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All The Best....!!

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## Part - A Physics

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### Section - I: Single Correct

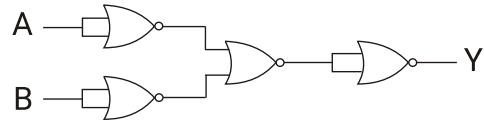
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1. A weight  $mg$  is suspended from the middle of a rope whose ends are at the same level. The rope is no longer horizontal. The minimum tension required to completely straighten the rope is:
- (a)  $\frac{mg}{2}$
  - (b)  $mg \cos \theta$
  - (c)  $2mg \cos \theta$
  - (d) Infinitely large

2. A block of weight 100 N is lying on a rough horizontal surface. If the coefficient of static friction is  $\frac{1}{\sqrt{3}}$ . The least possible force that can move the block is,
- (a)  $\frac{100}{\sqrt{3}}$  N
  - (b)  $100\sqrt{3}$  N
  - (c)  $50\sqrt{3}$  N
  - (d) 50 N

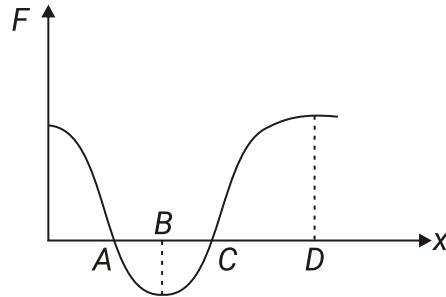
3. The output of the given combination gates represents :



- (a) XOR Gate
- (b) AND Gate
- (c) NAND Gate
- (d) NOR Gate

4. The base area of a boat is  $2 \text{ m}^2$ . A man weighing  $76 \text{ kg}$  weight steps into the boat. Calculate the depth to which the boat sinks further in the water.
- (a)  $1.2 \text{ cm}$
  - (b)  $2.5 \text{ cm}$
  - (c)  $3.8 \text{ cm}$
  - (d)  $4.2 \text{ cm}$

5. Consider a particle constrained to move along the  $x$ -axis. The following figure shows the graph of a conservative force  $F$  acting on the particle as a function of the position of the particle. The particle starts from rest at  $x = 0$ . At which point does the kinetic energy of the particle start decreasing for the first time? (Assume that  $F$  is the only force acting on the particle)



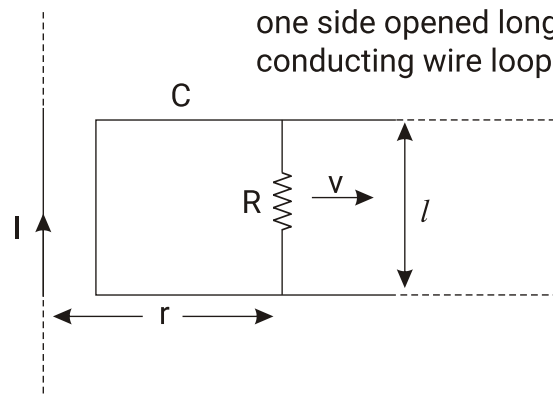
- (a) A
- (b) B
- (c) C
- (d) D

6. A wire of length 60 cm is bent into a circle with a gap of 1 cm at its ends. On heating it by 100 °C, the length of the gap increases to 1.02 cm. The coefficient of linear expansion ( $\alpha$ ) of the material of the wire is
- (a)  $2 \times 10^{-4} / ^\circ\text{C}$
  - (b)  $4 \times 10^{-4} / ^\circ\text{C}$
  - (c)  $6 \times 10^{-4} / ^\circ\text{C}$
  - (d)  $1 \times 10^{-4} / ^\circ\text{C}$

7. The Young's modulus of the material of a rod is  $20 \times 10^{10}$  Pascal. When the longitudinal strain is 0.04%, the energy stored per unit volume is
- (a)  $4 \times 10^{-3} \text{ J/m}^3$
  - (b)  $8 \times 10^3 \text{ J/m}^3$
  - (c)  $16 \times 10^{-3} \text{ J/m}^3$
  - (d)  $16 \times 10^3 \text{ J/m}^3$



8. An infinitely long straight wire carrying current  $I$ , one side opened rectangular loop and a conductor  $C$  with a sliding connector are located in the same plane, as shown in the figure. The connector has length  $l$  and resistance  $R$ . It slides to the right with a velocity  $v$ . The resistance of the conductor and the self-inductance of the loop are negligible. The induced current in the loop, as a function of separation  $r$ , between the connector and the straight wire is :



- (a)  $\frac{\mu_0}{\pi} \frac{Ivl}{Rr}$   
 (b)  $\frac{\mu_0}{2\pi} \frac{Ivl}{Rr}$   
 (c)  $\frac{2\mu_0}{\pi} \frac{Ivl}{Rr}$   
 (d)  $\frac{\mu_0}{4\pi} \frac{Ivl}{Rr}$

9. A helicopter flying horizontally with a speed  $v$  at an altitude  $h$  has to drop a food packet for a man on the ground. What is the distance of the helicopter from the man when the food packet is dropped?

