clamphook

Shift 2 | July 8

Clamphook CBT

2080

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

1. Which of the following sets of three vectors act on a body. whose resultant cannot be zero.

a. 10,10,10
b. 10,10,20
c. 10,20,30
d. 10,20,40

2. Two blocks of masses $m_1 = 1$ kg and $m_2 = 2$ kg , are connected by a non - deformed light spring . They are lying on a rough horizontal surface . The coefficient of friction between the block and the surface is 0.4 . What min. constant force F has to be applied in horizontal direction to the block of mass m1 in order to shift the other block ?

a. 8 N
b. 15 N
c. 10 N
d. 25 N

3. A mass 'M' is broken into two parts one of which has mass 'm'. To have maximum gravitational force of attraction between the broken masses.

a. m = 2M
b. m =M/2
c. m =M/4
d. m = M/6

4. The breaking stress for a wire of unit cross – section called its ,

a. yield point
b. tensile strength
c. elastic fatigue
d. Young's modulus

5. A body of weight 60g in air and 40g in water . The specific gravity of body is

a. 3
b. 2×10^3
c. 1.5
d. 0.5

6. The liquids of same volume have densities in the ratio $1:3$ and specific heat is the ratio $3:1$. The ratio of their heat capacities will be:

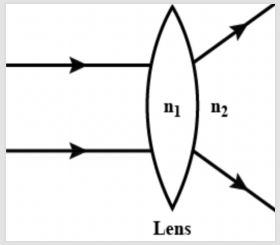
a. 1:1
b. 1:9
c. 4:1
d. 1:3

7. A steam pipe at 170 ℃ is covered by a materials with outer surface at 30 ℃ ,if a loss of 25 Cal/min.cm is observed , calculate the thermal conductivity of the pipe in CGS system

a. 3×10^{-3}
b. 4×10^{-3}

c. 5×10^{-3} d. 6×10^{-3}

8. A light ray is passed from one medium of RI(n_1) to another medium of RI (n_2) as shown in fig .The correct relation between n_1 and n_2 is



a. n1 $>$ n2 b. n1 $<$ n2

c. n1 = n2 d. There is no relation between n1 and n2 .

9. A plane glass slab is placed on the letter of different colors . The letters of which color are rasied by least amount ?

a. red b. yellow

c. blue d. especially for all colors

10. If the potential of metallic spheres sphere 100 V with respect to far away . Calculate the surface charge density if the radius of sphere 2 cm

a. 4.4×10^{-7} b. 2.4×10^{-6}

c. 2.4×10^{-5} d. 4.4×10^{-8}

11. if N and e be the Avogadro number and electronic charge respectively, the Faraday constant (F) is equal to

a. Ne b. $\frac{N}{e}$

c. N^2e d. Ne^2

12. A bar magnet is successively cut into equal halves along length and perpendicular to length . The magnetic moment of each part in comparison to original bar magnet is [IOE 2076]

a. half b. double

c. one – forth d. four – times

13. When an electric motor is run at 120 volt, 10A current flows through it and the induced back emf is 115 volts. What will be the current flowing in the coil at the time of switch off?

a. 230 A b. 10 A

c. 240 A d. zero

14. Fraunhofer diffraction experiment at a single slit using light of wavelength 400 nm , the first minimum is formed at an angle of 30° . Then the direction θ of the first secondary maximum is given by :

a. $\tan^{-1}(\frac{3}{4})$ b. $\sin^{-1}(\frac{3}{4})$

c. 60° d. $\tan^{-1}(\frac{4}{3})$

15. The amplitude due to superposition of two waves $y_1 = a\sin\left(\omega t + \frac{\pi}{6}\right)$ and $y_2 = a\cos\omega t$ will be:

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

c. $\sqrt{3}a$ d. $2a$

16. An electron of mass m and charge q is accelerated from rest in an electric field off strength E. the velocity acquired by its as it travels a distance is

a. $\sqrt{\frac{2Eql}{m}}$ b. $\sqrt{\frac{2Eq}{ml}}$

c. $\frac{2Eql}{m}$ d. $\sqrt{\frac{Eq}{ml}}$

17. Current gain (α) of transistor is [IOE 2075]

a. $\frac{I_C}{I_E}$ b. $\frac{I_C}{I_B}$

c. $\frac{I_E}{I_E}$ d. $\frac{I_E}{I_C}$

18. The order of power set of order K is

a. K b. $2K$

c. K^2 d. 2^K

19. A is a 3×3 matrix and $det(3A) = k \times det(A)$, then k is equal to:

a. 9 b. 6

c. 3 d. 27

20. Given $z = (1 + i\sqrt{3})^{100}$, then $\frac{Re(z)}{Im(z)}$ equals

a. 2100 b. 200

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

21. The sum to n terms of the series $1 \times 2 + 2 \times 3 + 3 \times 4 + 4 \times 5 + \ldots$ shall be:

a. n^3 b. $\frac{1}{3}n(n+1)(n+2)$

c. $\frac{1}{6}n(n+1)(n+2)$ d. $\frac{1}{3}n(n+1)(2n+1)$

22. $\tan\left[\cos^{-1}(x)\right]$ is equal to:

a. $\frac{\sqrt{1-x^2}}{x}$ b. $\frac{\sqrt{1+x^2}}{x}$

c. $\frac{x}{1+x^2}$ d. $\sqrt{1-x^2}$

23. The equation $a\sin x + b\cos x = c$, where $|c| > \sqrt{a^2+b^2}$ has

a. One solution b. Two solution

c. No solution d. Infinite number of solutions

24. In triangle ABC, angles A,B and C are on AP. If $b : c = \sqrt{3} : \sqrt{2}$, Find A. [IOE 2078]

a. 30 b. 60

c. 45 d. 75

25. In ΔABC, there is a point 'G' inside it, then $\overrightarrow{GA} + \overrightarrow{CG} =$ [IOE 2075]

a. $\overrightarrow{AB} + \overrightarrow{BC}$ b. $\overrightarrow{BA} + \overrightarrow{CB}$

c. $\overrightarrow{CB} + \overrightarrow{AB}$ d. $\overrightarrow{AC} + \overrightarrow{AB}$

