

**JEE MAIN-2024-25 (Part Test-3)**  
**(Physics, Chemistry and Mathematics)**

**SYLLABUS**

Physics :- EMI, AC, EMW

Chemistry :- p-Block Elements D & F Block, Coordination compound

Mathematics :- Indefinite Integration, Definite Integration, AUC

3

PART TEST

**CLASS-XII<sup>th</sup>**

Date :- .....

Time :- 3:00 Hrs.

Marks :- 300

**Important Instructions :**

1. The test duration is of **3 hours**.
2. The Test Booklet consists of 90 questions. The maximum marks are 300.
3. There are **three** parts in the question paper consisting of **Physics, Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each part (subject) has two sections.
  - (i) **Section-A:** This section contains 20 multiple choice questions which have only one correct answer. Each question carries **4 marks** for correct answer and **-1 mark** for wrong answer.
  - (ii) **Section-B:** This section contains 10 questions. In Section-B, attempt any **five questions out of 10**. The answer to each of the questions is a numerical value. Each question carries **4 marks** for correct answer and **-1 mark** for wrong answer. For Section-B, the answer should be rounded off to the nearest integer.

Student's Name :- .....

School Name :- .....

Student's Signature :- .....

Invigilator's Signature :- .....

PE

PHYSICS

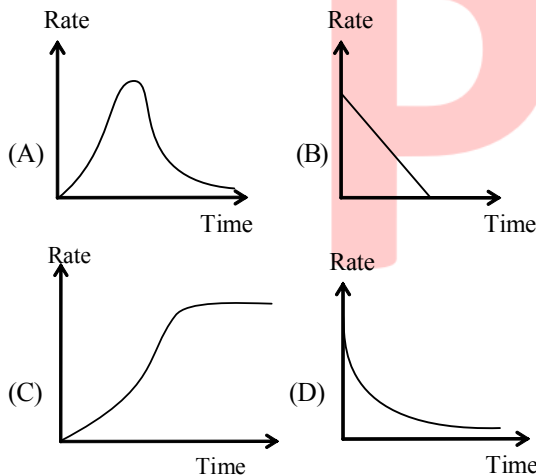
SECTION-A

1. Which one of the following is not electromagnetic in nature -  
 (A) X-rays (B) Gamma rays  
 (C) Cathode rays (D) Infrared rays

2. A copper disc of radius 0.1 m is rotated about its centre with 20 revolution per second in a uniform magnetic field of 0.1 T with its plane perpendicular to the field. The emf induced across the radius of the disc is -  
 (A)  $\frac{\pi}{20}$  volt (B)  $\frac{\pi}{10}$  volt  
 (C)  $20\pi$  millivolt (D)  $100\pi$  millivolt

3. If  $\lambda_v, \lambda_x$  and  $\lambda_m$  represent the wavelengths of visible light, X-rays and microwaves respectively, then -  
 (A)  $\lambda_m > \lambda_x > \lambda_v$  (B)  $\lambda_m > \lambda_v > \lambda_x$   
 (C)  $\lambda_v > \lambda_x > \lambda_m$  (D)  $\lambda_v > \lambda_m > \lambda_x$

4. In a LR circuit connected to a battery the rate at which energy is stored in the inductor is plotted against time during the growth of current in the circuit. Which of the following best represents the resulting curve ?



5. If an electron revolves around a proton, then its time period T is (R = radius of orbit) -  
 (A)  $\propto R^2$  (B)  $\propto R^{3/2}$  (C)  $\propto R^3$  (D)  $\propto R$

6. As a result of change in magnetic flux linked to the closed loop shown in Fig., an emf V volt is induced in the loop. The work done in taking a charge Q coulomb once along the loop is -

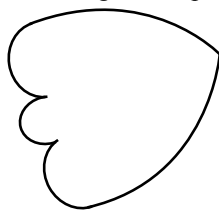


Fig.

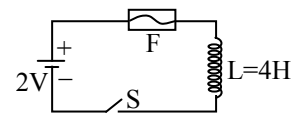
- (A) QV (B) 2QV (C) QV/2 (D) Zero

7. Which one statement is incorrect -  
 (A) Speed of light in free space =  $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$   
 (B) Speed of light in medium =  $\frac{1}{\sqrt{\mu \epsilon}}$   
 (C)  $\frac{E_0}{B_0} = C$   
 (D)  $\frac{B_0}{E_0} = C$

8. A thin circular ring of area A is held perpendicular to a uniform magnetic field of induction B. A small cut is made in ring and a galvanometer is connected across the ends such that total resistance of the circuit is R. When the ring is suddenly squeezed to zero area, the charge flowing through the galvanometer is -  
 (A)  $\frac{BR}{A}$  (B)  $\frac{AB}{R}$  (C) ABR (D)  $\frac{B^2 A}{R^2}$

