clamphook

Shift 4 | July 8

Tribhuvan University

2080

Full Marks: 140 **Time:** 2 hours **Pass Marks:** 56

1. The S.I. unit electric flux are:

a. NC^{-2} b. NmC^{-1}

c. Nm^2C^{-1} d. $CN^{-1}m^{-1}$

2. A force of 8N act on a body produce an acceleration $20m/s^2$ then mass of the body is:

a. 4 kg b. 40 kg

c. 8 kg d. 0.4 kg

3. If the radius of the earth contracts to half of its present value without change in mass , then the length of the day will be

a. 24 hours b. 48 hours

c. 6 hours d. 12 hours

4. A body oscillating in simple harmonic motion follows [IOE 2076]

a. Hooke's law b. Newton's law of cooling

c. Ohm's law d. Stoke's law

5. A soap bubble (surface tension 3.0×10^{-2}N/m) has radius 2cm. The work done in doubling its radius will be

a. Zero b. 9.34×10^{-4}J

c. 2.26×10^{-4}J d. 4.04×10^{-4}J

6. In the pressure cooker the cooking is faster because the increase of vapour pressure.

a. increases latent heat b. decreases latent heat

c. decreases boiling point d. increases boiling point

7. A diatomic gas $[\gamma = 1.40]$ does $200J$ of work when it is expanded isobarically, the heat given to the gas in the process will be

a. $400J$ b. $500J$

c. $600J$ d. $700J$

8. An aeroplane is flying at a height of 1500 m .It has a camera having convex lens of focal length 45 cm with photographic plate $30\ cm \times 30\ cm$. How much area on the ground can be photographed at one time ?

a. $10^3\ m^2$

b. $10^4\ m^2$

c. $10^5\ m^2$

d. $10^6\ m^2$

9. In a right angled isosceles prism , when the light falls from flat face and for total internal reflection to takes place in the second face , the minimum refractive index of the prism is

a. 1.34

b. $\sqrt{2}$

c. 1.55

d. 1.66

10. A charge q is placed at the centre of the line joining two equal charges Q . The system of three charges will be in equilibrium if q is equal to:

a. $-Q/2$

b. $-Q/4$

c. $-4Q$

d. $Q/2$

11. A battery is connected in a thermo couple. The two junctions will:

a. be heated up

b. remains at the same temperature

c. be cooled

d. be heated at one junction and cooled at other.

12. If a magnet is revolved end for end in a uniform magnetic field , the kinetic energy of magent

a. increases

b. decreases

c. remains constant

d. zero

13. Power dissipation in AC circuit depends upon

a. R

b. L

c. C

d. All

14. The frequency of radiowave is 15 MHz What is its wavelength ?

a. 20 m

b. 15 m

c. 5 m

d. 25 m

15. The speed of sound in H_2 at NTP is $1270m/s$. then speed of sound in mixture of H_2 and O_2 in the ratio of $4:1$ by volume will be

a. 630 m/s

b. 635 m/s

c. 680 m/s

d. 700 m/s

16. The electric field applied across the plates of a parallel plate capacitor is $2 \times 10^5 V/m$. An electron projected vertically parallel to the plates with a velocity of $2 \times 10^6 m/s$ moves undeflected between the plates . Then the magnitude of magnetic filed in the region between the plates will be

a. $10T$

b. $2T$

c. $0.5T$

d. $0.1T$

17. As the doping increases , the bulk resistance of semiconductor

a. decreases

b. increases

c. remains same

d. cant be determined

18. The cardinal number of a vowel set $V = \{a, e, i, o, u\}$ is

a. 2^5

b. 5^2

c. 5

d. 1

19. For a matrix $A = [a_{ij}], a_{ij} = 0$ when $i \neq j$ then A matrix is ; [IOE 2078]

a. diagonal
b. scalar
c. skew-symmetric
d. unit

20. The roots of the equation $(x-2)^3 + 27 = 0$ are

a. 1
b. $-1, 2-3\omega, 2-3\omega^2$
c. $1, 2+3\omega, 2-3\omega^2$
d. $-1, 2-3\omega, 2+3\omega^2$

21. In how many ways can n different object be filled in at most r places with repetition?

a. r, nr
b. $\frac{r(r^n-1)}{r-1}$
c. $\frac{n(n^r-1)}{r-1}$
d. $\frac{n(n^r-1)}{n-1}$

22. If $\tan\theta + \tan 2\theta + \sqrt{3}\tan\theta\tan 2\theta = \sqrt{3}$, then θ is equal to

a. $(6n+1)\frac{\pi}{18}$
b. $(3n+1)\frac{\pi}{18}$
c. $(6n+1)\frac{\pi}{9}$
d. $(3n+1)\frac{\pi}{9}$

23. $\sin\{\sin^{-1}(1/5) + \cos^{-1} x\} = 1$ then x = [IOE 2075]

a. 1
b. -1/2
c. 1/3
d. 1/5

24. In $\Delta ABC, \frac{2\Delta}{bc} =$ [IOE 2078]

a. $\cos A$
b. $\cot A$
c. $\sin A$
d. $2\sin A$

25. If $\hat{a}$ and $\hat{b}$ are unit vectors inclined at an angle θ then $|\hat{a} - \hat{b}| =$ [IOE 2074]

a. $2\cos\frac{\theta}{2}$
b. $\cos\frac{\theta}{2}$
c. $2\sin\frac{\theta}{2}$
d. $\sin\frac{\theta}{2}$

26. If lines pair $ax^2 + 2hxy + by^2 = 0$ and $a'x^2 + 2h'xy + b'y^2 = 0$ have the same bisectors then :

a. $h(a'-b') = h'(a-b)$
b. $h'(a'-b') = h(a-b)$
c. $h(a'+b') = h'(a+b)$
d. $h'(a'+b') = h'(a+b)$

27. The locus of the middle point of chords of the circle $x^2 + y^2 = 25$ which passes through $(6, 8)$ is :

a. $3x + 4y + 50 = 0$
b. $4x + 3y + 50 = 0$
c. $3x + 4y - 50 = 0$
d. $4x + 3y - 50 = 0$

