Sample Papers

JEE Mains

Time: 3 Hours ***Maximum Marks: 360***

Topics Covered:

Physics	:	*Properties of Solids, Properties of Liquids, Heat & Thermodynamics, Ray Optics, Wave Optics, Electromagnetic Waves*
Chemistry	:	*p-Block (13 & 14 Group), Thermodynamics, Thermochemistry, Solid State, Alkyl Halides & Haloalkane, Surface Chemistry, Metallurgy, Chemistry in Everyday Life*
Mathematics	:	*Progression, Permutation Combination, Straight Lines, Definite Integrals, Indefinite Integrals*

Important Instructions :

1. *The test is of **3 hours** duration.*
2. *The Test consists of 90 questions. The maximum marks are **360**.*
3. *There are three parts in the question paper A, B, C consisting of **Physics, Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each question is allotted 4 (four) marks for each correct response.*
4. *Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question. ¼ (one-fourth) marks of the total marks allotted to the question (i.e. 1 mark) will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.*
5. *There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 4 above.*
6. *For writing particulars/marking responses on Answer Sheet use **only Black/Blue Ball Point Pen** provided in the examination hall.*
7. *No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. except the Admit Card inside the examination hall/room.*

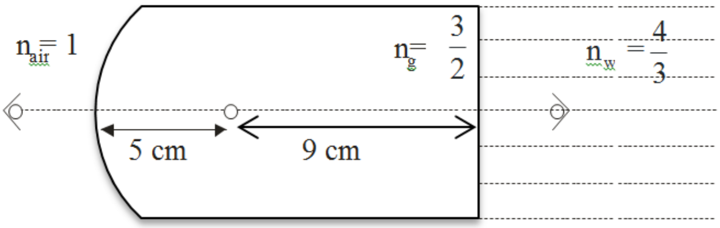
PART-A : PHYSICS

1. A water jet of area 50 cm^2, moving with a velocity of 25 m/s impinges normally on a plate moving with a velocity of 5 m/s in the same direction. If $\rho_\omega = 1000\ kg/m^3$, then the force exerted on the plate will be:
(A) 3750 N (B) 2000 N (C) 3125 N (D) 2500 N

2. If a rubber ball is taken at the depth of 200 m in a pool its volume decreases by 0.2%. If the density of the water is 10^3 kg/m^3 and $g = 10\ m/s^2$, then the volume elasticity in N/m^2 will be:
(A) 10^8 (B) 2×10^8 (C) 10^9 (D) 2×10^9

3. A mono-atomic ideal gas is compressed from volume V to V/2 through various processes. For which of the following process final pressure will be maximum?
(A) Isobaric (B) Isothermal (C) Adiabatic (D) PV^2 = constant

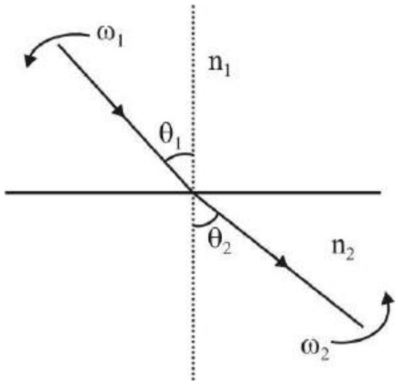
4. There is a small air bubble inside a thick lens of glass as shown in the figure. What is the distance between the images of the air bubble as seen by two observers, one in air and other in water?
(Given radius of curved surface is 5 cm)



(A) 1 cm (B) 9 cm (C) 1.5 cm (D) 4 cm

5. At a certain point on a screen in a YDSE apparatus, the path difference for the two interfering waves is $\left(\frac{1}{3}\right)^{rd}$ of the wavelength. Find the ratio of the intensity at this point to that at the centre of a bright fringe.
(A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{1}{3}$ (D) $\frac{3}{4}$

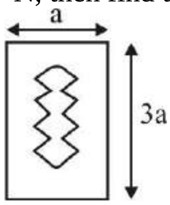
6. Consider the refraction of light ray as shown in the figure below. Incident ray is rotating with constant angular velocity 2 rad/sec. What is the angular velocity of refracted ray, when the angle of incidence becomes 30°? (Given $\frac{n_1}{n_2} = \sqrt{3}$)



(A) 2 rad/s (B) $\sqrt{3}$ rad/s (C) $\frac{1}{2}$ rad/s (D) 6 rad/s

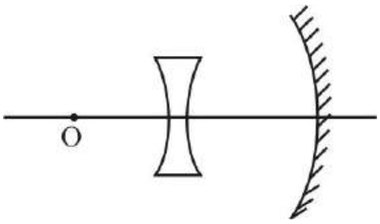
Space for Rough Work

7. A rectangular blade of negligible weight floats on a water surface of surface tension $\frac{1}{7} \times 10^{-1}$ N / m . If the minimum force to lift up blade from water surface is 2×10^{-2} N, then find the internal perimeter of blade. [Take a = 10 cm]



(A) 2a (B) 3a (C) 4a (D) 6a

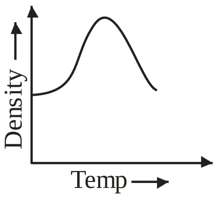
8. Consider the situation as shown in the figure. A point object O is placed at a distance of 20 cm from a concave lens of focal length 5 cm. Now a concave mirror of radius 9 cm is adjusted on the right side of the lens, so that the final image coincides with the object O. Find the separation between the lens and the mirror.

