MasterJEE

IIT-JEE | Medical | Foundations

Master JEE CLASSES
Kukatpally, Hyderabad.

JEE-ADVANCE-2011-P1-Model

Max.Marks: 240

IMPORTANT INSTRUCTIONS:

1) This booklet is your Question Paper.
2) Use the Optical Response Sheet (ORS) provided separately for answering the questions
3) Blank spaces are provided within this booklet for rough work.
4) Write your name, roll number and sign in the space provided on the back cover of this booklet.
5) You are allowed to take away the Question Paper at the end of the examination.

OPTICAL RESPONSE SHEET:

6) Darken the appropriate bubbles on the ORS by applying sufficient pressure. This will leave an impression at the corresponding place on the Candidate's sheet.
7) The ORS will be collected by the invigilator at the end of the examination.
8) Do not tamper with or mutilate the ORS. **Do not use the ORS for rough work**.
9) Write your name, roll number and code of the examination center, and sign with pen in the space provided for this purpose on the ORS. **Do not write any of these details anywhere else** on the ORS**.** Darken the appropriate bubble under each digit of your roll number.

DARKENING THE BUBBLES ON THE ORS

10) Use a **BLACK BALL POINT PEN** to darken the bubbles on the ORS.
11) Darken the bubble **COMPLETELY**.
12) The correct way of darkening a bubble is as :
13) The ORS is machine-gradable. Ensure that the bubbles are darkened in the correct way.
14) Darken the bubbles ONLY IF you are sure of the answer. There is NO WAY to erase or "un-darken" a darkened bubble.

JEE-ADVANCE-2011-P1-Model

IMPORTANT INSTRUCTIONS

Max Marks: 240

CHEMISTRY

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I (Q.N : 1 – 7)	Questions with Single Correct Choice	3	-1	7	21
Sec – II(Q.N : 8 – 11)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III(Q.N : 12 – 16)	Questions with Comprehension Type (2 Comprehensions – 2 + 3 = 5Q)	3	-1	5	15
Sec – IV(Q.N : 17 – 23)	Questions with Integer Answer Type	4	0	7	28
Total				**23**	**80**

PHYSICS

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 24 – 30)	Questions with Single Correct Choice	3	-1	7	21
Sec – II(Q.N : 31 – 34)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III(Q.N : 35 – 39)	Questions with Comprehension Type (2 Comprehensions – 2 + 3 = 5Q)	3	-1	5	15
Sec – IV(Q.N : 40 – 46)	Questions with Integer Answer Type	4	0	7	28
Total				**23**	**80**

MATHEMATICS

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 47 – 53)	Questions with Single Correct Choice	3	-1	7	21
Sec – II(Q.N : 54 – 57)	Questions with Multiple Correct Choice	4	0	4	16
Sec – III(Q.N : 58 – 62)	Questions with Comprehension Type (2 Comprehensions – 2 + 3 = 5Q)	3	-1	5	15
Sec – IV(Q.N : 63 – 69)	Questions with Integer Answer Type	4	0	7	28
Total				**23**	**80**

space for rough work

CHEMISTRY: **Max.Marks: 80**

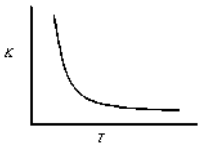
SECTION – I

(SINGLE CORRECT CHOICE TYPE)

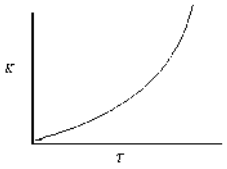
This section contains 7 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct

1. The rate constant of most of the reactions increases with increase in temperature. According to Arrhenius equation, $k = Ae^{-Ea/RT}$. The curve of rate constant k against temperature T will be

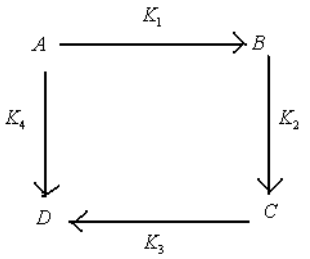
A) 

B) 

C) 

D) 

2. Consider an elementary reaction sequence shown in the figure which of the following equations is/are correct



A) $\frac{d[A]}{dt} = -K_1[A] + K_4[D]$

B) $\frac{d[C]}{dt} = K_2[B] - K_3[C]$

C) $\frac{d[D]}{dt} = -K_4[D] + K_3[D]$

D) $\frac{d[A]}{dt} = K_2[C] - K_4[D]$

space for rough work

3. For the formation of B from A, heat liberated is 20kJ/mol and required activation energy of 100 kJ/mol. Then activation energy (in kJ/mol) for the reaction $\text{A} \rightarrow \text{B}$ is :

A) 120 B) 100 C) 80 D) 60

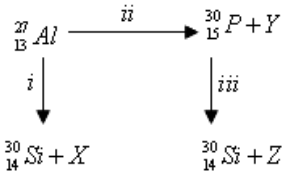
4. The nuclide sulphur-35, is neutron rich therefore, it is likely to undergo radioactive decay by

A) $\beta^- - emission$ B) electron capture C) $\beta^+ - emission$ D) neutron capture

5. $_{24}Cr^{53} + x \rightarrow y + {}_{26}Fe^{56}$ The correct combination of x, y is

A) $_0^1n, {}_2He^4$ B) $_2He^3, {}_1H^2$ C) $_2He^4, {}_0^1n$ D) $_2He^3, {}_0^1n$

6. Bombardment of aluminium by α–particle leads to list artificial disintegration in two ways, i and ii as shown, and $_{15}^{30}\text{P}$ is disintegrating to give $_{14}^{30}\text{Si}$. Products x, y and z respectively are



