FIITJEE INTERNAL TEST

SECOND YEAR 2018-20

JEE MAINS

REVISION-2 PART TEST - 4

Time: 3 hours **Maximum Marks: 300**

INSTRUCTIONS: **10th May 2020**

Instructions to the Candidates

A. General

1. This booklet is your Question Paper containing 75 questions.
2. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
3. Fill in the boxes provided for Name and Enrolment No.
4. The answer sheet, a machine-readable Objective Response (ORS), is provided separately.
5. DO NOT TAMPER WITH / MULTILATE THE ORS OR THE BOOKLET.

B. Filling in the OMR:

6. The instructions for the OMR sheet are given on the OMR itself.

C. Question paper format:

7. The question paper consists of **3 parts (Mathematics, Physics and Chemistry)**. Each part consists of **two sections**.
8. **Section I** contains **20 Multiple Choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE** is correct.
9. **Section II** contains **5 questions**. Each question is numerical value. For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to second decimal place.

   (e.g. 6.25, 7.00, - 0.33, - .30, 30.27, - 127.30)
10. **Q.No. 21-25, 46-50, 71-75** are Numerical based questions with answer is of the type xxxx.xx. Suppose your answer is 25.3 (example-1) you need to write answer as 0025.30, if your answer is only 1 (example-2) then you have bubble like 0001.00 and bubble accordingly including zero's and dot.

D. Marking Scheme

11. For each question in **Section I**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **–1 negative marks** will be awarded for incorrect answers in this section.
12. For each question in **Section II**, you will be awarded **4 marks** if you darken the bubble corresponding to the correct answer **ONLY.** In all other cases **zero (0) marks** will be awarded. **No negative marks** will be awarded for incorrect answers in this section.

Don't write / mark your answers in this question booklet.

If you mark the answers in question booklet, you will not be allowed to continue the exam.

NAME: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐☐☐

MATHEMATICS

Single Correct Answer Type

1. The horizontal asymptotes of the graph of $f(x)=\dfrac{x^3-2}{|x|^3+1}$

(A) $x=\pm1$ (B) $y=\pm1$ (C) $x=\pm2$ (D) $y=\pm2$

2. $\lim\limits_{x\to0^+} x\left[\dfrac{1}{x}\right]=$ (Here $[.]$ stands for greatest integer)

(A) 0 (B) 1 (C) – 1 (D) does not exist

3. The oblique asymptote of the graph of $f(x)=\dfrac{x^2-3}{2x-4}$ is

(A) $y=\dfrac{x}{2}+1$ (B) $y=\dfrac{x}{2}$ (C) $y=\dfrac{1}{2x-4}$ (D) $y=2x-4$

4. Let $f:R\to R$ be given by $f(x+y)=f(x)-f(y)+2xy+1$ for all $x,y\in R$.
If $f(x)$ is everywhere differentiable and $f'(0)=1$, then $f'(x)=$

(A) $2x+1$ (B) $2x-1$ (C) $x+1$ (D) $x-1$

5. If $f:R\to R$ is defined by

$$f(x)=\begin{cases}\dfrac{\cos3x-\cos x}{x^2}, & x\neq0\\ \lambda, & x=0\end{cases}$$

and if f is continuous at $x=0$, then λ is equal to

(A) -8 (B) -6 (C) -4 (D) -2

6. The range of the function $f(x)=\dfrac{x}{1+x^2}$ is

(A) $\left[0,\dfrac{1}{2}\right]$ (B) $\left[-\dfrac{1}{2},\dfrac{1}{2}\right]$ (C) $\left[-\dfrac{1}{2},0\right]$ (D) None of these

