clamphook

CBT | October 30

Clamphook's Model Exam

2080

Full Marks: 140 **Time:** 2 hours **Pass Marks:**

1. Frequency of vibration f of stretched string of length L under tension T in n loops is given by $F = \frac{n}{2L}\sqrt{\frac{T}{m}}$. The dimension of m is:

a. $[ML^{-2}T^{0}]$ b. $[ML^{-1}T^{0}]$

c. $[ML^{-1}T^{-1}]$ d. $[ML^{0}T^{0}]$

2. A block of mass M pulled along horizontal frictionless surface by a rope of mass m. If a force F is applied at one end of rope, the force which the rope exerts in the block is

a. F b. $\frac{FM}{M+m}$

c. $\frac{F}{2}$ d. $\frac{Fm}{M+m}$

3. g_p is the acceleration due to gravity is at pole and g_e is that at equator then [IOE 2078]

a. $g_p > g_e$ b. $g_p < g_e$

c. $g_p = g_e$ d. Cannot say

4. A disc of paper of radius R has a hole of radius r. It is floating on a liquid of surface tension T. The force of surface tension on the disc is

a. $2\pi rT$ b. $2\pi(R-r)T$

c. $2\pi(R+r)T$ d. $4\pi(R+R)T$

5. We need mechanical equivalent of heat because :

a. it converts work into heat. b. in cgs system, heat is not measured in the units of work

c. in SI, heat is measured in the units of work d. of some reason other than those mentioned above

6. N molecules, each of mass m of gas A and $2N$ molecules each of mass $2m$ of gas B are contained in the same vessel which is maintained at temperature T. The mean square velocity of molecules of B type of denoted to v^2 and $\frac{\omega^2}{v^2}$ is that of molecules of A type is denoted by ω^2, then $\frac{\omega^2}{v^2}$ is

a. 2 b. 1

c. $1/2$ d. $2/3$

7. Looming occurs due to [BP 2011]

a. Mirage
b. Interference
c. Diffraction effect
d. photoelectric

8. The focal length of a plano – convex lens is equal to radius of a curvature of its curved surface . Then refractive index of lens material

a. 1.33
b. 1.5
c. 1.6
d. 2

9. The fact that light can be polarized established the light . [KU 2013, 2012, 2011]

a. Travels in the form of particles
b. IS an electromagnetic wave
c. IS an longitudinal wave
d. IS a transverse wave

10. In a resonance tube , the air columns for the 1^{st} and 2^{nd} resonance differ by 31.5 cm . The wavelength of sound wave in the tube is :

a. 31.5 cm
b. 63 cm
c. 125 cm
d. 252 cm

11. The ratio of the forces between two small spheres charged to constant potentials in air and in medium of dielectric constant K is :

a. 1 : K
b. K : 1
c. $1 : K^2$
d. $K^2 : 1$

12. If a copper wire is stretched to make 0.1% thinner, then the percentage increase in resistance would be nearly

a. 0.1%
b. 0.2%
c. 0.4%
d. 0.025%

13. The power factor of a series RL circuit is 0.5 . IF R = 100Ω , f = 50 Hz , then L is

a. $\frac{\sqrt{2}}{\pi}$
b. $\frac{\sqrt{3}}{\pi}$
c. $\frac{\sqrt{3}}{2\pi}$
d. π

14. Light of wave length 400 nm is incident on a metal surface having threshold wave length 6000 nm and a photoelectric current I flows. If the wavelength is doubled, the magnitude of photoelectric current will be

a. I
b. 2I
c. 0
d. I/2

15. The minimum wavelength of X – rays can be obtained by

a. Increasing filament voltage .
b. Increasing potential between anode and cathode
c. Increasing intensity of X- rays
d. Changing target material .

16. As the doping to a pure silicon increases , the bulk resistance of material [IOE 2074]

a. increases
b. decreases
c. remains same
d. none

17. The range of the function f(x) = $\frac{(x+2)}{|x+2|}, x \neq -2$ is

a. $\{1\}$
b. $\{-1\}$
c. $\{-1, 0, 1\}$
d. $\{-1, 1\}$

18. $(A-B)\cap(B-A)=$ **[IOE 2075]**

a. $A-C$ b. $B-A$

c. $A\Delta B$ d. ϕ

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19. **If** $A=\begin{bmatrix}2 & -3\\ -3 & 4\end{bmatrix}$ **,then** A^2-I **is; [IOE 2078]**

a. A b. 4A

c. 6A d. 5A

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20. $\dfrac{1+2i}{1-i}$ **lies in the quadrant**

a. 1^{st} b. 2^{nd}

c. 3^{rd} d. 4^{th}

---

21. **When** x^2-px+3 **is divided by** $(x-2)$ **the remainder is** 5**. Then the value of** p **is**

a. $p=-1$ b. $p=-4$

c. $p=2$ d. $p=1$

---

22. $\sum_{n=1}^{\infty}\dfrac{(\log_e x)^n}{n!}$ **is equal to:**

a. $\log_e x$ b. $x-1$

c. e^x d. e^{-x}

---

23. **If** $\tan\theta+\tan\left(\dfrac{\pi}{2}-\theta\right)=2$**, then general value of** θ **is**

a. $n\pi+(-1)^n\dfrac{\pi}{4}$ b. $n\pi\pm\dfrac{\pi}{4}$

c. $2n\pi\pm\dfrac{\pi}{4}$ d. $n\pi+\dfrac{\pi}{4}$

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24. **If** $\tan^{-1}x+\tan^{-1}y=\dfrac{\pi}{2}$ **then the conic formed is [IOE 2077]**

a. circle b. parabolaa

c. hyperbola d. ellipse

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25. $a:b:c$ **is equal to** $1:2:3$ **where a,b,c are three sides of a triangle then [IOE 2077]**

a. $\angle A$ is greatest b. $\angle C$ is greatest

c. these donot form triangle d. is right angle triangle

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26. The product of length of perpendiculars drawn from the point (1,2) to the lines represented by $2x^2+5xy+3y^2=0$ **is :**

