

FIITJEE

ALL INDIA TEST SERIES

FULL TEST – V

JEE (Advanced)-2019

PAPER – 1

TEST DATE: 27-01-2019

Time Allotted: 3 Hours

Maximum Marks: 180

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-D**.
1. **Section-A (01– 06, 19 – 24, 37 - 42)** contains 18 multiple choice questions which have **one or more than one correct** answer. Each question carries **+4 marks** for all correct answer.
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, both of which are correct options.
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-A (07 – 10, 25 – 28, 43 - 46)** contains 12 questions. Based on this section contains **TWO (02)** paragraphs. Based on each paragraph, there are **TWO (02)** questions. Each question has **only one correct** answer and carries **+3 marks** for correct answer and **-1 mark** for wrong answer.
2. **Section-D (11 – 18, 29 – 36, 47 – 54)** contains 24 Numerical answer type questions with answer XXXXX.XX and each question carries **+3 marks** for correct answer. There is no negative marking.

Physics

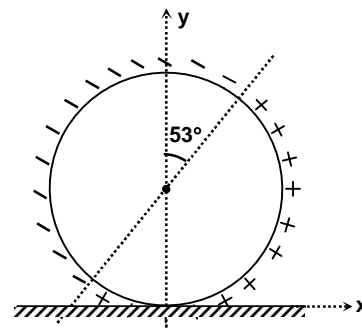
PART – I

SECTION – A

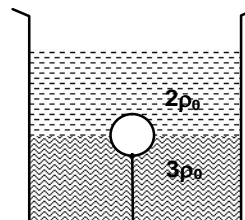
(One or More than one correct type)

This section contains 6 questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.

1. A non conducting uniform thin shell of mass m and radius R is having uniform charge density $+\sigma$ on one half and $-\sigma$ on another half as shown in figure. It is placed on a rough non conducting horizontal plane. At $t = 0$ a uniform electric field $\vec{E} = -E_0 \hat{j}$ N/C is switched on and the solid sphere starts rolling without slipping. Then which of the following is/are correct.

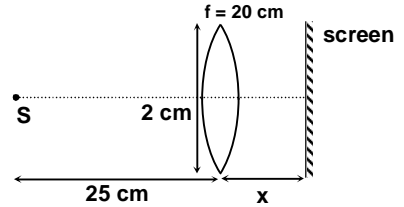


- (A) The acceleration of the topmost point of the hollow sphere at $t = 0$, is $\frac{36 \pi \sigma E_0 R^2}{25 m}$.
- (B) The magnitude of frictional force at $t = 0$ is $\frac{18}{25} \pi \sigma E_0 R^2$.
- (C) The acceleration of centre of mass of the hollow sphere at $t = 0$, is $\frac{12 \pi \sigma E_0 R^2}{25 m}$.
- (D) The magnitude of frictional force at $t = 0$ is $\frac{9}{25} \pi \sigma E_0 R^2$.
2. A large cubical vessel contains two immiscible liquid of density $2\rho_0$ and $3\rho_0$. A solid sphere of volume V_0 , radius $H/10$ and density ρ_0 is tied to one end of a string of length $\left(\frac{9H}{10}\right)$ and other end tied to the bottom of the vessel at centre of the base of the container as shown in the figure. The sphere is immersed with half of its volume in the liquid of higher density and remaining in the liquid of lower density. The entire system starts accelerating toward right side with an acceleration $\frac{4}{3}g$. Then which of the following is/are correct.
- (A) The angle made by the string with the horizontal is 37° .
- (B) The solid sphere moves towards right with respect to the vessel.
- (C) The tension in the string in the equilibrium is $\frac{5}{2} V_0 \rho_0 g$
- (D) The tension in the string in the equilibrium is $\frac{5}{3} V_0 \rho_0 g$
3. One mole of an ideal gas undergoes through the process $T = T_0 + V^3$ where T_0 is a positive constant and V is molar volume. Then which of the following is/are correct.
- (A) The volume for which pressure will be minimum is $(T_0/2)^{1/3}$.
- (B) The volume for which pressure will be minimum is $(T_0/2)^{2/3}$.
- (C) The minimum pressure attainable is $\frac{3}{2} 2^{1/3} RT_0^{2/3}$.