(a)  $\sqrt{\frac{2ghv^2 + 1}{h^2}}$

(b)  $\sqrt{2ghv^2 + h^2}$

(c)  $\sqrt{\frac{2v^2h}{g} + h^2}$

(d)  $\sqrt{\frac{2gh}{v^2} + h^2}$

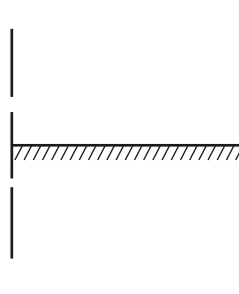
10. A container in steady-state is filled with a mixture of Helium (light molecules) and Oxygen (heavy molecules) gases. A thermometer in the container reads  $22\text{ }^{\circ}\text{C}$ . Which gas molecules have the greater average speed?
- (a) It is the same for both of the gases because the temperatures are the same.
  - (b) The Oxygen molecules because they are diatomic.
  - (c) The Oxygen molecules because they are more massive.
  - (d) The Helium molecules because they are less massive.

11. A vertical spring-mass system is used in a wall clock. The clock is accurate at the equator. If the clock is taken to the poles, it:
- (a) will become slow
  - (b) will become fast
  - (c) will give correct time
  - (d) will not work properly

12. A quantity  $f$  is given by  $f = \sqrt{\frac{hc^5}{G}}$  where  $c$  is the speed of light in vacuum,  $G$  is the universal gravitational constant and  $h$  is the Planck's constant. The dimension of  $f$  is the same as that of :
- (a) volume
  - (b) energy
  - (c) momentum
  - (d) area

13. When radiation of wavelength  $\lambda$  is incident on a metallic surface, the stopping potential of ejected photoelectrons is 4.8 V. If the same surface is illuminated by radiation of double the previous wavelength, then the stopping potential becomes 1.6 V. The threshold wavelength of the metal is:
- (a)  $6\lambda$
  - (b)  $4\lambda$
  - (c)  $8\lambda$
  - (d)  $2\lambda$

14. In YDSE, a mirror is introduced as shown in figure. It is perpendicular to the slit plane and the screen and is placed at the midpoint of two slits. What will happen to the fringe pattern on the upper half of the screen?



- (a) No fringe pattern will be seen.
- (b) Fringe pattern will not change at all.
- (c) Fringe width will change.
- (d) Fringe width will be same but pattern will shift.

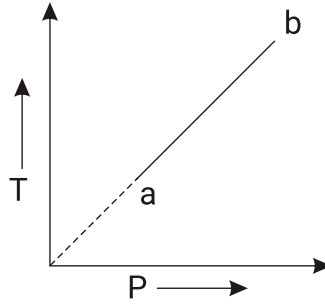
15. Two bars of thermal conductivities  $K$  and  $3K$  and lengths 1 cm and 2 cm respectively have equal cross-sectional area. They are joined length-wise. If the temperatures at the ends of this composite bar are  $0^\circ\text{C}$  and  $100^\circ\text{C}$  respectively, then the temperature  $\phi$  of the interface is (in steady-state)
- (a)  $50^\circ\text{C}$
  - (b)  $\frac{100}{3}^\circ\text{C}$
  - (c)  $60^\circ\text{C}$
  - (d)  $\frac{200}{3}^\circ\text{C}$



16. Starting from rest a wheel rotates with a uniform angular acceleration of  $2\pi \text{ rad s}^{-2}$ . After 4 s, if the angular acceleration ceases to act, its angular displacement in the next 4 s is
- (a)  $8\pi \text{ rad}$
  - (b)  $16\pi \text{ rad}$
  - (c)  $24\pi \text{ rad}$
  - (d)  $32\pi \text{ rad}$

17. A particle moves along the curve,  $x^2 + 4 = y$ . The point on the curve at which the y-coordinates changes twice as fast as the x-coordinates, is
- (a) (1, 5)
  - (b) (5, 29)
  - (c) (2, 8)
  - (d) None of these

18. An ideal gas changes from state 'a' to state 'b' as shown in the figure. What is the work done by the gas in the process?



