FIITJEE

ALL INDIA TEST SERIES

FULL TEST – X

JEE (Advanced)-2021

PAPER –1

TEST DATE: 19-09-2021

Time Allotted: 3 Hours **Maximum Marks: 198**

General Instructions:

- The test consists of total 54 questions.
- Each subject (PCM) has 18 questions.
- This question paper contains **Three Parts.**
- **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
- Each **Part** is further divided into **Two Sections**: **Section-A & Section-C.**

  Section-A (01 – 06, 19 – 24, 37– 42) contains **18 multiple** choice questions which have **ONLY ONE CORRECT ANSWER**. Each question carries **+3 marks** for correct answer and **–1 mark** for wrong answer.

  Section-A (07 – 12, 25 – 30, 43 – 48) *this section contains* ***18 multiple*** *choice questions.*
  Each question has FOUR options. ***ONE OR MORE THAN ONE*** *of these four option(s) is (are) correct answer(s).*
  For each question, choose the option(s) corresponding to (all) the correct answer(s)
  Answer to each question will be evaluated according to the following marking scheme:

  Full Marks **: +4** If only (all) the correct option(s) is (are) chosen:
  Partial Marks **: +3** If all the four options are correct but ONLY three options are chosen;
  Partial Marks **: +2** If three or more options are correct but ONLY two options are chosen and both of which are correct;
  Partial Marks **: +1** If two or more options are correct but ONLY one option is chosen and it is a correct option;
  Zero Marks **: 0** If none of the options is chosen (i. e. the question is unanswered);
  Negative Marks **: –2** In all other cases.

  Section-C (13 – 18, 31– 36, 49 – 54) *contains* ***18 Numerical*** *answer type questions with answer XXXXX.XX and each question carries* ***+4 marks*** *for correct answer and* ***0 marks*** *for wrong answer.*

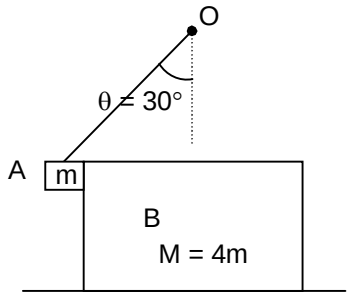
Physics

PART – I

SECTION – A
(One Options Correct Type)

This section contains **06 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

1. A small block 'A' of mass m suspended from a point 'O' with the help of a light inextensible string rests on a vertical face of a block 'B' of mass M = 4m which is placed on a smooth horizontal surface as shown in the figure. Initially the string makes an angle $\theta = 30°$ with the vertical and all contact surfaces are smooth. The acceleration of block 'A' just after released is (Take g = 10 m/s^2)



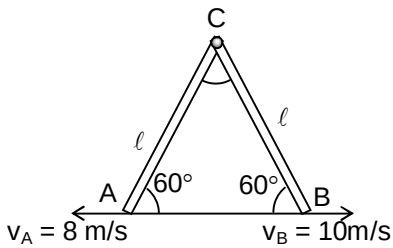
(A) $\frac{9}{4}$ m/s^2

(B) $\frac{7}{4}$ m/s^2

(C) $\frac{5}{4}$ m/s^2

(D) $\frac{3}{4}$ m/s^2

2. Two rods of equal length AC and BC are freely joined at C. Two ends A and B are pulled with velocities 8 m/s and 10 m/s respectively as shown in the figure, at a particular instant. The velocity of the point C at this instant is



(A) $2\sqrt{7}$ m/s

(B) $3\sqrt{7}$ m/s

(C) $4\sqrt{7}$ m/s

(D) $6\sqrt{7}$ m/s

3. If the molar heat capacity of an ideal gas in a process varies as $C = C_V + \alpha T^2$, where α is a constant. Then the equation of the process is