a. 24 b. $2\sqrt{26}$

c. $\dfrac{24}{\sqrt{26}}$ d. $5\sqrt{26}$

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27. The equation of the circle passing through the intersections of circle $x^2+y^2-8x-2y+7=0$ **and** $x^2+y^2-4x+10y+8=0$ **and passing through the point (−1, −2) is :**

a. $9x^2+9y^2-40x+78y+72=0$ b. $9x^2+9y^2-40x+78y-71=0$

c. $9x^2+9y^2+40x+78y+71=0$ d. $9x^2+9y^2-40x-78y+71=0$

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28. If plane passes through points (1,1,1),(1,-1,1) and (-5,2,-4),then equation of plane is? [IOE 2078]

a. parallel to x axis
b. parallel to y-axis
c. parallel to z axis
d. None

29. **If the line $ty = x + at^2$ touches the parabola $y^2 = 4ax$ then the point of contact is :**

a. $(2a, 2a)$
b. $(\mathrm{at}^2, 2at)$
c. $(2at, \mathrm{at}^2)$
d. (at, at^2)

30. $\lim_{x \to 1} \frac{\sin(x^2 - 1)}{(x - 1)}$
[IOE 2075]

a. 0
b. 1
c. -1
d. 2

31. **The differential coefficient of** $\coth^{-1} \cos x$ **is:**

a. $\operatorname{cosec} x$
b. $\sec x$
c. $-\operatorname{cosec} x$
d. $-\sec x$

32. $\int_a^b \frac{\log_e x}{x} dx =$

a. $\frac{1}{2}[(\log_e b)^2 - (\log_e a)^2]$
b. $[(\log_e b)^2 - (\log_e a)^2]$
c. $[(\log_e b) - (\log_e a)]$
d. $[(\log_e b) + (\log_e a)]$

33. **The solution of the differential equation** $x^2 + y^2 \frac{dy}{dx} = 4$

a. $x^2 + y^2 = 12x + c$
b. $x^2 + y^2 = 3x + c$
c. $x^3 + y^3 = 3x + c$
d. $x^3 + y^3 = 12x + c$

34. **If the position vectors A and B are** $3\vec{i} - 2\vec{j} + \vec{k}$ **and** $2\vec{i} + 4\vec{j} - 3\vec{k}$ **then** $|\overrightarrow{AB}| =$

a. $\sqrt{14}$
b. $\sqrt{29}$
c. $\sqrt{43}$
d. $\sqrt{53}$

35. **A bag contains 3 white , 2 red balls . A ball is drawn and another ball is drawn without replacing first ball. Then the probability second ball to be red is :**

a. $\frac{1}{5}$
b. $\frac{2}{5}$
c. $\frac{3}{5}$
d. $\frac{21}{25}$

36. **The height of most people at pulchowk is 5 feet 8 inch, which measure of central tendency does it represent?**

a. Mode
b. Median
c. All of the above
d. Mean

37. **The equivalent mass of an element is** 4**. Its chloride has a V.D.** 59.25**. Then valency of element is**

a. 1
b. 2
c. 3
d. 4

38. **Which of the following would you also know. If you are given the atomic number element.**

a. atomic weight
b. atomic volume
c. atomic number
d. atomic size

39. **The elements on the right side of the periodic table are**

a. Metals
b. Metalloids
c. Non-metals
d. Transition elements

40. Ksp for lead iodate $[Pb(IO_3)_2]$ is 3.2×10^{-14} at a given temperature. The solubility in $mol\ l^{-1}$ will be

a. 1×10^{-4}
b. 2×10^{-5}
c. 2×10^{-6}
d. 1×10^{-7}

41. CH_3-O-CH_3 is a

a. Arrhenius acid
b. Bronsted acid
c. Lewis base
d. Lewis acid

42. The most common oxidation state of an element is -1, It outermost shell contains

a. 8 electrons
b. 7 electrons
c. 6 electrons
d. 5 electrons

43. A Bessemer Converter is used in the manufacture of_____from pig iron

a. Steel
b. Cast iron
c. Pig Iron
d. Silver

44. In the cyanide process for the extraction of silver, sodium cyanide is used to

a. Convert silver into a soluble silver complex
b. Reduce silver
c. Precipitate silver
d. Oxidise silver

45. Which of following is used to absorb sulphur dioxide?

a. conc.H_2SO_4
b. KOH solution
c. water
d. Anhydrous $CaCl_2$

46. Which element is found in Free State

a. Iodine
b. Sulphur
c. Phosphorus
d. Magnesium

47. Which one of the following can best be used to distinguish between samples of ethane and ethene? [IOE 2074]

a. Lime water
b. Aqueous $AgNO_3$
c. Aqueous bromine
d. Litmus solution

48. Propyne and propene can be distinguished by

a. Br_2 in CCl_4
b. $dil \cdot KMnO_4$
c. $conc \cdot H_2SO_4$
d. $AgNO_3$ in ammonia

49. The bond angle in geometry of haloalkane involving triple bond is : [IOE 2078]

a. 120°
b. 180°
c. 90°
d. 45°

50. Fats and oils are

a. Acids
b. Alcohols
c. Esters
d. Hydrocarbons

51. I said to him, "Who are you?"

a. I asked him who he was.
b. I asked him who are you.
c. I asked him who was he.
d. I said to him who he was.

