

B-1

Entrance Examinations - 2013
M.Sc. (5-Year Integrated) Sciences
&
M.Sc. (5-Year Integrated) Earth Sciences

Max. Marks: 100

Time: 2 Hours

Hall Ticket No.

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Instructions for students

- I. Please enter your Hall Ticket Number on this page and on the OMR answer sheet without fail.
- II. Please read the following instructions carefully:
 - (a) There are 100 questions in this paper. Questions 1-25 are in Biology, 26-50 are in Chemistry, 51-75 are in Mathematics and 76-100 are in Physics.
 - (b) Each question carries one mark. Each wrong answer will be awarded -0.33 .
 - (c) Answers are to be marked on the OMR sheet following the instructions given there.
 - (d) Hand over the OMR answer sheet at the end of the examination to the Invigilator.
 - (e) Non-programmable calculators are allowed. Logarithmic tables, programmable calculators and mobile phones are not allowed.
 - (f) Rough work can be done anywhere on the question paper but not on the OMR sheet.
 - (g) This book contains 16 pages including this page and pages for the rough work. Please check that your question paper has all the pages.

Biology

1. Which one of the following animals lack acrosome in spermatozoa?
(A) Snake. (B) Frog. (C) Fish. (D) Quail.
2. Identify the statement that is FALSE from the following:
(A) Anti-diuretic hormone (ADH) helps in water elimination, making the urine hypotonic.
(B) Protein-free fluid is filtered from blood plasma into the Bowman's capsule.
(C) Henle's loop plays an important role in concentrating the urine.
(D) Glucose is actively reabsorbed in the proximal convoluted tubule.
3. DNA without introns is
(A) B-DNA. (B) Z-DNA. (C) Nuclear DNA. (D) Mitochondrial DNA.
4. If both parents are carriers of the gene for phenylketonuria what are the chances of them producing a child with this disorder?
(A) 25%. (B) 50%. (C) 75%. (D) 100%.
5. Double fertilization means that angiosperms
(A) produce twice as many embryos per fertilization event as do gymnosperms.
(B) have two sperm nuclei, which fertilize the single egg.
(C) have two sperm nuclei, both of which unite with nuclei of the female gametophyte.
(D) produce triploid cells via double fertilization.
6. Which one of the following statements is NOT TRUE?
(A) Menstrual cycle ceases at the time of pregnancy.
(B) Leydig cells are steroidogenic cells of testis.
(C) Oocyte gets nutrition from Sertoli cells.
(D) Fertilization normally occurs in Fallopian tube.

7. Oxygen evolution takes place during photosynthesis in green plants but not in bacterial photosynthesis, because
- Bacteria are prokaryotic and green plants are eukaryotic.
 - Only photo system 1 is present in bacterial photosynthesis.
 - Bacterial cell wall composition is different from green plant cell wall.
 - Rate of O_2 consumption in bacteria is higher than that in green plants.
8. Which of the following statements about enzymes is/are CORRECT?
- If extracellular, they are made outside the cell.
 - Allosteric enzymes have the same structure, but catalyze different reactions.
 - They are rapidly consumed by the reaction they catalyze.
 - They can work in both directions of the reaction.
- (A) (i) only. (B) (iv) only. (C) (i) and (iii) only. (D) (ii) and (iv) only.
9. Nucleotides are linked to one another in mRNA by
- Hydrogen bonds.
 - Hydrophobic bonds.
 - Glycoside bonds.
 - Phosphodiester bonds.
10. The alleles for eye colour and for fat body color are on the X chromosome of *Drosophila*, but not on the Y. Red eye color (w^+) is dominant to white eye color (w), and tan body color (y^+) is dominant to yellow body color (y). What is the genotype of a yellow-bodied, red eyed female who is homozygous for eye color?
- $X^{wy^+}X^{w+y}$.
 - $X^{wy}X^{w+y}$.
 - $X^{wy}X^{wy}$.
 - $X^{w+y}X^{w+y}$.
11. All are true about glutathione EXCEPT
- helps in conjugation reaction.
 - Decreases free radicals.
 - Converts hemoglobin to methemoglobin.
 - Cofactor of various enzymes.
12. Which of the following growth regulators can cause leaf senescence in plants?
- Gibberellic acid.
 - Kinetin.
 - Zeatin.
 - Ethylene.
13. Performing similar function, however, possessing different evolutionary origin is known as
- Vestigial.
 - Analogous.
 - Homologous.
 - Heterologous.