(A) $Ve^{-\frac{\alpha T}{R}} = \text{constant}$

(B) $Ve^{-\frac{\alpha T^2}{2R}} = \text{constant}$

(C) $Ve^{-\frac{3\alpha T^2}{2R}} = \text{constant}$

(D) $Ve^{-\frac{2\alpha T}{R}} = \text{constant}$

4. A steel tube of length ℓ with inner and outer radii R and 2R respectively is fixed at one end. The modulus of rigidity of the tube is η. The torque required in twisting the steel tube through an angle 'θ' about its axis is

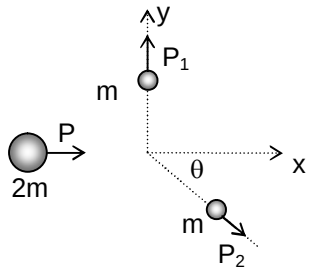
(A) $\frac{3\pi\eta R^4\theta}{2\ell}$

(B) $\frac{7\pi\eta R^4\theta}{2\ell}$

(C) $\frac{11\pi\eta R^4\theta}{2\ell}$

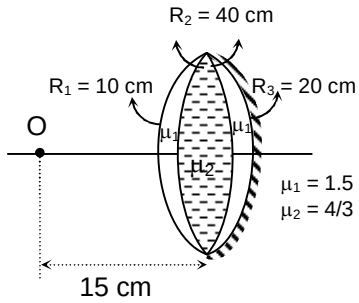
(D) $\frac{15\pi\eta R^4\theta}{2\ell}$

5. A hydrogen molecule in excited state travelling in the positive x-direction with kinetic energy of 2eV dissociates into two hydrogen atoms. If one of them moves perpendicular to the positive x-direction with kinetic energy 0.9 eV. Then the energy released in the dissociation process is



(A) 2.8 eV
(B) 3.8 eV
(C) 4.8 eV
(D) 5.8 eV

6. Two thin concavo-convex lenses made of same material (μ_1 = 1.5) are kept in contact with their concave surfaces facing each other as shown in the figure, with last surface silvered. The gap between the two lenses is filled with water $\left(\mu_2 = \frac{4}{3}\right)$. A point object 'O' is placed at a distance 15 cm from the lens on its optic axis. The distance of image formed from the lens is

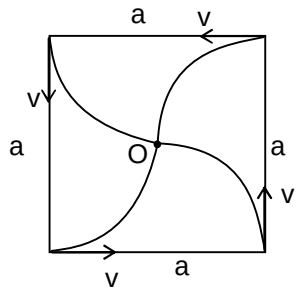


(A) 6 cm
(B) 12 cm
(C) 18 cm
(D) 24 cm

(One or More than one correct type)

This section contains **06** multiple choice questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.

7. Four particles are located at the vertices of a square of side 'a'. They all start moving simultaneously with constant speed v with the first particle always heading for the second, the second for the third, the third for the fourth and the fourth for the first. Then choose the correct option(s).



(A) The distance covered by each particle till they converge is a.

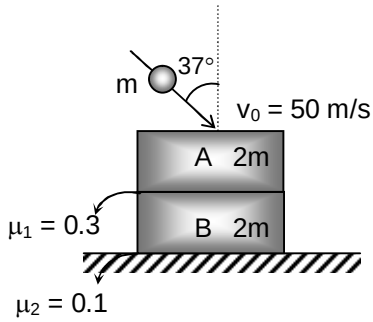
(B) The acceleration of each particle at $t = \frac{\tau}{5}$ is $\frac{5v^2}{4a}$

(C) The acceleration of each particle at $t = \frac{\tau}{5}$ is $\frac{5v^2}{2a}$

(D) The radius of curvature of the trajectory of each particle at $t = \frac{\tau}{3}$ is $\frac{2a}{3}$.