52. The children in that neighbourhood often ride ..... bikes through the park.

a. his or her
b. their
c. theirs
d. your

53. The bridge is _____the Bagmati river.

a. upon
b. up
c. above
d. over

54. I have a bone to pick with you in this matter.

a. desire
b. am angry
c. selfish motive
d. selfless motive

55. The phonemic transcription of the word 'paper' is [IOE 2077]

a. /eɪpə/
b. /'peɪpə/
c. /pepor/
d. /fpep/

56. The word "solar" is a ..... syllabled word.

a. One
b. Two
c. Three
d. Four

57. He would have repaired the car himself if he ... the tools. [IOE 2077]

a. had
b. would have
c. will have
d. had had

58. I reported .....the accident.

a. to see
b. seeing
c. seen
d. to seeing

59. His performance pleased us . Its passive form is [IOE 2074]

a. We are pleased by his performance
b. We were pleased by his performance
c. We were pleased with his performance
d. We were pleased to his performance

60. Synonym of 'Candid' is

a. Apparent
b. Explicit
c. Frank
d. Bright

61. A lift is moving up with tin acceleration equal to $\frac{8}{5}$. The apparent weight of 60 kg man standing in the lift is:

a. 48 kg
b. 60 kg
c. 72 kg
d. 12 kg

62. A 3 kg loaded on the string execute SHM as $x = 2\cos 50t$ where x is meters and t are sec. its spring constant is

a. 1 N/m
b. 2700 N/m
c. 7500 N/m
d. 3400 N/m

63. The force of surface tension on a ring situated on the surface of water is $14\pi \times 10^{-4}$N. The diameter of ring is(Surface Tension of water = 70×10^{-3}N/ m)

a. 5 mm
b. 1 cm
c. 2 cm
d. 4 cm

64. A vertical column 50 cm long at 50°C balances another column of same liquid 60 cm long at 100°C. The coefficient of absolute expansion of the liquid is

a. $0.005/^\circ C$ b. $0.0005/^\circ C$

c. $0.05/^\circ C$ d. $0.0025/^\circ C$

65. $100J$ of work is done by a diatomic gas at constant pressure then heat supplied will be:

a. $100J$ b. $250J$

c. $350J$ d. $500J$

66. When a light wave goes from air into water, the quality that remains unchanged is its

a. speed b. amplitude

c. frequency d. wavelength

67. Two plane waves of same frequencies having intensities I and 4I, are travelling in the same direction. The resultant intensity at minima is

a. I b. 3I

c. 5I d. 9I

68. Four metallic plates each with a surface area of one side, A are placed at a distance d apart from each other. The two inner plates are connected to point B and other two plates are connected to point A. Then capacitance of the system is:

a. $\frac{\epsilon_0 \mathrm{A}}{\mathrm{d}}$ b. $\frac{2\epsilon_0 \mathrm{A}}{\mathrm{d}}$

c. $\frac{3\epsilon_0 \mathrm{A}}{\mathrm{d}}$ d. $\frac{4\epsilon_0 \mathrm{A}}{\mathrm{d}}$

69. In a moving coil galvanometer magnet of magnetic field 2 Tesla is used. The number of turns coil is 1000 and area of coil is $500cm^2$. If torsional constant of the phosphor bronze strip be 2 units then what current must be passed through the galvanometer to make 1 degree deflection in the galvanometer? [IOE 2077]

a. 25 A b. 12.5 A

c. 36 A d. 50 A

70. A circular coil of radium 1m, 100 turns and kept to perpendicular to magnetic field of 4Gauss is turned by 180° in π sec. Find the EMF induced. [IOE 2078]

a. 0.4 V b. 0.8V

c. 0.04 V d. 0.08 V

71. The binding energy of hydrogen atom is

a. $1.0V$ b. $13.6eV$

c. $-13.6eV$ d. zero

72. Which wireless technology allows mobile devices to exchange data over short distances?

a. Wi-Fi b. Bluetooth

c. LTE d. NFC

73. $\log(\frac{a^2}{bc}) + \log(\frac{b^2}{ca}) + \log(\frac{c^2}{ab}) =$ **[IOE 2077]**

a. 0 b. 1

c. abc d. $a^2b^2c^2$

74. $\begin{vmatrix} 1 & a(b+c) & bc \\ 1 & b(c+a) & ca \\ 1 & c(a+b) & ab \end{vmatrix}$ **[IOE 2074]**

a. 1 b. 0

c. 1 + ab + bc + ca d. 4abc

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75. The value of $\sqrt{(6+8i)}+\sqrt{(6-8i)}$ **is**

a. $2\sqrt{2}(1+i)$ b. $3\sqrt{2}$

c. $4\sqrt{2}$ d. 1

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76. If the sum of the roots of the equation $x^2+px+q=0$ **is m times their difference, then**

a. $p(m-1)=4$ mq b. $p^2\left(m^2-1\right)=4m^2q$

c. $p\left(m^2+1\right)=4mq$ d. $p\left(m^2+1\right)=m^2q^2$

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77. The number of ways in which 5 boys and 5 girls can be sit in a circular table alternatively is [IOE 2076]

a. 2880 b. 1400

c. 1200 d. 3212

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78. If $3\tan(\theta-15^\circ)=\tan(\theta+15^\circ)$**, then** θ **is**

a. $n\pi+\frac{\pi}{4}$ b. $n\pi+\frac{\pi}{6}$

c. $n\pi+\frac{\pi}{8}$ d. $n\pi+\frac{\pi}{3}$

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79. In $\Delta ABC, \frac{r_2-r}{b\tan(\frac{B}{2})}=$ **[IOE 2076]**

a. $\frac{r}{R}$ b. $\frac{R}{r}$

c. $\frac{r_1}{R}$ d. 1

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80. $\lim_{x\to 0}\frac{1-\cos x}{1-\cos 2x}$ **[IOE 2075]**

a. 1 b. 0

c. $\frac{1}{2}$ d. $\frac{1}{4}$

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81. If $f(x)=\sin^{-1}(\cos x)+\cos^{-1}(\sin x)$ **then find** $f'(x)$**. [IOE 2078]**

a. 0 b. 1

c. 2 d. -2

---

82. $\int \sin 3x\cos 5xdx=$ **[IOE 2078]**

a. $\frac{\cos 2x}{2}+\frac{\cos 8x}{8}+c$ b. $\frac{\cos 2x}{4}+\frac{\cos 8x}{16}+c$

c. $\frac{\cos 2x}{4}-\frac{\cos 8x}{16}+c$ d. $\frac{\cos 2x}{2}-\frac{\cos 8x}{8}+c$

