Major Test-3-(Phase-1+2(A)+2)-Tallent-Pro

CLASS-XI-(JEE ADVANCED)

CLASSROOM CONTACT PROGRAMME

NURTURE COURSE

Time : 3 Hours

Test Pattern : JEE (Advanced)

Maximum Marks : 189

CODE: 4602CJA105021240018

Instructions

A. General :

1. Blank papers, clipboards, log tables, slide rules, calculators, cameras, cellular phones, pagers, and electronic gadgets are NOT allowed inside the examination hall.
2. The OMR sheet, a machine-readable Optical Response Sheet **(ORS),** is provided separately.
3. DO NOT TAMPER WITH/MUTILATE THE ORS OR THE BOOKLET.

B. Filling the ORS :

4. A candidate has to write his / her answers in the ORS sheet by darkening the appropriate bubble with the help of **Black ball point pen** as the correct answer(s) of the question attempted.
5. Write your Name, Form No. and sign with pen in the boxes provied on part of the ORS. **Do not write any of this information anywhere else**.

C. Question Paper Format :

6. The question paper consists of **3 parts** (Physics, Chemistry and Mathematics). Each part consists of **Three Sections (SECTION-I(i)), (SECTION-I(ii)) & (SECTION-III).**
7. **SECTION–I(i) :** This section contains **SIX (06) MULTIPLE CHOICE QUESTIONS.** Each question has four options **(A), (B), (C)** and **(D)** out of which **ONE** is correct.
8. **SECTION-I(ii) :** This section contains **SIX (06) MULTIPLE CHOICE QUESTIONS.** Each question has four options **(A), (B), (C)** and **(D)** out of which **ONE** or **MORE than ONE** is/are correct.
9. **SECTION-III :** This section contains **FIVE (05) SINGLE DIGIT INTEGER (0-9) TYPE QUESTIONS.**
10. **BOTH SECTION-I(i) AND SECTION-I(ii) SHOULD BE FILLED UNDER SECTION-I IN OMR.**
11. **SECTION-III SHOULD BE FILLED UNDER SECTION-III IN OMR.** (Leave Section-II in OMR).

D. Marking scheme :

12. **SECTION-I(i) :** For each question you will be awarded **+4 marks** if you darken the bubble corresponding to the correct option **ONLY. 1 mark** will be deducted for incorrect answers in this section.
13. **SECTION-I(ii) :** For each question you will be awarded **+4 marks** if you darken the bubble(s) corresponding to all the correct option(s) is (are) darkened. Partial marking of **+1 marks** will be awarded for **each** individual correct options. A Negative marking of **–2 marks** will be awarded for any wrong option choosen. **No marks** will be awarded for the unattempted questions.
14. **SECTION-III :** For each question you will be awarded **+3 marks** if you darken the bubble corresponding to the correct answer **ONLY. 1 mark** will be deducted for incorrect answers in this section.

Name of the Candidate **: .....**

Form Number **: .....**

HAVE CONTROL ⟶ HAVE PATIENCE ⟶ HAVE CONFIDENCE ⇒ 100% SUCCESS

BEWARE OF NEGATIVE MARKING

PART-A-PHYSICS

SECTION-I(i) : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks	:	+4	If ONLY the correct option is chosen.
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered).
Negative Marks	:	–1	In all other cases.

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1. Two particles are performing SHM with same angular frequency and amplitudes A and $2A$ respectively along same straight line with same mean position. They cross each other at position $A/2$ distance from mean position in opposite direction. The phase between them is :

(A) $\frac{5\pi}{6} - \sin^{-1}\left(\frac{1}{4}\right)$ (B) $\frac{\pi}{6} - \sin^{-1}\left(\frac{1}{4}\right)$

(C) $\frac{5\pi}{6} - \cos^{-1}\left(\frac{1}{4}\right)$ (D) $\frac{\pi}{6} - \cos^{-1}\left(\frac{1}{4}\right)$

2. A planet is revolving around the Sun in an elliptical orbit. Its closest distance from the Sun is r_{min}. The farthest distance from the Sun is r_{max}. If the orbital angular velocity of the planet when it is nearest to the Sun is w, then the orbital angular velocity at the point when it is at the farthest distance from the Sun is :

(A) $\left(\sqrt{\frac{r_{min}}{r_{max}}}\right)\omega$ (B) $\left(\sqrt{\frac{r_{max}}{r_{min}}}\right)\omega$