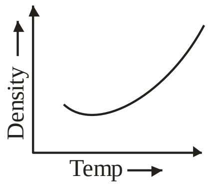


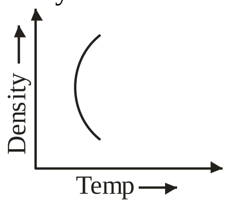
(A) 4 cm (B) 9 cm (C) 5 cm (D) 3 cm

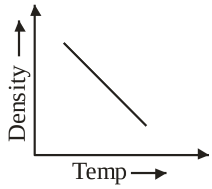
9. The surface tension of a liquid is 80 dyne/cm. Its relative density is 0.8. If the angle of contact between the liquid and glass is 60°, find the height to which the liquid rises in a glass capillary tube of radius 1 mm. (g = 10 m/s^2)
(A) 0.5 cm (B) 2 cm (C) 1 cm (D) 4 cm

10. The variation of density of water with temperature is represented by

(A) 

(B) 

(C) 

(D) 

11. A gasoline engine takes in 5 moles of air at 20°C and 1 atm, and compresses it adiabatically to 1/10th of the original volume. Find the change in internal energy. (Assume air to be diatomic)
(A) 92 kJ (B) 23 kJ (C) 46 kJ (D) 82 kJ

12. When an object is placed in front of a concave mirror of focal length f, a virtual image is produced with a magnification of 2. To obtain a real image with a magnification of 2, the object has to be moved by a distance equal to

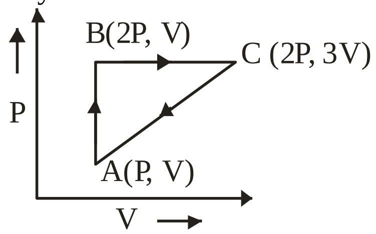
(A) $\frac{f}{2}$ (B) $\frac{2}{5f}$ (C) f (D) $\frac{3}{2}f$

13. The central fringe in a Young's double slit experiment with the wavelength λ = 500 nm has intensity I_0 . If one of the slits is covered by a 5μm thick film of glass (μ = 1.5), the intensity at centre of the screen becomes I_1. The ratio of $\frac{I_1}{I_0}$ is

(A) $\frac{3}{16}$ (B) $\frac{1}{4}$ (C) $\frac{1}{2}$ (D)1

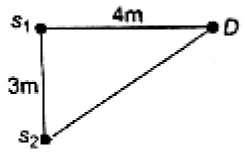
Space for Rough Work

14. A monoatomic ideal gas is taken through a cycle ABCA as shown. The efficiency of the cycle is



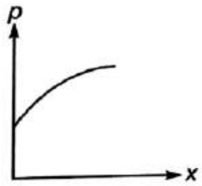
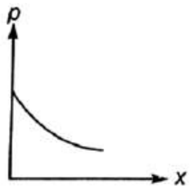
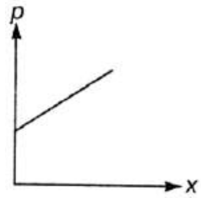
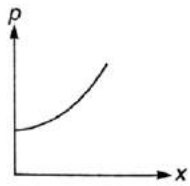
(A) 7% (B) 10% (C) 8.7% (D) 15%

15. In the figure, the intensity of waves arriving at D from two coherent sources s_1 and s_2 is I_0. The wavelength of the wave is λ = 4m. Resultant intensity at D will be



(A) $4I_0$ (B) I_0 (C) $2I_0$ (D) Zero

16. The cross-sectional area of a horizontal tube increases linearly along its length, as we move in the direction of flow. The variation of pressure, as we move along its length in the direction of flow (positive x-direction) is best represented by which of the following graphs?

(A)  (B)  (C)  (D) 

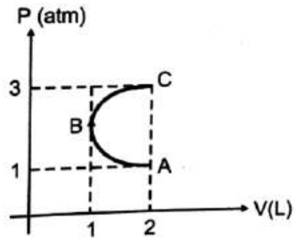
17. The velocity of water near the surface of river is 5 m/s whereas the depth is 5m. The coefficient of viscosity of water is 10^{-2} poise, then shearing stress will be

(A) 1 N/m^2 (B) 5×10^{-3} N/m^2 (C) 10^{-2} N/m^2 (D) 2.5×10^{-3} N/m^2

18. The minimum distance between an object and its real image formed by a thin convex lens of focal length f is Kf. Find the value of K.