A) Proton, neutron, positron B) neutron, positron, proton

C) proton, positron, neutron D) positron, proton, neutron

7. The rate constant of the reaction varies with temperature as :

$\text{ClO}_2 + \text{NO} \longrightarrow \text{Cl}_2 + \text{NO}_2$

T(K)	200	400
$\text{k}\left(\text{s}^{-1}\right)$	2.0×10^{-11}	1.0×10^{-11}

Assuming that the frequency factor does not change in this temperature range, the arhenius activation energy for the reaction is: (ln2 is 0.693)

A) 1.650kJ/mol B) $2.3046\,\text{kJ/mol}$ C) $23.046\ \text{kJ/mol}$ D) $16.5\ \text{kJ/mol}$

SECTION – II

(MULTIPLE CORRECT CHOICE TYPE)

This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONE OR MORE is/ are correct

8. According to Arrhenius equation, which of the following is /are correct Statement(s)

A) a high activation energy usually implies a fast reaction

B) rate constant increases with increase in temperature. This is due to greater number of collisions whose energy exceeds the activation energy

C) the pre-exponential factor is a measure of the rate at which collisions occur, irrespective of their energy.

D) higher the magnitude of activation energy, stronger is the temperature dependence of the rate constant.

9. Choose the correct statement(s) :

A) If rate of formation of NO is $3.6\times10^{-3} M/Sec$ in $4NH_{3_{(g)}} + 5O_{2_{(g)}} \rightarrow 4NO_{(g)} + 6H_2O_{(g)}$ then the rate of formation of H_2O is $5.4\times10^{-3} M/\text{sec}$

B) The plot of $\ln\frac{a}{a-x}$ against 't' is a straight line then the reaction may be decomposition of H_2O_2 to H_2O and O_2 (a= initial conc, a-x is conc at time 't',)

C) The value of rate constant, predicated by Arrhenius equation is 'A', if $T \rightarrow \infty$

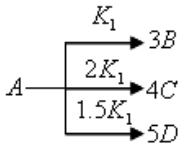
D) The rate constant k_1 and k_2 of two reactions are in the ratio 2 : 1. The corresponding energies of activation of the reactions will be related as $E_2 > E_1$. If A value is same for two reactions

10. A plot of number of neutrons (N) against the number of protons (P) of stable nuclei exhibits upward deviation from linearity for atomic number, Z > 20, For an unstable nucleus having $\frac{N}{P}$ ratio less than 1, the possible mode (s) of decay is (are) :

A) β^--decay (β-emission) B) neutron emission

C) orbital or K-electron capture D) β^+- decay (positron emission)

11.



All reactions are of first order. At time t=t_1 (t_1>0) $\frac{[B]}{[C]} = \alpha$; *at time* $t = t_2 (t_2 \geq t_1), \frac{[C]}{[D]} = \beta$

Which of the following is/are correct ?

A) $\alpha = 0.5$ B) $\beta = \frac{4}{3}$ C) $\alpha = 0.375$ D) $\beta = \frac{16}{15}$

SECTION – III

(COMPREHENSION TYPE)

This section contains 2 groups of questions. One group has 3 question and another group has 2 multiple choice questions based on a paragraph. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct.

Passage - I

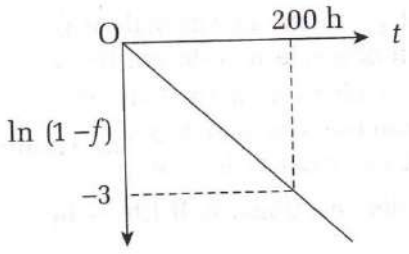
Oxidation of metals is generally a slow electrochemical reaction involving many steps. These steps involve electron transfer reactions. A particular type of oxidation involve overall first order kinetics with respect to fraction of unoxidised metal surface thickness (1-f) relative to the maximum thickness(T) of oxidized surface, when metal surface is exposed to air for a considerable period of time.

Rate law: $\frac{df}{dt} = k(1-f)$,

Where $f = x/T$, x= thickness of the oxide film at time 't'

And T= thickness of the oxide film at time t= ∞

For the oxidation of a particular metal, a graph is shown in the figure.



12. The time taken for thickness to grow 50% of T is

A) 23.1 h B) 46.2 h C) 100 h D) 92.4 h

13. The exponential variation of f with $t(h)$ is

A) $f = \left(1 - e^{-3t/200}\right)$ B) $f = e^{-3t/200} - 1$ C) $f = e^{-3t/200}$ D) $f = e^{3t/200}$

Passage - II

In any nuclear reaction, the total mass of product is found to be less than the total mass of reactants. The difference in mass is due to the conversion of some mass into energy and hence, energy is produced in the nuclear reactions.

14. The nuclide Sc^{50}, mass 49.9516 u, is neutron rich. It decays to form Ti^{50}, mass 49.94479 u. If the emitted β - particle has a kinetic energy of 0.80 MeV, what is the kinetic energy of the neutrino emitted simultaneously?

A) 2.87 MeV B) 5.54MeV C) 9.36 MeV D) 6.58 MeV

15. Calculate the binding energy per nucleon for the nuclide $_{17}Cl^{37}$, if its mass is 36.9659 u (Given m (neutron) = 1.0087 u, m(proton) = 1.0078 u)

A) 317.53 MeV B) 8.58 MeV C) 7.689 MeV D) 7.88 MeV

16. A nuclear explosion has taken place leading to increase in concentration of C^{14} in nearby areas. C^{14} concentration is C_1 in nearby areas and C_2 in areas far away. If the age of the fossil is determined to be T_1 and T_2 at the places respectively, then

A) The age of the fossil will increase at the place where explosion has taken and

$$T_1 - T_2 = \frac{1}{\lambda}\ln\frac{C_1}{C_2}$$

B) The age of the fossil will decrease at the place where explosion has taken and

$$T_1 - T_2 = \frac{1}{\lambda}\ln\frac{C_1}{C_2}$$

C) The age of fossil will be determined to be same

D) $\frac{T_1}{T_2} = \frac{C_1}{C_2}$

SECTION –IV

(INTEGER ANSWER TYPE)

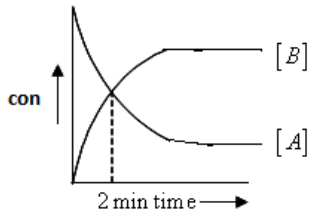
This section contains 7 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9. The appropriate bubbles below the respective question numbers in the ORS have to be darkened.

