

TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT II

PHYSICS UG – SHIFT III
(FINAL)

- A particle of mass m is tied to a light string and rotated with a speed v along a circular path of radius r . If T represents the tension in the string and mg represents the gravitational force acting on the particle, then actual/real forces acting on the particle are

 - mg and T only
 - mg , T and an additional force of mv^2/r directed inwards
 - mg , T and an additional force of mv^2/r directed outwards
 - only a force mv^2/r directed inwards
- If V_m and V_d represent the velocity of sound in moist air and dry air at the same temperature, which one of the following is **TRUE**?

 - $V_m = V_d$
 - $V_m > V_d$
 - $V_m < V_d$
 - $V_m = 2V_d$
- The stress required to double the length of a wire of Young's modulus Y is

 - Y
 - $2Y$
 - $\frac{Y}{2}$
 - $\frac{Y}{4}$
- A platinum resistance thermometer records the temperature as 0°C and 100°C when the resistance of the platinum wire is $80\ \Omega$ and $90\ \Omega$. Find the temperature read by the thermometer when the resistance of the platinum wire is $86\ \Omega$.

 - 10°C
 - 20°C
 - 30°C
 - 60°C

5. On which one of the following scales of temperature, the temperature is never negative?
- (A) Kelvin
 - (B) Fahrenheit
 - (C) Celcius
 - (D) Reaumur
6. A real gas behaves as an ideal gas at
- (A) very low pressure and high temperature
 - (B) high pressure and low temperature
 - (C) high pressure and high temperature
 - (D) low pressure and low temperature
7. Which one of the following is the defining equation for uniform circular motion? (Symbols have usual meaning.)
- (A) $V = \omega r$
 - (B) $V = \frac{\omega}{r}$
 - (C) $V = \omega^2 r$
 - (D) $V = \frac{r}{\omega}$
8. Which one of the following is **TRUE** for a conductor?
- (A) The resistivity of a conducting wire is proportional to its length
 - (B) The resistivity of a conducting wire is inversely proportional to its area of cross section
 - (C) The resistivity of a conducting wire is dependent both on its length and area of cross section
 - (D) The resistivity is a property of the material which does not depend on dimensions of the conductor but depends on nature and temperature of the conductor
9. The magnetic flux (in Webers) linked with a coil is given by the equation $\phi = 3t^2 + 4t + 9$. Then the magnitude of the induced emf at time $t = 2s$ will be
- (A) 2 V
 - (B) 4 V
 - (C) 8 V
 - (D) 16 V

10. An electromagnetic wave is propagating in a certain medium with a velocity V in the positive x direction. The instantaneous oscillating electric field of this wave is along the $+y$ direction. Then the direction of the oscillating magnetic field of the wave will be
- (A) $-y$ direction
 - (B) $+z$ direction
 - (C) $-z$ direction
 - (D) $-x$ direction
11. A common emitter transistor amplifier has a current gain of 50. If the input resistance and the load resistance of the amplifier circuit are $500\ \Omega$ and $4\ \text{k}\Omega$ respectively, the voltage gain of the amplifier is
- (A) 100
 - (B) 200
 - (C) 300
 - (D) 400
12. In the following nuclear reaction
- $$p + {}_3\text{Li}^7 \rightarrow 2 {}_2\text{He}^4$$
- if the binding energy per nucleon of the Li and He nuclei are 5.6 and 7.06 MeV, estimate what must be the energy of the proton?
- (A) 39.2 MeV
 - (B) 28.24 MeV
 - (C) 17.28 MeV
 - (D) 1.46 MeV
13. A double convex lens of focal length 20 cm with same radius of curvature for both the faces needs to be manufactured. If the refractive index of the glass is 1.55, the radius of curvature required will be
- (A) 10 cm
 - (B) 17.5 cm
 - (C) $-17.5\ \text{cm}$
 - (D) 22 cm

14. The velocity of a particle in time t is given by $v(t) = a + bt + ct^4$. What will be the dimension of 'c'?
- (A) T^{-2}
 - (B) L^2
 - (C) LT^{-4}
 - (D) LT^{-5}
15. A man of weight $W = mg$ is standing on a lift which is moving upward with an acceleration $\frac{a}{2}$. If g is the acceleration due to gravity, the apparent weight of the man is
- (A) $W\left(1 + \frac{a}{g}\right)$
 - (B) $W\left(1 - \frac{a}{g}\right)$
 - (C) $W\left(1 + \frac{a}{2g}\right)$
 - (D) $W\left(1 - \frac{a}{2g}\right)$
16. The centripetal force acting on a coin weighing 0.1 kg placed 0.1 m from the centre of a disc rotating at 600 rpm is
- (A) $\frac{\pi^2}{2}$ N
 - (B) $2\pi^2$ N
 - (C) $\frac{\pi^2}{4}$ N
 - (D) $4\pi^2$ N
17. Bernoulli theorem represents the law of conservation of
- (A) mass
 - (B) momentum
 - (C) energy
 - (D) angular momentum

