Class XII

EDUDIGM

Bengal Talent Search Examination

Instructions:

1) Write your name on the questions paper and fill the OMR sheet immediately.
2) Do not start to write unless instructed
3) Use of calculators or other gadgets is not allowed.
4) There are no negative marks
5) There will be **no** clarification given about the correctness or the meaning of a question. If you have any doubt you can make a comment in the answer script provided. If you feel that there is a different answer to the choices provided, write that on the answer script.
6) No Extra sheet will be provided for the rough work
7) Any question paper without the Candidate's name could be disqualified.
8) Any attempt of unfair means will lead to immediate cancellation of the paper.
9) A student's paper can be cancelled without assigning any reason.

Candidate's Name:

Duration: 2:00 Hrs

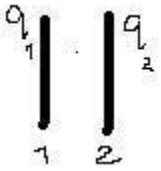
1. A body is moving along the line y = b on a plane. Its angular momentum about the origin

   a) Increases b) Decreases c) Remains constant d) Depends on the region.

2. In case of pure rolling the work done by friction force is always

   a) positive b) negative c) zero d) Can't be said.

3. If $q_1 > q_2$ what is the charge that appears in the inner surface of plate 1?

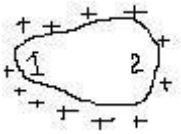


   a) $(q_1 - q_2)/2$ b) $-q_1$ c) $-q_2$ d) $(q_1+q_2)/2$

4. In the previous question what is the charge that appears on the outside of the plate 1?

   a) $(q_1-q_2)/2$ b) $(q_1+q_2)/2$ c) q_1 d) q_2

5. In the figure if σ_1 and σ_2 are the charge densities at 1 and 2. This is a conductor. Then,



   a) $\sigma_1 > \sigma_2$ b) $\sigma_1 = \sigma_2$ c) $\sigma_1 < \sigma_2$ d) None of these.

Space for Rough Work

6. A block of mass 0. 50 kg is moving with a speed of 2.00 ms^{-1} on a smooth surface. It strikes another mass of 1. 00 kg and then they move together as a single body. The energy loss during the collision is

   a) 1 J b) 0. 67 J c) 0. 16 J d) 0. 34 J

7. n resistors are connected in series and then in parallel. What is the ratio of power developed in the two cases?

   a) 1 : 1 b) 1 : n^2 c) n : 1 d) n^2 : 1

8. A metallic rod of length L rotates about one of its ends with angular speed ω in a magnetic field B. What is the potential difference between the two ends?

   a) $B\omega L^2$ b) $2B\omega L^2$ c) $^1/_2 B\omega L^2$ d) 0

9. A proton and an electron moving with equal momentum enter into a perpendicular magnetic field. Then,

   a) Radius of curvature of the path of electron will be more than that of the proton.

   b) Radius of curvature of the path of electron will be less than that of the proton.

   c) Radius of curvature of the path of electron will be same as that of the proton.

   d) None of these.

Space for Rough Work

10. The output of two signals is 1 when exactly one input is 0 and the other 1. Which GATE describes this situation?

    a) AND b) OR c) NOR d) XOR

11. A spherical solid ball of volume V is made of a material of density ρ1. It is falling through a liquid of density ρ_2 ($\rho_2 < \rho_1$). Assume that the liquid applies a viscous force on the ball that is proportional to the nth power of its speed υ, i. e. , $F_{viscous} = -k\upsilon^n$ ($k > 0$). The terminal speed of the ball is

    a) $Vg\rho_1/k$ b) $Vg\rho_2/k$ c) $(Vg(\rho_1 - \rho_2)/K)^{1/2n}$ d) $(Vg(\rho_1 - \rho_2)/K)^{1/n}$

12. Centre of mass of a solid sphere whose density varies as $\rho = \rho_o r$ will be

    a) The centre b) Offset from the centre c) Outside the sphere d) None of these.

13. Two blocks each of mass m and specific heat capacity C initially at temperatures at T_1 and T_2 are brought in contact. What is the final temperature of the block?

    a) $(T_1 - T_2)/2$ b) $(T_1 + T_2)/2$ c) $\sqrt{(T_1T_2)}$ d) None of these.

14. Light ray enters into a glass slab of refractive index μ and then comes out it. If θ_1 and θ_2 be the initial and final angles with normal then

    a) $\sin\theta_1 = \mu\sin\theta_2$ b) $\sin\theta_2 = \mu\sin\theta_1$ c) $\theta_1 = \theta_2$ d) None of these.