28. The area of the triangle formed by joining the end points of the latus rectum of the parabola $y^2 = 16x$ with the vertex is :

a. 16 sq. unit
b. 64 sq. unit
c. 32 sq. unit
d. 8 sq. unit

29. The ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 (b > a)$ has its length of latus rectum as [IOE 2074]

a. $\frac{2b^2}{a}$
b. $\frac{2b}{a}$

c. $\frac{2a^2}{b}$ d. $\frac{2a}{b}$

30. **If the direction cosines of the given line are $\frac{1}{k}, \frac{1}{k}, \frac{1}{k}$ then , find the value of k.**

a. 1 b. 3

c. $\pm\sqrt{3}$ d. $\sqrt{3}$

31. **The value of $\lim_{x\to\infty}\left(\frac{x^2+5x+3}{x^2+x+3}\right)^x$ is equal to**

a. e^1 b. e^2

c. e^3 d. e^4

32. **The derivative of $\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$ respect to $\cot^{-1}\left(\frac{1-3x^2}{3x-x^3}\right)$ is:**

a. $\frac{1}{3}$ b. $\frac{1}{2}$

c. 1 d. $\frac{2}{3}$

33. **If $y = 1+\frac{1}{x}+\frac{1}{x^2}+\frac{1}{x^3}+\ldots\ldots\ldots$ to ∞ with $|x|>1$, then $\frac{dy}{dx} =$**

a. $\frac{y}{x}$ b. $-\frac{y^2}{x^2}$

c. $\frac{y^2}{x^2}$ d. $-\frac{y}{x}$

34. **The minimum value of $\frac{x}{\log x}$ is**

a. e b. None

c. $\frac{1}{e}$ d. 1

35. **The slope of the tangent to the curve $y = 16 - x^2$ at $x = 0$**

a. 2 b. -2

c. 16 d. 0

36. $\int\left(\frac{2+\sin 2x}{1+\cos 2x}\right)e^x dx =$

a. $e^x\sin x + c$ b. $e^x\tan x + c$

c. $e^x\csc x + c$ d. $e^x\sec x + c$

37. **Area bounded by the curve $x^2 = 8y$ and its latus rectum is : [IOE 2077]**

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

c. $\frac{3}{32}$ d. None

38. **The process of conversion of solid into gas directly is [IOE 2076]**

a. combustion b. vaporization

c. sublimation d. filtration

39. **Methane can be prepared in one of the following reaction**

a. Catalytic hydrogenation
b. Wurtz reaction
c. Soda-lime decarboxylation
d. Klobe's electrolysis

40. Nitrogen dioxide cannot be obtained by heating

a. $Pb(NO_3)_2$
b. $Cu(NO_3)_2$
c. $AgNO_3$
d. KNO_3

41. Concentrated nitric acid oxidizes cane sugar to

a. CO_2 and H_2O
b. CO and H_2O
c. CO, CO_2 and H_2O
d. Oxalic acid and water

42. During the detection of organic compound sodium extract is prepared to

a. Dissolve it in water
b. To convert it into ionic form
c. Make it more reactive
d. Make the reaction slow

43. Paris green is

a. Double salt of $CuCO_3$ and $Cu(NO_3)_2$
b. Double salt of $Cu(CH_3COO)_2$ and $Cu_3(AsO_3)_2$
c. Double salt of $Cu(CH_3COO)_2$ and $CuSO_4$
d. Double salt of Cu and Ag nitrites

44. Zinc reacts with dilute nitric acid to produce

a. NO_2
b. NO
c. NH_4NO_3
d. N_2O_3

45. A reducing agent is a substance which can

a. Accept electrons
b. Donate electrons
c. Accept protons
d. Donate protons

46. Which anion is the weakest base?

a. $C_2H_5O^-$
b. NO_3^-
c. F^-
d. CH_3COO^-

47. An electrovalent compound is made up of

a. neutral particles
b. neutral molecules
c. neutral atoms
d. electrically charged atom or group of atoms

48. The electronic energy levels of the hydrogen atom in the Bohr theory are called:

a. orbitals
b. orbits
c. Rydberg levels
d. ground states

49. Teacher gave us a pen .....

a. no one
b. Neither
c. either
d. each

50. Neither fo the students .....arrived.

a. is
b. have been
c. has
d. had

51. We travel ___ a car but she travels ___ airplane. [IOE 2077]

a. by, by
b. In, by
c. by, in
d. in, in

52. He found them playing football. Its structure is [IOE 2074]

a. S + V + O + gerund
b. S + V + pronoun + gerund
c. S + V + pronoun + present participle
d. All of these

53. The price of gold as well as silver ..... risen.

a. are
b. have
c. has
d. is

54. The passive form of 'Give me your money.' is [IOE 2077]

a. Let your money be given to me.
b. Your money be given to me.
c. Your money let be given to me.
d. Let be your money given to me.

55. Which of the following does not have /∫/ sound?

a. invasion
b. contribution
c. motion
d. precious

56. There was no longer room for the car after we moved the patio furniture into the garage, so I had to park on the street.

a. Simple Sentence
b. Compound Sentence
c. Complex Sentence
d. Compound-Complex Sentence

57. The woman selected the best apples in the basket. The underlined word means

a. picked on
b. picked out
c. picked up
d. picked at

58. An office for which no salary is paid

a. Gratis
b. Hospitable
c. Free
d. Honorary

59. If he ..... earlier, he would have left on the afternoon flight.

a. decided
b. Had decided
c. would have decided
d. Will decided

60. They have all been friends _____ their first match as a team.

a. since
b. for
c. from
d. during

61. A car moving along straight line with constant acceleration has velocity u at point A and v at point B. Then the velocity at the midway between them is:

a. $\frac{2uv}{v+u}$
b. $\frac{u+v}{2}$
c. $\sqrt{u^2+v^2}$
d. $\sqrt{\frac{u^2+v^2}{2}}$

62. A long spring when stretched by $x$cm has a potential energy U. On increasing the stretching to nx, the potential energy stored in the spring will be

a. $\frac{U}{n}$
b. Un
c. n^2U
d. $\frac{U}{n^2}$

63. At time t=0.66 seconds, the displacement is equal to half of the amplitude, then find the time period of SHM. [IOE 2077]

a. 7.92 s
b. 13.4 s
c. 21.8 s
d. 14.34 s

64. A fisherman books as old log of wood of weight 12N and volume $1000cm^3$ .He pulls the log half way out of water .The tension in his line at this instant is

a. 12N
b. 7N
c. 10N
d. 5N

65. 24.5 mole of a gas at $350^\circ C$ is compressed adiabatically, temperature rises to 450° . Increase in internal energy of gas. [IOE 2078]

a. $5 \times 10^4 J$
b. $-5 \times 10^4 J$
c. $4.68 \times 10^4 J$
d. $-4.68 \times 10^4 J$