26. The distance of a point $(6, 8)$ from the origin is

a. 6 b. 8

c. 10 d. 5

27. The equation of the common chord of the circle $x^2 + y^2 - 8x - 2y + 9 = 0$ and $x^2 + y^2 - 4x + 10y + 8 = 0$ is :

a. $4x - 12y - 1 = 0$ b. $4x - 12y + 1 = 0$

c. $4x + 12y - 1 = 0$ d. $4x + 12y + 1 = 0$

28. If the equation $\mathrm{kx}^2 - 4\mathrm{y}^2 = 20$ represent rectangular hyperbola then the value of k is

a. 4 b. -4

c. 5 d. -5

29. Foci of hyperbola $x^2 - y^2 = a^2$ is [IOE 2075]

a. $(\pm \frac{a}{\sqrt{2}},\ 0\ )$ b. $(0, \pm \frac{a}{\sqrt{2}}\ )$

c. $(\pm \sqrt{2}a,\ 0\ )$ d. $(0, \pm \sqrt{2}e\ )$

30. In what ratio the XY ,Äì plane divides the line segment joining points (2, -6, 10) & (12, 9 , -25) is [IOE 2076]

a. 1 : 1 b. 5 : 2

c. 2 : 5 d. 3 : 5

31. The value of $\lim_{x \to 1} \left[\frac{x + x^2 + x^3 + ... + x^n - 1}{(x - 1)}\right] = 66$ then value of n is equal to

a. 10 b. 11

c. 12 d. 5

32. The derivative of $|x - 1| + |x - 3|$ at $x = 2$ is

a. 1 b. Doesnt Exist

c. 0 d. 2

33. If $y = \sec^{-1} \frac{1}{2x^2 - 1}$ then $\frac{dy}{dx}$ is equals to [IOE 2078]

a. $-\frac{1}{\sqrt{1 - x^2}}$ b. $\frac{1}{\sqrt{1 - x^2}}$

c. $-\frac{2}{\sqrt{1 - x^2}}$ d. $\frac{2}{\sqrt{1 - x^2}}$

34. The function of $f(x) = 5$ is

a. Neither increasing nor decreasing b. Increasing

c. Decreasing d. None of these

35. Maximum value of $\frac{\log x}{x}$ in the interval $[2, \infty)$ is

a. 1 b. 0

c. $\log 2$ d. $\frac{1}{e}$

36. If $f(x) = e^{\tan x}$ then $\int_0^{\frac{\pi}{4}} \log f(x) dx$ [IOE 2078]

a. $\ln 2$ b. $\ln \sqrt{2}$

c. $\ln 4$ d. $-\ln \sqrt{2}$

37. The area of the figure bounded by $y = e^x, y = e^{-x}$ and st. line $x = 1$ is:

a. $e + \frac{1}{e}$ b. $e + \frac{1}{e} - 2$

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

38. Which of these is not the property of organic compound?

a. Flammable
b. Isomerism
c. Directional character of bonds
d. high melting and boiling points

39. The compound B formed in the reaction in the following sequence of reaction is

$$CH_3\ CH_2\ CH_2\ OH \xrightarrow{PCl_5} A \xrightarrow{Alc \cdot NaOH} B$$

a. propane
b. propanal
c. propene
d. propyne

40. Which one is known as oil of vitriol?

a. H_2SO_3
b. H_2SO_4
c. H_2SO_5
d. $H_2S_2O_8$

41. In calgon process, hardness is removed by the formation of

a. precipitation
b. inactive complexes
c. exchanged ions
d. none above

42. The electrochemical process is employed to extract

a. Fe
b. Na
c. Pb
d. Ag

43. The chemical formula of basic copper acetate is

a. $Cu(CH_3COO)_2 \cdot Cu(OH)_2$
b. $Cu(OH)CH_2COO$
c. $Cu(OH)_2(CH_3COO)_2$
d. $CuCO_3 \cdot Cu(CH_3COO)_2$

44. The highest temperature is achieved in which type of furnace?

a. Blast
b. Reverberatory
c. Electric
d. Muffle

45. The conversion of lead carbonate to lead sulphate is

a. oxidation
b. reduction
c. both oxidation and reduction
d. neither oxidation nor reduction

46. Which of the following is a lewis base?

a. $NaOH$
b. NH_3
c. BCl_3
d. All

47. If $_3Li^7$ absorbs proton, the element formed is [IOE 2075]

a. Isotopes of Lithium
b. Isotopes of Boron
c. Beryllium
d. Isotopes of Beryllium

48. As per the modern periodic law, the physical and chemical properties of elements are periodic function of their

a. Atomic volume
b. Electronic configuration
c. Atomic weight
d. Atomic size

49. I have distributed the children four mangoes .....

a. each
b. any
c. neither
d. Either

50. The phenomenon ..... strange.

a. seem
b. have seemed
c. seems
d. are seeming

51. I went in search_____ the dog.

a. of
b. with
c. for
d. at

52. 'I sent her a gift.' The equivalent sentence pattern is [IOE 2077]

a. S+V+O
b. S+V+IO+DO
c. S+V+DO+IO
d. S+V+O+C

53. When she was driving, she _____ with an accident.

a. meets
b. had meeting
c. will meet
d. met

54. Come here on time.

a. You must come here on time.
b. On time you must be come here.
c. You should come here on time.
d. You are supposed to come here on time.