7. The domain of the function $f(x)=\dfrac{1}{x}+2^{\sin^{-1}x}+\dfrac{1}{\sqrt{x-2}}$ is

(A) $[-1,1]$ (B) $R-\{0\}$ (C) $[-1,0)\cup(0,1]$ (D) $\phi(\text{Null set})$

8. If the function $f:R\to A$ given by $f(x)=\dfrac{x^2}{x^2+1}$ is a surjection, then A =

(A) R (B) $[0,1]$ (C) $(0,1]$ (D) $[0,1)$

9. If two rods of length a and b slide along the coordinate axes, which are rectangular in such a way that their ends are always concyclic; then the locus of the centre of the circle passing through these ends is the curve

(A) $4(x^2+y^2)=a^2+b^2$ (B) $4(x^2+y^2)=a^2-b^2$

(C) $4(x^2-y^2)=a^2-b^2$ (D) $x^2-y^2=4(a^2-b^2)$

10. If $\dfrac{x}{\alpha}+\dfrac{y}{\beta}=1$ touches the circle $x^2+y^2=a^2$, then point $\left(\dfrac{1}{\alpha},\dfrac{1}{\beta}\right)$ lies on

(A) a straight line (B) a circle (C) a parabola (D) an ellipse

11. If an equilateral triangle is inscribed in the circle $x^2+y^2=a^2$, the length of its each side is

(A) $\sqrt{2}a$ (B) $\frac{\sqrt{3}}{2}a$ (C) $\sqrt{3}a$ (D) a

12. If the area of the circle $4x^2+4y^2-8x+16y+k=0$ is 9π square units, then the value of k is

(A) 4 (B) 10 (C) –16 (D) None of these

13. The equation $16x^2+y^2+8xy-74x-78y+212=0$ represents

(A) a circle (B) a parabola (C) an ellipse (D) a hyperbola

14. The equation of the parabola whose focus in the point $(0,0)$ and the tangent at the vertex is $x-y+1=0$

(A) $x^2+y^2-2xy-4x+4y-4=0$ (B) $x^2+y^2-2xy+4x-4y-4=0$

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

15. If three distinct normals are drawn from $(2k,0)$ to the parabola $y^2=4x$ such that one them is x-axis and the other two are perpendicular, then k =

(A) 1 (B) 1/2 (C) 3/2 (D) – 1

16. Two tangents are drawn from the point $(-2,-1)$ to the parabola $y^2=4x$. If α is the angle between these tangents, then $\tan\alpha=$

(A) 3 (B) 1/3 (C) 2 (D) 1/2

17. The number of values of c such that the straight line $y=4x+c$ touches the curve $\frac{x^2}{4}+y^2=1$ is

(A) 0 (B) 1 (C) 2 (D) 3

18. In an ellipse, the distance between its foci is 6 and minor axis is 8. The eccentricity is

(A) 1/2 (B) 4/5 (C) 3/4 (D) 3/5

19. The eccentricity of the hyperbola $9x^2-16y^2+72x-32y-16=0$ is

(A) 5/4 (B) 4/5 (C) 9/16 (D) 16/9

20. The equation of the hyperbola with vertices $(3,0)$ and $(-3,0)$ and semi-latusrectum 4 is given by

(A) $4x^2-3y^2+36=0$ (B) $4x^2-3y^2+12=0$ (C) $4x^2-3y^2-36=0$ (D) None of these

Numerical Based

21. The eccentricy of the conjugate hyperbola of the hyperbola $x^2-3y^2=1$ is

22. The number of integral values of λ for which the equation $x^2+y^2-2\lambda x+2\lambda y+14=0$ represents a circle whose radius cannot exceed 6 is

23. The number of points in $(1,3)$, where $f(x)=a^{\left[x^2\right]}$, a > 1 is not differentiable is ($[.]$ indicates greatest integer)

24. Let $f(x)=\left[x^3-3\right]$, where $[.]$ denotes the greatest integer function. Then the number of points in the interval $(1,2)$ where the function is discontinuous is

25. If a periodic function $f(x)$ satisfies the equation $f(x+1)+f(x-1)=\sqrt{3}\ f(x)$ for all $x\in R$, then the period of $f(x)$ is

