Sri Chaitanya IIT Academy.,India.

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A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.S60_Elite, Target & LIIT-BTs | **JEE-MAIN** | **Date: 22-12-2024**
Time: 09.00Am to 12.00Pm | **GTM-08/03** | **Max. Marks: 300**

KEY SHEET

MATHEMATICS

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

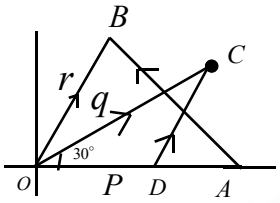
PHYSICS

26	**2**	27	**2**	28	**2**	29	**2**	30	**3**
31	**2**	32	**3**	33	**4**	34	**4**	35	**4**
36	**1**	37	**2**	38	**1**	39	**4**	40	**3**
41	**4**	42	**4**	43	**4**	44	**2**	45	**3**
46	**67**	47	**208**	48	**8**	49	**1**	50	**1**

CHEMISTRY

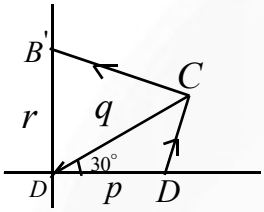
51	**3**	52	**4**	53	**4**	54	**4**	55	**2**
56	**1**	57	**3**	58	**3**	59	**2**	60	**4**
61	**1**	62	**1**	63	**1**	64	**1**	65	**1**
66	**4**	67	**2**	68	**3**	69	**3**	70	**3**
71	**10**	72	**3**	73	**687**	74	**6**	75	**6**

SOLUTIONS
MATHEMATICS

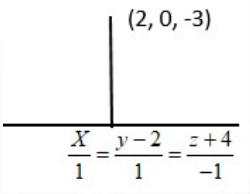
1. 

$\overline{DC} = \bar{a}, \overline{AB} = \bar{b}, \overline{OA} = q\hat{i}$

Rotate ΔOAB by 30° then A reaches C. B reaches B' Where $|\overline{AB}| = |\overline{CB}'|$



$|\overline{DC}| + |\overline{CB}'|$ is min if they are collinear

2. 

3.

$\alpha - \beta$	5	4	3	2	1	0	-1	-2	-3	-4	-5
Prob	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{1}{6}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{1}{12}$	$\frac{1}{18}$	$\frac{1}{36}$

4. R be $(2Cos\theta, 3Sin\theta)$, OP *perpendicular to* OR

$\therefore \frac{3}{2}\tan\theta \times \frac{3}{\sqrt{3}} = -1 \Rightarrow \tan\theta = \frac{-2\sqrt{3}}{9}$, Required $= \frac{1}{4}\left(\frac{1}{OP^2} + \frac{1}{OR^2}\right) = \frac{13}{144}$

5. Given $\int \tan^{-1}x.\frac{1}{x(\ln x)} + \frac{1}{1+x^2}.\ln(\ln x)$ $\therefore f(x) = \left(\tan^{-1}x\right)\ln(\ln x)$

6. By differentiating wrt x, we get $\left(1+x^2\right)f(x) = x \rightarrow f(x)$ is odd

Required integral $= \int_{-\pi/4}^{\pi/4} \sec^2 x \ dx = 2$

7. $D = p^2 - 5p$. If p=9, then D is perfect square $Area = \int_0^9 (x-9)^2 \, dx = 243$

8. $m = {}^6C_2 \times {}^5C_4 \times 2! \times 4! \times 5!$ $n = 5! \times 6!$

9. Required = *coefficient of* x^{99} *in* $x^{100}\left(1 + 2\left(\frac{1+x}{x}\right) + ...101\left(\frac{1+x}{x}\right)^{100}\right)$

10. $x^2 - 16 \geq 0,\ x \neq 2, -2,\ (x+5)(x-2) \geq 0$ $x \in (-\infty, -5)\,U\,(2, \infty)$

11. $Cos\left(2\sin^{-1}\frac{1}{\sqrt{5}}\right)=\frac{3}{5},\ \sin^{-1}\left(\sin\frac{2\pi}{3}\right)=\frac{\pi}{3}$ $\qquad Cos^{-1}\left(Cos\frac{7\pi}{6}\right)=2\pi-\frac{7\pi}{6}$

12. $ABA^T=I\Rightarrow AB^TA^T=I$

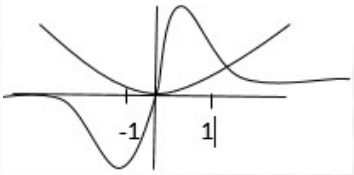
13. $a_1+a_2+a_3=2,\ \ b_1+b_2+b_3=2,\ \ c_1+c_2+c_3=2$
(det A) max when $a_1=2,\ b_2=2,\ c_3=2$ & else are '0'.

