BITSAT 2011 Question Paper PDF

Time Allowed :3 Hours	Maximum Marks :450	Total Questions :150

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The question paper contains a total of 150 questions divided into four parts:
   Part I: Physics (Questions 1 to 40)
   Part II: Chemistry (Questions 41 to 80)
   Part III: Mathematics (Questions 81 to 125)
   Part IV: (A) English Proficiency (Questions 126 to 140)
   (B) Logical Reasoning (Questions 141 to 150)
2. All questions are multiple-choice with four options, and only one of them is correct.
3. Each correct answer is awarded 3 marks and -1 for each incorrect answer.
4. The duration of the paper is 3 hours.

Part I: Physics

1. A passenger in an open car travelling at 30 m/s throws a ball out over the bonnet. Relative to the car, the initial velocity of the ball is 20 m/s at 60° to the horizontal. The angle of projection of the ball with respect to the horizontal road will be:
(1) $\tan^{-1}\left(\frac{2}{3}\right)$
(2) $\tan^{-1}\left(\frac{\sqrt{3}}{4}\right)$
(3) $\tan^{-1}\left(\frac{4}{\sqrt{3}}\right)$
(4) $\tan^{-1}\left(\frac{3}{4}\right)$

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2. A particle is moving in a straight line with initial velocity and uniform acceleration. If the sum of the distance travelled in t^{th} and $(t+1)^{\text{th}}$ seconds is 100 cm, then its velocity after t seconds, in cm/s, is:
(1) 80
(2) 50
(3) 20
(4) 30

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3. The two vectors $\vec{A}$ and $\vec{B}$ are drawn from a common point and $\vec{C} = \vec{A} + \vec{B}$. The angle between $\vec{A}$ and $\vec{B}$ is:
(1) 90° if $C^2 = A^2 + B^2$
(2) greater than 90° if $C^2 < A^2 + B^2$

(3) greater than 90° if $C^2 > A^2 + B^2$
(4) less than 90° if $C^2 > A^2 + B^2$
Correct options are —
(a) 1, 2 (b) 1, 2, 3, 4 (c) 2, 3, 4 (d) 1, 2, 4

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4. If $T = 2\pi\sqrt{\frac{ML^3}{3Yq}}$, then find the dimensions of q. Where T is the time period of a bar of mass M, length L, and Young's modulus Y.
(1) $[L]$
(2) $[L^2]$
(3) $[L^4]$
(4) $[L^3]$

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5. An object experiences a net force and accelerates from rest to its final position in 16 s. How long would the object take to reach the same final position from rest if the object's mass was four times larger?
(1) 64 s
(2) 32 s
(3) 16 s
(4) 8 s

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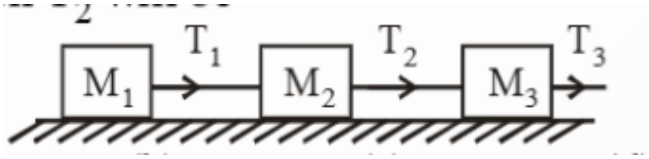
6. Three blocks of masses $m_1, m_2,$ and m_3 are connected by massless strings on a frictionless table and pulled by a force $T_3 = 40$ N. If $m_1 = 10$ kg, $m_2 = 6$ kg, and $m_3 = 4$ kg, the tension T_2 will be:



(1) 20 N
(2) 40 N
(3) 10 N
(4) 32 N

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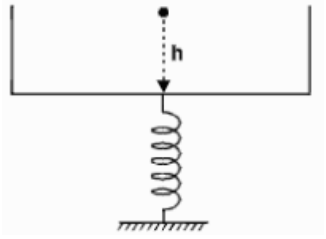
7. A massless platform is kept on a light elastic spring. When a sand particle of mass 0.1 kg is dropped from a height of 0.24 m, the spring compresses by 0.01 m. From what height should the particle be dropped to cause a compression of 0.04 m?



(1) 3.96 m

(2) 0.396 m
(3) 4 m
(4) 0.4 m

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8. A constant torque of 31.4 N-m is exerted on a pivoted wheel. If angular acceleration of wheel is 4 rad s^{-2}, then the moment of inertia of the wheel is:
(1) 2.5 kg m^2
(2) 3.5 kg m^2
(3) 4.5 kg m^2
(4) 5.5 kg m^2

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9. A man of mass m starts falling towards a planet of mass M and radius R. Inside the planet, which consists of a spherical shell of mass $2M/3$ and a point mass $M/3$ at centre, the change in gravitational force experienced by the man is:
(1) $\frac{2GMm}{3R^2}$
(2) 0
(3) $\frac{GMm}{3R^2}$
(4) $\frac{4GMm}{3R^2}$

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10. A geo-stationary satellite is one which:
(1) remains stationary at a fixed height from Earth's surface
(2) revolves like other satellites but in opposite direction of Earth's rotation
(3) revolves round Earth at a suitable height with same angular velocity and same direction as Earth
(4) None of these

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11. Two wires of same material and same volume have cross-sectional areas A and $2A$. If the first wire is elongated by Δx under force F, the force required to stretch the second wire by the same amount is:
(1) $4F$
(2) $6F$
(3) $9F$
(4) F

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12. An iron rod of length 2 m and cross-sectional area 50 mm^2 is stretched by 0.5 mm by hanging a mass of 250 kg. The Young's modulus of iron is:
(1) 19.6×10^{10} N/m^2
(2) 19.6×10^{18} N/m^2

(3) 19.6×10^{11} N/m^2
(4) 19.6×10^{15} N/m^2

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13. Viscosity is the property of a liquid due to which it:
(1) occupies minimum surface area
(2) opposes relative motion between adjacent layers
(3) becomes spherical in shape
(4) tends to regain its deformed position

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14. The radiation emitted by a perfectly black body is proportional to:
(1) temperature
(2) fourth root of temperature
(3) fourth power of temperature
(4) square of temperature

