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MOCK TEST PAPER

for

JEE (Main)-2023

General Instructions:

1. Duration of Test is 3 hrs.
2. The Test booklet consists of 90 questions. The maximum marks are 300.
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 part has two sections.
   (i) **Section-I :** This section contains 20 multiple choice questions which have only one correct answer. Each question carries **4 marks** for correct answer and **–1 mark** for wrong answer.
   (ii) **Section-II :** This section contains 10 questions. In Section II, attempt any **five questions out of 10**. The answer to each of the questions is a numerical value. Each question carries **4 marks** for correct answer and **–1 mark** for wrong answer.

PART – A : PHYSICS

SECTION - I

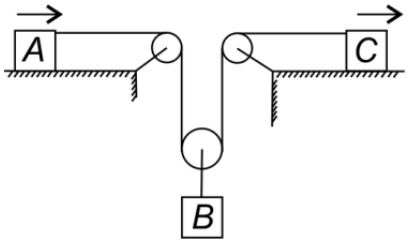
Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

1. A particle moves in the x, y plane according to the law, $x = kt$ and $y = kt(1-\alpha t)$, where k and α are constants and t is time. Time instant when angle between acceleration and velocity is 45°, is

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

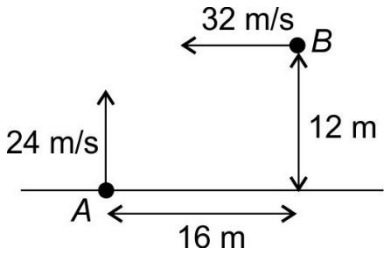
   (3) $\frac{1}{2\alpha}$ (4) $\frac{4}{\alpha}$

2. In the shown system the block A moves towards right with velocity $v = 2t$ m/s and block C moves towards right with constant velocity 4 m/s (time t is in seconds). Velocity of block 'B' at $t = 4$ sec, is



   (1) Zero
   (2) 2 m/s
   (3) 4 m/s
   (4) 3 m/s

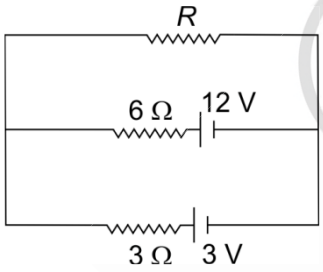
3. Two particles *A* and *B* are projected with velocities as indicated in vertical plane. Distance of the particles from point of projection of particle *A* where both particles collide, is [g = 10 m/s^2]



(1) 9.00 m (2) 8.00 m

(3) 10.75 m (4) 15.00 m

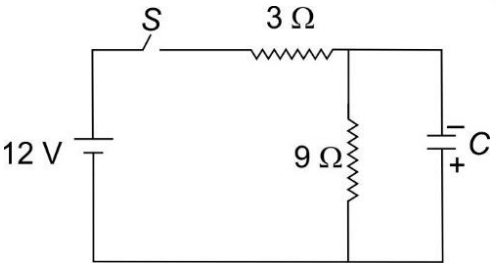
4. For the circuit shown in figure, value of resistance *R* is adjusted so that power delivered to resistor, *R* is maximum and is equal to P_0. Value of P_0, is



(1) 6.0 W (2) 3.0 W

(3) 9.0 W (4) 4.5 W

5. For the *RC* circuit as shown, capacitor '*C*' is charged to 4 V with polarity as shown. Switch '*S*' is closed at t = 0. Time, t_0 at which potential across capacitor becomes 6 V is



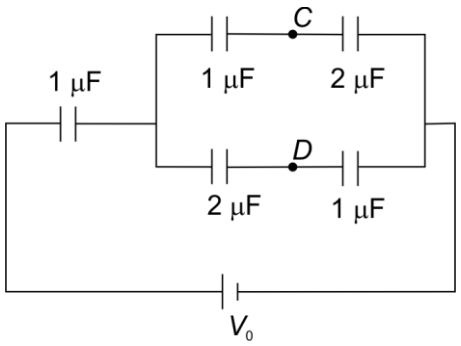
(1) $4C\ln(2)$

(2) $4C\ln\left(\frac{13}{6}\right)$

(3) $2C\ln(3)$

(4) $\frac{9C}{4}\ln\left(\frac{13}{3}\right)$

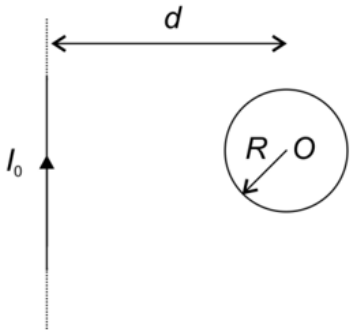
6. For the circuit shown, magnitude of potential difference across *C* and *D* is