9. Which of the following have zero average value in a plane electromagnetic wave-  
 (A) electric energy  
 (B) magnetic field  
 (C) magnetic & electric energy both  
 (D) none of these

10. In the circuit shown the cell is ideal. The coil has an inductance of 4H and zero resistance. F is a fuse of zero resistance and will blow when the current through it reaches 5A. The switch is closed at t = 0. The fuse will blow -



- (A) after 5 sec (B) after 2 sec  
 (C) after 10 sec (D) almost at once

11. The energy stored in a 90 cm length of laser beam operating at 10 mw-  
 (A)  $3 \times 10^8$  J (B)  $3 \times 10^9$  J  
 (C)  $3 \times 10^{11}$  J (D)  $3 \times 10^{-11}$  J

12. In series LCR circuit voltage drop across resistance is 8 volt and across capacitor is 12 volt. Then :  
 (A) Voltage of the source will be leading current in the circuit  
 (B) Voltage drop across each element will be less than the applied voltage  
 (C) power factor of circuit will be 4/3  
 (D) None of these

13. A square frame with side  $a$  as shown in Fig. is moved with a velocity  $v$  from a long straight wire carrying current  $I$ . Initial separation between straight long wire and square frame is  $x$ . Find the emf induced in the frame as a function of distance  $x$ .

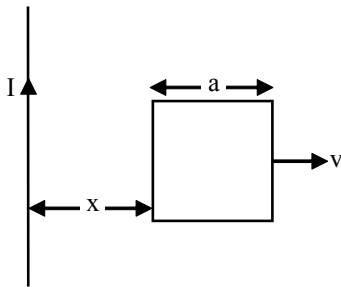
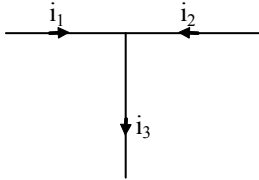
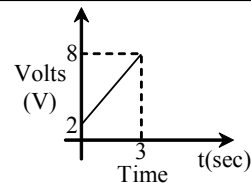
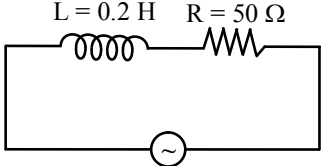


Fig.

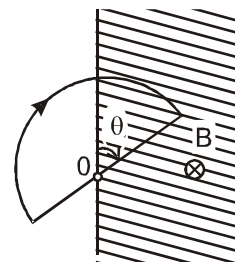
- (A)  $\frac{\mu_0 I a^2 v}{2\pi x(x+a)}$  (B)  $\frac{\mu_0 I a x v}{2\pi x(x+a)}$   
 (C)  $\frac{\mu_0 I a^2 v}{4\pi x(x+a)}$  (D) Zero
14. The e.m.f  $E = 4 \cos 1000t$  volts is applied to an L-R circuit containing inductance 3mH and resistance  $4 \Omega$ . The amplitude of current is -  
 (A)  $4\sqrt{7}$  A (B) 1.0 A  
 (C)  $\frac{4}{7}$  A (D) 0.8 A
15. The most penetrating radiation out of the following is -  
 (A) X-rays (B)  $\beta$ -rays  
 (C)  $\alpha$ -rays (D)  $\gamma$ -rays
16. If  $i_1 = 3 \sin \omega t$  and  $i_2 = 4 \cos \omega t$ , then  $i_3$  is -  
  
 (A)  $5 \sin (\omega t + 53^\circ)$  (B)  $5 \sin (\omega t + 37^\circ)$   
 (C)  $5 \sin (\omega t + 45^\circ)$  (D)  $5 \cos (\omega t + 53^\circ)$
17. Which of the following electromagnetic waves has minimum frequency?  
 (A) radio wave (B) ultrasonic wave  
 (C) microwave (D) audible wave
18. A circuit element is placed in a closed box. At time  $t = 0$ , a constant current generator supplying a current of  $I$  amp is connected across the box. Potential diff. across the box varies according to graph as shown in the figure. The element in the box is -



- (A) a resistance of  $2\Omega$  (B) a battery of emf 6V  
 (C) an inductance of 2H (D) a capacitance
19. An electromagnetic wave going through vacuum is described by-  
 $E = E_0 \sin(kx - \omega t)$   $B = B_0 \sin(kx - \omega t)$   
 (A)  $E_0 B_0 = \omega k$  (B)  $E_0 \omega = B_0 k$   
 (C)  $E_0 k = B_0 \omega$  (D) none of these
20. In the given circuit the average power developed is -  
  
