radioactive material has a mean life of 1620 years and 540 years for α and β emission respectively. The time in which one half of the material remains undecayed emitting both these radiations is
- (a) 202.5 yrs (b) 280.7 yrs
(c) 405 yrs (d) 1080 yrs
40. A hydrogen atom in its ground state absorbs 10.2 eV of energy. Its orbital angular momentum is increased by (given $h = 6.6 \times 10^{-34}$ Js)
- (a) 1.05×10^{-34} Js (b) 3.16×10^{-34} Js
(c) 2.11×10^{-34} Js (d) 4.22×10^{-34} Js

Section 3: Chemistry

41. The number of electrons in an atom with atomic number 105 having $(n + l) = 8$ are:
 (a) 30 (b) 17 (c) 15 (d) 18
42. The ratio $\frac{a}{b}$ (a and b being the van der Waal's constant of real gases) has the dimensions of
 (a) atm mol^{-1} (b) L mol^{-1} (c) atm L mol^{-1} (d) atm L mol^{-2}
43. Resultant molarity of H^+ ion in a mixture of 100 mL of 0.1 M H_2SO_4 and 200 mL of 0.1 M H_3PO_3 is:
 (a) 0.1 M (b) 0.2 M (c) 0.267 M (d) 0.133 M
44. The chemical reaction, $2\text{O}_3 \rightleftharpoons 3\text{O}_2$ proceeds as follows:
 $\text{O}_3 \xrightarrow{\text{fast}} \text{O}_2 + \text{O} \quad \dots \text{ (fast)}$
 $\text{O} + \text{O}_3 \xrightarrow{\text{slow}} 2\text{O}_2 \quad \dots \text{ (slow)}$
 The rate law expression should be:
 (a) $r = K[\text{O}_3]^2$ (b) $r = K[\text{O}_3]^2 [\text{O}_2]^{-1}$ (c) $r = K [\text{O}_3] [\text{O}_2]$ (d) unpredictable
45. For the reaction in equilibrium,
 $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$
 the concentrations, of N_2O_4 and NO_2 at equilibrium are 4.8×10^{-2} and $1.2 \times 10^{-2} \text{ mol L}^{-1}$ respectively. The value of K_c for this reaction is:
 (a) $3 \times 10^{-3} \text{ mol L}^{-1}$ (b) $3 \times 10^3 \text{ mol L}^{-1}$ (c) $3.3 \times 10^2 \text{ mol L}^{-1}$ (d) $3 \times 10^{-1} \text{ mol L}^{-1}$
46. Which one of the following is tribasic acid?
 (a) H_3PO_2 (b) H_3PO_3 (c) H_3PO_4 (d) $\text{H}_4\text{P}_2\text{O}_7$
47. In CsBr crystal structure edge length of unit cell is 4.3 \AA . The shortest interionic distance between Cs^+ and Br^- ions is
 (a) 3.72 \AA (b) 1.86 \AA (c) 7.44 \AA (d) 4.3 \AA

48. Which is deliquescent?

- (a) MgCl_2 (b) NaOH (c) CaCl_2 (d) All

49. For which change ΔH is ΔU ?

- (a) $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$ (b) $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
(c) $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightleftharpoons \text{CO}_2(\text{g})$ (d) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$

50. Which one of the following is incorrect for spontaneous adsorption of gas on solid surface?

- (a) ΔH decreases for system (b) ΔS (total) increases
(c) ΔS decreases for gas (d) ΔG increases for system

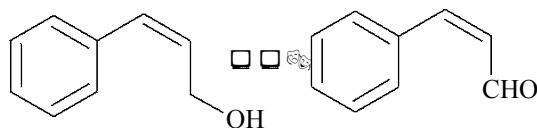
51. According to MO Theory,

- (a) O_2^+ is paramagnetic and bond order greater than O_2
(b) O_2^+ is paramagnetic and bond order less than O_2
(c) O_2^+ is diamagnetic and bond order is less than O_2
(d) O_2^+ is diamagnetic and bond order is more than O_2

