

Physics - Section A (MCQ.)

1. Imagine a system of unit in which the unit of mass is 10 kg , length is 1 km and time is 1 min . Then, 1 J in this system is equal to

1) 360 2) 3.6
3) 36×10^5 4) 36×10^{-5}

2. The time dependence of a physical quantity P is given by $P = P_0 e^{-\alpha t^2}$, where α is a constant and t is time. The constant α

1) is a dimensionless
2) has dimensions of P
3) has dimensions of T^{-2}
4) has dimensions of T^2

3. The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3} \text{ ms}^{-2}$, in the third second is:

1) 6 m 2) 4 m 3) $\frac{10}{3}$ m 4) $\frac{19}{3}$ m

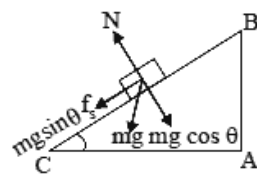
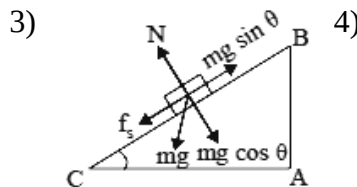
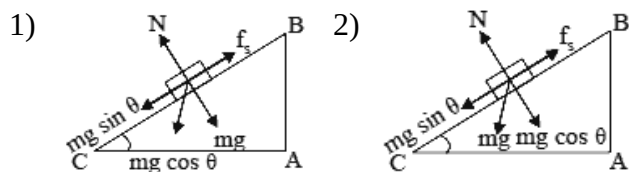
4. The horizontal range of a projectile is $4\sqrt{3}$ times of its maximum height. The angle of projection will be

1) 60° 2) 37°
3) 30° 4) 45°

5. A person swims in a river aiming to reach exactly on the opposite point on the bank of a river. His speed of swimming is 0.5 m/s at an angle of 120° with the direction of flow of water. The speed of water is

1) 1.0 m/s 2) 0.5 m/s
3) 0.25 m/s 4) 0.43 m/s

6. Which figure shows the correct force acting on the body sliding down an inclined plane? ($m \rightarrow$ mass, $f_s \rightarrow$ force of friction)



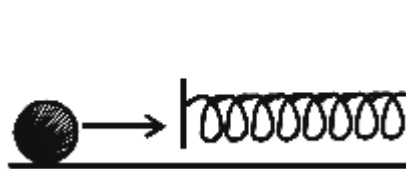
7. Which of the following is a self adjusting force?

1) Static friction 2) Limiting friction
3) Dynamic friction 4) Sliding friction

8. The potential energy of a system increases if work is done

1) upon the system by a non conservative force
2) by the system against a conservative force
3) by the system against a non conservative force
4) upon the system by a conservative force

9. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface, collides with a nearly weightless spring of force constant $k = 50 \text{ N/m}$. The maximum compression of the spring would be



1) 0.5 m 2) 0.15 m 3) 0.12 m 4) 1.5 m

10. A body of mass 5 kg makes an elastic collision with another body at rest and continues to move in the original direction after collision with a velocity equal to $\frac{1}{10}$ th of its original velocity. Then the mass of the second body is

1) 4.09 kg 2) 0.5 kg 3) 5 kg 4) 5.09 kg

11. A bullet of mass 0.02 kg travelling horizontally with velocity 250 ms^{-1} strikes a block of wood of mass 0.23 kg which rests on a rough horizontal surface. After the impact, the block and bullet move together and come to rest after travelling a distance of 40 m. The coefficient of sliding friction of the rough surface is ($g = 9.8 \text{ ms}^{-2}$)

1) 0.75 2) 0.61 3) 0.51 4) 0.30

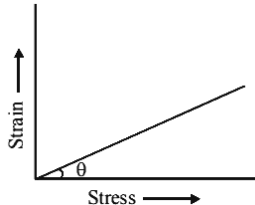
12. The centre of a wheel rolling on a plane surface moves with a speed v_0 . A particle on the rim of the wheel at the same level as the centre will be moving at speed

- 1) zero 2) v_0 3) $2v_0$ 4) $\sqrt{2v_0}$

13. The gravitational potential at a place varies inversely with x^2 (i.e., $V = k/x^2$), the gravitational field at that place is

- 1) $2k/x^3$ 2) $-2k/x^3$
3) k/x 4) $-k/x$

14. The value of $\tan(90^\circ - \theta)$ in the graph gives



- 1) Young's modulus of elasticity
2) compressibility
3) shear strain
4) tensile strength

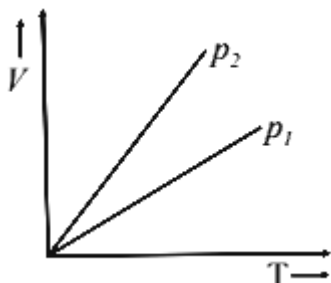
15. Two liquids of densities d_1 and d_2 are flowing in identical capillary tubes under the same pressure difference. If t_1 and t_2 are time taken for the flow of equal quantities (mass) of liquids, then the ratio of coefficient of viscosity of liquids must be

- 1) $\frac{d_1 t_1}{d_2 t_2}$ 2) $\frac{t_1}{t_2}$
3) $\frac{d_2}{d_1} \frac{t_2}{t_1}$ 4) $\sqrt{\frac{d_1 t_1}{d_2 t_2}}$

16. A bubble of n mole of helium is submerged at a certain depth in water. The temperature of water increases by $\Delta t^\circ\text{C}$. How much heat is added approximately to helium during expansion?