17. The human body contains about 18% carbon by weight. Of total carbon, $1.50\times10^{-10}\%$ is C^{14} (by weight). The number of disintegrations occurring per minute in a person of 70 kg is $x\times10^{y}$. The value of (x+y) is nearly (half- life of C^{14} is 5570 years)

18. $\underset{(1M)}{A} \underset{k=1}{\overset{k=3}{\rightleftharpoons}} \underset{(1M)}{B} \xrightarrow{k=2} \underset{(1M)}{C}$

If all the reactions in the above system give first order kinetics what is the rate of disappearance of 'B' in the given instant

19. For a first order reaction $A_{(g)} \rightarrow 3B_{(g)}$ the concentration verses time graph is given below



What is the half life in minutes (answer to the nearest integer) ?

(log 2= 0.3, log 3 = 0.48)

20. ${}_{92}U^{238}$ disintegrates to give 4α *and* 6β particles. The group number of the daughter element in modern periodic table is

21. For a reaction $A \rightarrow B,$ the rate law expression is $\frac{-d[A]}{dt} = K[A]^{1/2}$. If initial concentration of A is A_0. The number of correct statements are

i) The plot of $\sqrt{A}$ against 't' will be linear

ii) The half life period is $t_{1/2} = \frac{\sqrt{2}\left(\sqrt{2}-1\right)}{K}\sqrt{A_0}$

iii) The integrated form of rate expression is $\sqrt{A} = \frac{-K}{2}t + \sqrt{A_0}$

iv) Time taken for reaction is decreased for second half life than first half life period

v) When concentration of reactant is doubled rate increases to 4 times at that instant

22. The rate constant of a reaction at 27^0C is $3\times10^{-3}\,\text{min}^{-1}$. The fraction of molecules crossing the energy barrier of the reaction at that temperature is $10^{-3}\%$. If temperature is increased, the maximum value of rate constant k can be attained is $x\times100\,\text{min}^{-1}$. The value of x is

23. Half life of a radioactive nuclide is 20 years. If a sample of this nuclide has activity of 6400 dpm today, its activity (in dpm) after 100 years would be $x\times100\,\text{dpm}$; the value of 'x' is :

SECTION – I
(SINGLE CORRECT CHOICE TYPE)

This section contains 7 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct

24. A smooth wire frame in the form of a parabola $x^2 = cy$ is rotated about its vertical axis (y-axis) at angular speed ω. A bead of mass m is at rest relative to wire frame at $(-a,b)$. Then the value of 'ω' is :

A) $\sqrt{\frac{2g}{a}}$ B) $\sqrt{\frac{2g}{c}}$ C) $\sqrt{\frac{2g}{b}}$ D) $\sqrt{\frac{2gc}{ab}}$

25. A small block of mass 1 kg is connected by a light string passing through a hole in a smooth table with a block of mass 5kg which hangs vertically. Find the angular velocity of the block on the table moving in a circle of radius 0.1 m in order to keep the other block at rest?

A) 10rad/s B) $10\sqrt{5}\,rad/s$ C) $10\sqrt{2}\,rad/s$ D) $\frac{10}{\sqrt{2}}\,rad/s$

26. A thin rod of mass m and length 'ℓ' is rotated in a horizontal plane about one of its ends with a constant angular speed ω in gravity free space. Then the tension at the midpoint of the rod is :

A) $\frac{ml\omega^2}{2}$ B) $\frac{ml\omega^2}{4}$ C) $\frac{ml\omega^2}{8}$ D) $\frac{3}{8}ml\omega^2$

27. A small sphere of mass 0.2 kg is attached to a light string of length 1.3 m whose upper end is fixed to a ceiling. The sphere is made to describe a horizontal circle of radius 0.5 m. Then the time taken to complete one revolution is :

A) $\frac{2\pi}{5}\sqrt{3}\,\text{sec}$ B) $\frac{\pi}{5}\sqrt{3}\,\text{sec}$ C) $\frac{\pi}{5}\,\text{sec}$ D) $\frac{2\pi}{5}\,\text{sec}$

28. A smooth horizontal circular table is rotating at an angular speed ω about its vertical axis. A groove is made on the surface along a radius. A particle is gently placed inside the groove at a distance 'a' from the center. The speed of the particle w.r.t table when its distance from the center is 'x' is :

A) $\omega\sqrt{x^2-a^2}$ B) $\frac{\omega}{2}\sqrt{x^2-a^2}$ C) $\omega\sqrt{x^2+a^2}$ D) $\frac{\omega}{2}\sqrt{x^2+a^2}$

29. A car is moving in a circular horizontal track of radius 10 m with a constant speed of 10 m/s. A plumb bob is suspended from the roof of the car by a light string. The angle made by the string with the vertical(in steady state) is (g = 10 m/s^2)

A) zero B) 30^o C) 45^o D) 60^o

30. A point moves along an arc of a circle of radius R. Its velocity depends from upon the distance covered s as V = $a\sqrt{s}$, where a is constant. The angle θ between the vector of total acceleration and tangential acceleration is

A) $\tan\theta = \sqrt{\frac{s}{R}}$ B) $\tan\theta = \sqrt{\frac{s}{2R}}$ C) $\tan\theta = \frac{2s}{R}$ D) $\tan\theta = \frac{s}{2R}$

SECTION – II
(MULTIPLE CORRECT CHOICE TYPE)

This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONE OR MORE is/ are correct

31. The position of a particle varies with time as $\bar{r} = a\sin 2t\hat{i} + a\cos 2t\hat{j} + bt\hat{k}$. Then the

A) trajectory of particle as seen by an observer moving with a velocity $b\hat{k}$ is a circle.

