VITEEE 2024 Question Paper

Time Allowed :2 Hour 30 mins	**Maximum Marks :**125	**Total Questions :**125

General Instructions

Read the following instructions very carefully and strictly follow them:

1. This question paper contains total 125 questions divided into four parts :
2. Part I : Physics Q. No - 1 to 35
3. Part II : Chemistry Q. No - 36 to 70
4. Part III : Mathematics Q. No - 71 to 110
5. Part IV : Aptitude Test Q. No - 111 to 120
6. Part V : English Q. No - 121 to 125
7. All questions are multiple choice questions with four options, only one of them is correct.
8. For each correct response, the candidate will get 1 mark.
9. There is no negative marking for the wrong answer.
10. The test is of $2\frac{1}{2}$ hours duration.

Part I: Physics

1. Force between two point charges q_1 and q_2 placed in vacuum at r cm apart is F. Force between them when placed in a medium having dielectric $K = 5$ at $r/5$ cm apart will be:

(a) $\frac{F}{25}$

(b) $5F$

(c) $\frac{F}{5}$

(d) $25F$

---

2. A parallel plate capacitor has 1 μF capacitance. One of its two plates is given $+2\mu C$ charge and the other plate, $+4\mu C$ charge. The potential difference developed across the capacitor is:

(a) 3 V

(b) 1 V

(c) 5 V

(d) 2 V

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3. A body of mass M at rest explodes into three pieces, in the ratio of masses 1:1:2. Two smaller pieces fly off perpendicular to each other with velocities of 30 m/s and 40 m/s respectively. The velocity of the third piece will be:

(a) 15 m/s

(b) 25 m/s

(c) 35 m/s

(d) 50 m/s

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4. A charge particle moving in magnetic field B, has components of velocity along B as well as perpendicular to B. The path of the charge particle will be:

(a) Helical path with the axis perpendicular to the direction of magnetic field B

(b) Straight along the direction of magnetic field B

(c) Helical path with the axis along magnetic field B

(d) Circular path

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5. In meter bridge or Wheatstone bridge for measurement of resistance, the known and the unknown resistance are interchanged. The error so removed is:

(a) End error

(b) Index error

(c) Due to temperature effect

(d) Random error

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6. Spherical insulating ball and a spherical metallic ball of same size and mass are dropped from the same height. Choose the correct statement out of the following (Assume negligible air friction):

(a) Time taken by them to reach the earth's surface will be independent of the properties of their materials

(b) Insulating ball will reach the earth's surface earlier than the metal ball

(c) Both will reach the earth's surface simultaneously

(d) Metal ball will reach the earth's surface earlier than the insulating ball

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7. Two objects A and B are placed at 15 cm and 25 cm from the pole in front of a concave mirror having radius of curvature 40 cm. The distance between images formed by the mirror is:

(a) 60 cm

(b) 40 cm

(c) 160 cm

(d) 100 cm

---

8. A bob of mass m is suspended by a light string of length L. It is imparted a minimum horizontal velocity at the lowest point A such that it just completes half a circle, reaching the topmost position B. The ratio of kinetic energies $\left(\frac{K.E.}{K.E.}\right)_A$ to $\left(\frac{K.E.}{K.E.}\right)_B$ is:

(a) 3:2

(b) 5:1

(c) 2:5

(d) 1:5

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9. For a group of positive charges, which of the following statements is correct?

(a) Net potential of the system cannot be zero at a point, but net electric field can be zero at that point.
(b) Net potential of the system at a point can be zero, but net electric field can't be zero at that point.
(c) Both the net potential and the net electric field can be zero at a point.
(d) Both the net potential and the net electric field cannot be zero at a point.

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10. The work function of a substance is 4.0 eV. The longest wavelength of light that can cause photoelectron emission from this substance is approximately:

(a) 310 nm
(b) 400 nm
(c) 540 nm
(d) 220 nm

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11. Magnetic field at the centre of a circular coil of radius r, through which a current I flows is:

(a) directly proportional to r
(b) inversely proportional to I
(c) directly proportional to I
(d) directly proportional to I^2

---

12. The refractive index μ of the material of a prism is given by:

$$\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

where A is the apex angle of the prism and δ_m is the angle of minimum deviation.

(a) $\delta_m = \pi - 4A$

(b) $\delta_m = \pi - 3A$

(c) $\delta_m = \pi - 2A$

(d) $\delta_m = \pi - A$

---

13. If $\mathrm{A} = 4\hat{i} + 3\hat{j}$ and $\mathrm{B} = 3\hat{i} + 4\hat{j}$, then the cosine of the angle between A and $\mathrm{A} + \mathrm{B}$ is:

(a) $\frac{9\sqrt{2}}{5}$

(b) $\frac{7}{5\sqrt{2}}$

(c) $\frac{5\sqrt{2}}{49}$

(d) $\frac{5\sqrt{2}}{28}$

---

14. Two light beams of intensities in the ratio of 9:4 are allowed to interfere. The ratio of the intensity of maxima and minima will be:

(a) 2:3

(b) 16:81

(c) 25:169

(d) 25:1

---

15. A heavy box of mass 50 kg is moving on a horizontal surface. If the coefficient of kinetic friction between the box and the horizontal surface is 0.3, then the force of kinetic friction is:

(a) 14.7 N

(b) 147 N

(c) 1.47 N

(d) 1470 N

---

16. When unpolarized light is incident at an angle of 60° on a transparent medium from air, the reflected ray is completely polarized. The angle of refraction in the medium is:

(a) 30°

(b) 60°

(c) 90°

(d) 45°

---

17. The waves emitted when a metal target is bombarded with high energy electrons are:

(a) Microwaves

(b) X rays

(c) Infrared rays

(d) Radio waves

---

18. Two bodies of mass 4 g and 25 g are moving with equal kinetic energies. The ratio of magnitude of their linear momentum is:

(a) 3 : 5

(b) 5 : 4

(c) 2 : 5

(d) 4 : 5

---

19. The net electric flux through a closed surface enclosing charges $q, -2q,$ and $+5q$ is given by:

(a) $\frac{5q}{\epsilon_0}$

(b) $\frac{4q}{\epsilon_0}$

(c) $\frac{3q}{\epsilon_0}$

(d) $\frac{q}{\epsilon_0}$

---

20. Mass numbers of two nuclei are in the ratio of 4:3. Their nuclear densities will be in the ratio of:

(a) $4:3$

(b) $\left(\frac{3}{4}\right)^{1/3}$

(c) $1:1$

(d) $\left(\frac{4}{3}\right)^{1/3}$

---

21. Under the same load, wire A having length 5.0 m and cross-section 2.5×10^{-5} **m**^{2} **stretches uniformly by the same amount as another wire B of length 6.0 m and a cross-section** 3.0×10^{-5} **m**^{2} **stretches. The ratio of the Young's modulus of wire A to that of wire B will be:**

(a) 1:4

(b) 1:1

(c) 1:10

(d) 1:2

---

22. A current of 10 A exists in a wire of cross sectional area of 5×10^{-6} **m**^{2} **with a drift velocity of** 2×10^{-3} **m/s. The number of free electrons in each cubic meter of the wire is:**

(a) 2×10^{25}

(b) 2×10^{23}

(c) 625×10^{25}

(d) 2×10^{6}

---

23. A long straight wire of circular cross section (radius a**) is carrying a steady current** I**. The current** I **is uniformly distributed across this cross**

section. The magnetic field is:

(a) Zero in the region $r < a$ and inversely proportional to r in the region $r > a$

(b) Inversely proportional to r in the region $r < a$ and uniform throughout in the region $r > a$

(c) Directly proportional to r in the region $r < a$ and inversely proportional to r in the region $r > a$

(d) Uniform in the region $r < a$ and inversely proportional to distance r from the axis, in the region $r > a$

---

24. A small ball of mass M and density ρ is dropped in a viscous liquid of density ρ_0. After some time, the ball falls with a constant velocity. What is the viscous force on the ball?

(a) $F = Mg\,(1$

$\rho_0 \overline{\rho}$

(b) $F = Mg\left(1 + \frac{\rho}{\rho_0}\right)$

(c) $F = Mg\left(1 + \frac{\rho_0}{\rho}\right)$

(d) $F = Mg\,(1 \pm \rho\rho_0)$

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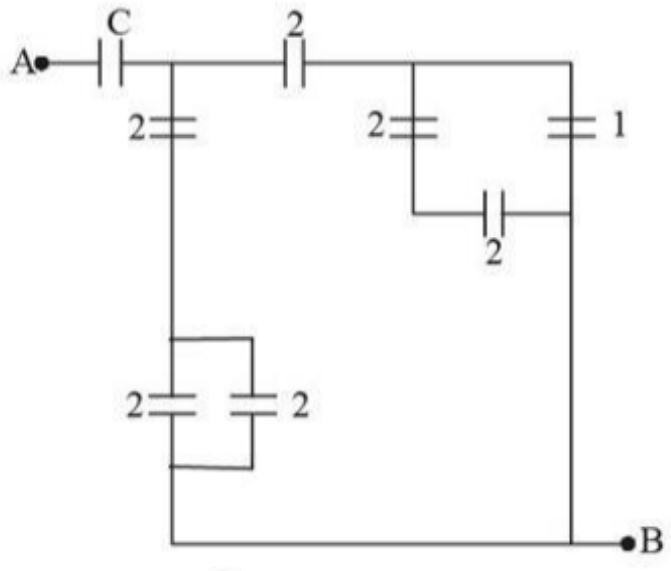
25. In the circuit shown, find C if the effective capacitance of the whole circuit is to be 0.5 μF. All values in the circuit are in μF.



(a) $\frac{7}{11}\,\mu F$

(b) $\frac{6}{5}\,\mu F$

(c) $4\,\mu F$

(d) $\frac{7}{10}\,\mu F$

---

26. Choose the correct option from the following options given below:

(a) In the ground state of Rutherford's model electrons are in stable equilibrium. While in Thomson's model electrons always experience a net
force.

(b) An atom has a nearly continuous mass distribution in Rutherford's model but has a highly non
uniform mass distribution in Thomson's model.

(c) A classical atom based on Rutherford's model is doomed to collapse.

(d) The positively charged part of the atom possesses most of the mass in Rutherford's model but not in Thomson's model.

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27. A cylinder of height 20 m is completely filled with water. The velocity of efflux of water (in ms^{-1}) through a small hole on the side wall of the cylinder near its bottom is:

(A) 10

(B) 20

(C) 25.5

(D) 5

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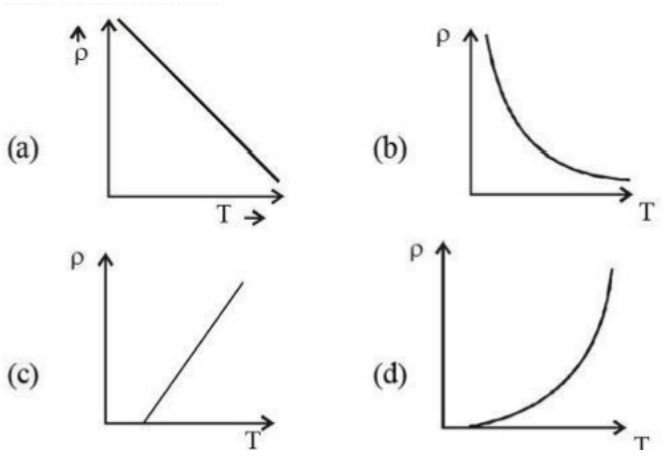
28. The resistivity (ρ) of a semiconductor varies with temperature. Which of the following curves represents the correct behavior?



