1. The dimensional formula of latent heat and gravitational constant G are respectively

(A) ML^2T^{-2} and $M^2L^1T^{-1}$

(B) $ML^{-2}T^{-2}$ and $M^2L^3T^{-1}$

(C) ML^2T^{-1} and $M^2L^0T^{-1}$

(D) $M^0L^2T^{-2}$ and $M^{-1}L^3T^{-2}$

2. The period of oscillation of a simple pendulum of length l is about 0.5sec. The time of 100 oscillations has been measured with a stop watch of 1 sec resolution. The length l is 10cm measured with the accuracy of 1mm. Then the percentage error in the g measurement is

(A) 1%
(B) 2%
(C) 3%
(D) 5%

3. The radius of a planet is double that of the earth but their average densities are the same. If the escape velocities at the planet and the earth are v_p and v_e respectively, then

(A) $v_p = 2v_e$

(B) $2v_p = v_e$

(C) $v_p = v_e$

(D) $v_p = \frac{1}{4}v_e$

4. A particle is projected at 60° to the horizontal with a kinetic energy K. The kinetic energy at highest point is

(A) Zero

(B) $\frac{K}{4}$

(C) $\frac{K}{2}$

(D) K

5. What is the angle between the frictional force and the instantaneous velocity of a vehicle plying on a rough road?

(A) 0°
(B) 45°
(C) 90°
(D) 180°

6. When the kinetic energy of a body increases by 4 times,then its momentum increases by

(A) 2 times
(B) 16 times
(C) $\sqrt{2}$ times
(D) 4 times

7. The radius of the earth is approximately 6000km, the weight of the object 6000km above the surface of the earth is

(A) $4g$
(B) g
(C) $\frac{g}{2}$
(D) $\frac{g}{4}$

8. The acceleration due to gravity on the moon's surface is 1.7m/sec^2 and acceleration due to gravity on earth is 9.8m/sec^2 . If time period of a simple pendulum on the earth is 3.5sec, its time period on the moon is

(A) 7sec
(B) 8.4sec
(C) 10.2sec
(D) 11.8sec

9. According to Stefan's law the total radiant energy emitted per second per unit surface area of a black body is proportional to

(A) T^{-1}
(B) T
(C) T^{-4}
(D) T^4

10. An electric current passes through a long straight wire. At a distance of 5cm from the wire, the magnetic field is B. The magnetic field at 20cm from the straight wire would be

(A) $\frac{B}{6}$

(B) $\frac{B}{4}$

(C) $\frac{B}{3}$

(D) $\frac{B}{2}$

11. The ratio of specific heats $\frac{C_p}{C_v} = \gamma$ in terms of degrees of freedom (f) is given by

(A) $\left(1+\frac{f}{3}\right)$

(B) $\left(1+\frac{2}{f}\right)$

(C) $\left(1+\frac{f}{2}\right)$

(D) $\left(1+\frac{1}{f}\right)$

12. What is the wavelength of a television station which transmits vision on 500 MHz?

(A) 0.6m
(B) 0.8m
(C) 1m
(D) 1.1m

13. A source of sound of frequency 600Hz is placed inside water. The speed of the sound in water is 1500m/sec and in air is 300m/sec. The frequency of sound detected in air is

(A) 200Hz
(B) 600Hz
(C) 750Hz
(D) 3000Hz

14. Two capacitors have a capacitance of 5μF when connected in parallel and 1.2μF when connected in series. Then the capacitances are

(A) 2μF and 3μF
(B) 3μF and 5μF
(C) 2μF and 4μF
(D) 1μF and 2μF

15. In the capacitor of capacitance C, charge Q and energy W is stored. If charge is increased upto $2Q$, the energy stored will be

(A) $\frac{W}{4}$

(B) $\frac{W}{2}$

(C) $2W$

(D) $4W$

16. At room temperature (27°C), the resistance of a heating element is 100Ω. At temperature T°C, the resistance is found to be 117Ω. Given that temperature coefficient of the resistor material is 1.7×10^{-4}/°C,then the temperature T is

(A) 1027°C
(B) 820°C
(C) 527°C
(D) 1232°C

17. An ideal gas is filled in a closed rigid and thermally insulated container. A coil of 100Ω resistor carrying current 1A for 5minutes supplies heat to the gas. The change in internal energy of the gas is

(A) 10kJ
(B) 20kJ
(C) 30kJ
(D) 0 kJ

18. Si and Cu are cooled from 300K to a temperature of 60K. Then resistivity

(A) for Si increases and for Cu decreases
(B) for Cu increases and for Si decreases
(C) decreases for both Si and Cu
(D) increases for both Si and Cu

19. The magnetic field near a current carrying conductor is given by

(A) Coulomb's law
(B) Lenz's law
(C) Biot-Savart's law
(D) Kirchhoff's law

20. A positive charge is moving upward in a magnetic field directed towards north. The particle will be deflected towards

(A) east
(B) west
(C) north
(D) south

21. In a common base mode of a transistor, the collector current is 5.488mA for an emitter current of 5.6mA. The value of the base current amplification factor (β) will be

(A) 49
(B) 50
(C) 51
(D) 48

22. How does the focal length of a convex lens change if monochromatic red light is used instead of violet light?

(A) Focal length is increased
(B) Focal length is decreased
(C) Focal length remains same
(D) Focal length does not depend on colour of light used

23. An electron of mass m and charge e is accelerated from rest through a potential difference V in vacuum. Its final velocity will be

(A) $\sqrt{\frac{2eV}{m}}$

(B) $\sqrt{\frac{eV}{m}}$

(C) $\frac{eV}{m}$

(D) $\frac{eV}{2m}$

24. Which of the following is *wrongly* matched?

(A) Raman effect- Scattering of light
(B) Thomson effect- Thermoelectricity
(C) Hall effect- Work function
(D) Photoelectric effect- Quantum nature of light

25. The speed of light in the medium is

(A) maximum on the axis of the beam
(B) minimum on the axis of the beam
(C) the same everywhere in the beam
(D) directly proportional to the intensity I

26. In an ac circuit, the voltage applied is $E = E_0 \sin \omega t$. The resulting current in the circuit is $I = I_0 \sin\left(\omega t - \frac{\pi}{2}\right)$. The power consumption in the circuit is given by

(A) $P = \sqrt{2} E_0 I_0$

(B) $P = \frac{E_0 I_0}{\sqrt{2}}$

(C) $P = 0$

(D) $P = \frac{E_0 I_0}{2}$

27. When a long spring is stretched by 2 cm, its potential energy is V. If the spring is stretched by 10 cm, the potential energy in it will be

(A) $10V$
(B) $25V$
(C) $\frac{V}{5}$
(D) $5V$

28. The centripetal force in a circular motion is given by the relation

(A) $\frac{mv^2}{r}$

(B) $\frac{mv^3}{r}$

(C) $\frac{mv^3}{r^3}$

(D) $\frac{mv}{r}$

29. A diesel engine pumps 40 kg of water in 1 second. The water comes out vertically upwards with a velocity of 3 m/s. What is the power of the engine in kilo watt ?

(A) 12 kW
(B) 1.2 kW
(C) 120 kW
(D) 1 kW

30. Two objects of mass 10 kg and 20 kg respectively are connected to the two ends of a rigid rod of length 10m with negligible mass. The distance of the center of mass of the system from the 10 kg mass is

(A) 5 m

(B) $\frac{10}{3}$ m

(C) $\frac{20}{3}$ m

(D) 10 m

31. Sphere A with radius a and sphere B with radius b are at same electric potential. Then the ratio of the surface charge densities of A and B is

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

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

(C) $\frac{a^2}{b^2}$

(D) $\frac{b^2}{a^2}$

32. An electron enters a higher potential region V_2 from a lower potential region V_1. Then what happens to its velocity?