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83. The area enclosed by curve $y^2=16x$ **and double ordinate at (1,4) is [IOE 2075]**

a. $\frac{32}{3}$ units b. $\frac{16}{3}$ units

c. $\frac{8}{3}$units d. $\frac{4}{3}$ units

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84. The area bounded by curve $y=2x$–$4, y=1$ **and y – axis is [IOE 2076]**

a. 4 sq. unit b. 10 sq. unit

c. 25/2 sq . units d. 25/4 sq. units

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85. $(1, 2, -1)$ **is the foot of the perpendicular from** $(0, 1, 2)$ **to a plane. The distance of** $(2, 2, 1)$ **from the plane is**

a. $\frac{5}{\sqrt{11}}$
b. $\frac{\sqrt{5}}{11}$
c. $\sqrt{\frac{5}{11}}$
d. $\frac{5}{11}$

86. The equation $2x = e^x + e^{-x}$ **and** $2y = e^x - e^{-x}$ **represents: [IOE 2077]**

a. Parabola
b. Ellipse
c. Hyperbola
d. Circle

87. if $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$ **then the angle between** $\vec{a}$ **and** $\vec{b}$ **such that** $a, b \neq 0$ **is**

a. $\frac{\pi}{3}$
b. $\frac{\pi}{6}$
c. $\frac{\pi}{4}$
d. $\frac{\pi}{2}$

88. In a vessel $2\text{g } O_2$, $2\text{ g } H_2$, **and** $2\text{ g } N_2$ **are present. Which has the largest number of atoms?**

a. O_2
b. H_2
c. N_2
d. equal in all

89. Which of the following constitutes a group of the isoelectronic species?

a. ${C_2}^{2-}$, ${O_2}^{-}$, CO, NO
b. NO^+, ${C_2}^{2-}$, CN^-, N_2
c. CN^-, N_2, ${O_2}^{2-}$, ${CO_2}^{2-}$
d. N_2, ${O_2}^{-}$, NO^+, CO

90. 10ml of $\frac{N}{10}$ **oxalic acid solution required 0.0316gm of** $KMnO_4$ **solution for complete oxidation. The eq.wt of** $KMnO_4$ **is**

a. 31.6
b. 20
c. 52.6
d. 31.6

91. pH of a saturated solution of $Ba(OH)_2$ **is** 12**. The value of solubility product, Ksp of** $Ba(OH)_2$ **is**

a. 3.3×10^{-7}
b. 5×10^{-7}
c. 4×10^{-6}
d. 5×10^{-6}

92. Identify the incorrect statement with respect to ozone

a. Ozone is formed in the upper atmosphere by a photochemical reaction involving dioxygen
b. Ozone is more reactive than oxygen
c. Ozone is diamagnetic whereas dioxygen is paramagnetic
d. Ozone protects the earth's inhabitants by absorbing γ radiations

93. The outer electronic configuration of alkaline earth metal is

a. ns2
b. ns1
c. np6
d. nd10

94. Raw juice in sugar factories is generally concentrated by

a. vacuum distillation
b. Steam distillation
c. sublimation
d. crystallization

95. Nitration of benzoic acid gives

a. 3-nitrobenzoic acid
b. 2-nitrobenzoic acid
c. 2, 3-dinitrobenzoic acid
d. 2, 4-dinitrobenzoic acid

96. None of them..... the facts

a. know
b. knows
c. is knowing
d. has known

97. Indirect form of –He said, "What a beautiful view it is !" is [IOE 2075]

a. He told it was a very beautiful view.
b. He told that it was a very beautiful view.
c. He exclaimed it was a very beautiful view.
d. He exclaimed joyfully that it was a very beautiful view.

Answer the following questions based on given passage *(Questions from 98 to 100)*

A pioneer leader for women's rights, Susan B. Anthony became one of the leading women reformers of the nineteenth century. In Rochester, New York, she began her first public crusade on behalf of temperance. The temperance movement dealt with the abuses of women and children who suffered from alcoholic husbands. Also,
she worked tirelessly against slavery and for women's rights. Anthony helped write the history of women suffrage.
At the time Anthony lived, women did not have the right to vote. Because she voted in the 1872 election, a U.S.
Marshall arrested Anthony. She hoped to prove that women had the legal right to vote under the provisions of the fourteenth and fifteenth amendments to the Constitution. At her trial, a hostile federal judge found
her guilty and fined her $100, which she refused to pay.
Anthony did not work alone. She col□laborated with reformers of women's rights such as Elizabeth Cady Stanton and Amelia Bloomer. Susan worked for the American Anti-Slavery Society with Frederick Douglass, a fugitive slave and black abolitionist. On July 2, 1979, the U.S. Mint honored her work by issuing the Susan B. Anthony dollar coin. Although Anthony did not live to see the fruits of her efforts, the establishment of the nineteenth amendment is indebted to her efforts.

98. What is the main idea of the passage?

a. Reformers do not always see the results of their efforts.
b. Susan B. Anthony never gave up her fight for all people's freedoms.
c. Slavery was one of Susan B. Anthony's causes.
d. Anthony did not condone the use of alcohol.