B) trajectory of the particle w.r.t ground observer is a circle.

C) Angle between velocity and acceleration is $\pi/2$

D) Angle between velocity and acceleration is constant.

32. A block of mass 1kg is placed on a horizontal turn table rotating at a constant angular velocity ω rad/s. at a distance 1m from the axis by connecting it to a string of length 1m whose other end is fixed at the centre of table. The value (/s) of ω for which tension in string is zero is/are : [the coefficient friction between block and surface is 0.4]

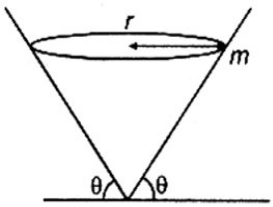
A) 2rad/s B) 1rad/s C) 0.5rad/s D) 4 rad/s

33. A particle is moving along y-axis with a speed of $10m/s$. At some instant of time it is at $(0,4m)$. The magnitude of its angular velocity about a point,

A) $(0,0)$ is zero B) $(0,0)$ is infinity

C) $(3m,0)$ is $1.2rad/s$ D) $(-3m,0)$ is $1.2rad/s$

34. A ball of mass m is rotating in a circle of radius r with uniform speed v inside a smooth cone as shown in figure. Let N be the normal reaction on the ball by the cone then choose the correct option



A) $N = mg\cos\theta$ B) $g\sin\theta = \frac{v^2}{r}\cos\theta$ C) $N\sin\theta = \frac{mv^2}{r}$ D) None of these

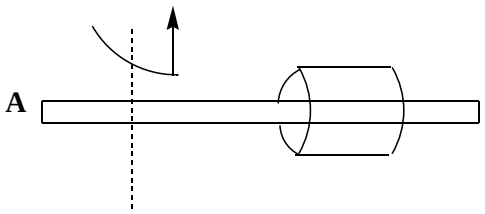
SECTION – III
(PARAGRAPH TYPE)

This section contains 2 paragraphs. Based upon one of the paragraphs 3 multiple choice questions based on the 3 multiple choice questions have to be answered. Each of these questions has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct.

Passage-1

The figure shows a rod which starts rotating with angular acceleration α about vertical axis passing through one of its end (A) in horizontal plane. A bead of mass m just fits

the rod and is situated at a distance r from end A. Friction exist between rod and the bead with coefficient μ. As the angular velocity of rod increases the bead starts sliding over the rod (say after time t_0) Based on above information answer the following questions)



35. The normal force acting on bead at time $t(<t_0)$ is

A) mg B) $mr(\alpha t)^2$ C) $m\sqrt{g^2+r^2(\alpha t)^4}$ D) $m\sqrt{g^2+(r\alpha)^2}$

36. Friction force acting on bead at time $t(<t_0)$ is given by

A) μmg B) $mr(\alpha t)^2$ C) $m\mu\sqrt{g^2+(r\alpha)^2}$ D) $\mu m\sqrt{g^2+r^2(\alpha t)^4}$

37. If the bead start sliding at $t=t_0$ then value of t_0 is given by

A) $\sqrt{\frac{\mu\sqrt{g^2+(r\alpha)^2}}{r\alpha^2}}$ B) $\sqrt{\frac{mg}{r\alpha^2}}$ C) $\sqrt{\frac{\mu\sqrt{g^2+(r\alpha)^2}}{r\alpha^2}}-\sqrt{\frac{mg}{r\alpha^2}}$ D) None of these

Passage-2

The role of friction is very important in determing the range of speeds of a vehicle on a banked road. It can change both in magnitude and direction to prevent the vehicle from slipping or skidding A turn of radius 20m is banked for vehicles going at a speed of 36 kmph. The coefficient of static friction between road and tyre is 0.4. Then mark the correct options.

38. The maximum speed of vehicle without skidding ?

A) 36 kmph B) 54 m/s C) 54 kmph D) 72 kmph

39. The minimum speed of vehicle without slipping is (approximate value)

A) 4 m/s B) 5 kmph C) 36 kmph D) 6 m/s

SECTION –IV
(INTEGER ANSWER TYPE)

This section contains 7 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9. **The appropriate bubbles below the respective question numbers in the ORS have to be darkened.**

40. A particle moves on a circular path of radius 0.2m with an angular acceleration 0.25 $rad./s^2$. The particle starts from rest at t = 0. The time at which magnitude of radial acceleration and tangential acceleration are same is _____sec.

41. A circular ring of mass 3.14 kg and radius 0.05 m is rotating with a constant angular velocity 10 rad/s about its vertical axis on a smooth horizontal table. Then the tension in the ring is 10/n N, then n is _____ .

42. A long horizontal rod has a bead which can slide along its length and is initially placed at a distance L from one end A. the rod is rotated in a horizontal plane about end A, with a constant angular acceleration $\alpha = 0.1 rad/s^2$. The coefficient of friction between rod and bead is $\mu = 0.4$. Neglecting gravity, the time after which the bead starts slipping is _____ sec.

43. A small block slides on a frictionless horizontal table. It is constrained to move inside a ring of radius 1m fixed to the table. At t = 0 the block is moving along the circumference inside the ring with speed 10 m/s. the coefficient of friction between block and ring is 0.1. the speed of the block at t = 1 sec is :_____m/s

44. A particle moves in the x-y plane with velocity $\vec{v} = a\hat{i} + bt\hat{j}$. At the instant $t = \frac{a\sqrt{3}}{b}$ the magnitude of radial acceleration is $\frac{b}{n}$. find n =?