52. How many chiral compounds are possible on mono chlorination of 2-methyl butane?

- (a) 2 (b) 4 (c) 6 (d) 8

53. Which of the following reagents can be used for the following conversions

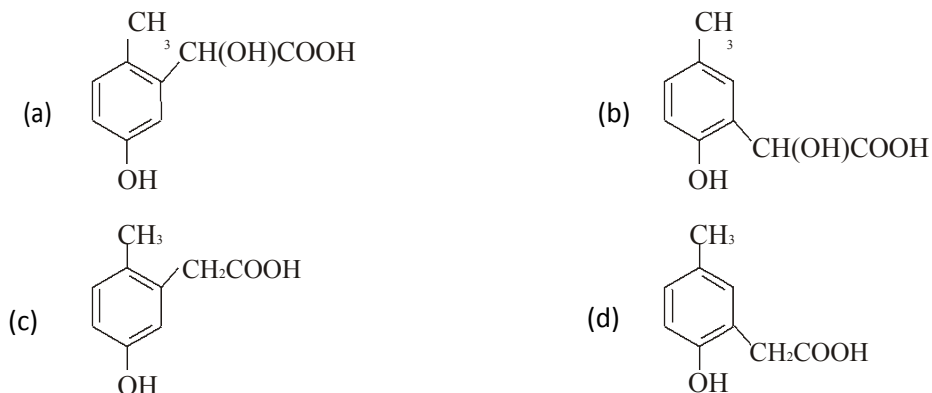


- (a) CrO_3 / Pyridine (b) $\text{H}_2/\text{Pd-C}$ (c) LiAlH_4 (d) $\text{KMnO}_4 / \text{OH}^-$

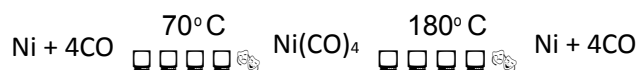
54. Which of the following is fully fluorinated polymer?

- (a) Neoprene (b) Teflon (c) Thiokol (d) PVC

55. p-cresol reacts with chloroform in alkaline medium to give the compound A which adds hydrogen cyanide to form, the compound B. The latter on acidic hydrolysis gives chiral carboxylic acid. The structure of the carboxylic acid is



56. Which method of purification is represented by the following equation?



- (a) van Arkel (b) zone refining (c) mond process (d) cupellation
57. Which of the following has -O-O- linkage
- (a) $\text{H}_2\text{S}_2\text{O}_6$ (b) $\text{H}_2\text{S}_2\text{O}_8$ (c) $\text{H}_2\text{S}_2\text{O}_3$ (d) $\text{H}_2\text{S}_4\text{O}_6$

58. 2-Methylbutane on reacting with bromine in the presence of sunlight gives mainly

- (a) 1-bromo-2-methylbutane (b) 2-bromo-2-methylbutane
(c) 2-bromo-3-methylbutane (d) 1-bromo-3-methylbutane

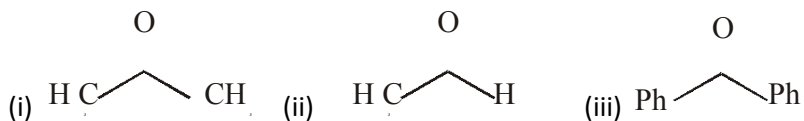
59. Acid catalyzed hydration of alkenes except ethene leads to the formation of

- (a) primary alcohol (b) secondary or tertiary alcohol
(c) mixture of primary and secondary alcohols (d) mixture of secondary and tertiary alcohols

60. The material used in semiconductors

- (a) Si (b) Sn (c) Ti (d) Cs

61. The order of reactivity of Phenyl Magnesium Bromide with the following compounds is



- (a) (ii) > (iii) > (i) (b) (i) > (iii) > (ii) (c) (ii) > (i) > (iii) (d) all react with same rate

62. Which one of the following types of drugs reduces fever ?

- (a) Analgesic (b) Antipyretic (c) Antibiotic (d) Tranquiliser

63. Tertiary alkyl halides are practically inert to substitution by mechanism because of

- (a) insolubility (b) instability (c) inductive effect (d) steric hindrance

64. Which of the following oxides is amphoteric in character?

- (a) CaO (b) CO_2 (c) SiO_2 (d) SnO_2

65. Among the following acids which has the lowest pK_a value ?

- (a) CH_3COOH (b) HCOOH
(c) $(\text{CH}_3)_2\text{CH}-\text{COOH}$ (d) $\text{CH}_3\text{CH}_2\text{COOH}$

Section 4: Mathematics / Biology

Students will have to attempt either Mathematics/Biology as per the eligibility of the program applied.