14. Gene duplication has the greatest role in the evolution of
(A) mRNA. (B) tRNA. (C) hnRNA. (D) rRNA.
15. A pedigree shows Ravi and Radha, two unaffected individuals, giving birth to four children; two unaffected boys, an affected boy, and an affected girl. Could the trait in question be
(A) autosomal recessive. (B) autosomal dominant.
(C) X-linked recessive. (D) X-linked dominant.
16. Largest and the most developed part of the human brain is
(A) Cerebellum. (B) Forebrain. (C) Hypothalamus. (D) Midbrain
17. Acetyl CoA cannot be converted directly into?
(A) Glucose. (B) Ketone bodies. (C) Fatty acids. (D) Cholesterol.
18. Down's syndrome is the most frequently occurring chromosomal disorder in human beings that causes delays in physical and intellectual development. The total number of autosomes and sex chromosomes in individuals affected by Down's syndrome will be
(A) 45 autosomes + XY. (B) 44 autosomes + XXY.
(C) 43 autosomes + XX. (D) 44 autosomes + XO.
19. At metaphase of cell cycle, which one of the following events occurs:
(A) Centromere splits and chromatids separate.
(B) Chromosomes are moved to spindle equator.
(C) Pairing between homologous chromosomes takes place.
(D) Crossing over between homologous chromosomes takes place.
20. The explant that is commonly used for producing virus free plants in plant tissue culture is
(A) Meristem. (B) Leaf. (C) Stem. (D) Zygotic embryos.
21. Which is the fastest member of the animal kingdom?
(A) Sail Fish. (B) Cheetah. (C) Antelope. (D) Peregrine Falcons.

22. The net gain of Adenosine-5'-triphosphate molecules after complete oxidation of one molecule of glucose is?
- (A) 38. (B) 36. (C) 32. (D) 30.
23. Which one of the following is CORRECT?
- (A) Cells of all living organisms have a nucleus.
(B) Both animal and plant cells have a well defined cell wall.
(C) In prokaryotes, there are no membrane bound organelles.
(D) Cells are formed *de novo* from abiotic materials.
24. In which of the following organisms the structural gene is polycistronic?
- (A) *Neurospora crassa*. (B) *Saccharomyces cerevisiae*.
(C) *Escherichia coli*. (D) *Drosophila melanogaster*.
25. C₄ plants are more efficient in photosynthesis than C₃ plants because of
- (A) Higher leaf area.
(B) The presence of a large number of chloroplasts.
(C) The presence of a thin cuticle on the leaf surface.
(D) Lower photorespiration.

Chemistry

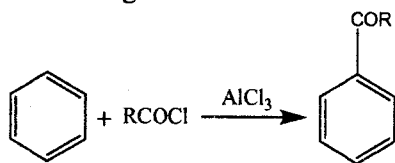
26. In the electromagnetic spectrum, which of the following has greater wavelength than visible light?
- (A) Ultraviolet. (B) Infrared. (C) Gamma rays. (D) X-rays.
27. Splitting of spectral lines under the influence of magnetic and electric fields are called
- (A) Zeeman and Compton effects, respectively.
(B) Stark and Zeeman effects, respectively.
(C) Compton and photoelectric effects, respectively.
(D) Zeeman and Stark effects, respectively.
28. The ion that is not isoelectronic with O²⁻ is
- (A) N³⁻. (B) F⁻. (C) Ti⁺. (D) Na⁺.

