Physics

1. **The pressure on a circular plate is measured by measuring the force on the plate and the radius of the plate. If the errors in measurement of the force and the radius are 5% and 3% respectively, the percentage of error in the measurement of pressure is**
   (a) 8 (b) 14 (c) 11 (d) 12
2. **A body is projected vertically from the surface of the earth of radius R with a velocity equal to half of the escape velocity. The maximum height reached by the body is**
   (a) $\frac{R}{2}$ (b) $\frac{R}{3}$ (c) $\frac{R}{4}$ (d) $\frac{R}{5}$
3. **A particle aimed at a target, projected with an angle 15° with the horizontal is short of the target by 10 m . If projected with an angle of 45° is away from the target by 15 m , then the angle of projection to hit the target is**
   (a) $\frac{1}{2}\sin^{-1}\left(\frac{1}{10}\right)$ (b) $\frac{1}{2}\sin^{-1}\left(\frac{3}{10}\right)$
   (c) $\frac{1}{2}\sin^{-1}\left(\frac{9}{10}\right)$ (d) $\frac{1}{2}\sin^{-1}\left(\frac{7}{10}\right)$
4. **A man running at a speed of 5 km/h, find that the rain falls vertically. When he stops running, he finds that the rain is falling at an angle of 60° with the horizontal. The velocity of rain with respect to running man is**
   (a) $\frac{5}{\sqrt{3}}$ km/h (b) $\frac{5\sqrt{3}}{2}$ km/h
   (c) $\frac{4\sqrt{3}}{2}$ km/h (d) $5\sqrt{3}$ km/h
5. **A horizontal force just sufficient to move a body of mass 4 kg lying on a rough horizontal surface, is applied on it. Coefficients of static and kinetic frictions are 0.8 and 0.6 respectively. If the force continues to act even after the body has started moving, the acceleration of the body is (take, $g = 10\ ms^{-2}$).**
   (a) 6 ms^{-2} (b) 8 ms^{-2}
   (c) 2 ms^{-2} (d) 4 ms^{-2}
6. **A force $(2\hat{i} + \hat{j} - \hat{k})$N acts on a body, which is initially at rest. At the end of 20 s the velocity of the body is $(4\hat{i} + 2\hat{j} - 2\hat{k})ms^{-1}$, then the mass of the body is**
   (a) 8 kg (b) 10 kg
   (c) 5 kg (d) 4.5 kg
7. **A man of weight 50 kg carries an object to a height of 20 m in a time of 10 s . The power used by the man in this process is 2000 W , then find the weight of the object carried by the man (take, $g = 10\ ms^{-2}$)**
   (a) 100 kg (b) 25 kg
   (c) 50 kg (d) 10 kg
8. **A ball P moving with a speed of v ms^{-1} collides directly with another identical ball Q moving with a speed $10\ ms^{-1}$ in the opposite direction. P comes to rest after the collision. If the coefficient of restitution is 0.6 , the value of v is**
   (a) 30 ms^{-1} (b) 40 ms^{-1}
   (c) 50 ms^{-1} (d) 60 ms^{-1}
9. **A particle of mass $m = 5$ units is moving with uniform speed $v = 3\sqrt{2}$ units in the XY-plane along the line $Y = X + 4$. The magnitude of the angular momentum about origin is**
   (a) zero (b) 60 units
   (c) 7.5 units (d) 40 units
10. **The kinetic energy of a circular disc rotating with a speed of 60 r.p.m. about an axis passing through a point on its circumference and perpendicular to its plane is (mass of circular disc = 5 kg, radius of disc = 1 m) approximately.**
    (a) 170 J (b) 160 J
    (c) 150 J (d) 140 J

11. The amplitude of a simple pendulum is 10 cm . When the pendulum is at a displacement of 4 cm from the mean position, the ratio of kinetic and potential energies at that point is

(a) 5.25 (b) 2.5
(c) 4.5 (d) 7.5

12. A satellite revolving around a planet has orbital velocity $10\ km/s$. The additional velocity required for the satellite to escape from the gravitational field of the planet is

(a) $14.14\ km/s$ (b) $11.2\ km/s$
(c) $4.14\ km/s$ (d) $41.4\ km/s$

13. The length of a metal wire is l_1 when the tension in it is F_1 and l_2 when the tension is F_2. Then, original length of the wire is

(a) $\frac{l_1F_1+l_2F_2}{F_1+F_2}$ (b) $\frac{l_2-l_1}{F_2-F_1}$
(c) $\frac{l_1F_2-l_2F_1}{F_2-F_1}$ (d) $\frac{l_1F_1-l_2F_2}{F_2-F_1}$

14. The average depth of Indian ocean is about 3000 m . The value of fractional compression $\left(\frac{\Delta V}{V}\right)$ of water at the bottom of the ocean is (given that the bulk modulus of water is $2.2\times10^9 Nm^{-2}, g=9.8, \rho_{H_2O}=1000\ kg\cdot m^{-3}$)

(a) 3.4×10^{-2} (b) 1.34×10^{-2}
(c) 4.13×10^{-2} (d) 13.4×10^{-2}

15. The ratio energies of emitted radiation by a black body at 600 K and 933 K when the surrounding temperature is 300 K

(a) $\frac{5}{16}$ (b) $\frac{7}{16}$ (c) $\frac{3}{16}$ (d) $\frac{9}{16}$

16. The specific heat of helium at constant volume is 12.6 $Jmol^{-1}\ K^{-1}$. The specific heat of helium at constant pressure in $Jmol^{-1}\ K^{-1}$ is about (Assume the temperature of the gas is moderate, universal gas constant, $R=8.314 Jmol^{-1}\ K^{-1}$)

(a) 12.6 (b) 16.8
(c) 18.9 (d) 21

17. A gas does 4.5 J of external work during adiabatic expansion. If its temperature falls by 2 K , then its internal energy will be

(a) increased by 4.5 J (b) decreased by 4.5 J
(c) decreased by 2.25 J (d) increased by 9.0 J