Mathematics

66. The solution of the equation $\log \log_5 \sqrt{x-5} - \sqrt{x} = 0$ is
- (a) 2 (b) 4 (c) 3 (d) 8
67. Let $\frac{1}{q}, \frac{1}{r}, \frac{1}{p}$ and $\frac{1}{p}, \frac{1}{q}$ are in A.P. where $p, q, r, \neq 0$, then
- (a) p, q, r are in A.P. (b) p^2, q^2, r^2 are in A.P.
- (c) $\frac{1}{p}, \frac{1}{q}, \frac{1}{r}$ in A.P. (d) none of these
68. If $b \in \mathbb{R}^+$ then the roots of the equation $2bx^2 - 3bx + 4b = 0$ is
- (a) real and distinct (b) real and equal (c) imaginary (d) cannot predicted
69. Solve for integral solutions $x_1 + x_2 + x_3 + \dots + x_6 = 17$, where $1 \leq x_i \leq 6, i = 1, 2, \dots, 6$. Number of solutions will be
- (a) ${}^{17}C_6 - 6{}^{11}C_5$ (b) ${}^{17}C_{11} - 6{}^{11}C_5$ (c) ${}^{17}C_5 - 6{}^{11}C_5$ (d) ${}^{17}C_{11} - 5{}^{11}C_6$
70. The probability that a certain beginner at golf gets a good shot if he uses the correct club is $\frac{1}{3}$, and the probability of a good shot with an incorrect club is $\frac{1}{4}$. In his bag there are 5 different clubs, only one of which is correct for the shot in question. If he chooses a club at random and take a stroke, the probability that he gets a good shot is
- (a) $\frac{1}{3}$ (b) $\frac{1}{12}$ (c) $\frac{4}{15}$ (d) $\frac{7}{12}$

71. OPQR is a square and M, N are the middle points of the side PQ and QR respectively. Then the ratio of the area of the square and the triangle OMN is

- (a) 4 : 1 (b) 2 : 1 (c) 4 : 3 (d) 8 : 3

72. Two vertices of an equilateral triangle are $(-1, 0)$ and $(1, 0)$ and its circumcircle is

- (a) $x^2 + y^2 = 4$ (b) $x^2 + y^2 = 4$
 (c) $x^2 + y^2 = 3$ (d) none of these
 (e) $x^2 + y^2 = \frac{3}{4}$

73. If in a $\triangle ABC$, $\sin^2 A + \sin^2 B + \sin^2 C = 2$, then the triangle is always

- (a) isosceles triangle (b) right angled (c) acute angled (d) obtuse angled

74. If the vertex and the focus of a parabola are $(1, 1)$ and $(2, 3)$ respectively, then the equation of the directrix is

- (a) $3x + 2y - 25 = 0$ (b) $x + 2y + 7 = 0$ (c) $2x - 3y + 10 = 0$ (d) $3x + 2y + 14 = 0$.

75. The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and having its centre at $(0, 3)$ is

- (a) 4 (b) 3 (c) $\sqrt{12}$ (d) $7/2$

76. If $P(x_1, y_1)$, $Q(x_2, y_2)$, $R(x_3, y_3)$ and $S(x_4, y_4)$ are four concyclic points on the rectangular hyperbola $xy = c^2$, then the co-ordinates of the orthocentre of $\triangle PQR$ are

- (a) (x_4, y_4) (b) (x_4, y_4) (c) $(\tilde{x}_4, \tilde{y}_4)$ (d) $(\tilde{x}_4, \tilde{y}_4)$