PHYSICS

Single Correct Answer Type

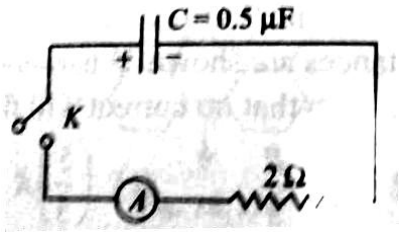
26. A conductor of area of cross section A having charge carriers, each having a charge q is subjected to a potential V. The number density of charge carriers in the conductor is n and the chare carrier (along with their random motion) are moving with a velocity v. If σ is the conductivity of the conductor and τ is the average relaxation time, then

(A) $\tau = \frac{m}{nq^2\sigma}$ (B) $\tau = \frac{m\sigma}{nq^2}$ (C) $\tau = \frac{2m\sigma}{nq^2}$ (D) $\tau = \frac{1}{2}\frac{m\sigma}{nq^2}$

27. A wire of length L and three identical cells of negligible internal resistances are connected in series. Due to the current, the temperature of the wire is raised by ΔT in a time t. A number N of similar cells is now connected in series with a wire of the same material and cross section but of length 2L. The temperature of the wire is raised by the same amount ΔT in the same time t. The value of N is

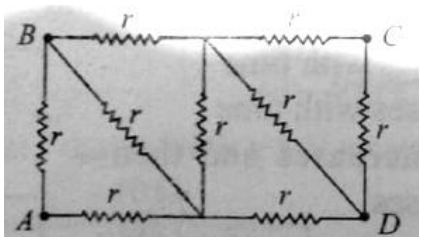
(A) 4 (B) 6 (C) 8 (D) 9

28. A charged capacitor is allowed to discharge through a resistor by closing the key at the instant $t = 0$. At the instant $t = (\ln 4)\mu s$, the reading of the ammeter falls half the initial value. The resistance of the ammeter is equal to



(A) $1\,M\Omega$ (B) $1\,\Omega$ (C) $2\,\Omega$ (D) $2\,M\Omega$

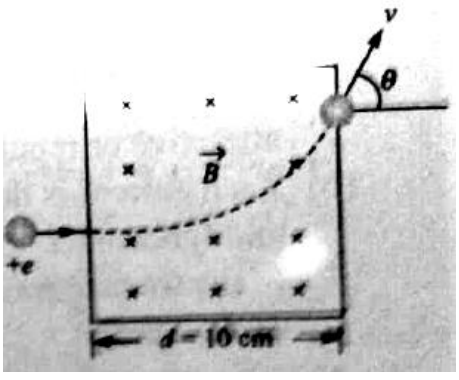
29. For the circuit shown in figure, the equivalent resistance between A and C is



(A) $\frac{12}{11}r$ (B) $\frac{13}{11}r$

(C) $\frac{14}{11}r$ (D) $\frac{15}{11}r$

30. A proton accelerated by a potential difference 500 kV moves though a transverse magnetic field of 0.51 T as shown in figure. The angle θ through which the proton deviates from the initial direction of its motion is



(A) 15°

(B) 30°

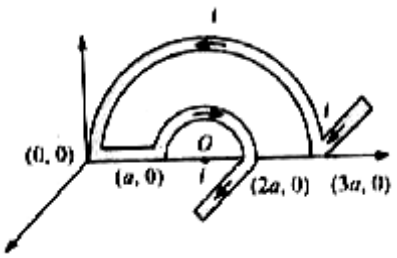
(C) 45°

(D) 60°

31. A coil having N turns is wound tightly in the form of a spiral with inner and outer radii a and b respectively. When a current I passes through the coil, the magnetic field at the centre is

(A) $\frac{\mu_0 NI}{b}$ (B) $\frac{2\mu_0 NI}{a}$ (C) $\frac{\mu_0 NI}{2(b-a)}\ln\frac{b}{a}$ (D) $\frac{\mu_0 I^N}{2(b-a)}\ln\frac{b}{a}$