(A) Its velocity decreases
(B) Its velocity increases
(C) There is no change in magnitude of the velocity but its direction changes
(D) Its velocity reduces to zero

33. If a magnetic material is having magnetic susceptibility $(\chi) = -1$, then the relative magnetic permeability (μ_r) and type of magnetic material are

(A) 0, diamagnetic
(B) 2, ferromagnetic
(C) 1, paramagnetic
(D) −1, diamagnetic

34. In an LCR circuit, the capacitance is changed from C to $2C$. For the resonant frequency to remain unchanged, the inductance should be changed from L to

(A) $4L$

(B) $2L$

(C) $\frac{L}{2}$

(D) $\frac{L}{4}$

35. The half-life of radioactive sample is 4 days. After 16 days how much quantity of matter remain undecayed?

(A) $\frac{1}{16}$

(B) $\frac{1}{32}$

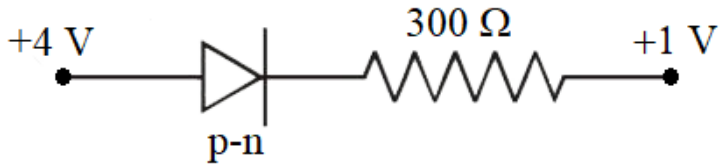
(C) $\frac{1}{4}$

(D) $\frac{1}{2}$

36. The colour of the light emitted by the light emitting diode (LED) depends on

(A) the magnitude of the current injected into the diode junction
(B) semiconductor material used in the making of LED
(C) doping concentration on either side of the diode junction
(D) forward bias voltage

37. In the circuit given below, the value of the current is



(A) Zero
(B) 10^{-2} A
(C) 10^{-3} A
(D) 10^{2} A

38. A strip of Copper and another of Germanium are cooled to a temperature of 80 K. The resistance of

(A) each of these decreases
(B) each of these increases
(C) Copper strip decreases and that of Germanium increases
(D) Copper strip increases and that of Germanium decreases

39. An explosion breaks a rock into three parts in a horizontal plane. Two of them go off at right angles to each other. The first part of mass 1 kg moves with a speed of 12 ms^{-1} and the second part of mass 2 kg moves with 8 ms^{-1} speed. If the third part flies off with 4 ms^{-1} speed, then its mass is

(A) 3 kg
(B) 5 kg
(C) 7 kg
(D) 17 kg

40. Which one of the following statements is INCORRECT?

(A) Frictional force opposes the relative motion
(B) Limiting value of static friction is directly proportional to normal reaction
(C) Rolling friction is smaller than sliding friction
(D) Coefficient of sliding friction has dimensions of length

41. A child is swinging a swing. Minimum and maximum heights of swing from the earth's surface are 0.75 m and 2 m respectively. The maximum velocity of this swing is

(A) 5 m/s
(B) 10 m/s
(C) 15 m/s
(D) 20 m/s

42. A piece of iron is heated in a flame. If first becomes dull red, then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using

(A) Stefan's law
(B) Wien's displacement law
(C) Kirchhoff's law
(D) Newton's law of cooling

43. Two cylinders *A* and *B* of equal capacity are connected to each other via a stop cock. *A* contains an ideal gas at standard temperature and pressure. *B* is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is

(A) adiabatic
(B) isochoric
(C) isobaric
(D) isothermal

44. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is

(A) 6.25%
(B) 20%
(C) 26.8%
(D) 12.5%

45. Nickel shows ferromagnetic property at room temperature. If the temperature is increased beyond Curie temperature, then it will show

(A) Paramagnetism
(B) anti-ferromagnetism
(C) no magnetic property
(D) diamagnetism

46. A magnetic field of 2×10^{-2} T acts at right angles to a coil of area 100 cm^2, with 50 turns. The average emf induced in the coil is 0.1 V, when it is removed from the field in t second. The value of t is

(A) 10 s
(B) 0.1 s
(C) 0.01 s
(D) 1 s

47. Pick the WRONG statement in the context of rainbow formation.

(A) The order of colours is reversed in the secondary rainbow
(B) An observer can see a rainbow when his front is towards the sun
(C) Rainbow is a combined effect of dispersion, refraction and reflection of sunlight
(D) When the light rays undergo total internal reflections in a water drop, a secondary rainbow is formed

48. The Brewster's angle i_b for an interface should be

(A) $30° < i_b < 45°$
(B) $45° < i_b < 90°$
(C) $i_b = 90°$
(D) $0° < i_b < 30°$

49. The number of beta particles emitted by a radioactive substance is twice the number of alpha particles emitted by it. The resulting daughter is an

(A) isobar of parent
(B) isomer of parent
(C) isotone of parent
(D) isotope of parent

50. In a fission reaction, ${}^{236}_{92}U \rightarrow {}^{117}X + {}^{117}Y + n + n$ the binding energy per nucleon of X and Y is 8.5 MeV whereas of ${}^{236}U$ is 7.6 MeV. The total energy liberated will be about

(A) 2000 MeV
(B) 200 MeV
(C) 2 MeV
(D) 1 keV

51. A uniform rod of length 2 m is pivoted at one end. If the rod is in equilibrium under its own weight, what is the distance of its center of mass from the pivot point?

(A) 1.0 m
(B) 0.5 m
(C) 0.75 m
(D) 0.25 m

52. The gravitational potential energy of a two-particle system is negative. What does this indicate about the system?

(A) The particles are repelling each other
(B) The particles are moving away from each other
(C) The particles are bound to each other
(D) None of the above

53. The rise of a liquid in a capillary tube depends on

(A) Mass of the liquid
(B) Radius of the capillary tube
(C) Density of the solid
(D) Bulk modulus of liquid

54. A gas expands from an initial volume of 2 m^3 to a final volume of 5 m^3 at a constant pressure of 100 Pa. Calculate the work done by the gas.

(A) 100 J
(B) 200 J
(C) 300 J
(D) 400 J

55. An electromagnetic wave is represented by the electric field $E = E_0 n \sin\left[\omega t + (6y - 8z)\right]$. Taking unit vectors in x, y and z directions to be l, j, k, the direction of propagation s is

(A) $s = \dfrac{4j - 3k}{5}$

(B) $s = \dfrac{3i - 4j}{5}$

(C) $s = \dfrac{-3j + 3k}{5}$

(D) $s = \dfrac{-4k + 3j}{5}$

56. Two objects A and B are placed at 15 cm and 25 cm from the pole in front of a concave mirror having radius of curvature 40 cm . The distance between images formed by the mirror is

(A) 40 cm
(B) 60 cm
(C) 160 cm
(D) 100 cm

57. In an electron microscope, the resolution that can be achieved is of the order of the wavelength of electrons used. To resolve a width of 7.5×10^{-12} m, the minimum electron energy required is close to

(A) 100 KeV
(B) 500 KeV
(C) 25 KeV
(D) 1 KeV

58. An excited He^+ ion emits two photons in succession, with wavelengths 108.5 nm and 30.4 nm, in making a transition to ground state. The quantum number n, corresponding to its initial excited state is (for photon of wavelength λ, energy $E = \frac{124\ eV}{\lambda\ (\text{in nm})}$).

(A) $n = 5$
(B) $n = 4$
(C) $n = 6$
(D) $n = 7$

59. If a semiconductor photodiode can detect a phonon with a maximum wavelength of 400 nm, then its band gap energy is

Plank's constant	$h = 6.63 \times 10^{-34}$ J s
Speed constant	$c = 3 \times 10^8$ m/s

(A) 2.0 eV
(B) 1.5 eV
(C) 3.1 eV
(D) 1.1 eV

60. The modulation frequency of an AM radio station is 250 kHz, which is 10% of the carrier wave. If another AM station approaches you for license what broadcast frequency will you allot ?