(1) $\frac{4V_0}{7}$ (2) $\frac{2V_0}{7}$

(3) $\frac{3V_0}{7}$ (4) $\frac{V_0}{7}$

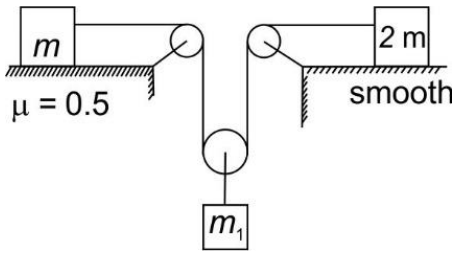
7. Current, I_0 flows in long straight conductor as shown. If magnetic field at center of circular loop in the same plane is zero, then current in the circular loop is



(1) $2I_0$ (2) $I_0\frac{d}{R}$

(3) $\frac{\pi I_0 R}{2d}$ (4) $\frac{I_0 R}{\pi d}$

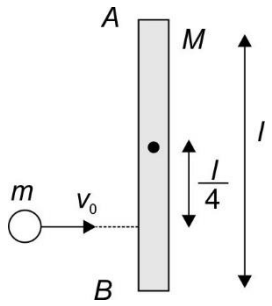
8. Value of mass m_1 is chosen so that mass 'm' is just in equilibrium. Acceleration of mass 'm_1' is



(1) $\frac{g}{8}$ (2) $\frac{g}{2}$

(3) $\frac{g}{4}$ (4) $\frac{3g}{4}$

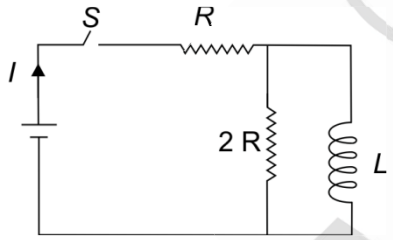
9. A metre stick lies on a frictionless horizontal plane. A small body of mass '*m*' moving with velocity, v_0 collides elastically with the stick as shown. If mass '*m*' comes to rest after collision, then velocity of end '*A*' just after the collision is



(1) $\frac{2v_0}{7}$ (2) $\frac{v_0}{7}$

(3) $\frac{3v_0}{7}$ (4) $\frac{4v_0}{7}$

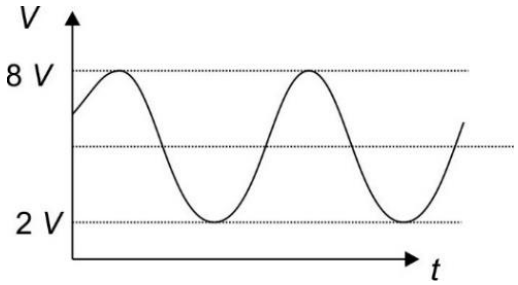
10. For the *L*-*R* circuit as shown, ratio of currents, *I* at $t = 0$ and $t = \infty$ after closing the switch is



(1) 2 (2) 3

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

11. A sinusoidally varying source voltage is given as a function of time as shown. RMS value of voltage is



(1) $\sqrt{\frac{59}{2}}V$ (2) $\frac{7}{\sqrt{2}}V$

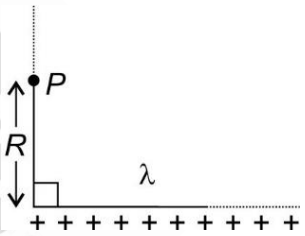
(3) $4V$ (4) $6V$

12. Two particles *A* and *B* are performing SHM with amplitude, A_0 and time period *T* about the same mean position. At $t = 0$, *A* is at mean position and *B* is at distance $\frac{A_0}{2}$ from mean position and is going towards mean position. At what time they will be at maximum separation? (At $t = 0$, direction of velocities of *A* and *B* are same)

(1) $\frac{T}{12}$ (2) $\frac{T}{8}$

(3) $\frac{T}{30}$ (4) $\frac{T}{24}$

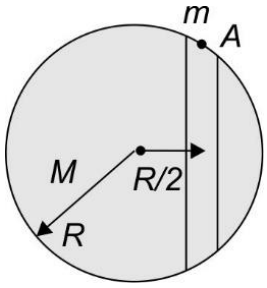
13. Electric field at point '*P*' due to long rod having uniform charge density, λ as shown is



(1) $\frac{\lambda}{4\pi\varepsilon_0 R}$ (2) $\frac{\lambda}{2\sqrt{2}\pi\varepsilon_0 R}$

(3) $\frac{\lambda}{2\pi\varepsilon_0 R}$ (4) $\frac{\lambda}{\sqrt{2}\pi\varepsilon_0 R}$

14. A point mass '*m*' is released from rest at point *A* along the smooth tunnel made at distance $\frac{R}{2}$ from center of the earth as shown. Velocity of point mass once it reaches the center of tunnel is



(1) $\sqrt{\frac{3GM}{2R}}$ (2) $\sqrt{\frac{GM}{4R}}$

(3) $\sqrt{\frac{3GM}{8R}}$ (4) $\sqrt{\frac{3GM}{4R}}$

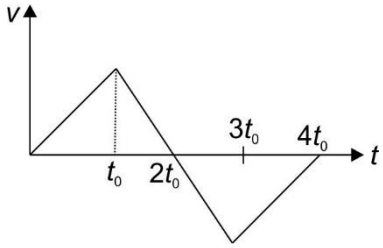
15. Molar heat capacity of the diatomic gas undergoing the process PV^3 = constant is

(1) $2R$ (2) $3R$

(3) R (4) $4R$

16. A solid ball of density half that of water falls freely under gravity from a height of 29.4 m and then enters water. *v-t* graph of solid ball is shown by the curve, (neglect friction and viscosity).

