Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60(Incoming)_STERLING BT **JEE-MAIN** **Date: 10-05-2025**
Time: 09:00AM to 12:00PM **WTM-31** **Max. Marks: 300**

KEY SHEET

MATHEMATICS

1)	**3**	2	**3**	3)	**1**	4)	**3**	5)	**3**
6)	**2**	7)	**1**	8)	**3**	9)	**2**	10)	**3**
11)	**4**	12)	**2**	13)	**1**	14)	**3**	15)	**4**
16)	**1**	17)	**4**	18)	**1**	19)	**1**	20)	**3**
21)	**2**	22)	**1**	23)	**2**	24)	**4**	25)	**1**

PHYSICS

26	**2**	27	**3**	28	**4**	29	**4**	30	**1**
31	**1**	32	**2**	33	**3**	34	**3**	35	**1**
36	**2**	37	**1**	38	**4**	39	**2**	40	**1**
41	**3**	42	**4**	43	**2**	44	**4**	45	**3**
46	**750**	47	**10**	48	**5**	49	**12**	50	**10**

CHEMISTRY

51	**1**	52	**1**	53	**1**	54	**4**	55	**3**
56	**3**	57	**2**	58	**1**	59	**1**	60	**2**
61	**1**	62	**3**	63	**2**	64	**4**	65	**1**
66	**1**	67	**1**	68	**2**	69	**2**	70	**2**
71	**0**	72	**630**	73	**3**	74	**8**	75	**3**

SOLUTION
MATHEMATICS

1.

Ans:

We have $\int_0^1 e^{x^2}(x-\alpha)dx = 0$

$$= \frac{1}{2}\int_0^1 e^{x^2} x dx = \int_0^1 e^{x^2}\alpha dx$$

$$\alpha = \frac{\frac{1}{2}(e-1)}{\int_0^1 e^{x^2}dx}$$

2.

Ans: Since e^{x^2} is an increasing function on (0, 1)

$m = e^0 = 1, M = e^1 = e$

$1 < e^{x^2} < e,$ for all $x \in (0,1)$

$$1 < \int_0^1 e^{x^2}dx < e$$

3.ans:

$$I = \int_0^\infty \frac{x\log x dx}{(1+x^2)^2}$$

$let, x = \frac{1}{t}$

$I = 0$

4. ans:

$$I_1 = \int_0^1 \frac{e^x dx}{1+x}, I_2 = \int_0^1 \frac{x^2 dx}{e^{x^3}(2-x^3)}$$

In I_2, put $1-x^3 = t$

$\therefore \frac{I_1}{I_2} = 3e$

5.ans:

In I_2, put $x+1 = t$. Then

$$I_2=\int_{-2}^{2}\frac{2t^2+11t+14}{t^4+2}dt=\int_{-2}^{2}\frac{2x^2+11x+14}{x^4+2}dx=2\int_{0}^{2}(x^2+7)dx=\frac{100}{3}$$

6. ans:

$$\sin nx-\sin(n-2)x=2\cos(n-1)x\sin x$$

$$=\int_{0}^{\pi/2}dx$$

$$=\frac{\pi}{2}$$

7. ans:

$$I_3=\int_{0}^{\pi}e^x(\sin x)^3dx$$

$$10I_3=6I_1$$

$$\frac{I_3}{I_1}=\frac{3}{5}$$

8.ans:

$$I=\int_{0}^{1}(x-f(x))^{2018}dx$$

$$x=f(t)\Rightarrow dx=f'(t)dt.....(1)$$

$$I=-\int_{0}^{1}(t-f(t))^{2018}f'(t)dt.....(2)$$

$$eq(1)+eq(2)$$

$$I=\frac{1}{2019}\equiv\frac{p}{q}\Rightarrow(p+q)=2020$$

9. ans:

$$A_n=\int_0^{\pi/4}\text{Tan}^n\,xdx=\frac{1}{n-1}-A_{n-2}$$

$$A_n+A_{n-2}=\frac{1}{n-1}.....(1)$$

$$\Rightarrow 0<\tan x<1$$

$$\Rightarrow \text{Tan}^2\,x<1$$

$$\Rightarrow\frac{1}{2n+2}<A_n$$

10. ans: Let

$$F(x)=\int_{1/e}^{\tan x}\frac{t}{1+t^2}dt+\int_{1/e}^{\cot x}\frac{dt}{t(1+t^2)}$$

$$F'(x)=\left(\frac{\tan x}{1+\tan^2 x}\right)\sec^2 x+\frac{1}{\cot x(1+\cot^2 x)}(-\operatorname{cosec}^2 x)=\tan x-(1/\cot x)=0$$

$$F(x)=1$$

11. ans: Given integral is $b_n=\int_0^{\pi/2}\frac{1+\cos 2nx}{2\sin x}dx$

$$\text{Now, } b_{n+1}=\int_0^{\pi/2}\frac{1+\cos 2(n+1)x}{2\sin x}dx$$

$$b_{n+1}-b_n=\left(\frac{\cos(2n+1)x}{2n+1}\right)_0^{\pi/2}=\frac{-1}{2n+1}$$

Put n=2,3,4,5 in the above equation

12. ans: $f(-x)=-f(x)$

$$\therefore f(x) \text{ is odd}$$

$$\text{So, } L.H.S=\int_{-\pi/2}^{\pi/2}\frac{x^2\cos x}{1+e^x}dx=\int_0^{\pi/2}x^2\cos x dx \text{ proceed}$$

13. ans:

$$I=\int_{\frac{-1}{\sqrt{3}}}^{\frac{1}{\sqrt{3}}}\frac{\cos^{-1}\left(\frac{2x}{1+x^2}\right)+\tan^{-1}\left(\frac{2x}{1-x^2}\right)}{e^x+1}dx$$

$$I=\frac{\pi}{2}\int_0^{\frac{1}{\sqrt{3}}}\left(\frac{1}{e^x+1}+\frac{e^x}{e^x+1}\right)dx=\frac{\pi}{2\sqrt{3}}$$

$$\Rightarrow f'(x)+f'(5-x)=C=8$$

14. ans:

$$I=\int_{e^{\pi/6}}^{e^{\pi/2}}\frac{\sin(In(\sin(Inx)))\cos(Inx)}{x\sin(Inx)}dx$$

Put $In(\sin(Inx))=t$

$$I=\int_{-In2}^{0}\sin t dt=\cos(in2)-1$$

Hence, $\cos^{-1}(I+1)=In2$

15.ans:

$$\therefore f''(x)=f''(5-x)\Rightarrow f'(x)=-f'(5-x)+C\Rightarrow f'(x)+f'(5-x)=C=8$$

Let $I=\int_1^4 f'(x)dx$

$$I=\int_1^4 f'(5-x)dx$$

$$2I=24$$

$$I=12$$

16. ans:

$$f(3)=\int_2^3 \frac{1}{1+t^4}dt$$

$$\therefore 2<t<3$$

$$\frac{1}{1+t^4}<\frac{1}{17}\Rightarrow f(3)<\int_2^3 \frac{1}{17}dt\Rightarrow f(3)<\frac{1}{17}$$

17. ans:

$$I=\int_1^{\sqrt{3}} (x^{x^2})^2(x+2x\log x)dx$$

Let

$$x^{x^2}=t\Rightarrow x^{x^2}(x+2xInx)dx=dt=\int_1^{3\sqrt{3}} tdt=\left(\frac{t^2}{2}\right)_1^{3\sqrt{3}}=\frac{27}{2}-\frac{1}{2}=13$$

18.ans:

Let $\vec{V_1}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{V_2}=f(x)\hat{i}+g(x)\hat{j}+h(x)\hat{k}$

Now $\vec{V_1}.\vec{V_2}=2=\left|\vec{V_1}\right|\left|\vec{V_2}\right|\cos\theta=\sqrt{3}\sqrt{f^2(x)+g^2(x)+h^2(x)}\cos\theta$