29. The molarity of concentrated sulphuric acid (density = 1.834g/cm^3) containing 95 % (by mass) of H_2SO_4 is
(A) 4.44M. (B) 17.78M. (C) 13.38M. (D) 8.88M.
30. The hybridization of Xe atom in XeF_4 is
(A) sp^3 . (B) sp^3d . (C) sp^3d^2 . (D) d^2sp^3 .
31. The compound that does NOT show hydrogen bonding is
(A) ammonia. (B) ethyl alcohol. (C) acetic acid. (D) diethyl ether.
32. The bonds present in $\text{K}_4[\text{Fe}(\text{CN})_6]$ are
(A) ionic and covalent. (B) ionic and coordinate.
(C) covalent and coordinate. (D) ionic, covalent and coordinate.
33. The number of atoms present in each unit cell of a body centred cubic lattice is
(A) 2. (B) 4. (C) 1. (D) 6.
34. 12.8gm of a gas occupies 10 liters of volume when the pressure is 750mm of Hg and the temperature is 27°C . The molecular weight of the gas is
(A) 47.02 (B) 31.91 (C) 28.1 (D) 34.2
35. The liquefaction of gas is impossible if its temperature is
(A) equal to its critical temperature.
(B) smaller than its critical temperature.
(C) greater than its critical temperature.
(D) greater than room temperature.
36. Molecule 'X' contains 40.92% C, 4.58% H and 54.50 % O by mass. The empirical formula of 'X' is
(A) $\text{C}_6\text{H}_4\text{O}_6$. (B) $\text{C}_6\text{H}_8\text{O}_6$. (C) $\text{C}_3\text{H}_8\text{O}_3$. (D) $\text{C}_3\text{H}_4\text{O}_3$.

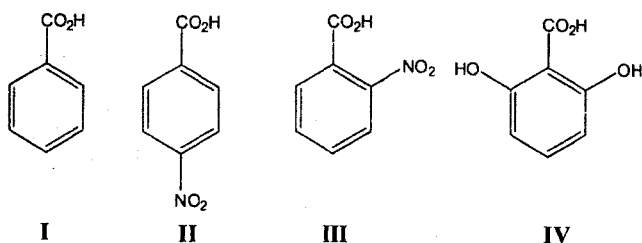
37. Choose the correct order of expected lattice energies
- (A) $\text{LiCl} > \text{KBr} > \text{MgCl}_2 > \text{KCl}$.
(B) $\text{MgCl}_2 > \text{LiCl} > \text{KCl} > \text{KBr}$.
(C) $\text{KBr} > \text{MgCl}_2 > \text{LiCl} > \text{KCl}$.
(D) $\text{KCl} > \text{KBr} > \text{LiCl} > \text{MgCl}_2$.
38. For an endothermic spontaneous reaction, which statement is correct?
- (A) $\Delta G < 0$ and $\Delta S > 0$. (B) $\Delta G < 0$ and $\Delta S < 0$.
(C) $\Delta G > 0$ and $\Delta S > 0$. (D) $\Delta G > 0$ and $\Delta S < 0$.
39. The correct order of dipole moment of the following compound is
- (A) *p*-dichlorobenzene > *m*-dichlorobenzene > *o*-dichlorobenzene.
(B) *o*-dichlorobenzene > *m*-dichlorobenzene > *p*-dichlorobenzene.
(C) *m*-dichlorobenzene > *o*-dichlorobenzene > *p*-dichlorobenzene.
(D) *m*-dichlorobenzene > *p*-dichlorobenzene > *o*-dichlorobenzene.
40. pH of 10^{-3} M H_2SO_4 solution is
- (A) 3. (B) 2.7 (C) 6. (D) 4.4
41. Among the following which one is used as a primary standard for redox titration
- (A) Potassium permanganate. (B) Oxalic acid.
(C) Potassium dichromate. (D) Potassium hydrogen phthalate.
42. In a radioactive decay $^{232}\text{Th}_{90}$ is transformed into $^{208}\text{Pb}_{82}$. The number of alpha and beta particles emitted respectively are
- (A) 4, 6. (B) 4, 4. (C) 6, 6. (D) 6, 4.
43. The amount of NH_3 (g) obtained from the reaction of N_2 (g) and H_2 (g) at equilibrium increases at
- (A) high pressure and low temperature. (B) low pressure and low temperature.
(C) high pressure and high temperature. (D) low pressure and high temperature.
44. The compound that does NOT give the silver mirror with Tollens reagent is
- (A) Glucose. (B) Acetaldehyde. (C) Benzaldehyde. (D) Acetophenone.