(A) Curve (a)

(B) Curve (b)

(C) Curve (c)

(D) Curve (d)

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29. Two parallel, long wires are kept 0.20 m apart in vacuum, each carrying current of x A in the same direction. If the force of attraction per meter of each wire is 2×10^{-6} N, then the value of x is approximately:

(A) 1

(B) 2.4

(C) 1.4

(D) 2

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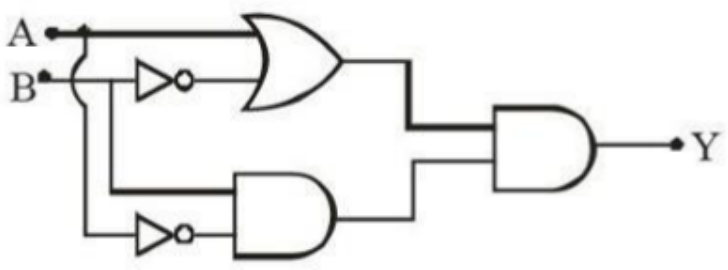
30. The output Y of the following logic circuit for given inputs is:



(A) $A \cdot B(A + B)$

(B) $A \cdot B$

(C) 0

(D) $A \cdot B$

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31. If you are provided a set of resistances $2\,\Omega$, $4\,\Omega$, $6\,\Omega$, and $8\,\Omega$. Connect these resistances so as to obtain an equivalent resistance of $\frac{46}{3}\,\Omega$.

(A) $4\,\Omega$ and $6\,\Omega$ are in parallel with $2\,\Omega$ and $8\,\Omega$ in series

(B) $6\,\Omega$ and $8\,\Omega$ are in parallel with $2\,\Omega$ and $4\,\Omega$ in series

(C) $2\,\Omega$ and $6\,\Omega$ are in parallel with $4\,\Omega$ and $8\,\Omega$ in series

(D) $2\,\Omega$ and $4\,\Omega$ are in parallel with $6\,\Omega$ and $8\,\Omega$ in series

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32. Two cells of the same emf but different internal resistances r_1 and r_2 are connected in series with a resistance R. The value of resistance R, for which the potential difference across the second cell is zero, is:

(A) $r_2 - r_1$

(B) $r_1 - r_2$

(C) r_1

(D) r_2

---

33. A cylinder of fixed capacity of 44.8 litres contains helium gas at standard temperature and pressure. The amount of heat needed to raise the temperature of gas in the cylinder by 20.0°C will be:

(A) 249 J

(B) 415 J

(C) 498 J

(D) 830 J

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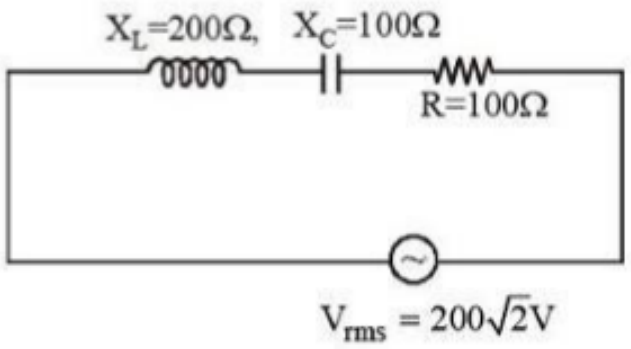
34. In the given circuit, the rms value of current (I_{rms}) through the resistor R is:



(A) $2A$

(B) $\frac{1}{2}A$

(C) $20A$

(D) $2\sqrt{2}A$

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35. At what temperature should a gold ring of diameter 6.230 cm be heated so that it can be fitted on a wooden bangle of diameter 6.241 cm? Both the diameters have been measured at room temperature (27 °C).

Given: Coefficient of linear thermal expansion of gold $\alpha = 1.4 \times 10^{-5}\,\mathrm{K}^{-1}$.

(A) 125.7°C

(B) 91.7°C

(C) 425.7°C

(D) 152.7°C

Part II: Chemistry

36. The wavelength (in cm) of the second line in the Lyman series of the hydrogen atomic spectrum is (Rydberg constant $R\,\mathbf{cm}^{-1}$).

(A) $\frac{8R}{9}$

(B) $\frac{9}{8R}$

(C) $\frac{4}{3R}$

(D) $\frac{3R}{4}$

---

37. Polarizability of halide ions increases in the order:

(A) $F^- < I^- < Br^- < Cl^-$

(B) $Cl^- < Br^- < I^- < F^-$

(C) $I^- < Br^- < Cl^- < F^-$

(D) $F^- < Cl^- < Br^- < I^-$

---

38. The statement that is not correct for periodic classification of elements is:

(A) The properties of elements are periodic function of their atomic numbers.

(B) Non-metallic elements are less in number than metallic elements.

(C) For transition elements, the $3d$-orbitals are filled with electrons after $3p$-orbitals and before $4s$-orbitals.

(D) The first ionisation enthalpies of elements generally increase with increase in atomic number as we go along a period.

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39. PCl_5 is dissociating 50% at 250°C at a total pressure of P atm. If the equilibrium constant is K_p, then which of the following relation is numerically correct?

(A) $K_p = 3P$

(B) $P = 3K_p$

(C) $P = \frac{2K_p}{3}$

(D) $K_p = \frac{2P}{3}$

---

40. Which of the following statements is false?

(A) Cannizzaro reaction is given by aldehydes in presence of alkali.

(B) Aldol condensation is given by aldehydes in presence of alkali.

(C) Aldol condensation is given by aldehydes and ketones in presence of acids.

