

Shift 2

Tribhuvan University

2080

Full Marks: 140

Time: 2 hours

Pass Marks: 56

**1. An aero plane travels 200 km on a straight course making 30 angle east of north. How far north the plane travel from its starting point?**

- a.  $200\sqrt{3}$  km      b.  $100\sqrt{3}$  km  
c. 100 km      d. 200 km

**2. A block moving initially with velocity of 10 m/s on a rough horizontal surface comes to rest after covering a distance of 50 m. The coefficient of dynamics friction between block and surface is**

- a. 0.1      b. 0.2  
c. 0.5      d. 0.2

**3. A satellite is moving around the earth in a circular orbit of radius 8000 km with a velocity of 800 m/s. The acceleration due to gravity on the satellite is nearly.**

- a.  $0.04 \text{ ms}^{-2}$       b.  $0.06 \text{ ms}^{-2}$   
c.  $0.08 \text{ ms}^{-2}$       d.  $0.01 \text{ ms}^{-2}$

**4. A pendulum has a time period  $T_1$ , when on earth's surface, and  $T_2$  when it is taken to a height 'R' above earth surface. Then  $\frac{T_2}{T_1} =$**

- a. 4      b. 2  
c.  $\sqrt{2}$       d. s1

**5. A paper disc of radius R from which a hole of radius r is cut out is floating in a liquid of the surface tension T. The force on the disc due to the surface tension is**

- a.  $2\pi rT$       b.  $2\pi RT$   
c.  $2\pi(r + R)T$       d.  $2\pi(R - r)T$

**6. A thermocouple produces an emf of  $40 \mu\text{V}/{}^\circ\text{C}$  in a linear range of temperature. A galvanometer of resistance  $10 \Omega$  and capable of detecting a current of  $1 \mu\text{A}$  is employed. What is the smallest temperature that can be detected by this arrangement?**

- a.  $0.15 {}^\circ\text{C}$       b.  $0.20 {}^\circ\text{C}$

c.  $0.25^{\circ}C$

d.  $0.40^{\circ}C$

**7.** Two rods of same length and diameter having conductivities 2 and 3 units respectively are joined in series. The equivalent thermal conductivity is

a. 1.0

b. 2.0

c. 3.0

d. 2.4

**8.** A convex mirror of focal length 20 cm produces an image

$\frac{1}{3}$  times the size of the object. Then the distance in between the object and its image is

a. 40 cm

b.  $\frac{40}{3}$  cm

c.  $\frac{160}{3}$  cm

d. None

**9.** The ray of light entering into a rectangular glass slab emerges from the slab. The incident ray and emergent ray are

a. Parallel.

b. Perpendicular

c. Makes an acute angle .

d. Makes an obtuse angle .

**10.** A spherical condenser has inner and outer spheres of radii  $a$  and  $b$  respectively . The space between the two is filled with air . The difference between the capacities of two condensers formed when outer sphere is earthed and then inner sphere is earthed will be :

a. zero

b.  $4 \pi \epsilon_0 a$

c.  $4 \pi \epsilon_0 b$

d.  $\frac{4\pi\epsilon_0 ab}{b-a}$

**11.** What is the temperature of inversion if temperature of cold junction is  $0^{\circ}C$  and neutral temperature is  $270^{\circ}C$  for a thermocouple ?

a.  $0^{\circ}C$

b.  $135^{\circ}C$

c.  $540^{\circ}C$

d. None of the above

**12.** A magnetizing field of  $2 \times 10^3$  Amp/m produces a magnetic flux density of  $8\pi$  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.** The primary winding a transformer has 200 turns and its secondary winding has 50 turns. If the current in the secondary winding is 40A, the current in the primary:

a. 10A

b. 80A

c. 160A

d. 8000A

**14.** A slit of width  $12 \times 10^{-7}$  m is illuminated by the light of wavelength  $6000\text{\AA}$ . the angular width of central maxima is:

a.  $0^{\circ}$

b.  $30^{\circ}$

c.  $60^{\circ}$

d.  $90^{\circ}$

**15.** A wave is reflected from a free boundary. The change of phase on reflection will be

a. Zero

b.  $\pi/4$

c.  $\pi/2$

d.  $\pi$

**16. An electron moves with a uniform velocity  $v$  and enters a region of uniform magnetic field  $B$ . If  $v$  and  $B$  are parallel to each other, then electron will**

- a. move in a circular path
- b. move in a direction perpendicular to  $B$
- c. continue to move in the same direction
- d. not move at all

**17. When the reverse potential in the semiconductor diode is 10 V and 20 V. The corresponding currents are  $25\mu A$  and  $50\mu A$  respectively. The reverse resistance of the junction diode will be:**

- a.  $40K$  ohm
- b.  $400K$  ohm
- c.  $4000K$  ohm
- d. Cannot be determined

**18. The set  $\{x : x^2 - 9 = 0\}$ , where  $x$  is a natural number is**

- a.  $\phi$
- b.  $\{-3, 3\}$
- c. Infinite set
- d. Singleton set

**19.**  
**If the value of**  $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0$ ; **then:**

- a.  $a \neq b \neq c$
- b.  $a + b + c = 0$
- c.  $a = b = c$
- d.  $a - b - c = 0$

**20. If  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 + x\sqrt{\alpha} + \beta = 0$ , then the value of  $\alpha$  and  $\beta$  are**