Hence, $\frac{4}{3}\sec^2\theta=f^2(x)+g^2(x)+h^2(x)\geq\frac{4}{3}$

Hence, $I_{\min}=\int_0^{3/4}(f^2(x)+g^2(x)+h^2(x))dx=\int_0^{3/4}\frac{4}{3}dx=1$

19.ans:

$$I_n=2\int_0^1 x\left(1+\frac{x^2}{2}+\frac{x^4}{4}+....+\frac{x^{2n}}{2n}\right)dx=2\left(\frac{x^2}{2}+\frac{x^4}{2.4}+\frac{x^6}{4.6}+....+\frac{x^{2n+2}}{2n(2n+2)}\right)_0^1$$

$$I_2 = 1 + \frac{1}{2}\left(1 - \frac{1}{3}\right) = \frac{4}{3} and I_\infty = \frac{3}{2}$$

20. ans:

$$\int_\alpha^\beta f(x)dx + \int_\alpha^\beta f^{-1}(x)dx = 13 \Rightarrow \beta^2 - \alpha^2 = 13$$

$$(\beta - \alpha)(\beta + \alpha) = 13 \times 1$$

$$\therefore \beta - \alpha = 1 \text{ and } \beta + \alpha = 13 \Rightarrow \beta = 7, \alpha = 6$$

21. ans:

$$f(x) = xF(x)$$

$$\therefore f'(x) = xF'(x) + F(x)$$

$$F(1) = 0 and F(3) = -4$$

$$f'(x) = xF'(x) + F(x) < 0$$

22.ans:

$$\text{Let } f(x) = \int_0^x \frac{t^2 dt}{1 + t^4} - 2x + 1$$

$$\therefore 0 < \int_0^1 \frac{t^2 dt}{1 + t^4} < 1$$

$$\therefore f(1) = \int_0^1 \frac{t^2 dt}{1 + t^4} - 1 < 0$$

23. ans:

$$I = \int_0^{1/2} \frac{1 + \sqrt{3}}{((x+1)^2 (1-x)^6)^{1/4}} dx = (1 + \sqrt{3})(\sqrt{3} - 1) = 2$$

24. ans:

$$I = \frac{2}{\pi} \int_{-\pi/4}^{\pi/4} \frac{dx}{(1 + e^{-\sin x})(2 - \cos 2x)}$$

$$\therefore 27I^2 = 4$$

25.ans:

$$I = \int_0^{\pi/2} \frac{3\sqrt{\cos\theta}}{(\sqrt{\cos\theta} + \sqrt{\sin\theta})^5} d\theta$$

$$= 3\left(\frac{1}{2} - \frac{1}{3}\right) = \frac{1}{2} = 0.5$$

PHYSICS

26.ans:

Induced emf $e=\frac{-d\phi}{dt}=-A.\frac{dB}{dt}$

27. ans:

$$e=\left|-\frac{d\phi}{dt}\right|=IR=\frac{dq}{dt}.R\Rightarrow dq=\frac{d\phi}{R}$$

28. ans:

$$e=N.\frac{d\phi}{dt}$$

29.ans:

$$e=NA.\frac{dB}{dt};A=\pi r^2$$

30.ans:

Len's law. Induced emf opposes the change of flux

31.ans:

$$e=iR=\frac{d\phi}{dt}=15t^2+8t+2$$

$$t=2s \text{ and } R=5\Omega$$

32.ans:

The direction of emf will change as the flux. First increases and then begins to decrease

33. ans:

emf

$$e=-\frac{d\phi}{dt}=-\frac{d}{dt}(BA)=-B.\frac{dA}{dt}$$

$$=-B.\frac{d}{dt}(\pi r^2)=-B\pi.2r.\frac{dr}{dt}$$

34.ans:

Lenz's law is a consequene of the law of conservation of energy

35. ans:

$$e=\left|-\frac{d\phi}{dt}\right|=\left|\frac{0-2}{6-0}\right|=\frac{1}{3}V.$$

36.ans:

$$e=\frac{-d\phi}{dt}$$

37. conceptual

38. conceptual

39.ans:

Induced emf is directly proportional to the rate of changes of magnetic flux but indued change is independent of time

40 ans:

magnetic Flux $\phi = NAB = 1\times 2\times \frac{1}{2}\times 2\times 1\times 10^{-4}$

41.ans:

Induced emf opposes the change in magnetic flux

42. ans:

Ans: The flux associated with the loop is $\phi = B\pi(a^2+b^2)$ the induced current is

$$I = \frac{\xi}{R} = \frac{1}{R}\left|\frac{d\phi}{dt}\right| = \frac{k\pi(a^2+b^2)}{2\pi(a+b)\lambda} = \frac{k(a^2+b^2)}{2(a+b)\lambda}$$

43.ans:

Flux

$\phi = \text{N}\ \vec{B}\bullet\vec{A}$

$= NBA$

$= 1\times 2\times \frac{1}{2}\times 2\times 1\times 10^{-4}$

$= 2\times 10^{-4} Wb$

44. Conceptual

45. Conceptual

46 ans:

Flux

$\phi = \vec{B}\bullet\vec{A}$

47.ans:

Induced charge q=$\frac{\Delta\phi}{R}$

48.ans:

emf

$e = NA\left(\frac{dB}{dt}\right)$

$= 500\times 100\times 10^{-4}\times 1 = 5V$

49.ans:

Induced emf

$e = A.\left(\frac{dB}{dt}\right)$

$= \pi r^2.\left(\frac{dB}{dt}\right)$

50. ans:

emf $e = -\frac{d\phi}{dt} = -\frac{d}{dt}\left(\pi r^2\right)B$

CHEMISTRY

51. Formation of H_2O is highly exothermic

52. Bond dissociation energy decreases from H_2S *to* H_2Te

53. Small size of oxygen atom

54. Florine pushes the elements to their highest oxidation state

55. Name of the compound should be ended with more eletronegative element among the elements present in Compound

56. High molecular wt of TeF_4

57. oxygen has no vacant d-orbitals in its valence shell

58. Bond dissociation decrease from top to bottom

59. $H-Te$ dissociation energy is low

60. Sulphur has tendency to for two covalent bonds

61. I.E first decreases sharply in beginning and then gradual decreases

62. $2Se_2Cl_2 \rightarrow SeCl_4 + 3Se$

63. Oxygen has no vacant orbitals in its valency shell

64. Half life period of Po is 13.8 days

65. SP^3 hybridisition is present in H_2O

66. Hydrogen bond is responsible for high boiling point

67. Sulphur exists as S_8 molecules where as oxygen exists as O_2 molecules

68. Metallic nature increases down the group

69. Sulphur is less abundant 0.03 to 0.1 percent

70. The genral name of PbS is Galena

71. Formal charge =(valance electrons)-(non bonding electrons) $-\frac{1}{2}$ (Bonding electrons)

Atom 1. $6-6-\frac{1}{2}(2)=-1$

Atom2. $6-4-\frac{1}{2}(4)=0$

Atom3. $6-2-\frac{1}{2}(6)=+1$

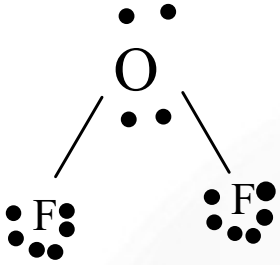
72. o-o bond energy =105 kJ/mole

2 bonds per ozone molecule $=2\times105=210KJ/mole$

For three mole of O_3 molecules $=3\times210=630KJ/mole$

73. SO_2 formed is first exited state therefore $d\pi - p\pi$ bonds =1 SO_3 formed is second exited state therefore $d\pi - p\pi$ bonds =2

74.



75. All 16^{th} group elements exhibite allotropy
16^{th} group elements are ore forming elements