(C) $\left(\frac{r_{max}}{r_{min}}\right)^2\omega$ (D) $\left(\frac{r_{min}}{r_{max}}\right)^2\omega$

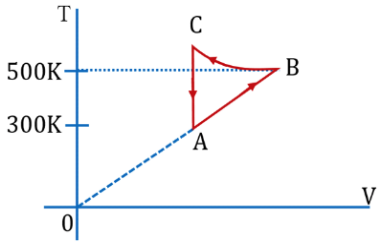
3. A solid cylinder of mass M and radius R rolls without slipping down an inclined plane of length L and height h. What is the linear speed of its centre of mass when the cylinder reaches its bottom?

(A) $\sqrt{\frac{3}{4}gh}$ (B) $\sqrt{\frac{4}{3}gh}$

(C) $\sqrt{4gh}$ (D) $2\sqrt{4gh}$

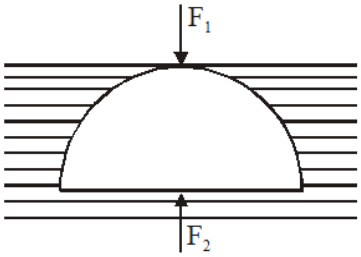
SPACE FOR ROUGH WORK

4. Consider the cyclic process *ABCA*, shown in figure, performed on a sample of 2.0 mole of an ideal gas. A total of 1200 *J* of heat is withdrawn from the sample in the process. Find the work done by the gas during the part *BC*.



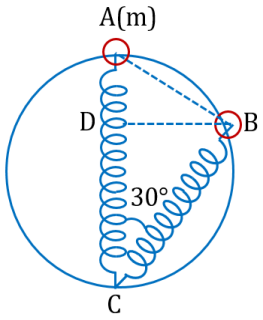
(A) $-4480\ J$ (B) $-4520\ J$ (C) $-4540\ J$ (D) $-4460\ J$

5. A solid hemisphere is just pressed below the liquid, the value of $\frac{F_1}{F_2}$ is (where F_1 and F_2 are the hydrostatic forces acting on the curved and flat surfaces of the hemisphere) (Neglect atmospheric pressure).



(A) $\frac{1}{2}$ (B) $\frac{2}{3}$ (C) $\frac{1}{3}$ (D) none of these

6. A ring '*A*' of mass '*m*' is attached to a stretched spring of force constant *K*, which is fixed at *C* on a smooth vertical circular track of radius *R*. Points *A* and *C* are diametrically opposite. When the ring slips from rest on the track to point *B*, making an angle of 30° with *AC*. ($\angle ACB = 30°$) spring becomes unstretched. Find the velocity of the ring at *B*.



(A) $\left[\frac{KR^2}{2m}(2-\sqrt{3})^2+gR\sqrt{3}\right]^{1/2}$ (B) $\left[\frac{KR^2}{m}(2-\sqrt{3})^2+gR\right]^{1/2}$

(C) $\left[\frac{2KR^2}{m}(2-\sqrt{3})^2+gR\sqrt{3}\right]^{1/2}$ (D) $\left[\frac{KR^2}{2m}(\sqrt{2}-1)^2+gR\right]^{1/2}$

SPACE FOR ROUGH WORK

SECTION-I(ii) : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- 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 all the four options are correct but **only two** options are chosen.
Partial Marks	:	+1	If all the four options are correct but **only one** options are chosen.
Zero Marks	:	0	If none of the options are chosen.
Negative Marks	:	–2	In all other cases.

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7. Two spherical planets P and Q have the same uniform density ρ, masses M_P and M_Q, and surface areas A and 4A, respectively. A spherical planet R also has uniform density ρ and its mass is $(M_P + M_Q)$. The escape velocities from the planets P, Q and R, are V_P, V_Q and V_R, respectively. Then

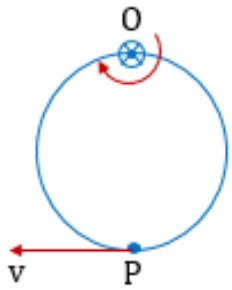
(A) $V_Q > V_R > V_P$

(B) $V_R > V_Q > V_P$

(C) $V_R/V_P = 3$

(D) $V_P/V_Q = 1/2$

8. A ring of mass *m*, radius *r* can oscillate in a vertical plane about is top most point '*O*' as shown. Axis is normal to the plane of ring. Maximum speed of lowest point '*P*' of ring is *v*.