(D) None of the above.

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41. How many electrons are involved in the following redox reaction?

$$Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} \rightarrow Cr^{3+} + Fe^{3+} + CO_2 \quad \text{(Unbalanced)}$$

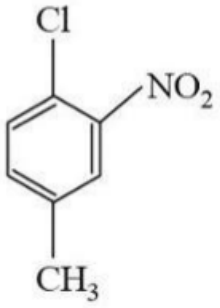
(A) 3

(B) 2

(C) 6

(D) 9

Q.42. The IUPAC name for



(A) 1-chloro-2-nitro-4-methylbenzene

(B) 1-chloro-4methyl-2-nitrobenzene

(C) 2-chloro-1-nitro-5-methylbenzene

(D) m-nitro-p-chlorotoluene

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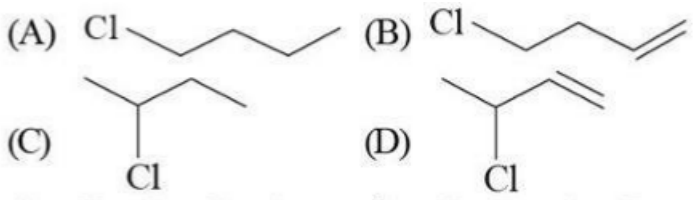
43. The decreasing order of reactivity towards dehydrohalogenation (E_1) reaction of the following compounds is:



(A) $D > B > C > A$

(B) $B > D > A > C$

(C) $B > D > C > A$

(D) $B > A > D > C$

---

44. Specific conductance of 0.1 M HNO_3 is 6.3×10

2 ohm

1 cm

1. The molar conductance of the solution is:

(A) 100 ohm

1 $\text{cm}^2\,\text{mol}$

1

(B) $515\,\text{ohm}$

1 $\text{cm}^2\,\text{mol}$

1

(C) $630\,\text{ohm}$

1 $\text{cm}^2\,\text{mol}$

1

(D) $6300\,\text{ohm}$

1 $\text{cm}^2\,\text{mol}$

1

Q.45. Which of the following compounds does not show Lassaigne's test for nitrogen?

(A) Urea

(B) Hydrazine

(C) Phenylhydrazine

(D) Azobenzene

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46. The strongest acid among the following is:

(A) Salicylic acid

(B) m-hydroxybenzoic acid

(C) p-hydroxybenzoic acid

(D) Benzoic acid

Q.47. At 25°C and 1 atm pressure, the enthalpy of combustion of benzene (l) and acetylene (g) are $3268\,\text{kJ mol}^{-1}$ and $1300\,\text{kJ mol}^{-1}$, respectively. The change in enthalpy for the reaction $3\,\mathbf{C_2H_2(g)} \rightarrow \mathbf{C_6H_6(l)}$, is

(A) $+324\,\text{kJ mol}^{-1}$

(B) $+632\,\text{kJ mol}^{-1}$

(C) $-632\,\text{kJ mol}^{-1}$

(D) $-732\,\text{kJ mol}^{-1}$

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48. How many conformations are possible for ethane?

(A) 2

(B) 3

(C) Infinite

(D) One

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49. For which one of the following sets of four quantum numbers, an electron will have the highest energy?

	n	l	m	s
(a)	3	2	1	$+\frac{1}{2}$
(b)	4	2	1	$+\frac{1}{2}$
(c)	4	1	0	$+\frac{1}{2}$
(d)	5	0	0	$+\frac{1}{2}$

Q.50. Using VSEPR theory, predict the species which has square pyramidal shape.

(A) $SnCl_2$

(B) CCl_4

(C) SO_3

(D) BrF_5

Q.51. Which of the following relation is not correct?

(A) $\Delta H = \Delta U - P\Delta V$

(B) $\Delta U = q + W$

(C) $\Delta S_{\text{sys}} + \Delta S_{\text{surr}} \geq 0$

(D) $\Delta G = \Delta H - T\Delta S$

---

52. The acidic, basic and amphoteric oxides, respectively, are:

(A) Na_2O, SO_3, Al_2O_3

(B) Cl_2O, CaO, P_4O_{10}

(C) N_2O_3, Li_2O, Al_2O_3

(D) MgO, Cl_2O, Al_2O_3

53. 100 mL of 0.04 N HCl aqueous solution is mixed with 100 mL of 0.02 N NaOH solution. The pH of the resulting solution is:

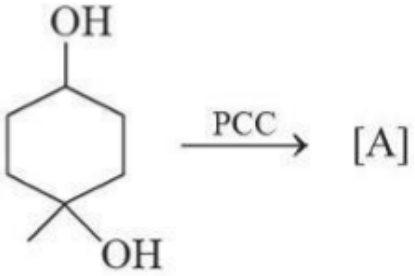
(A) 1.0

(B) 1.7

(C) 2.0

(D) 2.3

Q.54. Which of the following tests is positive for the given compound [A]?



(A) Br_2 water test

(B) Tollen's test

(C) Victor Meyer test

(D) Lucas test

Q.55. The value of van't Hoff factors for KCl, NaCl and K_2SO_4 respectively are .....

(A) 2, 2 and 2

(B) 2, 2 and 3

(C) 1, 1 and 2

(D) 1, 1 and 1

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56. A first

order reaction is half completed in 45 minutes. How long does it need for 99.9% of the reaction to be completed?