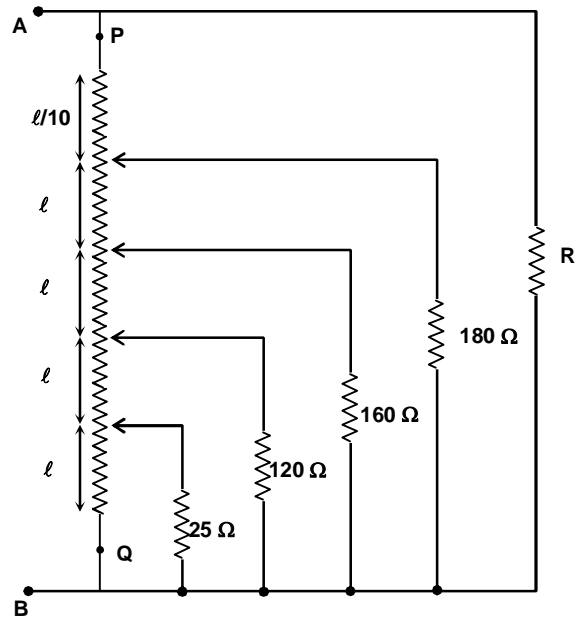
(D) The minimum pressure attainable is $\frac{3}{2^{2/3}} RT_0^{2/3}$.

4. A point source of light S is placed on the axis of the lens of focal length 20 cm as shown in the figure. A screen is placed normal to the axis of the lens at a distance x from it. Treat all rays as paraxial. Then which of the following is/are correct regarding the intensity of the image produced on the screen of the point source.



- (A) As x is increased from zero, intensity continuously decreases.
 (B) As x is increased from zero, intensity first increases then decreases.
 (C) Intensity at centre of screen for x = 90 cm and x = 110 cm is same.
 (D) Radius of bright circle obtained on screen is equal to 2 cm for x = 300 cm.
5. In a photoelectric effect experiment. If f is the frequency of radiations incident on the metal surface and I is the intensity of incident radiations, then which of the following is/are correct.
- (A) If 'f' is increased keeping 'I' and work function constant, stopping potential and maximum kinetic energy of photoelectron increases.
 (B) If distance between cathode and anode is increased, stopping potential remains same.
 (C) If 'I' is increased keeping 'f' and work function constant, saturation current increases and stopping potential remains same.
 (D) If the work function is decreased keeping 'f' and 'I' constant then stopping potential will increase and maximum kinetic energy of photoelectrons also increases.

6. The resistance of wire PQ is 410Ω , which is tapped with the external wire as shown in the figure. The value of R is not known. If the potential difference between AB is 400 volts and the net current through the source battery is 6 ampere, then which of the following is/are correct.



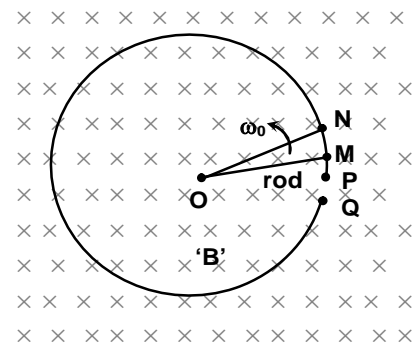
- (A) The resistance of unknown resistor R is 200Ω .
 (B) the equivalent resistance across AB is $\frac{200}{3} \Omega$
 (C) The current in 25Ω resistor is $\frac{2}{5}$ ampere.
 (D) The potential drop across 120Ω resistor is 60 volts.

(Paragraph Type)

This section contains **TWO** paragraphs. Based on each paragraph, there are **TWO** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.