- (a) zero
- (b) positive
- (c) negative
- (d) infinite

19. Two balls of masses  $m$  each are moving at right angles to each other on a smooth horizontal surface with velocities  $6$  m/s and  $8$  m/s respectively. If the collision between them is perfectly inelastic, the velocity of the combined mass is
- (a)  $15$  m/s
  - (b)  $10$  m/s
  - (c)  $5$  m/s
  - (d)  $2.5$  m/s

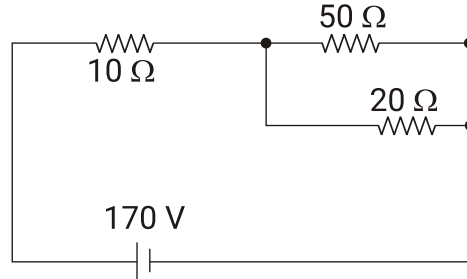
20. Two sinusoidal waves on a string have equations  $y_1 = a \sin(\omega t + kx + \phi_1)$  and  $y_2 = a \sin(\omega t + kx + \phi_2)$ . They are allowed to interfere. If in the resultant wave the frequency and amplitude remain equal to the amplitude of the superimposing waves, the phase difference between them is

- (a)  $\frac{\pi}{6}$
- (b)  $\frac{2\pi}{3}$
- (c)  $\frac{\pi}{4}$
- (d)  $\frac{\pi}{3}$

**Section - II: Numerical**

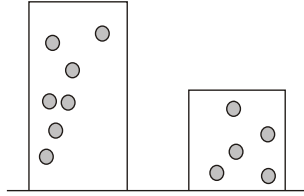
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21. The voltage across the  $10\ \Omega$  resistance in the given circuit is  $x$  volt. The value of ' $x$ ' to the nearest integer is \_\_\_\_\_.



22. The magnetic susceptibility of a paramagnetic substance at  $-173\text{ }^\circ\text{C}$  is  $1.5 \times 10^{-2}$ . If its value at  $-73\text{ }^\circ\text{C}$  is  $b \times 10^{-3}$ , then find  $b$ .

23. Two containers are filled with ideal gases at the same temperature. In the container on the left is a gas of molar mass  $2M$ , volume  $2V$ , and the number of mole  $2n$ . In the container on the right is a gas of molar mass  $M$ , volume  $V$ , and the number of mole  $n$ . The ratio of the pressure of the gas on the left to the pressure of the gas on the right is

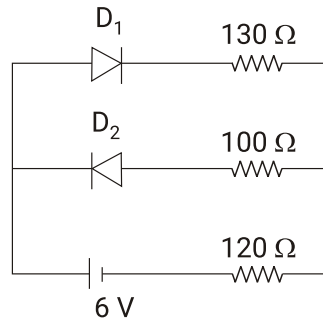




24. In an LCR series circuit, an inductor 30 mH and a resistor  $1\ \Omega$  are connected to an AC source of angular frequency 300 rad/s. The value of capacitance for which, the current leads the voltage by  $45^\circ$  is  $\frac{1}{x} \times 10^{-3}$  F. Then the value of x is \_\_\_\_\_.

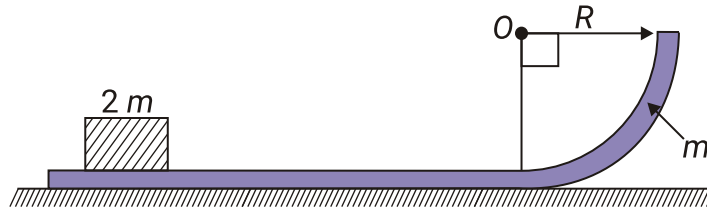
25. If a vector makes angles  $\frac{\pi}{3}$ ,  $\frac{\pi}{3}$  and  $\frac{\pi}{n}$  with the X-axis, the Y-axis and the Z-axis respectively, then find the value of  $n$ .

26. The circuit contains two diodes each with a forward resistance of  $50\ \Omega$  and with infinite reverse resistance. If the battery voltage is  $6\ \text{V}$ , the current through the  $120\ \Omega$  resistance is mA.



27. An  $\alpha$ -particle (mass 4 amu) and a singly charged sulfur ion (mass 32 amu) are initially at rest. They are accelerated through a potential  $V$  and then allowed to pass into a region of uniform magnetic field which is normal to the velocities of the particles. Within this region, the  $\alpha$ -particle and the sulfur ion move in circular orbits of radii  $r_\alpha$  and  $r_s$ , respectively. The ratio  $\left(\frac{r_s}{r_\alpha}\right)$  is \_\_\_\_.