14. $f''(1)=3-2a+b=a\ f''(2)=12-2a=b, f'''(3)=6 \qquad \therefore a=3,\ b=6$ s

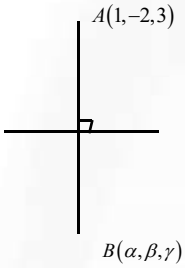
15. Conceptual

16. $\int e^y dy=\int 2x\ dx \quad =f(x)=\ln\left(x^2+c\right)$

$f'(1)=1\Rightarrow C=1$

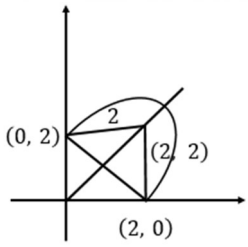


17. conceptual



18. $AB\perp line, (\alpha-1)2+4(\beta+2)+3(\gamma-3)=0\therefore 2\alpha+4\beta+3\gamma=3$

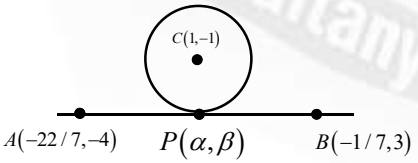
19.



20. $B=(1,2)\ \&\ Let\ C\equiv(\alpha,4-2\alpha)\therefore AB=\sqrt{2^2+1^2}=\sqrt{(2\alpha-3)^2+(3-\alpha)^2}, 5\alpha^2-18\alpha+13=0$

21. Equation of AB is 7X-3Y+10=0…..(I)
Equation of CP is 3x+7y=4=0…..(ii)

$\alpha=\frac{-41}{29} \qquad \beta=\frac{1}{29}$



22. $\left|kz_1+(1-k)z_2-z_3\right|=$ height from vertex C.

$\therefore Area=\frac{1}{2}(AB)(height)=\frac{1}{2}\left|z_1-z_3\right|\left|z_2-z_3\right|\sin C \qquad \alpha=\frac{Sin\ c}{AB}=\frac{1}{2R}=\frac{1}{6}$

23. $(Sin\,x+3)\left(Sin\,x-(x-1)^2\right)=0$

24. Required $= \lim_{n\to\infty} \dfrac{3\left(\sum_{r=1}^{n-1}\left(-r^3+r^2(n+1)-nr\right)\right)}{n(n+1)\left(3n^2-n-2\right)} = \dfrac{1}{6}$

25. $\mu = \dfrac{40\times 12.5 - 10\times 15}{25} = 14$ $\qquad \sigma^2 = 2 + \dfrac{15\times 25}{40\times 40}(4)^2 = 5.75$

PHYSICS

26. Gases have less viscosity.
Due to insoluble impurities like detergent surface tension decreases

27. $\omega = \dfrac{2\pi}{T} \Rightarrow \omega \propto \dfrac{1}{T}$ $\quad T_{moon} = 27\text{days}$
$T_{earth} = 365\,\text{days } 4\text{ hour} \quad \Rightarrow \omega_{moon} > \omega_{earth}$

28. Co-efficient of depends on surface in contact So, depends on material of object.

29.: Measuring instruments Theory

30. Ampere- Maxwell law
$\rightarrow \oint \vec{B}.\vec{dl} = \mu_0 i_c + \mu_0\varepsilon_0 \dfrac{d\phi_E}{dt}$

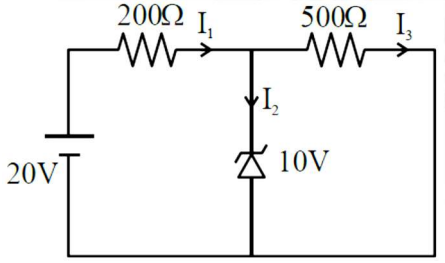
Faraday law $\rightarrow \oint \vec{E}.\vec{dl} = \dfrac{d\phi_B}{dt}$