Paragraph for Question Nos. 7 and 8

Two conducting rod OM and ON each of mass m and length ℓ can rotate about centre of the ring O, with its other end sliding smoothly on a circular conducting ring, as shown in the figure. A constant and uniform magnetic field 'B' acts into the plane of the ring. At $t = 0$ rod ON is given an angular velocity ω_0 as shown in figure. Assume that the space is gravity free and that there is electrical contact between the ring and the rod. The resistance of the ring is negligible and each rod is having resistance R . There is a small gap in the ring between P and Q, so that the current flows along a unique path (assume that time to rotate one complete revolution is infinite). Then,



7. Find the angular velocity of rod OM as a function of time 't'

(A) $\frac{\omega_0}{2} \left(1 - e^{-\frac{3B^2 \ell^2}{4mR} t} \right)$

(B) $\omega_0 \left(1 - e^{-\frac{3B^2 \ell^2}{4mR} t} \right)$

(C) $\frac{\omega_0}{2} \left(1 + e^{-\frac{3B^2 \ell^2}{4mR} t} \right)$

(D) $\frac{\omega_0}{4} \left(1 - e^{-\frac{3B^2 \ell^2}{4mR} t} \right)$

8. The total heat produced in the system is

(A) $\frac{1}{6} m \ell^2 \omega_0^2$

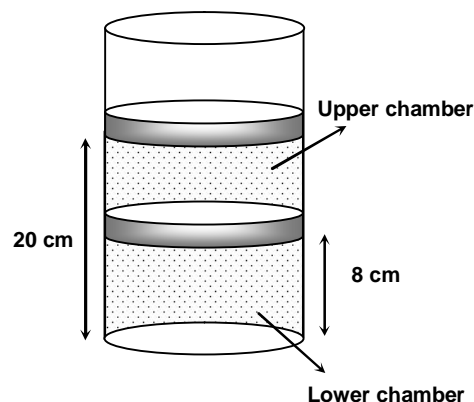
(B) $\frac{1}{12} m \ell^2 \omega_0^2$

(C) $\frac{1}{24} m \ell^2 \omega_0^2$

(D) $\frac{1}{48} m \ell^2 \omega_0^2$

Paragraph for Question Nos. 9 and 10

In a cylindrical container of sufficiently large height, two movable piston enclose certain amount of same ideal gas in two chambers as shown in the figure. The upper piston is at a height 20 cm from bottom and lower piston is at a height 8 cm from the bottom. The mass of each piston is m kg and cross-sectional area of each piston is A m², where $\frac{mg}{A} = P_0$ and P_0 is the atmospheric pressure = 1×10^5 N/m². The cylindrical container and piston are made of conducting material. Initially the temperature of gas is 27°C and whole system is in equilibrium. Now if the upper piston is slowly lifted by 16 cm and held in that position with the help of some external force. Then

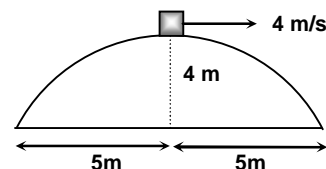


9. The lower piston will rise by
 (A) 2 cm
 (B) 4 cm
 (C) 8 cm
 (D) 6 cm
10. The ratio of volume of gas in upper chamber to that of in lower chamber in final state.
 (A) 2 : 1
 (B) 1 : 2
 (C) 4 : 2
 (D) 1 : 4

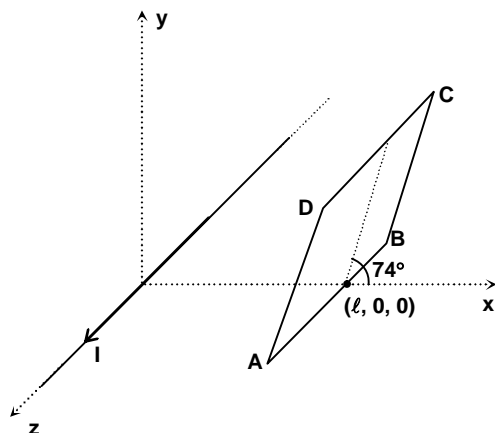
SECTION – D
(Numerical Answer Type)

This section contains **EIGHT** 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).