55. Which of the following has the same initial sound as 'pat'?

a. phone
b. physics
c. psychology
d. palm

56. "Standing on tip-toe, he reached for the rose." This sentence is [IOE 2077]

a. simple
b. compound
c. complex
d. none

57. My application form was turned down by the director.

a. accepted
b. reviewed
c. rejected
d. corrected

58. Mania for stealing articles

a. Hypomania
b. Kleptomania
c. Logomania
d. Stelomania

59. We'd terribly offered if he .....

a. didn't come
b. wouldn't come
c. hadn't have come
d. wouldn't have come

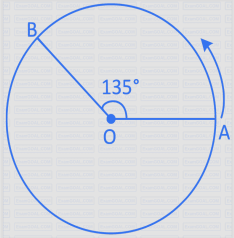
60. Antonym of Rabid ?

a. Frantic
b. Sober
c. Chaos
d. Vulgar

61. What determines the nature of the path followed by the particle

a. speed
b. velocity
c. acceleration
d. velocity and acceleration

62. A person moved from A to B on a circular path as shown in figure. If the distance travelled by him is 60 m, then the magnitude of displacement would be :



$\cos 135^\circ = -0.7$

a. 42 m
b. 47 m
c. 19 m
d. 40 m

63. A wheel rotates with a constant acceleration of $\pi\ rad/s^2$. If the wheel starts from rest then no of revolutions made by wheel in first two seconds will be:

a. 1 b. 2π

c. 4 d. 8

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64. A capillary tube of diameter 0.04cm is held vertically with its lower end below the surface of water. The height to which water rise in tube is:

a. 3.6cm b. 7.2cm

c. 13.2cm d. 15.25cm

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65. When an ideal diatomic gas is heated at constant pressure, the fraction of heat energy supplied which increases the internal energy of gas is [IOE 2077]

a. $\frac{2}{5}$ b. $\frac{3}{5}$

c. $\frac{3}{7}$ d. $\frac{5}{7}$

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66. A thin double convex lens has radii of curvature each of magnitude 40 cm and is made of glass with refractive index 1.65. Its focal length is nearly [ ]

a. 20 cm b. 35 cm

c. 31 cm d. 50 cm

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67. n equal capacitors are first connected in series and then in parallel. The ratio of maximum to minimum capacitance is:

a. n^2 b. $\frac{1}{\mathrm{n}}$

c. n d. $\frac{1}{n^2}$

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68. Kirchoff's loop law is based on conservation of [IOE 2077, IOE 2078]

a. conservation of charge b. conservation of mass

c. conservation of energy d. conservation of momentum

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69. The magnetic field intensity at one end due to long current carrying solenoid is

a. $\mu_o nI$ b. $\frac{\mu_o nI}{2}$

c. $\frac{\mu_o I}{2}$ d. $\frac{\mu_o nI}{0}2\pi$

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70. Choke is used in place of resistor because [IOE 2078]

a. Choke has high resistance b. There is no wastage of power

c. Choke has low impedance d. Current becomes wattful

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71. A tuning fork of frequency 480 Hz is used to vibrate a sonometer wire having natural frequency 240 Hz. The wire will vibrate with frequency of

a. 240 Hz b. 480 Hz

c. 720 Hz d. 1441 Hz

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72. A rocket is going towards moon with speed 'v'. the astronauts in the rocket sends signal of frequency 'f' towards moon and receives then back on reflection from the moon. The frequency of signal received by astronaut is [IOE 2075]

a. $\frac{cf}{c-v}$ b. $\frac{cf}{c-2v}$

c. $\frac{2vf}{c}$ d. $\frac{2cf}{v}$

73. In an X-ray tube if the electrons are accelerated through 140×10^3 volt, then anode current obtained is 30×10^{-3} A. If the whole energy of electrons is converted into heat then the rate of production of heat at anode will be

a. 968 calories b. 892 calories

c. 1000 calories d. 286 calories

74. The wavelength of first line of Lyman series hydrogen is $1216\mathring{A}$. The wavelength of second member of Balmer series would be:

a. $304\mathring{A}$ b. $4864\mathring{A}$

c. $\frac{2}{3} \times 1216\mathring{A}$ d. $\frac{3}{2} \times 1216\mathring{A}$

75. A relation $f : N \to N$ is defined by $y = x^2 \forall x \in N$, then f is :

a. One-to-one and into b. One-to-one and onto

c. Many to one and into d. Not a function

76. $\begin{vmatrix} 1 & 1 & 1 \\ xy & yz & zx \\ 1/z & 1/x & 1/y \end{vmatrix}$ [IOE 2074]

a. xyz b. $x^2y^2z^2$

c. $\frac{1}{xyz}$ d. 0

77. If $(3+4i)(x+iy) = (1+i)$ then the value of $x^2 + y^2 =$

a. $x^2 + y^2 = \frac{16}{25}$ b. $x^2 + y^2 = \frac{2}{5}$

c. $x^2 + y^2 = \frac{2}{25}$ d. $x^2 + y^2 = \frac{4}{25}$

78. If the sum of the first n natural numbers is $\frac{1}{5}$ times the sum of their squares, then the value of n is [IOE 2077]

a. 5 b. 6

c. 7 d. 8

79. The coefficient of x^{-3} in the expansion of $\left(x - \frac{m}{x}\right)^{11}$ is [IOE 2076]

a. $300m^5$ b. $-300m^5$

c. $330m^7$ d. $-330m^7$

80. If $\sin^{-1}\left(\frac{2a}{1+a^2}\right) + \sin^{-1}\left(\frac{2b}{1+b^2}\right) = 2\tan^{-1}(x)$, then x is equal to:

a. $\frac{a-b}{1+ab}$ b. $\frac{b}{1-ab}$

c. $\frac{b}{1+ab}$ d. $\frac{a+b}{1-ab}$

81. If semi perimeter is equal to ex – radius of a triangle , the triangle is [IOE 2076]

a. scalene b. isosceles

c. equilateral d. right angle

82. If three vectors $\vec{A} = \vec{i} - 2\vec{j} + 3\vec{k}, \vec{B} = x\vec{j} + 3\vec{k}$ and $\vec{C} = 7\vec{i} + 3\vec{j} - 11\vec{k}$ are coplanar then value of 'x'

equals to [IOE 2077]