(A) 1 (B) 4 (C) 3 (D) 2

19. In the P-V diagram shown in figure, ABC is a semicircle. The work done in the process ABC is



(A) Zero (B) $\frac{\pi}{2}$ atm L (C) $-\frac{\pi}{2}$ atm L (D) 4 atm L

Space for Rough Work

20. A plane electromagnetic wave of angular frequency ω propagates in a poorly conducting medium of conductivity σ and relative permittivity ε. Find the ratio of conduction current density and displacement current density in the medium.

(A) $\frac{\varepsilon\varepsilon_0\omega}{\sigma}$ (B) $\frac{\sigma}{\varepsilon\varepsilon_0\omega}$ (C) $\frac{\omega}{\sigma\varepsilon_0\varepsilon}$ (D) $\frac{\omega\sigma}{\varepsilon_0\varepsilon}$

21. Two identical cylindrical vessels, with their bases at the same level, each contain a liquid of density ρ. The height of the liquid in one vessel is h_1 and that in the other is h_2. The area of either base is A. What is the work done by gravity in equalizing the levels when the vessels are interconnected?

(A) $A\rho g(h_1 - h_2)^2$ (B) $A\rho g(h_1 + h_2)^2$ (C) $A\rho g\left(\frac{h_1 - h_2}{2}\right)^2$ (D) $A\rho g\left(\frac{h_1 + h_2}{2}\right)^2$

22. In Young's double slit experiment, the 10^{th} maximum of wavelength λ_1 is at distance y_1 from its central maximum and the 5^{th} maximum of wavelength λ_2 is at a distance y_2 from its central maximum. The ratio y_1/y_2 will be

(A) $\frac{2\lambda_1}{\lambda_2}$ (B) $\frac{2\lambda_2}{\lambda_1}$ (C) $\frac{\lambda_1}{2\lambda_2}$ (D) $\frac{\lambda_2}{2\lambda_1}$

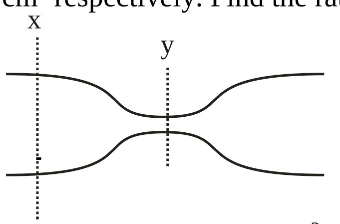
23. A point object is placed at a distance of 12 cm on the axis of a convex lens of focal length 10 cm. On the other side of the lens, a convex mirror is placed at a distance of 10 cm from the lens such that the image formed by the combination coincides with the object itself. What is the focal length of the convex mirror?

(A) 10 cm (B) 15 cm (C) 20 cm (D) 25 cm

24. The ratio of adiabatic bulk modulus and isothermal bulk modulus of a gas is ($\gamma = C_p/C_v$)

(A) 1 (B) γ (C) $\frac{\gamma}{(\gamma - 1)}$ (D) $\frac{(\gamma - 1)}{\gamma}$

25. Water flows in a horizontal tube as shown in figure. The pressure of water changes by 600 N/m^2 between x and y where the areas of cross section are 3 cm^2 and 1.5 cm^2 respectively. Find the rate of flow of water through the tube.



(A) 169 cm^3/s (B) 179 cm^3/s (C) 189 cm^3/s (D) 199 cm^3/s

26. A diatomic gas is heated at constant pressure. If 105 J of heat is given to the gas, find the change in internal energy of the gas.

(A) 30 J (B) 35 J (C) 55 J (D) 75 J

27. Two hails stones with radii in the ratio of 1 : 2 fall from a great height through the atmosphere. Then the ratio of their momentum after they have attained terminal velocity is:

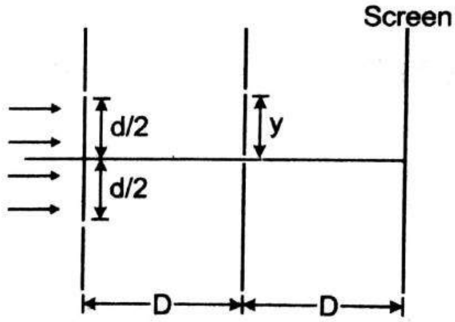
(A) 1 : 32 (B) 1 : 16 (C) 1 : 8 (D) 1 : 4

Space for Rough Work

28. Light of wavelength 6000Å is incident normally on a single slit of width 24×10^{-5} cm. Find out the angular position of second minimum from central maxima?
(A) 15° (B) 30° (C) 45° (D) 60°

29. A plane EM wave of frequency 25 MHz travels in free space along the +x direction. At a particular point in space and time, $\vec{E} = 6.3\hat{j}$ V/m. What is $\vec{B}$ at this point?
(A) $2.52 \times 10^{-5}\ \hat{k}$ T (B) $2.52 \times 10^{-5}(-\hat{k})$ T (C) $2.1 \times 10^{-8}\ \hat{k}$ T (D) $2.1 \times 10^{-8}(-\hat{k})$ T