- a.  $\alpha = 1, \beta = -1$
- b.  $\alpha = 1, \beta = -2$

- c.  $\alpha = 2, \beta = 1$
- d.  $\alpha = 2, \beta = -2$

**21. The coefficient of  $x^{n-1}$  in the expansion of  $(x - 1)(x - 2) \dots (x - n)$  is:**

- a.  $\frac{n(n+1)}{2}$
- b.  $-\frac{(n+1)(n+2)}{2}$
- c.  $-\frac{n}{(n+2)}$
- d.  $-\frac{n(n+1)}{2}$

**22. The range of the function  $\cot^{-1} x$  is [IOE 2074]**

- a.  $[-\frac{\pi}{2}, \frac{\pi}{2}]$
- b.  $(0, \pi)$
- c.  $[0, \frac{\pi}{2}) \cup [\pi, \frac{3\pi}{2})$
- d.  $(-\frac{\pi}{2}, \frac{\pi}{2})$

**23. If  $\sin 3\alpha = 4 \sin \alpha \sin(x + \alpha) \sin(x - \alpha)$ , then  $x$  is equal to**

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

**24. If**  $\frac{a}{\cos A} = \frac{b}{\cos B} = \frac{c}{\cos C}$ , **then the triangle is :**

- a. Isosceles
- b. Equilateral
- c. Right angled
- d. Isosceles and right angled triangle

**25. If  $\vec{a}$  is position vector  $(12, p)$  and  $|\vec{a}| = 13$ , the value of  $p$  may be [IOE 2075]**

- a. only 5
- b. only -5

c.  $\pm 5$

d.  $\pm 4$

**26. The locus of a point which is equidistant from the points (2, 3) and (4, -1) is**

a.  $2x + 4y + 21 = 0$

b.  $2x - 4y + 21 = 0$

c.  $x - 2y = 1$

d.  $x + 2y = 2$

**27. A circle touches x-axis and cuts off a constant length  $2l$  from the y-axis. The locus of its centre of**

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

b.  $x^2 - y^2 = l^2$

c.  $y^2 - x^2 = l^2$

d.  $x^2 + y^2 + l^2 = 0$

**28. If the point  $(at_1^2, 2at_1)$  and  $(at_2^2, 2at_2)$  are the ends of focal chord of parabola  $y^2 = 4ax$  then :**

a.  $t_1 t_2 = 1$

b.  $t_1 t_2 = -1$

c.  $t_1 t_2 = -2$

d.  $t_1 t_2 = 2$

**29. The equation of normal to the hyperbola  $3x^2 - 4y^2 = 12$  at point (4, 3) is**

a.  $x - y + 7 = 0$

b.  $x - y - 7 = 0$

c.  $x + y - 7 = 0$

d.  $x - y + 7 = 0$

**30. The distance of (1, -6, 2) from XZ plane is [IOE 2074]**

a. 6

b. -6

c.  $\sqrt{5}$

d. 3

**31. The value of  $\lim_{n \rightarrow \infty} \frac{3}{2} + \frac{9}{2^2} + \frac{27}{2^3} + \dots + \frac{3^n}{2^n}$  is equal to**

a. 1

b. 0

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

d. Does not exist

**32. If  $y = \frac{x}{1} + \frac{x^2}{2} + \frac{x^3}{3} + \dots + \infty$ , then  $\frac{dy}{dx}$**

a.  $\frac{1}{1-x}$

b.  $\frac{1}{1+x}$

c.  $\frac{x}{1+x}$

d.  $\frac{x}{1-x}$

**33. The set of points where the function  $f(x) = x|x|$  is differentiable in:**

a.  $(-\infty, 0)$

b.  $(0, \infty)$

c.  $R$

d.  $R - \{0\}$

**34. The side of the equilateral triangle is 2 cm and is increasing at the rate of 8 cm/hr. The area of the triangle is increasing at the rate of**

a.  $4\sqrt{2}$  sq.cm/hr

b.  $8\sqrt{2}$  sq.cm/hr

c.  $4\sqrt{3}$  sq.cm/hr

d.  $8\sqrt{3}$  sq.cm/hr

**35. In case of strictly decreasing functions, the derivative is**

a. zero

b. positive or zero

c. negative

d. positive

**36.  $\int_1^2 \frac{dx}{x+2}$  [IOE 2076]**

a. 1

b.  $\log_e 2$

c.  $\log_e(3/4)$

d.  $\log_e(4/3)$

**37. The area bounded by the curve  $y = x^3$  from  $x = -1$  to  $x = 1$  is [IOE 2074]**

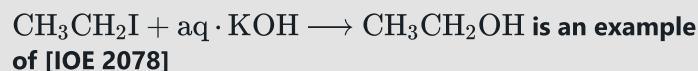
a.  $\frac{1}{2}$

b.  $\frac{1}{4}$

c. 0

d. 1

**38. The reaction of**



a. Elimination reaction

b. Electrophilic substitution reaction

c. Nucleophilic substitution reaction

d. Electrophilic addition reaction

**39. What forms as a final result when alkyne reacts with hydrogen in presence of catalyst**

a. Alkane

b. Alkene

c. Haloalkane

d. Methane

**40. The product on heating  $\text{NH}_4\text{NO}_2$  is**

a.  $\text{N}_2\text{O}$

b.  $\text{N}_2$

c. NO

d.  $\text{N}_2\text{O}_5$

**41. Permanent hardness cannot be removed by**

a. adding wasting soda

b. boiling

c. permutit process

d. calgon process

**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 cathoded. C is anode and Pt is cathode

**43. Blister copper is**

a. Ore of Cu

b. Pure Cu

c. Alloy of Cu

d. Cu containing 2% impurity

**44. Gravity separation process is used for the concentration of [IOE 2077]**

a. calamine

b. haematite

c. chalcopyrites

d. bauxite

**45. In the substance  $\text{Mg}(\text{HCO}_3)_2$  the oxidation number C is**

a. +1

b. +2

c. +3

d. +4

**46. The conjugate acid of a strong base is a**

a. Strong acid

b. Weak acid

c. Strong base

d. Weak base

**47. Which of the following bonds has the more polar character? [IOE 2076]**

a. C—O

b. C—Br

c. C—F

d. C—S

**48. In periodic table elements with similar valence shell configuration are placed in [IOE 2075]**

- a. different groups      b. same groups  
c. can be placed anywhere      d. none of above
- 