18. The relation between efficiency η of a heat engine and the coefficient of performance α of a refrigerator is

(a) $\eta=\frac{1}{1-\alpha}$ (b) $\eta=\frac{1}{1+\alpha}$
(c) $\eta=1+\alpha$ (d) $\eta=1-\alpha$

19. A flask contains argon and chlorine in the ratio of $2:1$ by mass. The temperature of the mixture is $27^\circ C$. The ratio of average kinetic energies of two gases per molecule is

(a) $1:1$ (b) $2:1$
(c) $3:1$ (d) $6:1$

20. A transverse wave is represented by the equation $y=2\sin(30t-40x)$ and the measurements of distances are in meters, then the velocity of propagation is

(a) $15\ ms^{-1}$ (b) $0.75\ ms^{-1}$
(c) $3.75\ ms^{-1}$ (d) $300\ ms^{-1}$

21. Two closed pipes have the same fundamental frequency. One is filled with oxygen and the other with hydrogen at the same temperature. Ratio of their lengths respectively is

(a) $1:4$ (b) $4:1$
(c) $1:2$ (d) $2:1$

22. An image is formed at a distance of 100 cm from the glass surface when light from point source in air falls on a spherical glass surface with refractive index 1.5. The distance of the light source from the glass surface

is 100 cm . The radius of curvature is

(a) 20 cm (b) 40 cm

(c) 30 cm (d) 50 cm

23. Two coherent sources of intensity ratio 9: 4 produce interference. The intensity ratio of maxima and minima of the interference pattern is

(a) 13: 6 (b) 5: 1

(c) 25: 1 (d) 3: 2

24. The energy of a parallel plate capacitor when connected to a battery is E. With the battery still in connection, if the plates of the capacitor are separated, so that the distance between them is twice the original distance, then the electrostatic energy becomes

(a) 2 E . (b) $\frac{E}{4}$

(c) $\frac{E}{2}$ (d) 4 E

25. Two-point charges +8 mC and +12 mC repel each other with a force of 48 N . When an additional charge of -10 mC is given to each of these charges (the distance between the charges is unaltered) then the new force is

(a) repulsive force of 24 N

(b) attractive force of 24 N

(c) repulsive force of 12 N

(d) attractive force of 2 N

26. If the dielectric constant of a substance is K = $\frac{4}{3}$,, then the electric susceptibility ye is

(a) $\frac{\varepsilon_0}{3}$ (b) 3 e 0

(c) $\frac{4}{3}\varepsilon_0$ (d) $\frac{3}{4}\varepsilon_0$

27. In a region of uniform electric field of intensity E, an electron of mass m_e is released from rest. The distance travelled by the electron in a time t is

(a) $\frac{2m_e t^2}{e}$ (b) $\frac{eEt^2}{2m_e}$

(c) $\frac{m_e g t^2}{eE}$ (d) $\frac{2Et^2}{em_e}$

28. A constant potential difference is applied between the ends of the wire. If the length of the wire is elongated 4 times, then the drift velocity of electrons will be

(a) increases 4 times (b) decreases 4 times

(c) increases 2 times (d) decreases 2 times

29. In a meter bridge, the gaps are enclosed by resistances of 2Ω and 3Ω. The value of shunt to be added to 3Ω resistor to shift the balancing point by 22.5 cm is

(a) 1Ω (b) 2Ω

(c) 2.5Ω (d) 5Ω

30. Two long straight parallel conductors 10 cm apart, carry equal currents of magnitude 3 A in the same direction. Then, the magnetic induction at a point midway between them is

(a) 2×10^{-5} T (b) 3×10^{-5} T

(c) zero (d) 4×10^{-5} T

31. In a crossed field, the magnetic field induction is 2.0 T and electric field intensity is 20×10^3 V/m. At which velocity the electron will travel in a straight line without the effect of electric and magnetic fields?

(a) $\frac{20}{16} \times 10^3$ ms^{-1} (b) 10×10^3 ms^{-1}

(c) 20×10^3 ms^{-1} (d) 40×10^3 ms^{-1}

32. A material of 0. 25 cm^2 cross-sectional area is placed in a magnetic field of strength (H) 1000Am^{-1}. Then, the magnetic flux produced is

(Susceptibility of material is 313)

(Permeability of free space, $\mu_0 = 4\pi \times 10^{-7} Hm^{-1}$)

(a) 8.33×10^{-8} Wb (b) 1.84×10^{-6} Wb

(c) 9.87×10^{-6} Wb (d) 3.16×10^{-6} Wb

33. The magnitude of the induced emf in a coil of inductance 30 mH in which the current changes from 6 A to 2 A in 2 s is

(a) 0.06 V (b) 0.6 V

(c) 1.06 V (d) 6 V

34. In an AC circuit V and I are given below, then find the power dissipated in the circuit $V = 50\sin(50t)vI = 50\sin\left(50t + \frac{\pi}{3}\right)mA$

(a) 0.625 W (b) 1.25 W

(c) 2.50 W (d) 5.0 W

35. Light with an energy flux of $9Wcm^{-2}$ falls on a nonreflecting surface at normal incidence. If the surface has an area of $20\ cm^2$. The total momentum delivered for complete absorption in one hour is

(a) $2.16 \times 10^{-4} kgms^{-1}$

(b) $1.16 \times 10^{-3} kgms^{-1}$

(c) $2.16 \times 10^{-3} kgms^{-1}$

(d) $3.16 \times 10^{-4} kgms^{-1}$

36. The ratio of the de-Broglie wavelengths for the electron and proton moving with the same velocity is (m_p-mass of proton, m_e-mass of electron)