 $V = 200 \sin(250 t)$  volt  
 (A)  $50 \sqrt{2}$  watt (B) 200 watt  
 (C)  $150 \sqrt{2}$  watt (D)  $200 \sqrt{2}$  watt

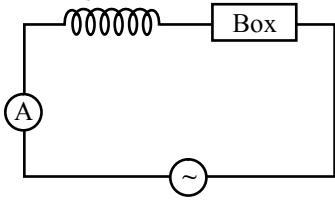
### SECTION-B

21. A wire loop enclosing a semi-circle of radius  $a = 2\text{cm}$  is located on the boundary of a uniform magnetic field of induction  $B = 1\text{T}$  (Figure). At the moment  $t = 0$  the loop is set into rotation with a constant angular acceleration  $\beta = 2 \text{ rad/sec}^2$  about an axis  $O$  coinciding with a line of vector  $B$  on the boundary. The emf induced in the loop as a function of time  $t$  is  $[x \times 10^{-4} (-1)^n \times t]$  volts, where  $n = 1, 2, \dots$  is the number of the half-revolution that the loop performs at the given moment  $t$ . Find the value of  $x$ . (The arrow in the figure shows the emf direction taken to be positive, at  $t = 0$  loop was completely outside)

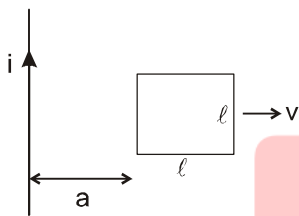


22. A very small circular loop of radius  $a$  is initially coplanar & concentric with a much larger circular loop of radius  $b$  ( $\gg a$ ). A constant current  $I$  is passed in the large loop which is kept fixed in space & the small loop is rotated with constant angular velocity  $\omega$  about a diameter. The resistance of the small loop is  $R$  & its inductance is negligible. The induced emf in the large loop due to current induced in smaller loop as a function of time is equal to  $\frac{1}{x} \left( \frac{\pi a^2 \mu_0 \omega}{b} \right)^2 \frac{I \cos 2\omega t}{R}$ . Find out value of  $x$ .

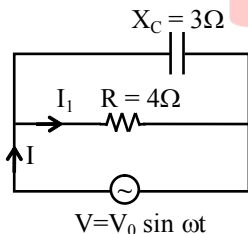
23. An inductor of 0.1 Henry and a box are connected to AC supply of 25 volts and  $\omega = 100 \text{ rad/sec}$  over all power factor of circuit is 1 and the reading of AC ammeter ( $I_{\text{rms}}$ ) is 5A. Find the power factor of box.



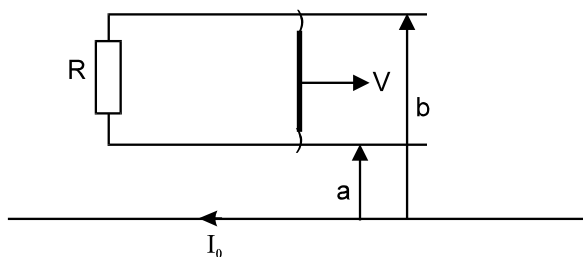
24. A square metallic loop of side  $\ell$  is placed near a fixed long wire carrying a current  $i$  (figure). The loop is moved towards right perpendicular to the wire with a speed  $v$  in the plane containing the wire and the loop. The emf induced in the loop when the rear end of the loop is at a distance  $a = 2\ell$  from the wire is  $\frac{\mu_0 i v}{x\pi}$ . Find out value of  $x$ .



25. A capacitor and Resistor are connected with an AC source as shown in figure. Reactance of capacitor is  $X_C = 3\Omega$  and resistance of resistor is  $4\Omega$ . Phase difference between current  $I$  and  $I_1$  is approx .....  $\times 10^{-1}$  radian.



26. A long straight wire carries a current  $I_0$ . At distance  $a$  and  $b = 3a$  from it there are two other wires, parallel to the former one, which are interconnected by a resistance  $R$  (figure). A connector slides without friction along the wires with a constant velocity  $v$ . Assuming the resistances of the wires, the connector, the sliding contacts, and the self-inductance of the frame to be negligible, ;

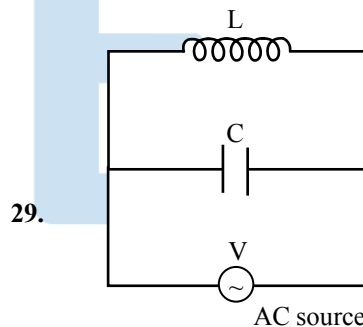


The point of application (distance from the long wire) of magnetic force on sliding wire due to the long wire is  $\frac{2a}{\ell nx}$  from long wire. Then find out value of  $x$ .