18. If the Young's modulus of the material of a rod is $1.5 \times 10^{11} \text{ n/m}^2$ and its density is 6000 kg m^{-3} , the time taken by a sound wave to traverse 1 m of the rod will be
- (A) $2 \times 10^{-4} \text{ s}$
(B) $2 \times 10^{-2} \text{ s}$
(C) 10^{-4} s
(D) 10^{-2} s
19. Two spherical rain drops reach the surface of the earth with terminal velocities having ratio 16 : 9. The ratio of their surface area is
- (A) 4 : 3
(B) 16 : 9
(C) 9 : 16
(D) 3 : 4
20. In Carnot's engine, efficiency is 50% at hot reservoir temperature T . For efficiency 40%, what will be the temperature of hot reservoir?
- (A) $\frac{2T}{5}$
(B) $6T$
(C) $\frac{6T}{5}$
(D) $\frac{5T}{6}$
21. A parallel plate capacitor is made by stacking 5 identical equally spaced metallic plates having the same dielectric between the plates. The alternate plates are then connected. If the capacitor formed by two neighbouring plates has a capacitance C , the total capacitance of the combination is
- (A) $5C$
(B) $4C$
(C) $\frac{C}{5}$
(D) $\frac{C}{4}$

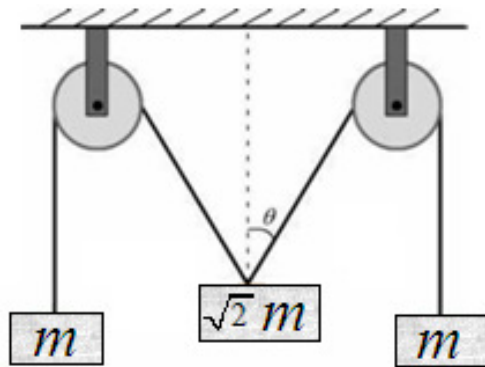
22. The magnetic susceptibility of a paramagnetic material at -73°C is 0.0075. Its value at -173°C will be
- (A) 0.0150
 - (B) 0.0075
 - (C) 0.0045
 - (D) 0.0030
23. When a charged particle moves perpendicular to a uniform magnetic field, its
- (A) energy changes but momentum remains unchanged
 - (B) momentum changes but energy remains unchanged
 - (C) energy and momentum both remain unchanged
 - (D) both energy and momentum are changed
24. When a wave travels from air into glass, there is no change in its
- (A) frequency
 - (B) velocity
 - (C) amplitude
 - (D) wavelength
25. If the radius of nucleus of ^{27}Al is 3.6 Fermi, the approximate nuclear radius of ^{64}Cu in Fermi is
- (A) 1.2
 - (B) 2.4
 - (C) 3.6
 - (D) 4.8
26. The earth's magnetic field is approximately
- (A) $2 \times 10^5 \text{ T}$
 - (B) $2 \times 10^{-5} \text{ T}$
 - (C) $4 \times 10^{-5} \text{ T}$
 - (D) $8 \times 10^{-5} \text{ T}$
27. The frequency of rotation of water molecules is about
- (A) 2.45 GHz
 - (B) 2.45 MHz
 - (C) 2.45 Hz
 - (D) 0.245 Hz

28. Consider a telescope whose objective has a focal length of 100 cm and the eyepiece has a focal length of 1 cm. The magnifying power of this telescope is
- (A) 100
 - (B) 200
 - (C) 10
 - (D) 5
29. In the hydrogen spectrum, Paschen and Brackett series are
- (A) infrared region
 - (B) UV region
 - (C) visible region
 - (D) microwave region
30. 1 curie is equal to
- (A) 3.7×10^{10} Bq
 - (B) 2.7×10^8 Bq
 - (C) 1.7×10^6 Bq
 - (D) 3.7×10^{-10} Bq
31. A pair of forces of equal magnitude but acting in opposite directions with different lines of action is known as a
- (A) stretching
 - (B) compression
 - (C) torque
 - (D) bending
32. What is the length of a simple pendulum?
- (A) 1 m
 - (B) 0.5 m
 - (C) 0.25 m
 - (D) 0.125 m

33. A rubber ball is dropped from a height of 5 m on a plane. On bouncing it rises to 1.8 m. The ball loses its velocity on bouncing by a factor of

- (A) $\frac{3}{5}$
- (B) $\frac{2}{5}$
- (C) $\frac{16}{25}$
- (D) $\frac{9}{25}$

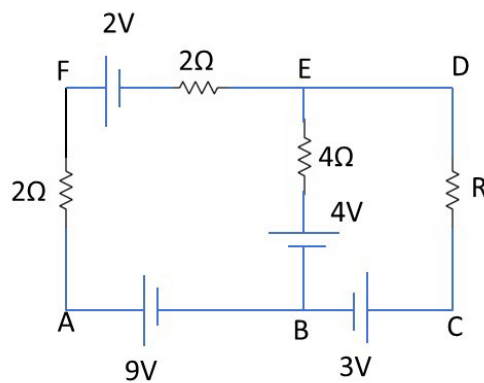
34. The pulleys and strings shown below are smooth and of negligible mass. For the system to remain in equilibrium, the angle of θ should be



- (A) 30°
 - (B) 45°
 - (C) 90°
 - (D) 60°
35. Which of the following methods can be used to measure the speed of light in laboratory?
- (A) Roemer method
 - (B) Fizeau method
 - (C) Foucault method
 - (D) Michelson method
36. A ballet dancer stretches her hands out for a slowing down; this is based on the principle of
- (A) conservation of force
 - (B) conservation of energy
 - (C) conservation of linear momentum
 - (D) conservation of angular momentum

37. As the wavelength is increased from violet to red, the luminosity of a source
- (A) continuously increases
 - (B) continuously decreases
 - (C) decreases then increases
 - (D) increases then decreases
38. Which wavelength of the radiation from sun is used for conversion into electrical energy?
- (A) Radio waves
 - (B) Infrared waves
 - (C) Visible light
 - (D) Micro waves