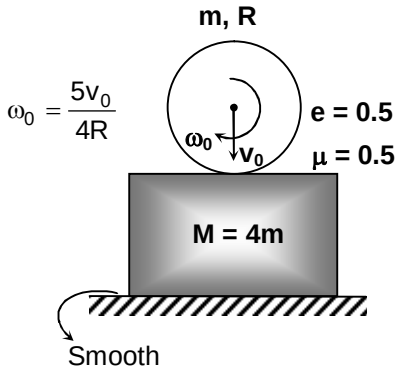
(where 'τ' is the time in which the particles converge)

8. A ball of mass m moving with a velocity v_0 = 50 m/s at an angle 37° from vertical collides with the block A and gets stuck to it as shown in the figure. The mass of each block A and B is 2m. The coefficient of friction between the blocks A and B is μ_1 = 0.3 and that between the block B and the horizontal surface is μ_2 = 0.1. Then choose the correct option(s).



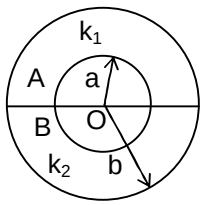
(A) The velocity of block A just after collision is 6 m/s
(B) The velocity of block A just after collision is 4 m/s
(C) The velocity of block B just after collision is 4 m/s
(D) The velocity of block B just after collision is 3 m/s

9. A solid sphere of mass m and radius R having initial angular velocity $\omega_0 = \frac{5v_0}{4R}$ and initial vertical velocity v_0 collides with a plank of mass M = 4m with a coefficient of restitution e = 0.5 as shown in the figure. The plank is placed on a smooth horizontal surface. The coefficient of friction between the sphere and the plank is μ = 0.5. Then choose the correct option(s).



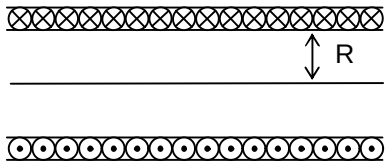
(A) The angular velocity of sphere just after collision is $\frac{5v_0}{12R}$
(B) The angular velocity of sphere just after collision is $\frac{5v_0}{6R}$
(C) The velocity of plank just after collision is $\frac{v_0}{12}$
(D) The impulse due to friction on the sphere during collision is $\frac{mv_0}{3}$

10. The inner and outer concentric conducting spheres of a spherical capacitor are having radii a and b. One half of the space between the spheres is filled with a dielectric A of dielectric constant k_1 and the other half with a dielectric B of dielectric constant k_2 as shown in the figure. The inner and the outer spheres are given charges +q and –q respectively. Then choose the correct option(s).



(A) The electric field in the dielectric A at a distance 'r' from its centre is $\frac{q}{2\pi\varepsilon_0(k_1+k_2)r^2}$
(B) The electric field in the dielectric B at a distance 'r' from its centre is $\frac{q}{2\pi\varepsilon_0(k_1+k_2)r^2}$
(C) The electric field in the dielectric B at a distance 'r' from its centre is $\frac{qk_1k_2}{2\pi\varepsilon_0(k_1+k_2)r^2}$
(D) The potential difference between the conducting spheres is $\frac{q(b-a)}{2\pi\varepsilon_0(k_1+k_2)ab}$

11. A single layer conducting coil carrying current I is wound with no gap between the adjacent turns on a long cylindrical frame of radius 'R'. The diameter of cross section of the wire used is d(d<<R). If breaking stress of the material of the wire is σ_0. Then choose the correct option(s).



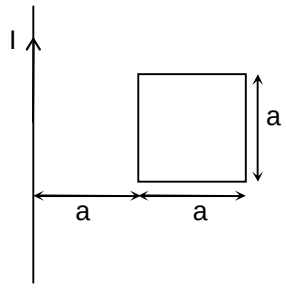
(A) The tension developed in the wire is $\frac{\mu_0 I^2 R}{2d}$

(B) The tension developed in the wire is $\frac{\mu_0 I^2 R}{d}$

(C) The minimum current at which the coil will rupture is $\sqrt{\frac{\sigma_0 \pi d^3}{2\mu_0 R}}$

(D) The minimum current at which the coil will rupture is $\sqrt{\frac{\sigma_0 \pi d^3}{4\mu_0 R}}$

12. A long fixed straight conductor carrying current I and a square conducting loop of side a, mass m and resistance R are located in the same plane in a gravity free space as shown in the figure. The current in the long straight conductor is suddenly switched off. Then choose the correct option(s).