66. Two convex lens having focal length 20 cm are separated by distance 10 cm. The final image of object placed at 10 cm from first lens is: [IOE 2078]

a. 45 cm
b. 60 cm
c. 20 cm
d. 15 cm

67. Eight small drops, each of radius r and having same charge q are combined to form a big drop. The ratio of potential of big drop to small drop is:

a. 8 : 1
b. 4 : 1
c. 2 : 1
d. 1 : 8

68. The resistance of a wire is r ohm. The wire is stretched to double its length. Now the resistance of wire in ohm is:

a. $\frac{r}{2}$
b. 4 r
c. 2 r
d. $\frac{r}{4}$

69. The force on a conductor of 2 m length carrying charge 1 C and moving with velocity 10 m/s is magnetic field of strength 2T is [IOE 2074]

a. 20 N
b. 25 N
c. 10 N
d. 15 N

70. $EMF = 5V, L = 2H$ then rate of increase in current is? [IOE 2078]

a. 5 A/s
b. 10 A/s
c. 2.5 A/s
d. 12.5 A/s

71. If oil of density higher than water filled in place of water in resonance tube, its frequency will

a. Increase
b. Decrease
c. Remain unchanged
d. Depend on the density of material of the tube

72. Two trains are moving towards each other at speeds of 20 m/s relative to the ground. The first train sounds like a whistle of frequency 1300 Hz, the frequency of whistle heard by passenger sitting in next train is (velocity of sound = 332 m/s) [IOE 2077]

a. 1466.67 Hz
b. 1300 Hz
c. 1152.27 Hz
d. 1128.42 Hz

73. Light of different energies 5 eV and 2 eV get incident on certain metal surface having work function 1 eV. What is the ratio of maximum velocity of the emitted electrons during both the cases?

a. 1 : 2
b. 1 : 4

c. 1 : 4 d. 2:1

74. The count rate of a radioactive source at t=0 was 1600 count/sec and at t= 8 sec it was 100 count/sec. The count rate at t = 6 sec will be

a. 150 b. 200

c. 300 d. 400

75. If $f(x) = 11 + x^2$ then, $fof(x)$ at $x = -1$ is equal to [IOE 2078]

a. 0.4 b. 155

c. 12 d. 11

76. If A is a square matrix for which $a_{ij} = i^2 - j^2$, then A is

a. Zero matrix b. Unit matrix

c. Symmetric matrix d. Skew symmetric matrix

77. If $|z-3| = |z-5|$, then the locus of the complex number represents [IOE 2074]

a. circle b. ellipse

c. straight line d. hyperbola

78. $1 + 3 + 7 + 15 + 31 + \ldots$ to n terms is equal to:

a. $2^n - n - 2$ b. $2^{n+1} - n$

c. $2^{n+1} - n - 2$ d. $2^n - n$

79. Value of $C_0^2 + C_1^2 + C_2^2 + C_3^2 + \ldots + C_n^2$ is:

a. $\dfrac{(2n)!}{2(n!)}$ b. $\dfrac{(2n!)}{(n!)(n+1)!}$

c. $\dfrac{2n!}{n!n!}$ d. $\dfrac{(2n)!}{(n-1)!(n+1)!}$

80. If $\cos^{-1} x + \cos^{-1} y = \pi/2$, then locus of point (x, y) represents [IOE 2074]

a. circle b. ellipse

c. parabola d. hyperbola

81. $\dfrac{c - a\cos B}{b - a\cos C}$ [IOE 2076]

a. $\dfrac{c}{b}$ b. $\dfrac{b}{c}$

c. $\dfrac{a}{b}$ d. $\dfrac{b}{a}$

82. If $\vec{a} = a_x\vec{i} + a_y\vec{j} + a_z\vec{k}\,\vec{b} = b_x\vec{i} + b_y\vec{j} + b_z\vec{k}$ then which of the following is not true? [IOE 2078]

a. $\vec{a} \times \vec{b} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ a_x & a_y & a_z \\ b_x & b_y & b_z \end{vmatrix}$ b. $|\vec{a} \times \vec{b}| = |\vec{b} \times \vec{a}|$

c. $\vec{a} \cdot \vec{b} = ab\cos\theta$ d. $\vec{a} \times \vec{b} = \vec{b} \times \vec{a}$

83. If slope of one line represented by $ax^2 + 2hxy + by^2$ = 0 is five times the slope of another line then [IOE 2076]

a. $5h^2 = ab$ b. $5h^2 = 9ab$

c. $9h^2 = 5ab$ d. $h^2 = ab$

84. The equation of the circle concentric with the circle $2x^2 + 2y^2 - 8x - 12y - 9 = 0$ passing through the center of the circle $x^2 + y^2 + 8x + 10y - 7 = 0$ is :

a. $x^2 + y^2 - 4x - 6y - 87 = 0$ b. $x^2 + y^2 - 4x + 6y - 87 = 0$

c. $x^2 + y^2 + 4x - 6y - 87 = 0$ d. $x^2 + y^2 + 4x + 6y - 87 = 0$

85. The equation of the tangent to the parabola $y^2 = 8x$ at point $(2, 4)$ is :

a. x + y + 2 = 0 b. x + y − 2 = 0

c. x − y + 2 = 0 d. x − y − 2 = 0

86. The reflection of $x + 2y + 2z = 0$ in the plane $4x - 3y + 12z + 13 = 0$

a. $7x - 470y + 190z + 572 = 0$ b. $7x + 470y + 90z - 572 = 0$

c. $470x - 7y + 190z + 572 = 0$ d. $90x + 7y + 19z + 72 = 0$

87. The value of $\lim_{x \to 1} \left(\frac{\sum_{r=1}^{n} (x^r - 1)}{x - 1} \right)$ is

a. $n(n+1)$ b. $\frac{(n^2 + n)}{2}$

c. 1 d. 0

88. If $y = e^{\sqrt{ab}\cos x}$, $\frac{dy}{dx} =$ [IOE 2075]

a. $-\frac{1}{2} e^{\sqrt{ab}\cos x} \sqrt{ab}\ \tan x \sin x$ b. $\frac{1}{2} e^{\sqrt{ab}\cos x} \sqrt{ab}\ \tan x \sin x$

c. $-e^{\sqrt{ab}\cos x} \sqrt{ab}\ \tan x \sin x$ d. $-e^{\sqrt{ab}\cos x} \sqrt{ab}\ \tan x \sin x$