Space for Rough Work

15. In the previous question if the wavelength of light ray is λ in air, what is the wavelength in glass?
    a) λ b) λ/μ c) μλ d) None of these.
16. Two concentric spheres are such that the outer sphere has a charge +Q and the inner is grounded. In another case the inner sphere has charge +Q and the outer is grounded. In which case will the capacitance be higher?
    a) first b) second c) same d) None of these.
17. When two different capacitors carrying different charges are connected, the final energy of the system
    a) Increases b) Decreases c) Remains same. d) None of these.
18. What is the average power delivered by gravity during a projectile motion?
    a) mgusinθ b) mgucosθ c) 0 d) None of these.
19. A charged spherical shell is cut into two unequal halves, one bigger and one smaller.
    Which part has greater electric field at the centre?
    a) Bigger b) Smaller c) same d) None of these.
20. A ring of mass m and radius r is hinged at its periphery and is hanging down. What is the frequency of small oscillations of the ring?
    a) $\sqrt{(g/r)}$ b) $\sqrt{(3g/2r)}$ c) $\sqrt{(g/2r)}$ d) None of these.
21. A capacitor is connected to a battery. A dielectric is brought close between the plates. The dielectric will
    a) Experience a force inward b) experience a force outward
    c) It wont experience any force. d) None of these.

Space for Rough Work

22. What will be the nature of plot of lnP vs lnV of an ideal gas for constant temperature and constant mass?

    a) Rectangular hyperbola b) parabola c) circle d) straight line

23. A wave is given by the expression $x = A\sin(2t-2\pi x)$. . What is it's wavelength?

    a) 1 b) 2 c) 2π d) π

24. What is the dimension of co-efficient of viscosity?

    a) $ML^{-1}T^{-1}$ b) $M^2L^{-2}T^{-1}$ c) $L^{-1}T^{-1}$ d) $M^{-1}L^{-1}T^{-1}$

25. Light is incident from a medium μ_1 at some angle θ with the vertical to another medium μ_2 and is refracted. If μ_2 varies with time as $\mu_2 = kt$, where k is a positive constant, When will the ray will be reflected instead of being refracted?

    a) $\mu_1\sin\theta/k$ b) $\mu_2\sin\theta/k$ c) $\mu_1\cos\theta/k$ d) $k\mu_1\sin\theta$

Space for Rough Work

26. The vapour pressure of solution of 5 g of non-electrolyte in 100 g of water at a particular temperature is 2985 M/m^2. The vapour pressure of pure water at that temperature is 3000 N/m^2. The molecular weight of the solute is

    a) 180 b) 270 c) 90 d) 200

27. The enthalpy of combustion at 25°C of H_2, cyclohexene(C_6H_{10}) and cyclohexane(C_6H_{12}) are -241, -3800 and -3920 kJ/mol respectively. The heat of hydrogenation of cyclohexene is

    a) -121 kJ/mol b) 121 kJ/mol c) -242 kJ/mol d) 242 kJ/mol

28. Consider the following equilibrium in a closed container N_2O_4 [eq] $2NO_2$

    At a fixed temperature the volume of the reaction container is halved, Then which of the following is true regarding equilibrium constant(K_p) and degree of dissociation(α)?

    a) neither K_p nor α changes b) K_p changes but α does not change

    c) both K_p nor α changes d) K_p does not change but α changes

29. In a compound, element Y form FCC and element X occupies half octahedral voids.

    The formula of the compound is

    a) XY b) XY_2 c) X_2Y d) X_4Y

30. Shape and hybridization of XeF_2 is

    a) linear and sp b) linear and sp^3d^2 c) linear and sp^3d d) none of these

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Space for Rough Work

31. Which of the following is true regarding bond order?

a) $N_2>O_2>O_2^+$ b) $O_2>N_2>O_2^+$ c) $N_2>O_2^+>O_2$ d) $O_2^+>N_2>O_2$

32. The emf of the cell, $Zn|Zn^{2+}(0.01M)||Zn^{2+}(0.1M)|Zn$ is given by ($E°_{Zn^{2+},Zn}$=-0.76 V)

a) 0.0295 V b) 0.059 V c) -0.0295 V d) -0.0059 V

33. For the reaction $N_2+3H_2\rightarrow 2NH_3$

rate of appearance of NH_3 is 6 mol L^{-1} s^{-1} then rate of disappearance of H_2 is

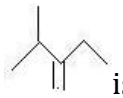
a) 6 mol L^{-1} s^{-1} b) 4 mol L^{-1} s^{-1} c) 2 mol L^{-1} s^{-1} d) 9 mol L^{-1} s^{-1}