(a) $m_p : m_e$ (b) $m_p^2 : m_e^2$

(c) $m_e : m_p$ (d) $m_e^2 : m_p^2$

37. The ratio of longest wavelength lines in the Balmer and Paschen series of hydrogen spectrum is

(a) $\frac{5}{36}$ (b) $\frac{7}{20}$ (c) $\frac{7}{144}$ (d) $\frac{5}{27}$

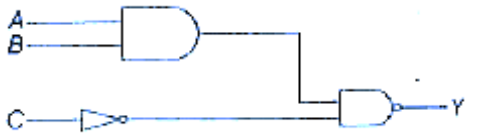
38. In the following nuclear reaction x stands for

$n \rightarrow p + e^- + x$

(a) α-particle (b) positron

(c) neutrino (d) antinutrino

39. In the following circuit, the output Y becomes zero for the input combinations.



(a) $A = 1, B = 0, C = 0$

(b) $A = 0, B = 1, C = 1$

(c) $A = 0, B = 0, C = 0$

(d) $A = 1, B = 1, C = 0$

40. The maximum amplitude of an amplitude modulated wave is 16 V , while the minimum amplitude is 4 V . The modulation index is

(a) 0.4 (b) 0.5

(c) 0.6 (d) 4

Chemistry

41. Which of the following sets of quantum numbers is correct for an electron in 3d-orbital?

(a) $n = 3, l = 2, m = -3, s = +\frac{1}{2}$

(b) $n = 3, l = 3, m = +3, s = -\frac{1}{2}$

(c) $n = 3, l = 2, m = -2, s = +\frac{1}{2}$

(d) $n = 3, l = 2, m = -3, s = -\frac{1}{2}$

42. If the kinetic energy of a particle is reduced to half, de-Broglie wavelength becomes

(a) 2 times (b) $\frac{1}{\sqrt{2}}$ times

(c) 4 times (d) $\sqrt{2}$ times

43. Identify the most acidic oxide among the following oxides based on their reaction.

(a) SO_3 (b) P_4O_{10}

(c) Cl_2O_7 (d) N_2O_5

44. Match the following.

List I	List II
(A) Rubidium	(I) Germanium
(B) Platinum	(II) Radioactive chalcogen
(C) Eka-silicon	(III) s-block element
(D) Polonium	(IV) Atomic number 78

A	B	C	D
(a) 4	3	2	1
(b) 3	4	1	2
(c) 2	1	4	3
(d) 4	3	1	2

45. Which of the following does not have triple bond between the atoms?

(a) N_2 (b) CO

(c) NO (d) C_2^{2-}

46. In which one of the following pairs the two species have identical shape, but differ in hybridisation?

(a) $I_3^-, BeCl_2$ (b) NH_3, BF_3

(c) XeF_2, I_3^- (d) NH_4^+, SF_4

47. On the top of a mountain, water boils at

(a) high temperature

(b) same temperature

(c) high pressure

(d) low temperature

48. Which one of the following is the wrong statement about the liquid?

(a) It has intermolecular force of attraction

(b) Evaporation of liquids increase with the decrease of surface area

(c) It resembles a gas near the critical temperature

(d) It is an intermediate state between gaseous and solid state

49. A carbon compound contains 12.8% of carbon, 2.1% of hydrogen and 85.1% of bromine. The molecular weight of the compound is 187.9. Calculate the molecular formula of the compound. (Atomic weight: $H = 1.008, C = 12.0, Br = 79.9$)

(a) CH_3Br (b) CH_2Br_2I

(c) $C_2H_4Br_2$ (d) $C_2H_3Br_3$

50. 3.011×10^{22} atoms of an element weighs 1.15 g . The atomic mass of the element is

(a) 23 (b) 10

(c) 16 (d) 35.5

51. Which one of the following is applicable for an adiabatic expansion of an ideal gas?

(a) $\Delta E = 0$ (b) $\Delta W = \Delta E$

(c) $\Delta W = -\Delta E$ (d) $\Delta W = 0$

52. On increasing temperature, the equilibrium constant of exothermic and endothermic reactions, respectively

(a) increases and decreases

(b) decreases and increases

(c) increases and increases

(d) decreases and decreases

53. What is the pH of the NaOH solution when 0.04 g of it dissolved in water and made to 100 mL solution?

(a) 2 (b) 1 (c) 13 (d) 12

54. Which of the following methods is used for the removal of temporary hardness of water?
(a) Treatment with washing soda
(b) Calgon method
(c) Ion-exchange method
(d) Clark's method

55. Assertion (A) : Alkali metals are soft and have low melting and boiling points.
Reason (R) : This is because interatomic bonds are weak.
(a) Both (A) and (R) are not true
(b) (A) is true but (R) is not the correct explanation of (A)
(c) (A) is true but (R) is false
(d) Both (A) and (R) are true and (R) is the correct explanation of (A)

56. Identify the correct statement.
(a) Lead forms compounds in +2 oxidation state due to inert pair effect
(b) All halogens show only negative oxidation state
(c) Catenation property increases from boron to oxygen
(d) Oxidation state of oxygen is -1 in ozonides

57. Assertion (A) : Noble gases have very low boiling points.
Reason (R): All noble gases have general electronic configuration of ns^2np^6 (except He).
(a) Both (A) and (R) are true and (R) is the correct explanation of (A)
(b) (A) is false but (R) is true
(c) (A) is true but (R) is false
(d) Both (A) and (R) are true and (R) is the not the correct explanation of (A)

58. Which of the following statements are correct?
(A) Ocean is sink for CO_2.
(B) Greenhouse effect causes lowering of temperature of earth's surface.
(C) To control CO emission by automobiles, usually catalytic convertor are fitted into exhaust pipes.
(D) H_2SO_4, herbicides and insecticides form mist.
(a) C and D (b) A and B
(c) B and D (d) A and D

59. The bond angle of bond in methoxy methane is
(a) 111.7° (b) 109°
(c) 108.9° (d) 180°

60. Which of the following compounds has zero dipole moment?
(a) 1,4-dichlorobenzene
(b) 1,2-dichlorobenzene
(c) 1,3-dichlorobenzene
(d) 1-chloro-2-methyl benzene

61. Which of the following reagent is used to find out carbon-carbon multiple bonds?
(a) Grignard reagent
(b) Baeyer's reagent
(c) Sandmeyer's reagent
(d) Gattermann reagent