(1)



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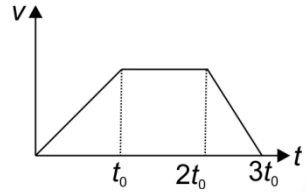

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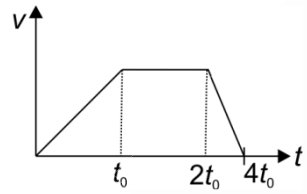

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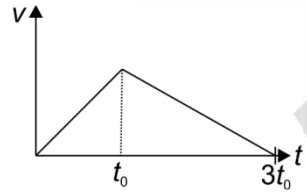
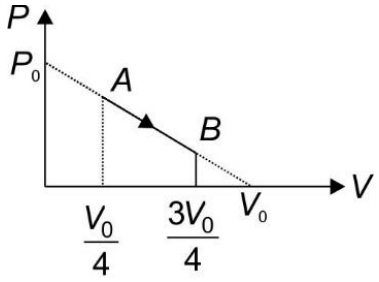


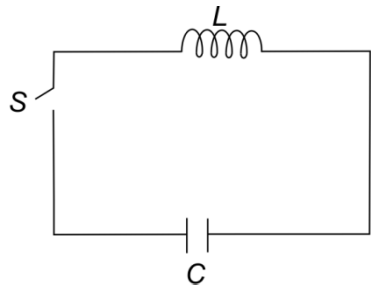
17. A diatomic gas undergoes the process $A \rightarrow B$ as shown in *P-V* diagram. Volume of gas when it changes from endothermic to exothermic, is



(1) $\frac{3V_0}{8}$ (2) $\frac{5V_0}{8}$

(3) $\frac{5V_0}{9}$ (4) $\frac{7V_0}{12}$

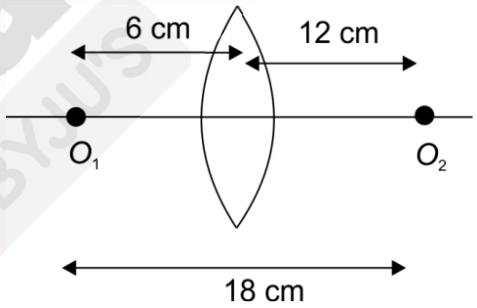
18. Switch '*S*' is closed at $t = 0$ and initial charge on capacitor is Q_0. At what time energy stored in capacitor is 3 times that of energy stored in inductor?



(1) $\frac{\pi}{6}\sqrt{LC}$ (2) $\frac{\pi}{3}\sqrt{LC}$

(3) $\frac{\pi}{2}\sqrt{LC}$ (4) $\frac{\pi}{4}\sqrt{LC}$

19. Two objects O_1 and O_2 are placed in front of a thin lens as shown. What should be the focal length of lens so that images of both the objects are formed on the same location?



(1) 7 cm (2) 9 cm

(3) 8 cm (4) 10 cm

20. In an electromagnetic wave, if $\bar{E}$ and $\bar{B}$ represent electric and magnetic field respectively, then

(1) $\bar{E}$ and $\bar{B}$ oscillate in same phase

(2) $\bar{E}$ and $\bar{B}$ oscillate in opposite phase

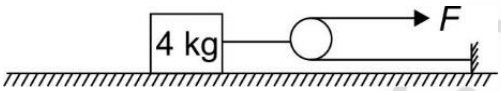
(3) $\bar{E}$ and $\bar{B}$ oscillate perpendicular to each other and $\bar{E}$ leads $\bar{B}$ by phase of $\frac{\pi}{2}$

(4) $\bar{E}$ and $\bar{B}$ oscillate parallel to each other

SECTION - II

Numerical Value Type Questions: This section contains 10 questions. In Section II, attempt any **five questions out of 10**. The answer to each question is a NUMERICAL VALUE. For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, –00.33, –00.30, 30.27, –27.30) using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.

21. If coefficient of friction between all the surfaces is 0.50, then force, F (in N) required to move the block of mass 4 kg is [g = 10 m/s^2]

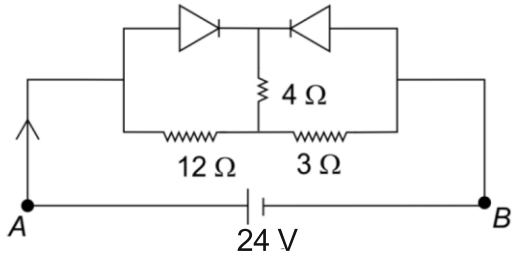


22. Fundamental frequency of an open organ pipe is f_0. If it is closed at one end, fundamental frequency becomes nf_0. Value of n is _____. (ignore end correction)

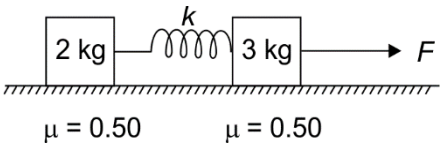
23. In a hydrogen atom, electron jumps from 4th excited state to 2nd excited state. Wavelength of photon emitted is $\frac{9n}{16R}$. Value of n is [R : Rydberg constant]

24. In a photoelectric experiment stopping potential changes from V_0 to $3V_0$ when frequency of incident radiation is changed from ν_0 to $2\nu_0$. If work function of metal is $\frac{h\nu_0}{n}$ then find the value of n.