27. A series LCR circuit containing a resistance of  $120\Omega$  has angular resonance frequency  $4 \times 10^5 \text{ rad/s}^{-1}$ . At resonance the voltage across resistance and inductance are 60 V & 40 V respectively. At what frequency the current in the circuit lags the voltage by  $45^\circ$ . Give answer in  $\text{---} \times 10^5 \text{ rad/sec}$ .

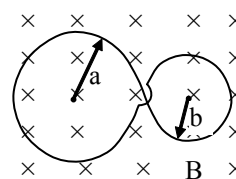
28. A circular loop carrying current  $i$  is made with a wire of length  $\ell$ . The loop can have integral no. of turns. We want to keep the loop in a uniform magnetic field  $B$  such that the torque on it is maximum. When we choose appropriate no. of turns, torque is  $\frac{iB\ell^2}{N\pi}$ .

Fill N in OMR sheet.



29. Current in the inductance is 0.8 A while in the capacitance is 0.6 A. The current drawn from the source is  $\text{---} \times 10^{-1} \text{ Amp}$ .

30. A plane loop is shaped in the form as shown in figure with radii  $a = 20 \text{ cm}$  and  $b = 10 \text{ cm}$  and is placed in a uniform time varying magnetic field  $B = B_0 \sin \omega t$ , where  $B_0 = 10 \text{ mT}$  and  $\omega = 100 \text{ rad/s}$ . Find the amplitude of the current induced in the loop if its resistance per unit length is equal to  $50 \times 10^{-3} \Omega/\text{m}$ . The inductance of the loop is negligible.



**CHEMISTRY**

**SECTION-A**

31. Which of the following is not a double salt but is a complex salt ?  
 (A)  $KCl.MgCl_2.6H_2O$   
 (B)  $FeSO_4.(NH_4)_2SO_4.6H_2O$   
 (C)  $K_2SO_4.Al_2(SO_4)_3.24H_2O$   
 (D)  $4KCN.Fe(CN)_2$
32. The solution of the complex  $[Cu(NH_3)_4]SO_4$  in water –  
 (A) Will give the tests of  $Cu^{2+}$  ions  
 (B) Will give the tests of  $NH_3$   
 (C) Will give the tests of  $SO_4^{2-}$  ions  
 (D) Will not give the tests of any of the above species
33. An ambidentate ligand is one which –  
 (A) Is linked to the metal atom at two points  
 (B) Has two donor atoms but only one of them has the capacity to form a coordinate bond  
 (C) Has two donor atoms but either of the two can form a coordinate bond  
 (D) Forms chelate rings
34. The coordination number and oxidation number of the central metal ion in the complex  $[Pt(en)_2]^{+2}$  is –  
 (A) C.N. = 2, O.N. = +2      (B) C.N. = 6, O.N. = +4  
 (C) C.N. = 4, O.N. = +4      (D) C.N. = 4, O.N. = +2
35. Which of the following is the correct order of acidic strength ?  
 (A)  $Cl_2O_7 > SO_3 > P_4O_{10}$       (B)  $CO_2 > N_2O_5 > SO_3$   
 (C)  $Na_2O > MgO > Al_2O_3$       (D)  $K_2O > CaO > MgO$
36. Match List I with List II and select the correct answer using the codes given below the lists –
- | List I (Equivalent)<br>conductance | List II<br>(Formula) |
|------------------------------------|----------------------|
| (i) $[Pt(NH_3)_5Cl]Cl_3$           | (1) 229              |
| (ii) $[Pt(NH_3)_3Cl_3]Cl$          | (2) 97               |
| (iii) $[Pt(NH_3)_4Cl_2]Cl_2$       | (3) 404              |
| (iv) $[Pt(NH_3)_6]Cl_4$            | (4) 523              |
- Code :
- |     | (1) | (2) | (3) | (4) |
|-----|-----|-----|-----|-----|
| (A) | iii | i   | i   | iii |
| (B) | i   | iv  | iii | ii  |
| (C) | ii  | iii | iv  | i   |
| (D) | iii | ii  | i   | iv  |
37. The complex ions  $[Fe(CN)_6]^{3-}$  and  $[Fe(CN)_6]^{4-}$   
 (A) Are both octahedral and paramagnetic  
 (B) Are both octahedral and diamagnetic  
 (C) Have same structure but different magnetic character  
 (D) Have different structures but same magnetic character