45. A particle of mass 1kg is moving in x-y plane with a velocity of 6 m/s at angle of 53^0 with x-axis. A force of 15N is applied along x-axis at t = 0 on it. The radius of curvature of the path of the particle just after application of force is _____m.

46. A particle of mass 1 kg is at origin. At t = 0. It is given a velocity of 1m/s at angle of 30^0 with y-axis in x-y plane. It is moved under the influence of a force $\vec{F} = \vec{V} \times \vec{A}$, where $\vec{A}$ is constant vector of magnitude π units directed along positive x-axis. The x-coordinate of particle at t = 2s is: _____m ($\vec{V}$ - instantaneous velocity)

MATHEMATICS: **Max.Marks: 80**

SECTION – I

(SINGLE CORRECT CHOICE TYPE)

This section contains 7 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct

47. If $p(1+\frac{t}{\sqrt{2}}, 2+\frac{t}{\sqrt{2}})$ is any point on a line, then the range of the value of t for which the point P lies between the parallel lines $x+2y=1$ *and* $2x+4y=15$ is

A) $-4\sqrt{2}/3 < t < 5\sqrt{2}/6$ B) $0 < t < 5\sqrt{2}/6$

C) $4\sqrt{2} < t < 0$ D) none of these

48. If the lines $ax+y+1=0, x+by+1=0$ and $x+y+c=0 (a,b,c$ being distinct and different from 1) are concurrent, then $\left(\frac{1}{1-a}\right)+\left(\frac{1}{1-b}\right)+\left(\frac{1}{1-c}\right)=$

A) 0 B) 1 C) $1/(a+b+c)$ D) none of these

49. The straight line $x+2y-9=0, 3x+5y-5=0$ and $ax+by-1=0$ are concurrent, if the Straight line $35x-22y+1=0$ passes through the point

A) (a, b) B) (b, a) C) (-a, -b) D) none of these

50. The locus of the image of the point (2, 3) in the line $(x-2y+3)+9\lambda(2x-3y+4)=0$ *is* $(\lambda \in R)$

A) $x^2+y^2-3x-4y-4=0$

B) $2x^2+3y^2+2x+4y-7=0$

C) $x^2+y^2-2x-4y+4=0$

D) $x^2+y^2-2x-4y+3=0$

51. The line x+3y-2=0 bisects the angle between a pair of straight lines of which one has equation x-7y+5=0. The equation of the other line is

A) 3x+3y-1=0 B) x-3y+2=0 C) 5x-5y-3=0 D) 5x+5y-3=0

space for rough work

52. If the pairs of lines $3x^2 - 2pxy - 3y^2 = 0$ *and* $5x^2 - 2qxy - 5y^2 = 0$ are such that each pair bisects the angle between the other pair, the pq equals to

A) -1 B) -7 C) -9 D) -15

53. The equation $a\left(x^4 + y^4\right) - 4bxy\left(x^2 - y^2\right) + 6cx^2y^2 = 0$ represents two pairs of perpendicular lines. The two pairs will coincide if

A) $b^2 = a + 3ac$ B) $a^2 = b^2 - 3ac$ C) $a^2 + b^2 = 3ac$ D) $2b^2 = a^2 + 3ac$

SECTION – II
(MULTIPLE CORRECT CHOICE TYPE)

This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONE OR MORE is/ are correct

54. If the chord $y = mx + 1$ of the circle $x^2 + y^2 = 1$ subtends an angle measure 45^0 at the major segment of the circle, then the value of 'm' can be

A) 2 B) 1 C) -1 D) none of these

55. If $\left(\alpha, \alpha^2\right)$ lies inside the triangle formed by the lines

$2x + 3y - 1 = 0, x + 2y - 3 = 0, 5x - 6y - 1 = 0$ then

A) $2\alpha + 3\alpha^2 - 1 > 0$ B) $\alpha + 2\alpha^2 - 3 > 0$ C) $\alpha + 2\alpha^2 - 3 < 0$ D) $6\alpha^2 - 5\alpha + 1 > 0$

56. The sides of a triangle are the straight lines x+y=1, 7y=x and $\sqrt{3}y + x = 0$. Then which of the following is an interior point of the triangle?

A) Circumcenter B) Centroid C) Incenter D) Orthocenter

57. The distance of any point (x,y) from the origin is defined as $d = \max\{|x|, |y|,\}$ then the distance of the common point for the family of lines

$x(1+\lambda) + \lambda y + 2 + \lambda = 0\left(\lambda \ being \ \ parameter\right)$ from the origin is

A) 1 B) 2 C) $\sqrt{5}$ D) 0

SECTION – III
(COMPREHENSION TYPE)

This section contains 2 paragraphs. based upon one of the paragraphs 3 multiple choice questions based on the 3 multiple choice questions have to be answered. Each of these questions has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct.

Passage - 1

Let L be the line belonging to the family of straight lines

$(a+2b)x+(a-3b)y+a-8b=0, a, b \in R$ which is the farthest from the point (2, 2)

58. The equation of line L is

A) $x+4y+7=0$ B) $2x+3y+4=0$ C) $4x-y-6=0$ D) none of these

59. Area enclosed by the line L and the coordinate axes is

A) 4/3 sq. units B) 9/2 sq. units C) 49/8 sq. units D) none of these

Passage - 2

A(1, 3) and C $(-2/5, -2/5)$ are the vertices of a triangle ABC and the equation of the internal angle bisector of $\angle ABC$ is x+y=2

60. The equation of side BC is

A) 7x+3y-4=0 B) 7x+3y+4=0 C) 7x-3y+4=0 D) 7x-3y-4=0

61. The coordinates of vertex B are

A) $(3/10, 17/10)$ B) $(17/10, 3/10)$ C) $(-5/2, 9/2)$ D) (1,1)

62. The equation of side AB is

A) $3x+7y=24$ B) $3x+7y+24=0$ C) $13x+7y+8=0$ D) $13x-7y+8=0$

SECTION –IV
(INTEGER ANSWER TYPE)

This section contains 7 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9. The appropriate bubbles below the respective question numbers in the ORS have to be darkened.