- 1) $nc_v \Delta t$ 2) $\frac{nc_p}{\Delta t}$
3) $\frac{n^2 c_v}{\Delta t}$ 4) $nc_p \Delta t$

17. In the $V - T$ diagram shown in adjoining figure, what is the relation between p_1 and p_2 ?



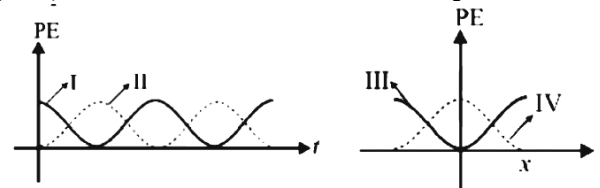
- 1) $p_2 = p_1$ 2) $p_2 < p_1$
3) $p_2 > p_1$ 4) insufficient data

18. If a gas mixture contains 2 moles of O_2 and 4 moles of Ar at temperature T , then what will be the total energy of the system (neglecting all vibrational modes)

- 1) $11RT$ 2) $15RT$

- 3) $8RT$ 4) RT

19. For a particle executing S.H.M. the displacement x is given by $x = A \cos \omega t$. Identify the graph which represents the variation of potential energy (P.E.) as a function of time t and displacement x .



- 1) I, III 2) II, IV 3) II, III 4) I, IV

20. Two waves $y_1 = A_1 \sin(\omega t - \beta_1)$ and $y_2 = A_2 \sin(\omega t - \beta_2)$ superimpose to form a resultant wave whose amplitude is

- 1) $A_1 + A_2$
2) $|A_1 + A_2|$
3) $\sqrt{A_1^2 + A_2^2 - 2A_1 A_2 \sin(\beta_1 - \beta_2)}$
4) $\sqrt{A_1^2 + A_2^2 + 2A_1 A_2 \cos(\beta_1 - \beta_2)}$

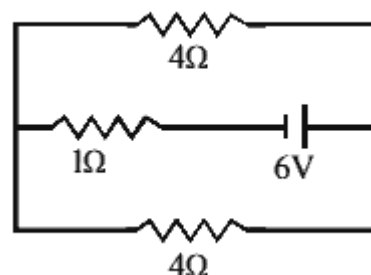
21. When a metallic plate swings between the poles of a magnet

- 1) no effect on the plate
2) eddy currents are set up inside the plate and the direction of the current is along the motion of the plate
3) eddy currents are set up inside the plate and the direction of the current oppose the motion of the plate
4) eddy currents are set up inside the plate

22. The capacitance of a parallel plate capacitor with air as medium is $3\mu\text{F}$. As a dielectric is introduced between the plates, the capacitance becomes $15\mu\text{F}$. The permittivity of the medium in $\text{C}^2 \text{N}^{-1} \text{m}^{-2}$ is

- 1) 8.15×10^{-11} 2) 0.44×10^{-10}
3) 15.2×10^{12} 4) 1.6×10^{-14}

23. The current in the 1Ω resistor shown in the circuit is



- 1) $\frac{2}{3} \text{ A}$ 2) 3 A 3) 6 A 4) 2 A

24. Radar waves are sent towards a moving airplane and the reflected waves are received. When the airplane is moving towards the radar, the wavelength of the wave

- 1) decrease
- 2) increase
- 3) remains the same
- 4) sometimes increase or decrease

25. The ratio of the amounts of heat developed in the four arms of a balance Wheatstone bridge, when the arms have resistances $P = 100\Omega$, $Q = 10\Omega$, $R = 300\Omega$ and $S = 30\Omega$ respectively is

- 1) 3 : 30 : 1 : 10
- 2) 30 : 3 : 10 : 1
- 3) 30 : 10 : 1 : 3
- 4) 30 : 1 : 3 : 10

26. The magnetic flux in a closed circuit of resistance 10Ω varies with time as $\phi = (2t - 4t^2 + 1)$. The current in the loop will change its direction after a time of

- 1) 0.25sec
- 2) 0.5sec
- 3) 1sec
- 4) none

27. An alternating voltage of 220 V, 50 Hz frequency is applied across a capacitor of capacitance $2\mu\text{F}$. The impedance of the circuit is

- 1) $\frac{\pi}{5000}$
- 2) $\frac{1000}{\pi}$
- 3) 500π
- 4) $\frac{5000}{\pi}$

28. An electromagnetic wave with poynting vector 6Wm^{-2} is absorbed by a surface area 12m^2 . The force on the surface is

- 1) $24 \times 10^{-8}\text{N}$
- 2) $30 \times 10^{-5}\text{M}$
- 3) $2.4 \times 10^{-12}\text{N}$
- 4) $3.6 \times 10^8\text{M}$

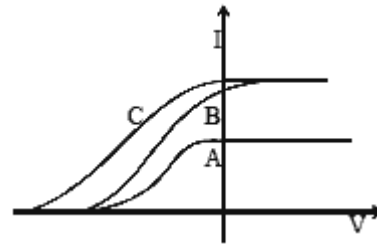
29. A prism has a refracting angle of 60° . When placed in the position of minimum deviation, it produces a deviation of 30° . The angle of incidence is

- 1) 30°
- 2) 45°
- 3) 15°
- 4) 60°

30. In Young's double slit experiment intensity at a point is $(1/4)$ of the maximum intensity. Angular position of this point is (separation between slits is d)

- 1) $\sin^{-1}(\lambda/d)$
- 2) $\sin^{-1}(\lambda/2d)$
- 3) $\sin^{-1}(\lambda/3d)$
- 4) $\sin^{-1}(\lambda/4d)$