(A) 2750 kHz
(B) 2000 kHz
(C) 2250 kHz
(D) 2900 kHz

61. A wire of 1 Ω has a length of 1 m. It is stretched till its length increases by 25%. The percentage change in resistance to the nearest integer is

(A) 56%
(B) 25%
(C) 12.5%
(D) 76%

62. The number of turns of the coil of a moving coil galvanometer is increased in order to increase current sensitivity by 50%. The percentage change in voltage sensitivity of the galvanometer will be

(A) 100%
(B) 50%
(C) 75%
(D) 0%

63. A proton and an αparticle (with their masses in the ratio of 1 : 4 and charges in the ratio of 1: 2) are accelerated from rest through a potential difference V. If a uniform magnetic field (B) is set up perpendicular to their velocities, the ratio of their radii r_p: r_α of the circular paths described by them will be

(A) $1 : \sqrt{2}$
(B) 1 : 2
(C) 1 : 3
(D) $1 : \sqrt{3}$

64. A 12 V battery connected to a coil of resistance 6 Ω through a switch, drives a constant current in the circuit. The switch is opened in 1 ms.Theemf induced across the coil is 20 V. The inductance of the coil is

(A) 5 mH
(B) 12 mH
(C) 8 mH
(D) 10 mH

65. For an RLC circuit driven with voltage of amplitude $v_m$and frequency $\omega_0 = \frac{1}{\sqrt{LC}}$.The quality factor, Q is given by

(A) $\frac{CR}{\omega_0}$
(B) $\frac{\omega_0 L}{R}$
(C) $\frac{\omega_0 R}{L}$
(D) $\frac{R}{\omega_0 C}$

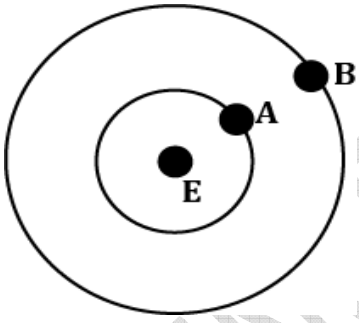
66. A child of mass 5 kg is going to round a merry-go-round that makes 1 rotation in 3.14 s. The radius of the merry-go-round is 2 m. The centrifugal force on the child will be

(A) 80 N
(B) 50 N
(C) 100 N
(D) 40 N

67. What percentage of kinetic energy is transferred to a stationary particle when a moving particle strikes a stationary particle of 5 times its mass? (Assume the collision to be head-on elastic collision)

(A) 50.0%
(B) 66.6%
(C) 55.5%
(D) 33.3%

68. Two satellites *A* and *B* of masses 200 kg and 400 kg are revolving around the earth at height of 600 km and 1600 km respectively. If T_A and T_B are the time periods of *A* and *B*respectively then the value of $T_B - T_A$



[Given: radius of earth = 6400 km, mass of earth = 6×10^{24} kg]

(A) 1.33×10^3 s
(B) 3.33×10^2 s
(C) 4.24×10^3 s
(D) 4.24×10^2 s

69. A cube of metal is subjected to a hydrostatic pressure of 4 GPa. The percentage change in the length of the side of the cube is close to (Given bulk modulus of metal $B = 8 \times 10^{10}$ Pa)

(A) 0.6
(B) 1.67
(C) 5
(D) 20

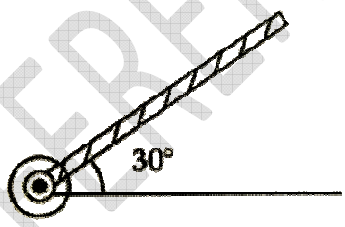
70. The root mean square speed of molecules of nitrogen gas at 27°C is approximately (given mass of a nitrogen molecule = 4.6×10^{-26} kg and take Boltzmann constant $K_B = 1.4 \times 10^{-13}$ JK^{-1})

(A) 523 m/s
(B) 1260 m/s
(C) 91 m/s
(D) 27.4 m/s

71. A granite rod of 60 cm length is clamped at its middle point and is set into latitudinal vibrations. The density of granite is 2.7×10^3 and its Young's modulus is 9.27×10^{10} Pa. What will be the fundamental frequency of the latitudinal vibrations?

(A) 7.5 kHz
(B) 5 kHz
(C) 2.5 kHz
(D) 10 kHz

72. A rod of length 50 cm is pivoted at one end. It is raised such that it makes an angle of 30° from the horizontal as shown and released from rest. Its angular speed when it passes through the horizontal (in rad s^{-1}) will be (g = 10 m/s^{-2})



(A) $\sqrt{30}$
(B) $\sqrt{\frac{30}{2}}$
(C) $\frac{\sqrt{30}}{2}$
(D) $\frac{\sqrt{20}}{2}$

73. Consider a situation in which a ring, a solid cylinder and a solid sphere roll down on the same inclined plane without slipping. Assume that they start rolling from rest and having identical diameter. The correct statement for this situation is

(A) The sphere has the greatest and the ring has the least velocity of the centre of mass at the bottom of the inclined plane
(B) The ring has the greatest and the cylinder has the least velocity of the centre of mass at the bottom of the inclined plane
(C) All of them will have same velocity
(D) The cylinder has the greatest, and the sphere has the least velocity of the centre of mass at the bottom of inclined plane

74. If the size of an atom (~ 1Å) is enlarged to the size of the earth (~ 10^7) what would be the size of the nucleus (10^{-15} m)?

(A) 10 m
(B) 100 m
(C) 1000 m
(D) 1 m

75. If the errors in the measurement of l and g are 2% and 4% respectively, the percentage of error in the time period of pendulum is

(A) 3
(B) 4
(C) 6
(D) 5

76. Which of the following fuel has the highest calorific value?

(A) Coal
(B) Gasoline
(C) Kerosine
(D) Hydrogen

77. Palmitic acid (Molecular weight = 256.42 g/mol) is one of the major sources of energy in our diet as shown in the chemical reaction provided below

$C_{16}H_{32}O_2(s)+23O_2(g)\rightarrow 16CO_2(g)+16H_2O(l)$

The energy released by the combustion of 1 g of palmitic acid is……. kJ/g

(ΔH^0_f (CO_2) = -393.5 kJ/mol; ΔH^0_f (H_2O) = -285.8 kJ/mol; ΔH^0_f (C16H32O2) = −891.5kJ/mol; ΔH^0_f (O2) = 0 kJ/mol)

(A) – 19 kJ/g
(B) – 29 kJ/g
(C) – 39 kJ/g
(D) – 49 kJ/g

78. A chemical reaction having higher equilibrium constant suggests

(A) Rate of forward reaction is faster
(B) Rate of backward reaction is faster
(C) Rate of both backward and forward reactions are equal
(D) None of the above

79. For a general chemical equilibria AX_3 (g)⇌ AX_2 (g) + ½ X_2 (g), the equilibrium constant is K_c; The equilibrium constant for the reaction $2AX_2$ (g) + X_2 (g) ⇌ 2 AX_3 (g) will be ……..

(A) $2K_c$
(B) $K_c/2$
(C) K_c^2
(D) $1/K_c^2$

80. For the Haber Process, N_2 (g) + $3H_2$ (g) ⇌ $2NH_3$ (g), the value of K_c at 300 $^oC$is 9.60. The value of K_p at same temperature will be
(The value of R, is 0.08206 L-atm. $mol^{-1}.K^{-1}$)

(A) 4.34×10^{-3}
(B) 2.17×10^{4}
(C) 1.6×10^{-2}
(D) 5.8×10^{3}

81. The standard EMF for the cell reaction $Zn + Cu^{2+}\rightarrow Cu + Zn^{2+}$ is 1.10 V at 25 ^oC. The EMF of the cell when 0.1M Zn^{2+} and 0.1M Cu^{2+} solutions are used at 25 ^oC is

(A) 1.10 V
(B) 0.55 V
(C) 0.275 V
(D) 0.11 V

82. The equilibrium constant for a cell reaction, $Cu(s) + 2Ag^{+}(aq) \rightarrow Cu^{2+}(aq) + 2Ag\ (s)$ is 4×10^{16}. $E^{0}(cell)$ for the cell reaction is

(A) 0.63 V
(B) 0.49 V
(C) 0.77 V
(D) 0.89 V

83. The chemical reactions of high molecularity are rare because

(A) Activation energy for many body collisions is very high
(B) Many body collisions are energetically less favorable
(C) Many body collisions have a low probability
(D) All of the above