30. In the Young's double slit experiment apparatus shown in figure, the ratio of maximum to minimum intensity on the screen is 9. The wavelength of light used is λ, then the value of y is



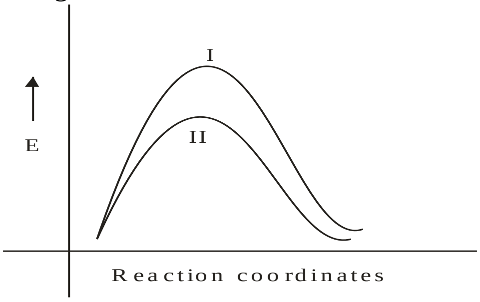
(A) $\frac{\lambda D}{d}$ (B) $\frac{\lambda D}{2d}$ (C) $\frac{\lambda D}{3d}$ (D) $\frac{\lambda D}{4d}$

Space for Rough Work

PART-B : CHEMISTRY

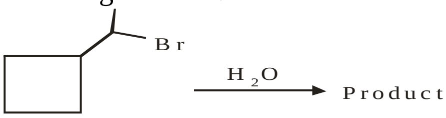
31. The increasing order of atomic radii of the following group 13 elements is
(A) Al < Ga < In < Tl (B) Ga < Al < In < Tl (C) Al < In < Ga < Tl (D) Al < Ga < Tl < In

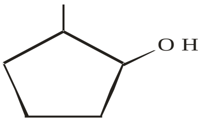
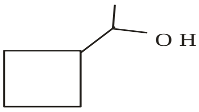
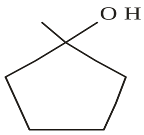
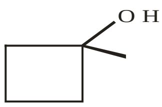
32. Consider the two lines shown in diagram given below



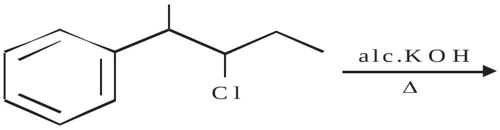
In a SN_2 reaction, these two lines compare the effect of the
(A) Substrate (B) Nucleophile (C) Leaving group (D) Substrate or nucleophile

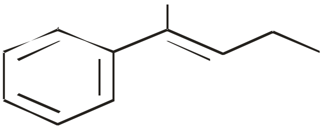
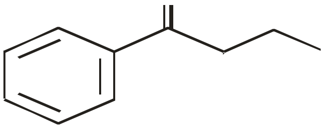
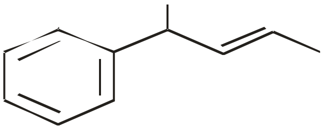
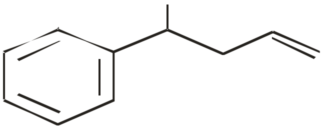
33. What will be the major product of the following reaction?



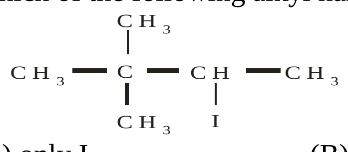
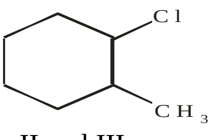
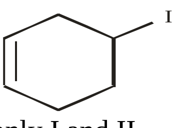
(A) 
(B) 
(C) 
(D) 

34. Major product of the reaction given below is



(A) 
(B) 
(C) 
(D) 

35. Which of the following alkyl halide undergo rearrangement in S_N1 reaction

(I)  (II)  (III) 

(A) only I (B) only II and III (C) only I and II (D) I, II, III

Space for Rough Work

36. Identify Bronsted acids in the reaction : $H_2CO_3 + HPO_4^{2-} \rightleftharpoons H_2PO_4^- + HCO_3^-$

(A) H_2CO_3 and HCO_3^- (B) H_2CO_3 and $H_2PO_4^-$ (C) HPO_4^{2-} and $H_2PO_4^-$ (D) HPO_4^{2-} and HCO_3^-

37. If unit cell of a mineral has cubic closed packed array of oxygen atoms with m fraction of octahedral holes occupied by aluminium ion and n fraction of tetrahedral holes occupied by magnesium ions, m and n, respectively are

(A) $\frac{1}{2},\frac{1}{8}$ (B) $1,\frac{1}{4}$ (C) $\frac{1}{2},\frac{1}{2}$ (D) $\frac{1}{4},\frac{1}{8}$

38. E represents an element belonging to carbon family.

$E + 2X_2 \rightarrow EX_4 (X = F, Cl, Br, I)$

(A) Stability of EX_4 decreases down the 14^{th} group (B) PbI_4 does not exist

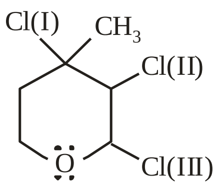
(C) Ge and Pb form EX_2 as well (D) All are correct

39. A compound of B (Boron), X reacts at 200°C with NH_3 to give another compound Y which is called as inorganic benzene. The compound Y is colorless liquid and is highly light sensitive. The compound X with excess of NH_3 and at still higher temp gives $(BN)_n$. The compound X and Y respectively.