62. Pure silicon doped with phosphorus is
(a) amorphous
(b) p-type semiconductor
(c) n-type semiconductor
(d) insulator

63. 18 g of glucose is dissolved in 90 g of water. The relative lowering of vapour pressure of the solution is equal to

(a) 6 (b) 0.2
(c) 5.1 (d) 0.02

64. A gas ' X ' is dissolved in water at 2 bar pressure. Its mole fraction is 0.02 in solution. The mole fraction of water when the pressure of gas is doubled at the same temperature is
(a) 0.04 (b) 0.98
(c) 0.96 (d) 0.02

65. Calculate ΔG° for the following cell reaction.
$Zn(s) + Ag_2O(s) + H_2O(l) \longrightarrow Zn^{2+}(aq) + 2Ag(s) + 2^{-}OH(aq)$
$E^{\circ}_{Ag^{+}/Ag} = +0.80\ V$ and $E^{\circ}_{Zn^{2+}/Zn} = -0.76\ V$
(a) $-305\ kJ/mol$ (b) $-301\ kJ/mol$
(c) $305\ kJ/mol$ (d) $301\ kJ/mol$

66. The time required for a first order reaction to complete 90% is ' t '. What is the time required to complete 99% of the same reaction?
(a) 2t (b) 3t
(c) t (d) 4t

67. Which of the following is the most effective in causing coagulation of ferric hydroxide solution?
(a) KCl (b) KNO_3
(c) K_2SO_4 (d) $K_3[Fe(CN)_6]$

68. Which of the following process does not involve heating?
(a) Calcination (b) Smelting
(c) Roasting (d) Levigation

69. Which one of the following is correct with respect to basic character?
(a) $P(CH_3)_3 > PH_3$ (b) $PH_3 > P(CH_3)_3$
(c) $PH_3 > NH_3$ (d) $PH_3 = NH_3$

70. When $AgNO_3$ solution is added in excess to 1 M solution of $CoCl_3 \cdot XNH_3$, one mole of AgCl is formed. What is the value of ' X '?
(a) 1 (b) 4 (c) 3 (d) 2

71. In which of the following coordination compounds, the central metal ion is in zero oxidation state?
(a) $[Fe(H_2O)_6]Cl_3$ (b) $K_4[Fe(CN)_6]$
(c) $Fe(CO)_5$ (d) $[Fe(H_2O)_6]Cl_2$

72. The percentage of lanthanides and iron, respectively, in misch metal are
(a) 50,50 (b) 75,25
(c) 90,10 (d) 95,5

73. Sea divers use a mixture of
(a) $O_2,\ N_2$ (b) O_2, H_2
(c) O_2, He (d) N_2, H_2

74. The polymer obtained with methylene bridges by condensation polymerisation
(a) PVC (b) buna-S
(c) polyacrylonitrile (d) bakelite

75. The amino acid containing indole part is
(a) tryptophan (b) tyrosine
(c) proline (d) methionine

76. The drug used as post- operative analgesic in medicine is
(a) L-dopa (b) amoxycillin
(c) sulphapyridine (d) morphine

77. $C_2H_5OH + 4I_2 + 3Na_2CO_3 \longrightarrow X + HCOONa + 5NaI + 3CO_2 + 2H_2O$

In the above reaction, ' X ' is

(a) diiodomethane (b) triiodo methane
(c) iodomethane (d) tetra iodomethane

78. Phenol on oxidation in air gives

(a) quinone (b) catechol
(c) resorcinol (d) o-cresol

79. Identify the reagents A and B respectively in the following reactions.

$\mathbf{CH_3COOH \xrightarrow{A} CH_3COCl \xrightarrow{B} CH_3CHO}$

(a) $SOCl_2, H_2/Pd - BaSO_4$
(b) $H_2/Pd - BaSO_4, SOCl_2$
(c) $SOCl_2, H_2O_2$
(d) $SOCl_2, O_5O_4$

80. Predict respectively ' X ' and ' Y ' in the following reactions.

$\mathbf{Ar - NH_2 \xrightarrow{x} Ar - \overset{+}{N} \equiv NCl^- \xrightarrow{y} Ar - Cl}$

(a) $NaNO_3$ and Cl_2
(b) $NaNO_3 - HCl$ and HCl
(c) $NaNO_2 - HCl$ and Cu/HCl
(d) $NaNO_2 - HCl$ and $NaNH_2$

Mathematics

81. If $f: R \to R, g: R \to R$ are defined by $f(x) = 5x - 3, g(x) = x^2 + 3$, then $gof^{-1}(3)$ is equal to

(a) $\frac{25}{3}$ (b) $\frac{111}{25}$ (c) $\frac{9}{25}$ (d) $\frac{25}{111}$

82. If $A = \left\{x \in R / \frac{\pi}{4} \le x \le \frac{\pi}{3}\right\}$ and $f(x) = \sin x - x$, then $f(A)$ is equal to

(a) $\left[\frac{\sqrt{3}}{2} - \frac{\pi}{3}, \frac{1}{\sqrt{2}} - \frac{\pi}{4}\right]$ (b) $\left[\frac{-1}{\sqrt{2}} - \frac{\pi}{4}, \frac{\sqrt{3}}{2} - \frac{\pi}{3}\right]$
(c) $\left[-\frac{\pi}{3}, -\frac{\pi}{4}\right]$ (d) $\left[\frac{\pi}{4}, \frac{\pi}{3}\right]$

83. The value of the sum $1 \times 2 \times 3 + 2 \times 3 \times 4 + 3 \times 4 \times 5 + \cdots$ upto n terms is equal to

(a) $\frac{1}{6}n^2(2n^2 + 1)$
(b) $\frac{1}{6}(n^2 - 1)(2n - 1)(2n + 3)$
(c) $\frac{1}{8}(n^2 + 1)(n^2 + 5)$
(d) $\frac{1}{4}n(n + 1)(n + 2)(n + 3)$