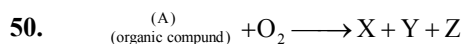
38. If  $\Delta_0 < P$  the correct electronic configuration for  $d^4$  system will be –  
 (A)  $t_{2g}^4 e_g^0$       (B)  $t_{2g}^3 e_g^1$       (C)  $t_{2g}^0 e_g^4$       (D)  $t_{2g}^2 e_g^2$
39. Match List-I (Complex ions) with List-II (Number of Unpaired Electrons) and select the correct answer using the codes given below the lists –
- | List - I<br>(Complex ions) | List - II<br>(Number of Unpaired Electrons) |
|----------------------------|---|
| (1) $[CrF_6]^{4-}$         | (i) One                                     |
| (2) $[MnF_6]^{4-}$         | (ii) Two                                    |
| (3) $[Cr(CN)_6]^{4-}$      | (iii) Three                                 |
| (4) $[Mn(CN)_6]^{4-}$      | (iv) Four                                   |
|                            | (v) Five                                    |
- Code :
- |     | 1    | 2   | 3     | 4   |
|-----|------|-----|-------|-----|
| (A) | (iv) | (i) | (ii)  | (v) |
| (B) | (ii) | (v) | (iii) | (i) |
| (C) | (iv) | (v) | (ii)  | (i) |
| (D) | (ii) | (i) | (iii) | (v) |
40. For the  $t_{2g}^6 e_g^2$  system, the value of magnetic moment ( $\mu$ ) is –  
 (A) 2.83 B.M.      (B) 1.73 B.M.  
 (C) 3.87 B.M.      (D) 4.92 B.M.
41. The phenomenon of optical activity will be shown by –
- (A)

(B)
- (C)

(D)
42.  $N_2(g) + 3H_2(g) \xrightarrow{Fe+Mo} 2NH_3(g)$ ; Haber's process, Mo is used as –  
 (A) A catalyst  
 (B) A catalytic promoter  
 (C) An oxidising agent  
 (D) As a catalytic poison
43. Coinage metals show the properties of –  
 (A) Typical elements  
 (B) Normal elements  
 (C) Inner-transition elements  
 (D) Transition elements

44. When  $\text{KMnO}_4$  solution is added to hot oxalic acid solution, the decolourisation is shown in the beginning but becomes instantaneous after some time. This is because-
- (A)  $\text{Mn}^{2+}$  acts as auto catalyst  
 (B)  $\text{CO}_2$  is formed  
 (C) Reaction is exothermic  
 (D)  $\text{MnO}_4^-$  catalysis the reaction.
45. Purple of cassius is :
- (A) Pure gold  
 (B) Colloidal solution of gold  
 (C) Gold (I) hydroxide  
 (D) Gold (III) chloride
46. Pick out the incorrect statement :
- (A)  $\text{MnO}_4^{2-}$  is quite strongly oxidizing and stable only in very strong alkalies. In dilute alkali, neutral solutions, it disproportionates.  
 (B) In acidic solutions,  $\text{MnO}_4^-$  is reduced to  $\text{Mn}^{2+}$  and thus,  $\text{KMnO}_4$  is widely used as oxidising agent.  
 (C)  $\text{KMnO}_4$  does not acts as oxidising agent in alkaline medium.  
 (D)  $\text{KMnO}_4$  is manufactured by the fusion of pyrolusite ore with  $\text{KOH}$  in presence of air or  $\text{KNO}_3$ , followed by electrolytic oxidation in alkaline solution.
47. Cerium can show the oxidation state of +4 because:-
- (A) it resemble alkali metals  
 (B) it has very low value of ionisation energy  
 (C) of its tendency to attain noble gas configuration of xenon  
 (D) of its tendency to attain  $4f^7$  configuration
48. A gas at low temperature does not react with the most of compounds. It is almost inert and is used to create inert atmosphere in bulbs. The combustion of this gas is exceptionally an endothermic reaction Based on the given information, we can conclude that the gas is:
- (A) Oxygen (B) Nitrogen  
 (C) Carbon monoxide (D) Hydrogen
49. An inorganic salt (A) is decomposed at about 523K to give products (B) and (C). Compound (C) is a liquid at room temperature and is neutral to litmus paper while oxide (B) on burning with white phosphorous gives a dehydrating agent (D). Compounds (A), (B), (C) and (D) will be identified as  $\text{N}_2\text{O}$

- (A)  $\text{NH}_4\text{NO}_3, \text{N}_2\text{O}, \text{H}_2\text{O}, \text{P}_2\text{O}_5$   
 (B)  $\text{NH}_4\text{NO}_2, \text{K}_2\text{O}, \text{H}_2\text{O}, \text{P}_2\text{O}_5$   
 (C)  $\text{CaCO}_3, \text{CaO}, \text{H}_2\text{O}, \text{CaCl}_2$   
 (D)  $\text{CaCO}_3, \text{CaO}, \text{H}_2\text{O}, \text{Ca}(\text{OH})_2$