a. $\frac{36}{21}$ b. $-\frac{36}{21}$

c. $\frac{51}{32}$ d. $-\frac{51}{32}$

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83. The value of 'r' when the line joining origin and point of intersec tion of $x+y=2$ and $x^2+y^2=r^2$ are at right angles [IOE 2075]

a. ± 4 b. ± 1

c. ± 3 d. ± 2

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84. The condition for a line $lx+my=n$ to touch the circle $x^2+y^2=a^2$ is [IOE 2077]

a. $(l^2+m^2)a^2=n^2$ b. $(l^2+n^2)a^2=m^2$

c. $(m^2+n^2)a^2=l^2$ d. $(l^2+m^2)n^2=a^2$

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85. If the normal at point $(at^2, 2at)$ of the parabola $y^2=4ax$ meets it again at point $(at'^2, 2at')$ then t' equals :

a. $\frac{-1}{\mathrm{t}}$ b. $\frac{1}{\mathrm{t}}$

c. $\mathrm{t}+\frac{2}{\mathrm{t}}$ d. $-\mathrm{t}-\frac{2}{\mathrm{t}}$

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86. The projection of the line joining the point (1,2,2) and (2,7, 3) on the plane 2x ,Äì y + 3z = 0 is [IOE 2074]

a. 2 units b. 22 units

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

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87. $f(x)=\begin{cases}\frac{\sin 3x}{x} & \text{for } x=0\\ \frac{k}{2} & \text{for } x\neq 0\end{cases}$.

is continuous at x=0, then find the value of k? [IOE 2078]

a. 3 b. 5

c. 6 d. 7

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88. If $x=at$ and $y=at^2$ then $\frac{dy}{dx}=$ [IOE 2077]

a. $2t$ b. t^2

c. $2a$ d. $2at$

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89. $\int_0^1 \frac{1-x}{1+x}dx$ **[IOE 2077]**

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

c. $2\ln 2+1$ d. $2\ln 2-1$

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90. Which of the following can be purified by sublimation?

a. Benzoic acid b. Camphor

c. Naphthalene d. All

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91. When ammonical solution is treated with $\mathrm{CuSO_4}$ the blue colour is due to

a. $[\mathrm{Cu(NH_3)_4}]\mathrm{SO_4}$ b. $[\mathrm{Cu(NH_3)_2}]\mathrm{SO_4}$

c. $\mathrm{C_2H_4}$ d. $\mathrm{C_2H_2}$

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92. From aqueous solution of $\mathrm{ZnSO_4}$, normal zinc carbonate may be precipitated by

a. Boiling with $CaCO_3$
b. Adding Na_2CO_3
c. Adding $NaHCO_3$
d. Passing CO_2

93. $18\ g$ **of water contains**

a. $1\ g$ atom of hydrogen
b. $2\ g$ atoms of hydrogen
c. $3\ g$ atoms of hydrogen
d. $4\ g$ atoms of hydrogen

94. $25\ ml$ of $0.5\ M\ H_2SO_4$ **is mixed with** $30\ ml$ of $1\ M\ NaOH$ **solution. The volume of** $\frac{N}{10}\ H_2SO_4$ **which will just neutralize the excess of alkali will be**

a. 5 ml
b. 50 ml
c. 10 ml
d. 20 ml

95. The solubility product K_{eq} **of** $Ca(OH)_2$ **is** 4.42×10^{-5} **, 500 ml of** $Ca(OH)_2$ **is mixed with equal volume of 0.4 M** $NaOH$ **. How much grams of** $Ca(OH)_2$ **will precipitate ? [IOE 2075]**

a. 0.5 gm
b. 0.6 gm
c. 0.75 gm
d. 0.85 gm

96. The time required to deposit 1 millimole of Aluminium when 0.965 A current is passed through the solution is [IOE 2076]

a. 5 minutes
b. 4 minutes
c. 3 minutes
d. 2 minutes

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

At one time in the history of India, most women knew very well how to bring up their infants and they lived a perfectly healthy life, free from diseases. The overall standard of women and children in the country was much better than that of other civilizations of that period. But ever since India was exposed to frequent foreign invasions from foreign nations, the life was unsafe and property unprotected, the people were forced to congregate in towns in such a compact way that it led to awful insanitation and diseases. The traditional knowledge of domestic and personal health and hygiene was ignored. Women were confined indoors for fear of insults and a train of social and unhealthy dangers followed all round. It is a problem how now we can restore the original conditions of healthy and happy life in India. This is a socio-economic problem which needs to be given priority to bring back the original culture and restore welfare of women and children in India.

97. What was the main cause of poor health conditions of women in India?

a. Women were confined indoors.
b. Illiteracy among women.
c. Frequent foreign invasions.
d. Awful sanitation.

98. What question has the writer posed before the readers?

a. How to check foreign invasion?

b. Why has the traditional knowledge been ignored?

c. What should be done for infants and women?

d. How to restore the original conditions of healthy and happy life in India?

99. What does the word 'congregate' mean in the passage?

a. forced

b. assemble

c. live

d. settle

100. Select from the answer choices the word which is as nearly opposite in meaning to 'confine' used in the passage?

a. forced

b. directed

c. to keep out

d. reject

Answer Key

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

Solutions

1. d

For the resultant to be zero, the vectors should form a triangle.

In a triangle, the sum of two smaller sides should be greater or equal to the third side.

In option a, $10 + 10 > 10$, hence it can have resultant zero.

In option b, $10 + 10 = 20$, hence it can have a resultant zero.

In option c, $10 + 20 = 30$, hence it can have resultant zero.

In option d, $10 + 20 < 40$, hence it cannot have resultant zero.