(A) 5 hours

(B) 7.5 hours

(C) 10 hours

(D) 20 hours

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57. The greater the valence of the flocculating ion added, the greater is its power to cause precipitation of a colloid. This rule is:

(A) Hund's rule

(B) Pauling rule

(C) Henry's rule

(D) Hardy—Schulze rule

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58. The number of hydrogen bonds formed by a water molecule at normal conditions is:

(a) 1

(b) 2

(c) 3

(d) 4

---

59. Element not showing variable oxidation state is:

(a) Bromine

(b) Iodine

(c) Chlorine

(d) Fluorine

---

60. Which of the following arrangements does not represent the correct order of the property stated against it?

(a) $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour

(b) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size

(c) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution

(d) $Sc < Ti < Cr < Mn$: number of oxidation states

---

61. Lanthanoid which has the smallest size in $+3$ state is:

(a) Tb

(b) Er

(c) Ce

(d) Lu

---

62. Oxidation number of H in NaH, CaH_2, and LiH, respectively is:

(a) +1, +1, -1

(b) -1, +1, +1

(c) +1, +1, +1

(d) -1, -1, -1

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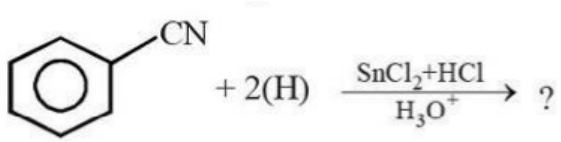
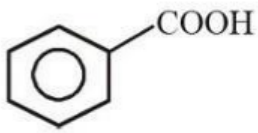
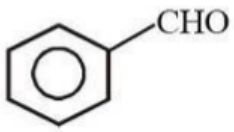
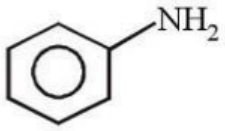
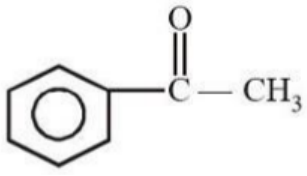
63. Product of the following reaction is:



(a) 

(b) 

(c) 

(d) 

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64. Which of the following alkyl halides will undergo S_N1 reaction most readily?

(a) $(CH_3)_3C\,F$

(b) $(CH_3)_3C\,Cl$

(c) $(CH_3)_3C\,Br$

(d) $(CH_3)_3C\,I$

---

65. Phenol does not undergo nucleophilic substitution reaction easily due to:

(a) acidic nature of phenol

(b) partial double bond character of C

OH bond

(c) partial double bond character of C

C bond

(d) instability of phenoxide ion

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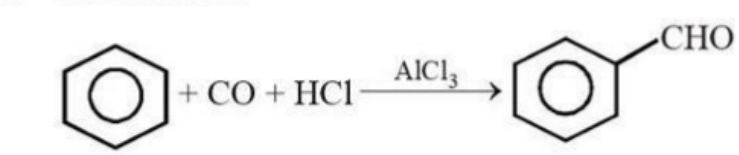
66. The reaction



(a) Rosenmund's reaction

(b) Stephen's reaction

(c) Cannizzaro's reaction

(d) Gattermann-Koch reaction

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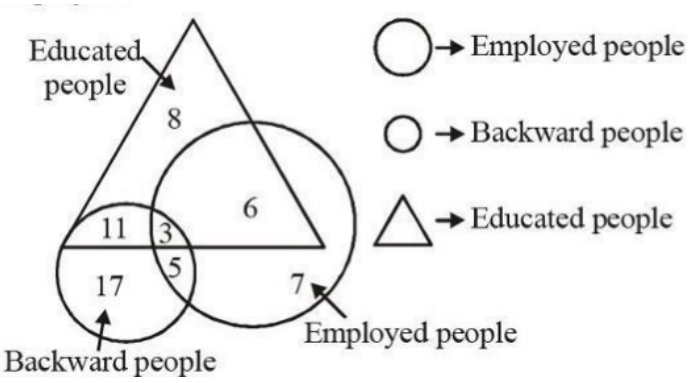
67. Hoffmann bromamide degradation reaction is shown by which of the following?



(a) $ArNH_2$

(b) $ArCONH_2$

(c) $ArNO_2$

(d) $ArCH_2NH_2$

---

68. Which of the following acids is a vitamin?

(a) Aspartic acid

(b) Ascorbic acid

(c) Adipic acid

(d) Saccharic acid

---

69. Intermolecular forces in nylon

6, 6 are:

(a) Dipole

dipole interactions

(b) Hydrogen bonding

(c) van der Waals' forces

(d) Ionic bonds

---

70. Which of the following does not form a chelate?

(a) EDTA

(b) Oxalate

(c) Pyridine

(d) Ethylenediamine

Part III: Mathematics

71. Let $n(A) = m$ and $n(B) = n$, if the number of subsets of A is 56 more than that of subsets of B, then $m + n$ is equal to:

(a) 9

(b) 13

(c) 8

(d) 10

---

72. If $f(x) = \cos 1\left(\frac{\sqrt{2x^2+1}}{x^2+1}\right)$, then the range of $f(x)$ is:

(a) $[0, \pi]$

(b) $\left[0, \frac{\pi}{4}\right]$

(c) $\left[0, \frac{\pi}{3}\right]$

(d) $\left[0, \frac{\pi}{2}\right]$

---

73. A, P, B are 3×3 matrices. If $|B| = 5$, $|BA^T| = 15$, $|P^TAP| = -27$, then one of the values of $|P|$ is:

(a) 3

(b) -5

(c) 9

(d) 6

---

74. If $f(x)$ defined as given below, is continuous on R, then the value of $a + b$ is equal to:

$$f(x) = \begin{cases} \sin x, & x \leq 0 \\ x^2 + a, & 0 < x < 1 \\ bx + 3, & 1 \leq x \leq 3 \\ 3, & x > 3 \end{cases}$$

(a) 0

(b) 2

(c) -2

(d) 3

---

75. Let $f(x)$ be defined as:

$$f(x) = \begin{cases} 3 - x, & x < -3 \\ 6, & -3 \leq x \leq 3 \\ 3 + x, & x > 3 \end{cases}$$

Let α be the number of points of discontinuity of $f(x)$ and β be the number of points where $f(x)$ is not differentiable. Then, $\alpha + \beta$ is:

[(a)]6 3 2 0

---

76. The derivative of $\sin^2\left(\cot^{-1}\left(\frac{1+x}{\sqrt{1-x}}\right)\right)$ with respect to x is equal to:

[(a)]0 $\frac{1}{2}$ $-\frac{1}{2}$ -1

---

77. The number of students who take both the subjects mathematics and chemistry is 30. This represents 10% of the enrolment in mathematics and 12% of the enrolment in chemistry. How many students take at least one of these two subjects?