11. There is a parabolic shaped bridge across the river of width 10 meter. The highest point of the bridge is 4 meter above the level of bank. A car of mass 952 kg is crossing the bridge at a constant speed of 4 m/s. Find the force (in Newton) exerted on the bridge by car when it is at the highest point 'P' of the bridge. (take $g = 10$ m/s²)

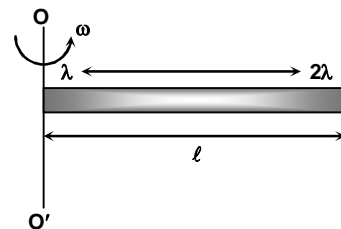


12. A wire of infinite length carrying current ' I ' lies along the z -axis. A square loop of side ' ℓ ' is placed such that the plane of the loop makes an angle 74° with the positive x -axis at $(\ell, 0, 0)$ and side AB touches the x -axis and parallel to z -axis as shown in the figure. The magnetic flux passing through the loop is $\frac{k\mu_0 \ell}{\pi}$. Find the value of k . [take $I = 10$ amp, $\ln(1.6) = 0.47$ and $\tan 37^\circ = 3/4$]

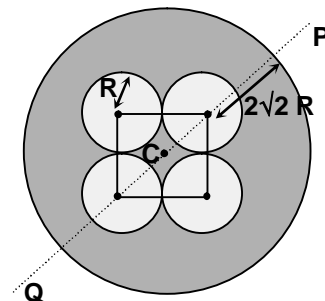


13. When an inductor coil is connected to an ideal battery of emf 15 volts, a constant current 2.5 amp flows if it is left connected for a long time. When the same inductor coil is connected to an AC source of 20 volts and 25 Hz then the current is 2 ampere. The inductance of the inductor is $\frac{k}{\pi}$ Henry. Find the value of k.
14. The excitation energy of a hydrogen like ion to its first excited state is 43.8 eV. Find the magnitude of energy (in electron volts) needed to remove the electron from the ion in the ground state.
15. One end of copper rod of uniform cross section and length 13.5 m is kept in contact with ice and other end with water at 100°C. At what distance 'x' (in meter) from 100°C water along its length should a temperature of 400°C be maintained so that in steady state, the mass of ice melting be equal to that of the steam produced in same time interval of time? Assume that whole system is insulated from surrounding. Latent heat of fusion of ice and vaporization of water are 80 cal/gm and 540 cal/gm, respectively.

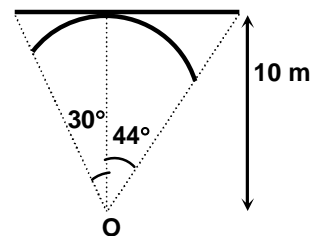
16. A rod of length ' ℓ ' can rotate freely in a horizontal plane about vertical axis OO' passing through one of its ends with angular velocity ω . The mass per unit length linearly increases from λ to 2λ from the axis of rotation to other end as shown in the figure. Find the tension (in Newton) in the rod at the middle point. (take $\omega = 2$ rad/sec, $\lambda = 4$ kg/m, $\ell = 3.6$ meter and neglect the gravity)



17. The moment of inertia of a circular disc of radius R about its diameter is $2 \times 10^{-2} \text{ kg-m}^2$. Then find the moment of inertia (in kg-m^2) of given lamina made up from same material and same thickness as that of above mentioned disc about line PQ which passes through C and parallel to plane of lamina as shown in figure.



18. A uniform thin rod and circular arc of radius 10 meter are situated as shown in the figure. The mass of the circular arc is 37π kg and mass per unit length of the rod and the circular arc is same. The net gravitational intensity at the centre O is KG newton/kilogram where G is gravitational constant. Find the magnitude of K. (take $\tan 37^\circ = 3/4$)



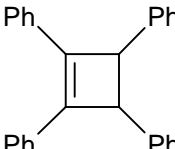
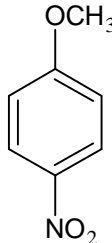
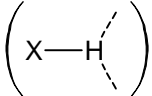
Chemistry

PART – II

SECTION – A

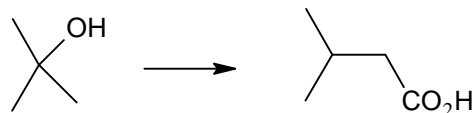
(One or More than one correct type)

This section contains 6 questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.