84. The shape of orbital with the value of l = 2, m = 0 is

(A) Spherical
(B) Double dumb-bell
(C) Trigonal planar
(D) Square planar

85. The vapour pressure of water at 300 K in a closed container is 0.4 atm. If the volume of container is doubled, its vapour pressure at 300 K will be

(A) 0.8 atm
(B) 0.2 atm
(C) 0.4 atm
(D) 0.6 atm

86. Internal energy does not include

(A) Rotational energy
(B) Vibrational energy
(C) Nuclear energy
(D) Gravitational energy pull

87. Precipitation takes place when

(A) Ionic product < Ksp
(B) Ionic product > Ksp
(C) $[\text{Ionic product}]^2 = Ksp$
(D) $[\text{Ionic product}]^2 > Ksp$

88. In the reaction $2A + B \rightarrow A_2B$, if the concentration of A is doubled and that of B is halved, then the rate of the reaction will

(A) increase 2 times
(B) increase 4 times
(C) decrease 2 times
(D) remain the same

89. Hess' law is applicable for the determination of heat of

(A) Transition
(B) Formation
(C) Reaction
(D) All of the above

90. Which of the following is an example of a fractional order reaction?

(A) $NH_4NO_2 \rightarrow N_2 + 2H_2O$
(B) $NO + O_3 \rightarrow NO_2 + O_2$
(C) $2NO + Br_2 \rightarrow 2NOBr$
(D) $CH_3CHO \rightarrow CH_4 + CO$

91. The $E^0_{M^{3+}/M^{2+}}$ values for Cr, Mn, Fe and Co are −0.41, + 1.57, + 0.77 and +1.97 V respectively. For which one of the metals, the change in oxidation state from +2 to +3 is easiest?

(A) Cr
(B) Mn
(C) Fe
(D) Co

92. Glucose of 18 g was dissolved in 170 g of water. The vapour pressure of water for this aqueous solution at 37°C is [Given : vapour pressure of water as solvent is 760 torr]

(A) 652 torr
(B) 752 torr
(C) 756 torr
(D) 854 torr

93. A mixed oxide has ccp arrangement in which the cations 'X' occupy $1/3^{rd}$ of octahedral voids and the cations 'Y' occupy $1/3^{rd}$ of tetrahedral voids. The formula of oxide is

(A) $X_2Y_3O_2$
(B) XY_3O
(C) X_2YO_3
(D) $XY\ O_3$

94. Calculate the energy associated with the second orbital of Li^{2+}. What is the radius of this orbit?

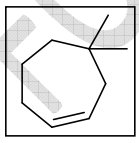
(A) -3.27×10^{-18} J, 0.0793 nm
(B) -4.905×10^{-18} J, 0.0705 nm
(C) -9.81×10^{-18} J, 0.1190 nm
(D) 1.635×10^{-18} J, 0.0352 nm

95. P, F, B represents Primitive, Face - centered, Body centered cubic structures respectively. The crystal structure types of CsCl and NaCl are

(A) B, F
(B) F, C
(C) P, F
(D) F, P

96. Arrange (i) 3- nitrophenol, (ii) 3-chlorophenol, (iii) 4-nitrophenol and (iv) phenol in decreasing order of acidity

(A) (i) > (ii) > (iii) > (iv)
(B) (iii) >(i) > (ii) > (iv)
(C) (iv) >(i) > (ii) > (iii)
(D) (iv) > (iii) > (ii) > (i)

97.  is named as

(A) 1,1-dimethyl-3-cycloheptene
(B) 4,4-dimethyl-cycloheptene
(C) 3,3-dimethyl-cycloheptene
(D) 6,6-dimethyl-cycloheptene

98. In E2 elimination, some compounds follow Hofmann's rule which means

(A) the double bond goes to the most substituted position
(B) newly formed double bond will be in conjugation with double bond already present in the molecule
(C) when strong bases are used double bond goes to the less substituted carbon, and when weak bases are used double bond goes to the less substituted carbon
(D) the double bond goes mainly towards the least substituted carbon

99. When pent-2-yne is treated with dil. H_2SO_4 and $HgSO_4$, major product formed is

(A) pentan-2-ol
(B) pentan-3-ol
(C) pentan-3-one
(D) pentane-2,3-diol

100. To which of the following molecules will ammonia (a nucleophile) add in a 1,4-fashion?

(A) *trans*-but-2-ene
(B) butenone
(C) 4-penten-2-one
(D) cyclopentanone

101. Phenol fails to

(A) release carbon dioxide from aqueous sodium bicarbonate solution
(B) decolorize bromine water
(C) give a violet color with neutral $FeCl_3$ solution
(D) dissolve in cold dilute sodium hydroxide solution

102. Most reactive compound among the following towards sulphonation is

(A) toluene
(B) chlorobenzene
(C) nitrobenzene
(D) thiophene

103. Which among the following amino acids has an aromatic ring residue?

(A) Tryptophan
(B) Valine
(C) Isoleucine
(D) Aspartic Acid

104. Which one of the following does not have sp^2 hybridized carbon?

(A) Acetonitrile
(B) Acetic acid
(C) Acetone
(D) Acetamide

105. Which among the following fails to give a positive test for nitrogen in Lassaigne's test?

(A) RNA
(B) Nicotine
(C) Insulin
(D) Cholesterol

106. Which of the following is not an addition polymer?

(A) Teflon
(B) Plexiglass
(C) Orlon
(D) Kevlar

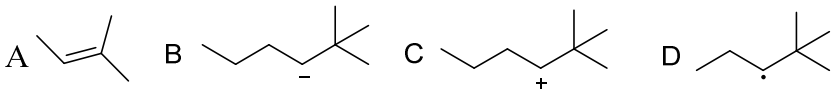
107. Among the following saccharides, identify the one that does not form silver mirror with Tollen's reagent

(A) Lactose
(B) Maltose
(C) Galactose
(D) Sucrose

108. Selective reduction of $PhCH=CHCO_2Et$ to $PhCH=CHCH_2OH$ is performed using

(A) Zn/Hg, HCl
(B) H_2/Pd-C
(C) NH_2NH_2, NaOH
(D) $LiAlH_4$ in dry ether

109. Listed below are one each of olefin, carbanion, carbocation and carbon centered radical. Stability of one among the following species cannot be explained on the basis of hyperconjugation. Identify it.



110. Pyrethrins are well-known as

(A) Anti-oxidants
(B) Insecticides
(C) Flavouring agent
(D) Drugs

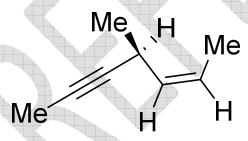
111. In Wolff-Kishner reduction, in the first step ketones (or aldehydes) are converted to the corresponding

(A) imine
(B) hydrazone
(C) semicarbazone
(D) cyanohydrin

112. Which reagent can be used to efficiently convert carboxylic acid to acid chloride derivative?

(A) $SOCl_2$
(B) Cl_2 in the presence of light
(C) Interhalogen compound bromine monochloride (Br-Cl) in the presence of peroxides
(D) Sodium hypochlorite (NaOCl)

113. Major product formed in the catalytic hydrogenation of the following optically active eneyne compound in the presence of poisoned palladium catalyst is



(A) an optically active compound
(B) an optically inactive compound
(C) a racemic mixture of two optical isomers
(D) a mixture of several optically active compounds

114. Aniline is successively treated with i) excess bromine ii) $NaNO_2$, HCl iii) H_3PO_2. Major product formed is

(A) 2,4,6-tribromoaniline
(B) 2,4-dibromoaniline
(C) 1,3,5-tribromobenzene
(D) 2,4-dibromobenzene

115. Ozonolysis of an organic compound '***A***' gave a 1:1 mixture of propanone and propanal. Identify '***A***' from the following compounds