(A) The charge $\left(\frac{\mu_0 I a \ell n 2}{2\pi R}\right)$ will flow through the loop.

(B) The charge $\left(\frac{\mu_0 I a \ell n 2}{4\pi R}\right)$ will flow through the loop.

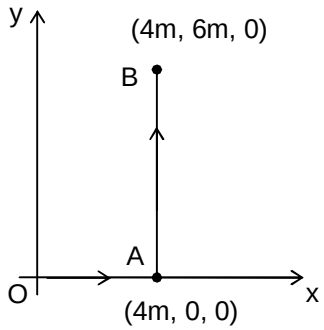
(C) The velocity acquired by the loop is $\left(\frac{\mu_0^2 I^2 a \ell n 2}{4\pi^2 m R}\right)$

(D) The velocity acquired by the loop is $\left(\frac{\mu_0^2 I^2 a \ell n 2}{16\pi^2 m R}\right)$

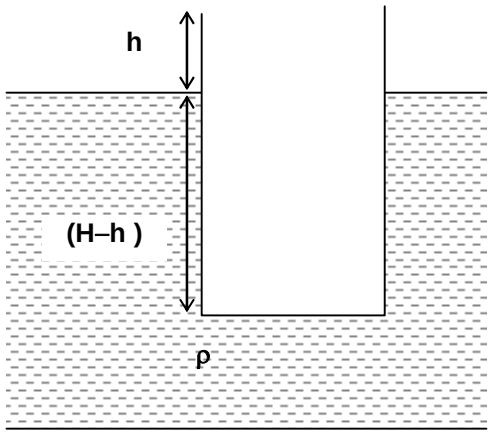
SECTION – C
(Numerical Answer Type)

This section contains **06** questions. 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. XXXXX.XX).

13. Find the work done (in Joule) by a force, $\vec{F} = [(y^2 - x^3 + 5z^2)\hat{i} + (3xy - 2z)\hat{j} + (3z)\hat{k}]$ newton in taking a particle from origin O to the point 'B' (4m, 6m, 0) along the path OAB as shown in the figure.

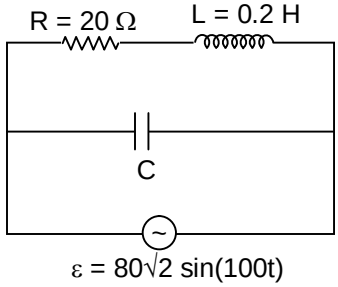


14. An open cuboidal tank of height H = 25 cm has rectangular bottom of length ℓ = 50 cm and width b = 20 cm. When it floats in water with the open top upside, a height h = 5 cm remains out of water. A small hole of area a = 2 cm^2 is made in the bottom. If water coming into the tank from the hole is not taken out. Find the time (in sec) in which the tank will sink. (Take g = 10 m/s^2)



15. An observer and a source of sound of frequency f_0 = 1000 Hz are located on the x-axis. The source executes simple harmonic motion along the x-axis with an angular frequency ω = 25 s^{-1}. Find the amplitude (in cm) of SHM executed by the source so that the frequency bandwidth registered by the stationary observer is equal to Δf = 40 Hz. The velocity of sound in air is equal to v = 340 m/s.

16. In the AC circuit shown in the figure, the rms current through the source is 2A. Find the value of capacitance C (in μF).



17. Consider the following nuclear fusion reaction

$${}_1^2H + {}_1^2H \rightarrow {}_1^3H + {}_1^1P$$

Assume binding energies per nucleon of deuterium and tritium are 1 MeV and 2.80 MeV respectively and neglect the kinetic energy of the nuclei before the fusion. Find the kinetic energy (in MeV) of the proton produced in the above nuclear reaction.

