clamphook

Shift 3

Tribhuvan University

2080

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

1. A man moves due east with velocity 10 km/hr east and then due north with velocity 20 km/hr. The resultant velocity is

a. 22.46 km/hr
b. 22.36 km/hr
c. 24.36 km/hr
d. 22.56 km/hr

2. A passenger in a moving train facing the engine, tosses the coin. If the coil falls behind him, the train must be

a. at Rest
b. Accelerating
c. Deccelerating
d. moving with uniform velocity

3. If the earth is asummed to be homogenous sphere and it is reduced to its half size. The length of the day will be [IOE 2072]

a. 48 hr
b. 24 hr
c. 12 hr
d. 6 hr

4. Three thin rods each of length L and mass M are placed along X , Y and Z – axis in such a way that one end of rod is at the origin . The moment of inertia of the system about Z-axis is

a. $\frac{ML^2}{3}$
b. $\frac{2ML^2}{3}$
c. ML^2
d. $\frac{ML^2}{6}$

5. Two hail stones with radii in the ratio of 1 : 2 fall from a great height through the atmosphere. Then the ratio of their momentum after they have attained terminal velocity is

a. 1 : 3
b. 1 : 1
c. 1 : 4
d. 1 : 32

6. At what condition the following substance will expand on heating and cooling

a. water at $0^\circ C$
b. Water at 4^0c
c. ice at $0^\circ C$
d. ice at -4^0c

7. The energy of molecular motion is expressed as :

a. Friction
b. Internal energy
c. Temperature
d. Potential energy

8. When a mirror is rotated through an angle 30° keeping incident ray constant then reflected ray is rotated through an angle

a. 25° b. 60°

c. 45° d. 90°

9. To make an achromatic combination a convex lens of focal length 42 cm having dispersive power 0.14 I placed in contact with a concave lens of dispersive power 0.21 . The length of the convex lens should be

a. 14 cm b. 21cm

c. 63cm d. 42cm

10. If a dielectric of K = 5 is put between the plates of a charged capacitor , the charge on capacitor will become (initial charge was Q)

a. Q b. 5 Q

c. $\frac{Q}{5}$ d. 25 Q

11. The emf of the battery in a thermo couple is doubled. The rate of heat generated at one of the two junctions will.

a. remains unchanged b. becomes half

c. be doubled d. be four times

12. A magnetizing field of $2 \times 10^3 Amp/m$ produces a magnetic flux density of 8π tesla in a rod . The relative permeability of the rod will be

a. 10^2 b. 10^0

c. 10^3 d. 10^4

13. In a circuit the current changes with time as $I = 2\sqrt{t}$. The rms current within $t = 2$ sec to 4 sec is :

a. $\sqrt{3}$ A b. 2 A

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

14. Two light rays having the same wavelength λ in vacuum are in phase initially . Then the first ray travels a path L_1 through a medium of refractive index μ_1 , while the second ray travels a path of length L_2 through a medium of refractive index μ_2 . The two waves are then combined to observe interference . The phase difference between the two waves is

a. $\frac{2\pi}{\lambda}(L_2 - L_1)$ b. $\frac{2\pi}{\lambda}(\mu_1 L_1 - \mu_2 L_2)$

c. $\frac{2\pi}{\lambda}(\mu_2 L_1 - \mu_1 L_2)$ d. $\frac{2\pi}{\lambda}\left(\frac{L_1}{\mu_1} - \frac{L_2}{\mu_2}\right)$

15. The speed of sound in perfectly rigid rod is

a. Infinite b. Zero

c. 332 m/s d. $3 \times 10^8 m/s$

16. An oil drop carrying a charge q has a mass m kg . It is falling freely in air with terminal velocity v . The electric field required to make the drop move upwards with the same speed is

a. $\frac{2mg}{q}$ b. $\frac{mg}{q}$

c. $\frac{mgv}{q^2}$ d. $\frac{2mgv}{q}$

17. A particle $^{92}U_{238}$ after undergoing 8 alpha decay and 6 beta decay gives [IOE 2076]

a. $^{92}U_{238}$ b. $^{76}U_{206}$

c. $^{76}U_{212}$ d. $^{82}U_{206}$

18. Which of the following set is empty ?

a. $\{x : x$ divides $\sqrt{3}, x$ is an integer $\}$ b. $\{x : x$ divides $1, x$ is an integer $\}$

c. $\{x : x$ divides $\sqrt{4}, x$ is an integer $\}$ d. $\{x : x$ divides $\sqrt{(-1)}, x$ is imaginary $\}$

19. If $A = \begin{bmatrix} 1 & -2 \\ 2 & 1 \end{bmatrix}$ then find $A \cdot (adjA) =$? [IOE 2078]

a. $\begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$ b. $\begin{bmatrix} 5 & 0 \\ 0 & -5 \end{bmatrix}$

c. $\begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$ d. $\begin{bmatrix} 1 & 2 \\ -2 & 1 \end{bmatrix}$

20. The value of $\left(1 + 2\omega + \omega^2\right)^{3n} - \left(1 + \omega + 2\omega^2\right)^{3n}$ is:

a. 0 b. 1

c. ω d. ω^2

21. The number of ways in which the word ,"PEOPLE" can be arranged are [IOE 2076]

a. 720 b. 360

c. 180 d. 90

22. $\cos^{-1}\left(\frac{1}{2}\right) + 2\sin^{-1}\left(\frac{1}{2}\right)$ is equal to:

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

c. $\frac{\pi}{6}$ d. $\frac{\pi}{3}$

23. If $\cos 3\theta - \cos\theta = 0$, then the general value of θ is

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

c. $2n\pi$ d. $\frac{n\pi}{2}$

24. If $\sin^2 A + \sin^2 B = \sin^2 C$, then the triangle is

a. Isosceles b. Equilateral

c. Right angled d. Isosceles right angled

25. The area of the parallelogram whose adjacent sides are $2\vec{i} - 3\vec{k}$ and $4\vec{j} + 2\vec{k}$ is

a. $2\sqrt{14}$ b. $4\sqrt{24}$

c. $4\sqrt{14}$ d. $\sqrt{14}$

26. If the equation $12x^2 + 7xy + ay^2 + 13x - y + 3 = 0$ represents a pair of perpendicular lines then the values of a is :

a. 12 b. -12

c. $\frac{7}{2}$ d. -19

27. The center of the circle passing through the points $(0,0),(2,0)$ and $(0,4)$ is

a. $(2,4)$ b. $(1,2)$

c. $(2,1)$ d. $(4,2)$

28. . The vertex of the parabola $(y-\mathrm{a})^2=4a(x-a)$is :

a. (a,0) b. (0,0)

c. (0,a) d. (a,a)

29. If P is a point on the hyperbola $16\mathrm{x}^2-9\mathrm{y}^2=144$ with foci S_1 and S_2 then the value of $|\mathrm{PS}_1-\mathrm{PS}_2|$ is

a. 6 b. 8

c. 10 d. 12

30. If the planes $4x+3y+2z+7=0, 2x+y-4z+1=0$ and $x+ky-7z-2=0$ have a common line of intersection then the value of k is

a. 1 b. 0

c. 2 d. -1

31. The value of $\lim_{x\to 0}\frac{\ln\left(1+x^3\right)}{\sin^3 x}$ is equal to

a. 0 b. 1

c. 3 d. None

32. What is the derivative of $\sqrt{\sin x}$ with respect to x?

a. $\frac{\sin x}{2\sqrt{\sin x}}$ b. $\frac{\cos x}{2\sqrt{\cos x}}$

c. $-\frac{\sin x}{2\sqrt{\sin x}}$ d. $\frac{\cos x}{2\sqrt{\sin x}}$

33. $\frac{d}{dx}\left[\log\sqrt{\frac{1-\cos x}{1+\cos x}}\right]=$

a. $\operatorname{cosec} x$ b. $\cot x$

c. $\operatorname{cosec}\left(\frac{x}{2}\right)$ d. $\cot\left(\frac{x}{2}\right)$

34. If the rate of of change of volume of a sphere is equal to the rate of change of its radius then its radius is

a. 1 b. 2π

c. $\frac{1}{4\pi}$ d. $\frac{1}{\sqrt{4\pi}}$

35. In case of decreasing function , the derivative is

a. Negative b. Either negative or zero

c. Zero d. Positive

36. $\int \operatorname{cosec} x\cot x dx=$ [IOE 2074]

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

c. $-\cot x$ + c d. $\cot x$ + c

37. **The area of the region bounded by $x = a\left(\frac{1-t^2}{1+t^2}\right)$ and $y = a\left(\frac{2t}{1+t^2}\right)$ is:**

a. $2\pi a^2$ b. πa^2

c. $3\pi a^2$ d. $4\pi a^2$

38. Which of the following can decolorize brown color of Br_2 and pink color of Bayer's reagent? [IOE 2075]

a. Ethane b. Ethene

c. Methane d. Benzene

39. Which would have the highest boiling point?

a. butan-2-ol b. butane

c. pentane d. ethane

40. Which of the following oxides of nitrogen is anhydride of HNO_3?

a. NO b. N_2O_3

c. N_2O_4 d. N_2O_5

41. Smallest halogen is [IOE 2078]

a. F b. Cl

c. Br d. I

42. In Down's process, for extraction of Na

a. C is anode and Fe is cathode b. C is cathode and Fe is anode

c. Pt is anode and Fe is cathode d. C is anode and Pt is cathode

43. Anhydrous $CuSO_4$ is used in laboratory to detect

a. Traces of alcohol in water b. Traces of water in organic liquids

c. Traces of alcohol in organic liquids d. None

44. Galvanization of Iron is treating it with [IOE 2078]

a. Fe b. Zn

c. Cu d. Sn

45. The strongest reducing agent is

a. K b. Mg

c. Al d. Br

46. The atomic number of an element which shows the oxidation state of +3 is

a. 13 b. 32

c. 33 d. 17

47. Most energetic species among the following is

a. H2 b. Ne

c. F d. F2

48. The correct set of four quantum numbers for outermost electron of potassium ($Z = 19$) is: [IOE 2075]

a. $n=4, l=0, m=0, s=\frac{1}{2}$ b. $n=3, l=1, m=0, s=\frac{1}{2}$

c. $n=4, l=1, m=0, s=-\frac{1}{2}$ d. $n=3, l=0, m=0, s=-\frac{1}{2}$

49. ..... of has no problem to go on the tour.

a. each b. any

c. neither d. Either

50. The professor and lawyer ..... responsible forthe plan.

a. is b. are

c. have been d. were

51. I arrived ____ the party late.

a. at b. on

c. with d. by

52. The sentence structure of ‚Äú She made him a good husband ,,Äô is [IOE 2076]

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

c. S + V + O+ Adverbial d. S + V + O

53. He ..... Here tomorrow.

a. Will come b. Came

c. come d. would came

54. Active form of 'The dog was run over by a car.' Is [IOE 2075]

a. A car run over the dog. b. A car runs over the dog.

c. A car ran over the dog. d. A car had run over the dog.