Gauss' law for electricity $\rightarrow \oint \vec{E}.\vec{dA} = \dfrac{Q}{\varepsilon_0}$

Gauss 'law for magnetism $\rightarrow \oint \vec{B}.\vec{dA} = 0$

31. $Y = AB + \bar{A}.B$
$= \left(A + \bar{A}\right).B$
$Y = 1.B$
$Y = B$

32.



Zener is in breakdown region.

$I_3 = \frac{10}{500} = \frac{1}{50}$

$I_1 = \frac{10}{200} = \frac{1}{20}$

$I_2 = I_1 - I_3$

$I_2 = \left(\frac{1}{20} - \frac{1}{50}\right) = \left(\frac{3}{100}\right) = 30mA$

33. $\text{K.E.} = \text{hf} - \phi$

$\tan\theta = h$

34. $\mu = \frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin\frac{A}{2}}$

$\frac{\cos\frac{A}{2}}{\sin\frac{A}{2}} = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\frac{A}{2}}$

$\sin\left(\frac{\pi}{2} - \frac{A}{2}\right) = \sin\left(\frac{A+\delta_m}{2}\right)$

$\frac{\pi}{2} - \frac{A}{2} = \frac{A}{2} + \frac{\delta m}{2}$

$\delta_m = \pi - 2A$

35. $\vec{F} = \left(6t\hat{i} + 6t^2\hat{j}\right)N$

$\vec{F} = m\vec{a} = \left(6t\hat{i} + 6t^2\hat{j}\right)$

$\vec{a} = \frac{\vec{F}}{m} = \left(3t\hat{i} + 3t^2\hat{j}\right)$

$\vec{v} = \int_0^t \vec{a}dt = \frac{3t^2}{2}\hat{i} + t^3\hat{j}$

$P = \vec{F}.\vec{v} = \left(9t^3 + 6t^5\right)W$

36. Since, Intensity $\propto$ width of slit (ω)

$I_{\min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2 = I$

So, $I_1 = I, I_2 = 4I$ $I_{\max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2 = 9I$

$\frac{I_{\max}}{I_{\min}} = \frac{9I}{I} = \frac{9}{1}$

37. $a \times 10^b$

If $a > 5$ order is b $a > 5$ order is $b+1$

38. $f = \rho A v^2$

39. $n = 4$

40. NCERT Theory

41. A pressure node is a displacement anti-node and displacement node is a pressure anti node. $\Delta P = -B\frac{\partial y}{\partial x}$ At displacement nodes, $\frac{\partial y}{\partial x}$ is both maximum and minimum

42. $I_1 = 3A,\ I_2 = 4\sqrt{2}\sin wt \qquad I_{net} = I_1 + I_2 = \left(3 + 4\sqrt{2}\ \sin wt\right)$

$$I_{rms} = \sqrt{3^2 + \left(4\sqrt{2}\right)^2 \times \frac{1}{2}} = 5A$$

43. Rubber experiences larger lateral strain than steel

44. According to Gauss's theorem in electrostatics, $\oint E.ds = \frac{q}{\varepsilon_0}$. Here, E is due to all the charges q_1, q_2, q_3, q_4 and q_5. As q is charge enclosed by the Gaussian surface, therefore, $q = q_2 + q_4$

45. Given, radius of earth $R = 6.37 \times 10^6 \text{m}$

Negative surface charge density $\sigma = 10^{-9} \text{C/m}^2$

Potential $V = 400kV = 400 \times 10^3 V$ Current on the globe $l = 1800\,A$

Surface area of earth $A = 4\pi R^2 = 4 \times 3.14 \times (6.37 \times 10^6)^2 = 509.64 \times 10^{12} m^2$

Charge on earth surface Q = Area of earth surface× Surface charge

$Q = A\sigma = 509.64 \times 10^{12} \times 10^{-9} = 509.64 \times 10^3 C$

We know that $Q = lt$ $\therefore$ Time required to neutralize earth's surface

$t = \frac{Q}{l} = \frac{509.64 \times 10^3}{1800}$ $t = 283.1\text{s}$ or $t = 4\,\text{min}\,43s$

Thus, the time required to neutralize the earth's surface is 283.1s.