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15. A copper sphere cools from 62°C to 50°C in 10 minutes and to 42°C in next 10 minutes. Calculate the temperature of surroundings.
(1) 18.01°C
(2) 26°C
(3) 10.6°C
(4) 20°C

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16. An air bubble of volume v_0 is released by a fish at depth h in a lake. The volume of bubble just before reaching the surface will be:
(1) v_0
(2) $v_0 \frac{\rho g h}{p}$
(3) $\frac{v_0}{1+\rho g h/p}$
(4) $v_0 \left(1 + \frac{\rho g h}{p}\right)$

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17. The molecules of a gas have rms velocity 200 m/s at 27°C. Find rms velocity at 127°C if pressure is constant.
(1) $\frac{400}{\sqrt{3}}$
(2) $100\sqrt{2}$
(3) $\frac{100\sqrt{2}}{3}$
(4) $\frac{100}{3}$

---

18. Which of the following expressions corresponds to simple harmonic motion

along a straight line, where x is displacement and a, b, c are positive constants?
(1) $a + bx - cx^2$
(2) bx^2
(3) $a - bx + cx^2$
(4) $-bx$

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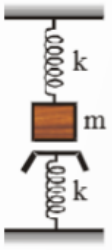
19. A mass m is suspended from a spring of force constant k and another identical spring is fixed to the floor as shown. The time period of small oscillations is:



(1) $2\pi\sqrt{\frac{m}{k}}$
(2) $\pi\sqrt{\frac{m}{k}} + \pi\sqrt{\frac{m}{2k}}$
(3) $\pi\sqrt{\frac{m}{3k/2}}$
(4) $\pi\sqrt{\frac{m}{k}} + \pi\sqrt{\frac{m}{2k}}$

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20. The fundamental frequency of an open organ pipe is 300 Hz. The first overtone of this pipe has the same frequency as the first overtone of a closed organ pipe. If the speed of sound is 330 m/s, then the length of the closed organ pipe is:
(1) 41 cm
(2) 37 cm
(3) 31 cm
(4) 80 cm

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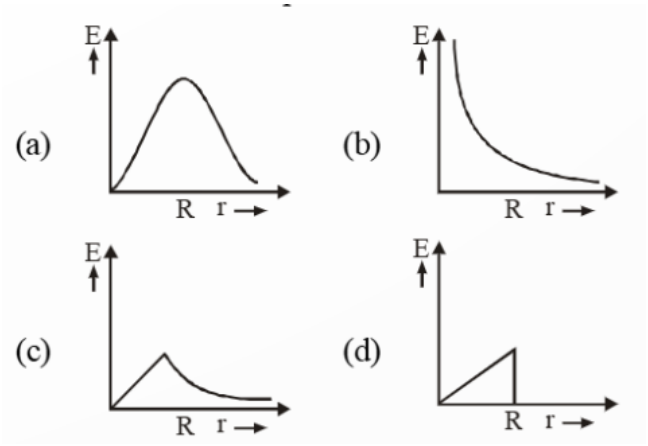
21. In a uniformly charged sphere of total charge Q and radius R, the electric field E is plotted as a function of distance r from the centre. Which graph correctly represents this variation?



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22. A charge Q_1 exerts some force on a second charge Q_2. If a third charge Q_3 is brought near, then the force exerted on Q_2 will:

(1) increase
(2) decrease
(3) remain unchanged
(4) increase if Q_3 has same sign as Q_1

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23. A hollow metal sphere of radius 5 cm is charged such that the potential at its surface is 10 V. The potential at a distance of 2 cm from the centre of the sphere is:

(1) zero
(2) 10 V
(3) 4 V
(4) $\frac{10}{3}$ V

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24. If the potential of a capacitor of capacity 6 F is increased from 10 V to 20 V, the increase in its energy will be:

(1) 4×10^{-4} J
(2) 4×10^{-6} J
(3) 9×10^{-4} J
(4) 12×10^{-6} J

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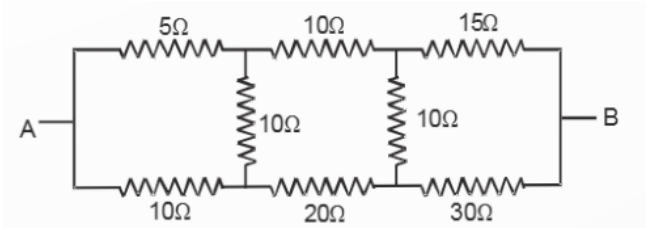
25. Calculate the effective resistance between points A and B in the given electrical network.



(1) 5 Ω
(2) 10 Ω
(3) 20 Ω
(4) 30 Ω

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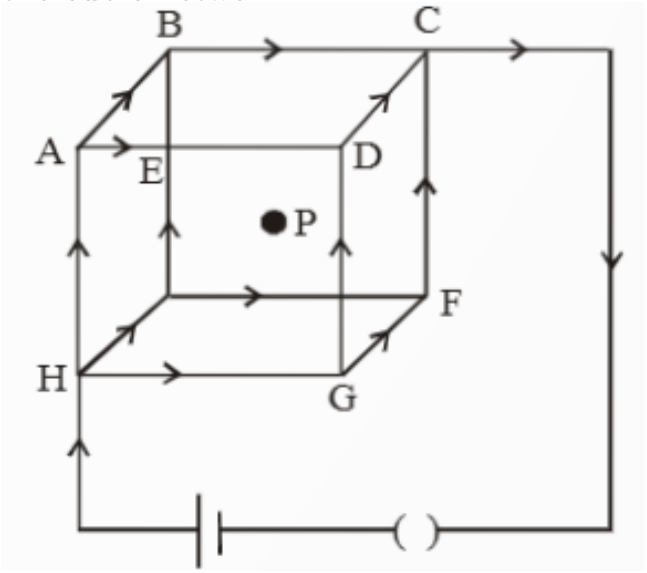
26. A steady current is set up in a cubic network composed of wires of equal resistance and length as shown. What is the magnetic field at the centre P due to the cubic network?