99. Anthony advocated all of the following EXCEPT

a. Slavery should be abolished.
b. Alcohol should be prohibited because of the abuse it causes.

c. Women are citizens and should have the right to vote.

d. Employers should provide child care for female employees

100. An effective reformer is

a. a person who has the support of family and friends.

b. an activist who can enlist the help of others to promote a cause.

c. a person who is knowledgeable about a particular cause.

d. a person who ignores what others think

Answer Key

1.b	2.b	3.a	4.c	5.b	6.a	7.a	8.d
9.d	10.b	11.a	12.c	13.b	14.c	15.b	16.b
17.d	18.d	19.c	20.b	21.d	22.b	23.d	24.c
25.c	26.c	27.a	28.b	29.b	30.d	31.c	32.a
33.d	34.d	35.b	36.a	37.c	38.c	39.c	40.b
41.c	42.b	43.a	44.a	45.b	46.b	47.c	48.d
49.b	50.c	51.a	52.b	53.d	54.b	55.b	56.b
57.d	58.b	59.b	60.c	61.c	62.c	63.a	64.a
65.c	66.c	67.a	68.b	69.d	70.d	71.b	72.b
73.a	74.b	75.c	76.b	77.a	78.a	79.d	80.d
81.d	82.c	83.b	84.d	85.a	86.c	87.d	88.b
89.b	90.a	91.b	92.d	93.a	94.a	95.a	96.b
97.d	98.b	99.d	100.b				

Solutions

1. b

m is mass per unit length in this formula hence $[m] = [ML^{-1}T^0]$

2. b

Acceleration of system= $\frac{F}{M+m}$

Force on block = $Ma = \frac{FM}{M+m}$

3. a

$g_p - g_e = R\omega^2$

4. c

Force = surface tension $\times$ perimeter

$F = T \times (2\pi R + 2\pi r) = 2\pi(R+r)T$

5. b

Mechanical equivalent relates heat in calories to the equivalent amount of work in joules.

6. a

$V_{rms} = \frac{3RT}{M} = \frac{3KT}{m}$

$..V_{rms}\alpha\alpha$

So, $\frac{\dot{\omega}^2}{v^2} = \frac{m_\pi}{m_A} = \frac{2m}{m} = 2$

7. a

●In deserts , mirage is observed because refractive index of air increases with height

● In cold , phenomenon if looming occurs because refractive index of air decreases with height .

8. d

$\frac{1}{f_l} = (\mu - 1)(\frac{1}{R_1} + \frac{1}{R_2})$
$or, \frac{1}{f_l} = (\mu - 1)(\frac{1}{R_1} + \frac{1}{\infty})$
$or, \frac{1}{R} = (\mu - 1) \times (\frac{1}{R})[\because f_l = R]$
$\therefore \mu = 2$

9. d

•

10. b

11. a

Potential on the surface of a sphere

$V = \frac{q}{4\pi\epsilon_\circ K \cdot r}$
$q = 4\pi\epsilon_\circ K \cdot V \cdot r$
$F_{air} = \frac{q_1 q_2}{4\pi\epsilon_\circ r^2}$
$= \frac{(4\pi\epsilon_\circ V_1 r_1) \cdot (4\pi\epsilon_\circ V_2 r_2)}{4\pi\epsilon_\circ r^2}$

In medium

$F_{medium} = \frac{(4\pi\epsilon_\circ K V_1 r_1) \cdot (4\pi\epsilon_\circ K V_2 r_2)}{4\pi\epsilon_\circ r^2}$

$\mathbf{F_{air}/F_{medium} = 1/K}$

NOTE: For constant charge $F_{air}/F_{medium} = K : 1$

12. c

While stretching $R \propto l_2$ and $R \propto \frac{1}{r^4}$

Thus for$\%$ change less than 10$\%$ when wire is made 0.1$\%$ thinner, resistance increases by $4 \times 0.1 = 0.4\%$

13. b

cos ϕ = 0.5 = 1/2= cos60°
.. ϕ = 60°
From impedence triangle ,

$\tan\phi = \frac{X_L}{R} = \frac{\omega L}{R} = \frac{2\pi f L}{R}$

or , $\tan 60^\circ = \frac{2\pi f L}{R}$

or, $L = \frac{R\sqrt{3}}{2\pi f} = \frac{\sqrt{3}}{\pi}$

14. c

15. b

The minimum wavelength of X-ray can be obtained by increasing the potential between anode and cathode.

16. b

Doping increases current conduction \ ð Resistance decreases.

17. d

$$y = f(x) = \frac{(x+2)}{|x+2|}$$

when $(x+2) < 0$

$$y = \frac{(x+2)}{-(x+2)} = -1$$

when $(x+2) > 0$

$$y = \frac{(x+2)}{(x+2)} = 1$$

$\therefore$ Range $= \{-1, 1\}$

18. d

$(A - B) \cap (B - A) = \phi$

19. c

$$A = \begin{bmatrix} 2 & -3 \\ -3 & 4 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 2 & -3 \\ -3 & 4 \end{bmatrix} \begin{bmatrix} 2 & -3 \\ -3 & 4 \end{bmatrix}$$

$$a_{11}^2 = 4 + 9 = 13$$

$$a_{11}^2 - I_{11} = 12$$

Here $a_{11}^2 - I_{11} = 6a_{11}$

Hence, $A^2 - I = 6A$

20. b

$$\frac{1+2i}{1-i}$$

$$= \frac{1+2i}{1-i} \times \frac{1+i}{1+i}$$

$$= \frac{1+i+2i-2}{1^2-(1)^2}$$

$$= \frac{3i-1}{1+1}$$

$$= \frac{3i-1}{2} = \frac{-1+3i}{2} = \left(-\frac{1}{2}, \frac{3}{2}\right)$$

This number lies in 2^{nd} quadrant.

21. d

Comparing $(x-a)$ with $(x-2)$, $a = 2$

From remainder theorem,

$$R = f(a)$$

$$5 = f(2)$$

$2^2 - 2p + 3 = 5$

$4 - 2p + 3 = 5$

$p = 1$

22. b

$\sum_{n=1}^{\infty} \frac{(\log_e x)^n}{x!}$

Putting $n = 1, 2, 3, \ldots$

$= \frac{\log_e x}{1!} + \frac{(\log_e x)^2}{2!} + \frac{(\log_e x)^2}{3!} + \ldots\ldots\ldots\infty$
$= e^{\log_e x} - 1$
$= x - 1$

23. d

$\tan\theta + \tan\left(\frac{\pi}{2} - \theta\right) = 2$

$\tan\theta + \cot\theta = 2$

$\tan^2\theta + 1 = 2\tan\theta$

$(\tan\theta - 1)^2 = 0$

$\tan\theta = 1$

$\tan\theta = \tan(\frac{\pi}{4})$

$\theta = n\pi + \frac{\pi}{4}$

24. c

$\tan^{-1} x + \tan^{-1} y = \frac{\pi}{2}$
$or, \tan^{-1}(\frac{x+y}{1-xy}) = \frac{\pi}{2}$
$i.e. \frac{x+y}{1-xy} = \tan\frac{\pi}{2} \implies \frac{1-xy}{x+y} = 0$
$i, e, xy = 1 \implies$ Rectangular Hyperbola

25. c

Let, $a = k$

then, $b = 2k$ and $c = 3k$

$a + b = c$ hence, it doesn't form triangle.