(A) Time period of SHM for small amplitude is $2\pi\sqrt{\frac{2r}{g}}$

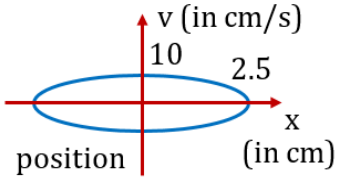
(B) Acceleration of centre of mass of ring at lowest position is zero

(C) Hinge force when centre of mass is at lowest point is $\frac{mv^2}{4r}$

(D) Mechanical energy of oscillation is $\frac{mv^2}{4}$ (when potential energy at mean position is taken as zero)

SPACE FOR ROUGH WORK

9. The figure shows a graph between velocity and displacement (from mean position) of a particle performing SHM :-



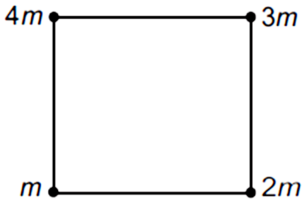
(A) the time period of the particle is 1.57s.

(B) the maximum acceleration will be 40 cm/s^2.

(C) the velocity of particle is $2\sqrt{21}$ cm/s when it is at a distance 1 cm from the mean position.

(D) minimum acceleration is 4 cm/s^2.

10. Four point-masses are placed at four corners of a square as shown. When positions of m and 2m are interchanged



(A) gravitational field strength at centre will increase

(B) gravitational field strength at centre will decrease

(C) gravitational potential at centre will remain unchanged

(D) gravitational potential at centre will decrease

11. The angle between two vectors $\vec{a}$&$\vec{b}$ is θ and the magnitude of $\vec{b}$ is half of magnitude of $\vec{a}$. If $\vec{c} = \vec{a} - \vec{b}$ & $|\vec{a}| = a$ then choose the correct statements :-

(A) if $c = \frac{a\sqrt{5}}{2}$ then θ will be 90°

(B) if $c = \frac{a\sqrt{3}}{2}$ then θ will be 60°

(C) if $c = \frac{a}{\sqrt{2}}$ then θ will be 45°

(D) if $c = \frac{3a}{2}$ then θ will be 180°

12. A car of mass M is travelling without sliding on a horizontal circular path of radius r. At an instant its speed is v and tangential acceleration is a. Find the correct statement

(A) The acceleration of the car is towards the centre of the path

(B) The magnitude of the frictional force on the car is greater than $\frac{Mv^2}{r}$

(C) The friction coefficient between the ground and the car is not less than a/g.

(D) The friction coefficient between the ground and the car is $\mu = \tan^{-1}\frac{v^2}{rg}$

SPACE FOR ROUGH WORK

SECTION-III : (Maximum Marks: 15)

- This section contains **FIVE (05)** questions. The answer to each question is a **SINGLE DIGIT INTEGER (0-9)**.
- For each question, enter the correct numerical value of the answer in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct option is chosen.
Zero Marks	:	0	If the question is unanswered.
Negative Marks	:	–1	In all other cases.

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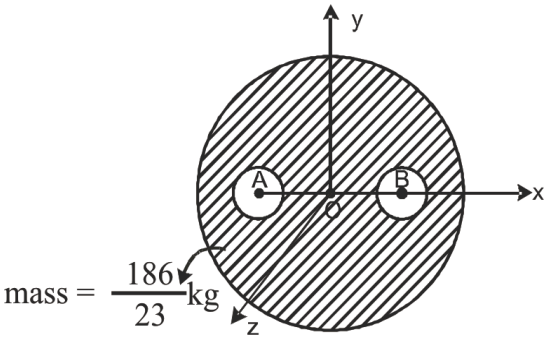
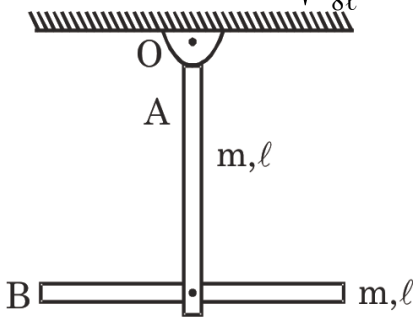
1. A solid sphere of uniform density and radius 4m is located with its centre at the origin O of coordinate system. Two spheres of equal radii 1m each, with their centres at A (– 2m, 0, 0) and B (2m, 0, 0) are taken out of the solid sphere leaving behind spherical cavities as shown in the figure and remaining body has mass of $\frac{186}{23}$kg. Gravitational potential at the centre of the sphere is given by $V_0 = -GX$ joule/kg. Find the value of 'X'.