(1) $\frac{\mu_0 2I}{4\pi d}$
(2) $\frac{\mu_0 2I}{4\pi\sqrt{2}d}$
(3) 0
(4) $\frac{\mu_0 6\pi I}{4\pi d}$

---

27. If $\vec{M}$ is the magnetic moment and $\vec{B}$ is the magnetic field, the torque acting on the magnetic dipole is given by:
(1) $\vec{M} \cdot \vec{B}$
(2) $\frac{|\vec{M}|}{|\vec{B}|}$
(3) $\vec{M} \times \vec{B}$
(4) $|\vec{M}||\vec{B}|$

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28. A metal rod of length 1 m is rotated about one of its ends in a plane perpendicular to a magnetic field of induction 2.5×10^{-3} Wb/m^2. If it makes 1800 revolutions per minute, calculate the emf induced between its ends.
(1) 2.471 V
(2) 3.171 V

(3) 0.471 V
(4) 1.771 V

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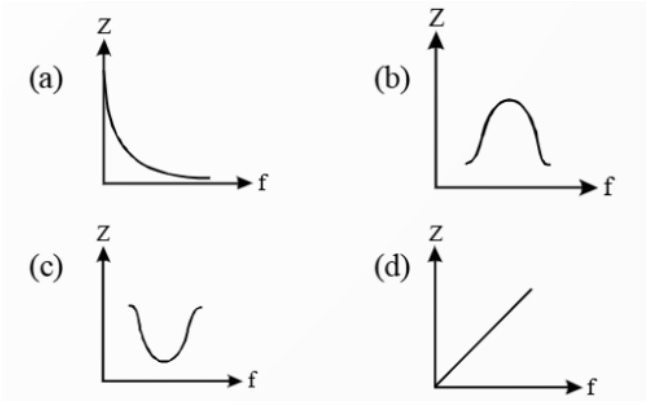
29. Which one of the following curves represents the variation of impedance Z with frequency f in a series LCR circuit?



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30. An electromagnetic wave passes through space and its equation is given by $E = E_0 \sin(\omega t - kx)$. The energy density of the electromagnetic wave in space is:
(1) $\frac{1}{2}\varepsilon_0 E_0^2$
(2) $\frac{1}{4}\varepsilon_0 E_0^2$
(3) $\varepsilon_0 E_0^2$
(4) $2\varepsilon_0 E_0^2$

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31. A thin convergent glass lens ($\mu_g = 1.5$) has a power of +5.0 D. When this lens is immersed in a liquid of refractive index μ, it acts as a divergent lens of focal length 100 cm. The value of μ must be:
(1) $\frac{4}{3}$
(2) $\frac{5}{3}$
(3) $\frac{5}{4}$
(4) $\frac{6}{5}$

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32. A vessel of depth d is half-filled with a liquid of refractive index μ_1 and the upper half with a liquid of refractive index μ_2. The apparent depth of the vessel seen perpendicularly is:
(1) $d\frac{\mu_1\mu_2}{\mu_1+\mu_2}$
(2) $d\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}\right)$
(3) $2d\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}\right)$
(4) $2d\left(\frac{1}{\mu_1\mu_2}\right)$

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33. If the distance between first maxima and fifth minima of a double slit pattern is 7 mm and the slits are separated by 0.15 mm with the screen 50 cm away, the wavelength of light used is:
(1) 200 nm
(2) 100 nm
(3) 800 nm
(4) 600 nm

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34. If the energy of a photon is 10 eV, its momentum is:
(1) 5.33×10^{-23} kg m/s
(2) 5.33×10^{-25} kg m/s
(3) 5.33×10^{-29} kg m/s
(4) 5.33×10^{-27} kg m/s

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35. The energies of energy levels A, B and C are $E_A < E_B < E_C$. If the radiations of wavelengths $\lambda_1, \lambda_2, \lambda_3$ are emitted due to transitions C to B, B to A and C to A respectively, then which relation is correct?
(1) $\lambda_1 + \lambda_2 = \lambda_3$
(2) $\lambda_3 = \lambda_1 + \lambda_2$
(3) $\lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$
(4) $\lambda_3^{-1} = \lambda_1^{-1} + \lambda_2^{-1}$

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36. Which one is correct about fission?
(1) Approximately 0.1% mass converts into energy
(2) Most energy of fission is in heat form
(3) 200 eV energy is released in U-235 fission
(4) One neutron is released per fission

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37. The output of an OR gate is connected to both inputs of a NAND gate. The combination serves as:
(1) NOT gate
(2) NOR gate
(3) AND gate
(4) OR gate

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38. In a semiconductor diode, the barrier potential offers opposition to:
(1) holes in P-region only
(2) free electrons in N-region only
(3) majority carriers in both regions

(4) minority carriers in both regions

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39. An electron in a hydrogen-like atom is in an excited state. It has total energy of -3.4 eV. The kinetic energy and de-Broglie wavelength respectively are:
(1) 3.4 eV, 0.66 nm
(2) -3.4 eV, 1.99 nm
(3) 2.8 eV, 2.38 nm
(4) 1.1 eV, 1.28 nm

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40. Light of wavelength 180 nm ejects photoelectrons from a metal plate of work function 2 eV. If a magnetic field of 5×10^{-3} T is applied parallel to the plate, the radius of the path followed by electrons ejected normally with maximum energy is:
(1) 1.239 m
(2) 0.149 m
(3) 3.182 m
(4) 2.33 m

Part II: Chemistry

41. The product of atomic weight and specific heat of an element is a constant, approximately 6.4. This law is known as:
(1) Dalton's law
(2) Newton's law
(3) Dulong Petit law
(4) Avogadro's law

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42. 1.520 g of hydroxide of a metal on ignition gave 0.995 g of oxide. The equivalent weight of the metal is:
(1) 1.52
(2) 0.995
(3) 190
(4) 9

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43. The correct order of radii is:
(1) N ¡ Be ¡ B
(2) F ¡ O^2 ¡ N^3
(3) Na ¡ Li ¡ K
(4) Fe^{3+} ¡ Fe^{2+} ¡ Fe^{4+}