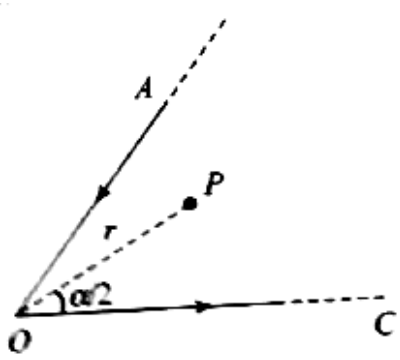
32. In the given figure, the net magnetic field at O will be



(A) $\frac{2\mu_0 i}{3\pi a}\sqrt{4-\pi^2}$ (B) $\frac{\mu_0 i}{3\pi a}\sqrt{4+\pi^2}$

(C) $\frac{2\mu_0 i}{3\pi a^2}\sqrt{4+\pi^2}$ (D) $\frac{2\mu_0 i}{3\pi a}\sqrt{\left(4-\pi^2\right)}$

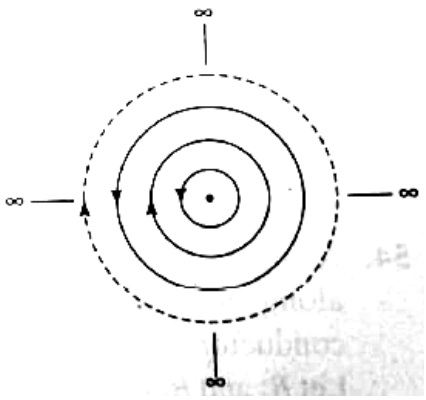
33. Two wires AO and OC carry equal currents i as shown in figure. One end of both the wires extends to infinity. Angle AOC is α. The magnitude of magnetic field at point P on the bisector of these two wires at a distance r from point O is



(A) $\frac{\mu_0}{2\pi}\frac{i}{r}\cot\left(\frac{\alpha}{2}\right)$ (B) $\frac{\mu_0}{4\pi}\frac{i}{r}\cot\left(\frac{\alpha}{2}\right)$

(C) $\frac{\mu_0}{2\pi}\frac{i}{r}\frac{\left(1+\cos\frac{\alpha}{2}\right)}{\sin\left(\frac{\alpha}{2}\right)}$ (D) $\frac{\mu_0}{4\pi}\frac{i}{r}\left(\frac{\alpha}{2}\right)$

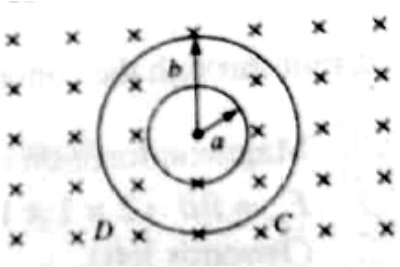
34. In figure, infinite conducting rings each having current i in the direction shown are placed concentrically in the same plane as shown in the figure. The radii of rings are $r, 2r, 2^2r, 2^3r..., \infty$. The magnetic field at the center of rings will be



(A) zero (B) $\frac{\mu_0 i}{r}$

(C) $\frac{\mu_0 i}{2r}$ (D) $\frac{\mu_0 i}{3r}$

35. Plane figure made of thin wires of resistance $R = 50$ milliohm/metre are located in a uniform magnetic field perpendicular into the plane of the figure and which decrease at the rate $dB/dt = 0.1\,mT/s$. Then currents in the inner and outer boundary are. (The inner radius $a = 10cm$ and outer radius $b = 20cm$)



(A) $10^{-4}\,A(\text{clockwise}),\ 2\times10^{-4}\,A(\text{clockwise})$ (B)

$10^{-4}\,A(\text{anticlockwise}),\ 2\times10^{-4}\,A(\text{clockwise})$

(C) $2\times10^{-4}\,A(\text{clockwise}),\ 10^{-4}\,A(\text{anticlockwise})$

(D) $2\times10^{-4}\,A(\text{anticlockwise}),\ 10^{-4}\,A(\text{anticlockwise})$

36. A small square loop of wire of side ℓ placed inside a large square loop of wire of side L $(L > \ell)$. The loop are coplanar and their centre coincide. The mutual inductance of the system is proportional to