18. The pitch of a screw gauge is 1 mm and its cap is divided into 100 divisions. When nothing is placed between its studs, the zero of the circular scale lies 6 divisions below the reference line. When a wire is placed between its studs, the main scale reading is 4 mm and 56^{th} division of circular scale coincides with the reference line. The length of the wire is 4.20 cm. Find the curved surface area (in cm^2) of the wire in true significant figures.

Chemistry

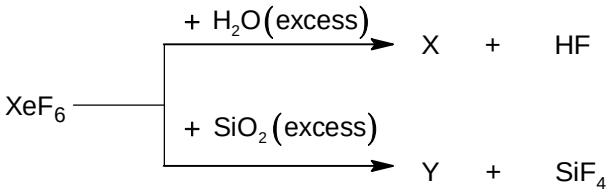
PART – II

SECTION – A
(One Options Correct Type)

This section contains **06 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

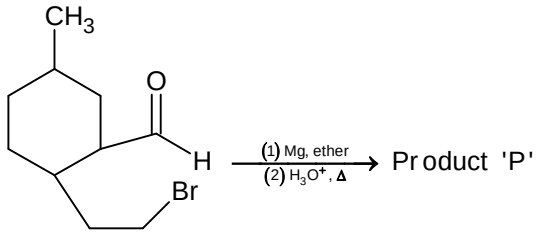
19. In a hydrogen like atom (atomic no – z), an electron transition from 2nd exited state to 1st excited state, results in the emission of a photon of 7.56 eV, How much energy will be emitted when an electron makes transition from 2nd excited state to the ground state?
(A) 7.56 eV
(B) 17.00 eV
(C) 40.80 eV
(D) 48.36 eV

20. Incorrect statement regarding the following reactions is

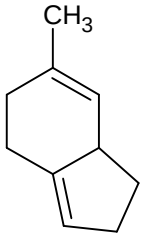


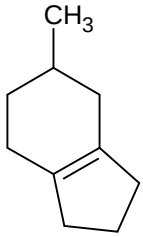
(A) 'X' is an explosive
(B) 'Y' is an explosive
(C) 'X' and 'Y' both are different
(D) 'X' and 'Y' both being same, react with aqueous alkali to form hydrogen xenate ion which slowly disproportionates to give Xe and perxenate ion.

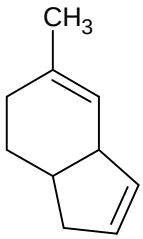
21. A mixture of 0.1 mole of ferrous oxalate and 29.2 g of calcium oxalate monohydrate (molecular mass = 146 g) requires 'x' litre of 0.035 M $KMnO_4$ for oxidation in acidic medium. What is the value of 'x'?
(A) 4
(B) 6
(C) 5
(D) 5.5

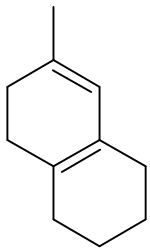
22. 

'P' in the above reaction is

(A) 

(B) 

(C) 

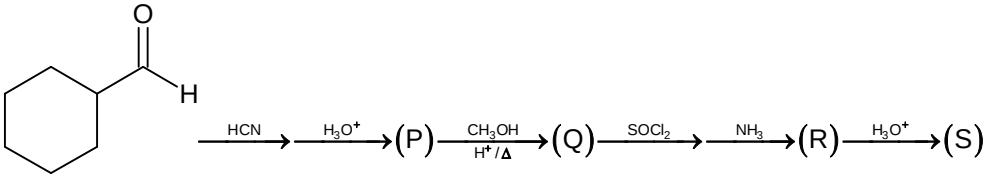
(D) 

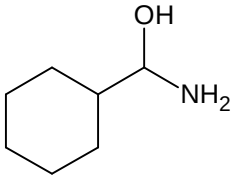
23. Water Soluble Salt $\xrightarrow{\Delta}$ $\underset{\text{(yellow in hot condition)}}{P}$ + O↑ + R↑
(Y) (gases)

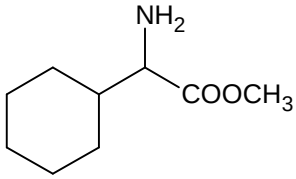
Which of the following salt(s) is/are 'Y'?