44. Beryllium and aluminium exhibit similar properties, but the two elements differ in:
(1) forming covalent halides
(2) forming polymeric hydrides
(3) exhibiting maximum covalency in compounds
(4) exhibiting amphoteric nature in their oxides

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45. Among Al_2O_3, SiO_2, P_2O_3 and SO_2 the correct order of acidic strength is:
(1) Al_2O_3 ¡ SiO_2 ¡ SO_2 ¡ P_2O_3
(2) SiO_2 ¡ SO_2 ¡ Al_2O_3 ¡ P_2O_3
(3) SO_2 ¡ P_2O_3 ¡ SiO_2 ¡ Al_2O_3
(4) Al_2O_3 ¡ SiO_2 ¡ P_2O_3 ¡ SO_2

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46. A bonded molecule MX_5 is T-shaped. The number of non-bonded pair of electrons is:
(1) 0
(2) 2
(3) 1
(4) cannot be predicted

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47. The correct bond order in the following species is:
(1) O_2^{2-} ¡ O_2 ¡ O_2^+
(2) O_2^+ ¡ O_2 ¡ O_2^{2-}
(3) O_2^{2-} ¡ O_2^+ ¡ O_2
(4) O_2^+ ¡ O_2^{2-} ¡ O_2

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48. What is the free energy change, ΔG, when 1.0 mole of water at 100°C and 1 atm pressure is converted into steam at 100°C and 1 atm pressure?
(1) 540 cal
(2) –9800 cal
(3) 9800 cal
(4) 0 cal

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49. H_2S gas when passed through a solution containing HCl precipitates cations of second group of qualitative analysis but not those of fourth group. It is because:
(1) presence of HCl decreases sulphide ion concentration
(2) solubility product of group II sulphides is more than that of group IV
(3) presence of HCl increases sulphide ion concentration

(4) sulphides of group IV cations are unstable

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50. The pH of a solution is increased from 3 to 6; its H^+ ion concentration will be:
(1) reduced to half
(2) doubled
(3) reduced by 1000 times
(4) increased by 1000 times

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51. A gas X at 1 atm is bubbled through a solution containing a mixture of 1 M Y^- and 1 M Z^+ at 25°C. If reduction potential is Z ¿ Y ¿ X, then:
(1) Y will oxidise X and not Z
(2) Y will oxidise Z and not X
(3) Y will oxidise both X and Z
(4) Y will reduce both X and Z

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52. When a crystal of caustic soda is exposed to air, a liquid layer is deposited because:
(1) crystal loses water
(2) crystal absorbs moisture and CO_2
(3) crystal melts
(4) crystal sublimes

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53. Which of the following compound is not chiral?
(1) $CH_2CH_2CH_2Cl$
(2) CH_3CHDCH_2Cl
(3) $CH_3CHClCH_2D$
(4) CH_3CH_2CHDCl

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54. C_6H_5CN and C_6H_5NC exhibit which type of isomerism?
(1) Position
(2) Functional
(3) Metamerism
(4) Position isomerism

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55. The correct nucleophilicity order is:
(1) CH_3^- ¡ NH_2^- ¡ HO^- ¡ F^-
(2) CH_3^- ¡ NH_2^- ¿ HO^- ¿ F^-
(3) CH_3^- ¿ NH_2^- ¿ HO^- ¿ F^-

(4) NH_2^- ¿ F^- ¿ HO^- ¿ CH_3^-

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56. In the anion $HCOO^-$, the two carbon-oxygen bonds are found to be of equal length. What is the reason for it?
(1) C=O bond is weaker than C–O bond
(2) the anion has two resonating structures
(3) the anion is obtained by removal of proton
(4) carbon orbitals are hybridised

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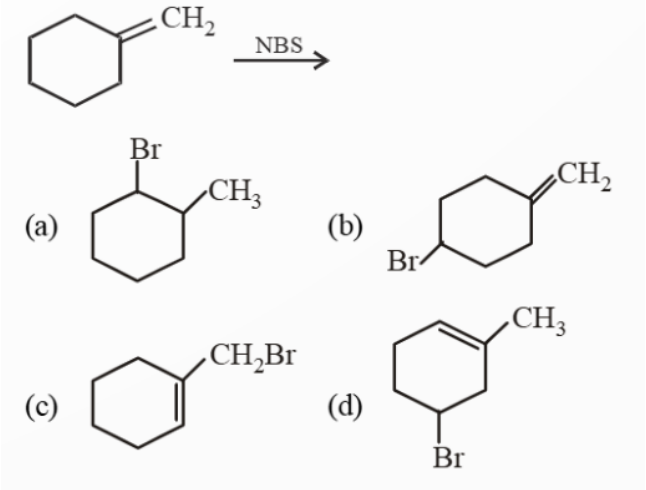
57. What will be the product in the following reaction?



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58. The fraction of total volume occupied by the atoms present in a simple cube is:
(1) $\frac{\pi}{3\sqrt{2}}$
(2) $\frac{\pi}{4\sqrt{2}}$
(3) $\frac{\pi}{4}$
(4) $\frac{\pi}{6}$

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59. 1.00 g of a non-electrolyte solute (molar mass 250 g mol^{-1}) was dissolved in 51.2 g of benzene. If the freezing point depression constant K_f of benzene is 5.12 K kg mol^{-1}, the freezing point of benzene will be lowered by:
(1) 0.3 K
(2) 0.5 K
(3) 0.4 K
(4) 0.2 K

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60. The number of coulombs required for the deposition of 108 g of silver is:
(1) 96500
(2) 48250
(3) 193000
(4) 100000

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61. During the kinetic study of the reaction $2A + B \rightarrow C + D$, the following results were obtained. Based on the data, which rate law is correct?
(1) rate $= k[A]^2[B]$
(2) rate $= k[A][B]^2$
(3) rate $= k[A]^2[B]^2$
(4) rate $= k[A][B]$