(A) $\frac{\ell}{L}$ (B) $\frac{\ell^2}{L}$ (C) $\frac{L}{\ell}$ (D) $\frac{L^2}{\ell}$

37. A coil of wire having finite inductance and resistance has a conducting ring placed coaxially within it. The coil is connected to a battery at time $t = 0$, so that a time dependent current $I_1(t)$ starts flowing through the coil. If $I_2(t)$ is the current induced in the ring and $B(t)$ is the magnetic field at the axis of the coil due to $I_1(t)$, then as a function of time $(t > 0)$, the product $I_2(t)\ B(t)$

(A) increases with time (B) decreases with time
(C) does not vary with time (D) passes through a maximum

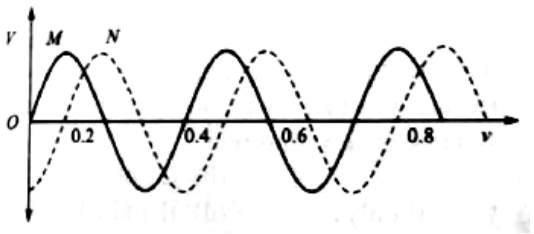
38. $\frac{2.5}{\pi}\mu F$ capacitor and 3000-ohm resistance are joined in series to an ac source of 200 volt and 50 sec^{-1} frequency. The power factor of the circuit and the power dissipated in it will respectively

(A) 0.6, 0.06 W (B) 0.06, 0.6 W (C) 0.6, 4.8 W (D) 4.8, 0.6 W

39. For a series RLC circuit $R = X_L = 2X_C$. The impedance of the circuit and phase difference (between) V and i will be

(A) $\frac{\sqrt{5}R}{2}, \tan^{-1}(2)$ (B) $\frac{\sqrt{5}R}{2}, \tan^{-1}\left(\frac{1}{2}\right)$ (C) $\sqrt{5}X_C, \tan^{-1}(2)$ (D) $\sqrt{5}R, \tan^{-1}\left(\frac{1}{2}\right)$

40. Two sinusoidal voltages of the same frequency are shown in the diagram. What is the frequency, and the phase relationship between the voltages

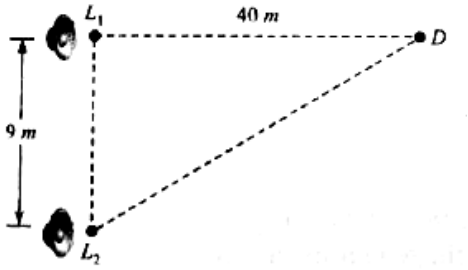


Frequency in Hz Phase lead of N over M in radians
(A) 0.4 $-\pi/4$
(B) 2.5 $-\pi/2$
(C) 2.5 $+\pi/2$
(D) 2.5 $-\pi/4$

41. The equation $y = A\cos^2\left(2\pi nt - 2\pi\frac{x}{\lambda}\right)$ represents a wave with

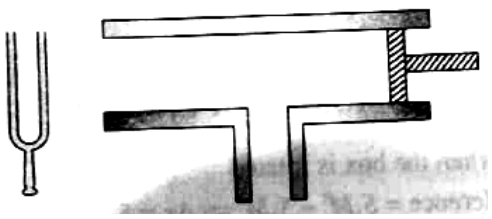
(A) Amplitude A/2, frequency 2n and wavelength $\lambda/2$
(B) Amplitude A/2, frequency 2n and wavelength λ
(C) Amplitude A, frequency 2n and wavelength 2λ
(D) Amplitude A, frequency n and wavelength λ

42. Two loudspeakers L_1 and L_2 driven by a common oscillator and amplifier, are arranged as shown. The frequency of the oscillator is gradually increased from zero and the detector at D records a series of maxima and minima. If the speed of sound is 330 ms^{-1} then the frequency at which the first maximum is observed is