39. In the electric network shown, when no current flows through the $4\ \Omega$ resistor in the arm EB the potential difference between the points A and D will be



- (A) 6 V
 - (B) 3 V
 - (C) 5 V
 - (D) 4 V
40. Two balls each of radius R , equal mass and density are placed in contact, then the force of gravitation between them is proportional to

- (A) $F \propto \frac{1}{R^2}$
- (B) $F \propto R$
- (C) $F \propto R^4$
- (D) $F \propto \frac{1}{R}$

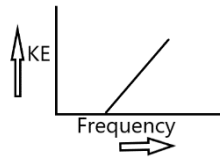
41. A hollow metallic sphere of radius 10 cm is charged such that the potential of its surface becomes 70 V. The potential at the centre of the sphere is
- (A) 100 V
 - (B) 35 V
 - (C) 70 V
 - (D) 7 V
42. Emission of β rays in radioactive decay results in the change of
- (A) mass but not in charge
 - (B) charge but not in mass
 - (C) both mass and charge
 - (D) either mass or charge
43. When you make ice cubes, the entropy of water
- (A) increases
 - (B) decreases
 - (C) does not change
 - (D) either increase or decrease depending on the process
44. A steel ball weighing 1 Kg is dropped from the Leaning tower of Pisa. It starts from rest and falls freely. The position after 1 sec is (g is 9.8 m/s^2)
- (A) 4.9 m
 - (B) -9.8 m
 - (C) -4.9 m
 - (D) 19.6 m
45. Kinetic energy of a body of mass m and momentum p is given by
- (A) $p^2 m$
 - (B) $\frac{m^2}{2p}$
 - (C) mp
 - (D) $\frac{p^2}{2m}$

46. Helium gas is filled in a closed vessel (having negligible thermal expansion coefficient). When it is heated from 300 K to 600 K then average kinetic energy of helium atoms will be
- (A) Half
 - (B) unchanged
 - (C) two times
 - (D) $\sqrt{2}$ times
47. The frequency of LC circuit is
- (A) $\frac{1}{2\pi} \sqrt{LC}$
 - (B) $\frac{1}{2\pi LC}$
 - (C) $\frac{1}{2\pi} \frac{\sqrt{L}}{C}$
 - (D) $\frac{1}{2\pi} \sqrt{\frac{1}{LC}}$
48. If the horizontal and vertical components of the earth's magnetic field are equal at a certain place, then the angle of dip at that place will be
- (A) 90°
 - (B) 60°
 - (C) 45°
 - (D) 0°
49. If in a moving coil galvanometer, a current i produces a deflection θ , then
- (A) i is proportional to $\tan \theta$
 - (B) i is proportional to θ
 - (C) i is proportional to θ^2
 - (D) i is proportional to $\sqrt{\theta}$
50. An achromatic combination of lenses is formed by joining
- (A) 2 convex lenses
 - (B) 2 concave lenses
 - (C) 1 convex and 1 concave lens
 - (D) 1 convex lens and a plane mirror

51. A material with overlapping conduction and valance bands will be

- (A) an insulator
- (B) a semiconductor
- (C) a metal
- (D) a superconductor

52. For the photoelectric effect, the maximum kinetic energy KE of the emitted photoelectrons is plotted against the frequency ν of the incident photons as shown in the figure below. The slope of the curve gives



- (A) charge of the electron
 - (B) work function of the metal
 - (C) Plank's constant
 - (D) ratio of the Plank's constant to electronic charge
53. A particle starts with an initial velocity 2.50 m/s along the positive x direction and it accelerates uniformly at the rate 0.50 m/s^2 . The distance traveled by it in the first 2 seconds is
- (A) 2.0 m
 - (B) 4.0 m
 - (C) 6.0 m
 - (D) 8.0 m
54. A toy car of 1 kg mass moves with circular speed in a horizontal circular groove, with vertical side walls, of radius 25 cm. The toy car takes 2.0 seconds to complete one round. The normal contact force by the side wall of the groove is
- (A) 0.025 N
 - (B) 0.247 N
 - (C) 2.47 N
 - (D) 24.7 N

55. A particle of mass 0.50 kg undergoes a simple harmonic motion under a force $F = -(50 \text{ N/m})x$. If it crosses the centre of oscillation with the speed of 10 m/s, find the amplitude of the motion.
- (A) 0.5 m
(B) 1 m
(C) 5 m
(D) 50 m
56. The displacement of a particle of a string carrying a travelling wave is $y = (3.0 \text{ cm}) \sin 6.28(0.50 x - 50 t)$, where x is in centimetre and t is in second. The speed of the wave is
- (A) 100 m/s
(B) 10 m/s
(C) 100 cm/s
(D) 10 cm/s
57. A vessel of volume 2000 cm^3 contains 0.1 mole of oxygen and 0.2 mole of carbon dioxide. If the temperature of the mixture is 300 K, find its pressure.
- (A) $1.25 \times 10^5 \text{ Pa}$
(B) $2.50 \times 10^5 \text{ Pa}$
(C) $3.75 \times 10^5 \text{ Pa}$
(D) $7.50 \times 10^5 \text{ Pa}$
58. A resistor develops 400 J of thermal energy in 10 s when a current of 2 A is passed through it. Find its resistance.
- (A) 10Ω
(B) 20Ω
(C) 200Ω
(D) 400Ω
59. A transistor is used in common-emitter mode in an amplifier circuit. When a signal of 20 mV is added to the base-emitter voltage, the base current changes by $20 \mu\text{A}$ and the collector current changes by 2 mA. If the load resistance is $5 \text{ k}\Omega$, find the β factor.
- (A) 1
(B) 10
(C) 100
(D) 1000