28. Mass  $2m$  is kept on a smooth circular track of mass  $m$ , which is kept on a smooth horizontal surface. The circular track is given a horizontal velocity  $\sqrt{2gR}$  towards left. Find the maximum height reached by  $2m$  in meters? ( $R = 6\text{ m}$ )



29. The diameter of a spherical bob is measured using a vernier callipers. 9 divisions of the main scale, in the vernier callipers, are equal to 10 divisions of vernier scale. One main scale division is 1 mm. The main scale reading is 10 mm and 8<sup>th</sup> division of vernier scale was found to coincide exactly with one of the main scale division. If the given vernier callipers has positive zero error of 0.04 cm, then the radius of the bob is \_\_\_\_\_  $\times 10^{-2}$  cm.

30. A large parallel plate capacitor, whose plates have an area of  $1 \text{ m}^2$  and are separated from each other by  $1 \text{ mm}$ , is being charged at a rate of  $25 \text{ V/s}$ . If the dielectric between the plates has the dielectric constant  $10$ , then the displacement current at this instant is? (in  $\mu\text{A}$ )

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## Part - B Chemistry

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### Section - I: Single Correct

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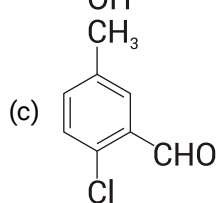
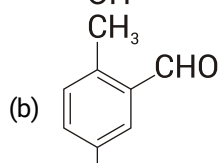
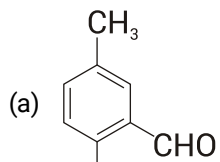
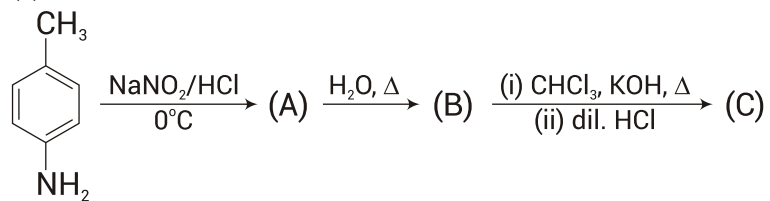
31.  $\text{FeSO}_4$  on heating gives

- (a)  $\text{SO}_2$  and  $\text{SO}_3$
- (b)  $\text{SO}_2$  only
- (c)  $\text{SO}_3$  only
- (d)  $\text{SO}_2$  and  $\text{O}_2$



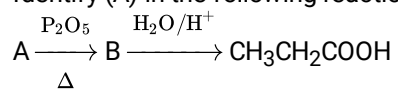
32. When NaCl is added to an aqueous solution of glucose
- (a) Freezing point is lowered
  - (b) Freezing point is raised
  - (c) Freezing point does not change
  - (d) Variation in freezing point can't be predicted

33. Identify (C) in the reaction(s)



(d) None of these

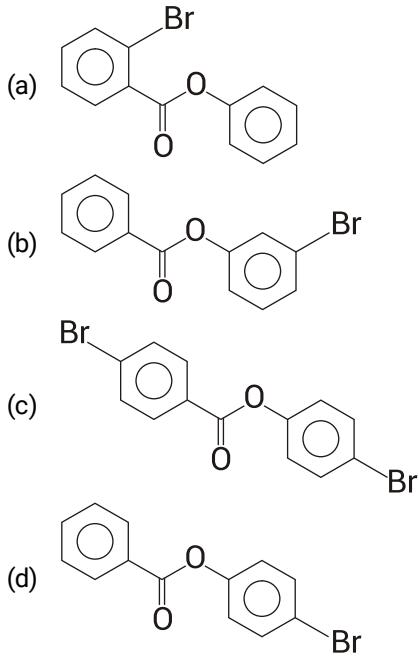
34. Identify (A) in the following reaction sequence



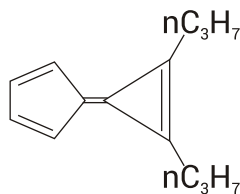
- (a)  $CH_3CH_2COOH$
- (b)  $CH_3CH_2CONH_2$
- (c)  $CH_3CH_2CH_2OH$
- (d) Both (A) and (B)

35. Electrolytic reduction method is used for extraction of
- (a) Highly electronegative elements
  - (b) Transition metals
  - (c) Highly electropositive elements
  - (d) Metalloids

36. The major product formed on monobromination(electrophilic) of phenylbenzoate is :



37. Ordinarily the barrier to rotation about a carbon-carbon double bond is quite high but in compound P double bond between two rings was observed by NMR to have a rotational energy barrier of only about 20 cal./mol., showing that it has lot of single bond character.