(A) 165 Hz (B) 330 Hz
(C) 496 Hz (D) 660 Hz

43. Vibrating tuning fork of frequency n is placed near the open end of a long cylindrical tube. The tube has a side opening and is fitted with a movable reflecting piston. As the piston is moved through 8.75 cm, the intensity of sound changes from a maximum to minimum. If the speed of sound is 350 m/s. Then n is



(A) 500 Hz (B) 1000 Hz
(C) 2000 Hz (D) 4000 Hz

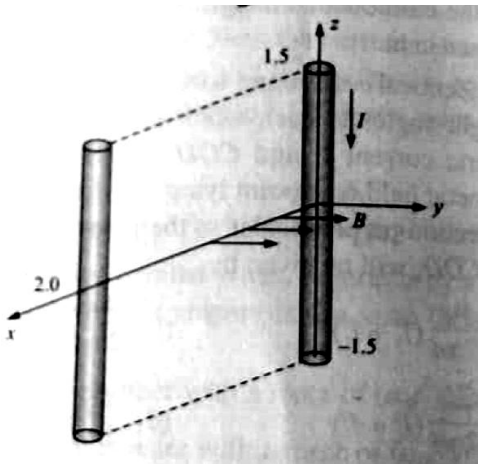
44. An organ pipe is closed at one end has fundamental frequency of 1500 Hz. The maximum number of overtones generated by this pipe which a normal person can hear is:
(A) 14 (B) 13 (C) 6 (D) 9

45. The difference between the apparent frequency of a source of sound as perceived by an observer during its approach and recession is 2% of the natural frequency of the source. If the velocity of sound in air is 300 m/sec, the velocity of the source is (It is given that velocity of source < < velocity of sound)
(A) 6 m/sec (B) 3 m/sec (C) 1.5 m/sec (D) 12 m/sec

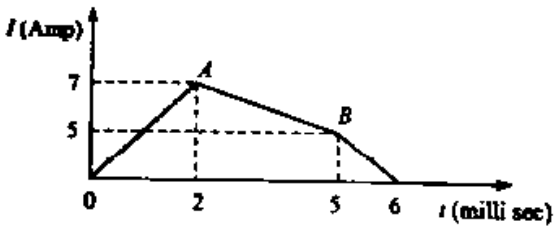
Numerical Based

46. It is desired to send a current of 8 A through a circuit whose resistance is $5\,\Omega$. Find the least number of cells which must be used for this purpose. The emf of each cell is 2 V and the internal resistance is $0.5\,\Omega$.

47. A conductor lies along the z-axis at $-1.5 \le z \le 1.5$ m and carries a fixed current of 10.0 A in $-\hat{a}_z$ direction. For a field $\vec{B} = 3.0\times10^{-4}\, e^{-0.2x}\, a_y T$, find the power required to move the conductor at constant speed to $x = 2.0$ m, $y = 0$ m in 5×10^{-3} s. Assume parallel motion along the x-axis (in W)

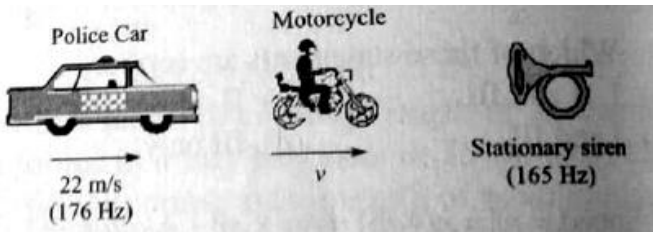


48. The current through a 4.6 H inductor is shown in the following graph. The induced emf during the time interval t = 5 milli-sec to 6 milli-sec will be ___ $\times10^3$ V



49. Two cars are moving on two perpendicular roads towards a crossing with uniform speeds of 72 km/hr and 36 km/hr. If first car blows horn of frequency 280 Hz, then the frequency of horn heard by the driver of second car when line joining the cards make 45° angle with the roads; will be (in Hz)