84. The value of the determinant

$\begin{vmatrix} b^2 - ab & b - c & bc - ac \\ ab - a^2 & a - b & b^2 - ab \\ bc - ac & c - a & ab - a^2 \end{vmatrix}$ **is**

(a) abc (b) $a + b + c$
(c) 0 (d) $ab + bc + ca$

85. If A is a square matrix of order 3 , then $|adj(adj\, A^2)|$ is equal to

(a) $|A|^2$ (b) $|A|^4$
(c) $|A|^8$ (d). $|A|^{16}$

86. The system $2x + 3y + z = 5, 3x + y + 5z = 7$ and $x + 4y - 2z = 3$ has

(a) unique solution
(b) finite number of solution
(c) infinite solutions
(d) no solution

87. $\sum_{k=1}^{6}\left[\sin\frac{2k\pi}{7} - i\cos\frac{2k\pi}{7}\right]$ is equal to

(a) -1 (b) 0 (c) $-i$ (d) i

88. If ω is a complex cube root of unity, then $\omega^{\left(\frac{1}{3}+\frac{2}{9}+\frac{4}{27}+\cdots\infty\right)}+\omega^{\left(\frac{1}{2}+\frac{3}{8}+\frac{9}{32}+\cdots\infty\right)}$ is equal to

(a) 1 (b) -1 (c) ω (d) i

89. The common roots of the equations $z^3+2z^2+2z+1=0, z^{2014}+z^{2015}+1=0$ are

(a) ω, ω^2 (b) $1, \omega, \omega^2$

(c) $-1, \omega, \omega^2$ (d) $-\omega, -\omega^2$

90. If a, b, c are distinct and the roots of $(b-c)x^2+(c-a)x+(a-b)=0$ are equal, then a, b and c are in

(a) arithmetic progression

(b) geometric progression

(c) harmonic progression

(d) arithmetico-geometric progression

91. If the roots of $x^3-kx^2+14x-8=0$ are in geometric progression, then k is equal to

(a) -3 (b) 7 (c) 4 (d) 0

92. If the harmonic mean of the roots $\sqrt{2}x^2-bx+(8-2\sqrt{d})=0$ is 4 , then the value of b is

(a) 2 (b) 3

(c) $4-\sqrt{5}$ (d) $4+\sqrt{5}$

93. For real value of x, the range of $\frac{x^2+2x+1}{x^2+2x-1}$ is

(a) $(-\infty, 0) \cup (1, \infty)$

(b) $\left[\frac{1}{2}, 2\right]$

(c) $\left(-\infty, \frac{-2}{9}\right] \cup (1, \infty)$

(d) $(-\infty, 0] \cup (1, \infty)$

94. T_m denotes the number of triangles that can be formed with the vertices of a regular polygon of m sides. If $T_{m+1}-T_m=15$, then m is equal to

(a) 3 (b) 6 (c) 9 (d) 12

95. If $|x|<1$, then the coefficient of x^5 in the expansion of $\frac{3x}{(x-2)(x+1)}$ is

(a) $\frac{33}{32}$ (b) $\frac{-33}{32}$ (c) $\frac{31}{32}$ (d) $\frac{-31}{32}$

96. If the coefficients of x^9, x^{10} and x^{11} in the expansion of $(1+x)^n$ are in arithmetic progression, then n^2-41n is equal to

(a) 399 (b) 298

(c) -398 (d) 198

97. If $\sin\theta+\cos\theta=p$ and $\tan\theta+\cot\theta=q$, then $q(p^2-1)$ is equal to

(a) $\frac{1}{2}$ (b) 2 (c) 1 (d) 3

98. $\tan\frac{\pi}{5}+2\tan\frac{2\pi}{5}+4\cot\frac{4\pi}{5}$ is equal to

(a) $\cot\frac{\pi}{5}$ (b) $\cot\frac{2\pi}{5}$

(c) $\cot\frac{3\pi}{5}$ (d) $\cdot\cot\frac{4\pi}{5}$

99. If $\sin A+\sin B+\sin C=0$ and $\cos A+\cos B+\cos C=0$, then $\cos(A+B)+\cos(B+C)+\cos(C+A)$ is equal to

(a) $\cos(A+B+C)$ (b) 2

(c) 1 (d) 0

100. If $\tan\theta\cdot\tan(120^\circ-\theta)\tan(120^\circ+\theta)=\frac{1}{\sqrt{3}}$, then θ is equal to

(a) $\frac{n\pi}{3}+\frac{\pi}{18}, n\in Z$ (b) $\frac{n\pi}{3}+\frac{\pi}{12}, n\in Z$

(c) $\frac{n\pi}{12}+\frac{\pi}{12}, n\in Z$ (d) $\frac{n\pi}{3}+\frac{\pi}{6}, n\in Z$

101. If $\sin^{-1}\left(x-\frac{x^2}{2}+\frac{x^3}{4}-\cdots\infty\right)+\cos^{-1}\left(x^2-\frac{x^4}{2}+\frac{x^6}{4}-\cdots\infty\right)=\frac{\pi}{2}$ and $0<x<\sqrt{2}$

then x is equal to

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

102. If $2\sin\ h^{-1}\left(\frac{a}{\sqrt{1-a^2}}\right) = \log\left(\frac{1+x}{1-x}\right)$, then x is equal to

(a) a (b) $\frac{1}{a}$

(c) $\sqrt{1-a^2}$ (d) $\frac{1}{\sqrt{1-a^2}}$

103. If in a $\triangle ABC, r_1 = 2r_2 = 3r_3$, then the perimeter of the triangle is equal to

(a) 3a (b) 3b

(c) 3c (d) $3(a+b+c)$

104. If M_1, M_2, M_3 and M_4, are respectively the magnitudes of the vectors $a_1 = 2\hat{i} - \hat{j} + \hat{k}, a_2 = -3\hat{i} - 4\hat{j} - 4\hat{k}, a_3 = -\hat{i} + \hat{j} - \hat{k}, a_4 = -\hat{i} + 3\hat{j} + \hat{k}$, then the correct order of M_1, M_2, M_3 and M_4 is