19. When CO_2 is passed into aqueous
- Na_2CrO_4 solution, its yellow colour changes to green
 - K_2MnO_4 solution, it disproportionates to KMnO_4 and MnO_2
 - $\text{Na}_2\text{Cr}_2\text{O}_7$ solution, its orange colour changes to green
 - KMnO_4 solution, its pink colour changes to colourless solution
20. Which of the following compound(s) is/are capable of producing H_2 on addition of active metal like (Na/K)?
- $\text{HC}\equiv\text{CH}$
 - 
 - 
 - $\text{CH}_3\text{CH}_2\text{SH}$
21. Which of the following statements is/are correct provided solutes are not to suffer dissociation or association?
- The magnitude of osmotic pressure is not dependent on the nature of the membrane provided it is perfectly semipermeable.
 - Equimolecular quantities of different solutes dissolved in the same volume of a solvent exert equal osmotic pressure at the same temperature.
 - Equal volumes of different solutions which are at the same temperature and exert same osmotic pressure contain an equal number of solute molecules.
 - The osmotic pressure of a substance in a dilute solution is the same as it would exert if it exists as a gas in the same volume as that occupied by the solution at the same temperature.
22. Which of the following is/are correct related to hydrogen bonding?
- The H-bond in the $\text{X}-\text{H}\cdots\text{Y}$ may be linear or bent.
 - Bifurcated  hydrogen bonds are not possible.
 - Symmetrical hydrogen bonding is present in HF_2^- . i.e. the H-atom is midway.

- (D) Hydrogen bond is an extreme of dipole – dipole attraction and therefore the force is inversely related to the cube of distance between the dipoles.

23.



Correct set of reagents required for above conversion is/are

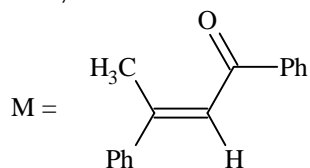
- (A) Conc. HI; KCN; H_3O^+
 (B) Conc. H_3PO_4 ; HBr in presence of peroxide, Mg-dryether; CO_2 , H_3O^+ .
 (C) Anhydrous ZnCl_2/HCl , Mg. dry ether, CO_2 , H_3O^+ .
 (D) Conc. H_2SO_4 , HCl in presence of peroxide, KCN, H_3O^+ .
24. Consider the reaction
 $2\text{CO}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{CO}_2(\text{g}) + \text{heat}$
 Under what conditions shift is undeterminable or no change
- (A) Addition of O_2 and decrease in volume
 (B) Addition of Ar at constant pressure
 (C) Addition of CO and increase in temperature at constant volume
 (D) Increase in temperature and decrease in volume

(Paragraph Type)

This section contains **TWO** paragraphs. Based on each paragraph, there are **TWO** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.

Paragraph for Question Nos. 25 and 26

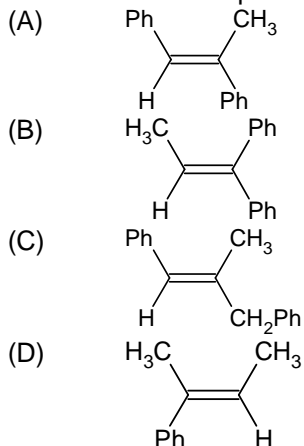
A tertiary alcohol H upon acid catalyzed dehydration gives a product I. Ozonolysis of I leads to compounds J and K. Compound J upon reaction with KOH gives benzyl alcohol and a salt of carboxylic acid, L. Whereas K on reaction with KOH gives only M.