55. The phonemic transcription of word 'mask' is [IOE 2075]

a. /məsk/ b. /mə:sk/

c. /mɑ:sk/ d. /mɑsk/

56. The teacher returned the homework after she noticed the error.

a. Simple Sentence b. Compound Sentence

c. Complex Sentence d. Compound-Complex Sentence

57. The government must _____ corruption in the country.

a. do away by b. do away at

c. do away with d. do away of

58. Synonym of wary

a. calm b. curved

c. confused d. cautious

59. Study hard, ___ you will fail the test . [IOE 2074]

a. if b. unless

c. or d. and

60. ____ his principles, he has to be very careful.

a. with regard of b. with regard on

c. with regard to d. None of these

61. The vertical displacement y and horizontal displacement x of a projectile are given by $y = (5t–8t^{2})$ m and$x = 12t$ m, then the velocity of a projection is:

a. 20 m/s
b. 12 m/ s
c. 13 m/ s
d. 5 m/ s

62. A car moving with a speed of 60 km/ hr can be stopped by brakes after at least 6 m. If the car is moving at a speed of 120km/ hr. The minimum stopping distance is

a. 12 m
b. 18 m
c. 24 m
d. 6 m

63. A rope is wrapped around a solid cylinder so that when the rope is pulled the cylinder rotates about its axis . the radius of cylinder is 0.1 m and its mass is 50 kg . the rope is pulled with 20 N force find the angular acceleration . [IOE 2078]

a. $8rad/s^2$
b. $10rad/s^2$
c. $11rad/s^2$
d. $12rad/s^2$

64. When air buble rises from the bottom of a lake to the surface ,its radius doubles . The atmospheric pressure is equal to that of column of water of height H. The depth of the lake is

a. H
b. 7H
c. 2H
d. 8H

65. Calculate the pressure in N/m^2 exerted by a hydrogen gas if the number of molecules per m^3 is 6.8×10^{21} and rms speed of molecules of a gas is 1.9×10^3 m/s [ ]

a. 27.54 N/m^2
b. 20.54N/m^2
c. $25.33N/m^2$
d. 2.01N/m^2

66. A fish rising vertically at speed 3 m/s to the surface of water sees a bird diving vertically itself at speed 9 m/s. if the refractive index of water is $\frac{4}{3}$, the actual velocity of diving the bird is :

a. $4\frac{m}{s}$
b. $4.5\frac{m}{s}$
c. $6\frac{m}{s}$
d. $8.4\frac{m}{s}$

67. Two small balls having equal positive charge Q on each are suspended by two insulating strings of equal length 'L' from hook fixed to stand. The whole setup is taken in a satellite into space then tension string will be:

a. 0
b. $\frac{1}{4\pi\epsilon_\circ}Q^2/L^2$
c. $\frac{1}{4\pi\epsilon_\circ}Q^2/2L^2$
d. $\frac{1}{4\pi\epsilon_\circ}Q^2/4L^2$

68. The length of the cylindrical wire is 5m & its inner and outer radius are 0.5 cm and 1 cm respectively. The resistivity of wire is 3.5×10^{-5} Ωm then the resistance of a wire is [IOE 2076]

a. 74.27 Ω
b. 7.42 mΩ
c. 0.74 Ω
d. 0.74 mΩ

69. The magnetic field at the center of a circular coil of radius 10 cm having 500 turns of the coil and carrying current 18 A is ($\mu_0 = 4\pi \times 10^{-7} Hm^{-1}$) [IOE 2076]

a. 5.65×10^{-5} T
b. 5.65×10^{-4} T
c. 5.65×10^{-3} T
d. 5.65×10^{-2} T

70. A transformer is employed to reduce 220V to 11V. The primary coil draws a current of 5A and secondary draws 90A. The efficiency of transformer is:

a. 20%
b. 40%
c. 70%
d. 90%

71. A sonometer wire, 100 cm in length, has a fundamental frequency of 330 Hz. the velocity of propagation of transverse waves along this wire is

a. 330 m/s
b. 660 m/s
c. 115 m/s
d. 990 m/s

72. A source of frequency 480 Hz is at rest, observer also at rest observes the frequency of source. If the wind is blowing from the source towards the observer at a speed of 30 m/sec, the frequency of the source heard by the observer is (v = 330 m/sec)

a. 480 Hz
b. 320 Hz
c. 640 Hz
d. 408 Hz

73. The time interval between the incidence of photon on a surface and the ejection of the electron might be in the range of: [IOE 2078]

a. ms
b. s
c. ns
d. ps

74. An electron jumps from n = 5 to n = 2 in Bohr's orbit in H –atom . The recoil velocity of H – atom is [IOE 2074]

a. 1 m/s
b. 0.98 m/s
c. 0.91 m/s
d. 0.82 m/s

75. If $f(x) = x - 1$, find the matrix $\begin{bmatrix} f(-1) & f(1) \\ f(2) & f(5) \end{bmatrix}$ [IOE 2078]

a. $\begin{bmatrix} -1 & 1 \\ 2 & 5 \end{bmatrix}$
b. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
c. $\begin{bmatrix} -2 & 0 \\ 1 & 5 \end{bmatrix}$
d. $\begin{bmatrix} -2 & 0 \\ 1 & 4 \end{bmatrix}$

76. If $A = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ $A^2 - 6A =$

a. 3I
b. -3I
c. 5I
d. -5I

77. If $x = 3 + i$ then $x^3 - 3x^2 - 8x + 15 = 0$

a. 6
b. 10
c. -15
d. -18

78. If $a^{1/x} = b^{1/y} = c^{1/z}$ and a, b and c are in GP then x, y and z are in: [IOE 2078]

a. AP
b. GP
c. HP
d. None

79. If $(1 + x - 2x)^6 = 1 + a_1x + a_2x^2 + \ldots\ldots\ldots + a_{12}x^{12}$ then the expression $a_2 + a_4 + a_6 + \ldots\ldots\ldots + a_{12}$ has the value:

a. 30
b. 31
c. 32
d. 33

80. If $\cot^{-1} x + \cot^{-1} y = \frac{\pi}{2}, xy =$ **[IOE 2075]**

a. x + y + 1 b. 0

c. -1 d. 1

81. The value of $\frac{(r_1 - r)}{(a \tan \frac{A}{2})}$ is: **[IOE 2077]**

a. 1 b. 2

c. 3 d. R

82. If $\overrightarrow{D}$ is the midpoint of line $\overrightarrow{BC}$ in ΔABC, then which of the following is true? **[IOE 2078]**

a. $2\overrightarrow{AD} = \overrightarrow{AB} + \overrightarrow{AC}$ b. $2\overrightarrow{AD} = \overrightarrow{AB} - \overrightarrow{AC}$

c. $2\overrightarrow{AB} = \overrightarrow{AD} - \overrightarrow{AC}$ d. $2\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{AD}$