50. A police car moving at 22 m/s, chases a motorcyclist. The police man sounds his horn at 176 Hz, while both of them move towards a stationary siren of frequency 165 Hz. Calculate the speed of the motorcycle, if it is given that he does not observes any beats (in m/s)

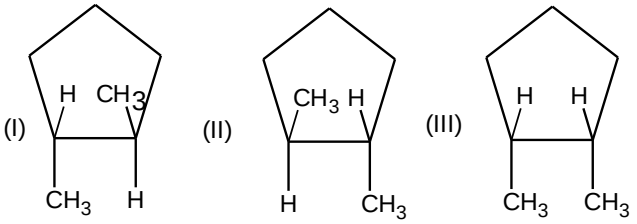


CHEMISTRY

Single Correct Answer Type:

51. Which one of the following is expected to have minimum boiling point?
(A) n-butane (B) n–pentane (C) 2-Methylbutane (D) 2,2-Dimethylpropane

52 1,2-dimethyl cylcopentane can be represented as I, II and III.



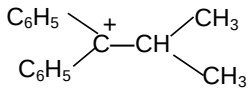
Which of these structures are enantiomers?
(A) I and II (B) I and III (C) II and III (D) I, II and III

53. $C_3H_8 + Cl_2 \xrightarrow{light} C_3H_7Cl + HCl$ is an example of
(A) Substitution (B) Elimination (C) Addition (D) Rearrangement reaction

54. 2-Methyl butane on reacting with Br_2 in presence of sunlight mainly gives:
(A) $CH_3–CH(CH_3)–CH_2–CH_2–Br$ (B) $(CH_3)_2–C(Br)–CH_2–CH_3$
(C) $(CH_3)_2–CH–CH(Br)–CH_3$ (D) $CH_3–CH(C_2H_5)–CH_2(Br)$

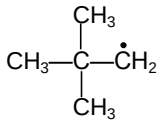
55. Which of the carbocations given below will undergo rearrangement by hydride shift?

(A) $C_6H_5 - \overset{(+)}{C}H - CH_2 - CH_3$ (B) $CH_3 - \overset{(+)}{C}H - CH_3$

(C)  (D) $CH_3 - CH_2 - CH_2 - \overset{(+)}{C}H_2$

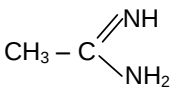
56. Which of the following carbon free radical is the most stable?
(A) Allyl carbon free radical (B) Benzyl carbon free radical
(C) Methyl free radical (D) Secondary carbon free radical

57. The number of hyperconjugable hydrogen atom in this species is



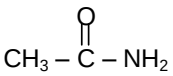
(A) Zero (B) Nine (C) Two (D) Four

58. The correct order of basicities of the following compounds is

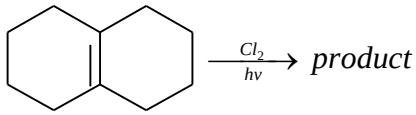

1

$CH_3 – CH_2 – NH_2$
2

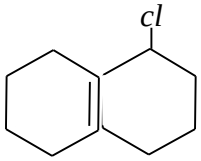
$(CH_3)_2NH$
3

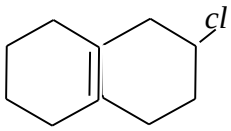

4

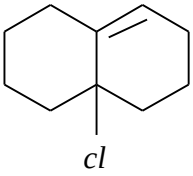
(A) 2 > 1 > 3 > 4 (B) 1 > 3 > 2 > 4 (C) 3 > 1 > 2 > 4 (D) 1 > 2 > 3 > 4

59. 

The major product of mono hdogenation is

(A) 

(B) 

(C) 

(D) None of these

60. An alkyne $\left(M.F-C_6H_{10}\right)$ gives same compound with Lindlar's catalyst (H_2 / pd- $BaSO_4$, xylene) & Na/ $liq\,NH_3$ (Birch reduction)The alkyne on hydrogenation with H_2/pt gives an alkane which can give 3 different types monohalogenation product.