Compound (A) in pure form does not give ppt. with  $\text{AgNO}_3$  solution. A mixture containing 70% of (A) and 30% of ether is used as an anaesthetic. Compound (X) and (Y) are oxides while (Z) is a pungent smelling gas. (X) is a neutral oxide which turns cobalt chloride paper pink. Compound (Y) turns lime water milky and produces an acidic solution with water. Compounds (A), (X), (Y) and (Z) respectively will be:

- (A)  $\text{CH}_4, \text{H}_2\text{O}, \text{CO}_2, \text{Cl}_2$   
 (B)  $\text{CHCl}_3, \text{H}_2\text{O}, \text{CO}_2, \text{Cl}_2$   
 (C)  $\text{CH}_3\text{OH}, \text{H}_2\text{O}, \text{CO}_2, \text{N}_2$   
 (D)  $\text{NH}_2\text{CONH}_2, \text{H}_2\text{O}, \text{N}_2\text{O}, \text{CO}_2$

### SECTION-B

51. For artificial respiration x% of  $\text{CO}_2$  is used with oxygen, then x is:
52. The maximum oxidation state shown by actinides :-
53. The number of ions given by  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  in aqueous solution is -
54. What is the oxidation number of chromium in the dimeric hydroxido bridged species ?
- $$\left[ (\text{H}_2\text{O})_4 \text{Cr} \begin{array}{c} \text{H} \\ \diagup \quad \diagdown \\ \text{O} \\ \diagdown \quad \diagup \\ \text{O} \\ \text{H} \end{array} \text{Cr} (\text{H}_2\text{O})_4 \right]^{4+}$$
55. According to EAN rule, how many CO groups should be attached to Fe ?
56. In the complex  $\text{Fe}(\text{CO})_x$ , the value of x is, if it follows sidgwick EAN rule :
57. Effective atomic number of Fe in  $[\text{Fe}(\text{CO})_4]^-$  is :
58. Oxidation number of Fe in violet coloured complex  $\text{Na}_4[\text{Fe}(\text{CN})_5(\text{NOS})]$  is :
59. Theoretically the number of geometrical isomers expected for octahedral complex  $[\text{Mabcdef}]$  is -
60. An ornament of gold having 75% of gold, is of ..... carat.

61.  $\int \frac{\sec x \cdot \cos ecx}{2 \cot x - \sec x \cos ecx} dx$  is equal to-

- (A)  $\frac{1}{2} \ln |\sec 2x + \tan 2x| + C$
- (B)  $\ln |\sec x + \cos ec x| + C$
- (C)  $\ln |\sec x + \tan x| + C$
- (D)  $\frac{1}{2} \ln |\sec x + \cos ec x| + C$

62. The integral  $\int_2^4 \frac{\log x^2}{\log x^2 + \log(36 - 12x + x^2)} dx$  is

- equal to  
 (A) 2      (B) 4      (C) 1      (D) 6

63. If  $f\left(\frac{3x-4}{3x+4}\right) = x+2$  then  $\int f(x)dx$  is equal to

- (A)  $e^{x+2} \ln \left| \frac{3x-4}{3x+4} \right| + c$
- (B)  $-\frac{8}{3} \ln |(1-x)| + \frac{2}{3}x + c$
- (C)  $\frac{8}{3} \ln |x-1| + \frac{x}{3} + c$
- (D) None of these

64. If the value of the integral  $\int_1^2 e^{x^2} dx = \alpha$ , then the

- value of  $\int_e^{e^4} \sqrt{\ln x} dx$  is  
 (A)  $e^4 - e - \alpha$       (B)  $2e^4 - e - \alpha$   
 (C)  $2(e^4 - e) - \alpha$       (D) None

65.  $\int \frac{\sin^3 x dx}{(\cos^4 x + 3 \cos^2 x + 1) \tan^{-1}(\sec x + \cos x)} =$

- (A)  $\tan^{-1}(\sec x + \cos x) + c$
- (B)  $\log \tan^{-1}(\sec x + \cos x) + c$
- (C)  $1/(\sec x + \cos x) + c$
- (D) None of these

66. If  $I_1 = \int_0^{\pi/2} \frac{x}{\sin x} dx$  and  $I_2 = \int_0^1 \frac{\tan^{-1} x}{x} dx$ , then  $\frac{I_1}{I_2} =$