89. $\int \frac{\sin x \cos x}{2 - \cos^2 x} dx =$ [IOE 2077]

a. $\log(1 + \sin^2 x) + c$ b. $\log(1 + \cos^2 x) + c$

c. $\log \sqrt{1 + \sin^2 x} + c$ d. $\log \sqrt{1 + \cos^2 x} + c$

90. Ethylene and acetylene can be separated by

a. ammoniacal $AgNO_3$ b. Alkaline $KMnO_4$

c. ammoniacal Cu_2Cl_2 d. aq. Br_2/ CCl_4

91. In the lab, H_2S gas is prepared by using black lumps and $dil \cdot H_2SO_4$. The black lumps are

a. $FeSO_4$ b. MnO_2

c. FeS d. $FeSO_3$

92. One of the characteristic properties of nonmetal is that they

a. Are reducing agent b. Form basic oxides

c. Forms cations by electron gain d. Are electronegative

93. 0.1 mole of a carbohydrate with empirical formula CH_2O contains 1 g of hydrogen. What is its molecular formula?

a. $C_5H_{10}O_5$ b. $C_6H_{12}O_6$

c. $C_4H_8O_4$ d. $C_3H_6O_3$

94. Consider the two reactions (A) and (B)

(A) $MnO_4 + 8\,H + 5\,e^- \longrightarrow Mn^{++} + 4\,H_2O$

(B) $MnO_4 + 2\,H_2O + 3\,e^- \longrightarrow MnO_2 + 4\,OH^-$

Eq.wt of $KMnO_4$ in (A) and (B) are

a. $5M$ and $3M$

b. M and $3M$

c. $\frac{M}{5}$ and $\frac{M}{3}$

d. $8M$ and $6M$

95. Ionization constant of acetic acid is 1.7×10^{-5} and concentration of H^+ in certain acetic acid solution is 3.4×10^{-4} M. The concentration of acetic acid solution is

a. 3.4×10^{-4} M

b. 3.4×10^{-3} M

c. 6.8×10^{-4} M

d. 6.8×10^{-3} M

96. 0.5 Faradays of electricity is passed through 500 ml of copper sulphate solution. The amount of copper which can be deposited will be

a. 63.5 g

b. 31.75 g

c. 15.8 g

d. Unpredictable

Read the following passage carefully, and find out the correct answers for the questions given below *(Questions from 97 to 100)*

Read not to contradict and confute, nor to believe and take for granted, nor to find talk and discourse, but to weigh and consider. Some books are to be tasted, others to be swallowed, and some few to be chewed and digested; that is, some books are to be read only in parts; others to be read, but not curiously; and some few to be read wholly, and with diligence and attention. Some books may also be read by deputy, and extracts made of them by others; but that would be only in the less important arguments and the meaner sort of books; else distilled books are like common distilled waters, flashy things. Reading maketh a full man, conference a ready man, and writing an exact man. And therefore if a man write little, he had need have a good memory; if he confer little, he had need have a present wit; and if he read little, he had need have much cunning to seem to know that he doth not. 'Histories make man wise, poets witty; the mathematics subtle; natural philosophy deep; moral grave; logic and rhetoric able to contend.'

97. What does the art of writing do to man's character?

a. It makes him a full man

b. It makes him a ready man

c. It makes him an exact man

d. It makes him a good author

98. How should you read those books which are to be 'read wholly'?

a. By making extracts from them

b. They should be chewed and digested

c. They should be read in parts

d. They should be read with diligence and attention

99. What should be the real object of reading?

a. To distil the contents

b. To understand author's views and their application in day-to-day life

c. To weigh and consider

d. Not to contradict and confute

100. What can be done with regard to the 'meaner' sort of books?

a. To be read but not to contradict and confute

b. To be read only in parts

c. They can be "read by deputy and extracts made of them by others."

d. To be read, but not curiously

Answer Key

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

Solutions

1. c

Electric flux(ϕ)= electric field (E) $\times$ Area

$= N/C \times m^2 = Nm^2C^{-1}$

unit of electric field = Newton /Coulomb = Volt /Meter

2. d

$F = m \times a$

or, $m = \frac{8}{20} = 0.4$ kg

3. c

By law of conservation of angular momentum,

$\frac{dL}{dt} = 0$

$\Rightarrow L\omega = const.$

i.e. $I_1\omega_1 = I_2\omega_2$

$\Rightarrow I_1 \times \frac{1}{T_1} = I_2 \times \frac{1}{T_2} \ldots (i)$ as $\omega = \frac{2\pi}{T}$

Also, $I \propto R^2$

Eq. (i) becomes

$T_1 \times R_1^2 = T_2 \times R_2^2$

when, $R_2 = \frac{R_1}{2}$

$T_2 = \frac{T_1}{4}$

$T_2 = 6$ hrs

4. a

$a \propto -x$

$F \propto -x$

$F = -kx$

5. b

$W = T\Delta A = T(8\pi {r_2}^2 - 8\pi {r_1}^2)$
$W = T \times 8({r_2}^2 - {r_1}^2)$
$W = 3 \times 10^{-2} \times 8 \times 3.14[(4 \times 10^{-2})2 - (2 \times 10^{-2})^2 =$
9.34×10^{-4}J

6. d

7. d

$\Delta Q = mC_p\Delta T$
$= \frac{mR\Delta T}{\gamma^{-1}}$

$\Delta U = mC_v\Delta T = \frac{mR\Delta T}{\gamma^{-1}}$
$\therefore \frac{\Delta Q}{\Delta U} = \gamma$

According to 1^{st} law of thermodynamics
$\Delta Q = \Delta U + \Delta W$
$\Delta Q = \frac{\Delta Q}{\gamma} + P\Delta V$
$\rightarrow \Delta Q(1 - \frac{1}{\gamma}) = 200$
$\Delta Q\left(\frac{\gamma - 1}{4}\right) = 200$
$..\Delta Q = \frac{200 \times 1.4}{0.4}$
$= 700J$

8. d

$m_A = m^2$
$= (\frac{f}{u - f})^2 = (\frac{45 \times 10^{-2}}{1500})^2$

or, Area of photographic plate $= (3 \times 10^{-4})^2$

Area of land $= 9 \times 10^{-8}$
$or, \frac{30 \times 30 \times 10^{-4}}{A} = 9 \times 10^{-8}$
$\therefore A = 10^6\, m^2$

9. b

For total internal reflection in the second face.
(i> C(Critical angle)
i.e $i_{max} = 45^\circ$ =C
$...\mu = \frac{1}{\sin \mathrm{C}} = \frac{1}{\sin 45^\circ} = \frac{1}{1/\sqrt{2}} = \sqrt{2}$

10. b

For the system to be in equilibrium net force on each charge should be zero.

i.e.

$$F1 + F2 = 0$$

$$\frac{Q.q}{4\pi\epsilon_\circ x^2} + \frac{Q.Q}{4\pi\epsilon_\circ (2x)^2} = 0$$

Taking $F_{net} on charge Q$

$$\frac{Q.q}{x^2} = \frac{-Q.Q}{4\pi\epsilon_\circ (2x)^2} = 0$$

$$\frac{Q.q}{x^2} = \frac{-Q.Q}{4x^2}$$

$$q = -\frac{Q}{4}$$

11. d

Peltier effect states that if emf is applied in a thermo couple formed of two junction, one junction is heated and other is coole(d)

This effect is reverse of See beck effect.