60. A stone of mass 1.3 kg slides on ice with velocity of 3.12 m/s. The stone stops due to friction in 10 seconds. Assuming the force of friction to be a constant, it is

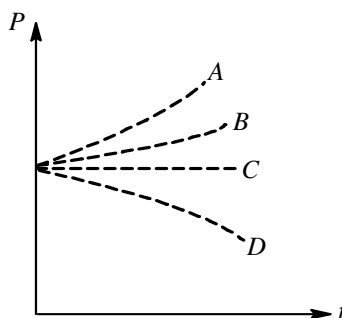
- (A) -0.41 N
- (B) 0.41 N
- (C) -0.82 N
- (D) 0.82 N

61. Regarding diffraction and interference phenomena consider the following statements:

- (i) In diffraction phenomena, the interfering beams originate from a continuous distribution of sources and interference phenomena, the interfering beams originate from a discrete number of sources.
- (ii) In the far-field (or Fraunhofer) diffraction as the viewing screen is moved relative to the aperture, the size of the diffraction scales uniformly, but the shape of the diffraction pattern does not change.
- (iii) In the near field (or Fresnel) diffraction both the shape and size of the diffraction pattern depend on the distance between the aperture and the screen. As the screen is moved away from the aperture, the image of the aperture passes through the forms predicted in turn by geometrical optics, near-field diffraction and far-field diffraction

- (A) (i) only is correct
- (B) (i), (ii) only are correct
- (C) (ii), (iii) only are correct
- (D) (i), (ii), (iii) are correct

62. A battery of emf E and negligible internal resistance is connected to a resistor R . Taking the heating effect of current and its further effects on circuit into the considerations, indicate which of the plots shown in figure best represents the rate of production of thermal energy in the resistor.



- (A) A
- (B) B
- (C) C
- (D) D

63. A positive charge enters in a magnetic field and travels opposite the field and it experiences
- (A) an upward force
 - (B) a downward force
 - (C) an accelerated force
 - (D) no force
64. Two pure inductors each of self inductance L are connected in series, the net inductance is
- (A) L
 - (B) $2L$
 - (C) $\frac{L}{2}$
 - (D) $\frac{L}{4}$
65. What is the force between two charged spheres having charges of 2×10^{-7} C and 3×10^{-7} C placed 30 cm apart in air?
- (A) 6×10^4 N
 - (B) 6×10^{-3} N
 - (C) 4×10^{-4} N
 - (D) 4×10^{-3} N
66. The ratio of contributions made by electric field and magnetic field components to the intensity of an electromagnetic wave is, (c being the velocity of light)
- (A) 1 : 1
 - (B) c : 1
 - (C) c^2 : 1
 - (D) \sqrt{c} : 1
67. A transverse wave travels along the z -axis. The particles of the medium must move
- (A) along the z -axis
 - (B) along the y -axis
 - (C) along the x -axis
 - (D) in the x - y plane

68. Kepler's second is a consequence of
- (A) conservation of energy
 - (B) conservation of linear momentum
 - (C) conservation of angular momentum
 - (D) conservation of mass
69. A reverse bias PN junction has
- (A) very narrow depletion layer
 - (B) almost no current
 - (C) very low resistance
 - (D) large current flow
70. The moment of inertia of a uniform semicircular wire of mass M and radius r about a line passing through its ends is
- (A) Mr^2
 - (B) $\frac{1}{2}Mr^2$
 - (C) $\frac{1}{4}Mr^2$
 - (D) $\frac{2}{5}Mr^2$
71. A particle is moving in a circle with uniform speed. Its motion is
- (A) not periodic
 - (B) periodic and simple harmonic
 - (C) periodic but not simple harmonic
 - (D) simple harmonic
72. Analogue of mass in rotational motion is
- (A) moment of inertia
 - (B) torque
 - (C) radius of gyration
 - (D) angular momentum
73. The displacement of a particle in simple harmonic motion is always measured from
- (A) extreme position
 - (B) mean position
 - (C) midpoint of mean and extreme position
 - (D) yield point

74. Can an ideal gas be liquefied?
- (A) Yes
 - (B) No
 - (C) Can be liquefied at low pressure
 - (D) Can be liquefied at high temperature
75. Specific resistance is numerically equal to the resistance offered by
- (A) 1 cm length of a conductor
 - (B) A conductor of unit cross-section
 - (C) 1 cm length of conductor of 1 cm^2 of cross-section
 - (D) 1 cm^3 of a conductor

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CHEMISTRY (UG)– **SHIFT III**
(FINAL)