**49. .... of you is not my friend.**

- a. neither      b. each  
c. either      d. any
- 

**50. Her father, as well as I, ..... the support for the project.**

- a. want      b. wants  
c. are wanting      d. have wanted
- 

**51. I shall entrust my money \_\_\_\_ him. [2078]**

- a. to      b. by  
c. with      d. for
- 

**52. The sentence structure of „She made him a good husband „ 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 come
- 

**54. The active form of " Music is listened to , " is [IOE 2076]**

- a. listen to the music      b. They should listen to music  
c. They are listening music .      d. They listen to music .
- 

**55. The phonemic transcription of the word 'trust' is [IOE 2075]**

- a. /trə:st/      b. /trʌst/  
c. /trA:st/      d. /trUst/
- 

**56. I admire time, but he doesn't admire me, although I try hard to impress him. It is a \_\_\_\_\_.**

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

**57. Kindly put on your uniforms. It is time to go to school.  
Underlined word means**

- a. wash      b. wear  
c. stitch      d. iron
- 

**58. The synonym of the word 'tranquility' is [IOE 2077]**

- a. agitation      b. serenity  
c. turbulence      d. chaos
- 

**59. I prefer ..... to playing the guitar.**

- a. singing      b. sang  
c. to singing      d. sung
- 

**60. He got too tired \_\_\_\_ over work.**

- a. because of      b. because off  
c. on      d. for
-

**61.** If  $x = a + bt + ct^2$ , find acceleration if x is displacement.

- a. c                            b.  $\frac{c}{2}$   
c.  $2c$                         d.  $b + 2ct$

**62.** The maximum velocity at the lowest point, so that the string just slack at the highest point in a vertical circle of radius l.

- a.  $\sqrt{gl}$                     b.  $\sqrt{3gl}$   
c.  $\sqrt{5gl}$                   d.  $\sqrt{7gl}$

**63.** A particle of mass 50 g executes SHM with period 0.1 sec. The amplitude of vibration is 10 cm then maximum force on a particle is:

- a. 10 N                      b. 20 N  
c. 30 N                      d. 35 N

**64.** A wooden block of volume 1000 cc is suspended from a spring balance. Its weight is 12 N in air. It is suspended in water such that the half of the block is below the surface of water. Reading of spring balance will be [IOE 2072]

- a. 7 N                        b. 8 N  
c. 9 N                        d. 10 N

**65.** The volume of the diatomic gas contained in a cylinder with insulated walls is made half adiabatically. The initial pressure is P then final pressure will be [IOE 2078]

- a. 1 P                        b. 0.5 P  
c. 2 P                        d. 2.639 P

**66.** The power of lens made by glass of a 1.5 is 5 D what is the R. I. of liquid when this lens is immersed then power become -1D.

- a. 1.5                        b. 1.6  
c. 1.66                      d. 1.57

**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.** EMF of car battery is 12 V and its internal resistance is  $5 \times 10^{-2} \Omega$ . A current of 60 A flows to starting motor when engine is started. The terminal pd of battery is [IOE 2075]

- a. 15 V                      b. 12 V  
c. 9 V                        d. 6 V

**69.** Magnetic field at axis 1.8m from center of coil having 500 turns and radius 1.5 m such that it carries 7A current is [IOE 2074]

- a. 2.6 gauss                b. 3.8 gauss  
c. 4.2 gauss                d. 5.4 gauss

**70.** A 100 turn coil of area  $0.1m^2$  rotates at half a revolution per second. It is placed in a magnetic field of 0.01 T perpendicular to the axis of rotation of the coil. Calculate the maximum voltage generated in the coil. [IOE 2077]

- a. 0.314 V                  b. 31.4 V  
c. 0 V                        d. 12.7 V

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**71. The wave produced in string of a sonometer is [IOE 2075]**

- a. Transverse , progressive , unpolarized      b. Transverse , progressive , polarized  
c. Transverse , stationary , unpolarized      d. Transverse , stationary , polarized
- 

**72. If a source emitting waves of frequency 'f' moves towards an observer with velocity  $v/3$  and observer moves away from the source with velocity  $v/4$ , the apparent frequency heard by the observer will be(v = velocity of sound) :**

- a.  $9/8 f$       b.  $8/9 f$   
c.  $3/4 f$       d.  $4/3 f$
- 

**73. Light of two different frequencies, whose photons have energies 1.5 eV and 3 eV respectively, successively illuminate a metal whose work function is 1 eV. The ratio of maximum speeds is:**

- a. 1 : 5      b. 1 : 4  
c. 1 : 2      d. 1 : 1
- 

**74. The isotope  $^{19}K^{40}$  with a half life of  $1.37 \times 10^9$  years, decays to  $^{18}Ar^{40}$  which is stable moon rocks from the sea of tranquility. Show that the ratio of these potassium atom to argon atoms is 1/7. Estimate the age of rocks.**

- a.  $2.11 \times 10^9$  years      b.  $2.11 \times 10^9$  years  
c.  $6.11 \times 10^9$  years      d.  $8.11 \times 10^9$  years
- 