(a) $M_3 < M_1 < M_4 < M_2$

(b) $M_3 < M_1 < M_2 < M_4$

(c) $M_3 < M_4 < M_1 < M_2$

(d) $M_3 < M_4 < M_2 < M_1$

105. If $\hat{a}, \hat{b}$ and $\hat{c}$ are unit vectors such that $\hat{a} + \hat{b} + \hat{c} = 0$, then the $\hat{a}\cdot\hat{b} + \hat{b}\cdot\hat{c} + \hat{c}\cdot\hat{a}$ is equal to

(a) $\frac{3}{2}$ (b) $-\frac{3}{2}$ (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

106. If $a = 2\hat{i} + \hat{k}, b = \hat{i} + \hat{j} + \hat{k}, c = 4\hat{i} - 3\hat{j} + 7\hat{k}$, then the vector r satisfying $r \times b = c \times b$ and $r.a = 0$ is

(a) $\hat{i} + 8\hat{j} + 2\hat{k}$ (b) $\hat{i} - 8\hat{j} + 2\hat{k}$

(c) $\hat{i} - 8\hat{j} - 2\hat{k}$ (d) $-\hat{i} - 8\hat{j} + 2\hat{k}$

107. If a, b and c are three vectors such that $|a| = 1, |b| = 2, |c| = 3$ and $a\cdot b = b\cdot c = c\cdot a = 0$, then $|[abc]|$ is equal to

(a) 2 (b) 3 (c) 4 (d) 6

108. If $[a \times bb \times cc \times a] = \lambda[abc]^2$, then λ is equal to

(a) 0 (b) 1 (c) 2 (d) 3

109. The cartesian equation of the plane passing through the point $(3, -2, -1)$ and parallel to the vectors $b = \hat{i} - 2\hat{j} + 4\hat{k}$ and $c = 3\hat{i} + 2\hat{j} - 5\hat{k}$ is

(a) $2x - 17y - 8z + 63 = 0$

(b) $3x + 17y + 8z - 36 = 0$

(c) $2x + 17y + 8z + 36 = 0$

(d) $3x - 16y + 8z - 63 = 0$

110. The arithmetic mean of the observations $10, 8, 5, a, b$ is 6 and their variance is 6.8 , then ab is equal to

(a) 6 (b) 4 (c) 3 (d) 12

111. If the median of the data $6, 7, x-2, x, 18$ and 21 written in ascending order is 16 , then the variance of that data is

(a) $30\frac{1}{5}$ (b) $31\frac{1}{3}$

(c) $32\frac{1}{2}$ (d) $33\frac{1}{3}$

112. Two persons A and B are throwing an unbiased six faced dice alternatively, with the condition that the person who throws 3 first wins the game. If A starts the game, then probabilities of A and B to win the same are, respectively

(a) $\frac{6}{11}, \frac{5}{11}$ (b) $\frac{5}{11}, \frac{6}{11}$

(c) $\frac{8}{11}, \frac{3}{11}$ (d) $\frac{3}{11}, \frac{8}{11}$

113. The letters of the word 'QUESTION' are arranged in a row at random. The probability that there are exactly two letters between Q and S is

(a) $\frac{1}{14}$ (b) $\frac{5}{7}$ (c) $\frac{1}{7}$ (d) $\frac{5}{28}$

114. If $\frac{1+3P}{3}, \frac{1-2P}{2}$ are probabilities of two mutually exclusive events, then P lies in the interval.

(a) $\left[-\frac{1}{3}, \frac{1}{2}\right]$ (b) $\left(\frac{-1}{2}, \frac{1}{2}\right)$

(c) $\left[-\frac{1}{3}, \frac{2}{3}\right]$ (d) $\left(\frac{-1}{3}, \frac{2}{3}\right)$

115. The probability that an event does not happen in one trial is 0.8 The probability that the event happens at most once in three trials is

(a) 0.896 (b) 0.791

(c) 0.642 (d) 0.592

116. The probability distribution of a random variable is given below

X = x	0	1	2	3	4	5	6	7
P(X=x)	0	K	2 K	2 K	3 K	K^2	$2K^2$	$7K^2 + K$

Then. $P(0 < x < 5)$ is equal to

(a) $\frac{1}{10}$ (b) $\frac{3}{10}$ (c) $\frac{8}{10}$ (d) $\frac{7}{10}$

117. If the equation to the locus of points equidistant from the points $(-2, 3), (6, -5)$ is $ax + by + c = 0$, where $a > 0$, then the ascending order of a, b, c is

(a) a, b, c (b) c, b, a

(c) b, c, a (d) a, c, b

118. The point $(2, 3)$ is first reflected in the straight line $y = x$ and then translated through a distance of 2 units along the positive direction X-axis. The coordinates of the transformed point are

(a) (5,4) (b) (2,3)

(c) (5,2) (d) (4,5)

119. If the straight line $2x + 3y - 1 = 0, x + 2y - 1 = 0$ and $ax + by - 1 = 0$ form a triangle with origin as orthocentre, then (a, b) is equal to

(a) (6,4) (b) $(-3,3)$

(c) $(-8,8)$ (d) (0,7)

120. The point on the line $4x - y - 2 = 0$ which is equidistant from the points $(-5, 6)$ and $(3, 2)$ is

(a) (2,6) (b) (4,14)

(c) (1,2) (d) (3,10)

121. If the lines $x + 2ay + a = 0, x + 3by + b = 0, x + 4cy + c = 0$ are concurrent, then a, b and c are in

(a) arithmetic progression

(b) geometric progression

(c) harmonic progression

(d) arithmetico-geometric progression

122. If the slope of one of the lines represented by $ax^2 - 6xy + y^2 = 0$ is the square of the other, then the value of a is