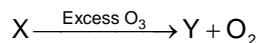
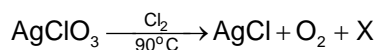
25. Compound H is formed by the reaction of

- (A) + PhMgBr
 (B) + PhCH₂MgBr
 (C) + PhCH₂MgBr
 (D) +

26. The structure of compound I is:



Paragraph for Question Nos. 27 and 28



27. Y on dissolving NaOH produces

- (A) Chlorite and chlorate salts
 (B) Chlorate and perchlorate salts
 (C) Only perchlorate salts
 (D) Hypochlorite and perchlorite salts

28. Which is **wrong** statement related to X and Y?

- (A) Both X and Y are mixed anhydride i.e. on treatment with water producing two acids
 (B) Y is a dark red liquid at room temperature
 (C) X is a paramagnetic
 (D) Y can be obtained by dehydrating perchloric acid with P_4O_{10}

SECTION – D

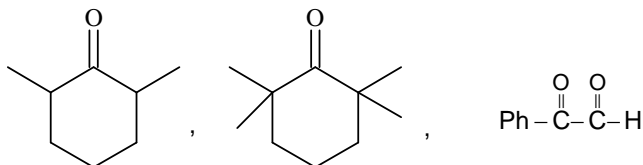
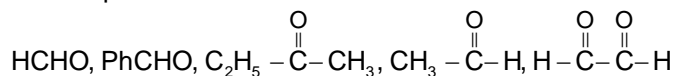
(Numerical Answer Type)

This section contains **EIGHT** 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).

29. The pH of a solution formed by mixing 10 ml 0.1 M NaH_2PO_4 and 20 ml 0.1 M Na_2HPO_4 would be (Given $\text{p}K_1 = 2.2$, $\text{p}K_2 = 7.2$, $\log 2 = 0.3$)

30. Among the following compounds

- (i) the compounds that will not form enamine with R_2NH is 'a'.
 (ii) the compounds which can involve in Cannizzaro reaction (including intramolecular) is 'b'.



Then what would be the value of a + b?

31. $X = C_4H_{10}O$
 (A) Isomers of compound X give positive iodoform test (excluding stereoisomer) = a
 (B) Isomers of compound X do not give H_2 on treatment with Na metal (excluding stereoisomers) = b
 (C) Isomers of compound X give red colour in Victor Mayer test = c
 Then $\frac{a+b+c}{2}$ would be?
32. If time required when a current of 9.65 amp is passed through 80 ml of 0.1 M NaCl solution in order to make its pH = 12 is x sec. and time required when a current of 965 amp is passed through an aqueous solution of $CuSO_4$ to produce 0.28 litres of oxygen gas at STP is y sec. then the value of $\frac{x}{y}$ would be
33. 6 mol of a mixture containing same number of moles of $NaNO_3$, NH_4NO_3 , $LiNO_3$, $Ca(NO_3)_2$, $Pb(NO_3)_2$ and $AgNO_3$, was heated strongly. Total number of moles of $O_2(g)$ evolved is:
34. Among the following acids, if number of acids stronger than H_3PO_4 is x and number of monobasic acids is y. then x/y would be?
 H_2CO_3 , H_3PO_3 , CH_3CO_2H , H_2SO_4 , H_3PO_2 , $H_4P_2O_7$, $HClO_4$, H_3BO_3 , HNO_3 .
35. The overall formation constant of $[Co(NH_3)_6]^{2+}$ in aqueous solution is 10^5 and the standard potential for reduction of $Co^{3+}(aq)$ and $[Co(NH_3)_6]^{3+}(aq)$ are as follows
 $Co^{3+}(aq) + e \rightleftharpoons Co^{2+}(aq) \quad E^\circ = 1.90$
 $[Co(NH_3)_6]^{3+}(aq) + e \rightleftharpoons [Co(NH_3)_6]^{2+}(aq) \quad E^\circ = +0.1 V$
 If the nearest overall formation constant of the $[Co(NH_3)_6]^{3+}$ ion is 10^x . Then the value of x would be (Given : $E_{cell} = E_{cell}^\circ - 0.06 \log Q$)
36. The activation energy for a reaction is $30.8 \times 298 \times 4.606$ cal/mol. If the increase in the rate constant when its temperature is increased from 298 K to 308 K is x % then 'x' would be

Mathematics**PART – III****SECTION – A****(One or More than one correct type)**

This section contains 6 questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.