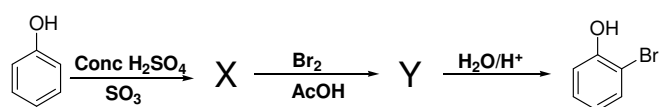
76. A mixture of 2 moles of carbon monoxide and one mole of oxygen in a closed vessel is ignited to convert carbon monoxide to carbon dioxide. If ΔH is the enthalpy change and ΔU is the change in internal energy, then
- (A) $\Delta H > \Delta U$
 - (B) $\Delta H < \Delta U$
 - (C) $\Delta H = \Delta U$
 - (D) $\Delta U = \Delta H = 0$
77. The decay of a radioactive element exhibits the characteristics of a reaction of
- (A) Zero order
 - (B) First order
 - (C) Second order
 - (D) Fractional order
78. Two platinum electrodes were immersed in a solution of copper sulphate and electric current was passed till copper sulphate is completely electrolysed. The resultant solution contains
- (A) Platinum sulphate
 - (B) Copper hydroxide
 - (C) Only water
 - (D) Dilute sulphuric acid
79. For a spontaneous reaction, the Gibbs free energy change (ΔG), the equilibrium constant (K) and E_{cell}° will be respectively
- (A) $-ve, > 1, +ve$
 - (B) $+ve, > 1, -ve$
 - (C) $-ve, < 1, -ve$
 - (D) $-ve, > 1, -ve$
80. A pressure cooker reduces cooking time for food because
- (A) heat is more easily distributed in the cooking space
 - (B) the higher pressure inside the cooker crushes the food material
 - (C) boiling point of water involved in cooking is increased
 - (D) cooking involves chemical changes helped by a rise in temperature

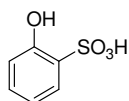
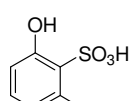
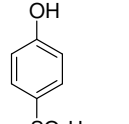
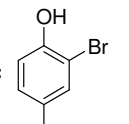
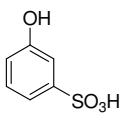
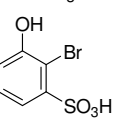
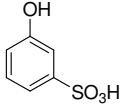
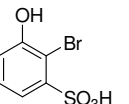
81. The molar conductances of NaCl, HCl and CH₃COONa at infinite dilution are 126.45, 426.16 and 91 Ohm⁻¹ cm² mol⁻¹, respectively. The molar conductance of acetic acid at infinite dilution is
- (A) 590.71 ohm⁻¹ cm² mol⁻¹
(B) 698.28 ohm⁻¹ cm² mol⁻¹
(C) 217.45 ohm⁻¹ cm² mol⁻¹
(D) 390.71 ohm⁻¹ cm² mol⁻¹
82. In salt bridge, KCl is used because
- (A) KCl is present in the calomel electrode
(B) K⁺ and Cl⁻ ions have same transport number
(C) K⁺ and Cl⁻ ions are isoelectronic
(D) KCl is a strong electrolyte
83. $E^{\circ}_{\text{Ag}^+/\text{Ag}} = 0.80 \text{ V}$ and $E^{\circ}_{\text{Ni}^{2+}/\text{Ni}} = -0.25 \text{ V}$. The EMF of the cell Ni-Ag is
- (A) +0.21 V
(B) +1.05 V
(C) -2.10 V
(D) -1.05 V
84. For a first order reaction, $t_{0.75}$ is 138.6 sec. Its specific rate constant (in sec) is
- (A) 10⁻²
(B) 10⁻⁴
(C) 10⁻⁵
(D) 10⁻⁶
85. The number of atoms in 100 g of fcc crystal with density $d = 10 \text{ g cm}^{-3}$ and cell edge equal to 100 pm is
- (A) 4×10^{25}
(B) 3×10^{25}
(C) 2×10^{25}
(D) 1×10^{25}

86. 40 mg of pure sodium hydroxide is dissolved in 10 litre of distilled water. The pH of the solution is
- (A) 9.0
 - (B) 10.0
 - (C) 11.0
 - (D) 12.0
87. Out of Cu, Ag, Fe and Zn, the metal which can displace all others from salt solution is
- (A) Ag
 - (B) Cu
 - (C) Zn
 - (D) Fe
88. Electrode potentials are reported with reference to
- (A) standard hydrogen electrode
 - (B) normal calomel electrode
 - (C) glass electrode
 - (D) silver-silver chloride electrode
89. The value of diffusion coefficient of methane at a given temperature is half of a gas X. The molecule weight of X is
- (A) 4
 - (B) 32
 - (C) 8
 - (D) 64
90. An electrochemical cell can behave like an electrolytic cell when
- (A) $E_{\text{cell}} = 0$
 - (B) $E_{\text{cell}} > E_{\text{ext}}$
 - (C) $E_{\text{ext}} > E_{\text{cell}}$
 - (D) $E_{\text{cell}} = E_{\text{ext}}$
91. A current of 9.65 A flowing for 10 min deposits 3.0 g of a metal. The equivalent of the metal is
- (A) 10
 - (B) 30
 - (C) 50
 - (D) 96.5

92. The vapour pressure of pure liquid solvent A is 0.80 atm. When non-volatile substance B is added to the solvent its vapour pressure drops to 0.40 atm. What is the mole fraction of B in solution?
- (A) 0.50
(B) 0.28
(C) 0.75
(D) 0.40
93. If the rate of reaction is equal to the rate constant, the order of the reaction is
- (A) 0
(B) 1
(C) 2
(D) 3
94. What is the molar solubility, s , of $\text{Ba}_3(\text{PO}_4)_2$ in terms of K_{sp} ?
- (A) $s = K_{\text{sp}}^{1/2}$
(B) $s = K_{\text{sp}}^{1/5}$
(C) $s = [K_{\text{sp}}/27]^{1/5}$
(D) $s = [K_{\text{sp}}/108]^{1/5}$
95. The region at which the probability density function reduces to zero is called as
- (A) Density region
(B) Nodal surfaces
(C) Orientation surfaces
(D) Wave function
96. Identify the compound having sp , sp^2 and sp^3 hybridized carbons.
- (A) 2,3-pentadiene
(B) 1,3-butadiene
(C) 2-heptyne
(D) phenylacetylene