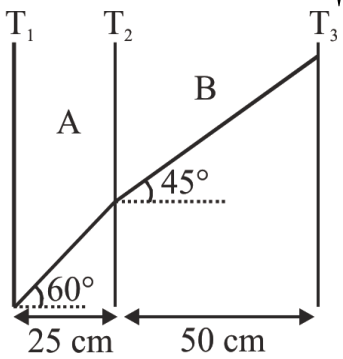


2. Two rods A and B (mass m and length ℓ each) are connected as shown. Rod A is free to rotate about O. Mid point of rod B is connected to lower end of rod A and free to rotate relative to A in the plane of paper. Angular frequency of oscillation of small angular amplitude of rod A is $\sqrt{\frac{Ng}{8\ell}}$. Find the value of N.



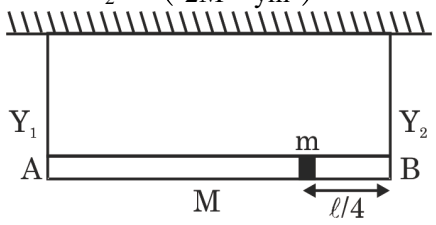
SPACE FOR ROUGH WORK

3. Two conductors A and B each of cross section area 5 cm^2 are connected in series. Variation of temperature (in °C) along the length (in cm) is as shown in the figure. If thermal conductivity of A is 200 J/m-sec0C and thermal conductivity of B (in J/m-sec °C upto one decimal place.) is k then find $\sqrt{\frac{k}{8\sqrt{3}}}$.



4. Velocity of a particle moving in a straight line is given by $3t^2 - 2t + 4$ then of acceleration is At + B then value of $\left|\frac{A}{B}\right|$ is.

5. A rigid rod AB of mass M and length ℓ is suspended horizontally from two vertical wires having same length and same area of cross-section. When a mass 'm' is placed at a distance $\frac{\ell}{4}$ from end B, rod remains horizontal. if the ratio of Young modulus of two wires $\frac{Y_1}{Y_2}$ is $\left(\frac{xM+m}{2M+ym}\right)$ then find the value of x + y.



SPACE FOR ROUGH WORK

PART-B-CHEMISTRY

SECTION-I(i) : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks	:	+4	If ONLY the correct option is chosen.
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered).
Negative Marks	:	–1	In all other cases.

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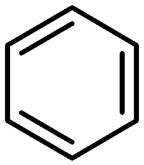
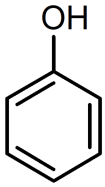
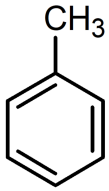
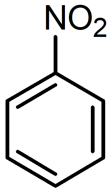
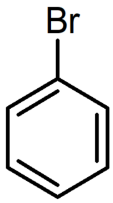
1. Give the order of decreasing reactivity towards an electrophile.

(1)  (2)  (3)  (4)  (5) 

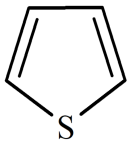
(A) 2 > 3 > 1 > 5 > 4

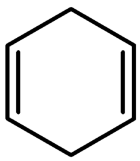
(B) 3 > 1 > 2 > 5 > 4

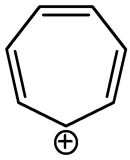
(C) 5 > 4 > 2 > 3 > 1

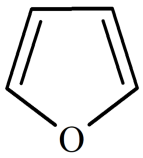
(D) 1 > 5 > 2 > 3 > 4

2. Which of the following is not an aromatic compound:

(A) 

(B) 

(C) 

(D) 