77. The coefficient of $x^n y^n$ in the expansion of $[(1+x)(1+y)(x+y)]^n$ is

- (a) $\sum_{r=0}^{\infty} C_r$ (b) $\sum_{r=0}^{\infty} C_r^2$ (c) $\sum_{r=0}^{\infty} C_r^3$ (d) none of these
78. z_0 is one of the roots of the equation $z^n \cos \theta_0 + z^{n-1} \cos \theta_1 + \dots + \cos \theta_n = 2$, where $\theta_i \in \mathbb{R}$, then $|z_0|$ is equal to
 (a) $\frac{1}{2}$ (b) $\frac{1}{2}$ (c) $\frac{1}{2}$ (d) none of these
79. The second order differential equation is $y'' + y = 0$
 (a) $y''^2 + x + y^2$ (b) $y''y'' + y = \sin x$ (c) $y'' + y = 0$ (d) $y'' = 0$
80. $\int e^{3x} \frac{3 \sin x}{\cos x} dx$ is equal to
 (a) $e^{3x} \cot x + c$ (b) $e^{3x} \tan \frac{x}{2} + c$ (c) $e^{3x} \sin x + c$ (d) $e^{3x} \cos x + c$
81. If m and n are positive integers and $f(x) = \int_1^x a t^{m-1} b t^{n-1} dt$, $a \neq b$, then
 (a) $x = b$ is a point of local minimum (b) $x = b$ is a point of local maximum
 (c) $x = a$ is a point of local minimum (d) $x = a$ is a point of local maximum
82. If in a triangle ABC $\frac{2 \cos A}{a} = \frac{\cos B}{b} = \frac{2 \cos C}{c} = \frac{a}{bc} = \frac{b}{ca}$, then the value of the angle A is
 (a) 45° (b) 90° (c) 135° (d) 60°
83. The general solution of the equation $2^{\cos 2x} + 1 = 3 \cdot 2^{\sin^2 x}$ is
 (a) $n\pi$ (b) $n\pi$ (c) $n\pi$ (d) all of the above.
84. Total number of positive real values of x satisfying $2[x] = x + \{x\}$, where $[.]$ and $\{.\}$ denote the greatest integer function and fractional part respectively is equal to
 (a) 2 (b) 1 (c) 0 (d) 3
85. If $\lim_{x \rightarrow 0} \frac{((a^n)^{nx} \tan x) \sin nx}{x^2} = 0$, where n is nonzero real number, then a is equal to
 (a) 0 (b) $\frac{n-1}{n}$ (c) n (d) $n + \frac{1}{n}$
86. $f(x) = \frac{1}{18} x^3 \ln a - 3a^3 x^2 + 3x$. Find the complete set of values of a such that $f(x) \geq 0$ for all $x \in \mathbb{R}$.

x

$f(x)$ has a local minima at $x = 3$ is

(a) $[-1, 2]$

(b) $(-\infty, 1) \cup (2, \infty)$

(c) $[1, 2]$

(d) $(-\infty, -1) \cup (2, \infty)$

87. The number of values of k for the system of equations $(k + 1)x + 8y = 4k$ and $kx + (k + 3)y = 3k - 1$ has infinitely many solutions

- (a) 0 (b) 1 (c) 2 (d) infinite

88. The matrix $\begin{bmatrix} 1 & i \\ 2 & i \\ i & 2 \end{bmatrix}$ is

- (a) unitary (b) null matrix (c) symmetric (d) none of these

89. The area between the curves $y = xe^x$ and $y = xe^{-x}$ and the line $x = 1$ is

- (a) $2e$ (b) e (c) $2/e$ (d) $1/e$

90. If the unit vectors \vec{a} and \vec{b} are inclined at an angle 2θ and $|\vec{a} - \vec{b}| = 1$ then θ lies in the interval

- (a) $(0, \frac{\pi}{6})$ (b) $(\frac{\pi}{6}, \frac{\pi}{2})$ (c) $(\frac{\pi}{2}, \frac{5\pi}{6})$ (d) $(\frac{5\pi}{6}, \pi)$

Biology

66. Mendel selected pea plant because
- (a) The flower structure of pea is such as to allow uncontrolled breeding
 - (b) Pea flower normally remains open and undergoes self-pollination
 - (c) It is an annual plant with short life span and give results within 3 months
 - (d) Small number of seeds are produced per pea plant
67. According to the concept of dominance the following statements are given below. Read the statements carefully and choose the correct answer
- (A) Wild allele is a fully functional allele that forms RNA, proteins but not enzymes
 - (B) The mutant allele generally produces a faulty product or no product at all
 - (C) The modified functional wild type allele represents the original phenotype
 - (D) The modified or mutated non-functional allele behave as recessive allele
- (a) A, B & C are correct (b) B & D are correct
(c) Only 'D' is correct (d) B, C & D are correct
68. What is the probability of obtaining pure homozygous individuals if a cross is made between AaBbCcDd \times aaBBCCdd individuals ?
- (a) $\frac{2}{16}$ (b) $\frac{1}{16}$ (c) $\frac{16}{248}$ (d) $\frac{1}{64}$
69. The minimum height of guava plant is 10 metre. 2 polygene pairs contribute to the height of plant. The maximum height of plant is 34 metres. What will be the height of plant with genotype AaBb ?
- (a) 12 metre (b) 22 metre (c) 32 metre (d) 30 metre