34. The half life for a radioactive disintegration is 100 $year^{-1}$. Time in which 87.5% of the radioactive element is decomposed is

a) 400 years b) 800 years c) 12.5 years d) none of these

35. A colloidal system in which solid is dispersed in a liquid is called

a) Precipitate b) sol c) emulsion d) gel

36. The IUPAC name of  is

a) 3-methyl-2-ethylbut-1-ene b) 2-methyl-3-ethylbut-1-ene

c) 2-ethyl-3-methylbut-1-ene d) none of these

37. Which of the following exhibits stereoisomerism?

a) 2-methylbut-1-ene b) 3-methylbut-1-ene

c) 3-methylbutanoic acid d) 2-methylbutanoic acid

38. Which one of the following heptanols can be dehydrated to hept-3-ene only?

a) Heptan-3-ol b) Heptan-4-ol c) Heptan-2-ol d) Heptan-1-ol

Space for Rough Work

39. The reaction of propene with HOCl proceeds via the addition of

a) H^+ in the first step b) OH^- in the first step

c) Cl^+ in the first step d) Cl^+ and OH^- in a single step

40. Identify the correct order of reactivity in electrophonic substitution reaction of the following compounds: 1:benzene 2:toluene 3:chlorobenzene

a) 1>2>3 b) 2>1>3 c) 2>3>1 d) 3>2>1

41. $CH_3CH_2CH_2Br \xrightarrow{Aq.NaOH} X \xrightarrow{Al_2O_3} Y \xrightarrow{Cl_2/H_2O} Z$ Then, Z is

a) Mixture of $CH_3CHClCH_2Cl$ and $CH_3CHOHCH_2Cl$ b) $CH_3CHClCH_2Cl$

c) $CH_3CHOHCH_2Cl$ d) $CH_3CHClCH_2OH$

42. What is Z in the following sequence of reactions?

$$\text{Phenol} \xrightarrow{\text{Zn Dust}} X \xrightarrow{CH_3Cl \,/\, \text{Anhydrous } AlCl_3} Y \xrightarrow{\text{Alkaline } KMnO_4} Z$$

a) Benzene b) Toluene c) Benzaldehyde d) Benzoic acid

43. Amongst the following ions which one has the highest paramagnetism?

a) $[Cr(H_2O)_6]^{3+}$ b) $[Fe(H_2O)_6]^{2+}$ c) $[Cu(H_2O)_6]^{2+}$ d) $[Zn(H_2O)_6]^{2+}$

Space for Rough Work

44. the geometry of $Ni(CO)_4$ and $Ni(PPh_3)_2Cl_2$ are

a) both square planar b) tetrahedral and square planar

c) both tetrahedral d) square planar and tetrahedral

45. Which of the following gives blood red colour with KCNS?

a) Cu^{2+} b) Fe^{3+} c) Al^{3+} d) Zn^{2+}

46. Which of the following salt will not produce black ppt. on passing H_2S through their aqueous salt solutions in desired medium?

a) $CuSO_4$ b) $PbCl_2$ c) $CdSO_4$ d) $NiCl_2$

47. A sodium salt of an unknown anion when treated with $MgCl_2$ gives white precipitate only on boiling. The anion is

a) SO_4^{2-} b) CO_3^{2-} c) NO_3^- d) HCO_3^-

48. Which of the following is wrong about white phosphorus (P_4)?

a) it has four P-P single bonds b) it has P-P-P angle of 60°

c) it has four lone pair of electrons d) it has six P-P single bonds

49. Identify the state function among the following

a) q b) q-w c) q/w d) q+w

50. pH of 0. 1M NaA at 25° C is (given Ka of HA is 10^{-5})

a) 5 b) 10 c) 9 d) 7

Space for Rough Work

51. A dice is thrown twice one after the other. What is the probability that the sum of the number that appears on the top surface is greater than or equal to 10?

a) 36/125 b) 23/125 c) 54/125 d) 27/125

52. If $(\tan 3x - \tan 2x)/(1+\tan 3x.\tan 2x) = 1$, $0 < x < \pi/2$, x is

a) $\pi/3$ b) $\pi/4$ c) $\pi/2$ d) Solution does not exist.