(A) hex-1-ene
(B) hex-2-ene
(C) 2-methylpent-2-ene
(D) 2-methylpent-1-ene

116. Which of the following statements about lithium compounds is untrue?

(A) The hydroxides, carbonates, nitrate, decompose, to give oxides on heating
(B) It is the most electronegative among alkali metals
(C) The hydrogen carbonates cannot be isolate as stable solid
(D) It forms a peroxide but not superoxide

117. Upon heating sodium hydrogen carbonate, the products formed are

(A) $Na_2O + CO_2 + H_2O$
(B) $Na_2CO_3 + CO_2$
(C) $Na_2CO_3 + CO_2 + H_2O$
(D) $NaCO_3 + H_2O$

118. Metallic magnesium is prepared by

(A) Displacement of magnesium by iron from magnesium sulphate solution
(B) Electrolysis of an aqueous solution of $Mg(NO_3)$
(C) Electrolysis of molten $MgCl_2$
(D) Reduction of MgO by aluminium

119. The sodium is made by the electrolysis of a molten mixture of about 40% NaCl and 60% $CaCl_2$ because

(A) Ca^{2+} can displace Na from NaCl
(B) This mixture has a lower melting point than NaCl
(C) $CaCl_2$ helps in conduction of electricity
(D) Ca^{2+} can reduce NaCl to Na

120. S and O both are non-metals in the oxygen family, but their melting points are largely different O = 90K and S = 718K this is because

(A) S is larger in size than O
(B) S exhibit more oxidation state +2, +4, +6 whereas O exhibit −2 and +2 oxidation state
(C) O exist as diatomic molecule whereas S exhibit polyatomic molecule (S_8)
(D) S has more allotropes than O

121. Of the following, which one isn't a reducing oxide?

(A) SO_2
(B) SeO_2
(C) TeO
(D) SO_3

122. The compound insoluble in aqueous NH_3 is

(A) AgI
(B) AgCl
(C) $ZnSO_4$
(D) $HgCl_2$

123. Which one of the following anions is present in the chain structure of silicates?

(A) SiO_4^{4-}
(B) $(Si_2O_7)^{6-}$
(C) $(SiO_3)^{2-}$
(D) $(Si_2O_5)^{2-}$

124. In borax bead test which compound is formed?

(A) Orthoborate
(B) Metaborate
(C) Double oxide
(D) Tetraborate

125. Carbon and silicon belong to (IV) group. The maximum coordination number of carbon in commonly occurring compounds is 4, whereas that of silicon is 6. This is due to

(A) Availability of low lying d-orbitals in Silicon
(B) Large size of Silicon
(C) More electropositive nature of Silicon
(D) None of the above

126. Nitrogen forms N_2, but phosphorus does not form P_2, However, it forms P_4, reason is

(A) Triple bond present between phosphorus atom
(B) $p\pi$-$p\pi$ bonding is weak
(C) $p\pi$-$p\pi$ bonding is strong
(D) Multiple bonds form easily

127. Transuranic elements start with

(A) Np
(B) Cm
(C) Pu
(D) U

128. The number of moles of $KMnO_4$ required to reduce one mole of KI in alkaline medium is

(A) 1/4
(B) 5
(C) 1
(D) 2

129. Which of the following is diamagnetic complex?

(A) $[Fe(H_2O)_6]^{3+}$
(B) $[Fe(H_2O)_6]^{2+}$
(C) $[Fe(CN)_6]^{3-}$
(D) $[Fe(CN)_6]^{4-}$

130. A magnetic moment of 1.73 BM will be shown by which one among the following?

(A) $[Ni(CN)_4]^{2-}$
(B) $TiCl_4$
(C) $[CoCl_6]^{4-}$
(D) $[Cu(NH)_3]^{2+}$

131. Which of the following complex ion is not expected to absorb visible light?

(A) $[Ni(CN)_4]^{2-}$
(B) $[Cr(NH)_6]^{3+}$
(C) $[Fe(H_2O)_6]^{2+}$
(D) $[Ni(H_2O)_6]^{2+}$

132. The colorless species are

(A) Cu_2Cl_2 and $[NiCl_4]^{2-}$
(B) $[TiF_6]^{2-}$ and Cu_2Cl_2
(C) $[CoF_6]^{3-}$and $[NiCl_4]^{2-}$
(D) $[TiF_6]^{2-}$and $[CoF_6]^{3-}$

133. The number of unpaired electrons in the complex ion $[CoF_6]^{3-}$ is

(A) 1
(B) 6
(C) 4
(D) 2

134. Which of the following electronic configuration has associated magnetic moment of 4.89 B.M.?

(A) [Ar] $3d^5$
(B) [Ar] $3d^6$
(C) [Ar] $3d^7$
(D) [Ar] $3d^8$

135. What is the number of electrons in all the completely filled subshells of n = 4 ?

(A) 30
(B) 32
(C) 34
(D) 36

136. The function $f : \mathbb{R} \to \mathbb{R},$ defined by $f(x) = \sin x + \cos x,$ is

(A) one-one
(B) onto
(C) one-one and onto
(D) neither one-one nor onto

137. The value of $y = \sec^{-1}(-2)$ is

(A) $\frac{\pi}{3}$

(B) $\frac{2\pi}{3}$

(C) $\frac{5\pi}{3}$

(D) $\frac{7\pi}{3}$

138. If $A=\begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$, then the matrix A^{2025} at $\theta=\frac{\pi}{3}$ is

(A) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$

(B) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

(C) $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$

(D) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

139. The value of x for which the matrix $A=\begin{pmatrix} 1 & -3 & 2 \\ 4 & -1 & x \\ 3 & 5 & 2 \end{pmatrix}$ is singular, is

(A) $\frac{31}{7}$

(B) $\frac{32}{7}$

(C) $\frac{33}{7}$

(D) $\frac{34}{7}$

140. Let f and g be continuous functions at a point x_0. Then which of the following is **NOT** necessarily true?

(A) $f+g$ is continuous at x_0

(B) $f-g$ is continuous at x_0

(C) $f\cdot g$ is continuous at x_0

(D) $\frac{f}{g}$ is continuous at x_0

141. The function $f(x)=|x-3|$ at $x=3$ is

(A) not defined
(B) differentiable
(C) not continuous
(D) not differentiable

142. If $f(x)=\begin{cases} x+1, & x<2 \\ 2x-1, & x\geq 2 \end{cases}$, then f is

(A) continuous except $x\neq 2$
(B) continuous only at $(-\infty, 2]$
(C) discontinuous in $\mathbb{R}$
(D) continuous in $\mathbb{R}$

143. The number of points at which $\sin x$ attains its minimum in $\mathbb{R}$, is

(A) 1
(B) 2
(C) 0
(D) infinitely many

144. The value of $\operatorname{cosec}(-1080°)$ is

(A) 2
(B) $\frac{1}{2}$
(C) 0
(D) ∞

145. A function f satisfies $f(x)+2f(6-x)=x$ for all real numbers x. Then the value of $f(1)$ is

(A) 1
(B) 2
(C) 3
(D) 4

146. If a line of slope π is reflected over y-axis, then the slope of the reflected line is

(A) π

(B) $-\pi$

(C) $\frac{\pi}{2}$

(D) $-\frac{\pi}{2}$

147. The largest possible domain of the real valued function $f(x)=\frac{\sqrt{4-x^2}}{\sqrt{x^2-9}}$ is

(A) [3, 4]
(B) (3, 4]
(C) [3, 4)
(D) (3, 4)

148. There are 7 bulbs in a room. Then the number of ways in which the room can be illuminated is

(A) 127
(B) 128
(C) 63
(D) 64

149. $\operatorname{cosec}\left(\operatorname{cosec}^{-1}x\right)=x$ holds if x belongs to