Peltier effect is used in refrigeration.

12. b

$U_i = -MB\cos\theta$
$= -MB\cos 0^\circ = -MB\,(minimum)$
$U_f = -MB\cos 180^\circ$
$= MB\,(maximum)$

So, K.E in this condition will be minimum i.e. decreases.

13. a

Power dissipate in ac circuit is given by $P_{av} = I_{RMS} V_{RMS} \cos\phi$

Where ,
cos ϕ = Power factor

and ϕ = 0° for resistancce

ϕ = 90° for inductance or capacitance .

So, power is dissipated only by Resistance in AC circuit .

14. a

Radio wave – Electromagnetic wavw so,

$$\lambda = cf = \frac{3\times 10^8 m/s}{15\times 10^6 Hz} = \frac{3\times 10^2}{15} = \frac{300}{15} = 20m$$

15. b

$\lambda_{mix} = 1.4$ since mixture is made of two diatomic gas.

$$\frac{V_{H_2}}{v_{mix}} = \sqrt{\frac{M_{mix}}{M_{H_2}}} \ldots\ldots (i)$$

$$M_{mix} = \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$$

$$= \frac{2\times 4 + 32\times 1}{4+1} = 8$$

Now putting in equation (i) we get

$$\frac{1270}{v_{mix}} = \sqrt{\frac{8}{2}}$$

So, $v_{mix} = \frac{1270}{2} = 635 m/s$

16. d

17. a

The number of charge carriers increases with doping. The increase in number of charge carriers is directly responsible for the increase in conductance of the semiconductor, which, in turn implies that the bulk resistance of the semiconductor is reduced.

18. c

19. a

It is definition of diagonal matrix.

20. b

$(x-2)^3+27=0$

$(x-2)^3=-27$

$(x-2)=-3,-3\omega,-3\omega^2$

$x=-1,2-3\omega,2-3\omega^2$

21. d

22. d

$\tan\theta+\tan 2\theta+\sqrt{3}\tan\theta\tan 2\theta=\sqrt{3}$

$\tan\theta+\tan 2\theta=\sqrt{3}(1-\tan\theta\tan 2\theta)$

$\frac{\tan\theta+\tan 2\theta}{1-\tan\theta\tan 2\theta}=\sqrt{3}$

$\tan 3\theta=\sqrt{3}=\tan(\frac{\pi}{3})$

$3\theta=n\pi+\frac{\pi}{3}$

$\theta=(3n+1)\frac{\pi}{9}$

23. d

$\sin\left\{\sin^{-1}\left(\frac{1}{5}\right)+\cos^{-1}x\right\}$

or $=\sin^{-1}(\frac{1}{5})+\cos^{-1}x=\sin^{-1}(1)$

or, $\sin^{-1}(\frac{1}{5})+\cos^{-1}(x)=\frac{\pi}{2}$

$x=\frac{1}{5}$ (Therefore $\sin^{-1}(x)+\cos^{-1}(x)=\frac{\pi}{2}$)

24. c

25. c

$|\hat{a}-\hat{b}|=\sqrt{a^2-2\hat{a}\hat{b}+b^2}=\sqrt{1-2ab\cos\theta+1}=$
$\sqrt{1-2\cos\theta+1}=\sqrt{2(1-\cos\theta)}=\sqrt{4\sin^2\frac{\theta}{2}}=2\sin\frac{\theta}{2}$

26. a

The equation of bisectors of $ax^2+2hxy+by^2=0$ is $h(x^2-y^2)=(a-b)xy$

The equation of bisectors of $a'x^2+2h'xy+b'y^2=0$ is $h'(x^2-y^2)=(a'-b')xy$

$$\frac{h(x^2-y^2)}{h'(x^2-y^2)}=\frac{(a-b)xy}{(a'-b')xy}$$

$$h(a'-b')=h'(a-b)$$

27. c

$T=S_1$

$T=6x+8y-25=0$

$S_1=x_1^2+y_1^2-25=6^2+8^2-25=75$

If (h,k) be the mid-point, then equation of chord by rule

$T=S_1$

$6x+8y-25=75$

$6x+8y-100=0$

$3x+4y-50=0$

28. c

$y^2=16x$ comparing with $y^2=4ax$ $a=4$

It is a parabola with vertex in origin $(0,0)$ and opening rightwards.

End point of latus rectum are $(a,2a)$ and $(a,-2a)$ i.e $(4,8)$ and $(4,-8)$

This triangle is sum of two right angled triangles of equal areas.

$$A=2\times\frac{1}{2}a\times 2a=2a^2=32$$

29. c

$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1(b>a)$: Latus rectum = $\frac{2a^2}{b}$

$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1(b<a)$: Latus rectum = $\frac{2b^2}{a}$

30. c

$$\frac{1}{k}^2+\frac{1}{k}^2+\frac{1}{k}^2=1$$

$$\frac{3}{k^2}=1$$

$$k=\pm\sqrt{3}$$

31. d

$$y=\lim_{x\to\infty}\left(\frac{x^2+5x+3}{x^2+x+3}\right)$$

$$y=\lim_{x\to\infty}\left(1+\frac{4x}{x^2+x+3}\right)^x$$

$$y=\lim_{x\to\infty}\ln\left(1+\frac{1}{\frac{x^2+x+3}{4x}}\right)^{\frac{(x^2+x+3)}{4x}\frac{4x}{(x^2+x+3)}\frac{x}{1}}$$

$$y = e^{\lim_{x\to\infty} \frac{4x^2}{(x^2+x+3)}} = e^4$$

32. d

$$\text{Let } y = \cos^{-1}\left(\tfrac{1-x^2}{1+x^2}\right) \text{ put } x = \tan\theta$$
$$= \cos^{-1}\left(\frac{1-\tan^2\theta}{1+\tan^2\theta}\right)$$
$$= \cos^{-1}\cos 2\theta = 2\theta = 2\tan^{-1}x$$
$$\text{and } w = \cot^{-1}\left(\frac{1-3x^2}{3x-x^3}\right)$$
$$= \cot^{-1}\left(\frac{1-3\tan^2\theta}{3\tan\theta-\tan^3\theta}\right)$$
$$= \tan^{-1}\left(\frac{3\tan\theta-\tan^3\theta}{1-3\tan^2\theta}\right)$$
$$= \tan^{-1}\tan 3\theta = 3\theta = 3\tan^{-1}x$$
$$\text{Now, } \frac{dy}{dw} = \frac{d\cos^{-1}\left(\frac{1-x^2}{1-x^2}\right)}{d\cot^{-1}\left(\frac{1-3x^2}{3x-x^3}\right)} = \frac{d\left(2\tan^{-1}x\right)}{d\left(3\tan^{-1}x\right)} = \frac{2}{3}$$