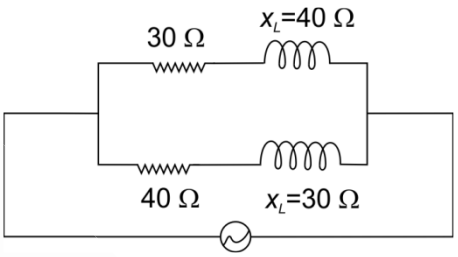
25. In the circuit with ideal diodes as shown, current (in A) through battery is



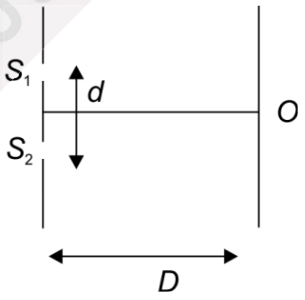
26. For the system shown in figure, initially spring is unstretched. Find minimum force F (in N) required to just move the block of mass 2 kg. [g = 10 m/s^2]



27. For the AC circuit as shown, power factor of circuit is $\frac{1}{\sqrt{n}}$. Find n.

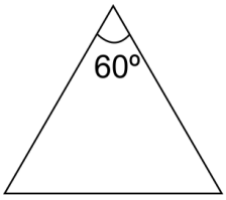


28. In a standard YDSE two identical slits S_1 and S_2 are illuminated by light of wavelength of λ. If light wave through slit S_1 leads S_2 by phase of $\frac{\pi}{3}$ at point O then nearest minima to O is at distance of $\frac{\lambda D}{nd}$. Find n.



29. If force (F), area (A) and time (T) are fundamental units, then dimension of mass, is $[F^x A^y T^z]$, then value of $x + y + z$, is

30. In an equilateral prism minimum deviation is obtained when angle of incidence is $\theta = 45^\circ$. Value of $\frac{d\theta}{dn}$ is $\frac{1}{\sqrt{x}}$, where n is refractive index of glass prism. Find x.



PART – B : CHEMISTRY

SECTION - I

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

31. Which one of the following halides will not undergo oxidation with dimethyl sulfoxide?

(1) $C_6H_5-\underset{\underset{Br}{|}}{CH}-CH_3$

(2) $C_6H_5-C(CH_3)_2-Br$

(3) $C_6H_5-\underset{\underset{Br}{|}}{CH}-C_6H_5$

(4) $C_6H_5-CO-CH_2Br$

32. The rate of a chemical reaction is found to be 0.92 mol L^{-1} min^{-1} at 15 min and 0.23 mol L^{-1} min^{-1} at 45 min from the start of the reaction. What is the order of reaction if half-life of the reaction is 15 min?

(1) Zero order (2) Second order

(3) Third order (4) First order

33. Positronium is a species consisting of an electron bound to a positron. What would be the radius of its first excited state?

(1) 2.12 Å (2) 1.06 Å

(3) 0.53 Å (4) 4.24 Å

34. Gallium dichloride exists as

(1) $GaCl_2$

(2) $Ga[GaCl_4]$

(3) $Ga_2[GaCl_6]$

(4) $[GaCl_2]_2$

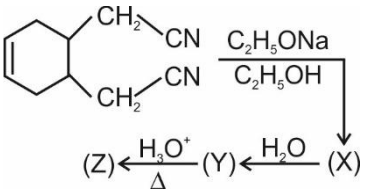
35. Oxidising power of perhalate ions (into halate ion) follows the order:

(1) $BrO_4^- > IO_4^- > ClO_4^-$

(2) $ClO_4^- > BrO_4^- > IO_4^-$

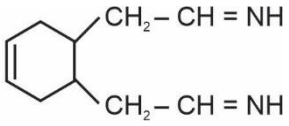
(3) $IO_4^- > BrO_4^- > ClO_4^-$

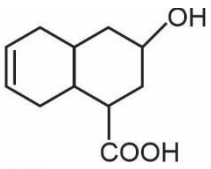
(4) $IO_4^- > ClO_4^- > BrO_4^-$

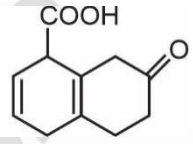
36. 

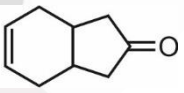
A sequence of reaction is given above.

Which of the following statements is correct about the products obtained?

(1) (X) is 

(2) (Z) is 

(3) (Z) is 

(4) (Z) is 

37. The K_f and K_b values of a solvent are 5.0 K kg mol^{-1} and 14.0 K kg mol^{-1} respectively. The boiling point of pure solvent is 84.0°C and its freezing point is (–2.0°C). What is the boiling point of a solution of solute (X) if it freezes at (–2.75°C)?