(A) $\mathbb{R}$

(B) $\left[\frac{-\pi}{2},\frac{\pi}{2}\right]$

(C) $\mathbb{R}-(-1,1)$

(D) $[-1,1]$

150. Sum of n terms of the series $\sqrt{3}+\sqrt{27}+\sqrt{75}+\sqrt{147}+...$ is

(A) $\dfrac{n(n+1)(2n+1)}{2\sqrt{3}}$

(B) $\dfrac{\sqrt{3}n(n+1)}{2}$

(C) $\dfrac{(n+1)}{\sqrt{3}}$

(D) $\dfrac{n(n-1)(2n-1)}{2\sqrt{3}}$

151. Let $P(x)$ be a polynomial in real variable x of degree 5. Then $\lim\limits_{n\to\infty}\dfrac{P(n)}{2^n}$ is

(A) 5
(B) 1
(C) 0
(D) ∞

152. Subject to the conditions $0\le x\le 10;\ 0\le y\le 5,$ the minimum value of the function $4x-5y+10=0$ is

(A) 5
(B) -15
(C) 10
(D) -2

153. $\lim\limits_{n\to\infty}\dfrac{1}{2}+\dfrac{1}{4}+\dfrac{1}{8}+...+\dfrac{1}{2^n}=$

(A) 0
(B) 1
(C) 2
(D) ∞

154. Let $f(n)$ defined to be the sum of all prime factors of n, where n is any composite positive integer. Then the range of f is the set of all

(A) positive integers
(B) composite positive integers
(C) integers greater than 3
(D) integers greater than 4

155. $\sum_{n=0}^{\infty} \cos^n \frac{\pi}{6} =$

(A) $\frac{2}{2-\sqrt{3}}$

(B) $\frac{\sqrt{3}}{2}$

(C) 2

(D) ∞

156. Consider $A = \begin{pmatrix} \cos x & -\sin x \\ \sin x & \cos x \end{pmatrix}$. Let S be set of all real x satisfying $A \cdot A^T = I_2$. Then S is equal to

(A) $\{0\}$

(B) $\{2\pi\}$

(C) $\mathbb{Z}$

(D) $\mathbb{R}$

157. An onto function $f : \{1,2,3,4,5\} \to \{1,2,3,6,7\}$ is

(A) one-to-one in some cases

(B) always one-to-one

(C) not one-to-one in some cases

(D) one-to-one if f is the identity

158. If $p(x)$ is a polynomial such that the sum of co-efficients of $p(-x)$ is zero, then one of the roots of $p(x) = 0$ is

(A) -1

(B) 0

(C) 1

(D) 2

159. The area enclosed within the curve $|x| + |y| = 2$ is

(A) 16 sq units

(B) 8 sq units

(C) 6 sq units

(D) 4 sq units

160. If $3x-6y+10=0$ and $12y-6x+16=0$ are two tangents to a circle, then the radius of the circle is

(A) $\frac{3}{2\sqrt{5}}$

(B) $\frac{3}{\sqrt{5}}$

(C) $\frac{3}{4\sqrt{5}}$

(D) $\frac{3}{2}$

161. Three normals are drawn to the parabola $y^2 = x$ through the point $(a, 0)$. Then

(A) $a = \frac{1}{2}$

(B) $a = \frac{1}{4}$

(C) $a > \frac{1}{2}$

(D) $a < \frac{1}{4}$

162. If a, b, c are elements of a group $(G, *)$, then the solution of the equation $c * y * a = b$ in G is

(A) $b * a^{-1} * c^{-1}$

(B) $b * c^{-1} * a^{-1}$

(C) $a^{-1} * b * c^{-1}$

(D) $c^{-1} * b * a^{-1}$

163. The equation $|z+3-2i| = |z+2i-3|$ represents

(A) a pair of straight lines

(B) two points

(C) a circle

(D) an ellipse

164. The radius of the circle $\left|\frac{z-i}{z+i}\right|=5$ is

(A) $\frac{20}{81}$

(B) $\frac{40}{81}$

(C) 4

(D) 484

165. The maximum sum of the series $30+29\frac{1}{3}+28\frac{2}{3}+28+...$ is

(A) 690
(B) 560
(C) 430
(D) 360

166. The positive integer n for which $2\times2^2+3\times2^3+4\times2^4+...+n\times2^n=2^{n+6}$, is

(A) 17
(B) 21
(C) 31
(D) 33

167. The number of points (a, b, c) in space, whose each coordinate is a negative integer such that $a + b + c + 12 = 0$ is

(A) 162
(B) 18
(C) 136
(D) 153

168. The roots of the equation $4^{2x+1}+4^2=4^{x+3}+4^x$ are

(A) 1, –2
(B) 1, 2
(C) –1, 2
(D) –1, –2

169. The value of $\frac{\binom{10}{r}}{\binom{11}{r}}$, when the numerator and the denominator take their greatest value, is

(A) $\frac{6}{11}$

(B) $\frac{5}{11}$

(C) $\frac{10}{6}$

(D) $\frac{10}{5}$

170. The coefficient of x^6 in $\left\{(1+x)^6+(1+x)^7+...+(1+x)^{15}\right\}$ is

(A) ${}^{16}C_9$

(B) ${}^{16}C_5 - {}^6C_5$

(C) ${}^{16}C_6 - 1$

(D) ${}^{16}C_6 - {}^6C_5$

171. If the matrix $\begin{bmatrix} \lambda & 1 & 6 \\ -3 & 0 & 4 \\ -1 & 1 & 2 \end{bmatrix}$ is not invertible, then

(A) 10
(B) −10
(C) −4
(D) 4

172. If $A=\begin{bmatrix} \cos^2\alpha & \cos\alpha\sin\alpha \\ \cos\alpha\sin\alpha & \sin^2\alpha \end{bmatrix}$ and $B=\begin{bmatrix} \cos^2\beta & \cos\beta\sin\beta \\ \cos\beta\sin\alpha & \sin^2\beta \end{bmatrix}$ are two matrices such that AB is a null matrix, then $\alpha-\beta$ is

(A) 0

(B) an odd multiple of $\frac{\pi}{2}$

(C) an even multiple of $\frac{\pi}{2}$

(D) $\alpha=\beta$

173. The sum of the series $\cos x-\frac{1}{2}\cos^2 x+\frac{1}{3}\cos^3 x-\frac{1}{4}\cos^4 x+\ldots$ is

(A) $\log 2+\log\left|\cos\left(\frac{x}{2}\right)\right|$

(B) $\log 2-2\log\left|\cos\left(\frac{x}{2}\right)\right|$

(C) $\log 2-\log\left|\cos\left(\frac{x}{2}\right)\right|$

(D) $\log 2+2\log\left|\cos\left(\frac{x}{2}\right)\right|$

174. Let N be the set of all natural numbers. If $aN=\{an:n\in N\}$ and $bN\cap cN=dN$, where $a,b,c\in N$ and b,c are coprimes, then

(A) $b=cd$
(B) $c=bd$
(C) $d=bc$
(D) $a=bc$

175. Two finite sets X and Y have p and q elements respectively. If the total number of subsets of X is 56 more than the total number of subsets of Y. Then the value of q is

(A) 2
(B) 3
(C) 6
(D) 28

176. A fair die is tossed until a number greater than 4 appears. The probability that an even number of tosses shall be required, is

(A) $\frac{1}{2}$

(B) $\frac{1}{5}$

(C) $\frac{3}{5}$

(D) $\frac{2}{3}$

177. Seven balls are drawn simultaneously from a bag containing 5 white and 6 green balls. The probability of drawing 3 white and 4 green balls is

(A) $\frac{7}{{}^{11}C_7}$

(B) $\frac{{}^5C_3 + {}^6C_4}{{}^{11}C_7}$

(C) $\frac{{}^5C_3 + {}^6C_2}{{}^{11}C_7}$

(D) $\frac{{}^6C_3 + {}^5C_4}{{}^{11}C_7}$

178. The maximum value of $5\cos x + 5\sin x + 5$ is

(A) 5
(B) 10
(C) $10 + \sqrt{2}$
(D) $5(1 + \sqrt{2})$

179. The equation $4 \sin x + 5 \cos x = 7$ has

(A) only one solution
(B) two solutions
(C) infinitely many solutions
(D) no solution