31. In a photoelectric experiment anode potential is plotted against plate current



- 1) A and B will have different intensities while B and C will have different frequencies
- 2) B and C will have different intensities while A and C will have different frequencies
- 3) A and B will have different intensities while A and C will have equal frequencies
- 4) A and B will have equal intensities while B and C will have different frequencies

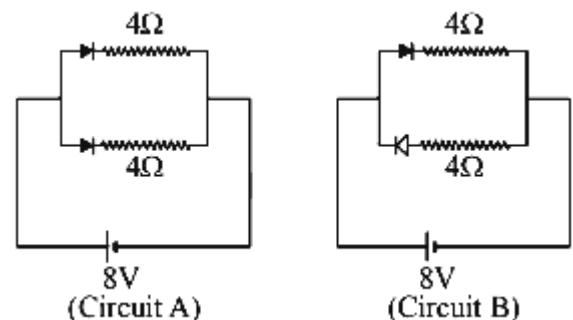
32. An arc of radius r carries charge. The linear density of charge is λ and the arc subtends an angle $\frac{\pi}{3}$ at the centre. What is electric potential at the centre?

- 1) $\frac{\lambda}{4\epsilon_0}$
- 2) $\frac{\lambda}{8\epsilon_0}$
- 3) $\frac{\lambda}{12\epsilon_0}$
- 4) $\frac{\lambda}{16\epsilon_0}$

33. Half-lives of two radioactive substances A and B are respectively 20 minutes and 40 minutes. Initially, the sample of A and B have equal number of nuclei. After 80 minutes, the ratio of remaining number of A and B nuclei is

- 1) 1 : 16
- 2) 4 : 1
- 3) 1 : 4
- 4) 1 : 1

34. Current flowing in each of the following circuit A and B respectively are



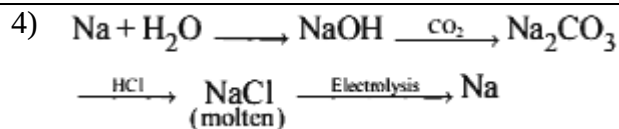
- 1) 1 A, 2 A
- 2) 2 A, 1 A
- 3) 4 A, 2 A
- 4) 2 A, 4 A

35. Beyond which frequency, the ionosphere bands any incident electromagnetic radiation but do not reflect it back towards the earth?

- 1) 50MHz
- 2) 40MHz
- 3) 30MHz
- 4) 20MHz

Chemistry - Section A (MCQ.)

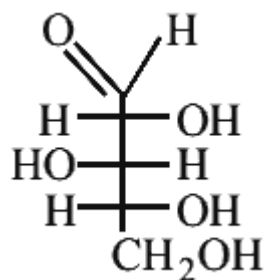
36. Caffeine has a molecular weight of 194u. If it contains 28.9% by mass of nitrogen, number of atom of nitrogen in one molecule of caffeine is
1) 4 2) 6 3) 2 4) 3
37. 19.85 mL of 0.1 N NaOH reacts with 20 mL of HCl solution for complete neutralisation. The molarity of HCl solution is
1) 9.9 2) 0.99 3) 0.099 4) 0.0099
38. Ionisation energy of He^+ is $19.6 \times 10^{-18} \text{ J atom}^{-1}$. The energy of the first stationary state ($n = 1$) of Li^{2+} is
1) $4.41 \times 10^{-16} \text{ J atom}^{-1}$
2) $-4.41 \times 10^{-17} \text{ J atom}^{-1}$
3) $-2.2 \times 10^{-15} \text{ J atom}^{-1}$
4) $8.82 \times 10^{-17} \text{ J atom}^{-1}$
39. The wavelengths of electron waves in two orbits is 3 : 5. The ratio of kinetic energy of electrons will be
1) 25 : 9 2) 5 : 3 3) 9 : 25 4) 3 : 5
40. Which of the following species has highest nucleophilicity?
1) F^- 2) OH^-
3) CH_3^- 4) NH_2^-
41. Which of the following order in respect to ionisation energy is correct?
1) $\text{N} > \text{O} > \text{F}$ 2) $\text{N} < \text{O} < \text{F}$
3) $\text{N} > \text{O} < \text{F}$ 4) $\text{N} < \text{O} > \text{F}$
42. Amongst NO_3^- , AsO_3^{3-} , CO_3^{2-} , ClO_3^- , SO_3^{2-} and BO_3^{3-} , the non-planar species are
1) CO_3^{2-} , SO_3^{2-} and BO_3^{3-}
2) AsO_3^{3-} , ClO_3^- and SO_3^{2-}
3) NO_3^- , CO_3^{2-} and BO_3^{3-}
4) SO_3^{2-} , NO_3^- and BO_3^{3-}
43. A bubble of air is underwater at temperature 15°C and the pressure 1.5 bar. If the bubble rises to the surface where the temperature is 25°C and the pressure is 1.0 bar, what will happen to the volume of the bubble?
1) Volume will become greater by a factor of 1.6
2) Volume will become greater by a factor of 1.1
3) Volume will become smaller by a factor of 0.70
4) Volume will become greater by a factor of 2.9
44. The standard molar heat of formation of ethane, CO_2 and water (1) are respectively -21.1 , -94.1 and -68.3kcal . The standard molar heat of combustion of ethane will be
1) -372kcal 2) 162kcal
3) -240kcal 4) 183.5kcal
45. Given that the equilibrium constant for the reaction $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ has a value of 278 at a particular temperature. What is the value of the equilibrium constant for the following reaction at the same temperature?
 $\text{SO}_3(\text{g}) \rightleftharpoons \text{SO}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$
1) 1.8×10^{-3} 2) 3.6×10^{-3}
3) 6.0×10^{-2} 4) 1.3×10^{-5}
46. At 298K, the conductivity of a saturated solution of AgCl in water is $2.6 \times 10^{-6} \text{ S cm}^{-1}$. Its solubility product at 298K.
Given : $\lambda^\infty(\text{Ag}^+) = 63.0 \text{ S cm}^2 \text{ mol}^{-1}$,
 $\lambda^\infty(\text{Cl}^-) = 67.0 \text{ S cm}^2 \text{ mol}^{-1}$
1) $2.0 \times 10^{-5} \text{ M}^2$ 2) $4.0 \times 10^{-10} \text{ M}^2$
3) $4.0 \times 10^{-16} \text{ M}^2$ 4) $2 \times 10^{-8} \text{ M}^2$
47. In the reaction, $8\text{Al} + 3\text{Fe}_3\text{O}_4 \rightarrow 4\text{Al}_2\text{O}_3 + 9\text{Fe}$ the number of electrons transferred from the reductant to the oxidant is
1) 8 2) 4 3) 16 4) 24
48. Some statements about heavy water are given below.
(i) Heavy water is used as moderator in nuclear reactors
(ii) Heavy water is more associated than ordinary water
(iii) Heavy water is more effective solvent than ordinary water
Which of the above statements are correct?
1) (i) and (ii) 2) (i), (ii) and (iii)
3) (ii) and (iii) 4) (i) and (iii)
49. Which sequence of reactions shows correct chemical relation between sodium and its compounds?
1) $\text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O} \xrightarrow{\text{HCl(aq)}} \text{NaCl} \xrightarrow{\text{CO}_2} \text{Na}_2\text{CO}_3 \xrightarrow{\Delta} \text{Na}$
2) $\text{Na} \xrightarrow{\text{O}_2} \text{Na}_2\text{O} \xrightarrow{\text{H}_2\text{O}} \text{NaOH} \xrightarrow{\text{CO}_2} \text{Na}_2\text{CO}_3 \xrightarrow{\Delta} \text{Na}$
3) $\text{Na} + \text{H}_2\text{O} \rightarrow \text{NaOH} \xrightarrow{\text{HCl}} \text{NaCl} \xrightarrow{\text{CO}_2} \text{Na}_2\text{CO}_3 \xrightarrow{\Delta} \text{Na}$