2. a

Work done by the various forces = change in kinetic energy i.e

$$F.x - \mu m_1 g x - \frac{1}{2} k x_2 = 0$$

But . $kx = \mu m_2 g$ for just shifting m_2

$$Fx - \mu m_2 gx - \frac{1}{2}\mu m_2 gx = 0$$

or, $F = \mu(m_1 + \frac{m_2}{2})g$

or, $F = 0.4(1 + \frac{2}{2}) \times 10 = 8$ N

3. b

$$F = \frac{Gm(M-m)}{r^2} = K(Mm - m^2)$$

$$\text{For F to be maximum} \frac{dF}{dm} = 0$$

$$\therefore M - 2m = 0 \rightarrow m = \frac{M}{2}$$

4. b

5. a

$$\text{Specific gravity } = \frac{\text{Weight in air}}{\text{Loss in weight}}$$

$$= \frac{60}{60-40} = 3$$

6. a

$$Q = ms\Delta\theta$$

or $Q = \rho V s \Delta\theta$

$$Q \propto \rho s$$

$$\therefore \frac{Q_1}{Q_2} = \frac{s_1}{s_2} \times \frac{r_1}{r_2}$$

$$\frac{Q_1}{Q_2} = \frac{1}{1}$$

7. a

$$\frac{Q}{t} = \frac{kA\theta}{x}$$

$$\frac{Qx}{At} = k\theta$$

$$\frac{25}{60} = k \times 140$$

8. b

9. a

Displacement $x = t\left(1 - \frac{1}{\mu}\right)$

Since μ is less for red , displacement x will be minimum for red color.

10. d

We have,

$$V = \frac{q}{4\pi\epsilon_\circ R}$$

$$= \frac{qR}{4\pi\epsilon_\circ R^2}$$

$$= \frac{R}{\epsilon_\circ} \times \frac{q}{4\pi R^2}$$

For sphere $A = 4\pi R^2$

$$V = \frac{R}{\epsilon_\circ} \times \frac{q}{A}$$

$$\frac{q}{A} = \sigma (\sigma = \text{ (surface charge density)}$$
$$V = \frac{R}{\epsilon_\circ} \times \sigma$$
$$\sigma = \frac{V\epsilon_\circ}{R}$$
$$= \frac{100 \times 8.85 \times 10^{-12}}{2 \times 10^{-2}}$$
$$= 4.4 \times 10^{-8} Coulomb/m^2$$

11. a

12. c

Original bar magnet $M = m2l$

New bar magnet $M_{new} = \frac{m}{2}\frac{2l}{2} = \frac{M}{4}$

13. a

$$R = \frac{E - V}{l} = \frac{120 - V}{10} = 5$$

At the time of switch off, E=0

$$\therefore I = \frac{V}{R} = \frac{115}{0.5} = 230A$$

14. b

$$\sin\theta = \frac{(2n-1)\lambda}{2d}$$

Where $n = 2, 3, \ldots$ (i.e n= 2 for 1st secondary maximum , n=3 for secondary maximum and so on) Direction of 1st minimum

$$d\sin\theta = d\sin 30^\circ = \lambda$$
$$d = 2\lambda \ldots\ldots\ldots (1)$$

For 1st secondary maxima , n=2

$$\sin\theta = \frac{(2 \times 2 - 1)\lambda}{2d}$$
$$or, \sin = \frac{3\lambda}{4\lambda}$$ (putting from equation 1)

$$\theta = \sin^{-1}(\frac{3}{4})$$

15. c

$$A = \sqrt{(a_1^2 + a_2^2 + 2a_1a_2\cos\phi)}$$

$$\text{Putting } a_1 = a_2 = a \text{ and } \phi = \frac{\pi}{3} \text{ we get, } A = \sqrt{3}a$$

16. a

Acceleration in electric field. $a = \frac{F}{m} = \frac{qE}{m}$

We have, $v^2 - u^2 = 2as$

or, $v^2 = 2\frac{qE}{m} \times l$

Therefore, $v = \sqrt{\frac{2qEl}{m}}$

17. a

18. d

The order of power set of order K is 2^K.

19. d

$det(3A) = kdet(A)$

$3^3 det(A) = kdet(A)$

$k = 3^3 = 27$

20. d

$z = (1 + i\sqrt{3})^{100}$

$2^{100}(\frac{1}{2} + i\frac{\sqrt{3}}{2})^{100}$

$2^{100}(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3})^{100}$

$2^{100}(\cos\frac{100\pi}{3} + i\sin\frac{100\pi}{3})$

$2^{100}(-\cos\frac{\pi}{3} - i\sin\frac{\pi}{3})$

$2^{100}(-\frac{1}{2} - \frac{\sqrt{3}}{2}i)$

$$\frac{Re(z)}{Im(z)} = \frac{-\frac{1}{2}}{-\frac{\sqrt{3}}{2}} = \frac{1}{\sqrt{3}}$$

21. b

The n^{th} term of given series,

$t_n = n(n+1) = n^2 + n$

Here,

$S_n = \sum t_n$

$= \sum(n^2 + n)$

$= \sum n^2 + \sum n$

$$= \frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2}$$

$$= \frac{n(n+1)}{2}\left[\frac{2n+1}{3} + 1\right]$$

$$= \frac{n(n+1)}{2}\left[\frac{2n+1+3}{3}\right]$$

$$= \frac{n(n+1)(n+2)}{3}$$

22. a

$$\tan\left[\cos^{-1}(x)\right] = \tan\left[\tan^{-1}\left(\frac{\sqrt{1-x^2}}{x}\right)\right] = \frac{\sqrt{1-x^2}}{x}$$

23. c

$a\sin x + b\cos x = c$

Dividing by $\sqrt{a^2 + b^2}$.

$$\frac{a}{\sqrt{a^2+b^2}}\sin x+\frac{b}{\sqrt{a^2+b^2}}\cos x=\frac{c}{\sqrt{a^2+b^2}}$$

Let $\cos\theta=\frac{a}{\sqrt{a^2+b^2}}$ then $\sin\theta=\frac{b}{\sqrt{a^2+b^2}}$

$$\sin(x+\theta)=\frac{c}{\sqrt{a^2+b^2}}>1$$

Hence solution is not possible.

24. d

Let the angles be a,a+d,a+2d.