33. b

$$y = 1 + \frac{1}{x} + \frac{1}{x^2} + \frac{1}{x^3} + \ldots\ldots\ldots \text{ to } \infty$$

$$y = \frac{1}{1-\frac{1}{x}} = \frac{x}{(x-1)} \cdots (i)$$

$$\frac{dy}{dx} = \frac{(x-1)\cdot 1 - x(1-0)}{(x-1)^2}$$
$$= -\frac{1}{(x-1)^2}$$
$$= -\frac{1}{(x/y)^2} \quad [\text{ from (i)}]$$
$$= -\frac{y^2}{x^2}$$

34. a

$$y = \frac{x}{logx}$$

$$\frac{dy}{dx} = \frac{\log x - x(\frac{1}{x})}{(\log x)^2}$$

$$0 = \log x - 1$$

$$x = e$$

$$y = \frac{e}{\log e} = e$$

35. d

$$y = 16 - x^2$$

$$\frac{dy}{dx} = -2x$$

$$\frac{dy}{dx} = -2 \times 0 = 0$$

36. b

Solution:

$$
\begin{aligned}
I &= \int \left(\frac{2 + \sin 2x}{1 + \cos 2x} \right) e^x dx \\
&= \int \left(\frac{2 + 2 \sin x \cos x}{2 \cos^2 x} \right) e^x dx \\
&= \int \left(\frac{1}{\cos^2 x} + \frac{\sin x}{\cos x} \right) e^x dx \\
&= \int e^x \left(\sec^2 x + \tan x \right) dx \\
&= e^x \cdot \tan x + c
\end{aligned}
$$

37. b

38. c

Sublimation is process of conversion of solid gas directly without transition to intermediate liquid state e.g. wearing down of camphor.

39. c

40. d

Nitrogen dioxide cannot be obtained by heating $\mathrm{KNO_3}$. The decomposition reactions are as follows:

A) $2\,\mathrm{Pb(NO_3)_2} \longrightarrow 2\,\mathrm{PbO} + 4\,\mathrm{NO_2} + \mathrm{O_2}$

B) $2\,\mathrm{Cu(NO_3)_2} \longrightarrow 2\,\mathrm{CuO} + 4\,\mathrm{NO_2} + \mathrm{O_2}$

C) $2\,\mathrm{AgNO_3} \longrightarrow 2\,\mathrm{Ag} + \mathrm{O_2} + 2\,\mathrm{NO_2}$

D) $4\,\mathrm{KNO_3} \longrightarrow 2\,\mathrm{K_2O} + 2\,\mathrm{N_2} + 5\,\mathrm{O_2}$

41. d

42. b

Sodium extract is prepared because the elements in the organic compounds are in the covalent form in which they cannot be detected but when the organic compound is fused with sodium metal, sodium salt are formed in which organic compound converted into ionic salt and hence elements can be easily detected.

43. b

Paris Green : $\mathrm{Cu(C_2H_3O_2)_2 \cdot 3\,Cu(AsO_2)_2}$
which means it is a double salt of copper acetate and copper nitrate.

44. c

When Zinc metal reacts with very dilute Nitric acid, it produces Zinc nitrate $\mathrm{Zn(NO_3)_2}$, Ammonium nitrate $\mathrm{NH_4NO_3}$, and water $\mathrm{H_2O}$.

$$4\,\mathrm{Zn} + 10\,\mathrm{HNO_3} \longrightarrow 4\,\mathrm{Zn(NO_3)_2} + \mathrm{NH_4NO_3} + 3\,\mathrm{H_2O}$$

45. b

A reducing agent is a substance which can donate electrons.

46. b

Conjugated base of a stronger acid is weak. The corresponding acids of the given conjugated bases are as (in order of acidity)

$C_2H_5OH < CH_3COOH < HF < HNO_3$

$\therefore$ The order of basicity is $C_2H_5O^- > CH_3COO > F^- > NO_3{}^-$

Thus, $NO_3{}^-$ is the weakest base among the given.

47. d

An electrovalent compound is made up of electrically charged ions or group of ions.

48. b

49. d

50. c

51. a

52. c

53. d

54. a

55. a

56. d

57. b

58. d

59. b

60. a

61. d

Let velocity at midpoint be w

$w^2 = u^2 + 2as \rightarrow w^2 - u^2 = 2as$

$v^2 = w^2 + 2as \rightarrow v^2 - w^2 = 2as$

$w^2 - u^2 = v^2 - w^2$

$2w^2 = u^2 + v^2$

$w = \sqrt{\frac{u^2 + v^2}{2}}$

62. c

$\frac{U'}{U} = (\frac{nx}{x})^2$

or, $U' = n^2U$

63. a

$y = A \sin \omega t$

$A/2 = A \sin \omega \times 0.66$

$\frac{\pi}{6} = \omega \frac{2}{3}$

$\omega = \pi/4$

$T = \frac{2\pi}{\omega} = 8s$

64. b

When the log is half way out of the water , the volume of water displaced by its half part is $500cm^3$

. .. Upthrust = Weight of water displaced

= Weight of 500 cm^3

$= V\rho g = \frac{500}{10^6} \times 1000 \times 10 = 5N$

...Tension = Weight – Upthrust = 12-5 = 7N

65. a

$dQ = dU + dW$

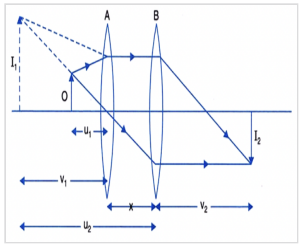
$dQ = -dW = -\frac{nR(T_1 - T_2)}{\gamma - 1} = \frac{24.5 \times 8.314 \times 100}{0.4} = 5 \times 10^4 J$

66. a

From first lens

$\frac{1}{20} = \frac{1}{10} + \frac{1}{v}$

$v = -10cm$



This is a virtual image.