(1) 87.9°C (2) 87.0°C

(3) 86.1°C (4) 85.2°C

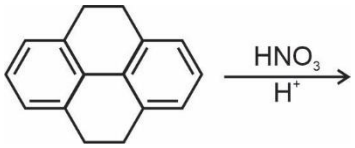
38. Silver acetate is a slightly soluble salt of weak acid ($K_a = 1.75 \times 10^{-5}$). At 20°C, 100 g of water dissolves 1.04 g of crystalline silver acetate. The density of saturated solution of silver acetate at 20°C is 1.01 g/cc. The solubility product constant for silver acetate at 20°C is (Atomic mass of Ag is 108 u and neglect hydrolysis of acetate ion)

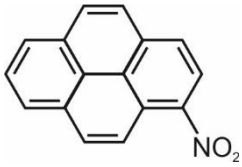
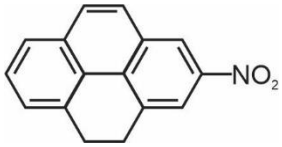
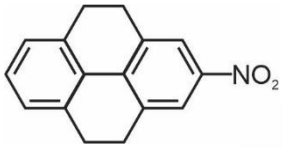
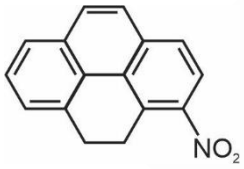
(1) 3.87×10^{-3} (2) 6.022×10^{-3}

(3) 2.84×10^{-4} (4) 5.35×10^{-5}

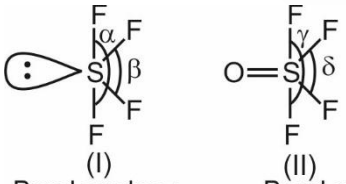
39. The correct order of increasing X – O – X bond angle is (X : H, F or Cl)
(1) $H_2O > Cl_2O > F_2O$
(2) $Cl_2O > H_2O > F_2O$
(3) $F_2O > Cl_2O > H_2O$
(4) $F_2O > H_2O > Cl_2O$

40. The major product obtained in the following reaction is



(1) 
(2) 
(3) 
(4) 

41. For the following geometry which of the given inequality is correct?



(I) Bond angles :
$F_{ax} – S – F_{ax} = \alpha$
$F_{eq} – S – F_{eq} = \beta$

(II) Bond angles :
$F_{ax} – S – F_{ax} = \gamma$
$F_{eq} – S – F_{eq} = \delta$

(1) $\alpha = \gamma$ and $\beta = \delta$ (2) $\alpha > \gamma$ and $\beta < \delta$
(3) $\alpha > \gamma$ and $\beta > \delta$ (4) $\alpha < \gamma$ and $\beta > \delta$

42. The overall reaction for the electrolytic production of aluminium by means of the Hall-Heroult process may be represented as
$Al_2O_3(s) + 3C(s) \longrightarrow 2Al(s) + 3CO(g)$
At 1000°C, the standard free energy change for the process is –594 kJ mol^{-1}. The minimum voltage required to produce one mole aluminium at this temperature is
(1) 1.02 V (2) 2.05 V
(3) 3.08 V (4) 4.03 V

43. $(X) \xleftarrow[\text{Boil}]{H_2O} H_4P_2O_7 \xrightarrow{\text{Strong heating}} (Y)$
In the sequence of reactions given above, compounds (X) and (Y) are respectively
(1) P_2O_5, H_3PO_4 (2) H_3PO_4, H_3PO_2
(3) P_2O_5, H_3PO_3 (4) H_3PO_4, P_2O_5

44. For a second order reaction, the ratio of $t_{3/4}$ to $t_{1/2}$ is
(1) 2 : 1 (2) 3 : 2
(3) 3 : 1 (4) 4 : 1

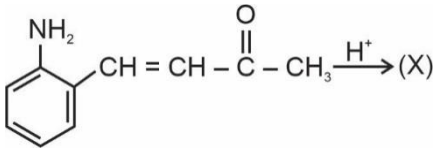
45. Treatment of D-fructose with concentrated HCl mainly gives product P. The degree of unsaturation of product P is _____
(1) 2 (2) 1
(3) 4 (4) 3

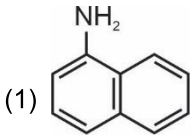
46. The iodide content of a solution was determined by titration with $Ce(SO_4)_2$ in presence of HCl in which I^- is converted to ICl. A 250 mL sample of the solution required 20 mL of 0.05 N Ce^{4+} solution. What is the iodide concentration in the original solution in g/L? (Atomic mass of I is 127 u)
(1) 5.08 g/L (2) 0.854 g/L
(3) 0.254 g/L (4) 3.26 g/L