63. In a plane there are two families of lines: $y = x + r, y = -x + r, where\ r \in \{0,1,2,3,4\}$ The Number of the squares of the diagonal of length 2 formed by these lines is

64. The straight lines $L \equiv x + y + 1 = 0\ and\ L_1 \equiv x + 2y + 3 = 0$ are intersecting, 'm' is the Slope of the straight line L_2 such that L is the bisector of the angle between $L_1\ and\ L_2$. The value of m^2 is

65. Let 'P' any point on x-y+3=0 and 'A" be fixed point (3,4). If the family of lines given by $(3\sec\theta + 5\cos ec\theta)x + (7\sec\theta - 3\cos ec\theta)y + 11(\sec\theta - \cos ec\theta) = 0$ are concurrent at B for all permissible values of $'\theta'$ and maximum of $1|PA - PB| = 2\sqrt{2n}\,(n \in N)$ then n=

66. If the point $P(\tan^2\theta, \tan\theta)$ lies in the region corresponding to the acute angle between the lines $2y = x\ and\ 4y = x, then \left[\frac{\tan\theta}{2}\right]$ is equal to (where [.] denotes greatest integer function)

67. The difference of the slopes of the lines represented by $x^2(\tan^2\theta + \cos^2\theta) + 2xy\tan\theta + y^2\sin^2\theta = 0$ is

68. If the area of the triangle formed by the lines $3x^2 - 2xy - 8y^2 = 0$ and the line $2x + y - k = 0$ is 5 sq. units. then '$|k|$' is

69. For all real values of a and b, lines $(2a+b)x + (a+3b)y + (b-3a) = 0\ and\ mx + 2y + 6 = 0$ are concurrent. Then $|m|$ is equal to

Master JEE CLASSES
Kukatpally, Hyderabad.

JEE-ADVANCE-2011-P1-Model
Max.Marks:240

KEY SHEET

CHEMISTRY

1	D	2	B	3	A	4	A	5	C	6	A
7	B	8	BCD	9	ABCD	10	CD	11	CD	12	B
13	A	14	B	15	B	16	A	17	7	18	0
19	5	20	3	21	4	22	3	23	2		

PHYSICS

24	B	25	B	26	D	27	A	28	A	29	C
30	C	31	ACD	32	ABC	33	ACD	34	BC	35	D
36	B	37	A	38	C	39	A	40	2	41	4
42	2	43	5	44	2	45	3	46	1		

MATHS

47	A	48	B	49	A	50	D	51	D	52	D
53	D	54	BC	55	ACD	56	BC	57	B	58	A
59	C	60	B	61	C	62	A	63	9	64	4
65	5	66	1	67	2	68	5	69	2		

SOLUTIONS

CHEMISTRY

1. rate constant increases exponentially with temperature.
2. For elementary reactions order is equal to molecularity.
3. Conceptual
4. ${}_0^1n \rightarrow {}_1^1H + {}_{-1}^0e + V \text{ or } \overline{V}$
5. ${}_{24}Cr^{53} + {}_2He^4 \rightarrow {}_0^1n + {}_{26}Fe^{56}$
6. ${}_{13}^{27}Al + {}_2^4\alpha \rightarrow {}_{14}^{30}Si + {}_1^1H\left(X\right)$

   ${}_{13}^{27}Al + {}_2^4\alpha \rightarrow {}_{15}^{30}P + {}_0^1n\left(Y\right)$

   ${}_{15}^{30}P \rightarrow {}_{14}^{30}Si + {}_{+1}^0e\left(Z\right)$

9. $+\frac{1}{4}\frac{d\left(NO_2\right)}{dt} = +\frac{1}{6}\frac{d\left(H_2O\right)}{dt}$
11. $\frac{\left[B\right]}{\left[C\right]} = \frac{3K_1}{8K_1} = \frac{3}{8} = \alpha; \frac{\left[C\right]}{\left[D\right]} = \frac{8K_1}{7.5K_1} = \frac{8}{7.5}$

12 & 13. $\frac{df}{dt} = k\left(1-f\right)$

$$\frac{df}{\left(1-f\right)} = kdt$$

On integration

$$-\ln\left(1-f\right) = kt + c$$

But C =0

$$k = -\frac{2.303}{t}\log\left(1-f\right)$$

$$k = \frac{-2.303}{200} \times -3$$

$$= \frac{2.303 \times 3}{200}$$

At half life

$$\frac{-2.303\times 3}{200} = -\frac{2.303}{t_{1/2}}\log\left(1-\frac{T}{2T}\right)$$

$$-\frac{3}{200} = \frac{1}{t_{1/2}}\log\frac{1}{2}$$

$$t_{1/2} = 46.2 hrs$$

14.

$$\Delta M \times 931.5 = kE_1 + kE_2$$

15. $\Delta m = (20\times 1.0087 + 17\times 1.0078)u; \overline{B.E} = \frac{37.3066 - 36.9659}{37} = 8.58 MeV$

16. $T_1 - T_2 = \frac{1}{\lambda}\ln\frac{C_1}{C_2}$

17. weight of C^{14} = $70\times\frac{18}{100}\times\frac{1.56\times 10^{-10}}{100} = 1.9656\times 10^{-11} kg$

Number of C^{14} atoms = $\frac{1.9656\times 10^{-11}\times 10^3}{14}\times 6.023\times 10^{23}$

$= 8.54\times 10^{14}$

Activity= $\lambda N = \frac{0.693}{5570\times 365\times 24\times 60}\times 8.54\times 10^{14}$

$= 2\times 10^5$ disintegrations/ min

18. $\frac{d(B)}{dt} = 2(B) + 1(B) - 3(B) = 2\times 1 + 1\times 1 - 3\times 1 = 0$

19.