26. c

$\frac{|ax_1^2 + 2hx_1y_1 + by_1^2|}{\sqrt{(a-b)^2 + 4h^2}}$

$= \frac{|2 \times 1^2 + 2 \times \frac{5}{2} \times 1 \times 2 + 3 \times 2^2|}{\sqrt{(2-3)^2 + 4(\frac{5}{2})^2}}$

$= \frac{24}{\sqrt{26}}$

27. a

the circle passing through the intersections of circle $x^2 + y^2 - 8x - 2y + 7 = 0$ and $x^2 + y^2 - 4x + 10y + 8 = 0$
is

$$x^2 + y^2 - 8x - 2y + 7 + \lambda(x^2 + y^2 - 4x + 10y + 8) = 0$$

It passes through the point $(-1, -2)$:

$$1 + 4 + 8 + 4 + 7 + \lambda(1 + 4 + 4 - 20 + 8) = 0$$

$$\lambda = 8$$

The equation is

$$x^2 + y^2 - 8x - 2y + 7 + \lambda(x^2 + y^2 - 4x + 10y + 8) = 0$$

$$x^2 + y^2 - 8x - 2y + 7 + 8(x^2 + y^2 - 4x + 10y + 8) = 0$$

$$9x^2 + 9y^2 - 40x + 78y + 71 = 0$$

28. b

Since the plane passes through (1,1,1)

or, a (x-1)+b (y-1)+c(z-1)=0 (1)

Since it also passes through (1,-1,1) and (-5,2,-4),

a(0)+b(-2)+c(0)=0 (2)

a(-6)+b(1)+c(-5)=0 (3)

Using cross multiplication method,

a10 = b0 = c -12 = k

a=10k

b=0

c=-12k

Using a,b,c in eqn(1),

or,10k(x-1)+0(y-1)-12k(z-1)=0

or,10x-10-12z+12=0

or,10x-12z+2=0 is the equation of plane

Since, Dc,Äôs of y-axis is 0,1,0 , y-axis is perpendicular to normal of given plane.

hence y axis is parallel to the plane.

29. b

ty = x + at^2

$$\frac{dy}{dx} = \frac{1}{t}$$

$$y^2 = 4ax$$

$$\frac{dy}{dx} = \frac{2a}{y} = \frac{1}{t}$$

$$y = 2at$$

When $y = 2at$, $x = \frac{y^2}{4a} = at^2$

$$(x, y) = (\mathrm{at}^2, 2at)$$

30. d

$$\lim_{x \to 1} \frac{\sin\left(x^2 - 1\right)}{(x - 1)}$$

($\frac{0}{0}$ form, apply L,ÄôHospital rule)

$$= \lim_{x \to 1} \frac{\cos(x^2 - 1) \times 2x}{1}$$

$$= 2 \times 1 \times \cos 0$$

$$= 2$$

31. c

$$Let y = \coth^{-1} \cos x$$

$$\frac{dy}{dx} = \frac{d \cot h^{-1} \cos x}{d \cos x} \cdot \frac{d \cos x}{dx}$$

$$= -\frac{1}{(\cos^2 x - 1)} \cdot (-\sin x)$$

$$= -\frac{1}{\sin^2 x} \sin x = -\mathrm{cosec}\ x$$

32. a

Solution:

$$\int_a^b \frac{\log_e x}{x} dx$$

$$= \left[\frac{(\log_e x)^2}{2}\right]_a^b$$

$$= \frac{1}{2}\left[(\log_e b)^2 - (\log_e a)^2\right]$$

$$\left[\begin{array}{c} put \quad \log_e x = y \\ \frac{1}{x} dx = dy \\ \frac{1}{x} dx = dy \\ I = \int y dy \\ = \frac{y^2}{2} + c \\ = \frac{(\log_e x)^2}{2} + c \end{array}\right]$$

33. d

$$x^2 + y^2 \frac{dy}{dx} = 4$$

$$x^2 dx + y^2 dy = 4dx$$

Integrating:

$$\int x^2 dx + \int y^2 dy = \int 4dx$$

$$\frac{x^3}{3}+\frac{y^3}{3}=4x+C$$

$$x^3+y^3=12x+c$$

34. d

$$\overrightarrow{OA}=3\overrightarrow{i}-2\overrightarrow{j}+\overrightarrow{k}$$

$$\overrightarrow{OB}=2\overrightarrow{i}+4\overrightarrow{j}-3\overrightarrow{k}$$

$$\overrightarrow{AB}=\overrightarrow{OB}-\overrightarrow{OA}=-\overrightarrow{i}+6\overrightarrow{j}-4\overrightarrow{k}$$

$$|\overrightarrow{AB}|=\sqrt{1^2+6^2+(-4)^2}=\sqrt{53}$$

35. b

From probability tree,

The possible outcome can be written as $p(WR)+p(RR)$ where W, R means white and red respectively.

$$=\frac{3*2}{5*4}+\frac{2*1}{5*4}=\frac{2}{5}$$

36. a

Mode represents highest frequency.

37. c

$$x=\frac{2\times V.D.}{E+35.5}$$

$$x=\frac{2\times 59.25}{4+35.5}=3$$

38. c

39. c

Elements on the right side of the periodic table are NONMETALS.