(a) -27 or 8 (b) -3 or 2

(c) -64 or 27 (d) -4 or 3

123. The sum of the minimum and maximum distance of the point $(4, -3)$ to the circle $x^2 + y^2 + 4x - 10y - 7 = 0$, is

(a) 10 (b) 12 (c) 16 (d) 20

124. The locus of centres of the circles, which cut the circles $x^2 + y^2 + 4x - 6y + 9$ and $x^2 + y^2 - 5x + 4y + 2 = 0$ orthogonally, is

(a) $3x + 4y - 5 = 0$ (b) $9x - 10y + 7 = 0$

(c) $9x + 10y - 7 = 0$ (d) $9x - 10y + 11 = 0$

125. If $x - y + 1 = 0$ meets the circle $x^2 + y^2 + y - 1 = 0$ at A and B, then the equation of the circle with AB as diameter is

(a) $2(x^2 + y^2) + 3x - y + 1 = 0$

(b) $2(x^2+y^2)+3x-y+2=0$
(c) $2(x^2+y^2)+3x-y+3=0$
(d) $x^2+y^2+3x-y+4=0$

126. **An equilateral triangle is inscribed in the parabola $y^2=8x$, with one of its vertices is the vertex of the parabola. Then, length of the side of that triangle is**
(a) $24\sqrt{3}$ units (b) $16\sqrt{3}$ units
(c) $8\sqrt{3}$ units (d) $4\sqrt{3}$ units

127. **The point $(3,4)$ is the focus and $2x-3y+5=0$ is the directrix of a parabola. Its latusrectum is**
(a) $\frac{2}{\sqrt{13}}$ (b) $\frac{4}{\sqrt{13}}$ (c) $\frac{1}{\sqrt{13}}$ (d) $\frac{3}{\sqrt{13}}$

128. **The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ and having its centre at $(0,3)$ is**
(a) 6 (b) 4 (c) 3 (d) 2

129. **The values that m can take, so that the straight line $y=4x+m$ touches the curve $x^2+4y^2=4$ is**
(a) $\pm\sqrt{45}$ (b) $\pm\sqrt{60}$
(c) $\pm\sqrt{65}$ (d) $\pm\sqrt{72}$

130. **The foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ and the hyperbola $\frac{x^2}{144}-\frac{y^2}{81}=\frac{1}{25}$ coincide. Then, the value of b^2 is**
(a) 5 (b) 7 (c) 9 (d) 1

131. **If $(2,-1,2)$ and $(K,3,5)$ are the triads of direction ratios of two lines and the angle between them is $45°$, then the value of K is**
(a) 2 (b) 3 (c) 4 (d) 6

132. **The length of perpendicular from the origin to the plane which makes intercepts $\frac{1}{3},\frac{1}{4}$ and $\frac{1}{5}$ respectively on the coordinate axes is**
(a) $\frac{1}{5\sqrt{2}}$ (b) $\frac{1}{10}$
(c) $5\sqrt{2}$ (d) 5

133. **Match the following columns.**

Column-I	**Column-II**
(A) The centroid of the triangle formed by $(2,3,-1),(5,6,3),(2,-3,1)$ is	**(p) $(2,2,2)$**
(B) The circum centre of the triangle formed by $(1,2,3),(2,3,1),(3,1,2)$ is	**(q) $(3,1,4)$**
(C) The ortho centre of the triangle formed by $(2,1,5),(3,2,3),(4,0,4)$ is	**(r)$(1,1,0)$**
(D) The incentre of the triangle formed by $(0,0,0),(3,0,0),(4,0,4)$ is	**(s) $(3,2,1)$**
(E) The incentre of the triangle formed by $(0,0,0),(3,0,0),(4,0,4)$ is	**(t) $(0,0,0)$**

A	B	C	D		A	B	C	D
(a)	s	p	q	r	(b)	p	q	r	s
(c)	s	r	q	r	(d)	s	p	t	r

134. If $g(x) = \frac{x}{[x]}$ for $x > 2$, then $\lim_{x\to 2} \frac{g(x)-g(2)}{x-2}$ is equal to

(a) -1 (b) 0 (c) $\frac{1}{2}$ (d) 1

135. $\lim_{x\to \frac{\pi}{2}} \left(\frac{2x-\pi}{\cos x}\right)$ is equal to

(a) 0 (b) $\frac{1}{2}$ (c) -2 (d) 5

136. If f is defined by $f(x) = \begin{cases} x \text{ for } 0 \le x < 1 \\ 2 - x \text{ for } x \ge 1 \end{cases}$, then at

(a) continuous and differentiable
(b) continuous but not differentiable
(c) discontinuous but differentiable
(d) neither continuous nor differentiable

137. If $x^2 + y^2 = t + \frac{1}{t}$ and $x^4 + y^4 = t^2 + \frac{1}{t^2}$, then $\frac{dy}{dx}$ is equal to

(a) $-\frac{x}{y}$ (b) $-\frac{y}{x}$
(c) $\frac{x^2}{y^2}$ (d) $\frac{y^2}{x^2}$

138. If $x = at^2$ and $y = 2at$, then $\frac{d^2y}{dx^2}$ at $t = \frac{1}{2}$ is

(a) $-\frac{2}{a}$ (b) $\frac{4}{a}$
(c) $\frac{8}{a}$ (d) $\frac{-4}{a}$

139. The volume of sphere is increasing at the rate of 1200 cu cm/s. The rate of increase in its surface area when the radius is 10 cm is

(a) 120 sq cm/s (b) 240 sq cm/s
(c) 200 sq cm/s (d) 100 sq cm/s

140. The slope of the tangent to the curve $y = \int_0^x \frac{1}{1+t^3} dt$ at the point, where $x = 1$ is

(a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) 1

141. If $x^2 + y^2 = 25$, then $\log_5[\max(3x + 4y)]$ is

(a) 2 (b) 3 (c) 4 (d) 5

142. $\int \frac{dx}{(x-1)\sqrt{x^2-1}}$ is equal to

(a) $-\sqrt{\frac{x-1}{x+1}} + C$ (b) $\sqrt{\frac{x-1}{x^2+1}} + C$
(c) $-\sqrt{\frac{x+1}{x-1}} + C$ (d) $\sqrt{\frac{x^2+1}{x-1}} + C$