**75. If  $n(U) = 100, n(A) = 30, n(B) = 50, n(A \cap B) = 15$ , then  $n(A - B)$**

a. 50

b. 30

c. 15

d. 35

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**76.**

If  $\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$  and  $A_1, B_1, C_1$  denote the co-

factors of  $a_1, b_1, c_1$  respectively, and determinant  $\Delta =$

$$\begin{vmatrix} A_1 & B_1 & C_1 \\ A_2 & B_2 & C_2 \\ A_3 & B_3 & C_3 \end{vmatrix} \text{ then } \begin{vmatrix} B_2 & C_2 \\ B_3 & C_3 \end{vmatrix} =$$

- a.  $a_1\Delta$       b.  $a_1a_3\Delta$   
c.  $(a_1 + b_1)\Delta$       d. None of these
- 

**77. If  $\frac{2z_1}{3z_2}$  is a purely imaginary number, then**

$$\left| \frac{z_1 - z_2}{z_1 + z_2} \right| =$$

- a.  $\frac{3}{2}$       b.  $\frac{2}{3}$   
c. 1      d.  $\frac{4}{9}$
- 

**78. Geometric mean of the series  $7, 7^2, 7^3, \dots, 7^n$  is [IOE 2077]**

- a. 0      b.  $7^{n/2}$   
c.  $7^{\frac{n+1}{2}}$       d. None
- 

**79. The constant coefficient of  $(x^3 - \frac{1}{x^2})^{15}$  is [IOE 2078]**

- a. C(15,6)      b.

- C(15,6)
- c. C(15,8)
- d.
- C(15,8)

**80. If**  $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = 3\pi$ ,  $xy + yz + zx =$  [IOE 2075]

- a. -1
- b. 1
- c. 0
- d. 3

**81. In a triangle ABC ,**  $(a + b + c)(a + b - c) = 3ac$  then ,  $\angle B = ?$  [IOE 2078]

- a.  $60^\circ$
- b.  $30^\circ$
- c.  $90^\circ$
- d.  $120^\circ$

**82. If**  $|\vec{a}| = 5$ ,  $|\vec{b}| = 4$  , **Find**  $(\vec{a} \cdot \vec{b})^2 + (\vec{a} \times \vec{b})^2$  ? [IOE 2078]

- a. 200
- b. 400
- c. 125
- d. 600

**83. The sum of slopes of the equation**  $x^2 - 2cxy - 7y^2 = 0$  **is three times the product of their slopes. Find the value of c** [IOE 2078]

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

**84. If an equation of circle given by**  $x^2 + y^2 + 2gx + 2fy + c = 0$  **touches y-axis, then** [IOE 2078]

- a.  $f^2 = c$
- b.  $g^2 = c$
- c.  $g^2 - f^2 = c$
- d.  $g^2 \pm f^2 = c$

- 
- C(15,6)
  - c. C(15,8)
  - d.
  - C(15,8)

**85. The focus of parabola**  $y^2 = 8x$  **is:** [IOE 2078]

- a. (2, 0)
- b. (0, 2)
- c. (4, 0)
- d. (0, 4)

**86. If a line makes ' $\alpha$ ', ' $\beta$ ' and ' $\gamma$ ' with coordinate axes then**

$$\cos 2\alpha + \cos 2\beta + \cos 2\gamma =$$
 [IOE 2077]

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

**87.**  $f(x) = \begin{cases} x \cos x + 15x^4 + 5 & \text{for } x \neq 0 \\ k & \text{for } x = 0 \end{cases}$ .

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

- a. 3
- b. 4
- c. 5
- d. 6

**88. The derivative of**  $\sin x^2$  **with respect to**  $x^2$  **is** [IOE 2078]

- a.  $\cos x^2$
- b.  $2x \cos x^2$
- c.  $x^2 \cos x^2$
- d.  $x^2 \cos x$

**89.  $\int e^x (\tan x + \sec^2 x)$**  [IOE 2078]

- a.  $e^x \tan x + c$
- b.  $e^x \sec x + c$
- c.  $e^x \sec^2 x + c$
- d.  $e^x \tan^2 x + c$

**90. IUPAC name of methyl carbinol is,**

- a. Methanol
  - b. Ethanol
  - c. Propanol
  - d. Butanol

**91. In the brown ring test for nitrates, the brown colouration is developed due to the formation of**

- a.  $\text{Fe}(\text{SO}_4)_3\text{NO}$       b.  $\text{FeSO}_4 \cdot \text{NO}$   
 c.  $\text{FeSO}_4\text{SO}_2$       d.  $\text{FeSO}_4\text{N}_2\text{O}_2$

**92. Sodium carbonate is prepared by**

- a. Solvay's process
  - b. Kolbe's process
  - c. Contact process
  - d. Nessler's process

**93. Vapor density of a volatile substance is 4 ( $\text{CH}_4 = 1$ ). Its molecular weight would be**

- a. 8
  - b. 2
  - c. 64
  - d. 11

**94. Which of the following should be done In order to prepare 0.40 M NaCl staring with 100ml of 0.30M NaCl (Mol. wt NaCl = 58.5) .**

- a. add 5.85 gm NaCl
  - b. add 20.0 ml of water
  - c. add 0.01 mole NaCl
  - d. evaporate 10ml water

**95. The pH of solution obtained by mixing 300 ml of 0.1 N HCl and 150 ml of 0.1 N NaOH is**



**96. What wt of copper (at. Mass =63.5) deposits when 2 faradays of electricity is passed through cupric salt solution?**

- a. 63.5 g
  - b. 31.75 g
  - c. 127 g
  - d. 2 g

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

Most of us use the products of science-railways, aeroplanes, electricity, wireless and thousands of others-without thinking how they came into existence. we take them for granted, is if we were entitled to them as a matter of right. And we are very proud of the fact that we live in an advanced age and are ourselves so very 'advanced'. Now, there is no doubt that our age is a very different one from previous ages and I think it is perfectly correct to say that it is far more advanced. But that is a different thing from saying that we as individuals or groups are more advanced. It would be the height of absurdity to say that because an engine-driver can run an engine and Plato or Socrates could not, the engine-driver is more advanced than, or is superior to Plato or Socrates. But it would be perfectly correct to say that the engine itself is a more advanced method of locomotion than Plato's chariot was.