180. In a triangle ABC, $b=\sqrt{3}, c=2$ and $\sin B=\frac{3}{4}$, then C is equal to

(A) $30°$
(B) $60°$
(C) $90°$
(D) $120°$

181. The equation of the straight line which is parallel to x-axis and crosses the curve $y=\sqrt{x}$ at an angle of $45°$, is

(A) $x=\frac{1}{2}$

(B) $y=\frac{1}{4}$

(C) $y=\frac{1}{2}$

(D) $y=1$

182. If $x^y y^x=100$, then $\frac{dy}{dx}$ is equal to

(A) $-\frac{y(x+y)\log x}{x(x\log y+y)}$

(B) $-\frac{y(y+x\log x)}{x(y\log x+x)}$

(C) $-\frac{y}{x}$

(D) $-\frac{x}{y}$

183. If $f:\mathbb{R}\to\mathbb{R}$ is defined by $f(x)=x-[x]-\frac{1}{4}$ for $x\in\mathbb{R}$ where $[x]$ is the greatest integer not exceeding x, then $\left\{x\in\mathbb{R}: f(x)=\frac{3}{4}\right\}$ is equal to

(A) $\mathbb{Z}$, the set of all integers
(B) $\mathbb{N}$, the set of all natural numbers
(C) ϕ, the empty set
(D) $\mathbb{R}$, the set of all real numbers

184. The value of $\lim_{x\to 0}\frac{5^x-5^{-x}}{2x}$ is

(A) $\log 5$
(B) 0
(C) 1
(D) $2\log 5$

185. The sum of series $\frac{1}{1!}+\frac{1+2}{2!}+\frac{1+2+3}{3!}+...+\infty$ equals

(A) e
(B) $\frac{e}{2}$
(C) $\frac{3e}{2}$
(D) $1+\frac{e}{2}$

186. $\int_{-2}^{2}|[x]|dx$ is equal to

(A) 1
(B) 2
(C) 4
(D) 5

187. A curve through (1, 0) and satisfying the differential equation $\left(1+y^2\right)dx-xydy=0$ represents a/an

(A) circle
(B) parabola
(C) ellipse
(D) hyperbola

188. If $\vec{a},\vec{b},\vec{c}$ are three non-coplanar mutually perpendicular unit vectors, then $\left[\vec{a}\quad\vec{b}\quad\vec{c}\right]$ is

(A) 2
(B) 0
(C) 1
(D) 3

189. The maximum value of $|z|$ when z satisfies the condition $\left|z+\frac{2}{z}\right|=2$ is

(A) $\sqrt{3}-1$
(B) $\sqrt{3}+1$
(C) $\sqrt{3}$
(D) $\sqrt{2}+\sqrt{3}$

190. If $a_1, a_2, ...a_n$ are n distinct odd natural numbers not divisible by any prime greater than 5, then $\frac{1}{a_1}+\frac{1}{a_2}+...+\frac{1}{a_n}$ is less than

(A) $\frac{15}{8}$
(B) $\frac{16}{8}$
(C) $\frac{8}{15}$
(D) $\frac{15}{4}$

191. The number of real solutions of the equation $e^x = x$ is

(A) 0
(B) 1
(C) 2
(D) infinite

192. If $f(x)=\begin{vmatrix} x+\lambda & x & x \\ x & x+\lambda & x \\ x & x & x+\lambda \end{vmatrix}$, then $f(3x)-f(x)$ is equal to

(A) $3x\lambda^2$
(B) $6x\lambda^2$
(C) $x\lambda^2$
(D) $4x\lambda^2$

193. If α and β are solutions of $\sin^2 x + a\sin x + b = 0$ as well that of $\cos^2 x + c\cos x + d = 0$, then $\alpha + \beta$ is equal to

(A) $\dfrac{2bd}{b^2 + d^2}$

(B) $\dfrac{a^2 + c^2}{2ac}$

(C) $\dfrac{b^2 + d^2}{2bd}$

(D) $\dfrac{2ac}{a^2 + c^2}$

194. The minimum number of terms of the series 1 + 3 + 9 + 27 + ... so that the sum may exceed 1000 is

(A) 7
(B) 5
(C) 3
(D) 8

195. If $f(x) = a + b|x| + c|x|^4$, where a, b, c are real constants, then $f(x)$ is differentiable at $x = 0$ if

(A) $a = 0$
(B) $b = 0$
(C) $c = 0$
(D) $a = b = c$

196. If $3a - 2b + 5c = 0$, the family of lines $ax + by + c = 0$ are always concurrent at a point whose coordinates are

(A) $\left(\dfrac{-3}{5}, \dfrac{2}{5}\right)$

(B) $\left(\dfrac{3}{5}, \dfrac{-2}{5}\right)$

(C) $\left(\dfrac{3}{5}, \dfrac{2}{5}\right)$

(D) $\left(\dfrac{-3}{5}, \dfrac{-2}{5}\right)$

197. For each $n \in \mathbb{N}$, $2^{3n} - 1$ is divisible by

(A) 6
(B) 16
(C) 8
(D) 7

198. The sum of all possible values of k for which the polynomials $x^2 - 3x + 2$ and $x^2 - 5x + k$ have a root in common is

(A) 7
(B) 8
(C) 9
(D) 10

199. If $a, b, c \in \mathbb{R}$ and quadratic equation $x^2 + (a + b)x + c = 0$ has no real roots, then

(A) $c(a + b + c) > 0$
(B) $c + c(a + b + c) > 0$
(C) $c + c(a + b - c) > 0$
(D) $c(a + b - c) > 0$

200. If $f(x) = \cos x \cos 2x \cos 4x \cos 8x$, then $f'\left(\frac{\pi}{4}\right)$ is

(A) -1
(B) 2
(C) $\sqrt{2}$
(D) $2\sqrt{2}$

201. If $\sum_{i=1}^{2n} \cos^{-1} x_i = 0$ then $\sum_{i=1}^{2n} x_i$ is

(A) n
(B) $2n$
(C) $\frac{n(n+1)}{2}$
(D) $\frac{n(n-1)}{2}$

202. There is a positive integer n such that $(n+1)! + (n+2)! = n! \cdot 440$. The sum of the digits of n is

(A) 3
(B) 8
(C) 10
(D) 11

203. If $a_n = \sqrt{7+\sqrt{7+\sqrt{7+...}}}$ having n radical signs, then by methods of mathematical induction which is true

(A) $a_n > 7, \forall n \geq 1$
(B) $a_n < 2, \forall n \geq 1$
(C) $a_n < 7, \forall n \geq 1$
(D) $a_n > 13, \forall n \geq 1$

204. The number of solutions of the equation $4e^{\sin x} - 3e^{-\sin x} + 4 = 0$ in $[0, 2\pi]$ is

(A) 1
(B) 2
(C) 3
(D) 4

205. In 4×4 matrix, sum of each row, column and both the main diagonal is α, then the sum of four diagonal corner elements

(A) α
(B) may not be α
(C) its never equal to α
(D) α^2

206. The image of the point $(-1, 3, 4)$ in the plane $x - 2y = 0$ is

(A) $\left(\frac{9}{5}, \frac{-13}{5}, 4\right)$
(B) $\left(\frac{-17}{3}, \frac{-19}{3}, 1\right)$
(C) $(8, 4, 4)$
(D) $\left(\frac{-17}{3}, \frac{-19}{3}, 4\right)$

207. The value of $\cos^3\left(\frac{\pi}{8}\right)\cos\left(\frac{3\pi}{8}\right)+\sin^3\left(\frac{\pi}{8}\right)\sin\left(\frac{3\pi}{8}\right)$ is

(A) $\frac{1}{\sqrt{2}}$

(B) $\frac{1}{2\sqrt{2}}$

(C) $\frac{1}{2}$

(D) $\frac{1}{4}$

208. If a and b are real numbers such that $(2+\alpha)^4 = a+b\alpha$ where $\alpha=\left(\frac{1+i\sqrt{3}}{2}\right)$, then $a+b=$