The alkyne on acidic hydrolysis gives 'B' which on treatment with Grignard reagent $\left(CH_3MgBr\right)$ followed by aq. NH_4Cl gives 'C'

'C' on E_2 elimination gives an alkene which on treatment with hot alkaline $KMnO_4$ produces CO_2 gas as a product. Theretere 'A' can be

(A) $CH_3-CH_2-CH_2-CH_2-C\equiv CH$

(B) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-C\equiv CH$

(C) $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-C\equiv CH$

(D) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-C\equiv CH$

61. K_{sp} of SrF_2 (s) in water is 3.2×10^{-11}. The solubility of SrF_2 (s) in 0.1 (M) NaCl solution is -
(A) 3.2×10^{-9} (M) (B) 2×10^{-4} (M)
(C) 4×10^{-4} (M) (D) slightly higher than 2×10^{-4} (M)

62. What is the minimum pH required to prevent the precipitation of ZnS in a solution that is 0.01 M $ZnCl_2$ and saturated with 0.10 M H_2S ? [Given $K_{sp} = 10^{-21}$, $K_{a_1}\times K_{a_2} = 10^{-20}$]
(A) 0 (B) 1 (C) 2 (D) 4

63. If equal volumes of HCl and ammonium hydroxide solutions of equal concentration are mixed, pH of resulting solution will be -
(A) 7 (B) Less than 7 (C) More than 7 (D) Not predictable

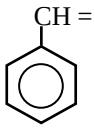
64. Which acid is produced in human stomach ?
(A) CH_3COOH (B) HCl (C) HNO_3 (D) H_2SO_4

65. Which of the following solvent will dissolve an ionic compound
(A) Benzene (B) Cyclohexane (C) Water (D) Ether

66. The electrophile involved in chlorination of benzene is
(A) chloride ion (B) Chloronium ion (C) Nitronium ion (D) None of the above

67. Benzene reacts with fuming sulphuric acid to give
(A) Sodium benzene sulphonate (B) Benzene sulphonic acid
(C) Sodium benzoate (D) All the above

68. Benzene reacts with benzoyl chloride to form–
(A) benzophenone (B) Acetophenone (C) Benzylchloride (D) Maleic anhydride

69. $Y - C_6H_5 \xrightleftharpoons{KMnO_4}$ 

$\xrightarrow{\text{ozonolysis}} C_6H_5 - X$

Functional groups Y, $-CH = CH_2$ and X respectively are ... and ... directing.
(A) Meta, ortho–para and ortho–para (B) Meta, meta and meta
(C) Meta, ortho–para and meta (D) All the three ortho–para

70. Toluene may be prepared by
(A) Friedel Craft's reaction (B) Wurtz–fitting reaction
(C) Methyl lithium (D) All of the above

Numerical Based:

71. How many of the following reactions goes by free radical mechanisings.

Wurtz reaction, kolbe's electrolysis of fatty acids, Decarboxylation of salts of fatty acids, Halogenation of alkanes,

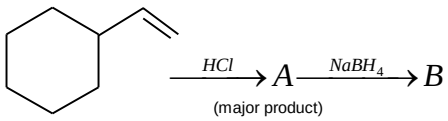
Treatment of an alkene with NBS

Treatment of an alkene with SO_2Cl_2

Treatment of an alkene with HBr in presence of peroxide corey house synthenis, cope's Elimination

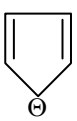
72. The no. of moles of gaseous product obtained by electrolysis of $HCOONa$ is_____

73. In the reaction



The no. of monohalogenated product that can be obtained from B is

74. How much water in ml must be added to 300 ml of 0.2 M solution of CH_3COOH ($K_a = 1.8 \times 10^{-5}$) for the degree of ionisation (α) of the acid to double

75. How many total equivalent resonating structure of  can be drawn (including this) (due to aromaticity)?