37. The number of codes of 20 digits which can be formed using digits 0, 1, 2, 3, 4 such that difference of consecutive digit is one is N, then
 (A) total number of positive integers which divides N is 40
 (B) N is divisible by 3^8
 (C) N is divisible by 7
 (D) the number of ordered pair (a, b) such that $a \times b = N$ and $a, b \in \mathbb{I}^+$ and $\gcd(a, b) = 1$ is 4
38. Person A randomly selects 4 distinct numbers from the set {1, 2, 3, 4, 5, 6, 7, 8, 9} and arrange them in descending order to form a 4 digit number and person B randomly selects 4 distinct numbers from set {1, 2, 3, 4, 5, 6, 7, 8} and also arranges them in descending order to form a 4 digit number. Then which of the following is/are correct?
 (A) probability that person A's 4 digit number is greater than person B's number is $\frac{{}^8C_3}{9C_4} + \frac{1}{2} \left(1 - \frac{1}{9C_4} \right)$
 (B) probability that person A and B have same 4 digit number is $\frac{1}{9C_4}$
 (C) probability that person A's 4 digit number is greater than person B's number is $\frac{2 \cdot {}^8C_3 + {}^8C_4 - 1}{2 \cdot 9C_4}$
 (D) probability that person A and B have same 4 digit number is $\frac{{}^8C_4}{9C_4}$
39. A rabbit begins at the origin and runs up the positive y-axis with speed 5 m/s. At the same time, a dog runs at speed 10 m/s from the point (20, 0) in pursuit of rabbit. Which of the following is/are correct?
 (A) the dog meet rabbit at the point $\left(0, \frac{40}{3} \right)$
 (B) the dog meet rabbit at the point (0, 10)
 (C) the equation of the path followed by dog $2y(x) = \frac{2}{3\sqrt{20}} \cdot x^{\frac{3}{2}} - 2\sqrt{20} \cdot \sqrt{x} + \frac{80}{3}$
 (D) the dog will pass the point $\left(4, \sqrt{20} \right)$ during his run
40. Let $f : \mathbb{R} \rightarrow (0, 1)$ be a continuous function, then which of the following function has/have the value zero at some point in the internal (0, 1)?
 (A) $f(x) + \int_0^{\pi/2} f(t) \tan t dt$
 (B) $x^{11} - f(x)$
 (C) $e^x - \int_0^x f^2(t) dt$
 (D) $e^x + \int_0^x f(t) dt$

41. The normal at a variable point P on ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, ($a > b$) meets axes of the ellipse in Q and R. Then which of the following is/are correct statement(s)
- (A) the locus of mid-point of QR is ellipse
 (B) the locus of mid-point of QR is conic whose eccentricity is same as of given ellipse
 (C) The locus of mid-point of QR is hyperbola
 (D) The locus of mid-point of QR is conic with its eccentricity half of the eccentricity of given ellipse
42. Two fixed points P and Q are 4 units apart and are on same side of a variable line L. Let PM and QN are perpendicular distance of P and Q from line L satisfy equation $PM + 3QN = 4$, then line L always touches a circle C
- (A) the centre of circle C lies on line PQ
 (B) the radius of circle is 1
 (C) the radius of circle is 2
 (D) the centre of the circle C lies on perpendicular bisector of PQ

(Paragraph Type)

This section contains **TWO** paragraphs. Based on each paragraph, there are **TWO** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.