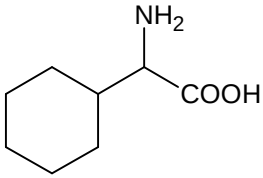
(A) $AgNO_3$
(B) FeC_2O_4
(C) $Pb(NO_3)_2$
(D) $ZnSO_4$

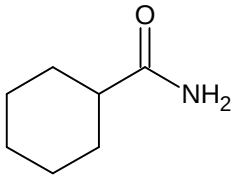
24. Consider the above sequence of reaction, which of the following is product 'S'?



(A) 

(B) 

(C) 

(D) 

(One or More than one correct type)

This section contains **06** multiple choice questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.

25. Which of the statement(s) is/are incorrect about chemisorption of a gas on solid adsorbent?
(A) The process is endothermic and hence is favoured by elevated temperature
(B) At low temperature the free energy change is positive and becomes negative only at high temperature
(C) At very low pressures amount of adsorption per gram of adsorbent increases linearly with pressure value but becomes almost independent of it at high pressure value
(D) Entropy factor ($T\Delta S$) does favour the process

26. Which of the following statement(s) is / are incorrect?
(A) Entropy of a system is a measure of available energy to do the useful work.
(B) In an irreversible process the entropy change between the two states is path dependent.
(C) Complete conversion of heat into work is possible in a reversible isothermal expansion of ideal gas.
(D) Decrease in free energy of a system represents the unavailable energy for doing useful work.

27. Which of the following alloys contain Aluminium?
(A) Duralumin
(B) Alnico
(C) Nickeloy
(D) Aluminium bronze

28. Which of the following statement(s) is/are correct?
(A) Glass is described as super cooled liquid
(B) Ordinary glass is mixture of sodium and calcium silicates
(C) XeF_6 cannot be stored in glass bottles
(D) Etching of glass is done by hydrofluoric acid

29. Which of the following sugar(s) is/are non-reducing sugars?
(A) Sucrose
(B) Glycogen
(C) Maltose
(D) Starch

30. Which of the following are not matched correctly?
(A) O-acetyl salicyclic acid : Anti-allergic
(B) $NaHCO_3$ and $Mg(OH)_2$: Anta-acid medicine
(C) Diethyl ether : Anaesthetic
(D) Iodoform : Anti biotic

SECTION – C
(Numerical Answer Type)

This section contains **06** questions. 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. XXXXX.XX).

31. A non-volatile solute 'X' (molar mass – 75.0 g) undergoes association in benzene to form $(X)_4$. If 5% (w/w) solution of 'X' in benzene produces depression of freezing point of benzene by 1.50°C (k_f for benzene = 5.7 K kg mol^{-1}). What percent of the solute undergoes association?

32. When an aqueous solution (having the empirical formula, $CoCl_3.5NH_3$) is mixed with excess of silver nitrate, 2 moles of AgCl precipitate per mol of compound is obtained. On reaction with excess of HCl no, NH_4^+ is detected. Considering 100% ionization of this complex, what will be the osmotic pressure (in atm) of its 1 M solution at 300 K? [Given: S = 0.0821 atm L K^{-1}]

33. 2.7 g of Aluminium is placed in a closed vessel of flexible volume along with dry chlorine just sufficient to react. What would be the volume (litres) of the system at a temperature of 227°C and pressure of 1 atm. (R = 0.082 atm $LK^{-1}mol^{-1}$)

34. 0.35 L of 0.1 M NH_3 and 0.15 L of 0.1 M $MgCl_2$ are mixed. What mass of $(NH_4)_2SO_4$ should be added to the resulting solution (above mixture) to just prevent the precipitation of $Mg(OH)_2$.
Given: K_{sp} for $Mg(OH)_2 = 1.2 \times 10^{-11}$ and K_b for $NH_3 = 2.0 \times 10^{-5}$, Molecular mass of $(NH_4)_2SO_4$ = 132.0

35. If 'X' is the total number of possible products (including stereoisomers) when ethanal and phenyl ethanal mixture is treated with dil. NaOH (at 5 – 10°C), then the value of $\frac{X}{5}$ is

36. An organic compound was analysed by Duma's method. 0.45 g of the compound on combustion gave 48.6 ml nitrogen at 27°C and 756 mm pressure. Calculate the percentage of nitrogen.