3. Anti–Markovnikov addition of HBr is not observed in –

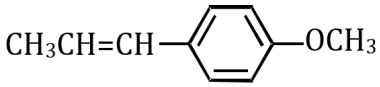
(A) Propene

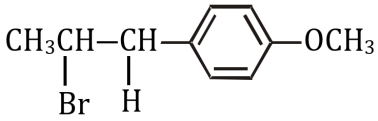
(B) But–2–ene

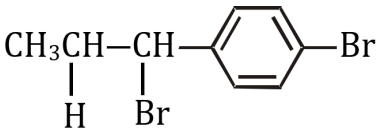
(C) But–1–ene

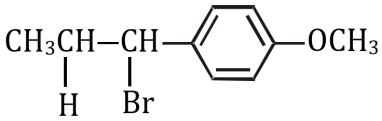
(D) Pent–2–ene

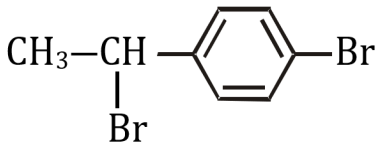
SPACE FOR ROUGH WORK

4.  on reaction with HBr gives :-

(A) 

(B) 

(C) 

(D) 

5. The number of sodium atoms in 2 moles of sodium ferrocyanide $Na_4[Fe(CN)_6]$ is :-

(A) 12×10^{23}

(B) 26×10^{23}

(C) 34×10^{23}

(D) 48×10^{23}

6. In isoelectronic series largest difference between size is observed in N^{3-}, O^{2-}, F^{-}, Na^{+}, Mg^{2+} :

(A) N^{3-}, Mg^{2+}

(B) N^{3-}, O^{2-}

(C) Mg^{2+}, Na^{+}

(D) F^{-}, Na^{+}

SPACE FOR ROUGH WORK

SECTION-I(ii) : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- 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 all the four options are correct but **only two** options are chosen.
Partial Marks	:	+1	If all the four options are correct but **only one** options are chosen.
Zero Marks	:	0	If none of the options are chosen.
Negative Marks	:	–2	In all other cases.

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7. Which of the following molecules do not exist ?

(A) Br_2O (B) SF_6

(C) NCl_5 (D) OF_4

8. Which of the following is/are **incorrect** with respect to dissociation of $CaCO_3(s)$.

$CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$

(A) It is a phase transition

(B) K_{eq} will be dependent on pressure of CO_2

(C) K_{eq} will increases as temperature increases

(D) Equilibrium can be established in an open container

9. Which of the following solutions will not have pH close to 1.0 ?

(A) 100 ml of (M/10) HCl + 100 ml of (M/10) NaOH

(B) 55 ml of (M/10) HCl + 45 ml of (M/10) NaOH

(C) 10 ml of (M/10) HCl + 90 ml of (M/10) NaOH

(D) 75 ml of (M/5) HCl + 25 ml of (M/5) NaOH

SPACE FOR ROUGH WORK

10. Which of the following as a Buffer ?

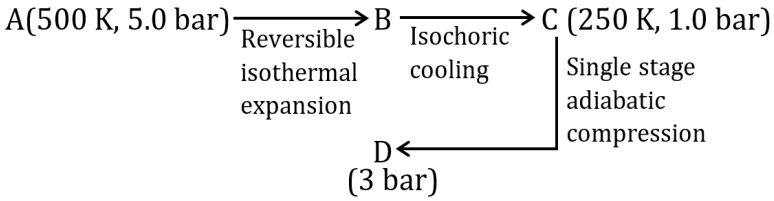
(A) $\underset{(10\ \text{mmol})}{CH_3COONa} + \underset{(5\ \text{mmol})}{HCl}$

(B) $\underset{(100ml\ 0.05M)}{NH_4OH} + \underset{(100ml\ 0.1M)}{HCl}$

(C) $\underset{(10\ \text{mmol})}{H_3BO_3} + \underset{(5\ \text{mmol})}{Na_2B_4O_7}$

(D) $\underset{(500ml\ 0.1M)}{NaOH} + \underset{(1000ml\ 0.1M)}{CH_3COOH}$

11. Two moles of an ideal gas ($C_{v,m} = \frac{3}{2}R$) The correct statement is/are



(A) The pressure at B is 2.0 bar

(B) The temperature at D is 450 K

(C) $\Delta H_{CD} = 1000\ R$

(D) $\Delta U_{BC} = 375\ R$

12. Which of the following substituents will increase the acidity of phenol-

(A) $-NO_2$

(B) $-CN$

(C) $-CHO$

(D) CH_3

SPACE FOR ROUGH WORK

SECTION-III : (Maximum Marks: 15)

- This section contains **FIVE (05)** questions. The answer to each question is a **SINGLE DIGIT INTEGER (0-9)**.
- For each question, enter the correct numerical value of the answer in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct option is chosen.
Zero Marks	:	0	If the question is unanswered.
Negative Marks	:	–1	In all other cases.