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

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

85. The tangent to parabola $y^2 = 16x$ which is perpendicular to line $3x - y + 8 = 0$ is **[IOE 2075]**

a. x + 3y + 36 = 0 b. x - 3y + 36 = 0

c. x + 3y - 36 = 0 d. -x + 3y + 36 = 0

86. 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

87. $\lim_{x \to \pi/2} (\sec x - \tan x) =$ **[IOE 2074]**

a. 0 b. 1

c. 1/2 d. -1

88. $\frac{d}{dx}(\sec^{-1} x^2)$ **[IOE 2078]**

a. $\frac{2}{|x|\sqrt{x^4 - 1}}$ b. $\frac{2}{x^2\sqrt{x^4 - 1}}$

c. $\frac{1}{x^2\sqrt{x^4 - 1}}$ d. $\frac{1}{|x|\sqrt{x^4 - 1}}$

89. $\int \frac{\log x}{x^3} dx$ = **[IOE 2076]**

a. $-\frac{\log x}{2x^2} - \frac{1}{4x^2} + c$ b. $\frac{\log x}{2x^2} - \frac{1}{4x^2} + c$

c. $-\frac{\log x}{2x^2} + \frac{1}{4x^2} + c$ d. $\frac{\log x}{2x^2} + \frac{1}{4x^2} + c$

90. When ammonium cyanate is heated it forms urea is an example of

a. addition
b. elimination
c. substitution
d. rearrangement

91. Chlorine is evolved by the action of

a. H_2SO_4 and NaCl
b. HCl on K_2SO_4
c. HCl on $KMnO_4$
d. HNO_3 on KCl

92. An essential metal in amalgam is

a. Gold
b. Any alkali metal
c. Copper
d. Mercury

93. The balancing of chemical equation is based upon

a. Law of combining volume
b. Law of multiple proportions
c. Law of conservation of mass
d. Law of definite proportions

94. 5 ml of 1 N HCl, 20ml of $\frac{N}{2}H_2SO_4$ and 30 ml of $\frac{N}{3}HNO_3$ are mixed together and the volume made to 1 litre. The weight of pure NaOH required to neutralize the acid mixture

a. 10 gm
b. 2 gm
c. 1 gm
d. 2.5 gm

95. Solubility of AgBr is 5×10^{-13}. The quantity of KBr (molar mass =120) to be added to 1 litre of 0.05 M solution of silver nitrate to start the precipitation of AgBr is

a. 6.2×10^{-5} g
b. 5×10^{-8} g
c. 1.2×10^{-10} g
d. 1.2×10^{-9} g

96. Passage of 10800 C of electricity through the electrolyte deposited 2.977 g of metal with atomic mass 106.4. The charge on metal cation is

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

Read the following passage and answer the questions below: *(Questions from 97 to 100)*

Speech is a great blessing but it can also be a great curse, for while it helps us to make out intentions and desires known to our fellows, it can also, if we use it carelessly, make our attitude completely understood. A slip of the tongue, the use of an unusual word, or of an ambiguous had hoped to win a friend. Again, different classes of people use different vocabularies, and the ordinary speech of an educated man may strike an uneducated listener as pompous. Unwittingly, we may use a word which bears a different meaning to our listener from what is does to men of our own class. Thus, speech is not a gift to use lightly without thought, but one which demands careful handling. Only a fool will express himself alike to all kinds and conditions of men.

97. Speech can be a curse, because it can:

a. reveal our intentions
b. lead to carelessness
c. hurt others
d. create misunderstanding

98. A 'slip of the tongue' means something said:

a. unintentionally
b. wrongly by chance
c. without giving proper thought
d. to hurt another person

99. The best way to win a friend is to avoid _____

a. polite language
b. ordinary speech
c. his vocabulary
d. simple word

100. what's the meaning of pompous?

a. solemn
b. verbosity
c. pomposity
d. irony

Answer Key

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

Solutions

1. b

The resultant velocity is:

$\vec{V}_f = \vec{V}_2 + \vec{V}_1$

$V_f = \sqrt{(V_2)^2 + (V_1)^2} = \sqrt{(10)^2 + (20)^2}$

=22.36 km/hr

2. b

3. d

Angular momentum is conserved hence,

$I\omega = C$

$$\frac{2}{5}MR^2\omega = C$$

$$\frac{2}{5}MR^2\frac{2\pi}{T} = C$$

$$T \propto R^2$$

$$\frac{T_1}{T_2} = (\frac{R}{R/2})^2$$

$$T_2 = \frac{1}{4}T_1 = 6hr$$

4. b

$\text{Moment of inertia of rod having length along Z- axis} = 0$

$$\text{M.I of system} = \frac{ML^2}{3} + \frac{ML^2}{3} + 0 = \frac{2}{3}ML^2$$

5. d

$m \propto r^3$

$v \propto r^2$

$mv \propto r^5$

6. b

- Water shows anomalous expansion.
  - On heating water from $0^\circ c$ to $4^\circ c$ density increases and volume decreases.
  - On further heating water at $4^\circ c$ to above density decreases and volume increases.
  - Water shows maximum density at $4^\circ c$ but heavy water shows maximum density at $11^\circ c$.