The reason for this is

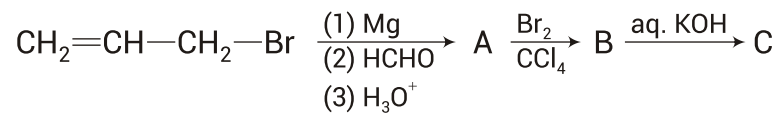
- (a) Double bond having partial triple bond character because of resonance
- (b) Double bond undergo flipping
- (c) Double bond having very high single bond character because of aromaticity gained in both three and five membered rings.
- (d) +I effect of nC<sub>3</sub>H<sub>7</sub> groups makes double bond having partial single bond character.

38. The mass percentage of  $\text{Fe}^{3+}$  ion present in  $\text{Fe}_{0.93}\text{O}_{1.00}$  is
- (a) 15%
  - (b) 5.5%
  - (c) 10.0%
  - (d) 11.5%

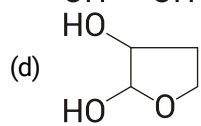
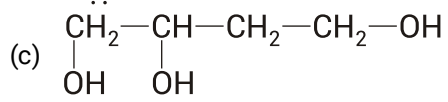
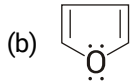
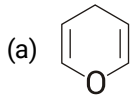
39. Which one of the following is the correct match?
- (a)  $\text{Cl}_2$  - only reducing agent
  - (b)  $\text{HNO}_2$  - only oxidizing agent
  - (c)  $\text{HNO}_3$  - both oxidising and reducing agent
  - (d)  $\text{SO}_2$  - both oxidising and reducing agent



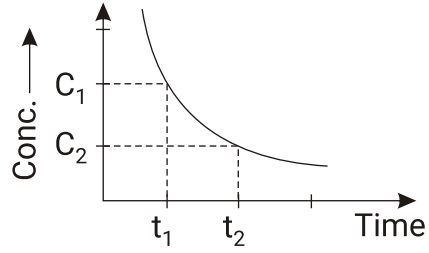
40.



Product (C) is



41. The graph plotted between concentration versus time



(a) It gives rate of disappearance of reactant

(b) 
$$\text{Rate} = - \frac{[C_2 - C_1]}{t_2 - t_1}$$

(c) Both (1) & (2)

(d) It predicts the order of reaction

42. IUPAC name of  $[\text{Pt}(\text{NH}_3)_3\text{Br}(\text{NO}_2)\text{Cl}]\text{Cl}$  is –
- (a) Triamminechlorobromonitroplatinum(IV) chloride
  - (b) Triamminebromonitrochloroplatinum(IV) chloride
  - (c) Triamminebromochloronitroplatinum(IV) chloride
  - (d) Triamminenitrochlorobromoplatinum(IV) chloride

43. 0.20 g of an organic compound gave 0.5544 g of  $\text{BaSO}_4$ . The percentage of S is
- (a) 38%
  - (b) 19%
  - (c) 18%
  - (d) 83%

44. Lactic acid on oxidation by alkaline  $\text{KMnO}_4$  gives
- (a) Tartaric acid
  - (b) Cinnamic acid
  - (c) Propionic acid
  - (d) Pyruvic acid

45. Which of the following is the correct statement?
- (a) Hydrogen has the same I.E. as that of alkali metals
  - (b) Hydrogen has a strong tendency to gain one electron same as that of alkali metals
  - (c) Hydrogen molecule is diatomic so are the halogens
  - (d) The electron affinity of hydrogen is the same as that of halogens

46. How many litre of oxygen at STP is required to burn 60 g  $C_2H_6$ ?
- (a) 22.4 L
  - (b) 11.2 L
  - (c)  $22.4 \times 7$  L
  - (d) 8.5 L

47. The general order of reactivity of carbonyl compounds for nucleophilic addition reactions is -
- (a)  $\text{H}_2\text{C}=\text{O} > \text{RCHO} > \text{ArCHO} > \text{R}_2\text{C}=\text{O} > \text{Ar}_2\text{C}=\text{O}$
  - (b)  $\text{ArCHO} > \text{Ar}_2\text{C}=\text{O} > \text{RCHO} > \text{R}_2\text{C}=\text{O} > \text{H}_2\text{C}=\text{O}$
  - (c)  $\text{Ar}_2\text{C}=\text{O} > \text{R}_2\text{C}=\text{O} > \text{ArCHO} > \text{RCHO} > \text{H}_2\text{C}=\text{O}$
  - (d)  $\text{H}_2\text{C}=\text{O} > \text{R}_2\text{C}=\text{O} > \text{Ar}_2\text{C}=\text{O} > \text{RCHO} > \text{ArCHO}$



48. The entropy change when two moles of ideal monoatomic gas is heated from  $200^{\circ}\text{C}$  to  $300^{\circ}\text{C}$  reversibly and isochorically