(A) BH_3 and B_2H_6 (B) $NaBH_4$ and C_6H_6 (C) B_2H_6 and $B_3N_3H_6$ (D) B_4C_3 and C_6H_6

40. Vitamin B_{12} is called

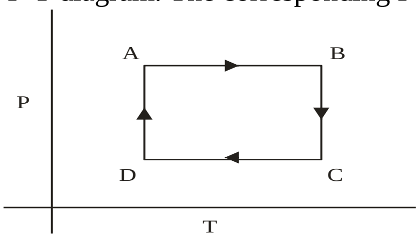
(A) Riboflavin (B) Cyanocobalamine (C) Pyridoxine (D) Thiamine

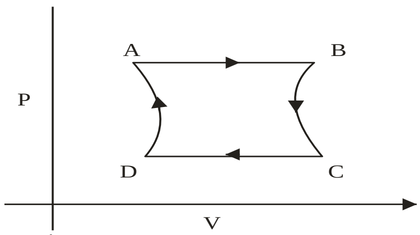
41. 

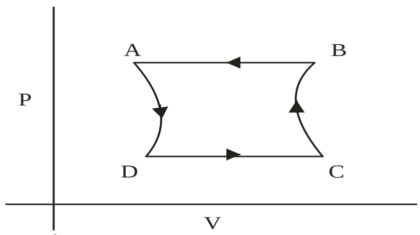
The rate of reaction with $AgNO_3$ will be

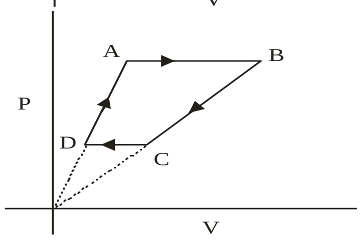
(A) I > II > III (B) III > I > II (C) III > II > I (D) I > III > II

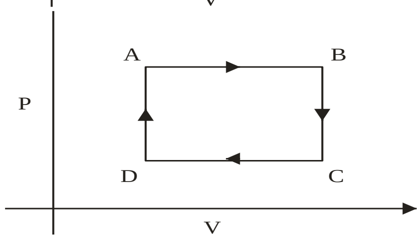
42. A cyclic process ABCDA is shown in a P-T diagram. The corresponding P-V diagram is



(A) 

(B) 

(C) 

(D) 

Space for Rough Work

43. $CH_2=CH-CH_2-\underset{\displaystyle Cl}{CH}-\overset{\displaystyle CH_3}{CH}-CH_3 \xrightarrow{CH_3O^-} P(major)$

The major product is

(A) $CH_2=CH\ CH=CH\ \overset{\displaystyle CH_3}{CH}-CH_3$

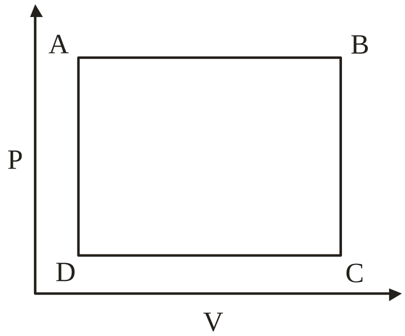
(B) $CH_2=CH\ CH_2CH=\overset{\displaystyle CH_3}{C}-CH_3$

(C) $CH_2=CH-CH_2-\underset{\displaystyle OCH_3}{CH}-\overset{\displaystyle CH_3}{CH}-CH_3$

(D) None of the above

44. The heats of neutralisation of CH_3COOH, HCOOH, HCN and H_2S are –12.8, –13.2, –3.2 and –3.9. Kcal per equivalent. Arrange these acids in increasing order of strength.
(A) $H_2S < HCN < HCOOH < CH_3COOH$
(B) $HCN < H_2S < CH_3COOH < HCOOH$
(C) $HCOOH < CH_3COOH < H_2S < HCN$
(D) $CH_3COOH < HCOOH < HCN < H_2S$

45. A fixed mass of gas is subjected to transformation of states from A to B to C to D and back to A as shown in figure



The succeeding operation that enables this transformation of states are:
(A) heating, cooling, heating, cooling
(B) cooling, heating, cooling, heating
(C) heating, cooling, cooling, heating
(D) cooling, heating, heating, cooling