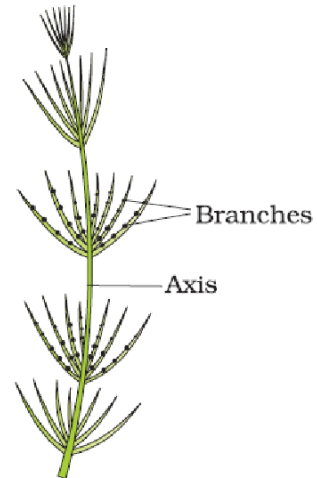
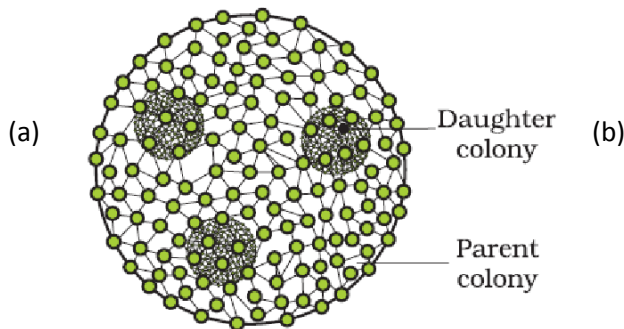
70. A plant (*Mirabilis jalapa*) with homozygous red flowers and round seeds (RRWW) was crossed with white flowers and wrinkled seeds to get the F₁ generation. What will be the percentage of plants having red flowers and round seeds obtained in F₂ generation ?

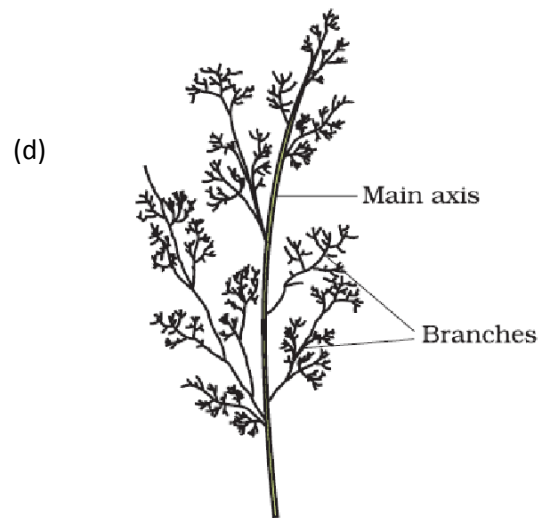
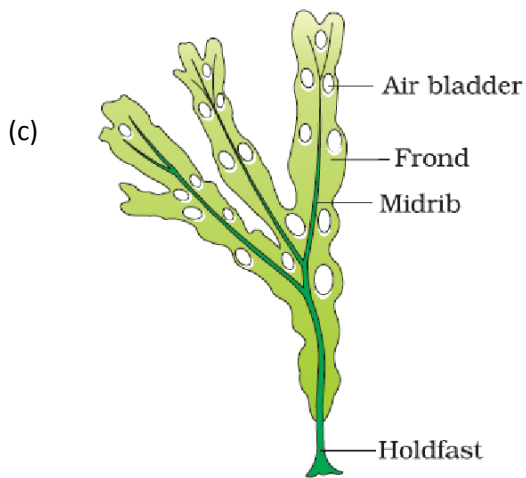
- (a) 75% (b) 18.75% (c) 50% (d) 12.5%

71. Choose the correct match

- (a) Dominant epistasis – 9 : 3 : 4
(b) Duplicate genes – 9 : 6 : 1
(c) Dominant – recessive epistasis – 13 : 3
(d) Polymeric gene – 12 : 3 : 1

72. Identify the figure and select the correct one:





- (a) A–Volvox, B–Fucus, C–Chara, D–Polysiphasia
 (b) A–Volvox, B–Polysiphonia, C–Fucus, D–Chara
 (c) A–Volvox, B–Chara, C–Dictyota, D–Polysiphonia
 (d) A–Volvox, B–Chara, C–Fucus, D–Polysiphonia

73. The dominant phase in the life cycle of bryophytes is

- (a) Gamophytic plant body
 (b) Sporophytic plant body
 (c) Both gametophytic and sporophytic plant body
 (d) None of these