(a)  $\frac{3}{2} R \ln\left(\frac{300}{200}\right)$

(b)  $\frac{5}{2} R \ln\left(\frac{573}{273}\right)$

(c)  $3 R \ln\left(\frac{573}{473}\right)$

(d)  $\frac{3}{2} R \ln\left(\frac{573}{473}\right)$

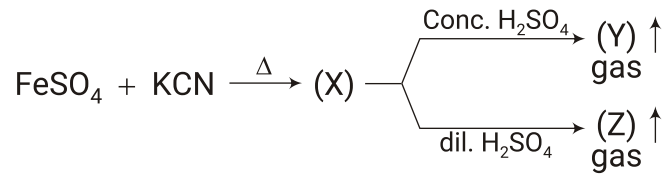
49. An inorganic Compound 'X' on treatment with concentrated  $\text{H}_2\text{SO}_4$  produces brown fumes and gives a dark brown ring with  $\text{FeSO}_4$  in presence of concentrated  $\text{H}_2\text{SO}_4$ . Also Compound 'X' gives precipitate 'Y', when its solution in dilute  $\text{HCl}$  is treated with  $\text{H}_2\text{S}$  gas. The precipitate 'Y' on treatment with concentrated  $\text{HNO}_3$  followed by excess of  $\text{NH}_4\text{OH}$  further gives deep blue coloured solution. Compound 'X' is
- (a)  $\text{Cu}(\text{NO}_3)_2$
  - (b)  $\text{Pb}(\text{NO}_2)_2$
  - (c)  $\text{Pb}(\text{NO}_3)_2$
  - (d)  $\text{Co}(\text{NO}_3)_2$

50. Electrolysis of  $\text{H}_2\text{SO}_4$  (conc.) gives the following at anode
- (a)  $\text{H}_2$
  - (b)  $\text{O}_2$
  - (c)  $\text{H}_2\text{S}_2\text{O}_3$
  - (d)  $\text{H}_2\text{S}_2\text{O}_8$

**Section - II: Numerical**

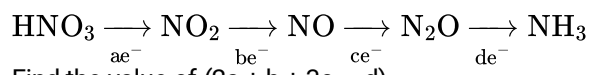
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51.



The sum of number of  $p\pi - p\pi$  bonds present in gas (Y) & (Z) are:

52. Below reaction sequence illustrates the various stages of reduction of nitric acid where a, b, c, d are the number of electrons involved in the reduction of 1 mole N-atoms.



Find the value of  $(2a + b + 3c - d)$ .

53. In an estimation of bromine by Carius method, 1.6 g of an organic compound gave 1.88 g of AgBr. The mass percentage of bromine in the compound is\_\_\_\_\_ (Atomic mass, Ag=108, Br = 80 g mol<sup>-1</sup>)

54. Out of given molecular hydrides find number of hydrides which is/are electron deficient hydride : Silane, Germane, Phosphine, Arsine, Diborane.

55. A and B decompose via first order kinetics with half-lives 54.0 min and 18.0 min respectively. Starting from an equimolar non-reactive mixture of A and B, the time taken for the concentration of A to become 16 times that of B is \_\_\_\_\_ min. (Round off to the Nearest Integer).



56. A compound  $H_2X$  with molar weight of 75 is dissolved in a solvent having density of  $0.4 \text{ g mL}^{-1}$ . Assuming no change in volume upon dissolution, the molality of a 3.2 M solution is:

57. 1.22 g of an organic acid is separately dissolved in 100 g of benzene ( $K_b = 2.6 \text{ K kg mol}^{-1}$ ) and 100 g of acetone ( $K_b = 1.7 \text{ K kg mol}^{-1}$ ). The acid is known to dimerize in benzene but remains as a monomer in acetone. The boiling point of the solution in acetone increases by  $0.17^\circ\text{C}$ . The increase in the boiling point of the solution in benzene in  $^\circ\text{C}$  is  $Z \times 10^{-2}$ . The value of Z is \_\_\_\_\_. (Nearest integer)  
[Atomic mass : C = 12.0, H = 1.0, O = 16.0]

58. How many of the following statement(s) is/are correct?
- (A) o-phenolsulphonic acid can be converted into p-phenolsulphonic acid in the presence of  $H_2SO_4$  if temperature is increased.
  - (B) Phenol is more acidic than benzyl alcohol
  - (C) Phenoxide ion activates the ring less in comparison to phenol
  - (D) Bromination of phenol in an aqueous medium produces 2-bromophenol and 4-bromophenol.

59. The number of nitrogen atoms in a semicarbazone molecule of acetone is .....

60.  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  absorbs light of wavelength 498 nm during a d-d transition. The octahedral splitting energy for the above complex is  $\text{_____} \times 10^{-19}$  J. (Round off to the Nearest Integer).  
 $h = 6.626 \times 10^{-34}$  Js;  $c = 3 \times 10^8$  ms $^{-1}$ .