45. The compound that is not an organometallic compound is
 (A) RMgX . (B) R_2CuLi . (C) NaBH_4 . (D) RZnX .

46. The following reaction is known as

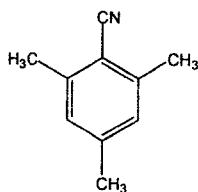


- (A) Wurtz reaction. (B) Friedel-Crafts reaction.
 (C) Cannizzaro reaction. (D) Reimer-Tiemann reaction.
47. The correct order of acidity of the following acids is



- (A) $\text{IV} > \text{III} > \text{II} > \text{I}$. (B) $\text{I} > \text{III} > \text{IV} > \text{II}$.
 (C) $\text{IV} > \text{II} > \text{III} > \text{I}$. (D) $\text{IV} > \text{I} > \text{III} > \text{II}$.

48. The IUPAC name of the following compound is



- (A) 2,4,6-trimethylbenzenecarbonitrile. (B) 2,4,6-trimethylbenzenenitrile.
 (C) 2,4,6-trimethylcarbonitrile. (D) 2,4,6-trimethylbenzoylnitrile.

49. The correct order the basicity of the following is

- (A) aniline > ammonia > cyclohexylamine
 (B) ammonia > cyclohexylamine > aniline
 (C) cyclohexylamine > ammonia > aniline
 (D) cyclohexylamine > aniline > ammonia

50. The toxic chemical associated with Bhopal Gas Tragedy is

- (A) methyl isocyanate.
- (B) methyl cyanide.
- (C) methyl isocyanide.
- (D) methyl mercaptan.

Mathematics

51. Let n be any natural number and $\binom{n}{r} = \frac{n!}{r!(n-r)!}$ then the value of

$$\binom{n}{1} - 2\binom{n}{2} + 3\binom{n}{3} + \dots + (-1)^{n+1}n\binom{n}{n}$$

is equal to

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

52. The value of $\frac{\sec 8A - 1}{\sec 4A - 1}$ is equal to

- (A) $\frac{\tan 4A}{\tan 2A}$. (B) $\frac{\tan 8A}{\tan 2A}$. (C) $\frac{\tan 2A}{\tan 8A}$. (D) $\frac{\tan 8A}{\tan 4A}$.

53. The value of $\lim_{x \rightarrow 0} \frac{1}{x} \sin\left(\frac{1}{x}\right)$ is equal to

- (A) zero. (B) a nonzero real number. (C) infinity. (D) none of the above.

54. The system of equations $2x + ay = 4$, $x + 3y = b$ has

- (A) a unique solution for all b and when $a = 6$.
- (B) a unique solution for all a and b .
- (C) infinitely many solutions for all b and when $a = 6$.
- (D) infinitely many solutions when $a = 6$ and $b = 2$.

55. Let $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ with a, b, c, d being positive real numbers such that $a + b < 1/2$ and $c + d < 1/2$. Which of the following statements is FALSE?

- (A) $I + A$ is invertible.
- (B) $I - A$ is invertible.
- (C) $I + A^2$ is invertible.
- (D) there exists a natural number m such that $I + A^m$ is NOT invertible.

56. The equation $x^5 - 2x^2 + 7 = 0$ has

- (A) at least two imaginary roots. (B) at least four real roots.
 (C) only real roots. (D) only imaginary roots.