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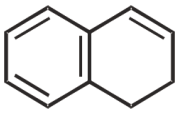
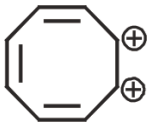
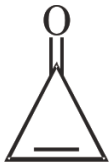
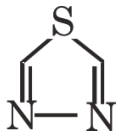
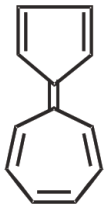
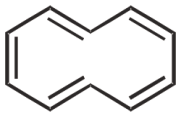
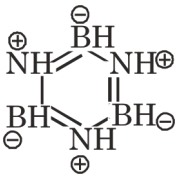
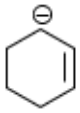
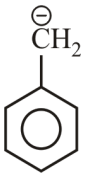
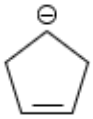
1. How many of following compound are aromatic in nature :

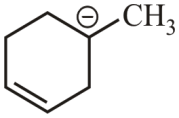
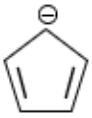
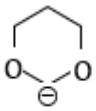
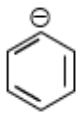
(1)  (2)  (3)  (4) 

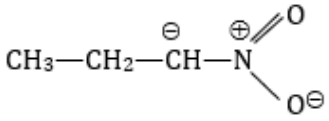
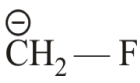
(5)  (6)  (7)  (8) 

(9)  (10) 

2. In how many of the following cases, the negative charge is delocalised?

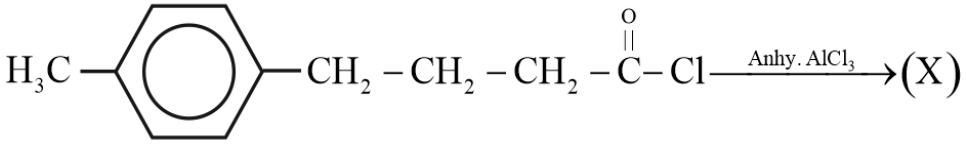
(i)  (ii)  (iii)  (iv) 

(v)  (vi)  (vii)  (viii) 

(ix)  (x) 

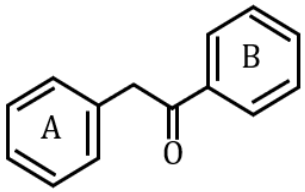
SPACE FOR ROUGH WORK

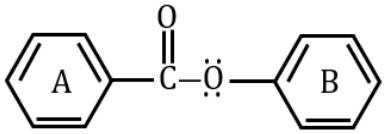
3. In the given reaction

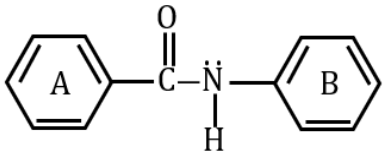


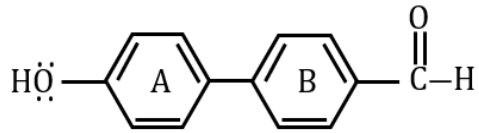
Double bond equivalent of (X) is:

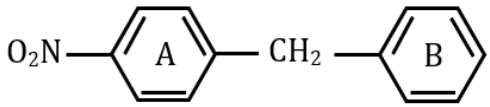
4. Each of the compounds shown below has two aromatic ring, labelled as A and B. Identify number of compounds in which ring B is more active than ring A for electrophilic aromatic substitution reaction.

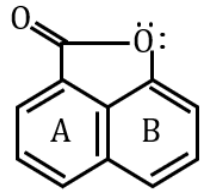
(i) 

(ii) 

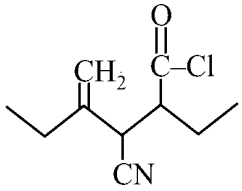
(iii) 

(iv) 

(v) 

(vi) 

5. How many carbons are present in parent carbon chain of following compound :



SPACE FOR ROUGH WORK

PART-C-MATHEMATICS

SECTION-I(i) : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme :

Full Marks	:	+4	If ONLY the correct option is chosen.
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered).
Negative Marks	:	–1	In all other cases.