7. b

Internal energy is the function of temperature. At given temperature,
the gas molecules are in certain velocity in random directions.
The molecule gains energy ,
the total energy of molecular motion is internal energy i.e
potential energy changes to kinetic energy
Potential energy is the function of configuration i. e position of molecules, attraction of molecules, etc

8. b

$\text{If mirror is rotated by angle } \theta, \text{reflected ray is rotated by angle } 2\theta$

9. c

$$\frac{\omega_1}{\mathrm{f}_1} + \frac{\omega_2}{\mathrm{f}_2} = 0$$

$$\text{or,} \frac{0.14}{2} + \frac{0.21}{\mathrm{f}_2} = 0$$

$$\mathrm{f}_2 = -\frac{0.2 \times 42}{0.14} = -63\text{cm}$$

10. a

When a dielectric is introduced , charge remains unchanged though capacitance increases .

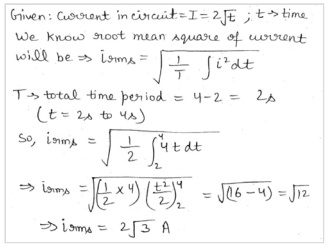
11. c

Peltier, heat produced at a junction is directly proportional to the quality of charge passed through the junction.

12. d

$$\mu_r = \frac{\mu}{\mu_o} = \frac{\mu H}{\mu_o H} = \frac{B}{\mu_o H}$$
$$= \frac{8\pi}{(4\pi \times 10^{-7}) \times (2 \times 10^3)}$$
$$\mu_r = 10^4$$

13. d



14. b

Optical path for first ray = $\mu_1 L_1$

$$\text{Optical path for second ray} = \mu_2 L_2$$
$$\text{Path difference }, \Delta x = \mu_1 L_1 - \mu_2 L_2$$
$$\text{Phase difference }, \Delta\phi = \frac{2\pi}{\lambda}\Delta x$$
$$= \frac{2\pi}{\lambda}(\mu_1 L_1 - \mu_2 L_2)$$

15. a

The sound would be transmitted instantly from the rigid body and hence the speed of sound through a rigid body is infinite.

16. a

When oil drop falls freely with terminal velcoti v

$$mg = 6\pi\eta r v$$

To move the oil upwards with terminal velocity v, electric field intensity E is required.

$$qE = mg + 6\pi\eta r V = mg + mg$$

$$E = \frac{2mg}{q}$$

17. d

$$^{92}\mathrm{U}_{238} \longrightarrow {}_z\mathrm{X}^{\mathrm{A}} + 8\,{}_2\mathrm{He}^4 + 6\,{}_{-1}\mathrm{e}^0$$

Balancing mass number and atomic number,

$$92 = \mathrm{Z} + 8\cdot 2 + 6\cdot(-1) \;\rightarrow \mathrm{Z} = 82$$

$$238 = \mathrm{A} + 8\cdot 4 + 6\cdot 0 \;\rightarrow \mathrm{A} = 206$$

18. a

$\sqrt{3} \approx 1.732$ which is not exactly divide by any integer.

19. a

$$|A| = \begin{vmatrix} 1 & -2 \\ 2 & 1 \end{vmatrix} = 1 + 4 = 5$$

$$A \cdot (adjA) = |A| I = 5I = \begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$$

20. a

$\left(1+2\omega+\omega^2\right)^{3n}-\left(1+\omega+2\omega^2\right)^{3n}$

$=\left(1+\omega+\omega^2+\omega\right)^{3n}-\left(1+\omega+2\omega^2\right)^{3n}$

$=(0+\omega)^{3n}-\left(0+\omega^2\right)^{3n}$

$=1-1=0$

21. c

As there are two P's and two E's, the number of ways of arrangement = $\frac{6!}{2!2!}=180$

22. b

$\cos^{-1}\left(\frac{1}{2}\right)+2\sin^{-1}\left(\frac{1}{2}\right)$

$\cos^{-1}\left(\frac{1}{2}\right)+\sin^{-1}\left(\frac{1}{2}\right)+\sin^{-1}\left(\frac{1}{2}\right)$

$\frac{\pi}{2}+\sin^{-1}\left(\frac{1}{2}\right)$

$\frac{\pi}{2}+\frac{\pi}{6}$

$\frac{2\pi}{3}$

23. d

$\cos 3\theta-\cos\theta=0$

$-2\sin\left(\frac{3\theta+\theta}{2}\right)\sin\left(\frac{3\theta-\theta}{2}\right)=0$

$\sin 2\theta\sin\theta=0$

Either $\sin 2\theta=0\rightarrow 2\theta=n\pi\rightarrow\theta=\frac{n\pi}{2}$

Or $\sin\theta=0\rightarrow\theta=n\pi$

The solution $\frac{n\pi}{2}$ incorporates $\theta=n\pi$.

Hence the general solution is $\frac{n\pi}{2}$.

24. c

$\sin^2 A+\sin^2 B=\sin^2 C$

Multiplying by $2R^2$

$2R^2\sin^2 A+2R^2\sin^2 B=2R^2\sin^2 C$

$a^2+b^2=c^2$

It is right angled triangle.