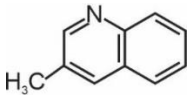
47. Consider the following sequential reaction starting with excess of (A):
$A \xrightarrow{k_1} B \xrightarrow{k_2} C$
Where $k_1 = 2 \times 10^{-3}$ mol $L^{-1}s^{-1}$; $k_2 = 3 \times 10^{-3}$ s^{-1}. Calculate the maximum concentration of B obtained during the reaction.
(1) 2.0 mol L^{-1} (2) 1.5 mol L^{-1}
(3) 0.5 mol L^{-1} (4) 0.67 mol L^{-1}

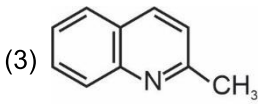
48. Identify the product formed on heating (alone) the following allyl vinyl ether.
$CH_2 = CH – CH_2 – O – CH = CH_2 \xrightarrow{\Delta}$
(1) $CH_3 – CH = CH – \overset{\overset{O}{\|}}{C} – CH_3$
(2) $CH_2 = CH – CH_2OH + HC \equiv CH$
(3) $CH_2 = CH – CH_2 – CH_2 – \overset{\overset{O}{\|}}{C} – H$
(4) $CH_3 – CH_2 – CH = CH – \overset{\overset{O}{\|}}{C} – H$

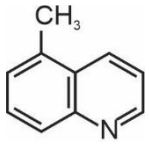
49. Identify the major product (X) formed in the following reaction.

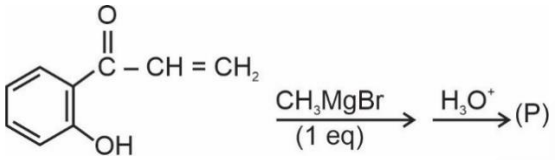


(1) 

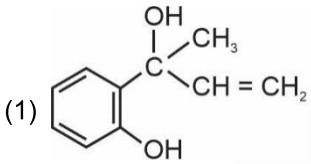
(2) 

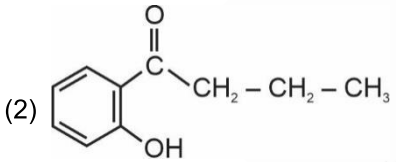
(3) 

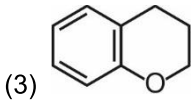
(4) 

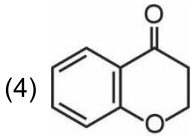
50. 

The major product (P) formed in the above reaction would be

(1) 

(2) 

(3) 

(4) 

SECTION - II

Numerical Value Type Questions: This section contains 10 questions. In Section II, attempt any **five questions out of 10**. The answer to each question is a NUMERICAL VALUE. For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, –00.33, –00.30, 30.27, –27.30) using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.

51. A 2 g sample of impure anhydrous oxalic acid is added to 100 mL of 0.1 M acidified $Ba(MnO_4)_2$. Excess of $Ba(MnO_4)_2$ was completely reduced by 60 mL of 1 M $FeSO_4$. Calculate the percentage purity of the anhydrous oxalic acid sample.

52. An aromatic compound contains 69.4% carbon, 5.8% hydrogen. A sample of 0.303 g of this compound was analysed for nitrogen by Kjeldahl's method. The NH_3 evolved was absorbed in 50 mL of 0.05 M H_2SO_4. The excess of acid required 25 mL of 0.1 M NaOH for neutralisation. Find out the percentage of oxygen in the aromatic compound. (Report answer to the nearest integer)

53. The solubility of CaF_2 in water at 25°C is 1.56×10^{-3} g per 100 mL. The solubility product of CaF_2 at 25°C is $x \times 10^{-12}$. The value of x is (Report answer to the nearest integer). Molar mass of CaF_2 is 78 g mol^{-1}.

54. When excess of KCN is added to aqueous solution of $CuSO_4$, a co-ordination compound $K_x[Cu(CN)_y]$ is formed. What is the value of (x + y)?

55. The total number of stereoisomers possible for 2,5-dibromohex-3-ene is ___.

56. The half-cell potentials of half cell $A^{(x+n)+}$, A^{x+}| Pt were found to be as follows

% of reduced form	75	60
Half cell potential (V)	0.1066	0.115

Determine the value of 'n' (Round off to the nearest integer) assuming reduction takes place. Use log2 = 0.3.

57. 0.044 mol of solid NaOH is added to 250 mL of 0.1 M $NiCl_2$ solution. Calculate the approximate pH of the final solution, [K_{sp} $(Ni(OH)_2) = 1.6 \times 10^{-14}$ M^3] rounded off to the nearest integer. Given log3 = 0.48.

58. Consider the following compounds.
(A) Phenol
(B) Propyne
(C) Benzene sulphonic acid
(D) Benzoic acid
(E) Cyclopentadiene
(F) Ethane
(G) Picric acid
(H) 4-Nitro Cyclohexanol
If (X) is the total number of compounds which evolve H_2 gas with Na metal and (Y) is the total number of compounds which evolve CO_2 gas with $NaHCO_3$. Then find the value of (X – Y).