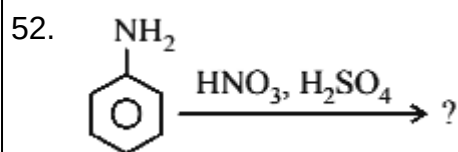
50. Diamond is hard because

- 1) all the four valence electrons are bonded to each carbon atoms by covalent bonds
- 2) it is a giant molecule
- 3) it is made up of carbon atoms
- 4) it cannot be burnt

51. What is the R and S configuration for each stereogenic centre in this sugar from top to bottom?



- 1) R, R, S
- 2) R, S, S
- 3) R, S, R
- 4) S, S, R



The product P for the above given reaction will be

- 1) *m*-nitroaniline
- 2) *o*-nitroaniline
- 3) *p*-nitroaniline
- 4) both *o* & *p* nitroaniline

53. The metal that crystallises in simple cubic system is

- 1) Po
- 2) Na
- 3) Cu
- 4) Ag

54. The freezing point of a solution composed of 10.0 g of KCl in 100 g of water is 4.5°C . Calculate the van't Hoff factor, *i* for this solution.

- 1) 2.50
- 2) 1.8
- 3) 1.2
- 4) 1.3

55. The standard Gibbs free energy change, ΔG° is related to equilibrium constant, K_p as

- 1) $K_p = -RT \ln \Delta G^\circ$
- 2) $K_p = \left[\frac{e}{RT} \right]^{\Delta G^\circ}$
- 3) $K_p = -\frac{\Delta G}{RT}$
- 4) $K_p = e^{-\Delta G^\circ/RT}$

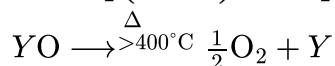
56. The rate constant of a reaction at temperature 200 K is 10 times less than the rate constant at 400 K. What is the activation energy of the reaction?

- 1) 1842.4R
- 2) 460.6R
- 3) 230.3R,
- 4) 921.2R

57. Which one of the following is the most effective in causing the coagulation of an As_2S_3 sol?

- 1) KCl
- 2) AlCl_3
- 3) MgSO_4
- 4) $\text{K}_3\text{Fe}(\text{CN})_6$

58. $\text{XCl}_2 (\text{excess}) + \text{YCl}_2 \longrightarrow \text{XCl}_4 + \text{Y} \downarrow$



Ore of Y would be,

- 1) siderite
- 2) malachite
- 3) hornsilver
- 4) cinnabar

59. Xenon hexafluoride on partial hydrolysis produces compounds 'X' and 'Y'. Compounds 'X', 'Y' and the oxidation state of Xe are respectively:

- 1) $\text{XeOF}_4(+6)$ and $\text{XeO}_3(+6)$
- 2) $\text{XeO}_2(+4)$ and $\text{XeO}_3(+6)$
- 3) $\text{XeOF}_4(+6)$ and $\text{XeO}_2\text{F}_2(+6)$
- 4) $\text{XeO}_2\text{F}_2(+6)$ and $\text{XeO}_2(+4)$

60. Which one of the following has maximum number of unpaired electrons?

- 1) Mg^{2+}
- 2) Ti^{3+}
- 3) V^{3+}
- 4) Fe^{2+}

61. AgCl dissolves in a solution of NH_3 but not in water because

- 1) NH_3 is a better solvent than H_2O
- 2) Ag^+ forms a complex ion with NH_3
- 3) NH_3 is a stronger base than H_2O
- 4) the dipole moment of water is higher than NH_3

62. $\text{CH}_3\text{CH}_2\text{Br}$ undergoes Wurtz reaction. We may expect some of the following product

A : $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

B : $\text{CH}_2 = \text{CH}_2$

C : $\text{CH}_3 - \text{CH}_3$

Select correct product.