46. $I_{\text{sphere}} = \frac{2}{3}MR^2 = Mk_1^2$

$$I_{\text{cylinder}} = \frac{1}{12}M(4R^2) + \frac{1}{4}MR^2 + M(2R)^2 = \frac{67}{12}MR^2 = Mk_2^2, \frac{k_1}{k_2} = \sqrt{\frac{2}{3}.\frac{12}{67}} = \sqrt{\frac{8}{67}}$$

47. $^{235}U \rightarrow {}^{140}Ce + {}^{94}Zr + n$

Disintegration energy $Q = (m_R - m_P).c^2, m_R = 235.0439\ u$

$m_P = 139.9054u + 93.9063u + 1.0086u \qquad = 234.8203u$

$Q = (235.0439u - 234.8203u)c^2 \quad = 0.2236\ c^2 \quad = 0.2236 \times 931, Q = 208.1716$

48. $dF = \frac{\mu_0}{2\pi a}\left(\frac{i}{2\pi R}dx\right)^2 l = \frac{\mu_0}{2\pi \times 2R}.\frac{i^2}{4\pi^2 R^2}.dx.dx.l$ Pressure on the element

$$= \frac{\mu_0}{2\pi.2R}.\frac{i^2 dx}{4\pi^2 R^2}.\frac{dx.l}{dx.l}$$

49. Potential V= xy

50. Redraw the circuit in series and parallel combination

CHEMISTRY

51. $A = PhCH_2OH \ , B = HCOOH$

52 $A = PhOH \ , B = PhH \ , C = PhCH_3$

53. due to lanthanide contraction size of Mo=W

54. O_2 has 2 upe-

55. only I^- is oxidized by O_2 based on SRP values

56. $K_2SO_4 \rightarrow 2K^+ + SO_4^{2-} \qquad i = 3$

57. Tollen's Test – Aldehydes
Barfoed Test – Monosaccharides
Molisch Test – Carbohydrates
Biuret Test – Proteins and peptides

58. $d^8 SFL \Rightarrow 2upe^-$

59 NCERT

60 III and IV are correct

61. Both correct & correct explanation

62. both correct and correct explanation

63. $\left(t_{\frac{1}{2}}\right)_o = \dfrac{[A]_o}{2K}$

64. Based on n+l value

65. $0.02 \times 100 \times 10^{-23} \times 6.022 \times 10^{23} = 12.044 \times 10^{20}$

66. $2NO_2 + 2OH^- \rightarrow NO_2^- + NO_3^- + H_2O$

67. $\dfrac{3+6+1+0}{5} = \dfrac{10}{5} = 2$

68. $\dfrac{1}{\lambda} \alpha R_n z^2 \Rightarrow \lambda_1 : \lambda_2 : \lambda_3 = \dfrac{1}{1^2} : \dfrac{1}{2^2} : \dfrac{1}{3^2} \qquad 1 : \dfrac{1}{4} : \dfrac{1}{9} = 36 : 9 : 4$

69. $Ni(OH)_2 \rightarrow Ni^2 + 2OH^- \ 2 \times 10^{-15} = \qquad x = 2 \times 10^{-15}$

71. $t_{99.9} = \dfrac{2.303}{K} \log \dfrac{100}{0.1} = \dfrac{6.909}{K} = \dfrac{\dfrac{6.909}{0.69}}{t_{\frac{1}{2}}} = 10 t_{\frac{1}{2}}$

72. $if \ \ P = 1 \Rightarrow q = 2 , \dfrac{2+1}{2-1} = 3$

73. $N_2O_4(g) \rightarrow 2NO(g)$
$1-0.5 = 0.5 \qquad 2 \times 0.5 = 1$

74. $Sr^{2+}, Ba^{2+}, Ca^{2+}, Cu^{2+}, Na^+, K^+$

75. Except sucrose remaining given sugars are reducing