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62. Position of non-polar and polar part in micelle is:
(1) polar at outer surface and non-polar at inner surface
(2) polar at inner surface and non-polar at outer surface
(3) distributed all over the surface
(4) present on the surface only

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63. For adsorption of a gas on a solid, the plot of $\log x/m$ vs $\log P$ is linear with slope equal to (n being whole number):
(1) k
(2) $\log k$
(3) n
(4) $\frac{1}{n}$

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64. Calcination is used in metallurgy for removal of:
(1) water and sulphide
(2) water and CO_2
(3) CO_2 and H_2S
(4) H_2O and H_2S

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65. Phosphine is not obtained by the reaction:
(1) White P is heated with NaOH
(2) Red P is heated with NaOH
(3) Ca_3P_2 reacts with water
(4) Phosphorus trioxide is boiled with water

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66. Which of the following halides is not oxidized by MnO_2?
(1) F^-
(2) Cl^-
(3) Br^-
(4) I^-

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67. Which of the following exhibits only +3 oxidation state?
(1) U
(2) Th
(3) Ac
(4) Pa

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68. Which of the following pairs has the same size?
(1) Fe^{2+}, Ni^{2+}
(2) Zr^{4+}, Ti^{4+}
(3) Zr^{4+}, Hf^{4+}
(4) Zn^{2+}, Hf^{4+}

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69. Which of the following is not considered as an organometallic compound?
(1) cis-platin
(2) Ferrocene
(3) Zeise's salt
(4) Grignard reagent

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70. The most stable ion is:
(1) $[Fe(OH)_3]$
(2) $[FeCl_6]^{3-}$
(3) $[Fe(CN)_6]^{3-}$
(4) $[Fe(H_2O)_6]^{3+}$

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71. A is an optically inactive alkyl chloride which on reaction with aqueous KOH gives B. On heating with Cu at 300°C gives alkene C. What are A and C?
(1) CH_3CH_2Cl, $CH_2{=}CH_2$
(2) Me_3CCl, MeCH=CHMe
(3) Me_3CCl, $Me_2C{=}CH_2$
(4) Me_2CHCH_2Cl, $Me_2C{=}CH_2$

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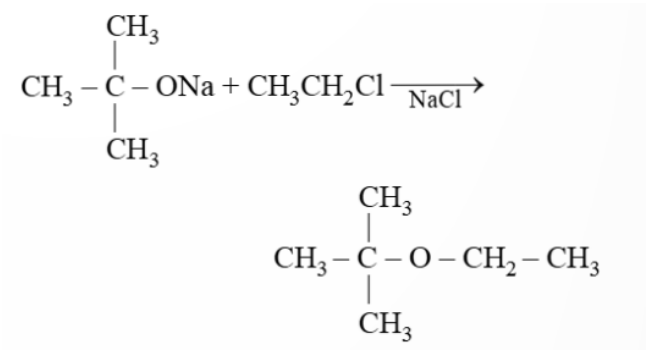
72. The reaction shown is called:



(1) Williamson continuous etherification process
(2) Etard reaction
(3) Gattermann-Koch reaction
(4) Williamson synthesis

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73. Which of the following esters cannot undergo Claisen self-condensation?
(1) $CH_3CH_2CH_2COOC_2H_5$
(2) $C_6H_5COOC_2H_5$
(3) $C_6H_{11}CH_2COOC_2H_5$
(4) $C_6H_5CH_2COOC_2H_5$

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74. Schotten–Baumann reaction is a reaction of phenols with:
(1) benzoyl chloride and sodium hydroxide
(2) acetyl chloride and sodium hydroxide
(3) salicylic acid and conc. H_2SO_4
(4) acetyl chloride and conc. H_2SO_4

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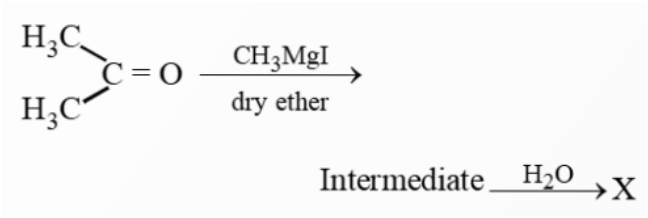
75. Identify X in the following reaction:



(1) CH_3OH
(2) Ethyl alcohol
(3) Methyl cyanide
(4) tert-Butyl alcohol

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76. The reagent(s) which can be used to distinguish acetophenone from benzophenone is (are):
(1) 2,4-dinitrophenylhydrazine

(2) aqueous sodium bisulphite
(3) Benedict reagent
(4) I_2 and NaOH

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77. Aniline reacts with nitrous acid to produce:
(1) phenol
(2) nitrobenzene
(3) chlorobenzene
(4) benzene diazonium chloride

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78. The structural feature which distinguishes proline from natural α-amino acids is:
(1) Proline is optically inactive
(2) Proline contains aromatic group
(3) Proline is a dicarboxylic acid
(4) Proline is a secondary amine

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79. Which of the following cannot give iodometric titration?
(1) Fe^{3+}
(2) Cu^{2+}
(3) Pb^{2+}
(4) Ag^{2+}

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80. Acetaldehyde and acetone can be distinguished by:
(1) Iodoform test
(2) Nitroprusside test
(3) Fehling's solution test
(4) C & P test

Part III: Mathematics

81. If $f(x)$ is a function that is odd and even simultaneously, then $f(3) - f(2)$ is equal to:
(1) 1
(2) 1
(3) 0
(4) None of these

---

82. If $\tan A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$, then find the value of $A + B$.
(1) π
(2) $\frac{\pi}{2}$
(3) $\frac{\pi}{4}$
(4) $-\frac{\pi}{4}$

---

83. If $\sin\theta = -\frac{1}{2}$ and $\tan\theta = \frac{1}{\sqrt{3}}$, then θ is equal to:
(1) $2\pi + \frac{\pi}{6}$
(2) $2\pi + \frac{11\pi}{6}$
(3) $2\pi + \frac{7\pi}{6}$
(4) $2\pi + \frac{\pi}{4}$