- (A) 1      (B) 1/2      (C) 2      (D)  $\pi/2$

67. The indefinite integral of  $(12 \sin x + 5 \cos x)^{-1}$  is, for any arbitrary constant -

- (A)  $1/13 \log \left| \tan \left( \frac{x}{2} + \frac{1}{2} \tan^{-1} \frac{5}{12} \right) \right| + c$
- (B)  $1/13 \log \left| \tan \left( \frac{x}{2} + \frac{1}{2} \tan^{-1} \frac{12}{5} \right) \right| + c$
- (C)  $1/13 \log \left| \tan \left( x + \tan^{-1} \frac{5}{12} \right) \right| + c$
- (D)  $1/13 \log \left| \tan \left( x + \tan^{-1} \frac{12}{5} \right) \right| + c$

68. The value of  $\int_1^{16} \tan^{-1} \sqrt{\sqrt{x}-1} dx$  is

- (A)  $\frac{16\pi}{3} + 2\sqrt{3}$       (B)  $\frac{4}{3}\pi - 2\sqrt{3}$
- (C)  $\frac{4}{3}\pi + 2\sqrt{3}$       (D)  $\frac{16}{3}\pi - 2\sqrt{3}$

69. If  $\int \sin^4 x \cos^4 x dx = \frac{1}{128}$

- $\left[ ax - \sin 4x + \frac{1}{8} \cdot \sin 8x \right] + C$  then value of 'a' equal to :  
 (A) 0      (B) -3      (C) 3      (D) 1

70. If  $\int_0^{\pi/2} \log \sin x dx = k$ , then

- $\int_0^{\pi} \log(1 + \cos x) dx$  is given by  
 (A)  $\pi \log 2 + 4k$       (B)  $\pi \log 2 + 2k$   
 (C)  $\pi \log 2 + k$       (D)  $\pi \log 9 + k^2$

71. If  $I = \int (\sqrt{\tan x} + \sqrt{\cot x}) dx$ , then I equals:

- (A)  $\sqrt{2} \sin^{-1}(\sin x + \cos x) + C$
- (B)  $\sqrt{2} \cos^{-1}(\sin x - \cos x) + C$
- (C)  $\sqrt{2} \sin^{-1}(\sin x - \cos x) + C$
- (D)  $\sqrt{2} \cos^{-1}(\sin x + \cos x) + C$

72. Let  $I_1 = \int_{\pi/6}^{\pi/3} \frac{\sin x}{x} dx$ ,  $I_2 = \int_{\pi/6}^{\pi/3} \frac{\sin(\sin x)}{\sin x} dx$ ,

$I_3 = \int_{\pi/6}^{\pi/3} \frac{\sin(\tan x)}{\tan x} dx$ , then -

- (A)  $I_1 < I_2 < I_3$                       (B)  $I_2 < I_1 < I_3$   
 (C)  $I_3 < I_1 < I_2$                       (D)  $I_3 < I_2 < I_1$

73. If  $I = \int \frac{dx}{x\sqrt{1-x^3}}$ , then I equals:

(A)  $\frac{1}{3} \log \left| \frac{\sqrt{1-x^3}-1}{\sqrt{1-x^3}+1} \right| + C$

(B)  $\frac{1}{3} \log \left| \frac{\sqrt{1-x^3}+1}{\sqrt{1-x^3}-1} \right| + C$

(C)  $\frac{2}{3} \log |1-x^3| + C$

(D)  $\frac{1}{3} \log \left| x^{3/2} + \sqrt{1-x^3} \right| + C$

74. If  $I = \int_{-3}^2 (|x+1| + |x+2| + |x-1|) dx$ , then I equals:

- (A)  $\frac{31}{2}$       (B)  $\frac{35}{2}$       (C)  $\frac{37}{2}$       (D)  $\frac{39}{2}$

75. If  $I = \int \frac{x^5}{\sqrt{1+x^3}} dx$ , then I is equal to:

(A)  $\frac{2}{9} (1+x^3)^{5/2} + \frac{2}{3} (1+x^3)^{3/2} + C$

(B)  $\frac{2}{9} (1+x^3)^{3/2} - \frac{2}{3} (1+x^3)^{1/2} + C$

(C)  $\log \left| \sqrt{x} + \sqrt{1+x^3} \right| + C$

(D)  $x^2 \log (1+x^3) + C$

76. If  $\pi/2 < \alpha < \pi$ , then  $\int_0^1 \frac{dx}{\sqrt{1-x^2} \sin^2 \alpha}$  is equal to -

- (A)  $\left| \frac{\alpha}{\sin \alpha} \right|$                       (B)  $\left| \frac{\pi-\alpha}{\sin \alpha} \right|$   
 (C)  $\left| \frac{2\pi-\alpha}{\sin \alpha} \right|$                       (D) None of these