**97. Which one of the following statements is true?**

- |  |   |
|--|---|
| a. An engine driver is cleverer than Plato or Socrates             | b. Plato or Socrates is in no way inferior to the engine driver |
| c. Plato and Socrates surpassed the engine driver in every respect | d. The engine driver cannot be compared to Plato or Socrates.   |

**98. According to the author, the present age is far more advanced than**

- |  |   |
|--|---|
| a. All the previous ages in some respects    | b. The age of Socrates and Plato in some respects |
| c. Some of the previous ages in all respects | d. All the previous ages in all respects.         |

**99. Many of us make use of machines**

- |   |   |
|---|---|
| a. With very little knowledge of their mechanism. | b. Without any knowledge of their historical significance |
| c. With full knowledge of their genesis           | d. Without knowing how they were invented                 |

**100. People today are very proud because they live**

- |                                      |                                  |
|--------------------------------------|----------------------------------|
| a. In a philosophically advanced age | b. In a materially advanced age  |
| c. In a scientifically advanced age  | d. In a spiritually advanced age |

**Answer Key**

1.b	2.a	3.c	4.b	5.c	6.c	7.d	8.c
9.a	10.c	11.c	12.d	13.a	14.c	15.a	16.c

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

**Solutions**

1. b

$$\text{Distance along north} = 200 \cos 30^\circ = 100\sqrt{3}$$

2. a

$$s = \frac{v^2}{2g\mu}$$

$$\mu = 0.1$$

3. c

For satellites orbiting around the earth, the necessary centripetal force is provided by gravitational force.

Hence,

Centripetal acceleration = Acceleration due to gravity

$$\frac{v^2}{r} = a$$

$$\therefore a = \frac{(800)^2}{8000 \times 1000} = 0.08 \text{ m/s}^2$$

4. b

$$g_2 = g_1 \left( \frac{R^2}{(R+h)^2} \right)$$

$$\text{or}, \frac{g_2}{g_1} = \frac{R^2}{(R+R)^2}$$

$$\text{or}, \frac{g_2}{g_1} = \frac{1}{4}$$

$$\text{so}, \frac{g_2}{g_1} = \frac{1}{4}$$

$$T \propto \frac{1}{\sqrt{g}}$$

$$\text{so}, \frac{T_2}{T_1} = \frac{2}{1}$$

5. c

$$F = T \times \text{perimeter} = 2\pi(r+R)T$$

6. c

$$\text{Thermo emf } E = at + bt^2$$

For linear range of temp.,  $E = at$

where  $a = 40 \mu\text{V}/^\circ\text{C}$

$$\text{Therefore, } E = 40t$$

Now,

$$t' = \frac{E}{R} = \frac{40t}{10} = 4t$$

$$t' = 4t$$

$$\text{Thus, } t = \frac{1}{4} = 0.25^\circ\text{C}$$

7. d

$$K_{eq} = \frac{2K_1 K_2}{K_1 + K_2} = \frac{2 \times 3 \times 2}{2 + 3} = \frac{12}{5} = 2.4$$

8. c

$$\frac{v}{u} = -\frac{1}{3} \rightarrow v = -\frac{u}{3}$$

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

$$\text{or}, \frac{1}{u} - \frac{1}{u/3} = -\frac{1}{f}$$

$$\text{or}, -\frac{2}{u} = -\frac{1}{20} \rightarrow u = 40$$

$\therefore$  Distance between object and its image is  $= u + v =$

$$40 + \frac{40}{3} = \frac{160}{3} \text{ cm}$$

9. a

10. c

When outer sphere is earthed ,

$$C_1 = \frac{4\pi\epsilon_o ab}{b-a}$$

When outer sphere is earthed ,

$$C_2 = \frac{4\pi\epsilon_o b^2}{b-a}$$

$$\Delta C = 4\pi\epsilon_o b$$

11. c

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. a

$$\frac{I_p}{I_s} = \frac{\eta_s}{\eta_p} \implies I_p = \frac{\eta_s}{\eta_p} \times I_s = \frac{50}{200} \times 40 = 10 \text{ A}$$

14. c

15. a

16. c

17. b

18. d

$$x^2 - 9 = 0$$

$$x = \pm 3$$

but x is natural number so, 3 is the set and it has cardinality one.

Hence it is singleton set.