[(a)]520 490 560 480

---

78. If A and B are the two real values of k for which the system of equations $x + 2y + z = 1$, $x + 3y + 4z = k$, $x + 5y + 10z = k^2$ is consistent, then $A + B =$:

[(a)]3 4 5 7

---

79. The radius of the base of a cone is increasing at the rate of 3 cm/minute and the altitude is decreasing at the rate of 4 cm/minute. The rate of change of lateral surface when the radius is 7 cm and altitude is 24 cm is:

(a) $54\pi\,\text{cm}^2/\text{min}$

(b) $7\pi\,\text{cm}^2/\text{min}$

(c) $27\pi\,\text{cm}^2/\text{min}$

(d) None of these

---

80. The maximum area of a right-angled triangle with hypotenuse h is:

[(a)]$\frac{h^2}{2\sqrt{2}}$ $\frac{h^2}{2}$ $\frac{h^2}{\sqrt{2}}$ $\frac{h^2}{4}$

---

81. If $f(x)$ is continuous and $\int_0^9 f(x)\,dx = 4$, then the value of the integral $\int_0^3 x \cdot f(x^2)\,dx$ is:

(a) 2

(b) 18

(c) 16

(d) 4

---

82. The area bounded by $y - 1 = |x|$ and $y + 1 = |x|$ is:

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

(b) 1

(c) 2

(d) 0

83. Let the vectors $\overrightarrow{AB} = 2\hat{i} + 2\hat{j} + \hat{k}$ and $\overrightarrow{AC} = 2\hat{i} + 4\hat{j} + 4\hat{k}$ be two sides of a triangle ABC. If G is the centroid of $\triangle ABC$, then $\frac{22}{7}|\overrightarrow{AG}|^2 + 5 =$:

(a) 25

(b) 38

(c) 47

(d) 52

---

84. If the two lines $l_1 : x$

$2\frac{}{3=\frac{y+1}{2}=\frac{z2}{1}}$ and $l_2 : \frac{x1}{1} = \frac{2y+3}{1} = \frac{z+5}{2}$ are perpendicular, then the angle between the lines l_2 and $l_3 : \frac{1x}{3} = \frac{2y1}{4} = \frac{z}{4}$ is:

(a) $\cos^1\left(\frac{29}{4}\right)$

(b) $\sec^1\left(\frac{29}{4}\right)$

(c) $\cos^1\left(\frac{2}{29}\right)$

(d) $\cos^1\left(\frac{2}{\sqrt{29}}\right)$

---

85. If $f(x) = \ln\left(\frac{x^2+e}{x^2+1}\right)$, then the range of $f(x)$ is:

(a) $(0, 1)$

(b) $(0, 1]$

(c) $[0, 1]$

(d) $\{0, 1\}$

---

86. If $f(x) = \frac{\log(\pi+x)}{\log(e+x)}$, then the function is:

(a) Increasing in $[0, \infty)$

(b) Decreasing in $[0, \infty)$

(c) Decreasing in $[0, \frac{\pi}{e}]$ and increasing in $[\frac{\pi}{e}, \infty)$

(d) Increasing in $[0, \pi]$ and decreasing in $[\pi, \infty)$

87. Evaluate the integral:

$$\int_{-\pi}^{\pi} x^2 \sin(x)\, dx$$

(a) π^2

(b) $\frac{\pi^2}{2}$

(c) 0

(d) $2\pi^2$

---

88. The solution of the differential equation:

$$x^4 \frac{dy}{dx} + x^3 y + \csc(xy) = 0$$

is equal to:

(a) $x^{-2} + 2\cos(xy) = c$

(b) $y^{-2} + 2\cos(xy) = c$

(c) $x^{-2} + 2\sin(xy) = c$

(d) $y^{-2} + 2\sin(xy) = c$

---

89. If the solution of

$$\left(1 + 2e^{\frac{x}{y}}\right) dx + 2e^{\frac{x}{y}} \left(1 - \frac{x}{y}\right) dy = 0$$

is

$x + \lambda y e^y = c$ (where c is an arbitrary constant), then λ is:

(a) 1

(b) 2

(c) 3

(d) None of these

90. The probability distribution of a random variable is given below:

$X = x$	0	1	2	3	4	5	6	7
$P(X = x)$	0	K	$2K$	$2K$	$3K$	K^2	$2K^2$	$7K^2 + K$

Find $P(0 < X < 5)$**.**

(a) $\frac{1}{10}$

(b) $\frac{3}{10}$

(c) $\frac{8}{10}$

(d) $\frac{7}{10}$

---

91. The length of the perpendicular from the point $(1, -2, 5)$ **on the line passing through** $(1, 2, 4)$ **and parallel to the line given by** $x + y - z = 0$ **and** $x - 2y + 3z - 5 = 0$ **is:**

(a) $\frac{\sqrt{21}}{2}$

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

(c) $\frac{\sqrt{73}}{2}$

(d) 1

---

92. The range of $2\left|\sin x + \cos x\right| - \sqrt{2}$ **is:**

(a) $\left[-\sqrt{2}, \sqrt{2}\right]$

(b) $\left[3\sqrt{2}, \sqrt{2}\right]$

(c) $\left(3\sqrt{2}, \sqrt{2}\right)$

(d) None of these

---

93. The integral $I = \int_{\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{x+\frac{\pi}{4}}{2-\cos 2x}\, dx$ **is equal to:**