59. If equivalent volume of N_2 in a given reaction under STP conditions is x liter per equivalent $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$, then the value of $\frac{3x}{5.6}$ will be _____ . (Report the answer to the nearest integer)

60. Find the number of angles less than 120° in PF_5.

PART – C : MATHEMATICS

SECTION - I

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

61. If two real numbers a and b are randomly chosen from the interval (0, 1), then the probability that the equation $x^2 - \sqrt{a}x + b = 0$ has real roots is

(1) $\frac{1}{4}$ (2) $\frac{1}{8}$

(3) $\frac{5}{15}$ (4) $\frac{3}{16}$

62. Let S = {1, 2, 3, …, 99, 100}. Then, the number of ordered triplet (x, y, z) such that $x, y, z \in S$, $x < z$ and $y < z$ is equal to

(1) $3 \cdot {}^{100}C_2$ (2) ${}^{100}C_2 + {}^{101}C_3$

(3) ${}^{101}C_3 + {}^{100}C_3$ (4) $2 \cdot {}^{101}C_3$

63. Sum of 36 terms of the series $\frac{1}{9\sqrt{11}+11\sqrt{9}} + \frac{1}{11\sqrt{13}+13\sqrt{11}} + \frac{1}{13\sqrt{15}+15\sqrt{13}} + \ldots$ is equal to

(1) $\frac{2}{3}$ (2) $\frac{1}{9}$

(3) $\frac{2}{9}$ (4) $\frac{4}{9}$

64. The value of $\frac{\sin\frac{4\pi}{9}}{\sin\frac{\pi}{9}} - \frac{\sqrt{3}}{2\sin\frac{4\pi}{9}}$ is equal to

(1) 2 (2) 3

(3) 4 (4) 1

65. Let $a, b, c \in I^+$, such that the roots of the three quadratic equations $x^2 - 2ax + b = 0$, $x^2 - 2bx + c = 0$, $x^2 - 2cx + a = 0$ are all positive integers, then the maximum value of the product abc is equal to

(1) 1 (2) 2

(3) 4 (4) 6

66. Let $f : Q - \{0, 1\} \to Q$ be a function such that $x^2 f(x) + f\left(\frac{x-1}{x}\right) = 2x^2$ for all rational numbers $x \neq 0, 1$. Then the value of $f(2)$ is

(1) $\frac{3}{4}$

(2) $\frac{7}{4}$

(3) $\frac{11}{4}$

(4) $\frac{13}{4}$

67. The locus of point of intersection of tangents of the parabola $y^2 = 4(x + 1)$ and $y^2 = 8(x + 2)$ which are perpendicular to each other is

(1) $x + 7 = 0$

(2) $x - y = 4$

(3) $x + y = 3$

(4) $x + 3 = 0$

68. In a triangle ABC, coordinates of A are (1, 2) and the equations of medians through B and C are $x + y = 5$ and $x = 4$ respectively. The coordinates of C and B are respectively

(1) (3, 3), (7, 2)

(2) (–4, 3), (7, –2)

(3) (–4, –3), (7, 2)

(4) (4, 3), (7, –2)

69. The equation of circle having the pair of lines $x^2 + 2xy + 3x + 6y = 0$ as its normal and having size just sufficient to contain the circle $x(x - 4) + y(y - 3) = 0$ is

(1) $x^2 + y^2 + 6x - 3y - 35 = 0$

(2) $x^2 + y^2 - 6x + 3y - 35 = 0$

(3) $x^2 + y^2 + 6x - 3y - 45 = 0$

(4) $x^2 + y^2 - 6x + 3y - 45 = 0$

70. From a point 'O' on circle $x^2 + y^2 = r^2$, tangents OP and OQ are drawn to ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, then the locus of mid-point of chord PQ is

(1) $r^2\left(\frac{x^2}{a^2}+\frac{y^2}{b^2}\right)=x^2+y^2$

(2) $r^2\left(\frac{x^2}{a^2}+\frac{y^2}{b^2}\right)^2=x^2+y^2$

(3) $\frac{x^2}{a^2}+\frac{y^2}{b^2}=r^2(x^2+y^2)$

(4) $\left(\frac{x^2}{a^2}+\frac{y^2}{b^2}\right)^2=r^2(x^2+y^2)$

71. Let $f(x)=g(x)\frac{e^{1/x}-e^{-1/x}}{e^{1/x}+e^{-1/x}}$ and $x \neq 0$, where $g(x)$ is a continuous function. Then $\lim\limits_{x\to 0} f(x)$ exists if

(1) $g(x)$ is any polynomial

(2) $g(x) = x + 4$

(3) $g(x) = x^2$

(4) $g(x) = 2 + 3x + 4x^2$

72. Let $f(x)$, $f'(x)$ and $f''(x)$ are all positive for all $x \in [0, 7]$. If $f^{-1}(x)$ exists, then $2f^{-1}(1)+f^{-1}\left(\frac{3}{2}\right)+3f^{-1}\left(\frac{32}{5}\right)$ is

(1) Always negative

(2) Always positive

(3) Non-positive

(4) Nothing can be said

73. The value of $\lim\limits_{x\to 0^+}\left(\frac{(1+\{x\})^{\frac{1}{\{x\}}}}{e}\right)^{\frac{1}{\{x\}}}$, where $\{x\}$ represents fractional part of x, is equal to