19. c

$$\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0$$

$$1(c^2 - ab) - a(c - a) + b(b - c) = 0$$

$$c^2 - ab - ac + a^2 + b^2 - bc = 0$$

$$a^2 + b^2 + c^2 - ab - ac - bc = 0$$

$$\frac{1}{2}[(a-b)^2 + (b-c)^2 + (c-a)^2] = 0$$

$$(a-b)^2 = 0 \rightarrow a = b$$

$$(b-c)^2 = 0 \rightarrow b = c$$

$$(c-a)^2 = 0 \rightarrow c = a$$

$$a = b = c$$

20. b

$$\alpha + \beta = -\sqrt{\alpha} \dots \text{(i)}$$

$$\alpha\beta = \beta \implies \alpha = 1$$

Equation (i) becomes:

$$1 + \beta = -\sqrt{1}$$

$$\beta = -2$$

21. d

roots of  $(x - 1)(x - 2) \dots (x - n)$  are  $1, 2, 3 \dots n$

$$\text{Sum of the roots} = -\frac{b}{a}$$

$$1 + 2 + 3 + \dots + n = -\frac{\text{coefficient of } x^{n-1}}{\text{coefficient of } x^n}$$

$$\frac{n(n+1)}{2} = -\frac{\text{coefficient of } x^{n-1}}{1}$$

$$\therefore \text{Coefficient of } x^{n-1} = -\frac{n(n+1)}{2}$$

22. b

For domain  $(-\infty, \infty)$ , its range is  $(0, \pi)$

23. b

$$\sin 3\alpha = 4 \sin \alpha \sin(x + \alpha) \sin(x - \alpha)$$

$$3 \sin \alpha - 4 \sin^3 \alpha = 4 \sin \alpha (\sin^2 x - \sin^2 \alpha)$$

$$3 \sin \alpha - 4 \sin^3 \alpha = 4 \sin \alpha \sin^2 x - 4 \sin^3 \alpha$$

$$3 \sin \alpha = 4 \sin \alpha \sin^2 x$$

$$\sin \alpha (3 - 4 \sin^2 x) = 0$$

$$\sin^2 x = \frac{3}{4}$$

$$\sin^2 x = \left(\frac{\sqrt{3}}{2}\right)^2$$

$$x = n\pi \pm \frac{\pi}{3}$$

24. b

$$\frac{a}{\cos A} = \frac{b}{\cos B} = \frac{c}{\cos C}$$

$$\frac{2R \sin A}{\cos A} = \frac{2R \sin B}{\cos B} = \frac{2R \sin C}{\cos C}$$

$$\tan A = \tan B = \tan C$$

$$A = B = C$$

25. c

$$\vec{a} = (12-0)\vec{i} + (p-0)\vec{j}$$
$$|\vec{a}| = \sqrt{12^2 + p^2} = 13$$

i.e.,  $12^2 + p^2 = 13^2$

or,  $p^2 = 25$

$p = \pm 5$

$$x^2 - 2xh + h^2 + y^2 - 2yk = 0$$

Comparing with  $x^2 + y^2 + 2gx + 2fy + c = 0$

$$2l = 2\sqrt{f^2 - c}$$

26. c

Let  $(x,y)$  be the point equidistant from  $(2,3)$  and  $(4,-1)$ . Then

$$(x-2)^2 + (y-3)^2 = (x-4)^2 + (y+1)^2$$

$$x^2 - 4x + 4 + y^2 - 6y + 9 = x^2 - 8x + 16 + y^2 + 2y + 1$$

$$-4x + 4 - 6y + 9 = -8x + 16 + 2y + 1$$

$$4x - 8y = 4$$

$$x - 2y = 1$$

27. c

The equation of circle is:

$$(x-h)^2 + (y-k)^2 = r^2$$

Circle touches x-axis so,  $|k| = |r|$

$$(x-h)^2 + (y-k)^2 = k^2$$

$$l^2 = f^2 - c$$

$$l^2 = k^2 - h^2$$

Hence the locus is  $l^2 = y^2 - x^2 \rightarrow y^2 - x^2 = l^2$

28. b

$$(a, 0) = \left( \frac{at_1^2 + at_2^2}{2}, \frac{2at_1 + 2at_2}{2} \right)$$

$$t_1 + t_2 = 0$$

$$t_1^2 + t_2^2 = 2$$

$$(t_1 + t_2)^2 - 2t_1 t_2 = 2$$

$$0 - 2t_1 t_2 = 2$$

$$t_1 t_2 = -1$$

29. c

$$3x^2 - 4y^2 = 12$$

Differentiating:

$$6x - 8y \frac{dy}{dx} = 0$$

$$\frac{dy}{dx} = \frac{6x}{8y}$$

$$\text{Slope of normal} = -\frac{8y}{6x} = -\frac{8 \times 3}{6 \times 4} = -1$$

Hence equation of normal is

$$y - 3 = -1(x - 4)$$

$$y - 3 = -x + 4$$

$$x + y - 7 = 0$$

30. a

: 'y' coordinate of  $(x, y, z)$  is distance from  $xz$ -plane. i.e., distance = 6 (as it cannot be negative)

31. d

$$\lim_{n \rightarrow \infty} \frac{3}{2} + \frac{9}{2^2} + \frac{27}{2^3} + \dots + \frac{3^n}{2^n} = \lim_{n \rightarrow \infty} \frac{\frac{3}{2} \left( \left(\frac{3}{2}\right)^n - 1 \right)}{\frac{3}{2} - 1} =$$