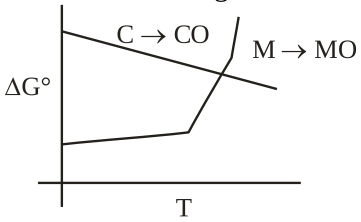
46. The standard molar enthalpies of cyclohexane (*l*) and benzene (*l*) at 25°C are –156 and +49 KJ/mol. The standard enthalpy of hydrogenation of cyclohexene (*l*) at 25°C is –119 KJ/mol. Estimate the magnitude of resonance energy.
(A) 357 KJ/mol
(B) 205 KJ/mol
(C) 152 KJ/mol
(D) None of the above

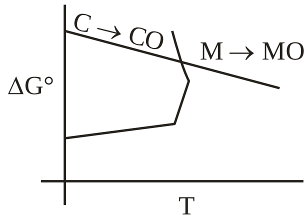
47. The correct order of Lewis acidity of BX_3 molecule is
(A) $BF_3 > BCl_3 > BBr_3 > BI_3$
(B) $BF_3 < BCl_3 < BBr_3 < BI_3$
(C) $BCl_3 > BF_3 > BI_3 > BBr_3$
(D) $BBr_3 > BF_3 > BCl_3 > BI_3$

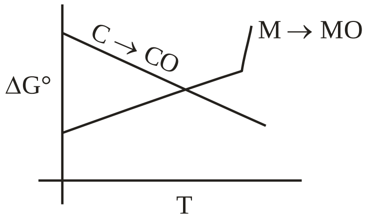
48. In which of the following 3C – $2e^-$ bonds are present.
(A) Al_2Cl_6
(B) I_2Cl_6
(C) $Al_2(CH_3)_6$
(D) $(BeCl_2)_n$

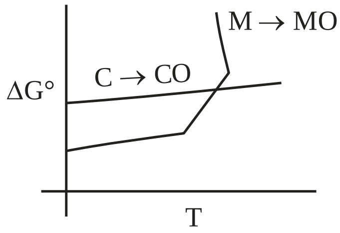
Space for Rough Work

49. Which of the following curve assures that the metal obtained by carbon reduction is in vapour state

(A) 

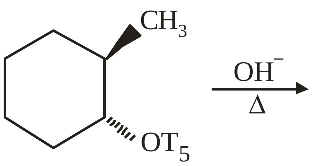
(B) 

(C) 

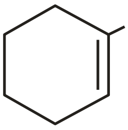
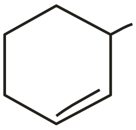
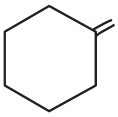
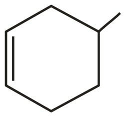
(D) 

50. Copper is purified by electrolytic refining of blister copper. The incorrect statement about this process is:
(A) Pure Cu deposits at cathode
(B) Impure Cu is used as cathode
(C) Acidified aqueous $CuSO_4$ is used as electrolyte
(D) Impurities settle as anode mud.

51. In silicon dioxide
(A) There are double bonds between Si and O atoms.
(B) Silicon atom is bonded to two oxygen atoms.
(C) Each Si atom is surrounded by two oxygen atoms and each O atom is bonded to two silicon atoms.
(D) Each Si atom is surrounded by four oxygen atoms and each oxygen atom is bonded to two silicon atoms.

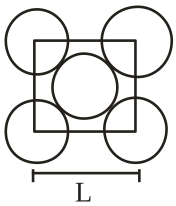
52. 

Major product of the reaction

(A) 
(B) 
(C) 
(D) 

53. A solid AB has NaCl type structure. If the radius of cation A is 100 pm, then the radius of the anion B will be
(A) 241 pm
(B) 414 pm
(C) 22.5 pm
(D) 44.4 pm

54. The packing efficiency of the two dimensional unit cell show below is



(A) 39.27%
(B) 68.02%
(C) 74.05%
(D) 78.54%

55. For which of the following equation will ΔH be equal to ΔU.

(A) $H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(\ell)$

(B) $H_2(g) + I_2(g) \longrightarrow 2HI(g)$

(C) $2NO_2(g) \longrightarrow N_2O_4(g)$

(D) $3NO_2(g) + O_2(g) \longrightarrow 2N_2O_5(g)$

56. In which of the following regioselectivity can be observed.

(A) $CH_3-\overset{\overset{H}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2-Cl \xrightarrow{alc.KOH}$

(B) $CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{Cl}{|}}{C}}-CH_3 \xrightarrow{alc.KOH}$

(C) $CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{Cl}{|}}{C}}-CH_2-CH_3 \xrightarrow{alc.KOH}$

(D) $CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2-Cl \xrightarrow{alc.KOH}$

57. A sequence of how many nucleotides in messenger R.N.A. makes a codon for an amino acid

(A) 3 (B) 4 (C) 1 (D) 2

58. The pH value of solution in which a polar amino acids does not migrate under the influence of electric field is called

(A) Neutralization point (B) Isoelectronic point (C) Isoelectric point (D) None

59. Which of the following is not true for B_2H_6.

(A) B_2H_6 is an electron-deficient molecule

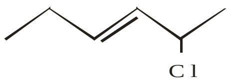
(B) Hybridization of B atom is sp^2 and molecule is planar

(C) B_2H_6 contain four $2C-2e^-$ bond and two $3C-2e^-$ bond.