97. Identify X and Y in the following chemical steps



- (A) X =  Y = 
- (B) X =  Y = 
- (C) X =  Y = 
- (D) X =  Y = 

98. What is the main chemical component of oil of wintergreen?

- (A) Methyl salicylate
(B) Menthol
(C) Benzaldehyde
(D) Camphor

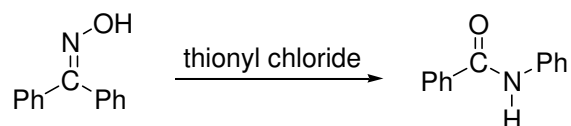
99. Lindlar Catalyst is

- (A) NaBH_4
(B) NH_2NH_2
(C) HCl/ZnCl_2
(D) Pd/BaSO_4 poisoned with Quinoline

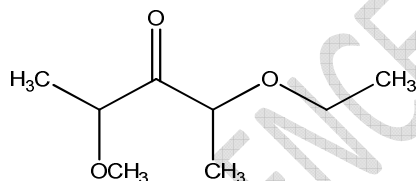
100. Which among the following methods is **NOT** suitable for preparing phenol under mild conditions?

- (A) Treatment of chlorobenzene with NaOH in water
(B) Hydrolysis of phenyl acetate
(C) Treatment of methoxybenzene (anisole) with 57% HI
(D) Treatment of cumene hydroperoxide with dil. HCl

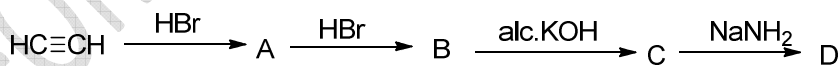
101. Thionyl chloride mediated rearrangement of benzophenone oxime to benzanilide is an example for



- (A) Hofmann rearrangement
(B) Curtius rearrangement
(C) Schmidt rearrangement
(D) Beckmann rearrangement
102. Among the following, the amino acid which does not have aromatic/heteroaromatic ring residue is
- (A) Tyrosine
(B) Asparagine
(C) Tryptophan
(D) Histidine
103. IUPAC name for the following compound is

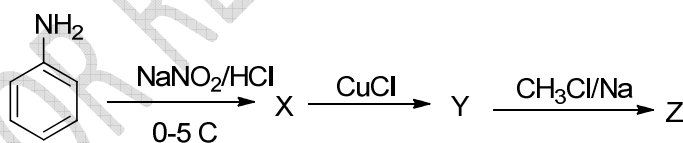


- (A) 2-methoxy-4-ethoxy-3-pentanone
(B) 2-ethoxy-4-methoxy-3-pentanone
(C) 2-ethoxy-3-methoxy-3-pentanone
(D) None of the above
104. In the following sequence of reactions, the product 'D' is



- (A) Ethanol
(B) Ethyne
(C) Ethylamine
(D) Ethene

105. Aniline is selectively converted to 4-bromoaniline in high yields by
- treatment with bromine water
 - conversion to acetanilide by treatment with acetic anhydride followed by bromination and hydrolysis
 - treatment with bromine in the presence of a halogen carrier
 - treatment with bromine in CCl_4 in the presence of light
106. Maltose is a disaccharide made up of
- α -D-glucose only
 - one each of α - and β -D-glucose units
 - β -D-glucose and D-fructose
 - two D-fructose units only
107. Dynel, polymer used for hair wigs, is a
- copolymer of butadiene and styrene
 - copolymer of vinyl chloride and acrylonitrile
 - polyamide resin
 - cross linked polystyrene
108. Which among the following statements is **incorrect** about Hunsdiecker reaction?
- It proceeds through a carbocation intermediate
 - Silver salts of carboxylic acids are used in this reaction
 - One equivalent of CO_2 is liberated in this reaction
 - It is not suitable for the generation of alkyl fluoride
109. In the following reaction sequence, the major product 'Z' is

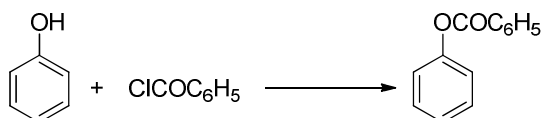


- toluene
- biphenyl
- 4-chlorotoluene
- N-methylaniline

110. Which of the following is Lucas Reagent?

- (A) Ammonical silver nitrate
- (B) Br_2/CCl_4
- (C) Anhy. $\text{ZnCl}_2/\text{conc. HCl}$
- (D) Alk. KMnO_4

111. The following reaction is called



- (A) Wurtz reaction
- (B) Kolbe's reaction
- (C) Reimer-Tiemann reaction
- (D) Schotten-Baumann reaction

112. A 1 : 1 mixture of benzaldehyde and formaldehyde on heating with concentrated aq NaOH solution gives

- (A) sodium benzoate and methyl alcohol
- (B) methyl benzoate
- (C) disodium salt of phthalic acid
- (D) benzyl alcohol and sodium formate

113. Reaction of $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-Cl}$ with KCN in acetonitrile to give $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CN}$ proceeds predominantly by

- (A) Nucleophilic Substitution bimolecular
- (B) Nucleophilic Substitution unimolecular
- (C) Radical Substitution bimolecular
- (D) Radical Substitution unimolecular