(a) $\frac{8\pi\sqrt{3}}{5}$

(b) $\frac{2\pi\sqrt{3}}{9}$

(c) $\frac{4\pi^2\sqrt{3}}{9}$

(d) $\frac{\pi^2}{6\sqrt{3}}$

---

94. A and B are independent events of a random experiment if and only if:

(a) $P(A|B) \neq P(A \cap B)$

(b) $P(A|B) = P(B|A)$

(c) $P(A|B) \neq P(A|B^c)$

(d) $P(A|B) = P(A|B^c)$

---

95. The equation of a common tangent to the parabolas $y = x^2$ and $y = (x-2)^2$ is:

(a) $y = 4(x-2)$

(b) $y = 4(x-1)$

(c) $y = 4(x+1)$

(d) $y = 4(x+2)$

---

96. Negation of the statement $(p \wedge r) \rightarrow (r \vee q)$ is:

(a) $\sim (p \wedge r) \rightarrow \sim (r \vee q)$

(b) $(\sim p \vee \sim r) \vee (r \vee q)$

(c) $(p \wedge r) \wedge (r \wedge q)$

(d) $(p \wedge r) \wedge (\sim r \wedge \sim q)$

---

97. The number of different permutations of all the letters of the word "PERMUTATION" such that any two consecutive letters in the arrangement are neither both vowels nor both identical is:

(a) $63 \times 6! \times 5!$

(b) $57 \times 5! \times 5!$

(c) $33 \times 6! \times 5!$

(d) $7 \times 7! \times 5!$

---

98. The coefficient of x^{50} in $(1+x)^{101}(1-x+x^2)^{100}$ is:

(a) 1

(b) -1

(c) 0

(d) 2

---

99. If $\frac{1}{q+r}, \frac{1}{r+p}, \frac{1}{p+q}$ are in A.P., then:

(a) p, q, r are in A.P.

(b) p^2, q^2, r^2 are in A.P.

(c) $\frac{1}{p}, \frac{1}{q}, \frac{1}{r}$ are in A.P.

(d) $p+q+r$ are in A.P.

---

100. The coordinates of the foot of perpendicular from the point $(2,3)$ on the line $y = 3x+4$ is given by:

(a) $\left(\frac{37}{10}, \frac{-1}{10}\right)$

(b) $\left(\frac{-1}{10}, \frac{37}{10}\right)$

(c) $\left(\frac{10}{37}, -10\right)$

(d) $\left(\frac{2}{2}, \frac{-1}{3}\right)$

---

101. The circle touching the y axis at a distance 4 units from the origin and cutting off an intercept 6 from the x axis is:

(A) $x^2+y^2 \pm 10x - 8y + 16 = 0$

(B) $x^2+y^2 \pm 5x - 8y + 16 = 0$

(C) $x^2+y^2 \pm 5x - 2y - 8 = 0$

(D) $x^2 + y^2 \pm 2x - y - 12 = 0$

---

102. The points A(4, -2, 1), B(7, -4, 7), C(2, -5, 10), and D(-1, -3, 4) are the vertices of a:

(A) Tetrahedron

(B) Parallelogram

(C) Rhombus

(D) Square

Q.103. If A, B, C, D are the angles of a quadrilateral, then

$$\frac{\tan A + \tan B + \tan C + \tan D}{\cot A + \cot B + \cot C + \cot D} =$$

(A) $\cot A \cot B \cot C \cot D$

(B) $\tan A \tan B \tan C \tan D$

(C)

$\tan A \tan B \tan C \tan D$

(D)

$\cot A \cot B \cot C \cot D$

Q.104. Let $z \neq 1$ be a complex number and let $\omega = x + iy, y \neq 0$. If

$$\frac{\omega\overline{\omega}z}{1\ z}$$

is purely real, then $|z|$ is equal to

(A) $|\omega|$

(B) $|\omega|^2$

(C) $\frac{1}{|\omega|^2}$

(D) 1

---

105. If the roots of the quadratic equation

$$(a^2 + b^2)\, x^2 - 2\,(bc + ad)\, x + (c^2 + d^2) = 0$$

are equal, then:

(A) $\frac{a}{b} = \frac{c}{d}$

(B) $\frac{a}{c} + \frac{b}{d} = 0$

(C) $\frac{a}{d} = \frac{b}{c}$

(D) $a + b = c + d$

---

106. Evaluate the limit:

$$L = \lim_{x \to 0} \frac{35^x - 7^x - 5^x + 1}{(e^x - e^{-x}) \ln(1 - 3x)}$$

(A) $\frac{\ln 35}{6}$

(B) $\frac{\ln 35}{6}$

(C) $\frac{\ln 2}{6}$

(D) $\frac{\ln(5) \cdot \ln 7}{-6}$

---

107. If $z_r = \cos \frac{r\alpha}{n^2} + i \sin \frac{r\alpha}{n^2}$**, where** $r = 1, 2, 3, ..., n$**, then the value of** $\lim_{n \to \infty} z_1 z_2 z_3 ... z_n$ **is:**

(A) 0

(B) $e^{\frac{i\alpha}{2}}$

(C) $e^{\frac{i\alpha}{2}}$

(D) $e^{i\alpha}$

Q.108. Let $f(x)$ **be a polynomial function satisfying**

$$f(x) \cdot f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right).$$

If $f(4) = 65$ **and** I_1, I_2, I_3 **are in GP, then** $f'(I_1), f'(I_2), f'(I_3)$ **are in:**