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## Part - C Mathematics

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### Section - I: Single Correct

*This section contains a total of 20 questions.  
All questions in this section are mandatory.  
For every correct response you shall be awarded 4 marks.  
For every incorrect response -1 marks shall be deducted.  
For more details refer the first page of this booklet.*

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61. The ratio of the circum-radius and in-radius of an equilateral triangle is -
- (a) 3 : 1
  - (b) 1 : 2
  - (c)  $2 : \sqrt{3}$
  - (d) 2 : 1

62. The general solution of the equation  $\tan^2 \theta + 2\sqrt{3} \tan \theta = 1$  is given by -

(a)  $\theta = \frac{\pi}{2}$

(b)  $\left(n + \frac{1}{2}\right)\pi$

(c)  $(6n + 1)\frac{\pi}{12}$

(d)  $\frac{n\pi}{12}$

63. If  $f(a + b - x) = f(x)$ , then  $\int_a^b x f(x) dx =$

(a)  $\frac{a + b}{2} \int_a^b f(b - x) dx$

(b)  $\frac{a + b}{2} \int_a^b f(x) dx$

(c)  $\frac{b - a}{2} \int_a^b f(x) dx$

(d) None of these



64. The set  $(A \cap B^c)^c \cup (B \cap C)$  is equal to -
- (a)  $A \cup B \cup C$
  - (b)  $A^c \cup B$
  - (c)  $A^c \cup B^c$
  - (d) none

65. If matrix  $A$  is given by  $A = \begin{bmatrix} 6 & 11 \\ 2 & 4 \end{bmatrix}$  then the determinant of  $A^{2005} - 6A^{2004}$  is
- (a)  $2^{2006}$
  - (b)  $(-11)2^{2005}$
  - (c)  $-2^{2005} \cdot 7$
  - (d)  $(-9)^{2004}$

66. If  $d_i$  is the deviation of a class mark  $y_i$  from ' $a$ ', the 'assumed mean' and  $f_i$  is the frequency, then Mean

$$M_g = x + \frac{1}{\sum f_i} (\sum f_i d_i), \text{ then } x \text{ is -}$$

- (a) lower limit
- (b) assumed mean
- (c) number of observations
- (d) class size

67. If  $f(x) = \begin{cases} \frac{x^2 - 1}{x + 1}, & \text{when } x \neq -1 \\ -2, & \text{when } x = -1 \end{cases}$

(a)  $\lim_{x \rightarrow (-1)^-} f(x) = -2$

(b)  $\lim_{x \rightarrow (-1)^+} f(x) = -2$

(c)  $f(x)$  is continuous at  $x = -1$

(d) All the above are correct

68. If  $\log_x a$ ,  $a^{\frac{x}{2}}$  and  $\log_b x$  are in G.P. Then  $x$  is equal to:
- (a)  $\log_a(\log_b a)$
  - (b)  $\log_a(\log_e a) + \log_a \log_b b$
  - (c)  $-\log_a(\log_a b)$
  - (d) None of these

69.  $\log_4 18$  is
- (a) a rational number
  - (b) an irrational number
  - (c) a prime number
  - (d) none of these

70. The area of the region  $\{(x, y) : x^2 \leq y \leq |x|\}$  is

(a)  $\frac{1}{3}$

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

(c)  $\frac{1}{4}$

(d) None

71. In an ellipse the distance between its foci is 6 and its minor axis is 8. Then its eccentricity is -

(a)  $\frac{4}{5}$

(b)  $\frac{1}{\sqrt{52}}$

(c)  $\frac{3}{5}$

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



72. Which of the following is always false?

(a)  $(p \Rightarrow q) \equiv \sim q \Rightarrow \sim p$

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

(c)  $\sim (p \Rightarrow q) \equiv p \wedge \sim q$

(d)  $\sim (p \vee q) \equiv \sim p \wedge \sim q$

73. The value of  $\begin{vmatrix} a & a+b & a+b+c \\ 2a & 3a+2b & 4a+3b+2c \\ 3a & 6a+3b & 10a+6b+3c \end{vmatrix}$  is equal to -

- (a)  $a^3$
- (b)  $b^3$
- (c)  $c^3$
- (d)  $a^3 + b^3 + c^3$

74. If  $\frac{dy}{dx} = \frac{2^x y + 2^y \cdot 2^x}{2^x + 2^{x+y} \log_e 2}$ ,  $y(0) = 0$ , then for  $y = 1$ , then the value of  $x$  lies in the interval:

- (a)  $(1, 2)$
- (b)  $\left(\frac{1}{2}, 1\right]$
- (c)  $(2, 3)$
- (d)  $\left(0, \frac{1}{2}\right]$