$A \rightarrow 3B$

$At\ t = 0 \quad a \quad 0$

$At\ t = t \quad a - x \quad 3x$

$At\ time\ t,\ (a-x) = 3x$

$a = 4x$

$k = \frac{2.303}{t}\log\frac{4x}{3x} \Rightarrow \frac{0.693}{t_{1/2}} = \frac{2.303}{t}\log\frac{4}{3}$

$t_{1/2} = 4.82$ min

20. $no.\ of\ \alpha = 4 \quad A = 238 - 16 = 222$

$no.\ of\ \beta = 6 \quad Z = 92 - 2 = 90$

$_{90}Th^{232}$ *belongs* 3^{rd} *group*

21. i, ii,iii,iv,v are correct statements

22. $f = e^{-Ea/RT} = \frac{10^{-3}}{100} = 10^{-5}$

$K = A.e^{-Ea/RT}$

$3\times10^{-3} = A.10^{-5}$

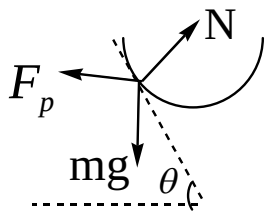
$A = \frac{3\times10^{-3}}{10^{-5}} = 300\,\text{min}^{-1}$

23. No. of half lives (h) = $\frac{100}{20} = 5$

$$A = \lambda N = \lambda \frac{No}{2^n} = \frac{6400}{2^5} = 200$$

PHYSICS

24.



$N\cos\theta = mg$

$N\sin\theta = mr\omega^2$

$\tan\theta = \frac{r\omega^2}{g}$

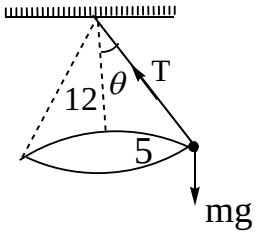
$\frac{dy}{dx} = \frac{r\omega^2}{g}$

$\omega = \sqrt{\frac{2g}{c}}$

25. $m, r\omega^2 = m_2 g$

26. $T = \int_{r=\frac{2}{2}}^{2} d\, mr\omega^2$

27.



$T\cos\theta = mg$

$T\sin\theta = mr\omega^2$

Time taken $= \dfrac{2\pi}{\omega}$

28. $a = r\omega^2 = x\omega^2 = \upsilon\dfrac{d\upsilon}{dx}$

29. $\tan\theta = \dfrac{g}{a} = \dfrac{gr}{\upsilon^2}$

30. $N = mr\omega^2$ & $mg\sin\theta - f = ma_t$

$\therefore f = mg\sin\theta = 5N$

31. $\bar{S}_{rel} = a\sin 2t\hat{i} + a\cos 2t\hat{j}$

$\bar{a} \perp \bar{v}$

32. $T + f = mr\,\omega^2$

$T = 0 \Rightarrow f = mr\omega^2 \le \mu mg$

33. $w = \dfrac{v_\perp}{r}$

34. $N\cos\theta = mg$

$N\sin\theta = \dfrac{m\upsilon^2}{r}$

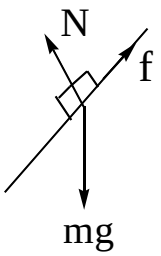
35-37. $N_1 = mg$ & $N_2 = ma_t = mr\alpha$

$N = \sqrt{N_1^2 + N_2^2}$

For $t < t_0$, $f = mr\omega^2 = mr(\alpha t)^2$

At $t = t_0 = f = \mu N$

38-39.



$$N\sin\theta \mp f\cos\theta = \frac{m\upsilon^2}{r}$$

$$N\cos\theta \pm f\sin\theta = mg$$

40. $R\alpha = R\omega^2, \omega = \alpha t$

41. $T = mr\omega^2 / 2\pi$

42. $N = ma_t = mr\alpha$

$$f = mr\omega^2$$

$$t = \sqrt{\frac{\mu}{\alpha}}$$

43. $N = mr\omega^2$

$$f = \mu N$$

$$f = \mu mr\omega^2 = -mr\alpha$$

$$\frac{d\omega}{dt} = -\mu\omega^2$$

$$\int \frac{d\omega}{\omega^2} = \int -\mu dt$$

44. $a = \sqrt{a_t^{\,2} + a_r^{\,2}}$

45. $R = \frac{\upsilon^2}{a_N} = \frac{m\upsilon^2}{F\sin\theta}$

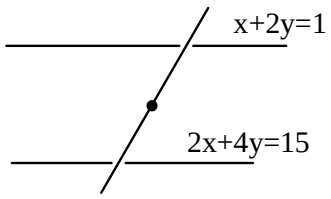
46. path followed is helix, with its axis along x-axis. X-coordinate = pitch = $\upsilon\,\upsilon\cos 60^0.t$

=1

MATHS

47. Let P be on x+2y-1, then

$$1+\frac{t}{\sqrt{2}}+2\left(2+\frac{t}{\sqrt{2}}\right)-1$$



Let P be on 2x+4y=15, then

$$2\left(1+\frac{t}{\sqrt{2}}\right)+4\left(2+\frac{t}{\sqrt{2}}\right)-15$$

Since the point lies between the lines and x=t, $t \in \left(\frac{-4\sqrt{2}}{3}, \frac{5\sqrt{2}}{3} \right)$

48. If the given lines are concurrent, then $\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix} = 0$

Applying $C_2 \to C_2 - C_1 \; and \; C_3 \to C_1$)