40. b

$$K_{sp}=s(2s)^2=4s^3=3.2\times10^{-14}$$

$$s=2\times10^{-5}$$

41. c

Lewis Base is one which is electron-rich specie and can donate electron to an electrophile.

$\mathrm{CH_3-O-CH_3}$ is an electron rich specie can donate electron.

42. b

43. a

Bessemer converter is used for the preparation of steel. It was the first inexpensive industrial process for the mass production of steel from molten pig iron. The key principle is the removal of impurities from the iron by oxidation with air being blown through the molten iron.

Cast iron or Pig iron is extracted in a blast furnace.

Wrought iron is prepared in a special type of reverberatory furnace called pudding furnace.

44. a

45. b

SO_2 is absorbed on the KOH.

46. b

47. c

ethane and ethene = $\mathrm{Aq} \cdot \mathrm{Br}_2$

ethene and ethyne = Ammoniacal Cuprous Chloride

48. d

Propyne is terminal alkyne so it gives white precipitate with ammonical silver nitrate solution but alkene does not.Thus propene and propyne can be distinguished by ammonical silver nitrate solution.

49. b

If a double bond is formed, the angle between the bonds is 120°, and if a triple bond is involved, the angle is 180°.

50. c

Fats and oil jointly known as lipid which are the ester of glycerol with high fatty acid.

51. a

52. b

53. d

54. b

55. b

56. b

57. d

58. b

59. b

60. c

Apparent : clearly visible or understood; obvious.
Explicit : stated clearly and in detail, leaving no room for confusion or doubt.
"the arrangement had not been made explicit"
Frank : open, honest, and direct in speech or writing, especially when dealing with unpalatable matters.
Bright : giving out or reflecting much light; shining.
Candid : truthful and straightforward; frank.

61. c

$a = \frac{g}{5}$

$R–mg = ma$

$R = mg + ma = m(g + a) = 60\left(g + \frac{g}{5}\right)$

$= 60 \times \frac{6g}{5}$

$= 72$ kg wt.

62. c

$\omega = \sqrt{\frac{K}{m}}$

$where,\ K = spring\ constant$

$x = 2\cos 50t - - - - - (i)$

$x = a\cos \omega t - - - - - (ii)$

Comparing (i) and (ii),

$\omega = 50\ rad/s$
$m = 3kg$
$now, K = \omega^2 \times m = 50^2 \times 3 = 7500\ N/m$

63. a

$P = 2(2\pi r)T$
$r = \dfrac{F}{4\pi T}$
$r = \dfrac{14\pi \times 10^{-4}}{2\pi \times 70 \times 10^{-3}} = 5 \times 10^{-3} m$

64. a

$\dfrac{h_1}{h_2} = \dfrac{\rho_1}{\rho_2} = \dfrac{(1+\gamma\theta_1)}{(1+\gamma\theta_2)}$

$[\because \rho = \rho_0(1+\gamma\theta)]$

$\dfrac{50}{60} = \dfrac{1+\gamma \times 50}{1+\gamma \times 100}$

$\gamma = 0.005/^\circ C$

65. c

$dw = nRdT = 100J$
$dQ = nCpdT = n \times 7R/2dT$
$= 3.5 \times 100 = 350J$

66. c

67. a

$I_m in = I_1 + I_2 - 2\sqrt{I_1 I_2}$
$= 4I + I - 24\sqrt{4I.I} = I$

68. b

The connected plates acts as a single conductor. So, effectively there are two capacitors connected in parallel. The capacity of each capacitor is given by

$C = \dfrac{\epsilon_0 A}{d}$

Hence, net capacitance between A and B is given by:

$C_{AB} = C + C = \dfrac{2\epsilon_0 A}{d}$

69. d

$BiNA\cos\theta = k\theta$

$2 \times i \times 1000 \times 500 \times 10^{-4} = 2 \times \theta$

$i = 50A$

70. d

$V = \dfrac{NBA\cos 0 - NBA\cos 180}{t} = \dfrac{2 \times 100 \times 4 \times 10^{-4} \times \pi(1)^2}{\pi} = 10V$

71. b

Binding energy $= E_1$

72. b

73. a

$\log(\dfrac{a^2}{bc}) + \log(\dfrac{b^2}{ca}) + \log c^2 ab$
$= \log(\dfrac{a^2}{bc} \times \dfrac{b^2}{ca} \times \dfrac{c^2}{ab})$
$= \log(1) = 0$

74. b

$$\begin{vmatrix} 1 & a(b+c) & bc \\ 1 & b(c+a) & ca \\ 1 & c(a+b) & ab \end{vmatrix}$$

$C_2 \to C_2 + C_3$

$$\begin{vmatrix} 1 & a(b+c)+bc & bc \\ 1 & b(c+a)+ca & ca \\ 1 & c(a+b)+ab & ab \end{vmatrix}$$

$$(ab+bc+ca)\begin{vmatrix} 1 & 1 & bc \\ 1 & 1 & ca \\ 1 & 1 & ab \end{vmatrix}$$

0

75. c

$\sqrt{a+ib} - \sqrt{a-ib} = \sqrt{2|z|+2a}$

$\therefore \sqrt{6+8i} + \sqrt{6-8i} = \sqrt{2\times 10+12} = 4\sqrt{2}$

76. b

Given, $x^2 - px + q = 0$ If $\alpha \& \beta$ are the roots then,

$\alpha + \beta = p$

$\alpha\beta = q$

$\alpha - \beta = \sqrt{(\alpha+\beta)^2 - 4\alpha\beta} = \sqrt{p^2-4q}$

By given

$p = m\sqrt{p^2-4q}$

or, $p^2 = m^2p^2 - 4m^2q$

$\therefore 4m^2a = p^2\left(m^2-1\right)$

77. a

Number of ways = no. of sitting boy * no. of ways of sitting boys = 5! * (5 - 1)! = 5! ,Äì 4! = 2880