---

1. Consider a parallelogram whose sides are represented by the lines $2x + 3y = 0$; $2x + 3y - 5 = 0$; $3x - 4y = 0$ and $3x - 4y = 3$. The equation of the diagonal not passing through the origin, is

(A) $21x - 11y + 15 = 0$ (B) $9x - 11y + 15 = 0$

(C) $21x - 29y - 15 = 0$ (D) $21x - 11y - 15 = 0$

2. The number of solutions of the equation $\sin 2x - 2\cos x + 4\sin x = 4$ in the interval $[0, 5\pi]$ is

(A) 6 (B) 4

(C) 3 (D) 5

3. If n is the number of solutions of the equation $2\cos x\left(4\sin\left(\frac{\pi}{4}+x\right)\sin\left(\frac{\pi}{4}-x\right)-1\right)=1, x \in [0, \pi]$ and S is the sum of all these solutions, then the ordered pair (n, S) is

(A) $(3, 13\pi/9)$ (B) $(2, 2\pi/3)$

(C) $(2, 8\pi/9)$ (D) $(3, 5\pi/3)$

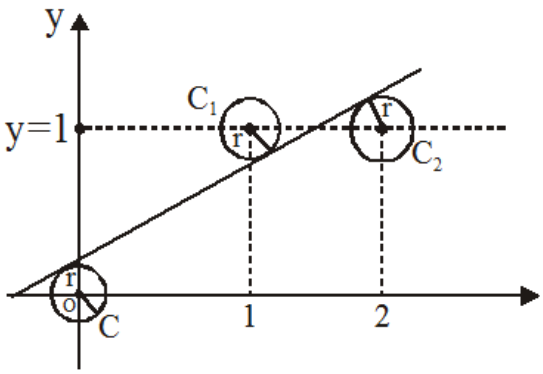
4. If $A = \sum_{n=1}^{\infty} \frac{1}{(3+(-1)^n)^n}$ and $B = \sum_{n=1}^{\infty} \frac{(-1)^n}{(3+(-1)^n)^n}$, then $\frac{A}{B}$ is equal to

(A) $\frac{11}{9}$ (B) 1

(C) $-\frac{11}{9}$ (D) $-\frac{11}{3}$

SPACE FOR ROUGH WORK

5. As shown in the figure, three circles which have the same radius r, have centres at (0,0) ; (1,1) and (2,1). If they have a common tangent line, as shown then, their radius 'r' is



(A) $\frac{\sqrt{5}-1}{2}$

(B) $\frac{\sqrt{5}}{10}$

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

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

6. The positive difference between the length of the latus rectum of $3y = x^2 + 4x - 9$ and $x^2 + 4y^2 - 6x + 16y = 24$ is

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

(B) 2

(C) $\frac{3}{2}$

(D) $\frac{5}{2}$

SPACE FOR ROUGH WORK

SECTION-I(ii) : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- 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 all the four options are correct but **only two** options are chosen.
Partial Marks	:	+1	If all the four options are correct but **only one** options are chosen.
Zero Marks	:	0	If none of the options are chosen.
Negative Marks	:	–2	In all other cases.

---

7. Consider the ellipse $\frac{x^2}{4} + \frac{y^2}{b^2} = 1$ ($b^2 < 4$) and whose eccentricity is 'e'. If the normal at the end of latus-rectum passes through one extremity of minor axis, then which of the following statement(s) is/are true ?

(A) Equation of director circle of ellipse is $x^2 + y^2 = 10 - 2\sqrt{5}$

(B) Length of latus rectum of the ellipse is equal to b^2

(C) The value of $e^2 + e$ is 1

(D) Area of region between director and auxiliary circle of the ellipse is $2\pi\left(3 - \sqrt{5}\right)$

8. Let a and b be positive real numbers such that $a > 1$ and $b < a$. Let P be a point in the first quadrant that lies on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. Suppose the tangent to the hyperbola at P passes through the point (1, 0), and suppose the normal to the hyperbola at P cuts off equal intercepts on the coordinate axes. Let Δ denote the area of the triangle formed by the tangent at P, the normal at P and the x-axis. If e denotes the eccentricity of the hyperbola, then which of the following statements is/are TRUE?