57. Let z_1, z_2 be two complex nonzero numbers. Then which of the following statements is FALSE?

- (A) $|z_1 + \sqrt{z_1^2 - z_2^2}| + |z_1 - \sqrt{z_1^2 - z_2^2}| = |z_1 + z_2| + |z_1 - z_2|$.
 (B) $|z_1 + z_2|^2 + |z_1 - z_2|^2 = 2(|z_1|^2 + |z_2|^2)$.
 (C) $|z_1 + z_2|^2 + |z_1 - z_2|^2 = 4(|z_1|^2 + |z_2|^2)$.
 (D) $\left| \frac{\bar{z}_1}{z_2} \right| = \frac{|z_1|}{|z_2|}$.

58. The equation $\csc^{-1}(\sqrt{1+x^2}) + \cot^{-1}(1+x) = \pi/4$ has

- (A) a unique solution. (B) infinitely many solutions.
 (C) finitely many solutions. (D) no solution.

59. The value of the integral $\int_1^4 |x-2| + |x-3| dx$ is equal to

- (A) 0. (B) 1. (C) 5. (D) none of these.

60. The value of $\tan \frac{\pi}{8}$ is equal to

- (A) $1 - \sqrt{2}$. (B) $1 + \sqrt{2}$. (C) $\sqrt{2} - 1$. (D) $-\sqrt{2} - 1$.

61. The value of the integral $\int \frac{1}{(1+e^x)(1+e^{-x})} dx$ is equal to

- (A) $\frac{1}{1+e^x}$. (B) $\frac{-1}{1+e^x}$. (C) $\frac{1}{1+e^{-x}}$. (D) $\frac{-1}{1+e^{-x}}$.

62. If $a > 0$ and $x = \frac{1}{2} \left(\sqrt{a} + \frac{1}{\sqrt{a}} \right)$ then $\frac{\sqrt{x^2-1}}{x-\sqrt{x^2-1}}$ is equal to

- (A) $\frac{a+1}{2}$. (B) $\frac{a-1}{2}$. (C) a^2+1 . (D) a^2-1 .

70. The locus of the centre of the circle which touches the line $x \cos \alpha + y \sin \alpha = p$ and the circle $(x - a)^2 + (y - b)^2 = c^2$ is
- (A) $(x - a)^2 + (y - b)^2 = (x \cos \alpha + y \sin \alpha - p + c)^2$.
 (B) $(x - a)^2 + (y - b)^2 = x \cos \alpha + y \sin \alpha - p + c$.
 (C) $(x - a)^2 + (y - b)^2 = (x \cos \alpha + y \sin \alpha - p \pm c)^2$.
 (D) $(x - a)^2 + (y - b)^2 = x \cos \alpha + y \sin \alpha - p \pm c$.
71. The value of k such that the line $y = 4x + k$ be the tangent to the curve $y^2 - 2y - 16x + 33 = 0$ is
- (A) $k = -6$. (B) $k = 6$. (C) $k = 5$. (D) $k = -5$.
72. If $x \cos \alpha + y \sin \alpha = p$ is a tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then p^2 is equal to
- (A) $a^2 \cos^2 \alpha + b^2 \sin^2 \alpha$. (B) $a^2 |\cos \alpha| + b^2 |\sin \alpha|$.
 (C) $a \cos^2 \alpha + b \sin^2 \alpha$. (D) $a |\cos \alpha| + b |\sin \alpha|$.
73. Three balls are drawn without replacement from a bag containing 5 red balls, 4 blue balls and 3 green balls and they are arranged in a row. The number of different ways of arranging them in a row is
- (A) 1. (B) 24. (C) 27. (D) 30.
74. In a box there are 10 chits numbered 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Pick up a chit and note down the chit number on a different paper and replace the chit back in the box. Shake the box and pick up a chit and again note down the chit number next to previous number. Carry out the same experiment again and hence you have a three digit number. Then the probability that it is at least 500 is
- (A) 0. (B) $1/10$. (C) $1/5$. (D) $1/2$.
75. Consider the experiment conducted in the previous problem number 74. The probability that no digit is repeated is
- (A) 0. (B) greater than $1/4$ and less than $1/3$.
 (C) greater than $1/3$ and less than $2/3$. (D) greater than $2/3$.