---

84. $\dfrac{\cos\theta}{1-\tan\theta} + \dfrac{\sin\theta}{1-\cot\theta}$ is equal to:
(1) $\sin\theta - \cos\theta$
(2) $\sin\theta + \cos\theta$
(3) $\tan\theta + \cot\theta$
(4) $\tan\theta - \cot\theta$

---

85. For $n \in \mathbb{N}$, $x^{n+1} + (x+1)^{2n-1}$ is divisible by:
(1) x
(2) $x + 1$
(3) $x^2 + x + 1$
(4) $x^2 - x + 1$

---

86. If α, β are the roots of the equation $ax^2 + bx + c = 0$, then the roots of the equation $ax^2 + bx(x+1) + c(x+1)^2 = 0$ are:
(1) $\alpha - 1, \beta - 1$
(2) $\alpha + 1, \beta + 1$
(3) $\frac{\alpha}{\alpha-1}, \frac{\beta}{\beta-1}$
(4) $\frac{\alpha}{1-\alpha}, \frac{\beta}{1-\beta}$

---

87. If $a > 0$, $a \in \mathbb{R}$, $z = a + 2i$ and $|z| = -az + 1$, then:
(1) z is always a positive real number
(2) z is always a negative real number
(3) z is purely imaginary number
(4) such a complex z does not exist

---

88. Which of the following is not a vertex of the positive region bounded by the inequalities $2x + 3y \leq 6$, $3x + 3y \leq 15$ and $x, y \geq 0$?
(1) (0,2)
(2) (3,0)
(3) (0,0)
(4) None of these

---

89. If ${}^{20}C_r = {}^{20}C_{r-10}$, then ${}^{15}C_r$ is equal to:
(1) 4896
(2) 816
(3) 1632
(4) None of these

---

90. The term independent of x in the expansion of $\left(9x - \frac{1}{\sqrt[3]{x}}\right)^{18}$, $x > 0$, is a times the corresponding binomial coefficient. Then a is:
(1) 3
(2) $\frac{1}{3}$
(3) $\frac{1}{3}$
(4) None of these

---

91. In the binomial $(2^{1/3}+3^{-1/3})^n$, if the ratio of the seventh term from the beginning to the seventh term from the end is $1/6$, then n is equal to:
(1) 6
(2) 9
(3) 12
(4) 15

---

92. If p, q, r are the n^{th}, q^{th} terms of H.P. and are u, v, w respectively, then the value of the expression $(q - r)v + (r - p)w + (p - q)u$ is:
(1) 2
(2) 0
(3) 4
(4) 8

---

93. If the sum of the first 2n terms of 2, 5, 8, ... is equal to the sum of the first n terms of 57, 59, 61, ..., then n is equal to:
(1) 10
(2) 12

(3) 11
(4) 13

---

94. The distance of the point $(-1, 1)$ from the line $2(x + 6) - 5(y - 2) = 0$ is:
(1) 2
(2) 3
(3) 4
(4) 5

---

95. The family of straight lines $(2a + 3b)x + (a - b)y + 2a - 4b = 0$ is concurrent at the point:
(1) $\left(\frac{2}{5}, -\frac{14}{5}\right)$
(2) $\left(-\frac{2}{5}, -\frac{14}{5}\right)$
(3) $\left(-\frac{2}{5}, \frac{14}{5}\right)$
(4) $\left(\frac{2}{5}, \frac{14}{5}\right)$

---

96. The length of the latus-rectum of the parabola whose focus is $\left(\frac{u^2}{2g}\sin 2\alpha, -\frac{u^2}{2g}\cos 2\alpha\right)$ and directrix is $y = \frac{u^2}{2g}$, is:
(1) $\frac{u^2}{g}\cos^2\alpha$
(2) $\frac{u^2}{g}\cos 2\alpha$
(3) $\frac{2u^2}{g}\cos^2 2\alpha$
(4) $\frac{2u^2}{g}\cos^2\alpha$

---

97. The equation of the ellipse with focus at $(\pm 5, 0)$ and eccentricity $= \frac{5}{6}$ is:
(1) $\frac{x^2}{36} + \frac{y^2}{25} = 1$
(2) $\frac{x^2}{36} + \frac{y^2}{11} = 1$
(3) $\frac{x^2}{25} + \frac{y^2}{11} = 1$
(4) None of these

---

98. For what value of k do the circles $x^2+y^2+5x+3y+7 = 0$ and $x^2+y^2-8x+6y+k = 0$ cut orthogonally?
(1) 16
(2) 18
(3) 13
(4) 10

99. If the lines $3x - 4y + 4 = 0$ and $6x - 5y - 7 = 0$ are tangents then the radius of the circle is:
(1) $\frac{3}{2}$
(2) $\frac{3}{4}$
(3) $\frac{1}{10}$
(4) $\frac{1}{20}$

---

100. Evaluate $\lim_{x\to\infty} \frac{\sqrt{1+\sin 3x}-1}{\ln(1+\tan 2x)}$.
(1) 1/2
(2) 3/2
(3) 3/4
(4) 1/4

---

101. Negation of "Paris is in France and London is in England" is:
(1) Paris is in England and London is in France
(2) Paris is not in France or London is not in England
(3) Paris is in England or London is in France
(4) None of these

---

102. Find the A.M. of the first ten odd numbers.
(1) 10
(2) 20
(3) 15
(4) 25

---

103. If A and B are mutually exclusive events and if $P(B) = \frac{1}{3}$, $P(A \cup B) = \frac{13}{21}$, then $P(A)$ is equal to:
(1) 17/21
(2) 4/7
(3) 2/7
(4) 5/7

---

104. A die is loaded such that the probability of throwing the number is proportional to its reciprocal. The probability that 3 appears in a single throw is:
(1) 3/22
(2) 3/11
(3) 9/22

(4) None of these

---

105. If $f(x) = \begin{cases} x, & x \textbf{ rational} \\ 1-x, & x \textbf{ irrational} \end{cases}$ **then** $f(f(x))$ **is equal to:**