75. If  $x, y$  are real numbers such that  $3^{\frac{x}{y}+1} - 3^{\frac{x}{y}-1} = 24$ , then the value of  $\frac{(x+y)}{(x-y)}$  is:

- (a) 0
- (b) 1
- (c) 2
- (d) 3

76. For any parabola focus is  $(2, 1)$  and directrix is  $2x - 3y + 1 = 0$ , then equation of the latus rectum is
- (a)  $3x + 2y + 8 = 0$
  - (b)  $2x - 3y - 1 = 0$
  - (c)  $2x - 3y + 1 = 0$
  - (d)  $3x - 2y + 4 = 0$

77. If  $y = \tan^{-1} \frac{x}{1 + \sqrt{1 - x^2}} + \sin \left\{ 2 \tan^{-1} \sqrt{\left( \frac{1 - x}{1 + x} \right)} \right\}$ , then  $\frac{dy}{dx} =$

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

78. If  $4 \sin^{-1} x + \cos^{-1} x = \pi$ , then  $x$  is equal to

(a) 0

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

(c)  $-\frac{\sqrt{3}}{2}$

(d)  $\frac{1}{\sqrt{2}}$

79. The equation  $16x^2 - 3y^2 - 32x + 12y - 44 = 0$  represents hyperbola -
- (a) the length of whose transverse axis is  $4\sqrt{3}$
  - (b) the length of whose conjugate axis is 4
  - (c) whose centre is  $(-1, 2)$
  - (d) whose eccentricity is  $\sqrt{\frac{19}{3}}$



80.  $\int \frac{x}{\sqrt{4-x^4}} dx =$

(a)  $\cos^{-1} \frac{x^2}{2} + c$

(b)  $\frac{1}{2} \cos^{-1} \frac{x^2}{2} + c$

(c)  $\sin^{-1} \frac{x^2}{2} + c$

(d)  $\frac{1}{2} \sin^{-1} \frac{x^2}{2} + c$

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**Section - II: Numerical**

*This section contains a total of 10 questions.  
Out of the 10 questions, 5 questions are mandatory.  
For every correct response you shall be awarded 4 marks.  
For every incorrect response -1 marks shall be deducted.  
For more details refer the first page of this booklet.*

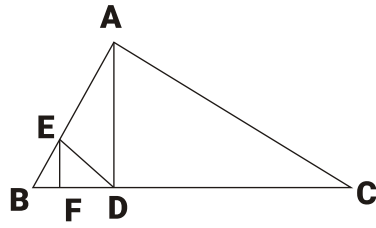
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81. If ' $e$ ' is eccentricity and  $l$  is the length of latus rectum of the ellipse  $9x^2 + 5y^2 - 30y = 0$ , then  $e + l$  is

82. The sum of all 3-digit numbers less than or equal to 500, that are formed without using the digit "1" and they all are multiple of 11, is .....

83. If  $28 \sin^4 \alpha + 21 \cos^4 \alpha = 12$  then the value of  $24(\tan^2 \alpha + \cot^2 \alpha)$  is:

84. In the given figure,  $EF \parallel AD$  and  $ED \parallel AC$ . If  $BF = 4$  cm,  $FD = 6$  cm and  $BE = 8$  cm, then  $BC = \underline{\hspace{2cm}}$  cm.



85. The rectangular hyperbola  $xy = 1$  cuts the circle  $x^2 + y^2 = 1$  at four points. The sum of abscissae of these points is

86. If  $A$  and  $B$  are square matrices such that  $A^{2006} = 0$  and  $AB = A + B$ , then  $\det(B) =$

87. The standard deviation of 25 numbers is 40. If each of the numbers is increased by 5, then the new standard deviation will be



88. Let  $A = \log_{11}(11^{\log_{11}(1331)})$ ,  $B = \log_{385}(5) + \log_{385}(7) + \log_{385}(11)$ ,  $C = \log_4(\log_2(\log_5 625))$ ,  $D = 10^{\log_{10}(16)}$ .  
Find the value of  $\frac{AD}{BC}$

89. If  $\int \frac{\ln(ex^{x+1}) + (\ln(x^{\sqrt{x}}))^2}{1 + (x \ln x)(\ln(e^2 x^x))} dx = f(x) + C$ , where  $f(1) = 0$ , then  $e^{e^{f(2)}-1}$  is equal to

90. Given  $n(U) = 20$ ,  $n(A) = 12$ ,  $n(B) = 9$ ,  $n(A \cap B) = 4$ , where  $U$  is the universal set,  $A$  and  $B$  are subsets of  $U$ , then  $n((A \cup B)^C) =$