(A) AP

(B) GP

(C) Both

(D) None of these

---

109. In four schools B_1, B_2, B_3, B_4**, the number of students is given as follows:**

$$B_1 = 12, \quad B_2 = 20, \quad B_3 = 13, \quad B_4 = 17$$

A student is selected at random from any of the schools. The probability that the student is from school B_2 is:

(a) $\frac{6}{31}$

(b) $\frac{10}{31}$

(c) $\frac{13}{62}$

(d) $\frac{17}{62}$

---

110. For real numbers x and y, we define xRy iff $x - y + \sqrt{5}$ is an irrational number. Then, relation R is:

(a) Reflexive

(b) Symmetric

(c) Transitive

(d) None of these

Part 4: Aptitude Test

DIRECTIONS (Qs. 111-113): *These questions are to be answered on the basis of the pie chart given below showing how a person's monthly salary is distributed over different expense heads.*

111. For a person, whose monthly salary is Rs 6,000 p.m., how many items are there on which he has to spend more than Rs 1,000 p.m.?

(A) 1

(B) 2

(C) 3

(D) 4

---

112. The annual saving for such a person will be approximately:

(A) $5,000

(B) $10,000

(C) $15,000

(D) $16,560

---

113. The monthly salary for a person who follows the same expense pattern, but has a petrol expense of Rs 500 p.m., is:

(A) $2,500

(B) $3,000

(C) $5,000

(D) $6,500

---

114. If NATION is coded as 467234 and EARN is coded as 1654, then ATTENTION should be coded as:

(A) 432769561

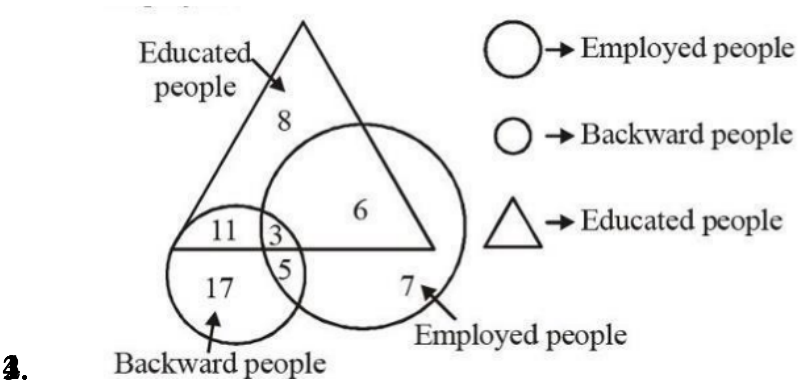
(B) 956143654

(C) 766412743

(D) 677147234

---

115. In the following figure, how many educated people are employed?



(a) 18

(b) 20

(c) 15

(d) 9

---

116. A man is facing west. He runs 45° in the clockwise direction and then another 180°

in the same direction and then 270° in the anticlockwise direction. Which direction is he facing now?

(a) South

(b) North-West

(c) West

(d) South-West

---

117. A is the brother of B. A is the brother of C. To determine the relation between B and C, what minimum information is necessary?

(a) Only (i)

(b) Only (ii)

(c) Either (i) or (ii)

(d) Both (i) and (ii)

---

118. In a class of 20 students, Alisha's rank is 15th from the top. Manav is 4 ranks above Alisha. What is Manav's rank from the bottom?

(a) 10th

(b) 11th

(c) 9th

(d) 12th

---

119. In this question, there are three statements followed by conclusions numbered I and II. You have to take the given statements to be true even if they seem to be at variance from commonly known facts and then decide which of the given conclusions logically follow from the three statements.

Statements:

- All books are ledgers.
- All pens are keys.
- Some pens are books.

Conclusions:

- I. Some ledgers are keys.
- II. Some keys are books.

(a) if only conclusion I follows
(b) if only conclusion II follows
(c) if neither I nor II follows
(d) if both I and II follow

---

120. If it was a Friday on 1 January 2016, what was the day of the week on 31 December 2016?

(A) Saturday
(B) Friday
(C) Monday
(D) Sunday

Part V: English

DIRECTIONS (Qs. 121-125): *Read the passage carefully and choose the best answer to each question out of the four alternatives.*

"People very often complain that poverty is a great evil and that it is not possible to be happy unless one has a lot of money. Actually, this is not necessarily true. Even a poor man, living in a small hut with none of the comforts and luxuries of life, may be quite contented with his lot and achieve a measure of happiness. On the other hand, a very rich man, living in a palace and enjoying everything that money can buy, may still be miserable, if, for example, he does not enjoy good health or his only son has taken to evil ways. Apart from this, he may have a lot of business worries which keep him on tenterhooks most of the time. There is a limit to what money can buy and there are many things which are necessary for a man's happiness

and which money cannot procure. Real happiness is a matter of the right attitude and the capacity of being contented with whatever you have is the most important ingredient of this attitude."

---

121. The phrase "on tenterhooks" means:

(a) in a state of thoughtfulness

(b) in a state of anxiety

(c) in a state of sadness

(d) in a state of forgetfulness

---

122. It is true that:

(a) money alone can give happiness

(b) money always gives happiness

(c) money seldom gives happiness

(d) money alone cannot give happiness

---

123. A rich man's life may become miserable if he:

(a) has evil son, bad health and business worries

(b) does not enjoy good health

(c) has business worries

(d) has business worries and his only son has taken to evil ways

---

124. Which of the following is the most appropriate title to the passage?

(a) Poverty, a great evil

(b) The key of happiness

(c) Contentment, the key of happiness

(d) Money and contentment

Solution:

---

125. Which of the following statement is true?

(a) Only a poor but contented man can be happy

(b) A poor but contented man can never be happy

(c) A poor but contented man can be happy

(d) A poor but contented man is always happy