- 1) Only A
- 2) A and B
- 3) A, B and C
- 4) A and C

63. Ethanol and dimethyl ether form a pair of functional isomers. The boiling point of ethanol is higher than that of dimethyl ether, due to the presence of

- 1) H-bonding in ethanol

- 2) H-bonding in dimethyl ether
- 3) CH₃ group in ethanol
- 4) CH₃ group in dimethyl ether

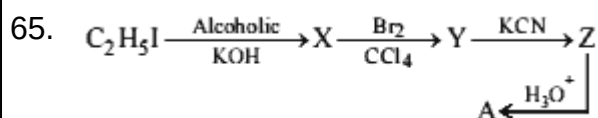
64. Match the compounds given in List-I with List-II and select the suitable option using the codes given below

List-I	List-II
A. Benzaldehyde	1. Phenolphthalein
B. Phthalic anhydride	2. Benzoin condensation
C. Phenyl benzoate	3. Oil of wintergreen
D. Methyl salicylate	4. Fries rearrangement

Codes:

A B C D

- 1) 4 1 3 2 2) 4 2 3 1
- 3) 2 3 4 1 4) 2 1 4 3



The product 'A' is

- 1) succinic acid 2) melonic acid
- 3) oxalic acid 4) maleic acid



The product P in this reaction is

- 1) R-NH₂ 2) $\text{R}-\underset{\text{H}}{\text{N}}-\text{CH}_3$
- 3) R-CH₃ 4) R-N-(CH₃)₂

67. The secondary structure of a protein refers to

- 1) α-helical backbone
- 2) hydrophobic interactions
- 3) sequence of α-amino acids
- 4) fixed configuration of the polypeptide backbone

68. Super glue or crazy glue is

- 1) poly (methyl methacrylate)
- 2) poly (ethyl acrylate)
- 3) poly (methyl α-cyanoacrylate)
- 4) poly (ethyl methacrylate)

69. Which of the following sets of reactants is used for preparation of paracetamol from phenol?

- 1) HNO₃, H₂/Pd, (CH₃CO)₂O
- 2) H₂SO₄, H₂/Pd, (CH₃CO)₂O
- 3) C₆H₅N₂Cl, SnCl₂/HCl, (CH₃CO)₂O
- 4) Br₂/H₂O, Zn/HCl, (CH₃CO)₂O

70. Assertion (A) Cu²⁺ and Cd²⁺ are separated by first adding KCN solution and then passing H₂S gas.

Reason (R) KCN reduces Cu²⁺ to Cu⁺ and forms a complex with it.

The correct answer is

- 1) Both (A) and (R) are true and (R) is the correct explanation of (A)
- 2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
- 3) (A) is true but (R) is not true
- 4) (A) is not true but (R) is true

Maths - Section A (MCQ.)

71. $\log \left(\log_{ab} a + \frac{1}{\log_b ab} \right)$ is (where $ab \neq 1$)

- 1) 0 2) 1
- 3) $\log_a ab$ 4) $\log_b ab$

72. Which of the following inequality is true for $x > 0$?

- 1) $\log(1+x) < \frac{x}{1+x} < x$
- 2) $\frac{x}{1+x} < x < \log(1+x)$
- 3) $x < \log(1+x) < \frac{x}{1+x}$
- 4) $\frac{x}{1+x} < \log(1+x) < x$

73. Let $f(x) = x^2 + ax + b$, where $a, b \in \mathbb{R}$. If $f(x) = 0$ has all its roots imaginary, then the roots of $f(x) + f'(x) + f''(x) = 0$ are

- 1) real and distinct 2) imaginary
- 3) equal 4) rational and equal

74. If $\sin \theta, \cos \theta, \tan \theta$ are in G.P. then $\cos^9 \theta + \cos^6 \theta + 3 \cos^5 \theta - 1$ is equal to

- 1) -1 2) 0 3) 1 4) 2

75. A complex number z is such that $\arg \left(\frac{z-2}{z+2} \right) = \frac{\pi}{3}$. The points representing this complex number will lie on

- 1) an ellipse 2) a parabola
- 3) a circle 4) a straight line

76. The solution of $(x \operatorname{cosec} \left(\frac{y}{x} \right) - y) dx + x dy = 0$ is

- 1) $\log |x| - \cos \left(\frac{x}{y} \right) = c$
- 2) $\log |x| - \cos \left(\frac{y}{x} \right) = c$
- 3) $\log |x| - \sin \left(\frac{x}{y} \right) = c$
- 4) $\log |x| - \sin \left(\frac{y}{x} \right) = c$

77. A binary sequence is an array of 0's and 1's. The number of n -digit binary sequences which contain even number of 0's is

- 1) 2^{n-1} 2) $2^n - 1$
 3) $2^{n-1} - 1$ 4) 2^n

78. Five balls of different colours are to be placed in three boxes of different sizes. Each box can hold all five balls. In how many ways can we place the balls so that no box remains empty?