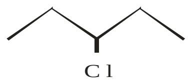
(D) The electronic distribution of the bridge bond has a banana like appearance.

60. Consider the following chlorides

(P)



(Q)



(R)

The correct order of SN_1 reactivity is

(A) (Q) > (R) > (P) (B) (Q) > (P) > (R) (C) (R) > (Q) > (P) (D) (P) > (Q) > (R)

Space for Rough Work

PART-C : MATHEMATICS

61. $\lim_{n\to\infty}\left(\frac{1}{n}+\frac{n^2}{(n+1)^3}+\frac{n^2}{(n+2)^3}+\ldots+\frac{1}{8n}\right)$ is equal to

(A) $\frac{3}{8}$ (B) $\frac{1}{4}$ (C) $\frac{1}{8}$ (D) $\frac{7}{8}$

62. ABCD is a convex quadrilateral with 3, 4, 5 and 6 points marked on its sides AB, BC, CD and DA respectively. Triangles are formed using these 18 points and original vertices of the quadrilateral. Number of such triangles that do not have any side common with the quadrilateral are

(A) 342 (B) 461 (C) 422 (D) 384

63. Let $a_1, a_2, a_3, \ldots, a_{11}$ be real numbers satisfying $a_1 = 15$, $27 - a_2 > 0$ and $a_k = 2a_{k-1} - a_{k-2}$ for $k = 3, 4, \ldots 11$. If $\frac{a_1^2 + a_2^2 + a_3^2 + \ldots . a_{11}^2}{11} = 90$, then $\frac{a_1 + a_2 + a_3 + \ldots . a_{11}}{11}$ is equal to

(A) 4 (B) 6 (C) 9 (D) 0

64. The number of ways so that the birthdays of 6 people falls in exactly 3 calendar months is

(A) 118800 (B) 36960 (C) 158400 (D) 47520

65. Let a, b, c be non-zero real numbers such that $\int_0^3 (3ax^2 + 2bx + c)dx = \int_1^3 (3ax^2 + 2bx + c)dx$. Then

(A) $a + b + c = 3$ (B) $a + b + c = 1$ (C) $a + b + c = 0$ (D) $a + b + c = 2$

66. The sum of the series $\sum_{k=1}^{360} \frac{1}{k\sqrt{k+1} + (k+1)\sqrt{k}}$ is

(A) $\frac{18}{19}$ (B) $\frac{19}{18}$ (C) $\frac{13}{19}$ (D) $\frac{14}{13}$

67. For some $\alpha \in R$, if $\frac{\alpha - x}{px} = \frac{\alpha - y}{qy} = \frac{\alpha - z}{rz}$ and p, q, r are in A.P., then

(A) x, y, z are in H.P. (B) x, y, z are in G.P.
(C) x^2, y^2, z^2 are in A.P. (D) No such relation in x, y, z

68. Arithmetic mean of three numbers which are in G.P. is $\frac{14}{3}$. By adding 1 to the first and second number, and subtracting 1 from the third number, resulting numbers are in A.P. Then sum of squares of original three numbers is

(A) 91 (B) 364 (C) 84 (D) 273

69. The least positive integer k for which the value $k \times n^2(n^2 - 1^2)(n^2 - 2^2)\ldots(n^2 - (n-1)^2)$ turns into a factorial of some positive integer is

(A) 2 (B) 1 (C) 4 (D) 8

70. $I = \int_0^a \ln(\cot a + \tan x)dx$, where $a \in \left(0, \frac{\pi}{2}\right)$, then I is equal to

(A) a ln (sin a) (B) –a ln(sin a) (C) 2a ln(cosa) (D) –2a ln(sin a)

71. The possible values of a for which the point (a, a^2) lies inside the triangle formed by the straight lines 2x + 3y – 1 = 0, x + 2y = 3 and 5x – 6y – 1 = 0 is

(A) (–3, 2) ∪ (3, 6) (B) $\left(\frac{-3}{2}, -1\right) \cup \left(\frac{1}{2}, 1\right)$ (C) (–3, 1) ∪ (1, 2) (D) (–1, 1) ∪ (1, 3)

72. $\int \frac{e^x (x-1)(x-\ln x)}{x^2} dx$ is equal to

(A) $e^x\left(\frac{x-\ln x}{x}\right) + c$ (B) $e^x\left(\frac{x-\ln x+1}{x}\right) + c$ (C) $e^x\left(\frac{x-\ln x}{x^2}\right) + c$ (D) $e^x\left(\frac{x-\ln x-1}{x}\right) + c$

73. The value of λ for which the lines 3x – 4y – 13 = 0, 8x – 11y – 33 = 0 and 2x – 3y + λ = 0 are concurrent is

(A) –6 (B) –7 (C) +8 (D) +9

74. For an increasing A.P. $a_1, a_2, a_3 \ldots a_n$,
if $a_1 + a_3 + a_5 = -12$ and $a_1a_3a_5 = 80$, then which of the following is true.