For second lens the object distance is

$10 + 20 = 30cm$

$\frac{1}{v_2} = \frac{1}{10} - \frac{1}{30} = \frac{1}{15}$

$v_2 = 15cm$

Total distance = 30 + 15 = 45 cm

67. b

Volume of 1 big drop = Volume of 8 small drops

or, V = 8 V

or, $\frac{4}{3}\pi R^3 = 8 \times \frac{4}{3}\pi r^3$

or,R=2r

Potential of big drops and small drops are:

V= $\frac{Q}{C}$ ....(i)

v= $\frac{q}{c}$ ....(ii)

Dividing (i) by (ii)

$\frac{V}{v} = \frac{Q}{c} \times \frac{c}{q}$

$\frac{V}{v} = \frac{8q}{4\pi\epsilon 0R} \times \frac{4\pi\epsilon 0r}{q}$

$\frac{V}{v} = \frac{8r}{2r}$

V:v=4:1

68. b

$R = \frac{\rho l}{A} \times \frac{l}{I}$

$R = \frac{\rho \times l2}{V}$

$R \propto t^2$

$\frac{r}{r'} = \left(\frac{I'}{I}\right)^2 = \left(\frac{2I}{I}\right)^2$

$r' = 4r$

69. a

$F = ilB\sin\theta = ilB = \frac{q}{t}lB = \frac{l}{t}qB = qvB = 1 \times 10 \times 2 = 20$ N

70. c

$E = L\frac{di}{dt}$

$5 = 2 \times \frac{di}{dt}$

$\frac{di}{dt} = 2.5A/s$

71. c

The unchanged in the frequency on replacement of liquid is due to the fact that the frequency is due to the vibration of air column and not due to the liquid.

72. a

$We\ have\ f' = \left(\frac{v \pm v_0}{v \pm v_s}\right) \times f$

For passenger sitting in next train,

$f' = \left(\frac{v + v_0}{v - v_s}\right) \times f = \left(\frac{332 + 20}{332 - 20}\right) \times 1300$

$= 1466.67Hz$

73. d

E1 = 5 eV

E2 = 2 eV

φo = 1 eV

We have from Einstein's photo – electric equation

$u1/u2 = \sqrt{E1–\varphi o/E2 - \varphi o}$

$= \sqrt{5–1/2–1} = 2/1$

74. b

75. b

76. d

$a_{ij} = i^2 - j^2$

$a_{ji} = j^2 - i^2 = -(i^2 - j^2) = -a_{ij}$

Hence it is skew symmetric matrix.

77. c

$|z - 3| = |z - 5|$

or, $|x + iy - 3| = |x + iy - 5|$

or, $(x - 3)^2 + y^2 = (x - 5)^2 + y^2$

or, $(x - 3)^2 = (x - 5)^2$

or, $x^2 - 6x + 9 = x^2 - 10x + 25$

or, $4x = 16$

or, $x = 4$ i.e. a straight line

Note: $|z - a| = |z - b|$ always represents straight line.

78. c

Hit and Trial Method

The sum up to the third term is 11.

Put n= 3

$2^n - n - 2 = 3$

$2^{n+1} - n = 13$

$2^{n+1} - n - 2 = 11$

$2^n - n = 5$

Hence (c) is the correct answer.

Process Method

$S_n = 1 + 3 + 7 + 15 + 31 + \ldots\ldots + t_n \ldots$ (i)

$S_n = \quad 1 + 3 + 7 + 15 + \ldots\ldots t_{n-1} + t_n \ldots$

Subtracting,

$0 = 1 + 2 + 4 + 8 + 16 + \ldots + (t_n - t_{n-1}) - t_n$

or $t_n = 1 + 2 + 4 + 8 + 16 + \ldots$ n terms

or, $t_n = \dfrac{1(2^n - 1)}{2 - 1}$

$t_n = 2^n - 1$

$S_n = \sum t_n$

$= \sum (2^n - 1)$

$= \sum 2^n - \sum 1$

$= (2 + 2^3 + 2^3 + \text{n terms}) - n$

$= \dfrac{2(2^n - 1)}{2 - 1} - n$

$= 2(2^n - 1) - n$

$= 2^{n+1} - 2 - n$

79. c

$(1 + x)^n = C_0 + C_1 x + C_2 x^2 + C_3 x^3 + \ldots\ldots + C_n x^n$

$(x + 1)^n = C_0 x^n + C_1 x^{n-1} + C_2 x^{n-2} + C_3 x^{n-3} + \ldots\ldots + C_n$

$(1+x)^{2n} = [C_0^2 + C_1^2 + C_2^2 + ...]x^n + [C_0C_1 + C_1C_2 + C_2C_3 + ...]x^{n-1} + [C_0C_2 + C_1C_3 + C_2C_4 + ...]x^{n-2} + ...$

Comparing powers of x^n

$$C_0^2 + C_1^2 + C_2^2 + \ldots = C(2n, n) = \frac{2n!}{n!n!}$$

80. a

$\cos^{-1} x + \cos^{-1} y = \pi/2$

$\cos^{-1}(xy - \sqrt{1-x^2}\sqrt{1-y^2}) = \pi/2$

$xy - \sqrt{1-x^2}\sqrt{1-y^2} = \cos \pi/2 = 0$

$xy = \sqrt{1-x^2}\sqrt{1-y^2}$

$x^2y^2 = 1 - x^2 - y^2 + x^2y^2$

$x^2 + y^2 = 1$

i.e., circle with center (0,0) and radius 1.