25. c

Area of parallelograms = $|\overrightarrow{A}\times\overrightarrow{B}|$

$= \begin{vmatrix} \overrightarrow{i} & \overrightarrow{j} & \overrightarrow{k} \\ 2 & 0 & -3 \\ 0 & 4 & 2 \end{vmatrix}$

$= 12\overrightarrow{i} - 4\overrightarrow{j} + 8\overrightarrow{k}$

$= \sqrt{12^2 + (-4)^2 + 8^2}$

$= 4\sqrt{14}$

26. b

$12x^2 + 7xy + ay^2 + 13x - y + 3 = 0$

Comparing with $Ax^2 + By^2 + 2Hxy + 2Gx + 2Fy + C = 0$

$A = 12, B = a$

For perpendicular $A + B = 0 \rightarrow 12 + a = 0 \rightarrow a = -12$

27. b

$(0, 0), (2, 0)$ and $(0, 4)$

Let the center be (h, k)

$(0 - h)^2 + (0 - k)^2 = (2 - h)^2 + (0 - k)^2$

$h^2 = 4 - 4h + h^2$

$h = 1$

Using Points as $(2, 0)$ and $(0, 4)$

$(2 - h)^2 + (0 - k)^2 = (0 - h)^2 + (4 - k)^2$

$(2 - 1)^2 + (0 - k)^2 = (0 - 1)^2 + (4 - k)^2$

$1 + k^2 = 1 + 16 - 8k + k^2$

$8k = 16$

$k = 2$

Hence center is $(1, 2)$

28. d

$(y - \mathrm{a})^2 = 4a(x - a)$

Comparing with standard equation of parabola.

$(y - k)^2 = 4a(x - h)$

$h = a, k = a$

29. a

$16\mathrm{x}^2 - 9\mathrm{y}^2 = 144$

$$\frac{x^2}{9} - \frac{y^2}{16} = 1$$

$$a = 3$$

$$|PS_1 - PS_2| = 2a = 6$$

30. b

Using the condition for 3 planes to intersect in a line

we have,

$$\begin{vmatrix} 4 & 3 & 3 \\ 2 & 1 & -4 \\ 1 & k & -7 \end{vmatrix}$$

$= 0$ giving $k = 0$

31. b

$$\lim_{x \to 0} \frac{\ln\left(1 + x^3\right)}{\sin^3 x} (0/0)$$

Using L' Hospital Rule:

$$\lim_{x \to 0} \frac{\frac{3x^2}{1 + x^3}}{3 \sin^2 x \cos x}$$

$$\lim_{x \to 0} \frac{x^2}{(1 + x^3)(\sin^2 x \cos x)}$$

$$\lim_{x \to 0} \frac{1}{(1 + x^3)(\frac{\sin^2 x}{x^2}) \cos x}$$

= 1

32. d

$y = \sqrt{\sin x}$

$$\frac{dy}{dx} = \frac{d}{d(\sin x)}(\sqrt{\sin x}) \frac{d}{dx}(\sin x) = \frac{\cos x}{2\sqrt{\sin x}}$$

33. a

$$\begin{aligned} \text{Let } y &= \log \left(\frac{1 - \cos x}{1 + \cos x}\right)^{1/2} \\ &= \frac{1}{2} \log \left(\frac{2 \sin^2(x/2)}{2 \cos^2(x/2)}\right) \\ &= \frac{1}{2} \log \tan^2 \frac{x}{2} = \frac{1}{2} \cdot 2 \log \tan \frac{x}{2} \\ &= \log \tan \frac{x}{2} \end{aligned}$$

Now,

$$\begin{aligned} \frac{dy}{dx} &= \frac{d \log \tan(x/2)}{d \tan(x/2)} \cdot \frac{d \tan(x/2)}{d(x/2)} \cdot \frac{d(x/2)}{dx} \\ &= \frac{1}{\tan(x/2)} \cdot \sec^2(x/2) \cdot \frac{1}{2} \\ &= \frac{1}{\sin x} = \operatorname{cosec} x \end{aligned}$$

34. d

$$V = \frac{4}{3}\pi r^2$$

$$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$$

$$\frac{dr}{dt} = 4\pi r^2 \frac{dr}{dt}$$

$$4\pi r^2 = 1$$

$$r = \frac{1}{\sqrt{4\pi}}$$

35. b

Strictly Increasing: Positive

Neither increasing nor decreasing: 0

Strictly Decreasing: Negative

Incase of just decreasing: Either negative or zero

Incase of just increasing: Either positive or zero

36. b

$$\frac{d}{dx}(\operatorname{cosec} x) = -\operatorname{cosec} x \cot x$$

Using fundamental theorem of calculus;

$$\int \operatorname{cosec} x \cot x dx = -\operatorname{cosec} x + c$$

37. b

Solution:

Putting $t = \tan\theta$ we get,

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

and

$$y = a\left(\frac{2\tan\theta}{1+\tan^2\theta}\right)$$

$$x = a\cos 2\theta \ldots (i)$$
$$y = a\sin 2\theta \ldots (ii)$$

Squaring and adding we get,

$$x^2 + y^2 = a^2$$

which is a circle with radius a

Area of the circle $= \pi a^2$

38. d

Bromine water test and bayer's reagent test is shown by alkenes to detect $\mathrm{C} = \mathrm{C}$ bonds. However, benzene fails due to

delocalized π bonds.

39. a

There is a large difference between boiling points of butanol and butanal, although they have almost the same solubility in water. Buta-2-nol contains -OH group and can form hydrogen bonds. Hence, the molecules are associated. A large amount of energy is required to break the association. Hence, butanol has a higher boiling point. Hydrogen bonding is not possible in butanal.

40. d

Anhydride means 'without water' It can be defined as the chemical compound formed by eliminating water from another compound.

Anhydrides react with water to produces either base or an acid. Acid anhydrides are the molecules that are capable of forming acidic solutions in water. Dinitrogen pentoxide ($\mathrm{N_2O_5}$) is the anhydride of nitric acid. It means Hydration of Dinitrogen pentoxide ($\mathrm{N_2O_5}$) gives Nitric acid.

$$\mathrm{N_2O_5 + H_2O \longrightarrow 2\,HNO_3}$$

41. a

Among halogens, fluorine has the smallest atomic radius.

42. a

In extraction of sodium by Down's process, anode is made by graphite and cathode is made by iron.