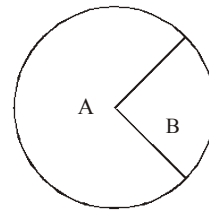
74. Parental combination in coupling and repulsion can be expressed as

- | Coupling | Repulsion |
|------------------------|--------------------|
| (a) AABb \times aabb | AABB \times aabb |
| (b) aaBB \times aabb | AAbb |
| (c) AABb \times aabb | AAbb \times aabb |
| (d) AAbb \times aaBB | aaBB |
| | AaBb \times aabb |
| | aabb |

75. The term X body given by Henking was actually
- (a) Chromatin body of the nucleus (b) Centrioles
(c) Autosomes (d) X chromosome

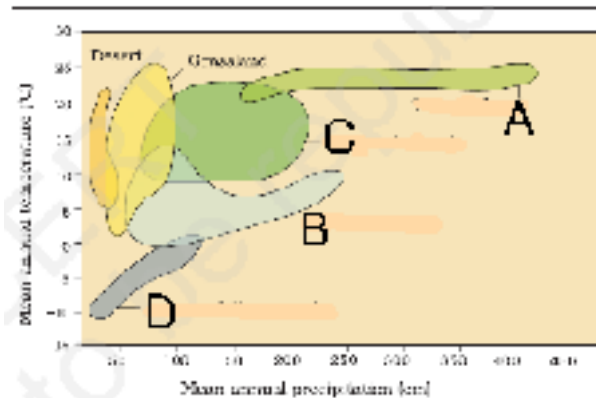
76. Turner's syndrome has the following genotype
- (a) XXX (b) XXYY (c) XYY (d) XO

77. In the global biodiversity of vertebrates, (A) and (B) in the following figure represent
- (a) Amphibians and Reptiles
(b) Fishes and Reptiles
(c) Mammals and Birds
(d) Fishes and Birds



78. In the given diagram biome distribution with respect to annual temperature and precipitation. A, B and C represent

- (a) A-Coniferous forest, B-Desert, C-Grassland, D-Alpine tundra
(b) A-Desert, B-Grassland, C-Temperate forest, D-Arctic
(c) A-Tropical forest, B-Coniferous forest, C-Temperate forest, D-Alpine tundra
(d) A-Temperature forest, B-Alpine tundra, C-Arctic, D-Grassland



79. Undifferentiated layer present between extoderm and endoderm is called
- (a) Mesoglea (b) Mesoderm (c) Epithelium (d) Spongocoel

80. In some, animals body is externally and internally divided into segments, this phenomenon of segmentation is called
- (a) Division (b) Amitosis (c) Fragmentation (d) Metamerism
81. Bath sponge commonly called as
- (a) Sycon (b) Spongilla (c) Euspongia (d) Pleurobrachia
82. Which of the following statement is incorrect ?
- (a) Inspiration can occur if there is a positive pressure in the lungs with respect to atmospheric pressure
- (b) An increase in pulmonary volume decreases the intra-pulmonary pressure to less than the atmospheric pressure
- (c) Expiration takes place when the intra-pulmonary pressure is higher than the atmospheric pressure
- (d) On an average, a healthy human breathes 12-16 times/minute
83. For completion of respiration process, write the given steps in sequential manner
- (A) Diffusion of gases (O_2 and CO_2) across alveolar membrane.
- (B) Transport of gases by blood.
- (C) Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2 .
- (D) Pulmonary ventilation by which atmospheric air is drawn in and CO_2 rich alveolar air is released out.
- (E) Diffusion of O_2 and CO_2 between blood and tissues.
- (a) D A B E C (b) B D C A E (c) A B E C D (d) C E A D B

84. Identify the correct and incorrect match about respiratory volume and capacities and mark the correct answer

- i. Inspiratory capacity (IC) = Tidal Volume + Residual Volume
- ii. Vital Capacity (VC) = Tidal Volume (TV) + Inspiratory Reserve Volume (IRV) + Expiratory Reserve Volume (ERV).
- iii. Residual Volume (RV) = Vital Capacity (VC) - Inspiratory Reserve Volume (IRV)
- iv. Tidal Volume (TV) = Inspiratory Capacity (IC) - Inspiratory Reserve Volume (IRV)

Options:

- (a) (i) Incorrect, (ii) Incorrect, (iii) Incorrect, (iv) Correct
- (b) (i) Incorrect, (ii) Correct, (iii) Incorrect, (iv) Correct
- (c) (i) Correct, (ii) Correct, (iii) Incorrect, (iv) Correct
- (d) (i) Correct, (ii) Incorrect, (iii) Correct, (iv) Incorrect

85. The 24 hour (diurnal) rhythm of our body such as the sleep-wake cycle is regulated by the hormone

- (a) Melatonin
- (b) Calcitonin
- (c) Prolactin
- (d) Adrenaline

86. Hormones are called chemical signals that stimulate specific target tissues. Their specificity is due to the presence of signal receiving 'receptors' only in the respective target tissues. Where are these receptors present in case of hormones of protein nature ?