Mathematics

PART – III

SECTION – A
(One Options Correct Type)

This section contains **06 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

37. Evaluate the limit $\lim\limits_{x\to 0}\int\limits_{0}^{x}\frac{\sin\left(xt^5\right)}{x^7}dt$

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

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

(C) $\frac{1}{5}$

(D) $\frac{1}{6}$

38. The number of integer solution of inequality $221 < x_1 + x_2 + x_3 + x_4 < 2021$ where $x_1, x_2, x_3, x_4 \geq 0$ is equal to

(A) ${}^{2024}C_4 - {}^{224}C_4$

(B) ${}^{224}C_4$

(C) ${}^{2024}C_4 + {}^{224}C_4$

(D) ${}^{2024}C_4 - {}^{225}C_4$

39. If there are only two points on the hyperbola $2x^2 - 2y^2 - 4x + 41 = 0$, such that tangents drawn to ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ ($a, b \in N$) are perpendicular, then $|a - b|$ is equal to

(A) 2
(B) 4
(C) 6
(D) none of these

40. Let z_1, z_2, z_3 be three complex number i.e. $|z_1 - 3| = |z_2 - 3| = |z_3 - 3|$ and $\arg\left(\frac{z_3 - z_1}{z_2 - z_1}\right)=\frac{\pi}{6}$. Then $z_2^2 + z_3^2 - 3z_2 - 3z_3 - z_2z_3 + 10$ is equal to

(A) 1
(B) 2
(C) 9
(D) 10

41. If in a ΔABC, $\frac{1}{1+\sin\frac{A}{2}}+\frac{1}{1+\sin\frac{B}{2}}+\frac{1}{1+\sin\frac{C}{2}}=2$ and b = 3. Then circumradius of the triangle lies in the interval

(A) $\left(0,\frac{1}{2}\right)$

(B) $\left(\frac{1}{2},1\right)$

(C) $\left(1,\frac{3}{2}\right)$

(D) $\left(\frac{3}{2},2\right)$

42. Number of different terms in the expression $(1+x)^{300}+(1+x^2)^{200}+(1+x^3)^{150}$ are

(A) 385
(B) 386
(C) 384
(D) 387

(One or More than one correct type)

This section contains **06** multiple choice questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.

43. Suppose f is twice differentiable function satisfying f(0) = –2, f′(0) = 11; f″(0) = –8, f(2) = 5; f′(2) = –3; f″(2) = 7 and also suppose that the function $g(x)=\frac{1}{x}\int_0^x f(t)dt$ has a critical point at x = 2. Then

(A) critical point of g(x) at x = 2 is local minima
(B) critical point of g(x) at x = 2 is local maxima
(C) $\int_0^2 f(t)dt=10$
(D) $\int_0^2 f(t)dt=20$

44. m_1, m_2, m_3 are slope of normal's ($m_1 < m_2 < m_3$) drawn through the point (9, –6) to the parabola $y^2 = 4x$ and A = (a_{ij}) is square matrix of order 3 such that $a_{ij}=\begin{cases}1 & \text{if } i\neq j\\ m_i & \text{if } i=j\end{cases}$, then the correct statements are

(A) $\det\text{adj}(\text{adj } A)=2^{12}$
(B) $\det(\text{adj } A)=2^6$
(C) $\det|A^{-1}|=\frac{1}{8}$
(D) $\det(\text{adj } A^{-1})^{-1}=2^6$