- 1) 50 2) 100 3) 150 4) 200

79. Sum of first 'n' terms of a series $a_1 + a_2 + \dots + a_n$ is given by $S_n = \frac{n(n^2-1)(n+2)}{4}$, then the value of $\lim_{n \rightarrow \infty} \sum_{r=2}^n \frac{1}{a_r}$ is

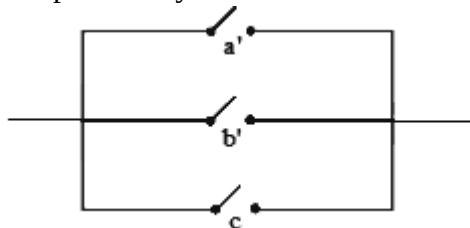
- 1) 4 2) 2 3) $\frac{1}{4}$ 4) $\frac{1}{2}$

80. Let S be a finite set containing n elements. Then the total number of commutative binary operation on S is

- 1) $n^{\lfloor \frac{n(n+1)}{2} \rfloor}$ 2) $n^{\lfloor \frac{n(n-1)}{2} \rfloor}$
 3) $n^{(n^2)}$ 4) $2^{(n^2)}$

81. Consider the switching circuit

Logical expression corresponding to the complimentary to the above circuit is



- 1) $a.b.c'$ 2) $a + b + c'$
 3) $a' \cdot b' \cdot c$ 4) none

82. Find the value of $\sin 12^\circ \sin 48^\circ \sin 54^\circ$.

- 1) $\frac{1}{2}$ 2) $\frac{1}{4}$ 3) $\frac{1}{6}$ 4) $\frac{1}{8}$

83. $\frac{\cos \theta}{1-\tan \theta} + \frac{\sin \theta}{1-\cot \theta}$ is equal to

- 1) $\sin \theta - \cos \theta$ 2) $\sin \theta + \cos \theta$
 3) $\tan \theta + \cot \theta$ 4) $\tan \theta - \cot \theta$

84. A straight line through the point A(3,4) is such that its intercept between the axes is bisected at A, its equation is

- 1) $3x - 4y + 7 = 0$ 2) $4x + 3y = 24$
 3) $3x + 4y = 25$ 4) $x + y = 7$

85. If $\left| \frac{z-25}{z-1} \right| = 5$, the value of $|z|$

- 1) 3 2) 4 3) 5 4) 6

86. The value of $\int_1^4 |x-3| dx$ is equal to

- 1) 2 2) $\frac{5}{2}$ 3) $\frac{1}{2}$ 4) $\frac{3}{2}$

87. The normal at the point $(at_1^2, 2at_1)$ on the parabola meets the parabola again in the point $(at_2^2, 2at_2)$, then

- 1) $t_2 = -t_1 + \frac{2}{t_1}$ 2) $t_2 = -t_1 - \frac{2}{t_1}$
 3) $t_2 = t_1 - \frac{2}{t_1}$ 4) $t_2 = t_1 + \frac{2}{t_1}$

88. The conic represented by $x = 2(\cos t + \sin t)$, $y = 5(\cos t - \sin t)$ is

- 1) a circle 2) a parabola
 3) an ellipse 4) a hyperbola

89. If the eccentricity of the hyperbola $x^2 - y^2 \operatorname{cosec}^2 \alpha = 25$ is $\sqrt{5}$ times the eccentricity of the ellipse $x^2 \operatorname{cosec}^2 \alpha + y^2 = 5$ then α is equal to :

- 1) $\tan^{-1} \sqrt{2}$ 2) $\sin^{-1} \sqrt{\frac{3}{4}}$
 3) $\tan^{-1} \sqrt{\frac{2}{5}}$ 4) $\sin^{-1} \sqrt{\frac{2}{5}}$

90. $\lim_{x \rightarrow 0} \frac{1}{x} \int_0^x (1 + \sin 3t)^{\frac{1}{3}} dt$ is equal to

- 1) 2 2) 1 3) e^2 4) e^3

91. The logical expression X, in its simplest form for the truth table

a	b	X
1	0	0
1	1	1
0	1	0
0	0	0

is

- 1) $X = a.b$ 2) $X = a + b$
 3) $X = a'b$ 4) $X = a \cdot b'$

92. If the normal to the curve $y = f(x)$ at (3,4) makes an angle $\frac{3\pi}{4}$ with the positive x-axis, then $f'(3)$ is equal to

- 1) -1 2) $\frac{3}{4}$ 3) 1 4) $-\frac{3}{4}$

93. The angle of depressions of the top and the foot of a chimney as seen from the top of a second chimney, which is 150 m high and standing on the same level as the first are θ and ϕ respectively, then the distance between their tops when $\tan \theta = \frac{4}{3}$ and $\tan \phi = \frac{5}{2}$ is

- 1) $\frac{150}{\sqrt{3}}$ m 2) $100\sqrt{3}$ m
 3) 150 m 4) 100 m

94. In an equilateral triangle, the inradius, circumradius and one of the exradii are in the ratio

- 1) 2 : 3 : 5 2) 1 : 2 : 3
 3) 1 : 3 : 7 4) 3 : 7 : 9

95. In the set $\mathbb{N} \times \mathbb{N}$, the relation R is defined by (a, b) R (c, d) $\Leftrightarrow ad = bc$. Then R is

- 1) partial order relation
 2) equivalence relation

- 3) reflexive and transitive but not symmetric
 4) symmetric and transitive but not reflexive
96. If the normal to the rectangular hyperbola $xy = c^2$ at the point $(ct, \frac{c}{t})$ meets the curve again at $(ct', \frac{c}{t'})$, then