43. b

Anhydrous copper sulphate is a white coloured powder, which turns blue when it comes in contact with water.

The colour change on adding water to anhydrous Copper sulphate($\mathrm{CuSO_4}$) has been used as test for the presence of water in a liquid.

The appearance of a blue color in anhydrous Copper sulphate indicates the presence of moisture or water in the liquid.

$$\mathrm{CuSO_4 + 5\,H_2O \longrightarrow CuSO_4 \cdot 5\,H_2O}$$

44. b

Galvanization is the process of coating iron with a layer of zinc to prevent rusting.

45. a

From the given element, potassium has the maximum tendency to lose its electron and hence it is most reactive metal and no doubt, the strongest reducing agent as well.

46. a

For +3 oxidation state the outer orbital configuration has to be $\mathrm{ns^2\ ns^1}$ and that is possible for atomic number 13.
Al having atomic no. 13 shows +3 oxidation state

47. c

Fluorine is more electronegative and thus is much more reactive too.
This can be considered energetic as it tries to attain a stable configuration by gaining electrons.

48. a

$\mathrm{Z(19) = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 4s^1}$

Outermost electron :$4s^1$

$n=4, l=0, m=0, s=\frac{1}{2}$

49. c

50. a

51. a

52. a

53. a

54. c

55. c

56. c

57. c

58. d

wary means to be attentive especially to danger, or to be cautious

59. c

60. c

61. c

$y = 5t–8t^2$

$V_y = 5–16t$

Initially $t = 0 so V_y = 5m/s$

$x = 12t$

$V_x = 12$m/ s

$V = \sqrt{V_x^2 + V_y^2}$

$= \sqrt{12^2 + 5^2} = 13$ m/ s

62. c

$\frac{1}{2}mv^2 = F.s$

Or, $\frac{1}{2}mv^2 = F \times 6 \ldots$(i)

Again, $\frac{1}{2}mv^2 = Fs' \ldots$ (ii)

Dividing (ii) by (i)

$(\frac{v'}{v})^2 = \frac{s'}{s}$

or, $s' = (\frac{120}{60})^2 \times 6 = 24$ m

63. a

$I = \frac{mr^2}{2}$

$Fr = I\alpha$

$20 \times 0.1 = \frac{50 \times 0.1^2}{2} \times \alpha$

$\alpha = 8rad/s^2$

64. b

As the radius doubles , the volume of the bubble becomes 8 times ($V = \frac{4}{3}\pi r^3$)

If P_1 , V_1 and P_2 ,V_2 be the pressure and volumes of bubble at the bottom and surface ,then ,

$P_1V_1 = P_2V_2$

$\text{Or }, (\rho gh + P_2) \times 4/3\pi r^3 = P_2 \times 4/3\pi (2r)^3$

$\text{Or }, (\rho gh + P_2) \times 4/3\pi r^3 = P_2 \times 4/3\pi (2r)^3$

$\text{Or }, \rho gh = 7P_2$

Where $P_2 = \rho gH$ is atmospheric pressure

$\rho gh = 7\rho gH$

$h = 7H$

Some important tactics in solving above problems

(A) If radius becomes 'n' times

i) If atm . pressure at the places is equal to height H of water column then

$h = (n^3 - 1)H$

ii) If atm. pressure is equal to the height H of mercury coloumn then

$h = (n^3 - 1)H \times 13.6$

(B) If volume increases 'n' times

$h = (n - 1)H$ of water

65. a

$P = \frac{1}{3}\rho v_{rms}^2$

$P = \frac{1}{3} \times 6.8 \times 10^{21} \times 3.332 \times 10^{-27} \times (1.9 \times 10^3)^2 = 27.54 N/m^2$

66. b

For the fish inside water

$\mu = \frac{\text{Apparent height of bird}}{\text{Real height of the bird}}$

.. Apparent height =μx , where x be real height

Let actual distance between the bird and the fish is

$p = y + \mu x$

$or, \frac{\mathrm{dp}}{\mathrm{dt}} + \frac{\mathrm{dy}}{\mathrm{dt}} + \frac{\mu \mathrm{dx}}{\mathrm{dt}}$

or,$9 = 3 + \frac{4}{3}\frac{\mathrm{dx}}{\mathrm{dt}}$

$\frac{\mathrm{dx}}{\mathrm{dt}} = 4.5 m/s$

67. d

$T = \frac{1}{4\pi\epsilon_\circ Q^2/(2L)^2}$

$\frac{1}{4\pi\epsilon_\circ} Q^2/4L^2$

68. c

$R = \rho\frac{l}{A} = \rho\frac{l}{\pi(r_o^2 - r_i^2)} = 3.5 \times 10^{-5} \times \frac{5}{\pi(0.01^2 - 0.005^2)} = 0.7427\Omega$

69. d

$B = \frac{\mu_0 NI}{2r} = \frac{4\pi \times 10^{-7} \times 500 \times 18}{2 \times 10 \times 10^{-2}} = 0.0565T = 5.65 \times 10^{-2}$ T

70. d

Transformer transforms power

$E_p = 220V$

$E_s = 11V$

$I_p = 5A$

$I_s = 90A$

output power$= (11 \times 90)$ Watt

input power=$E_pE_s = (220 \times 5)$ Watt

$$\text{power} = \frac{\text{output}}{\text{input}} \times 100\% = \frac{I_pI_s}{E_pE_s} \times 100\%$$

$$= \frac{11 \times 90}{220 \times 5} \times 100\% = 90\%$$

71. b

$V = \lambda f = 2lf = 2 \times 1 \times 330 = 660m/s$

72. a

Since there is no relative motion between source and observer hence no Doppler's effect is observed