- (a) Extra cellular matrix
- (b) Blood
- (c) Plasma membrane
- (d) Nucleus

87. Which one is involved in carbohydrate metabolism ?

- (a) Cortisol
- (b) Parathormone
- (c) Somatotrophin
- (d) Aldosterone

88. How many of the given statements are correct with regard to placenta in embryonic development ?
- (A) The chorionic villi and uterine tissue become interdigitated with each other and jointly form placenta.
 - (B) Placenta is a structural and functional unit between developing embryo (foetus) and maternal body.
 - (C) The placenta facilitates the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory/waste materials produced by the embryo.
- (a) None (b) One (c) Two (d) Three
89. Which one of the following conditions of the zygotic cell would lead to the birth of a normal human female child ?
- (a) One X and one Y chromosome
 - (b) Two X chromosomes
 - (c) Only one Y chromosome
 - (d) Only one X chromosome
90. Which one can be considered as most advanced type of IUD ?
- (a) Lippes loop
 - (b) CuT
 - (c) Multiload 375
 - (d) LNG-20

Answer Key for EPCM

1	(d)	16	(b)	31	(c)	46	(c)	61	(c)	76	(c)
2	(c)	17	(b)	32	(b)	47	(a)	62	(b)	77	(c)
3	(d)	18	(a)	33	(d)	48	(d)	63	(d)	78	(b)
4	(c)	19	(d)	34	(c)	49	(d)	64	(d)	79	(b)
5	(d)	20	(c)	35	(b)	50	(d)	65	(b)	80	(b)
6	(c)	21	(a)	36	(c)	51	(a)	66	(b)	81	(a)
7	(d)	22	(a)	37	(d)	52	(a)	67	(b)	82	(b)
8	(c)	23	(b)	38	(c)	53	(a)	68	(c)	83	(d)
9	(d)	24	(b)	39	(c)	54	(b)	69	(b)	84	(b)
10	(b)	25	(b)	40	(a)	55	(b)	70	(c)	85	(d)
11	(a)	26	(c)	41	(b)	56	(c)	71	(d)	86	(c)
12	(b)	27	(d)	42	(c)	57	(b)	72	(a)	87	(a)
13	(c)	28	(b)	43	(b)	58	(b)	73	(b)	88	(a)
14	(c)	29	(c)	44	(b)	59	(b)	74	(d)	89	(c)
15	(a)	30	(c)	45	(a)	60	(a)	75	(a)	90	(a)

Answer Key for EPCB

1	(d)	16	(b)	31	(c)	46	(c)	61	(c)	76	(d)
2	(c)	17	(b)	32	(b)	47	(a)	62	(b)	77	(b)
3	(d)	18	(a)	33	(d)	48	(d)	63	(d)	78	(c)
4	(c)	19	(d)	34	(c)	49	(d)	64	(d)	79	(a)
5	(d)	20	(c)	35	(b)	50	(d)	65	(b)	80	(d)
6	(c)	21	(a)	36	(c)	51	(a)	66	(c)	81	(c)
7	(d)	22	(a)	37	(d)	52	(a)	67	(b)	82	(a)
8	(c)	23	(b)	38	(c)	53	(a)	68	(b)	83	(a)
9	(d)	24	(b)	39	(c)	54	(b)	69	(b)	84	(b)
10	(b)	25	(b)	40	(a)	55	(b)	70	(b)	85	(a)
11	(a)	26	(c)	41	(b)	56	(c)	71	(b)	86	(c)
12	(b)	27	(d)	42	(c)	57	(b)	72	(d)	87	(a)
13	(c)	28	(b)	43	(b)	58	(b)	73	(a)	88	(d)
14	(c)	29	(c)	44	(b)	59	(b)	74	(c)	89	(b)
15	(a)	30	(c)	45	(a)	60	(a)	75	(d)	90	(d)