53. Real part of $e^{e^{i\theta}}$ is

a) $e^{\cos\theta}\sin(\cos\theta)$ b) $e^{\cos\theta}\cos(\cos\theta)$ c) $e^{\cos\theta}\cos(\sin\theta)$ d) None of these

54. A work is done in two phases. The probability of the success of the phases is 0.9 and 0.8 respectively. What is the probability that the work cannot be done?

a) 0. 72 b) 0. 24 c) 0. 28 d) None of these

55. A ray of light emanating from (0,b) is reflected on X-axis and passes through (p,q). What is the slope of the reflected line?

a) p/(b+q) b) q/p c) (b+p)/q d) (b+q)/p

56. What is the maximum value of $(a^2\cos^2\theta+b^2\sin^2\theta)$?

a) a^2 b) b^2 c) $\sqrt{(a^2+b^2)}$ d) None of the above

Space for Rough Work

57. $f(x+y) = f(x)+f(y)$ and $f(0) = 1$ $f'(0) = 1$, then $f(x) = ?$

a) $x+2$ b) $2x+1$ c) $x+1$ d) None of these.

58. What is the locus of centre of a circle that touches two other circles externally?

a) Straight Line b) parabola c) Hyperbola d) None of these.

59. $\int (e^x/(1+e^x)^2 dx$

a) $e^x/(1+e^x) + C$ b) $e^{2x}/(1+e^x) + C$ c) $e^x/(1+e^x)^2 + C$ d) None of these.

60. if $dy/dx - y = x^x \ln x$ what might be y?

a) x^x b) $x^x e^x$ c) $x^{\ln x}$ d) None of these.

61. $\lim_{x\to\left(\frac{\pi}{2a}\right)} \frac{\cos(ax)}{f(x)-a} = 2$, then $f\left(\frac{\pi}{2a}\right) = ?$

a) a b) $\pi/2a$ c) 2 d) data insufficient.

62. $\lim_{x\to 0} \frac{\sqrt{(x^2)}}{x}$

a) 1 b) 2 c) 0 d) Doesnot Exist

63. $\lim_{n\to\infty} \left(\frac{1}{n^2} + \frac{1}{n^2} + \frac{1}{n^2} + \cdots + \frac{1}{n^2}\right)$ is

a) 1 b) 0 c) ½ d) None of these.

Space for Rough Work

64. What is the equation of a quadratic curve has maxima at (1,1) and cuts X axis at a distance 2 from origin?

a) $y = x^2+x+1$ b) $y = x^2+2x+1$

c) $y = x^2-2x+1$ d) $y = x^2-2x+2$

65. $f(x) = \sin^{-1}x + \cos^{-1}x$, then $f'(x) = ?$

a) $2/\sqrt{(1+x^2)}$ b) $1/\sqrt{(1+x^2)}$ c) $-1/\sqrt{(1+x^2)}$ d) 0

66. What is the volume of a cuboid, whose sides are given by vectors 2i, 3j and 4k?

a) 25 b) 23 c) 24 d) None of these.

67. Resultant of two vectors a and b having angle 90° between them is doubled in magnitude if b is tripled. If $|a| = 4$ then the magnitude of resultant is

a) $8\sqrt{(5/2)}$ b) $8\sqrt{(2/5)}$ c) 8 d) None of these.

68. What is the unit vector perpendicular to the plane containing (i+j+k) and (i - j - k)?

a) $(j - k)/\sqrt{2}$ b) $(i - k)/\sqrt{2}$ c) $(j + k)/\sqrt{2}$ d) None of these.

Space for Rough Work

69. The family of lines given by the equation $x(1+\gamma) + y(2 - \gamma) - 3 = 0$ where γ is a parameter always passes through

a) (1,0) b) (2,1) c) (1,1) d) None of these

70. What is the local maxima of the curve $y = x+1/x$

a) 2 b) -2 c) 1 d) None of these.

71. IF A and B are mutually independent events, $P(AUB) = 1/2$, $P(A) = 1/3$, $P(B) =?$

a) 1/3 b) 1/6 c) ¼ d) None of these.

72. $|Z_1| = 1$ and $|Z_2 - 3 - 3i| = 1$, then minimum value of $|Z_1 - Z_2| =?$

a) $3\sqrt{2}$ b) $3\sqrt{2} - 1$ c) $3\sqrt{2} - 2$ d) None of these.

73. What is the distance of a point on the ellipse $(x^2/9+y^2/b =1)$ with ecentricity 1/2, whose x coordinate is 3 from the farther focus?

a) 1 b) 2 c) 3 d) 4

74. $\int dx/(x^3+x^4)$

a) $\ln(x/x+1)+1/x+1/2x^2$ b) $\ln(x/x+1)+1/2x+1/x^2$

c) $\ln(x-1/x+1)+1/x+1/2x^2$ d) None of these.

75. Area under the curve $y = n\sin(nx)$ and X axis between any two consecutive points where it becomes zero is

a) 2 b) 2n c) 2/n d) n/2

Space for Rough Work