(A) $1 < e < \sqrt{2}$

(B) $\sqrt{2} < e < 2$

(C) $\Delta = a^4$

(D) $\Delta = b^4$

SPACE FOR ROUGH WORK

9. Lines $y = x + i$ & $y = -x + j$ are drawn in $x - y$ plane such that $i \in \{1, 2, 3, 4\}$ & $j \in \{1, 2, 3, 4, 5,6\}$. If m represents the total number of squares formed by the lines and n represents the total number of triangles formed by the given lines & x-axis, then correct option/s is/are

(A) $m + n = 50$

(B) $m - n = 2$

(C) $m + n = 48$

(D) $m - n = 4$

10. For non-negative integers s and r, let $\binom{s}{r} = \begin{cases} \frac{s!}{r!(s-r)!} & \text{if } r \leqslant s, \\ 0 & \text{if } r > s. \end{cases}$

For positive integers m and n, let $g(m, n) = \sum_{p=0}^{m+n} \frac{f(m, n, p)}{\binom{n+p}{p}}$

Where p is any non-negative integer, $f(m, n, p) = \sum_{i=0}^{p} \binom{m}{i} \binom{n+i}{p} \binom{p+n}{p-i}$

Then which of the following statements is/are TRUE?

(A) $g(m, n) = g(n, m)$ for all positive integers m, n

(B) $g(m, n+1) = g(m + 1, n)$ for all positive integers m, n

(C) $g(2m, 2n) = 2g(m, n)$ for all positive integers m, n

(D) $g(2m, 2n) = (g(m, n))^2$ for all positive integers m, n

11. A circle $(x - 3)^2 + (y - 6)^2 = r^2$ touches parabola $y^2 = 4x$ at P(a, b). If the slope of common tangent at P is m, then (where b, r > 0)

(A) $r = 5$

(B) $\frac{r^2}{m} = 10$

(C) $(a + b)m = 4$

(D) $a\sqrt{b} = 8$

12. The locus of the mid point of the focal radii of a variable point moving on the parabola, $y^2 = 8x$ is a parabola whose

(A) Latus rectum is half the latus rectum of the original parabola

(B) Vertex is (1, 0)

(C) Directrix is y-axis

(D) Focus has the co-ordinates (2,0)

SPACE FOR ROUGH WORK

SECTION-III : (Maximum Marks: 15)

- This section contains **FIVE (05)** questions. The answer to each question is a **SINGLE DIGIT INTEGER (0-9)**.
- For each question, enter the correct numerical value of the answer in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct option is chosen.
Zero Marks	:	0	If the question is unanswered.
Negative Marks	:	–1	In all other cases.

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1. The value of $6 + \log_{\frac{3}{2}} \left(\frac{1}{3\sqrt{2}} \sqrt{4 - \frac{1}{3\sqrt{2}} \sqrt{4 - \frac{1}{3\sqrt{2}} \sqrt{4 - \frac{1}{3\sqrt{2}} \ldots\ldots\infty}}} \right)$ is

2. If '4' lies between the roots of the equation $x^2 - (3k - 1)x + 5k = 0$, then minimum possible integral value of k is

3. Let $P = \left(2 + \sqrt{3}\right)^5$ and $f = P - [P]$, where [P] denotes the greatest integer function, then the value of $\left(\frac{f^2}{1 - f} \right) - 720$ is

4. Let $(a_1, a_2, a_3 \ldots . a_n)$ be a permutation of (1, 2, 3 .....n) for which $a_1 > a_2 > a_3 > \ldots\ldots . > a_{\frac{n}{2}}$ and $a_{\frac{n}{2}} < a_{\frac{n}{2}+1} < a_{\frac{n}{2}+2} < \ldots . < a_n$ for n as, an even positive integer. Also $a_1 > a_2 > a_3 \ldots\ldots . > a_{\frac{n+1}{2}}$ and $a_{\frac{n+1}{2}} < a_{\frac{n+1}{2}+1} < \ldots . < a_n$ for n as an odd positive integers. Let the total number of permutation of n be p(n), if $200 < p(n) < 500$, then last digit of sum of the values of n is

5. If locus of reflection of the foci of the ellipse $3x^2 + 4y^2 - 6x + 4y - 32 = 0$ in its tangents are two curves then sum of squares of their eccentricities is

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SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

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