73. c

74. c

We have, $\frac{1}{\lambda} = R(\frac{1}{n_2^2} - \frac{1}{n_1^2})$

Momentum of photon $(P) = \frac{h}{\lambda} = hR(\frac{1}{n_2^2} - \frac{1}{n_1^2}) = 1.527 \times 10^{-27}$ kgm/s

Momentum of H – atom = momentum of photon

or, $mv = 1.527 \times 10^{-27}$

$1.6 \times 10^{-27} \times v = 1.527 \times 10^{-27}$

$v = 0.91m/s$

75. d

76. d

$$A^2 - 6\,A = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix} \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix} - 6 \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 19 & 6 \\ 18 & 7 \end{bmatrix} - \begin{bmatrix} 24 & 6 \\ 18 & 12 \end{bmatrix}$$

$$\begin{bmatrix} -5 & 0 \\ 0 & -5 \end{bmatrix} = -5I$$

77. c

78. a

79. b

$(1+x-2x)^6 = 1 + a_1x + a_2x^2 + \ldots\ldots + a_{12}x^{12}$

Putting $x = 1$

$0 = 1 + a_1 + a_2 + \ldots\ldots\ldots + a_{12}$

Putting $x = -1$

$2^6 = 1 - a_1 + a_2 - \ldots + a_{12}$

Adding:

$64 = 2\,(1 + a_2 + a_4 + \ldots + a_{12})$

$32 = 1 + a_2 + a_4 + \ldots\ldots + a_{12}$

$a_2 + a_4 + \ldots\ldots + a_{12} = 31$

80. d

$\cot^{-1} x + \cot^{-1} y = \dfrac{\pi}{2}$

or, $\cot^{-1} \dfrac{xy-1}{x+y} = \dfrac{\pi}{2}$

or, $\dfrac{xy-1}{x+y} = \cot\dfrac{\pi}{2} = 0$

or, $xy - 1 = 0 \to xy = 1$

81. a

$$\frac{(r_1 - r)}{(a\tan\frac{A}{2})}$$

$$\frac{(\frac{\Delta}{s-a} - \frac{\Delta}{s})}{(a\tan\frac{A}{2})}$$

$$\frac{\Delta(s-(s-a))}{(s(s-a)a\tan\frac{A}{2})}$$

$$\frac{\Delta}{s(s-a)\tan\frac{A}{2}}$$

$$\frac{\sqrt{s(s-a)(s-b)(s-c)}}{s(s-a)\tan\frac{A}{2}}$$

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

1

82. a

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 $x^2 + y^2 = a^2$

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

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

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

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

85. a

Tangent to $y^2 = 16x$ (i.e., a = 4) is

$= mx + \frac{a}{m}$

$y = mx + \frac{4}{m}$

now, slope of $y = 3x + 8$ i.e., 3

so, tangent must have slope $= -\frac{1}{3}$

i.e., $m = -\frac{1}{3}$

so, tangent is $y = -\frac{1}{3}x + \frac{4}{(-\frac{1}{3})}$

or, $y = -\frac{x}{3} - 12$

i.e $x + 3y + 36 = 0$

86. 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's of y-axis is 0,1,0 , y-axis is perpendicular to normal of given plane.

hence y axis is parallel to the plane.

87. a

$\lim_{x \to \pi/2} (\sec x - \tan x)$

$\lim_{x \to \pi/2} (\frac{1}{\cos x} - \frac{\sin x}{\cos x})$

$\lim_{x \to \pi/2} (\frac{1 - \sin x}{\cos x})(0/0)$

using L'hopital rule:

$\lim_{x \to \pi/2} \frac{-\cos x}{-\sin x} = 0$

88. a

89. a

$\int \frac{\log x}{x^3} dx$ =

$u' = \frac{1}{x^3} \to u = -\frac{1}{2x^2}$

$v = \log x \to v' = \frac{1}{x}$

we know:

$$\int u'vdx = uv - uv'dx$$

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

$$-\frac{\log x}{2x^2} - \frac{1}{4x^2} + c$$

90. d

$$\mathrm{NH_4CNO} \xrightarrow[\text{Rearrangement}]{\Delta} \mathrm{NH_2{-}CO{-}NH_2}$$

91. c

Chlorine is evolved by the action of $\mathrm{HCl\ on\ KMnO_4}$.

The required equation is:

$$\mathrm{16\,HCl + 2\,KMnO_4 \longrightarrow 2\,MnCl_2 + 2\,KCl + 8\,H_2O + 5\,Cl_2}$$

92. d

Mercury is alloyed with many metals forms amalgam which is used for dental fillings. Mercury metal is the essential constituent of amalgam.

93. c

94. c

$$\mathrm{NV = N_1V_1 + N_2V_2 + N_3V_3}$$

$$\mathrm{NV} = 5\ \times 1 + 20\ \times \frac{1}{2} + 30\ \times \frac{1}{3}$$

$$\mathrm{NV} = 25$$

$$\mathrm{NV = N_1V_1}$$

$$25 = 1000\ \times \mathrm{N}$$

$$\mathrm{N} = 0.025\,\mathrm{N}$$

For neutralization of NaOH

$$\frac{w}{E} = \frac{NV}{1000}$$

$$\frac{w}{40} = 0.025$$

$w = 1$ gm

95. d

$[AgNO3] = [Ag^+] = 0.05M$

For AgBr

$$K_{sp} = [Ag^+][Br^-]$$

$$5 \times 10^{-13} = 0.05 \times [Br^-]$$

$[Br^-] = 10^{-11}$ M

$\text{Amount of KBr needed} = \text{molarity } \times \text{molar mass} = 10^{-11} \times 120 = 1.2 \times 10^{-9}$

96. a
$M^{+n} + ne^- \longrightarrow M$

106.4 g of metal=96500 n C

2.977 g of metal=2700n C

Q=2700n

10800=2700 n

n= +4

97. d

98. c

99. c

100. `