78. a

$3\tan(\theta - 15^\circ) = \tan(\theta + 15^\circ)$

$3 = \dfrac{\tan(\theta+15^\circ)}{\tan(\theta-15^\circ)}$

Using competendo and dividendo

$\dfrac{3+1}{3-1} = \dfrac{\tan(\theta+15^\circ)+\tan(\theta-15^\circ)}{\tan(\theta+15^\circ)-\tan(\theta-15^\circ)}$

$2 = \dfrac{\sin(\theta+15^\circ)\cos(\theta-15^\circ)+\sin(\theta-15^\circ)\cos(\theta+15^\circ)}{\sin(\theta+15^\circ)\cos(\theta-15^\circ)-\sin(\theta-15^\circ)\cos(\theta+15^\circ)}$

$2 = \dfrac{\sin 2\theta}{\sin 30^\circ}$

$\sin 2\theta = 1$

$$2\theta = 2n\pi + \frac{\pi}{2}$$

$$\theta = n\pi + \frac{\pi}{4}$$

79. d

$$\frac{r_2 - r}{b\tan(\frac{B}{2})} = \frac{\frac{\Delta}{s-b} - \frac{\Delta}{s}}{b\sqrt{\frac{(s-a)(s-c)}{(s-b)}}} = \frac{\frac{b\Delta}{s(s-b)}}{b\sqrt{\frac{(s-a)(s-c)}{(s-b)}}}$$

$$= \frac{\Delta}{\sqrt{s(s-a)(s-b)(s-c)}}$$

$$= 1$$

80. d

$$\lim_{x\to 0} \frac{1-\cos x}{1-\cos 2x} \quad \left(\frac{0}{0}\right)$$

Applying L,ÄôHospital rule,

$$\lim_{x\to 0} \frac{0-(-\sin x)}{0-(-\sin 2x)\,2}$$

$$= \lim_{x\to 0} \frac{\sin x}{2\sin 2x} (0/0)$$

Applying L,ÄôHospital rule,

$$= \lim_{x\to 0} \frac{\cos x}{4\cos 2x} (0/0)$$

$$\frac{1}{4}$$

81. d

$$f(x) = \sin^{-1}(\cos x) + \cos^{-1}(\sin x)$$

$$f(x) = \sin^{-1}(\sin(\frac{\pi}{2} - x)) + \cos^{-1}(\cos(\frac{\pi}{2} - x))$$

$$f(x) = \frac{\pi}{2} - x + \frac{\pi}{2} - x$$

$$f(x) = \pi - 2x$$

$$f'(x) = -2$$

82. c

$$\int \sin 3x \cos 5x dx$$

$$\frac{1}{2}\int 2\sin 3x \cos 5x dx$$

$$\frac{1}{2}\int (\sin 8x - \sin 2x) dx$$

$$\frac{\cos 2x}{4} - \frac{\cos 8x}{16} + c$$

83. b

$$A = 2\int_0^1 y dx$$

$$= 2\int_0^1 \sqrt{16}\, x dx$$

$= \frac{16}{3} \times (1-0) = \frac{16}{3}$ unit

84. d

Area of right angle triangle = $\frac{1}{2} \times bh = \frac{1}{2} \times \frac{5}{2} \times 5 = \frac{25}{4}$ sq. units

85. a

Let $A(1, 2, -1)$ be the foot of perpendicular from $B(0, 1, 2)$

Direction ratios of AB are $1, 1, -3$

As AB is perpendicular to the plane, equation of the plane is of the form.

$x + y - 3z = k$ ... (1)

(1) passes through $A \Rightarrow k = 6$

$\therefore$ Distance of $C(2, 2, 1)$ from $x + y - 3z = 6$ is

$$d = \left| \frac{2 + 2 - 3 - 6}{\sqrt{1 + 1 + 9}} \right| = \frac{5}{\sqrt{11}}$$

86. c

87. d

$|\overrightarrow{a} + \overrightarrow{b}| = |\overrightarrow{a} - \overrightarrow{b}|$

$|\overrightarrow{a} + \overrightarrow{b}|^2 = |\overrightarrow{a} - \overrightarrow{b}|^2$

$a^2 + 2\overrightarrow{a}.\overrightarrow{b} + b^2 = a^2 - 2\overrightarrow{a}.\overrightarrow{b} + b^2$

$4\overrightarrow{a}.\overrightarrow{b} = 0$

$4ab\cos\theta = 0$

$a, b \neq 0$

$\cos\theta = 0$

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

88. b

mole of O_2, H_2, and N_2 are $\frac{2}{32} = 0.0625, \frac{2}{2} = 1$ and $\frac{2}{28} = 0.071$

H_2 has maximum mole, so it has maximum no of atom.

89. b

$NO^+ = 7 + 8 - 1 = 14$

$C_2^{2-} = 6 + 6 + 2 = 14$

$CN^- = 6 + 7 + 1 = 14$

$N_2 = 7 + 7 = 14$

NO^+, C_2^{2-}, CN^-, N_2 are isoelectronic species.

90. a

$$E = \frac{W \times 1000}{N \times V} = \frac{0.0316 \times 1000}{0.1 \times 10} = 31.6$$

91. b

$\mathrm{Ba(OH)_2} \rightleftharpoons \mathrm{Ba^{++}} + 2\,\mathrm{OH^-}$

$\mathrm{pH} = 12 \ \rightarrow p\,\mathrm{OH} = 2$

$\mathrm{OH^-} = 10^{-2}$

Conc. of $\mathrm{Ba^{++}}$ is half i.e 0.5×10^{-2}

$\mathrm{K_{sp}} = [\mathrm{Ba^{++}}]\,[\mathrm{OH^-}]^2 = 0.5 \times 10^{-2} \times (10^{-2})^2 = 5 \times 10^{-7}$

92. d

93. a

94. a

In sugar in dustry, sugar cane juice is concentrated by vacuum distillation.

95. a

96. b

97. d

98. b

99. d

100. b