77. If  $I = \int \frac{1}{x} \sqrt{\frac{1+x}{1-x}} dx$ , then I equals:

(A)  $\log |x| + \log \left| 1 + \sqrt{1-x^2} \right| + \sin^{-1} \sqrt{x} + C$

(B)  $\log |x| - \log \left| 1 - \sqrt{1-x^2} \right| + \tan^{-1} x + C$

(C)  $\log |x| - \log \left| 1 + \sqrt{1-x^2} \right| - \sin^{-1} x + C$

(D)  $\log \left| 1 + \sqrt{1-x^2} \right| - \log |x| + \cos^{-1} x + C$

78. If  $g(x) = \int_0^x \cos^4 t dt$ , then  $g(x+\pi)$  equals-

- (A)  $g(x) + g(\pi)$                       (B)  $g(x) - g(\pi)$   
 (C)  $g(x) \cdot g(\pi)$                       (D) 0

79. If  $I = \int \frac{dx}{\sqrt{(x-\alpha)(\beta-x)}}$ , ( $\beta < \alpha$ ) then value of I is:

(A)  $\sin^{-1} \left( \frac{2x-\alpha-\beta}{\beta-\alpha} \right) + C$

(B)  $\sin^{-1} \left( \frac{x-\alpha-\beta}{\beta-\alpha} \right)$

(C)  $\sin^{-1} \left( \frac{2x+\beta-\alpha}{\alpha+\beta} \right)$

(D) None of these

80. If  $I = \int_{-\pi}^{\pi} \frac{2x(1+\sin x)}{1+\cos^2 x} dx$ , then I equals-

(A)  $-\sqrt{2}\pi$                       (B)  $\sqrt{2}\pi$

(C)  $\frac{\pi}{\sqrt{2}}$                       (D)  $-\frac{\pi}{\sqrt{2}}$

### SECTION-B

81. If  $I = \int \frac{dx}{\cos^5 x + \sin^5 x} = \sqrt{2} \log \left| \frac{\sqrt{2+t}}{\sqrt{2-t}} \right| +$

$\frac{1}{(2-b^2)b^3} \log \left| \frac{b+t}{b-t} \right| + \frac{1}{(2-b^2)b^3} \tan^{-1} \left( \frac{t}{b} \right) + C$

where  $t = \sin x - \cos x$ . Then the value of b is ? (C is integral constant)

82. Let  $\frac{d}{dx}(f(x)) = \frac{e^{\sin x}}{x}$ ,  $x > 0$ . If  $\int_1^4 \frac{2e^{\sin x^2}}{x} dx = f(k)$  -  $f(1)$  then find one possible value of  $k$ .

83. Let  $f(x)$  be the primitive of  $\frac{3x+2}{\sqrt{x-9}}$  w.r. to  $x$ . If  $f(10) = 60$  then twice of sum of digits of the value of  $f(13)$  is.

84. Let  $y = f(x)$  be a differentiable function  $\forall x \in \mathbb{R}$  and satisfies

$$f(x) = x + \int_0^1 x^2 z f(z) dz + \int_0^1 x z^2 f(z) dz. \text{ Determine } f(10).$$

85. If  $\int \frac{\sqrt{4+x^2}}{x^6} dx = \frac{(a+x^2)^{3/2} \cdot (x^2-b)}{120x^5} + C$  then  $a + b$  equals to :

86.  $\int_0^{\pi/4} (\cos 2\theta)^{3/2} \cos \theta d\theta = \frac{a \cdot \pi}{b\sqrt{2}}$ , where  $a$  &  $b$  are coprime then find sum of digits of  $3a + b$ .

87. If  $\int e^{\sin x} \cdot \frac{x \cos^3 x - \sin x}{\cos^2 x} dx = e^{\sin x} f(x) + C$  such that  $f(0) = -1$  then  $\frac{\pi}{3} - f\left(\frac{\pi}{3}\right)$  is equal to :

88. The value of the definite integral  $\int_0^a \frac{\sqrt{a^2 - x^2}}{c^2 - x^2} dx$  is  $\frac{\pi(c - \sqrt{c^2 - a^2})}{\lambda c}$  where  $c > a > 0$  and  $\lambda$  is a numerical quantity then  $\lambda$  must be.....

89. Let  $g(x) = \int \frac{1 + 2 \cos x}{(\cos x + 2)^2} dx$  and  $g(0) = 0$  then value of  $32 g\left(\frac{\pi}{2}\right)$  is.

90. Determine a positive integer  $n$  such that

$$\int_0^{\pi/2} x^n \sin x dx = \frac{3}{4}(\pi^2 - 8)$$