Physics

76. A particle moves such that its acceleration a is given by $-bx$, where x is the displacement from the equilibrium position and b is a constant. The period of oscillation is
- (A) $\sqrt{2\pi/b}$. (B) $2\pi/\sqrt{b}$. (C) $2\pi/b$. (D) $2\sqrt{\pi/b}$.
77. Two parts of a sonometer wire divided by a movable bridge differ in length by 0.2cm and produce one beat per second, when together. If the total length of the wire is 1 meter, the frequencies are
- (A) 210.5 and 209.5 Hz. (B) 220.5 and 219.5 Hz.
(C) 230.5 and 229.5 Hz. (D) 250.5 and 249.5 Hz.
78. An organ pipe of effective length 0.6m is closed at one end. Given that the speed of sound in air is 300m/s, the two lowest frequencies of the pipe are
- (A) 250 Hz, 750 Hz. (B) 250 Hz, 500 Hz.
(C) 125 Hz, 375 Hz. (D) 125 Hz, 250 Hz.
79. An ideal gas is expanding such that $PT^2 = \text{constant}$. The coefficient of volume expansion of the gas is
- (A) $1/T$. (B) $2/T$. (C) $3/T$. (D) 4.
80. One mole of a monatomic gas is contained in an insulated and rigid container. It is heated by passing a current of 2A for 10 minutes through a filament of resistance 100Ω . The change in the internal energy of the gas is
- (A) 30 kJ. (B) 60 kJ (C) 120 kJ (D) 240 kJ
81. The speed at which a galaxy should move with respect to us so that the sodium line at 589.0nm from the galaxy can be observed at 589.6nm is
- (A) towards us at a speed of approximately 300km/sec.
(B) away from us at a speed of approximately 300km/sec.
(C) towards us at a speed of approximately 3×10^5 km/sec.
(D) away from us at a speed of approximately 3×10^5 km/sec
82. The Brewster angle for light transition from medium 1 of refractive index 1.2 to a medium 2 of refractive index 1.7 is
- (A) 33.4° . (B) 57.6° . (C) 35.2° . (D) 54.8° .

83. Two light beams, with a photon flux of n photons and $2n$ photons at green (~ 2.0 eV) and red wavelength (~ 1.0 eV) respectively fall on a photoresponsive plate whose work function is ~ 1.5 eV. The number of electrons emitted from the photoresponsive plate would be:
- (A) n for green light and $2n$ for red light. (B) $2n$ for green light and n for red light.
(C) 0 for green light and n for red light. (D) n for green light and 0 for red light.
84. When an object of size h kept at infinity on the left side of a convex lens of focal length f and another convex lens of focal length $2f$ is kept at a distance of $f/2$ from the first lens on its right side, the focal point due to the combination of lenses is at a position
- (A) greater than f from the first lens. (B) greater than f from the second lens.
(C) less than f from the first lens. (D) less than f from the second lens.
85. Consider a charge of q is placed at each vertex of an equilateral triangle of side a . The force on any charge is proportional to
- (A) $\frac{q}{a^2}$ and directed towards the centroid.
(B) $\frac{q^2}{a^2}$ and directed away from the centroid.
(C) $\frac{q^2}{a^2}$ and directed towards the centroid.
(D) $\frac{q}{a^2}$ and directed away from the centroid.
86. The main principle used behind the propagation of light in a fiber for communication purpose is
- (A) interference. (B) diffraction.
(C) total internal reflection. (D) refraction of light.
87. When a body floats in a fluid, the magnitude of the force of buoyancy, F_b , and magnitude of the gravitational force, F_g , acting on the body are related as
- (A) $F_b = F_g$. (B) $F_b < F_g$. (C) $F_b > F_g$. (D) $F_b \leq F_g$.
88. The magnetic moment of paramagnetic material is a result of
- (A) addition of spin and orbital magnetic dipole moments of electrons in each atom.
(B) addition of orbital magnetic dipole moments of electrons in each atom.
(C) addition of spin and orbital magnetic dipole moments of electrons in each molecule.
(D) addition of orbital magnetic dipole moments of electrons in all molecules.