(A) 9
(B) 24
(C) 33
(D) 57

209. If the sum of the coefficients of all even powers of x in the product $\left(1+x+x^2+...x^{2n}\right)\left(1-x+x^2-x^3+...+x^{2n}\right)$ is 61, then n is equal to

(A) 30
(B) 60
(C) 61
(D) 122

210. If 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) 9
(B) 1
(C) 5
(D) 7

211. If $\omega \neq 1$ is the complex cube root of unity and matrix $H = \begin{bmatrix} \omega & 0 \\ 0 & \omega \end{bmatrix}$, then H^{70} is equal to

(A) 0
(B) $-H$
(C) H^2
(D) H

212. Let $f : R \to R$ be a differential function with $f(2) = 6$ and $f'(2) = \frac{1}{48}$. Then $\lim_{x \to 2} \int_0^{f(x)} \frac{4t^3}{x-2} dt =$

(A) 24
(B) 36
(C) 12
(D) 18

213. $\tan x$ is not defined when x is

(A) 0
(B) $\frac{n\pi}{2}$
(C) $\frac{(2n+1)\pi}{2}$
(D) $n\pi$

214. If $-2 < 2x - 1 < 2$, then the value of x lies in the interval

(A) $\left(\frac{1}{2}, \frac{3}{2}\right)$
(B) $\left(\frac{-1}{2}, \frac{3}{2}\right)$
(C) $\left(\frac{3}{2}, \frac{1}{2}\right)$
(D) $\left(\frac{3}{2}, \frac{-1}{2}\right)$

215. If the slope of a line is $\frac{2}{3}$, then the slope of the line perpendicular to that line is

(A) $-\frac{3}{2}$

(B) $\frac{3}{2}$

(C) $\frac{2}{3}$

(D) $-\frac{2}{3}$

216. The value of $\lim_{x \to 0} \frac{\sin^2 x}{x^2}$ is

(A) 2
(B) 1
(C) 4
(D) limit does not exist

217. The principal value of $\cos^{-1}\left(\cos\frac{13\pi}{6}\right)$ is

(A) $\frac{13\pi}{6}$

(B) $\frac{\pi}{2}$

(C) $\frac{\pi}{3}$

(D) $\frac{\pi}{6}$

218. The value of $\int_{-\pi}^{\pi} \left(x^3 + \sin x\right) dx$ is

(A) 0

(B) π

(C) 2π

(D) π^3

219. The direction cosines of the *y*-axis are respectively

(A) $1,0,0$
(B) $1,1,0$
(C) $0,1,0$
(D) $0,0,1$

220. The principal argument of $z=-\dfrac{2}{1+\sqrt{3}i}$ is

(A) $\dfrac{\pi}{3}$

(B) $\dfrac{2\pi}{3}$

(C) $\dfrac{\pi}{6}$

(D) $\dfrac{\pi}{4}$

221. The multiplicative inverse of the given complex number $z=12-5i$ is

(A) $-12+5i$
(B) $\dfrac{12}{169}+\dfrac{5}{169}i$
(C) $\dfrac{12}{13}+\dfrac{5}{13}i$
(D) $12+5i$

222. The value of definite integral $\displaystyle\int_0^1 \frac{\tan^{-1}x}{1+x^2}dx$ is

(A) $\dfrac{\pi^3}{72}$

(B) $\dfrac{\pi^2}{32}$

(C) $\dfrac{\pi^3}{4}$

(D) $\dfrac{\pi^3}{8}$

223. There is an equilateral triangle with each side of length 24 cm. The mid-point of its sides is joined to form another triangle. This process is going continuously infinitely many times. Then the sum of perimeter of first 6 triangles (in cm) is

(A) 144
(B) 120
(C) 139.5
(D) 141.75

224. If C be the centroid of the triangle having vertices $(3,-1)$, $(1,3)$ and $(2,4)$. Let A be the point of intersection of the lines $x+3y-1=0$ and $3x-y+1=0$, then the line passing through the points C and A also pass through the point

(A) (–9, –7)
(B) (–9, –6)
(C) (7, 6)
(D) (9, 7)

225. If $x=e^{y+e^{y+e^{y+\ldots\infty}}}$, then $\frac{dy}{dx}$ is

(A) $\frac{1}{x+1}$

(B) $\frac{1-x}{x}$

(C) $\frac{x-1}{x+1}$

(D) $\frac{1}{x}$

KEY (PROVISIONAL)															
SI No	**Key**	**SI No**	**Key**	**SI No**	**Key**	**SI No**	**Key**	**SI No**	**Key**	**SI No**	**Key**	**SI No**	**Key**	**SI No**	**Key**
1	D	**31**	B	**61**	A	**91**	A	**121**	D	**151**	C	**181**	C	**211**	D
2	D	**32**	B	**62**	D	**92**	B	**122**	A	**152**	B	**182**	B	**212**	D
3	A	**33**	A	**63**	A	**93**	D	**123**	D	**153**	B	**183**	D	**213**	C
4	B	**34**	C	**64**	D	**94**	B	**124**	B	**154**	C	**184**	A	**214**	B
5	D	**35**	A	**65**	B	**95**	C	**125**	A	**155**	A	**185**	C	**215**	A
6	A	**36**	B	**66**	D	**96**	B	**126**	B	**156**	D	**186**	C	**216**	B
7	D	**37**	B	**67**	C	**97**	B	**127**	A	**157**	B	**187**	D	**217**	D
8	B	**38**	C	**68**	A	**98**	D	**128**	D	**158**	A	**188**	C	**218**	A
9	D	**39**	B	**69**	B	**99**	C	**129**	D	**159**	B	**189**	B	**219**	C
10	B	**40**	D	**70**	A	**100**	B	**130**	D	**160**	A	**190**	A	**220**	B
11	B	**41**	A	**71**	B	**101**	A	**131**	A	**161**	B	**191**	A	**221**	B
12	A	**42**	B	**72**	A	**102**	D	**132**	B	**162**	D	**192**	B	**222**	B
13	B	**43**	A	**73**	A	**103**	A	**133**	C	**163**	A	**193**	D	**223**	D
14	A	**44**	C	**74**	B	**104**	A	**134**	B	**164**	B	**194**	A	**224**	B
15	D	**45**	A	**75**	A	**105**	D	**135**	B	**165**	A	**195**	B	**225**	B
16	A	**46**	B	**76**	D	**106**	D	**136**	D	**166**	D	**196**	B		
17	C	**47**	B	**77**	C	**107**	D	**137**	B	**167**	C	**197**	D		
18	A	**48**	B	**78**	A	**108**	D	**138**	C	**168**	C	**198**	D		
19	C	**49**	D	**79**	D	**109**	B	**139**	D	**169**	A	**199**	B		
20	B	**50**	B	**80**	A	**110**	B	**140**	D	**170**	A	**200**	C		
21	A	**51**	A	**81**	A	**111**	B	**141**	D	**171**	C	**201**	B		
22	A	**52**	C	**82**	B	**112**	A	**142**	D	**172**	B	**202**	C		
23	A	**53**	B	**83**	C	**113**	B	**143**	D	**173**	D	**203**	C		
24	C	**54**	C	**84**	B	**114**	C	**144**	A	**174**	C	**204**	B		
25	B	**55**	C	**85**	C	**115**	C	**145**	C	**175**	B	**205**	A		
26	C	**56**	C	**86**	D	**116**	D	**146**	B	**176**	C	**206**	A		
27	B	**57**	C	**87**	B	**117**	C	**147**	B	**177**	C	**207**	B		
28	A	**58**	A	**88**	A	**118**	C	**148**	A	**178**	D	**208**	A		
29	B	**59**	C	**89**	D	**119**	B	**149**	C	**179**	D	**209**	A		
30	C	**60**	B	**90**	D	**120**	C	**150**	A	**180**	B	**210**	D		