143. $\int e^x \frac{x^2+1}{(x+1)^2} dx$ is equal to

(a) $\frac{e^x}{x+1} + C$ (b) $\frac{-e^x}{x+1} + C$
(c) $e^x \left(\frac{x-1}{x+1}\right) + C$ (d) $e^x \left(\frac{x+1}{x-1}\right) + C$

144. $\int \frac{x+1}{x(1+xe^x)} dx$ is equal to

(a) $\log \left|\frac{1+xe^x}{xe^x}\right| + C$
(b) $\log \left|\frac{xe^x}{1+xe^x}\right| + C$
(c) $\log|xe^x(1 + xe^x)| + C$
(d) $\log|1 + xe^x| + C$

145. $\int \frac{f(x)g'(x)-f'(x)g(x)}{f(x)g(x)} \times [\log g(x) - \log f(x)]dx$ is equal to

(a) $\log\left[\frac{g(x)}{f(x)}\right] + C$

(b) $\frac{1}{2}\left[\log\frac{g(x)}{f(x)}\right]^2 + C$

(c) $\frac{g(x)}{f(x)}\log\left[\frac{g(x)}{f(x)}\right] + C$

(d) $\log\left[\frac{g(x)}{f(x)}\right] - \frac{g(x)}{f(x)} + C$

146. $\int_0^{\frac{\pi}{4}} \frac{\sin x+\cos x}{3+\sin 2x} dx$ is equal to

(a) $\frac{1}{2}\log 3$ (b) $\log 2$

(c) $\log 3$ (d) $\frac{1}{4}\log 3$

147. $\int_{-1}^{1} \frac{\sqrt{1+x+x^2}-\sqrt{1-x+x^2}}{\sqrt{1+x+x^2}+\sqrt{1-x+x^2}} dx$ is equal to

(a) $\frac{3\pi}{2}$ (b) $\frac{\pi}{2}$ (c) 0 (d) -1

148. The area of the region described by $\{(x,y)/x^2+y^2 \le 1 \text{ and } y^2 \le 1-x\}$ is

(a) $\frac{\pi}{2}-\frac{2}{3}$ (b) $\frac{\pi}{2}+\frac{2}{3}$

(c) $\frac{\pi}{2}+\frac{4}{3}$ (d) $\frac{\pi}{2}-\frac{4}{3}$

149. The solution of $\frac{dy}{dx}+\frac{1}{x}=\frac{e^y}{x^2}$ is

(a) $2x = (1+Cx^2)e^y$

(b) $x = (1+Cx^2)e^y$

(c) $2x^2 = (1+Cx^2)e^{-y}$

(d) $x^2 = (1+Cx^2)e^{-y}$

150. The differential equation $\frac{dy}{dx} = \frac{1}{ax+by+c}$, where a, b, c are all non-zero real numbers, is

(a) linear in y

(b) linear in x

(c) linear in both x and y

(d) homogeneous equation

151. $\left(\frac{1+\cos\frac{\pi}{8}-i\sin\frac{\pi}{8}}{1+\cos\frac{\pi}{8}+i\sin\frac{\pi}{8}}\right)^8$ is equal to

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

152. The number of four-digit numbers formed by using the digits 0, 2, 4, 5 and which are not divisible by 5 , is

(a) 10 (b) 8 (c) 6 (d) 4

153. If $x = \frac{1}{5}+\frac{1.3}{5\cdot10}+\frac{1\cdot3\cdot5}{5\cdot10.5}+\cdots\infty$, then $3x^2+6x$ is equal to

(a) 1 (b) 2 (c) 3 (d) 4

154. In a $\triangle ABC$, $(a+b+c)(b+c-a) = \lambda bc$, then

(a) $\lambda < -6$ (b) $\lambda > 6$

(c) $0 < \lambda < 4$ (d) $\lambda > 4$

155. In a $\triangle ABC$, $\frac{a}{\tan A}+\frac{b}{\tan B}+\frac{c}{\tan C}$ is equal to

(a) 2r (b) r + 2R

(c) 2r + R (d) 2(r + R)

156. The angle between the straight lines represented by $(x^2+y^2)\sin^2\alpha = (x\cos\alpha - y\sin\alpha)^2$ is

(a) $\frac{\alpha}{2}$ (b) α (c) 2α (d) $\frac{\pi}{2}$

157. **The equation of the circle passing through $(2,0)$ and $(0,4)$ and having the minimum radius, is**

(a) $x^2+y^2=20$

(b) $x^2+y^2-2x-4y=0$

(c) $x^2+y^2=4$

(d) $x^2+y^2=16$

158. **If $x^2+y^2-4x-2y+5=0$ and $x^2+y^2-6x-4y-3=0$ are members of a coaxial system of circles, then the centre of a point circle in the system is**

(a) $(-5,-6)$ (b) $(5,6)$

(c) $(3,5)$ (d) $(-8,-13)$

159. **Let D be the domain of a twice differentiable function f. For all $x \in D, f''(x)+f(x)=0$ and $f(x)=\int g(x)dx+$ constant. If $h(x)=\{f(x)\}^2+\{g(x)\}^2$ and $h(0)=5$, then $h(2015)-h(2014)$ is equal to**

(a) 5 (b) 3 (c) 0 (d) 1

160. **If f is defined in $[1,3]$ by $f(x)=x^3+bx^2+ax$, such that $f(1)-f(3)=0$ and $f'(c)=0$, where $c=2+\frac{1}{\sqrt{3}}$, then (a,b) is equal to**

(a) $(-6,11)$ (b) $\left(2-\frac{1}{\sqrt{3}},2+\frac{1}{\sqrt{3}}\right)$

(c) $(11,-6)$ (d) $(6,11)$