89. Curie-Weiss law is applicable for
(A) Ferromagnets. (B) Diamagnets. (C) Spermagnets. (D) Paramagnets.
90. The capacitive reactance of a Capacitor "C" to direct current is
(A) 0. (B) infinity. (C) C. (D) $1/C$.
91. Charge Q is divided into two parts Q_1 and Q_2 and separated by a distance R . For maximum repulsion between these charges
(A) $Q_1 = Q_2 = Q/2$. (B) $Q_1 = 3Q/4$ and $Q_2 = Q/4$.
(C) $Q_1 = 2Q/3$ and $Q_2 = Q/3$. (D) $Q_1 = Q - Q/R$ and $Q_2 = Q/R$.
92. A charged oil drop of mass 2.5×10^{-4} gm is in space between the two plates each of area 200cm^2 of a parallel plate capacitor. When the upper plate has a charge $5 \times 10^{-7}\text{C}$ and the lower plate has an equal negative charge, the drop remains stationary. The charge of oil drop is
(A) $9 \times 10^{-1}\text{C}$. (B) $9 \times 10^{-6}\text{C}$. (C) $9 \times 10^{-13}\text{C}$. (D) $1.8 \times 10^{-14}\text{C}$.
93. A circuit has one ideal battery of 12 V and two resistances of equal value of 20 kOhms connected in parallel. The current through the battery is
(A) 0.3mA (B) 0.6mA (C) 1.2mA (D) 2.4mA
94. The significance of built-in potential in a p-n junction diode is to
(A) oppose the flow of holes and electrons across the junction.
(B) mobilise the flow of holes and electrons across the junction.
(C) oppose the flow of electrons only.
(D) oppose the flow of holes only.
95. In a half-wave rectifier the most significant component of ripple voltage is:
(A) the fundamental frequency.
(B) the second harmonic.
(C) the DC component.
(D) both the fundamental and the second harmonic frequencies.
96. The SI unit of Power, called Watt (W) is
(A) 1 kg.m/s^3 . (B) $1 \text{ kg.m}^2/\text{s}$. (C) $1 \text{ kg.m}^2/\text{s}^2$. (D) $1 \text{ kg.m}^2/\text{s}^3$.

97. The position of a particle moving along the x axis is given by $x = 7.8 + 9.2t - 2.1t^3$, with x in meters and t in seconds. The velocity of the particle at $t = 3.5$ s is
- (A) 68 m/s. (B) -68 m/s. (C) -60 m/s. (D) 58 m/s.
98. The speed at which a ball must be thrown vertically upward from ground level to rise to a maximum height of 50m is
- (A) 31m/s. (B) 30m/s. (C) 29m/s. (D) 28m/s.
99. A helicopter lifts a 72kg astronaut 15m vertically from the ocean by means of a cable. The acceleration of the astronaut is $g/10$. The work done on the astronaut by the force from the helicopter and the gravitational force are respectively
- (A) 11kJ and -11kJ. (B) -12kJ and 11kJ.
(C) 12kJ and -11kJ. (D) 10kJ and -11kJ.
100. A ball of mass M rotates in a circular path of radius r with linear velocity v . The force acting on the ball is given by
- (A) Mv^2/r acting away from the center of circular path.
(B) Mv^2/r acting towards the center of circular path.
(C) Mv/r acting towards the center of circular path.
(D) Mv/r acting away from the center of circular path.