(1) 1
(2) x
(3) 1+x
(4) None of these

---

106. If $f(x) = \frac{1-x}{1+x}$**, the domain of** $f^{-1}(x)$ **is:**
(1) $\mathbb{R}$
(2) $\mathbb{R} - \{-1\}$
(3) $(-\infty, -1)$
(4) $(-1, \infty)$

---

107. The value of $\sin\left(4\tan^{-1}\frac{1}{3}\right) - \cos\left(2\tan^{-1}\frac{1}{3}\right)$ **is:**
(1) 3/7
(2) 7/8
(3) 8/21
(4) None of these

---

108. The matrix $A^2 + 4A - 5I$**, where** I **is identity matrix and** $A = \begin{bmatrix} 1 & 2 \\ 4 & -3 \end{bmatrix}$**, equals:**

(1) $4\begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix}$
(2) $4\begin{bmatrix} 0 & -1 \\ 2 & 2 \end{bmatrix}$
(3) $32\begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix}$
(4) $32\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

---

109. If $A = \begin{bmatrix} 2 & 0 & 0 \\ 2 & 2 & 0 \\ 2 & 2 & 2 \end{bmatrix}$**, then** $\det(\textbf{adj } A)$ **is equal to:**

(1) $8\begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$

(2) $16\begin{bmatrix}1 & 0 & 0\\ 1 & 1 & 0\\ 1 & 1 & 1\end{bmatrix}$
(3) $64\begin{bmatrix}1 & 0 & 0\\ 1 & 1 & 0\\ 1 & 1 & 1\end{bmatrix}$
(4) None of these

---

110. If $y = x^{x^2}$, then $\dfrac{dy}{dx}$ is equal to:
(1) $2\ln x$
(2) $2\ln x + 1$
(3) $(\ln x + 1)x^{x^2}$
(4) None of these

---

111. The function $f(x) = (x-1)\sqrt{|x|}$ is at $x = 1$:
(1) discontinuous
(2) continuous but not differentiable
(3) differentiable with $f'(1) = 0$
(4) differentiable with $f'(1) \neq 0$

---

112. The function $f(x) = \sin x - kx - c$, where k and c are constants, decreases always when:
(1) $k > 1$
(2) $k \geq 1$
(3) $k < 1$
(4) $k \leq 1$

---

113. The minimum value of $f(x) = \sin^4 x + \cos^4 x$ in the interval $\left(0, \frac{\pi}{2}\right)$ is:
(1) $\frac{1}{2}$
(2) 2
(3) $\sqrt{2}$
(4) 1

---

114. The curve $y - e^x + x = 0$ has a vertical tangent at:
(1) (1,1)
(2) (1,0)
(3) (0,1)
(4) no point

115. The function $f(x) = 2x^3 - 3x^2 - 12x + 4$ has:
(1) two points of local maxima
(2) two points of local minima
(3) one maxima and one minima
(4) no maxima or minima

---

116. Evaluate $\int \frac{x^2}{x^2-1}dx$.
(1) $x - \frac{1}{2}\ln\left|\frac{x-1}{x+1}\right| + C$
(2) $x + \frac{1}{2}\ln\left|\frac{x+1}{x-1}\right| + C$
(3) $x + \frac{1}{2}\ln\left|\frac{x-1}{x+1}\right| + C$
(4) None of these

---

117. Find the value of $\int_0^{\frac{4\pi}{3}} |\sin x|\, dx$.
(1) 4
(2) 2
(3) 3
(4) 1

---

118. Let $I_1 = \int_0^2 \frac{1}{\sqrt{1+x^2}}dx$ and $I_2 = \int_0^2 \frac{1}{x}dx$, then:
(1) $I_1 > I_2$
(2) $I_2 > I_1$
(3) $I_1 = I_2$
(4) None of these

---

119. What is the area bounded by $y = \tan x$, $y = 0$ and $x = \frac{\pi}{4}$?
(1) $\ln 2$
(2) $\frac{\ln 2}{2}$
(3) $2\ln 2$
(4) None of these

---

120. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + 4 - 3\frac{d^2y}{dx^2} + 5\frac{dy}{dx} = 0$ is:
(1) 1
(2) 2

(3) 3
(4) None of these

---

121. Two vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$. The angle between them is:
(1) 60°
(2) 90°
(3) 180°
(4) 0°

---

122. Given the line $L : \frac{x-1}{3} = \frac{y+1}{2} = \frac{z-3}{-1}$ and the plane $\pi : x - 2y - z = 0$. Of the following assertions, the only one that is always true is:
(1) L is perpendicular to π
(2) L lies in π
(3) L is not parallel to π
(4) None of these

---

123. A ladder rests against a wall so that its top touches the roof of the house. If the ladder makes an angle of $60°$ with the horizontal and height of the house is $6\sqrt{3}$ meters, then the length of the ladder is:
(1) $12\sqrt{3}$
(2) 12
(3) $12/\sqrt{3}$
(4) None of these

---

124. In an equilateral triangle, the inradius, circumradius and one of the ex-radii are in the ratio:
(1) 2:3:5
(2) 1:2:3
(3) 3:7:9
(4) 3:7:9

---

125. The constraints of the L.P. problem given by $x_1 + 2x_2 \leq 2000$, $x_1 + x_2 \leq 1500$ and $x_2 \leq 600$, $x_1, x_2 \geq 0$, which of the following points does not lie in the positive bounded region?
(1) (1000,0)
(2) (0,500)
(3) (2,0)
(4) (2000,0)

Part IV: English

126. I. Although he was innocent, baseless accusations were leveled at him.
II. Despite operated representations from the people, the authorities have failed to take any action.
(1) if there is an error only in the first sentence
(2) if there is an error only in the second sentence
(3) if there are errors in both sentences
(4) if there is no error in either of the sentences

---

127. I deem it as a privilege to address the gathering.
II. Perfection can be achieved with practice.
(1) if there is an error only in the first sentence
(2) if there is an error only in the second sentence
(3) if there are errors in both sentences
(4) if there is no error in either of the sentences