81. b

$$\frac{c - a\cos B}{b - a\cos C}$$

$$= \frac{c - a(\frac{a^2 + c^2 - b^2}{2ac})}{b - a(\frac{a^2 + b^2 - c^2}{2ab})}$$

$$= \frac{(\frac{2c^2 - a^2 - c^2 + b^2}{c})}{(\frac{2b^2 - a^2 - b^2 + c^2}{b})}$$

$$= \frac{c^2 - a^2 + b^2}{c} \times \frac{b}{c^2 + b^2 - a^2}$$

$$= \frac{b}{c}$$

82. d

83. b

$m_1 = 5m_2$

$m_1 + m_2 = 5m_2 + m_2 = 6m_2 = -\frac{2h}{b} \rightarrow m_2 = -\frac{h}{3b}$

$m_1m_2 = 5m_2^2 = \frac{a}{b}$

$5(-\frac{h}{3b})^2 = \frac{a}{b}$

$5h^2 = 9ab$

84. a

$2\mathrm{x}^2 + 2\mathrm{y}^2 - 8\mathrm{x} - 12\mathrm{y} - 9 = 0$

$\mathrm{x}^2 + \mathrm{y}^2 - 4\mathrm{x} - 6\mathrm{y} - 9/2 = 0$

Center$(h, k) = (-g, -f) = (2, 3)$

For $\mathrm{x}^2 + \mathrm{y}^2 + 8\mathrm{x} + 10\mathrm{y} - 7 = 0$

center is $(-4, -5)$

The radius of circle having center $(2, 3)$ and passing through $(-4, -5)$.

Radius = $\sqrt{(2-(-4))^2 + (3-(-5))^2} = 10$

Hence the equation is

$(x-2)^2 + (y-3)^2 = 10^2$

$\mathrm{x}^2 + \mathrm{y}^2 - 4\mathrm{x} - 6\mathrm{y} - 87 = 0$

85. c

$\mathrm{y}^2 = 8x$

$2y\frac{dy}{dx} = 8x$

$\frac{dy}{dx} = \frac{4}{y}$

The slope at $(2, 4)$ is $\frac{4}{4} = 1$

Hence the equation of tangent is

$y - 4 = 1(x - 2)$

$y - 4 = x - 2$

$x - y + 2 = 0$

86. a

Reflection P of the plane P_1 in the plane P_2 is such that it is through the intersection of P_1 and P_2. Perpendicular distance of a point on P_2 to P_1 and P are equal.

Here, $P_1 : x + 2y + 2z = 0$ .. (1)

$P_2 : 4x - 3y + 12z + 13 = 0$ .. (2)

Plane passing through the intersection of P_1 and P_2 is of the form,

$(x + 2y + 2z) + \lambda(4x - 3y + 12z + 13) = 0$ ... (3)

i.e., $x(1 + 4\lambda) + y(2 - 3\lambda) + z(2 + 12\lambda) + 13\lambda = 0$

We note that $Q(-1, -1, -1)$ is a point on P_2. Let M and N be the feet of the perndiculars from Q on P and P_1 respectively. Then we have,

$QM = QN$, if (3) is the reflection of (1) on (2)

$\Rightarrow$

$$\frac{(1+4\lambda)(-1) + (2-3\lambda)(-1) + (2+12\lambda)(-1) + 13\lambda}{\sqrt{(1+4\lambda)^2 + (2-3\lambda)^2 + (2+12\lambda)^2}} =$$

$$\frac{1}{\sqrt{2}}$$

$$\Rightarrow \lambda(169\lambda + 44 = 0 \Rightarrow \lambda = \frac{-44}{169} [\because \lambda \neq 0]$$

$\therefore$ Equation of the plane of reflection of (1) in (2) is

$$7x - 470y + 190z + 572 = 0$$

87. b

$$\lim_{x \to 1} \left(\frac{\sum_{r=1}^{n} (x^r - 1)}{x - 1} \right)$$

$$\lim_{x \to 1} \left(\frac{(x-1) + (x^2 - 1) + (x^3 - 1) + \cdots (x^n - 1)}{x - 1} \right) (0/0$$

Using L'Hospital Rule:

$$\lim_{x \to 1} \left(\frac{1 + 2x + 3x^2 + \cdots n x^{n-1}}{1} \right)$$

$$1 + 2 + 3 + \cdots n$$

$$\frac{(n^2 + n)}{2}$$

88. a

$y = e^{\sqrt{ab \cos x}}$

$$\frac{dy}{dx} = e^{\sqrt{ab \cos x}} \frac{d}{dx} (\sqrt{ab \cos x})$$

$$\frac{dy}{dx} = e^{\sqrt{ab \cos x}} \times \frac{1}{2\sqrt{ab \cos x}} ab \times - \sin x$$

$$\frac{dy}{dx} = -\frac{1}{2} e^{\sqrt{ab \cos x}} \sqrt{ab \ \tan x \sin x}$$

89. c

$$\int \frac{\sin x \cos x}{2 - \cos^2 x} dx = \int \frac{\sin x \cos x dx}{1 + \sin^2 x}$$
$Put\ y = \sin x \implies dy = \cos x dx$
$$= \int \frac{y dy}{1 + y^2} dy$$

$$\frac{1}{2} \log(1 + y^2) + c$$

$$\log \sqrt{(1 + y^2)} + c$$

$$\log \sqrt{1 + \sin^2 x} + c$$

90. c

Ammoniacal $\mathrm{Cu_2Cl_2}$ is used to separate ethylene from acetylene.

91. c

In laboratory, $\mathrm{H_2S}$ is prepared by treating ferrous sulphide (black lumps) with $\mathrm{dil \cdot H_2SO_4}$.

$$\mathrm{FeS + H_2SO_4(dil \cdot) \longrightarrow FeSO_4 + H_2S}$$

92. d

Non-metal like halogens are strongest oxidizing agents according to electrochemical series. They form acidic oxides like

SO_2, they from anion by eletron gain and they are highly electronegative.

93. a

1 mole of carbohydrate contain 10 g of hydrogen

In E.F., $C : H : O$ ratio is $1 : 2 : 1$

with 10 H atom, there is 5 C atom and 5 O atom

M.F $C_5H_{10}O_5$

94. c

In A, $\text{Change in Oxidation Number} = 5$,

$\text{Eq wt of } KMnO_4 = \dfrac{M}{5}$

In B, $\text{Change in Oxidation Number} = 3$,

$\text{Eq wt of } KMnO_4 = \dfrac{M}{3}$

95. d

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

$\text{Initially, } \quad c \qquad\qquad 0 \qquad 0$

$\text{eq point, } \quad c - s \qquad\qquad s \qquad s$

$K_a = \dfrac{S^2}{C - S}$

$C - S \approx C$

$1.7 \times 10^{-5} = \dfrac{(3.4 \times 10^{-4})^2}{C}$

$C = 6.8 \times 10^{-3}$ M

96. c

$Cu^{+2} + 2\,e^- \longrightarrow Cu$

$2\,F \longrightarrow 1\,\text{mole of Cu}{=}63.5\,\text{g of Cu}$

$0.5\,F \longrightarrow 63.52 \times 0.5 = 15.8\text{g}$

97. c

98. d

99. c

100. c