(A) $a_1 = +2$ (B) $a_2 = -1$ (C) $a_3 = 4$ (D) $a_5 = +2$

75. The number of ways in which 5A′s and 6B′s can be arranged to form a string of text which reads the same way backward and forward is

(A) 10 (B) 24 (C) 42 (D) 15

76. If $\int_{\ln 2}^{x} \frac{du}{(e^u - 1)^{1/2}} = \frac{\pi}{6}$, then e^x equals

(A) 1 (B) 2 (C) 4 (D) 3

77. If $\int_0^{x^2(1+x)} f(t)dt = x$, then value of f(2) is

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) $\frac{1}{5}$

78. The value of k for which the lines kx + y = 6 and 2x – 5y = 1 are perpendicular to each other is

(A) $-\frac{5}{2}$ (B) $\frac{2}{5}$ (C) $\frac{+5}{2}$ (D) $-\frac{2}{5}$

79. The number of possible straight lines, passing through (2, 3) and forming a triangle with coordinate axes, whose area is 12 sq. units is

(A) One (B) Two (C) Three (D) Four

Space for Rough Work

80. $\int \frac{dx}{x^2\sqrt{16-x^2}}$ has the value equal to

(A) $-\frac{1}{4}\tan^{-1}\left(\sec\left(\frac{x}{4}\right)\right)+c$ (B) $\frac{1}{4}\tan^{-1}\left(\sec\left(\frac{x}{4}\right)\right)+c$ (C) $-\frac{\sqrt{16-x^2}}{16x}+c$ (D) $\frac{\sqrt{16+x^2}}{16x}+c$

81. A light ray coming along the line 3x + 4y = 5 gets reflected from the line ax + by = 1 and goes along the line 5x – 12y = 10. Then,

(A) $a=\frac{64}{115}, b=\frac{112}{15}$ (B) $a=\frac{14}{15}, b=\frac{-8}{115}$ (C) $a=\frac{64}{115}, b=\frac{-8}{115}$ (D) $a=\frac{64}{15}, b=\frac{14}{15}$

82. The value of $\int \frac{(x+1)^2}{x(x^2+1)}dx$ is equal to

(A) ln x + c (B) lnx + $2\tan^{-1}x$ + c (C) $-\ln(x^2+1)+c$ (D) $\ln(x(x^2+1))+c$

83. The diagonals of a parallelogram PQRS are along the lines x + 3y = 4 and 6x – 2y = 7. Then PQRS must be
(A) Rectangle (B) Square (C) Cyclic quadrilateral (D) Rhombus

84. The equation of line which passes through the point of intersection of 2x + 3y – 5 = 0 and x + y = 2 and also which is farthest from (2, 3) is
(A) 2y + 3x = 5 (B) 2x + y = 3 (C) x + 2y = 3 (D) 2x + 3y = 5

85. If $\int x^{26}(x-1)^{17}(5x-3)dx = \frac{x^{27}.(x-1)^{18}}{k}+c$, where c is the constant of integration, then the value of k is

(A) 3 (B) 4 (C) 9 (D) 10

86. Statement 1 : If two lines are perpendicular, then product of their slopes is –1.
Statement 2: If the product of slopes of two lines is –1, then these lines will be perpendicular.
(A) Only 1 is true (B) Both 1 and 2 are true (C) Only 2 is true (D) Both are false

87. The maximum number of points of intersection of five distinct lines and four distinct circles is
(A) 60 (B) 72 (C) 62 (D) None of these

88. The condition on a and b, such that the portion of the line ax + by – 1 = 0, intercepted between the lines ax + y = 0 and x + by = 0, subtends a right angle at the origin is
(A) a = b (B) a + b = 0 (C) a = 2b (D) 2a = b

89. If a vertex of a triangle is (1, 1) and the middle points of two sides passing through it are (–2, 3) and (5, 2), then find coordinates of centroid of the triangle.

(A) (5, 3) (B) (5, 1) (C) $\left(\frac{5}{3},3\right)$ (D) (3, 1)

90. If $\int \frac{dx}{(1+\sqrt{x})^{2010}} = 2\left[\frac{1}{\alpha(1+\sqrt{x})^{\alpha}}-\frac{1}{\beta(1+\sqrt{x})^{\beta}}\right]+c$, where c is constant of integration and $\alpha, \beta > 0$, then $\alpha-\beta$ is

(A) 1 (B) 2 (C) –1 (D) –2

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