---

128. TURBULENCE
(1) Treachery
(2) Triumph
(3) Commotion
(4) Overflow

---

129. DEFER
(1) Discourage
(2) Minimize
(3) Postpone
(4) Estimate

---

130. ADAGE
(1) Proverb
(2) Youth
(3) Supplement
(4) Hardness

---

131. FRAGRANCE

(1) Aroma
(2) Perfume
(3) Smell
(4) Stink

---

132. PECULIAR
(1) Characteristic
(2) Special
(3) Specific
(4) Universal

---

133. ETERNAL
(1) Momentary
(2) Continual
(3) Everlasting
(4) Endless

---

134. _____ to popular belief that red meat makes humans aggressive, scientists have found that it actually has a calming effect.
(1) Sticking
(2) Similarly
(3) Opposite
(4) Contrary

---

135. From its _____ opening sequence, it is clear that we are in the grip of a delicious new voice, a voice of breathtaking _____.
(1) Imagination
(2) Evocative
(3) Mesmerizing
(4) Resonance

---

136. 1. making ourselves
P. our language
Q. part of growing into
R. Masters of
6. full manhood or womanhood
(1) PSRQ
(2) SQPR
(3) RPSQ

(4) PRSQ

---

137. 1. The very first battle they fought
P. and they had to fall back
Q. across the border
R. was lost
S. letting the enemy
6. enter the country
(1) RQSP
(2) RPSQ
(3) QRPS
(4) QPRS

---

138. 1. A nation
P. the material assets it possesses
Q. is not made by
R. and collective determination
S. but by the will
6. of the people
(1) PQRS
(2) QPSR
(3) RSPQ
(4) SRPQ

---

139. 1. When the Governor
P. the bell had rung
Q. justice should be immediately
R. he ordered that
S. found out why
6. done to the horse
(1) RSPQ
(2) PQSR
(3) SPRQ
(4) SQRP

---

140. 1. When you ponder over
P. that the only hope
Q. you will realize
R. of world peace lies
S. the question deeply
6. in the United Nations

(1) QRSP
(2) SQPR
(3) SQPR
(4) RSPQ

---

141. One of the numbers does not fit into the series. Find the wrong number.
15, 20, 45, 145, 565, 2830
(1) 20
(2) 45
(3) 145
(4) 565

---

142. VWX, BCD, HIJ, ?
(1) NOQ
(2) NOP
(3) MNO
(4) OPQ

---

143. In a code language, if TARGET is coded as 201187520, then the word WILLUM will be coded as:
(1) 239121292113
(2) 239121292113
(3) 239121291213
(4) 239121292213

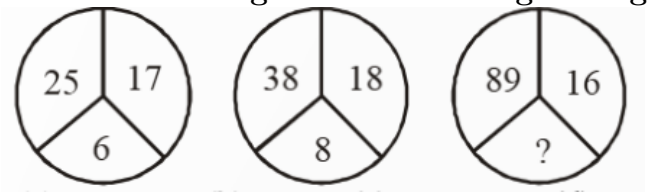
---

144. Sanjay is taller than Suresh but shorter than Rakesh. Rakesh is taller than Harish but shorter than Binit. Who among them is the tallest?
(1) Suresh
(2) Binit
(3) Sanjay
(4) Rakesh

---

145. In a row of 62 persons, Rahul is 36th from left side of the row and Nitesh is 29th from the right side of the row. Find out the number of persons sitting between them.
(1) 1
(2) 2
(3) 3
(4) 4

146. The missing number in the given figure is:



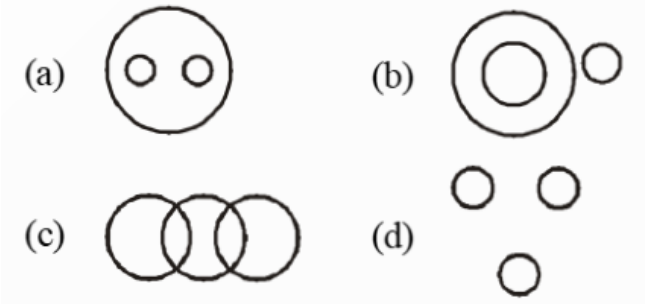
(1) 13
(2) 15
(3) 17
(4) 19

---

147. Select the combination of numbers so that the letters arranged will form a meaningful word.
H N R C A B
1 2 3 4 5 6
(1) 2,5,3,4,1,6
(2) 3,5,6,4,1,2
(3) 4,1,5,6,2,3
(4) 6,3,5,2,4,1

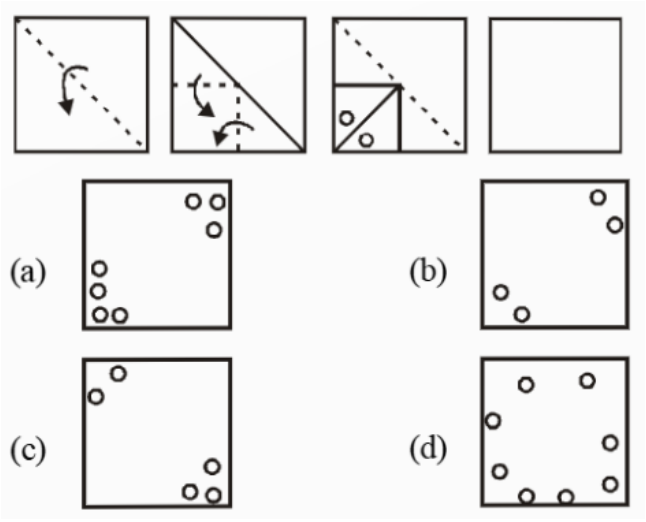
---

148. Which of the given Venn diagrams correctly represents the relationship among Rose, Flower, Lotus?



---

149. A piece of paper is folded and cut as shown. From the given responses indicate how it will appear when opened.



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150. Which answer figure will complete the question figure?