45. If three planes $P_1 = 2x + y + z - 1 = 0$, $P_2 = x - y + z - 2 = 0$, $P_3 = 4x - y + \alpha z - 5 = 0$. Intersect each other at point P on OXY plane at point Q on YOZ plane, where O is origin. Then identity the correct statements

(A) the straight line perpendicular to plane P_3 and passing through P is $\frac{x-1}{4} = \frac{y+1}{-1} = \frac{z}{3}$

(B) length of projection of $\overline{PQ}$ on x-axis is 1

(C) centroid of ΔOPQ is $\left(\frac{1}{3}, -\frac{1}{2}, \frac{1}{2}\right)$

(D) the distance of the point Q from the line $\frac{x-\frac{47}{6}}{6} = \frac{y-\frac{3}{2}}{2} = \frac{z+\frac{1}{2}}{-4}$ is equal to $\frac{\sqrt{301}}{8}$

46. Let $f(m) = \sum_{r=1}^{m} \frac{1}{\sqrt{r}}$, then (where [.] denotes the greatest integer function)

(A) $\left[f(1006)^2\right] = 2010$

(B) total number of integer between $[f(10^4)]$ and $[f(10^6)]$ is 1799

(C) total number of integer between [f(100)] and [f(400)] is 21

(D) $[f(1006)^2] = 2009$

47. Let $\alpha_1, \alpha_2, \ldots \alpha_{20}$ are roots of equation $1 + 2x + 3x^2 + \ldots + 11x^{10} + 10x^{11} + \ldots x^{20} = 0$, then

(A) equation has 10 repeated roots

(B) all roots are complex

(C) $|\alpha_1| + |\alpha_2| + \ldots + |\alpha_{20}| = 20$

(D) equation has 10 real roots

48. Let $C_1 \equiv x^2 + y^2 = 64$ and $C_2 \equiv x^2 + y^2 - 24x + 108 = 0$ intersect at point P and Q. A line through P meets the circle C_1 and C_2 at R and S respectively. If PS = PR, then

(A) length of $PR = \sqrt{130}$

(B) length of perpendicular from centre of C_1 to PR is $\sqrt{\frac{63}{2}}$

(C) length of perpendicular from centre of C_2 to PR is $\sqrt{\frac{7}{2}}$

(D) slope of PR = $\frac{1}{\sqrt{3}}$

SECTION – C
(Numerical Answer Type)

This section contains **06** questions. 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. XXXXX.XX).

49. Let a, b, c > 0 and $\frac{1}{1+a^4} + \frac{1}{1+b^4} + \frac{1}{1+c^4} = 1$, then the minimum value of $a^2 b^2 c^2$
(Consider $\sqrt{2} = 1.41$ and $\sqrt{3} = 1.73$)

50. The probability that a screw manufactured by a company is defective is 0.1. The company sells screws in pocket containing 10 screws and gives a guarantee of replacement if three or more screws in pocket are found to be defective. The probability that a pocket would have to be replaced is $1 - \frac{(\lambda)9^8}{10^{10}}$. Then find λ

51. Let f(x) be a polynomial of degree 5 with integral coefficient that has atleast one integral root. If f(2) = 13 and f(10) = 5, then value of α such that f(α) = 0 (where $\alpha \in$ I)

52. Let $f(x) = x^4 - 4a^3x - 4a^3 + 3a + 5$ and min(f(x)) = 1 for $x \in [-1, 1]$. If n is number of possible values of a and s be the sum of all the possible values of a, then [n + s] is equal to
(where [.] denotes greatest integer function)

53. Let f(x) and g(x) are differentiable function such that
$g(x)\, f'(x) - (1 + f(x))\, g'(x) + g'(x)\, g(x)\, (1 + f(x))^2 = 0$, and g(1) = –1, g(2) = 2. If f(1) = 0, then f(2) is equal to

54. If $|\vec{a}| = 1$, $|\vec{b}| = 3$ and $|\vec{c}| = 4$, then maximum value of $|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2$ is $12k + \lambda$, where k is prime, then number of values of λ is (Given $\lambda > 0$)