$or \; a(b-1)(c-1)-(c-1)(1-a)-(b-1)(1-a)=0$

Dividing by $(1-a)(1-b)(1-c)$

Adding 1 on both sides we get $\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}=1$

49. The three lines are concurrent if $\begin{vmatrix} 1 & 2 & -9 \\ 3 & 5 & -5 \\ a & b & -1 \end{vmatrix} = 0$ or 35a-22b+1=0

Which is true if the line 35x-22y+1=0 passes through (a, b)

50. The family of lines $(x-2y+3)+\lambda(2x-3y+4)=0$ is concurrent at point P(1,2)

If the images of point A(2, 3) in the above variable lines is B(h, k), then

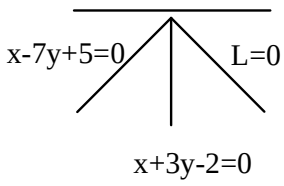
AP=BP

Or $(h-1)^2+(k-2)^2=(2-1)^2+(3-2)^2$

51. The family of line through the given lines is $L \equiv x-7y+5+\lambda(x+3y-2)=0$

For line L=0 n the diagram , the distance of any point say $(2,0)$ on the line x+3y-2=0 from the line x-7y+5=0 and line L=0 must be the same, therefore

$$\left| \frac{2+5}{\sqrt{50}} \right| = \left| \frac{2+2\lambda+5-2\lambda}{\sqrt{(1+\lambda)^2+(3\lambda-7)^2}} \right|$$



Or $10\lambda^2-40\lambda=0$

i.e $\lambda = 4 \; or \; 0$

Hence, $L=0, \lambda=4$

Therefore,the required line is 5x+5y-3=0

52. Use angular bisector formulae

53. Conceptual

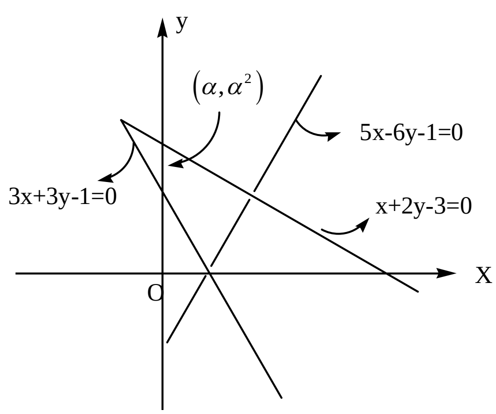
54. The chord subtends 90^0 at the center $(0,0)$. Making $x^2+y^2=1$ homogeneous in The second degree with help of y-mx+1, we get

$$x^2+y^2=(y-mx)^2$$

Or $(1-m^2)x^2+2mxy=0$

The angle between these lines is 90^0 if $1-m^2+0=0$ i.e $m=\pm 1$

55.



O and the point (α,α^2) lie on the opposite sides with respect to 2x+3y-1=0 Hence,

$2\alpha+3\alpha^2-1>0$ …………………………..(i)

O and the point (α,α^2) lie on the same side with respect to x+2y-3=0, Hence

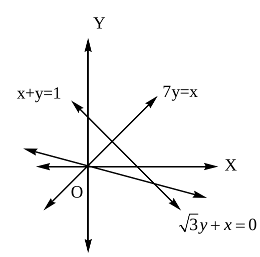
$\alpha+2\alpha^2-3<0$.....................(2)

Again O and the point (α,α^2) lie on the same side with respect to 5x-6y-1=0

Hence

$5\alpha-6\alpha^2-1<0$ *or* $6\alpha^2+5\alpha+1>0$

56. Clearly from the figure, the triangle is obtuse –angled. Hence the centroid and incenter lie inside thetriangle. The orthocenter and circumcenter lie outside the triangle Therefore, it is an obtuse-angled triangle



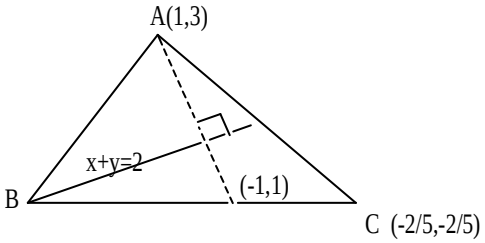
57. Conceptual

58. Given lines (x+y+1) +b (2x-3y-8) -0 are concurrent at the

Point of intersection of the lines x+y+1=0 and 2x-3y-8=0 which is (1, -2) Now, the line through A (1 , -2) which is farthest from the point B(2, 2) is perpendicular to AB. Now , the slope of AB is 4. Then the required line is y+2= -(1/4)(x-1) or x+4y+7=0

59. Also, the line x+4y+7 =0 meets the axes at C (-7,0) and D(0, -7/4). Then the area of triangle COD is (1/2) | (07) (-7/4)| or 49/8

60. The image of A(1, 3) in line x+y=2 is (1-2(2) /2,3 -2(2)/2=(-1,1)
So line BC passes through (-1,1) and (-2/5, -2/5) The equation of line BC is



Or $7x+3y+4=0$

61. Vertex B is the point of intersection of 7x+3y+4=0 and x+y=2, ie $B \equiv \left(-5/2, \frac{9}{2}\right)$

62. Line AB is $y-3=\frac{3-9/2}{1+5/2}(x-1)$ or 3x+7y=24

63. Each family has parallel lines having the distance between them as $\frac{1}{\sqrt{2}}$ unit. Both the familiesare perpendicular to each other. So, to form a square of diagnomal 2 units, lines of alternate pair to be chosen. Both the families have three such pairs. So, the number of squares possible is 3 x3 =9

66. position of a point with respect to align

67. Use the formula $|m_1 - m_2| = \frac{2\sqrt{h^2-ab}}{|b|}$

68. Conceptual

69. Conceptual