$\infty$

32. a

$$y = \frac{x}{1} + \frac{x^2}{2} + \frac{x^3}{3} + \dots + \infty$$

$$y = - \left( -\frac{x}{1} - \frac{x^2}{2} - \frac{x^3}{3} \dots \infty \right)$$

$$y = -\log_e(1 - x)$$

Differentiating,

$$\frac{dy}{dx} = -\frac{1}{(1-x)} \cdot (-1) = \frac{1}{1-x}$$

33. c

By definition,

$$|x| = \begin{cases} x & \text{for } x \geq 0 \\ -x & \text{for } x < 0 \end{cases}$$

$$\text{Now, } f(x) = x|x| = \begin{cases} x^2 & \text{for } x \geq 0 \\ -x^2 & \text{for } x < 0 \end{cases} \quad Lf'(0) =$$

$$f'(x) = \begin{cases} 2x & \text{for } x \geq 0 \\ -2x & \text{for } x < 0 \end{cases}$$

$$0 = Rf'(0)$$

34. d

$$A = \frac{\sqrt{3}}{4} a^2$$

$$\frac{dA}{dt} = \frac{\sqrt{3}}{4} 2a \frac{da}{dt}$$

$$\frac{dA}{dt} = \frac{\sqrt{3}}{4} 2a \times 8 = \frac{\sqrt{3}}{2} 2 \times 8 = 8\sqrt{3}$$

35. c

Strictly Increasing: Positive

Neither increasing nor decreasing: 0

Strictly Decreasing: Negative

36. d

$$\int_1^2 \frac{dx}{x+2} = \log_e(x+2)|_1^2 = \log_e 4 - \log_e 3 = \log_e \frac{4}{3}$$

37. a

$$\text{Area} = \int_{-1}^1 x^3 dx$$

$$\text{Area} = 2 \times \int_0^1 x^3 dx = 2 \times \frac{x^4}{4} \Big|_0^1 = 2 \times \frac{1}{4} = \frac{1}{2}$$

38. c



It is an example of nucleophilic substitution reaction. The hydroxyl group of  $\text{KOH}(\text{OH}^-)$  with a lone pair of itself acts as a nucleophile and substitutes iodide ion in  $\text{CH}_3\text{CH}_2\text{I}$  to form ethanol.

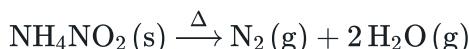
39. a

Ethyne undergoes catalytic hydrogenation which is an addition reaction , to form ethene which on further addition forms ethane.



40. b

$\text{NH}_4\text{NO}_2$  gives  $\text{N}_2$ ,  $\text{H}_2\text{O}$  on heating.



41. b

Permanent hardness is hardness (mineral content) that cannot be removed by boiling. When this is the case, it is usually caused by the presence of calcium sulfate and/or magnesium sulfates in the water, which do not precipitate out as the temperature increases.

42. a

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

43. d

Copper that is 97 to 98 percent pure, produced by smelting is called as Blister Copper. It has a blistery surface caused by sulfur dioxide bubbles.

44. b

Gravity separation is used for concentration of denser ores from lighter impurities and is generally used for oxide and carbonate ores.

45. d

$$2 + 2 \times (1 + x + -2 \times 3) = 0$$

$$x = +4$$

46. b

The conjugate acid of a strong base is a Weak acid.

47. c

· Electronegativity is a measure of the tendency of an atom to attract a bonding pair of electrons. The polar character depends on the electronegativity difference of the constituent atoms.

· Since, carbon (C) is common among all options hence, the polar character of molecules will depend on the electronegativity of other atoms.

· Fluorine is the most electronegative element. Hence, maximum electronegativity difference is seen in carbon and fluorine (C - F). Thus, the C-F bond has the most polar character.

48. b

In periodic table elements with similar valence shell configuration are placed in same groups.

49. b

50. b

51. a

52. a

53. a

54. d

55. b

56. d

57. b

58. b

59. a

60. a

61. c

$$x = a + bt + ct^2,$$

$$\frac{dx}{dt} = b + 2ct$$

$$\frac{d^2x}{dt^2} = 2c$$

62. c

63. b

$$F_{max} = mr\omega^2 = 50 \times 10^{-3} \times 0.1 \times \left(\frac{2\pi}{T}\right)^2$$

64. a

65. d

$$PV^\gamma = C$$

$$\frac{P_1}{P_2} = \left(\frac{V_2}{V_1}\right)^\gamma = \frac{1}{2^\gamma}$$

$$P_2 = 2.639 P_1$$

66. d

$$p = (\mu - 1) \left( \frac{1}{R_1} + \frac{1}{R_2} \right)$$

$$\text{or, } \frac{1}{R_1} + \frac{1}{R_2} = \frac{5}{1.5} - 1 = 10$$

$$\text{Again, } p' = (\mu_g - 1) \left( \frac{1}{R_1} + \frac{1}{R_2} \right)$$

$$-1 = \left( \frac{\mu_g}{\mu_1} - 1 \right) 10$$

$$\frac{\mu_g}{\mu_1} = 1 - \frac{1}{10} = \frac{9}{10}$$

$$\mu_1 = 10 \times \frac{1.5}{9} = 1.66$$

67. b

Volume of 1 big drop = Volume of 8 small drops

$$\text{or, } V = 8 V$$

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

$$\text{or, } R = 2r$$

Potential of big drops and small drops are:

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

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

Dividing (i) by (ii)

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

$$\frac{V}{v} = \frac{8q}{4\pi\epsilon_0 R} \times \frac{4\pi\epsilon_0 r}{q}$$

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

V:v=4:1

68. c

Battery is providing current to starting motor in car (i.e., discharging) So,  $V = E - Ir = 12 - 60 * (5 * 10^{-2}) = 9V$

69. b

The field at axis of circular coil is given by

$$B = \frac{\mu_0 NiR^2}{2(R^2 + x^2)^{3/2}} = \frac{4\pi \times 10^{-7} \times 500 \times 7 \times 1.5^2}{2(1.5^2 + 1.8^2)^{3/2}} = \\ 3.84 \times 10^{-4} T$$

As 1 gauss =  $10^{-4} T$  so, B = 3.84 gauss

70. a

71. d

Transverse stationary waves are produced in string off sonometer and we know that only transverse waves can be polarized.