Paragraph for Question Nos. 43 and 44

Let L be a straight line passing through (1, 1, 1) which is parallel to $x + y + z = 1$ and intersect the line $x + 2y + z = 1$, $x + y + 2z = 3$

43. The line L is parallel to the line
- (A) $\frac{x-1}{4} = \frac{y-1}{-3} = \frac{z-1}{1}$
 (B) $\frac{x}{4} = \frac{y}{-3} = \frac{z}{2}$
 (C) $\frac{x}{4} = \frac{y}{-7} = \frac{z}{2}$
 (D) $\frac{x}{4} = \frac{y}{-3} = \frac{z}{-1}$
44. The equation of line which intersect the line L and $\frac{x}{1} = \frac{y}{9} = \frac{z}{17}$ & parallel to $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ is
- (A) $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-2}{3}$
 (B) $\frac{x-1}{2} = \frac{y-2}{4} = \frac{z-2}{3}$
 (C) $\frac{x}{7} = \frac{y}{14} = \frac{z}{21}$
 (D) $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-1}{3}$

Paragraph for Question Nos. 45 and 46

$$\text{Let } f(x) = x + \frac{2}{1.3}x^3 + \frac{2.4}{1.3.5}x^5 + \frac{2.4.6}{1.3.5.7}x^7 + \dots \quad \forall x \in (0, 1)$$

45. The value of $f\left(\frac{1}{\sqrt{2}}\right)$ is

- (A) $\frac{\pi}{\sqrt{2}}$
 (B) $\frac{\pi}{3\sqrt{2}}$
 (C) $\frac{\pi}{2\sqrt{2}}$
 (D) $\frac{\pi}{4\sqrt{2}}$

46. Let $g(x) = \sqrt{1-x^2} f(x)$ for $\forall x \in (0, 1)$. The range of $g(x)$ is

- (A) $(0, 1)$
 (B) $\left(\frac{1}{2}, 1\right)$
 (C) $\left(0, \frac{1}{2}\right)$
 (D) $\left(0, \frac{\pi}{2}\right)$

SECTION – D

(Numerical Answer Type)

This section contains **EIGHT** 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).

47. If $\lim_{n \rightarrow \infty} \sum_{r=1}^n \frac{(\cos 2\theta)^{2r-1}}{2r-1}$ is ℓ for $\theta \in (\cot^{-1} 2, \cot^{-1} 1)$, then the value of $[\ell]$ is equal to _____ (where $[\cdot]$ denotes the greatest integer function)

48. If the value of $\frac{{}^nC_1(n-1)^3 + {}^nC_3(n-3)^3 + \dots}{n^2(n+3) \cdot 2^n}$, where $n = 10$, is ℓ , then 16ℓ is equal to _____

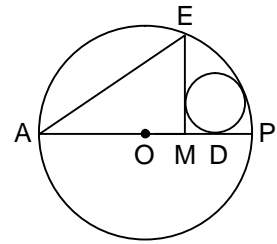
49. In ΔABC let the value of $a^3 \cos 3B + 3a^2b \cos(A-2B) + 3ab^2 \cos(2A-B) + b^3 \cos 3A$ is ℓ , then the value of $\frac{\ell}{c^3}$ is equal to _____

50. The value of $\frac{1}{\pi^2} \int_0^{\frac{\pi}{2}} \frac{(\ell \ln x)^2}{\sqrt{x}(1-x)^2} dx$ is equal to _____

51. Let $a_n = 8 + (n-1)d$, $n \in \mathbb{N}$. If $\lim_{n \rightarrow \infty} \prod_{r=1}^n \left(1 - \frac{d^2}{a_r^2}\right) = \frac{1}{4}$, then the value of d is equal to _____

52. Let $P(x)$ be a polynomial whose coefficient are integer satisfies $P(1) = 5$ and $P(2) = 7$. The smallest possible positive value of $P(10)$ is equal to _____

53. Let 'O' be centre of circle as shown in figure and AE be a chord from A the diameter AP is drawn and M is foot of perpendicular drawn from E on AP. A circle is drawn such that it touches EM, AP at D and circle whose diameter is AP, then the value of $\frac{AE}{AD}$ is _____



54. Let $f : A \rightarrow A$ where $A = \{1, 2, 3, 4, 5, 6, 7\}$, then number of functions f such that $f(f(f(x))) = x$, $\forall x \in A$ is _____