Then, $a+a+d+a+2d=180^\circ$

or, $a+d=60^\circ$

So $\angle B=60$

Now, $\frac{b}{c}=\frac{\sin B}{\sin C}=\frac{3}{2}$

$$\sin C=\sqrt{\frac{2}{3}}\times\frac{\sqrt{3}}{2}=\frac{1}{\sqrt{2}}$$

$C=45$

So, $\angle A=75$

25. b

$$\overrightarrow{GA}+\overrightarrow{CG}=\overrightarrow{CG}+\overrightarrow{GA}=\overrightarrow{CA}$$

$$=\overrightarrow{CB}+\overrightarrow{BA}$$

$$=\overrightarrow{BA}+\overrightarrow{CB}$$

26. c

Distance of a point from origin $=\sqrt{|\text{x-coordinate}|^2+|\text{y-coordinate}|^2}=\sqrt{6^2+8^2}=10$ units

27. c

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

$\mathrm{x}^2+\mathrm{y}^2-4x+10y+8=0$

subtracting we get:

$-4x-12y+1=0$

$4x+12y-1=0$

28. a

$\mathrm{kx}^2-4\mathrm{y}^2=20$

$$\frac{\mathrm{x}^2}{\frac{20}{k}}-\frac{\mathrm{y}^2}{5}=1$$

For rectangular hyperbola: $a=b$

$$\frac{20}{k} = 5$$

$$k = 4$$

29. c

$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$
has foci $(\pm\ ae,\ 0)$
As a = b results, $x^2 - y^2 = a^2$ and foci still remains $(\pm ae, 0) = (\pm\ \sqrt{2}a,\ 0\ )$

30. c

z = 0 in XY - plane and if it divides in ratio k: 1 then $z = \frac{k \times (-25) + 1 \times 10}{k+1} = 0 \rightarrow k = 2/5$

31. b

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

Using L'Hospital Rule:

$$\lim_{x \to 1} \left[\frac{1 + 2x + 3x^2 + ... + nx^{n-1}}{(1)} \right] [\frac{0}{0}]$$

$$1 + 2 + 3 + \cdots + n = 66$$

$$\frac{n(n+1)}{2} = 66$$

$$n = 11$$

32. c

$f(x) = |x-1| + |x-3|$

$$= \begin{cases} 1 - x + 3 - x & 0 < x \leq 1 \\ x - 1 + 3 - x & 1 < x \leq 2 \\ x - 1 + 3 - x & 2 < x < 3 \end{cases}$$

$$f(x) = \begin{cases} 4 - 2x & 0 < x \leq 1 \\ 2 & 1 < x \leq 2 \\ 2 & 2 < x < 3 \end{cases}$$

$$\Rightarrow f'(x) = \begin{cases} -2 & 0 < x < 1 \\ 0 & 1 < x < 2 \\ 0 & 2 < x < 3 \end{cases}$$

$$\mathrm{Lf}'(2) = 0 = \mathrm{Rf}'(2)$$
$$\Rightarrow \mathrm{f}'(2) = 0$$

33. c

$$y = \sec^{-1} \frac{1}{2x^2 - 1}$$

$$y = \cos^{-1}(2x^2 - 1)$$

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

$$\frac{dy}{dx} = -\frac{2}{\sqrt{1 - x^2}}$$

34. a

$f(x) = 5$

$f'(x) = 0$ Neither increasing nor decreasing

35. d

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

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

$$\log x - 1 = 0$$

$$\log x = 1$$

$$x = e$$

$$y = \frac{\log e}{e} = \frac{1}{e}$$

36. b

37. b

Given equations of the curves:

$$y = e^x .....(i)$$

$$y = e^{-x} .....(ii)$$

Area bounded

$$(A) = \int_0^1 (e^x - e^{-x})dx = [e^x + e^{-x}]_0^1 = e + e^1 - e^0 - e^0 = \left(e + \frac{1}{e} - 2\right) \text{ sq units}$$

38. d

Organic compounds donot have high melting and boiling points.

39. c

$$\mathrm{CH_3\ CH_2\ CH_2\ OH} \xrightarrow{\mathrm{PCl_5}} \underset{\text{chloropropane}}{\mathrm{CH_3\ CH_2\ CH_2\ Cl}} \xrightarrow{\mathrm{Alc \cdot NaOH}} \underset{\text{Propene}}{\mathrm{CH_3{-}CH{=}CH_2}}$$

A= chloropropane

B = Propene

40. b

Sulfuric acid whose chemical formula is $\mathrm{H_2SO_4}$ is called as "oil of vitriol" by medieval European chemists because it was prepared by roasting "green vitriol" (iron(II) sulfate i.e. $\mathrm{FeSO_4}$) in an iron container.

41. b

The hardness in water is removed by the adsorption of $\mathrm{Ca^{++}\ and\ Mg^{++}}$ ions.

42. b

Na is extracted by electrolysis process.

43. a

(Verdigris–$\mathrm{(CH_3COO)_2Cu \cdot Cu \cdot (OH)_2}$) is a blue-green powder used in green pigment and in dyes and also in the manufacture of insecticides and fungicides.

44. c

Blast furnace: this type of furnace is used in industries to obtain various metals, like pig iron. This works on the heat generated by air under high pressure. It has a temperature range from $900^{\circ}C - 1300^{\circ}$ C.

Reverberatory furnace: this type of furnace is used in the extraction of metals like copper, tin, nickel, etc. This furnace does not have direct contact with the metal, but uses a flame blown on them. It is used for melting or smelting. It works on a temperature of 1927° C.

Electrical furnace: These types of furnaces contain a supply of electrical sources for raising the temperature. It is used in melting alloys. It works on the temperature between 1800° C–3000° C

Muffle furnace: This type of furnace is used to extract ashes of various compounds. It has a temperature of 1200° C
Hence, the furnace that has the highest temperature is an electrical furnace, with 1800° C–3000° C.

45. d

Then lead nitrate is treated with sulphuric acid to get lead sulphate.

$$\mathrm{Pb(NO_3)_2 + H_2SO_4 \longrightarrow PbSO_4 + 2\,HNO_3}$$

It is a double displacement reaction. There is no oxidation and reduction.