72. a

Here, source is approaching and observer is receding from it.

Apparent frequency is given by:

$$f' = \left( v + \frac{v_o}{v} - v_s \right) \times f = \left( v - \frac{v/4}{v} - \frac{v}{3} \times f \right) = \frac{9}{8} f$$

73. c

$$\frac{v_1}{v_2} = \sqrt{\frac{E_1 - \varphi o}{E_2 - \varphi o}}$$

74. b

75. c

$$n(A - B) = n_0(A) = n(A) - n(A \cap B) = 30 - 15 = 15$$

76. a

$$B_2 = \begin{vmatrix} a_1 & c_1 \\ a_3 & c_3 \end{vmatrix} = a_1c_3 - c_1a_3$$

$$C_2 = - \begin{vmatrix} a_1 & b_1 \\ a_3 & b_3 \end{vmatrix} = -(a_1b_3 - a_3b_1)$$

$$B_3 = - \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix} = -(a_1c_2 - a_2c_1)$$

$$C_3 = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} = a_1b_2 - a_2b_1$$

$$\begin{vmatrix} B_2 & C_2 \\ B_3 & C_3 \end{vmatrix}$$

$$= \begin{vmatrix} a_1c_3 - a_3c_1 & -(a_1b_3 - a_3b_1) \\ -(a_1c_2 - a_2c_1) & a_1b_2 - a_2b_1 \end{vmatrix}$$

$$= \begin{vmatrix} a_1c_3 & -a_1b_3 \\ -a_1c_2 & a_1b_2 \end{vmatrix} + \begin{vmatrix} a_1c_3 & a_3b_1 \\ -a_1c_2 & -a_2b_1 \end{vmatrix} + \\ \begin{vmatrix} -a_3c_1 & -a_1b_3 \\ a_2c_1 & a_1b_2 \end{vmatrix} + \begin{vmatrix} -a_3c_1 & a_3b_1 \\ a_2c_1 & -a_2b_1 \end{vmatrix}$$

$$= a_1^2(b_2c_3 - b_3c_2) + a_1b_1(-c_3a_2 + a_3c_2) + a_1c_1(-a_3b_2 + a_2b_3) + c_1b_1(a_3a_2 - a_2a_3) = a_1\Delta$$

77. c

$$\frac{2z_1}{3z_2} = iy$$

$$\frac{z_1}{z_2} = \frac{3y}{2}i$$

$$\left| \frac{z_1 - z_2}{z_1 + z_2} \right|$$

$$\left| \frac{z_2 \left( \frac{z_1}{z_2} - 1 \right)}{z_2 \left( \frac{z_1}{z_2} + 1 \right)} \right|$$

$$\left| \frac{\left( \frac{z_1}{z_2} - 1 \right)}{\left( \frac{z_1}{z_2} + 1 \right)} \right|$$

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

$$= \frac{\sqrt{\left( \frac{3y}{2} \right)^2 + 1^2}}{\sqrt{\left( \frac{3y}{2} \right)^2 + 1^2}} = 1$$

78. c

$$= 2 \times 1 - 3$$

79. b

$$= -1$$

80. d

Range of  $\cos^{-1} x$  is  $[0, \pi]$

87. c

So, for sum of three cosine inverse function to be  $3\pi$ ,  $\cos^{-1} x = \cos^{-1} y = \cos^{-1} z = \pi$

88. a

i.e.,  $x = y = z = -1$

89. a

so  $xy + yz + zx = (-1)(-1) + (-1)(-1) + (-1)(-1) = 3$

90. b

Carbinol system is an old system of nomenclature of alcohols. In this we named the methyl alcohols ( $\text{CH}_3\text{OH}$ ) as carbinol and other alcohols are alkyl or aryl derivatives of carbinol. For e.g.  $\text{CH}_3\text{CH}_2\text{OH}$  is known as methyl carbinol.

81. a

91. b

82. b



83. b

As Ferrous sulphate reacts with Nitrogen oxide, a compound called Nitroso ferrous sulphate is formed which is responsible for brown ring formation.

84. a

92. a

85. a

Sodium carbonate is now exclusively manufactured by the Solvay process. In this process carbon dioxide and ammonia are passed into a cold saturated solution of sodium chloride.

86. c

93. c

$\cos 2\alpha + \cos 2\beta + \cos 2\gamma$

$$\begin{aligned} &= (2 \cos^2 \alpha - 1) + (2 \cos^2 \beta - 1) + (2 \cos^2 \gamma - 1) \\ &= 2(\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma) - 3 \end{aligned}$$
$$\text{mol mass of volatile substance} = \frac{\text{vapor density of volatile substance}}{\text{vapor density of methane}} \times$$

mol mass of methane

100. c

$$\text{mol mass of volatile substance} = \frac{4}{1} \times 16 = 64$$

94. a

$$100 \text{ ml of } 0.30 \text{ M} = 0.3 \times \frac{100}{1000} = 0.03 \text{ mole of NaCl}$$

Similarly, 100 ml of 0.40 M = 0.04 mol of NaCl

Moles of NaCl to be added

$$= 0.04 - 0.03 = 0.01 \text{ mol} = 0.01 \times 58.5 \text{ g} = 0.585 \text{ g}$$

95. b

$$300 \times 0.1 - 150 \times 0.1 = N \times 450$$

$$N = 0.0333$$

$$\text{pH} = -\log [\text{H}^+] = -\log (0.0333) = 1.46$$

96. a

$$m = Zq = \frac{E}{F}it = \frac{31.751}{F} \times 2F = 63.5g$$

97. b

98. c

99. d