114. **Oxides of nitrogen and sulphur, formed by burning fossil fuels, combine with oxygen in the presence of sun light to form**

- (A) dioxins
- (B) thiourea
- (C) smog
- (D) ammonium sulphate nano particles

115. Carbocation intermediates are involved in
- (A) S_N1 and S_N2 substitution reaction
 - (B) E1 and E2 elimination reaction
 - (C) S_N2 substitution and E2 elimination
 - (D) S_N1 substitution and E1 elimination
116. Which is the correct order of second ionization potential of C, N, O, and F in the following?
- (A) $O > N > F > C$
 - (B) $O > F > N > C$
 - (C) $F > O > N > C$
 - (D) $C > N > O > F$
117. In the following the correct bond order sequence is
- (A) $O_2^{2-} > O_2^+ > O_2^- > O_2$
 - (B) $O_2^+ > O_2^- > O_2^{2-} > O_2$
 - (C) $O_2^+ > O_2 > O_2^- > O_2^{2-}$
 - (D) $O_2 > O_2^- > O_2^{2-} > O_2^+$
118. Which of the following ions has the lowest ionic conductivity in aqueous solution?
- (A) Na^+
 - (B) Rb^+
 - (C) Li^+
 - (D) K^+
119. The element that shows greater ability to form $p\pi-p\pi$ multiple bonds, is
- (A) Sn
 - (B) C
 - (C) Ge
 - (D) Si
120. The form of iron obtained from blast furnace is
- (A) Steel
 - (B) Cast iron
 - (C) Pig iron
 - (D) Wrought iron

121. The element that can be refined by distillation is
- (A) Nickel
 - (B) Zinc
 - (C) Tin
 - (D) Gallium
122. XeF_6 on partial hydrolysis with water produces a compound 'x'. The same compound 'x' is formed when XeF_6 reacts with silica. The compound 'x' is
- (A) XeF_2
 - (B) XeF_4
 - (C) XeOF_4
 - (D) XeO_3
123. Which of the following arrangements does **NOT** represent the correct order of the property stated against it?
- (A) $\text{V}^{2+} < \text{Cr}^{2+} < \text{Mn}^{2+} < \text{Fe}^{2+}$: paramagnetic behaviour
 - (B) $\text{Ni}^{2+} < \text{Co}^{2+} < \text{Fe}^{2+} < \text{Mn}^{2+}$: ionic size
 - (C) $\text{Co}^{3+} < \text{Fe}^{3+} < \text{Cr}^{3+} < \text{Sc}^{3+}$: stability in aqueous solution
 - (D) $\text{Sc} < \text{Ti} < \text{Cr} < \text{Mn}$: number of oxidation states
124. The correct order of atomic radii is
- (A) $\text{Nd} > \text{Dy} > \text{Ce} > \text{Yb}$
 - (B) $\text{Nd} > \text{Ce} > \text{Dy} > \text{Yb}$
 - (C) $\text{Ce} > \text{Dy} > \text{Yb} > \text{Nd}$
 - (D) $\text{Ce} > \text{Nd} > \text{Dy} > \text{Yb}$
125. Photon of which light has maximum energy?
- (A) Red
 - (B) Blue
 - (C) Violet
 - (D) Green

126. Which of the following is the correct set with reference to molecular formula, hybridisation of central atom and shape of the molecule?
- (A) CO_2 , sp^2 , bent
 - (B) H_2O , sp^2 , bent
 - (C) BeCl_2 , sp^2 , linear
 - (D) H_2O , sp^3 , bent
127. The covalent energy is maximised in
- (A) Heteronuclear molecule of AB type
 - (B) Heteronuclear molecule of A^+B^- type
 - (C) Homonuclear diatomic molecule
 - (D) None of the above
128. Which one of the following characteristics of the transition metals is associated with higher catalytic activity?
- (A) High enthalpy of atomisation
 - (B) Paramagnetic behaviour
 - (C) Colour of hydrate ions
 - (D) Variable oxidation states
129. The oxidation number of cobalt in $\text{K}[\text{Co}(\text{CO})_4]$ is
- (A) +1
 - (B) +3
 - (C) -1
 - (D) -3
130. The correct electronic configuration and spin only magnetic moment of Gd^{+3} are
- (A) $[\text{Xe}] 4f^7$ and 7.9BM
 - (B) $[\text{Xe}] 4f^7$ and 8.9BM
 - (C) $[\text{Xe}] 4f^6 5d^1$ and 7.9BM
 - (D) $[\text{Xe}] 5f^7$ and 7.9BM

131. How many moles of O_2 can be produced during electrolytic decomposition of 90 g of water?
- (A) 1.25 moles
(B) 2.5 moles
(C) 5.0 moles
(D) 3.5 moles
132. Orbital angular momentum depends on the quantum number/s
- (A) l
(B) n and l
(C) n and m
(D) m and s
133. Crystal field stabilization energy (CFSE) of a high spin octahedral iron(III) complex (atomic number of iron = 26)
- (A) $-20 Dq$
(B) 0
(C) $-6 Dq$
(D) $-4 Dq$
134. What is the most important factor which makes Li strong reducing agent?
- (A) Sublimation energy
(B) Ionization energy
(C) Hydration energy
(D) Electron gain enthalpy
135. Which of the following complex of M (atomic number 26) will be most stable?
- (A) $[M(CO)_5]$
(B) $[M(CO)_4]$
(C) $[M(CO)_5]^-$
(D) $[M(CO)_6]$

MATHEMATICS UG
(SHIFT – III FINAL)