46. b

Lewis bases are electron pair donors. Thus $\mathrm{NH_3}$ is a Lewis base.

47. d

$$_3\mathrm{Li}^7 + {}_1\mathrm{H}^1 \longrightarrow {}_4\mathrm{H}^8$$

Atomic number 4 is beryllium but its atomic mass is 9. Here the atomic mass observed is 8 so it is its isotopes.

48. b

As per the modern periodic law, the physical and chemical properties of elements are periodic functions of their atomic number and electronic configuration.

49. a

50. c

51. a

52. b

53. d

54. c

55. d

56. a

57. c

58. b

59. a

60. b

61. d

62. b

63. a

$\theta = \omega_0 t + \frac{1}{2}\alpha t^2$

$\theta = \frac{1}{2}\pi \times 2^2 = 2\pi$ again,

$\theta = 2\pi n$

$n = 1$

64. b

$h = \frac{2T\cos\theta}{\rho g r}$

$h = \frac{2 \times 7.2 \times 10^{-2} \times cos0^\circ}{10^3 \times 10 \times 0.02 \times 10^{-2}} = 7.2$ cm

65. d

$f = \frac{\Delta U}{\Delta Q} = \frac{nC_v\Delta\theta}{nC_p\Delta\theta} = \frac{C_v}{C_p} = \frac{1}{\frac{C_p}{C_v}} = \frac{1}{\gamma}$

For diatomic gas,

$\gamma = \frac{7}{5}$

$\therefore f = \frac{5}{7}$

66. c

$f = \frac{R}{2(\mu - 1)} \approx 31cm$

67. a

$\frac{1}{\mathrm{C_s}} = \frac{1}{\mathrm{C}} + \frac{1}{\mathrm{C}} + ...$

n times = $\mathrm{C_s} = \frac{\mathrm{C}}{\mathrm{n}}$

Similarly,

$\mathrm{C_p} = C + C + ...n$ times

$\mathrm{C_s} = nC$

The ratio of maximum to minimum capacitance is given as:

$\frac{\mathrm{C_p}}{\mathrm{C_s}} = \frac{\mathrm{nC}}{\frac{\mathrm{C}}{\mathrm{n}}} = \mathrm{n^2}$

68. c

69. b

$B = \frac{\mu_o ni}{2}(\cos\alpha - \cos\beta)$

$B = \frac{\mu_o ni}{2}(1 - 0)$

70. b

71. b

When a vibrating body (A) with a certain frequency is kept near to another body (B), then B vibrates with the frequency of A.

72. b

This is similar to case of reflected sound from a cliff.

i.e., $f' = \frac{c+v}{c-v} \times f$

$= \frac{c+v}{c-v} \times \frac{c-v}{c-v} \times f$

$= \frac{c^2-v^2}{c^2-2vc+v^2} \times f$

As $v <<< c$, $f' = \frac{c^2}{c^2-2vc} \times f = \frac{c}{c-2v} \times f$

73. c

P = VI

74. b

$$\frac{1}{\lambda_L} = R\left[\frac{1}{1} - \frac{1}{4}\right]$$

or, $\lambda_L = \frac{4}{3R}$ ..... (i)

For Balmer Series

$$\frac{1}{\lambda_B} = R\left[\frac{1}{4} - \frac{1}{16}\right] = \frac{3R}{16}$$

$\lambda_B = \frac{16}{3R}$ .....(ii)

Dividing (ii) by (i)

$$\frac{\lambda_B}{\lambda_L} = \frac{\frac{16}{3R}}{\frac{4}{3R}}$$

$\lambda_B = 4864\mathring{A}$

75. a

Let $x_1, x_2 \in N$ and $f(x_1) = f(x_2)$. Then

$x_1^2 = x_2^2$

Both x_1 and x_2 are positive.

Hence, $x_1 = x_2$

Hence, f is one to one.

And,

$f^{-1}(x) = \sqrt{x}$

For x= 3 in the range of f(x), the pre-image doesn't exist in N.

Hence it is into function.

76. d

$$\begin{vmatrix} 1 & 1 & 1 \\ xy & yz & zx \\ 1/z & 1/x & 1/y \end{vmatrix}$$

$$= \frac{xyz}{xyz} \begin{vmatrix} 1 & 1 & 1 \\ xy & yz & zx \\ 1/z & 1/x & 1/y \end{vmatrix}$$

$$= \frac{1}{xyz} \begin{vmatrix} 1 & 1 & 1 \\ xy & yz & zx \\ xy & yz & zx \end{vmatrix}$$

0

77. c

$(3+4i)(x+iy) = (1+i)$

Taking modulus on both sides:

$|(3+4i)(x+iy)| = |(1+i)|$

$\sqrt{3^2+4^2}\sqrt{x^2+y^2} = \sqrt{1^2+1^2}$

Squaring $x^2 + y^2 = \frac{2}{25}$

78. c

79. d

General terms of term os expansion is $T_{r+1} =^{11}$

$C_r x^r \left(-\frac{m}{x}\right)^{11-r} =^{11} C_r x^{2r-11}(-m)^{11-r}$

for coefficient of x^{-3}, $2r-11 = -3$ i.e., $r = 4$

coefficient of $x^{-3} =^{11} C_4(-m)^{11-4} = -330m^7$

80. d

$\sin^{-1}\left(\frac{2a}{1+a^2}\right) + \sin^{-1}\left(\frac{2b}{1+b^2}\right) = 2\tan^{-1}(x)$

Let $a = \tan A, b = \tan B$

$\sin^{-1}\left(\frac{2\tan A}{1+\tan^2 A}\right) + \sin^{-1}\left(\frac{2\tan B}{1+\tan^2 B}\right) = 2\tan^{-1}(x)$

$\sin^{-1}(\sin 2A) + \sin^{-1}(\sin 2B) = 2\tan^{-1}(x)$

$2A + 2B = 2\tan^{-1} x$

$x = \tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B} = \frac{a+b}{1-ab}$