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

(3) $\frac{e}{2}$ (4) $\frac{1}{\sqrt{e}}$

74. Let $g(x)=\begin{cases}\frac{x^2+x\tan x-x\tan 2x}{ax+\tan x-\tan 3x}, & x\neq 0\\ 0, & x=0\end{cases}$.

If $g'(0) = b$, then the value of $\frac{b}{a}$ where $a \cdot b \neq 0$ is

(1) $\frac{7}{52}$

(2) $\frac{9}{52}$

(3) $\frac{7}{51}$

(4) $\frac{9}{51}$

75. The angle between the tangents at any point P and the line joining the origin O to the point P, of the curve $\ln(x^2+y^2)=3\tan^{-1}\left(\frac{y}{x}\right)$ is θ, then $\tan\theta$ is equal to

(1) $\sqrt{3}$ (2) $\frac{1}{\sqrt{3}}$

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

76. If $|z-1|+|z+3|\le 8$, where $z = x + iy$, where $x, y \in R$ and $i=\sqrt{-1}$, then range of the values of $|z-4|$ is

(1) [0, 7] (2) [1, 8]

(3) [2, 12] (4) [1, 9]

77. The value of $\int\frac{e^x dx}{(\sin e^x+e^{-x}\cos e^x)^2}$ is equal to

(1) $\tan(e^x-\tan^{-1}e^x)+C$

(2) $\tan(e^{-x}-\tan^{-1}e^{-x})+C$

(3) $\tan(e^x+\tan^{-1}e^x)+C$

(4) $\tan(e^x-\tan^{-1}e^{-x})+C$

78. The value of $\int_{1/e}^{\tan x}\frac{t}{1+t^2}dt+\int_{1/e}^{\cot x}\frac{dt}{t(1+t^2)}$ is equal to $\left(\text{where } x\in\left(0,\frac{\pi}{2}\right)\right)$

(1) Zero

(2) 1

(3) $2e$

(4) $\frac{2}{e}$

79. If the area of the region bounded by the curves $y=\frac{1}{x}, y=\frac{1}{2x-1}, x=2$ and $x=a$; where $a > 2$ equal to $\ln\frac{4}{\sqrt{5}}$, then one possible value of a is

(1) 5

(2) 6

(3) 7

(4) 8

80. Let $f(x)$ be a continuous function which takes positive values for $x \ge 0$ and satisfy $\int_0^x f(t)dt = x\sqrt{f(x)}$ with $f(1)=\frac{1}{2}$. Then the value of $f(2\sqrt{2}+2)$ is equal to

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

(2) $\frac{1}{7}$

(3) $\frac{1}{9}$

(4) $\frac{1}{18}$

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81. $\vec{b}$ and $\vec{c}$ are non collinear vectors. If $\vec{a}\times(\vec{b}\times\vec{c})+(\vec{a}\cdot\vec{b})\vec{b}=(4-2x-\sin y)\vec{b}+(x^2-1)\vec{c}$ and $(\vec{c}\cdot\vec{c})\vec{a}=\vec{c}$, then the value of $x^{\sin y}+(4\sin y)^x$ is

82. The distance from the point (3, 4, 5) to the point where the line $\frac{x-3}{1}=\frac{y-4}{2}=\frac{z-5}{2}$ meets the plane $x + y + z = 17$ is equal to

83. If the distance between line $3(x+3)=2(y-5)=z+1$ and a line passing through (1, –2, 0) and having direction ratios (2, 3, 6) is K units, then K^2 is equal to

84. If $z = x + iy$, where $x, y \in R$ and $i=\sqrt{-1}$ satisfies the relation $|2z + 5| = |6z – 9|$, then $|z|^2 = a\,\text{Re}(z) + b$ where $a, b \in R$. The value of $(a – 4b)$ is

85. Let a matrix $a=[a_{ij}]_{n\times n}$ be such that $a_{ij}=\begin{cases}1 & \text{if } i\neq j\\ 0 & \text{if } i=j\end{cases}$ then in inverse of A, each diagonal elements is equal to $\frac{p-n}{n-q}$. The value of $(p+q)^3$ is

86. The coefficient of x^{18} in $(1-x)^{15}(1+x+x^2+\ldots+x^8)^{14}$ is equal to

87. The number of solutions of the equation $\cos(\pi\sqrt{x-4})\cdot\cos(\pi\sqrt{x})=1$ is equal to

88. In a ΔABC, the maximum value of $\frac{\Sigma a\cos^2\frac{A}{2}}{a+b+c}$ is equal to λ, then 16λ is equal to

89. Let $f(x)$ be a thrice differentiable function satisfying $f(x+y)=f(x-y)+y\{f'(x+y)+f'(x-y)\}$, where $f(0)=0$, $f'(0)=1$ and $f(1)=2$, then $f(5)$ is equal to

90. Let $f(x)$ be cubic polynomial which has local maximum at $x=-1$ and $f'(x)$ has local minimum at $x=1$. If $f(-1)=10$ and $f(3)=-22$, then the distance between its two horizontal tangents is

❑ ❑ ❑