- 1) $t^3 t' = 1$
 2) $t^3 t' = -1$
 3) $tt' = 1$
 4) $tt' = -1$

97. The value of the determinant

$$\begin{vmatrix} \cos \alpha & -\sin \alpha & 1 \\ \sin \alpha & \cos \alpha & 1 \\ \cos(\alpha + \beta) & -\sin(\alpha + \beta) & 1 \end{vmatrix} \text{ is}$$

- 1) independent of α
 2) independent of β
 3) independent of α and β
 4) None of the above

98. The value of $\sin(\cot^{-1}(\cos(\tan^{-1}x)))$ is

- 1) $\sqrt{\frac{x^2+2}{x^2+1}}$ 2) $\sqrt{\frac{x^2+1}{x^2+2}}$
 3) $\frac{x}{\sqrt{x^2+2}}$ 4) $\frac{1}{\sqrt{x^2+2}}$

99. The domain of the function

$$\sqrt{x^2 - 5x + 6} + \sqrt{2x + 8 - x^2} \text{ is}$$

- 1) $[2, 3]$ 2) $[-2, 4]$
 3) $[-2, 2] \cup [3, 4]$ 4) $[-2, 1] \cup [2, 4]$

100. $f(x) = \begin{cases} x \sin 1/x & , x \neq 0 \\ 0 & , x = 0 \end{cases}$ at $x = 0$ is

- 1) continuous as well as differentiable
 2) differentiable but not continuous
 3) continuous but not differentiable
 4) neither continuous nor differentiable

101. Area enclosed by the curve $\pi [4(x - \sqrt{2})^2 + y^2] = 8$ is

- 1) π 2) 2 3) 3π 4) 4

102. If the tangent to the function $y = f(x)$ at $(3, 4)$ makes an angle of $\frac{3\pi}{4}$ with the positive direction of x -axis in anticlockwise direction then $f'(3)$ is

- 1) -1 2) 1 3) $\frac{1}{\sqrt{3}}$ 4) $\sqrt{3}$

103. The value of the integral

$$\int_{-1/2}^{1/2} \left[\left(\frac{x+1}{x-1} \right)^2 + \left(\frac{x-1}{x+1} \right)^2 - 2 \right]^{1/2} dx \text{ is}$$

- 1) $\log\left(\frac{4}{3}\right)$ 2) $4\log\left(\frac{3}{4}\right)$
 3) $4\log\left(\frac{4}{3}\right)$ 4) $\log\left(\frac{3}{4}\right)$

104. Evaluate $\int \frac{x^2+4}{x^4+16} dx$.

- 1) $\frac{1}{2\sqrt{2}} \tan^{-1} \left(\frac{x^2-4}{2x\sqrt{2}} \right) + c$
 2) $\frac{1}{2\sqrt{2}} \tan^{-1} \left(\frac{x^2-4}{2\sqrt{2}} \right) + c$
 3) $\frac{1}{2\sqrt{2}} \tan^{-1} \left(\frac{x^2-4}{x\sqrt{2}} \right) + c$
 4) None of the above

105. The chances of defective screws in three boxes

A, B, C are $\frac{1}{5}, \frac{1}{6}, \frac{1}{7}$ respectively. A box is selected at random and a screw drawn from it at random is found to be defective. Then, the probability that it came from box A, is

- 1) $\frac{16}{29}$ 2) $\frac{1}{15}$ 3) $\frac{27}{59}$ 4) $\frac{42}{107}$

106. The solution of the differential equation $\log x \frac{dy}{dx} + \frac{y}{x} = \sin 2x$ is

- 1) $y \log |x| = C - \frac{1}{2} \cos x$
 2) $y \log |x| = C + \frac{1}{2} \cos 2x$
 3) $y \log |x| = C - \frac{1}{2} \cos 2x$
 4) $xy \log |x| = C - \frac{1}{2} \cos 2x$

107. The length of the parabola $y^2 = 12x$ cut off by the latus-rectum is

- 1) $6(\sqrt{2} + \log(1 + \sqrt{2}))$ 2) $3(\sqrt{2} + \log(1 + \sqrt{2}))$
 3) $6(\sqrt{2} - \log(1 + \sqrt{2}))$ 4) $3(\sqrt{2} - \log(1 + \sqrt{2}))$

108. The line which passes through the origin and intersect the two lines $\frac{x-1}{2} = \frac{y+3}{4} = \frac{z-5}{3}, \frac{x-4}{2} = \frac{y+3}{3} = \frac{z-14}{4}$, is

- 1) $\frac{x}{1} = \frac{y}{-3} = \frac{z}{5}$
 2) $\frac{x}{-1} = \frac{y}{3} = \frac{z}{5}$
 3) $\frac{x}{1} = \frac{y}{3} = \frac{z}{-5}$
 4) $\frac{x}{1} = \frac{y}{4} = \frac{z}{-5}$

109. Convert the hexadecimal numeral ABCD into binary numeral

- 1) -1010101111001100
 2) (1001000011111111)₂
 3) (1111110000010001)₂
 4) (1000100100111100)₂

110. If X is a poisson variate such that $P(X = 1) = P(X = 2)$, then $P(X = 4)$ is equal to

- 1) $\frac{1}{2e^2}$ 2) $\frac{1}{3e^2}$
 3) $\frac{2}{3e^2}$ 4) $\frac{1}{e^2}$

English - Section A (MCQ.)

111. Earth has not anything to show more fair. Dull would he be of soul who could pass doth like a garment wear. The beauty of the morning; silent, bare, Ships, towers, dor and to the sky; All bright and glittering in the smokeless air. Never did Sun more bea hill; Ne'er saw I, never felt a calm so deep! The river glideth at his own sweet will: De mighty heart is lying still.