81. d

Semi perimeter = ex – radius

Or, $s = r_1$

Or, $s = \frac{\Delta}{s-a}$

Or, $s(s-a)=\Delta$

Or, $s(s-a)=\sqrt{s(s-a)(s-b)(s-c)}$

Or, $\sqrt{\frac{(s-b)(s-c)}{s(s-a)}}=1$

Or, $\tan(\frac{A}{2})=\tan(\frac{\pi}{4})$ i.e., $A=\frac{\pi}{2}$

82. d

For coplanar vectors, $\begin{vmatrix}1 & -2 & 3\\0 & x & 3\\7 & 3 & -11\end{vmatrix}=0$

Expanding along second row,

$x\begin{vmatrix}1 & 3\\7 & -11\end{vmatrix}+(-3)\begin{vmatrix}1 & -2\\7 & 3\end{vmatrix}$

$-32x+51=0$

$x=-\frac{51}{32}$

83. d

Making $x^2+y^2=r^2$ homogenous with help of $x+y=2$

$x^2+y^2+=r^2(x+y/2)^2$

or, $x^2+y^2=\frac{r^2}{4}(x^2+2xy+y^2)$

or,$(1-\frac{r^2}{4})x^2+(1-\frac{r^2}{4})y^2-\frac{r^2}{2}xy=0$

for right angle

coeff. Of x^2+ cooeff. Of $y^2=0$

or, $1-\frac{r^2}{4}+1-\frac{r^2}{4}=0$

$2-\frac{r^2}{2}=0$

$r=\pm 2$

84. a

$lx+my=n$

$y=-\frac{l}{m}x+\frac{n}{m}$

$m'=-\frac{l}{m}, c=\frac{n}{m}$

Condition for tangency to circle $x^2+y^2=a^2$

$c=a\sqrt{1+m'^2}$

$c^2=a^2+a^2m'^2$

$\frac{n^2}{m^2}=a^2+a^2\frac{l^2}{m^2}$

$n^2 = a^2(m^2 + l^2)$

85. d

Slope of normal = $-\frac{y}{2a} = -\frac{2at}{2a} = -t$

Equation of normal is $y - 2at = -t(x - at^2)$

This also satisfied by second point:

$2at' - 2at = -t(at'^2 - at^2)$

$2a(t' - t) = -ta(t' - t)(t' + t)$

$2a = -ta(t' + t)$

$2 = -t(t' + t)$

$t' = -\frac{2}{t} - t$

86. d

D.rs. of line = 2 -1, 7 - 2, 3 - 2, = 1, 5, 1

d.r.s of line perpendicular to 2x - y + 3z = 0 are 2, - 1, 3,

so, $a_1a_2 + b_1b_2 + c_1c_2 = 1 \times 1 + 5 \times (-1) + 1 \times 3 = 0$

line and perpendicular to plane are at right angle which means the project is just the length of line.

$\sqrt{(2-1) + (7-2)^2 + (3-2)^2} = 3\sqrt{3}$

87. c

88. a

$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{2at}{a} = 2t$

89. d

$\int_0^1 \frac{1-x}{1+x} dx$

$\int_0^1 \frac{2-(1+x)}{1+x} dx$

$\int_0^1 (\frac{2}{1+x} - 1) dx$

$2\ln(1+x) - x\Big|_0^1$

$2\ln 2 - 1$

90. d

Benzoic acid, Camphor and naphthalene sublime on heating hence, they are purified by sublimation method.

91. a

Ammonia solution in water gives a blue precipitate when it combines with a solution of copper salt. The pale blue precipitate of copper hydroxide dissolves in excess of ammonium hydroxide

forming tetraamine copper[II] sulphate, an azure blue (deep blue) soluble complex salt.

$$CuSO_4 + NH_4OH \longrightarrow [Cu(NH_3)_4]SO_4 + H_2O$$

92. c

$$ZnSO_4 + 2\,NaHCO_3 \longrightarrow ZnCO_3 + Na_2SO_4 + H_2O + CO_2$$

93. b

$18\,g$ of water$=2\,g$ of hydrogen

94. b

$25\,ml$ of $0.5\,M\ H_2SO_4 \equiv 25\,ml$ of $1\,N\ H_2SO_4$

$30\,ml$ of $1\,M\ NaOH\ \equiv 30\,ml$ of $1\,N\ NaOH$

Excess: $5\,ml$ of $1\,N\ NaOH$

$(NV)_{NaOH} = (NV)_{H2SO4}$

$5 \times 1 = V \times \frac{1}{10}$

$V = 50$ ml

95. c

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

i.e. $K_{sp} = s \times (2s)^2$

i.e$s = \sqrt[3]{\frac{K_{sp}}{4}} = \sqrt[3]{\frac{4.42 \times 10^{-5}}{4}} = 2.227 \times 10^{-2}$

So, initial concentration of Ca^{2+} ion in 500 ml solution.

$$= \frac{2.227 \times 10^{-5}}{500/1000} = 0.011135M$$

When 500 ml of $Ca(OH)_2$ is mixed with 500 ml of $0.4MNaOH$, the volume of 1000ml. the molarity of OH^- ion gets halved i.e, $0.1M$

So, $[Ca^{2+}] = \frac{K_{sp}}{[OH^-]^2} = \frac{4.42 \times 10^{-5}}{-0.2^2}$

$= 0.001105M$

$\therefore$ mole of Ca^{2+} ion precipitated.

$= 0.011135 - 0.001105 = 0.0010245$

Grams of $Ca(OH)_2$ precipitated

$= 0.010245 \times 74$

$= 0.758gm$

96. a

$M = Zlt$

$$0.001 \times M = \frac{E}{F} \times It$$

$$0.001 \times 27 = \frac{9}{96500} \times 0.965 \times t$$

$$\mathrm{t} = 300\,\mathrm{seconds} = 5\,\mathrm{minutes}$$

97. c

98. d

99. b

100. c