The narrator call a person dull if he/she

- 1) does not talk to him openly 2) does not know about romantic sites 3) passes by without experiencing the beauty of the area. 4) passes over the site and shouts loudly

112. Pick out the correct synonym of the word 'Solitude'.

- 1) Musical 2) Alonenes 3) Time 4) Single-composition statement mindedness

113. Select the antonym of the word 'Gregarious'.

- 1) Antisocial 2) Horrendous 3) Glorious 4) Similar

114. Earth has not anything to show more fair. Dull would he be of soul who could pass by A sight so touching in its majesty. This city now doth like a garment wear. The beauty of the morning; silent, bare, Ships, towers, domes, theatres and temples lie Open unto the field and to the sky; All bright and glittering in the smokeless air. Never did Sun more beautifully steep. In his first splendour valley, rock or hill; Ne'er saw I, never felt a calm so deep! The river glideth at his own sweet will: Dear God! The very houses seem asleep; And all that mighty heart is lying still.

The city of London appear as if it is _____

- 1) covered with thick layer of smoke 2) clad in attractive colourful clothing 3) desolate and lonely 4) sleeping beauty

Aptitude - Section A (MCQ)

115. From the given options, choose the correct one that will replace the question mark (?) in the following series.

ZBO, YEJ, XHE, WKZ, ?

- 1) VNU 2) INU 3) ZXP 4) VUN

116. The questions given below consist of a question followed by two statements labelled as I and II. We have to decide whether these statements given enough information required to answer the question or not.

Question in which year was Ritika born?

Statement

I. Ritika at present is 25 years younger to her mother.

II. Ritika's sister who was born in 1964, is 35 years younger to her mother.

Give answer

- 1) I alone is sufficient while II alone is not sufficient. 2) II alone is sufficient while I alone is not sufficient. 3) Either I or II is sufficient. 4) Both I and II are sufficient.

117. In a code language, 'TIGER' is written as 'JUI SF'. How will 'EQUAL' be written as in that language?

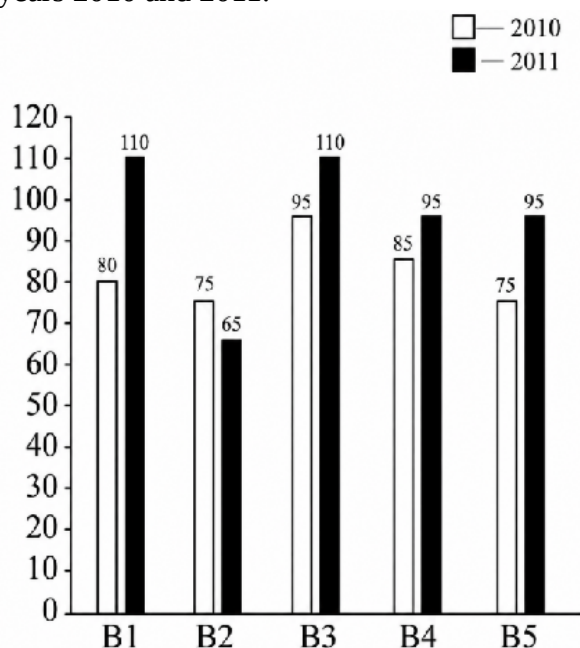
- 1) RFXMB 2) RFWMB 3) RXMBF 4) RFWBE

118. Select the number from among the given options that can replace the question mark (?) in the following series.

38, 77, 233, ?, 4679

- 1) 641 2) 842 3) 699 4) 935

119. Following bar graph shows the sales of books (in thousand number) from Five branches of a publishing company during two consecutive years 2010 and 2011.



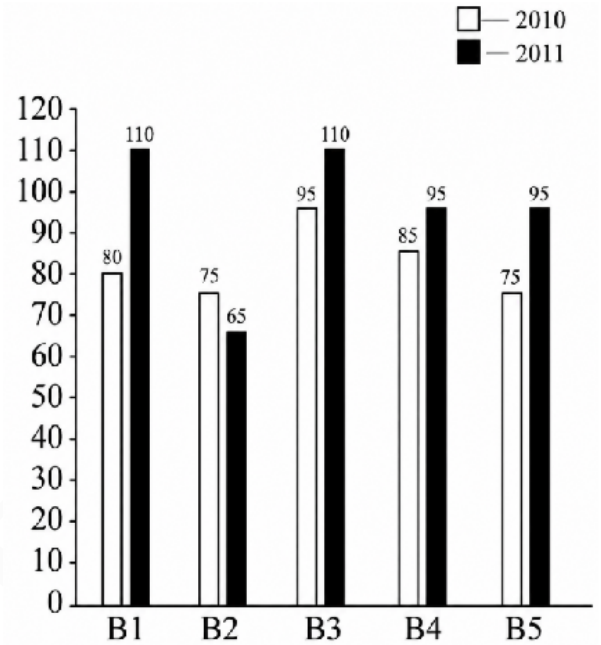
What is the ratio of total sale of branch B_2 for both year to the total sale of branch B_4 for both year?

- 1) 2 : 3 2) 3 : 5 3) 7 : 9 4) 4 : 5

120. Four letter-clusters have been given, out of which three are alike in same manner and one is different. Select the letter cluster that is different.

- 1) CDFIM 2) DEGJN 3) RSUYC 4) XYADH

121. Following bar graph shows the sales of books (in thousand number) from Five branches of a publishing company during two consecutive years 2010 and 2011.



What is the average sales of all the branches (in thousand numbers) for the year of 2010?

- 1) 85 2) 82 3) 90 4) 93