136. Nishi has 5 coins each of the different denomination. The number of different sums of money, she can form, is
- (A) 25
(B) 30
(C) 31
(D) 32
137. The number of ordered pairs (m, n) , $m, n \in \{1, 2, \dots, 50\}$ such that $6^n + 9^m$ is a multiple of 5, is
- (A) 2500
(B) 1500
(C) 1250
(D) 750
138. In a decimal system of numeration, the number of exactly 6-digit numbers in which the sum of the digits is divisible by 5 is
- (A) 180000
(B) 210000
(C) 360000
(D) 540000
139. Let $A = \begin{bmatrix} 2 & 1 \\ 4 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix}$. Then
- $$tr(A) + tr\left(\frac{ABC}{2}\right) + tr\left(\frac{A(BC)^2}{4}\right) + tr\left(\frac{A(BC)^3}{8}\right) + \dots \infty$$
- where $tr(A)$ is the trace of A , is equal to
- (A) 6
(B) 9
(C) 12
(D) 16

140. The determinant $\begin{vmatrix} a & b & a\alpha+b \\ -b & c & b\alpha+c \\ a\alpha+b & b\alpha+c & 0 \end{vmatrix} = 0$, if

- (A) $b^3 = ac$
- (B) $ab = c^3$
- (C) $x - \alpha$ is a factor of $bx^2 + 2ax + c$
- (D) $x - \alpha$ is a factor of $ax^2 + 2bx + c$

141. $\frac{2}{3!} + \frac{4}{5!} + \frac{6}{7!} + \dots$ will be equal to

- (A) $2e^{-2}$
- (B) e^{-2}
- (C) e^{-1}
- (D) $2e^{-1}$

142. If $x = 1 + 2 + \frac{4}{2!} + \frac{8}{3!} + \frac{16}{4!} + \dots$, then x^{-1} is equal to

- (A) e^{-2}
- (B) e^2
- (C) $e^{1/2}$
- (D) $e^{-1/2}$

143. Let $f(x) = \left[\frac{1}{\sin\{x\}} \right]$ where $\{.\}$ and $[.]$ respectively denote the fractional part and greatest integer. Then range of f is

- (A) real numbers
- (B) negative integers
- (C) natural numbers
- (D) rationals

144. Two die are thrown simultaneously to get the coordinates of a point on $x - y$ plane. Then the probability that this point lies inside or on the region bounded by $|x| + |y| \leq 3$ is

(A) $\frac{2}{14}$

(B) $\frac{3}{14}$

(C) $\frac{1}{12}$

(D) $\frac{4}{14}$

145. A pair of fair dice is thrown independently three times. The probability of getting a score of exactly a twice is

(A) $\frac{8}{9}$

(B) $\frac{1}{729}$

(C) $\frac{8}{243}$

(D) $\frac{8}{729}$

146. If $\sin \theta = n(\sin(\theta + 2\alpha))$, then $\tan(\theta + \alpha)$ is equal to

(A) $n \tan \alpha$

(B) $\frac{1-n}{1+n} \tan \alpha$

(C) $\tan \alpha$

(D) $\frac{1+n}{1-n} \tan \alpha$

147. If $S = \cos^2 \frac{\pi}{n} + \cos^2 \frac{2\pi}{n} + \dots + \cos^2 \frac{(n-1)\pi}{n}$, then S is equal to

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

(B) $\frac{1}{2}(n-1)$

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

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

148. If $\operatorname{cosec} A + \cot A = \frac{9}{2}$, then $\tan A$ is

(A) $\frac{77}{36}$

(B) $\frac{36}{77}$

(C) $\frac{18}{77}$

(D) $\frac{77}{72}$

149. If $\tan^2 x + \sec x - a = 0$ has atleast one solution, then the complete set of values of ' a ' is

(A) $(-\infty, 2)$

(B) $(-1, 1)$

(C) $[-1, 1]$

(D) $[-1, \infty)$

150. The values of ' λ ', for which the equation $\cos^4 x - (\lambda + 2)\cos^2 x - (\lambda + 3) = 0$ possesses a solution, lies in

- (A) $[-3, -1]$
- (B) $[-3, -2]$
- (C) $[0, 2]$
- (D) $(0, 3)$

151. Let $\sin^{-1} x - \cos^{-1} x = \frac{\pi}{6}$. Then x is

- (A) $\frac{1}{2}$
- (B) $\frac{\sqrt{3}}{2}$
- (C) $-\frac{1}{2}$
- (D) $\frac{3}{4}$

152. The sum of 10 terms is 12 and the sum of their squares is 17. Then the standard deviation will be

- (A) $-\frac{3}{5}$
- (B) $\frac{6}{5}$
- (C) $\frac{3}{5}$
- (D) $\frac{4}{5}$

153. If the circle $x^2 + y^2 + 4x + 22y + c = 0$ bisects the circumference of the circle $x^2 + y^2 - 2x + 8y - d = 0$, then $c + d$ is equal to

- (A) 60
- (B) 40
- (C) 80
- (D) 50

154. The second order derivative of $a \sin^3 t$ with respect to $a \cos^3 t$ at $t = \frac{\pi}{4}$ is

(A) $\frac{4\sqrt{2}}{3a}$

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

(C) $\frac{4}{3a}$

(D) $\frac{4}{a\sqrt{2}}$

155. The period of the function $f(x) = \cos\left(\frac{\pi x}{n!}\right) - \sin\left(\frac{\pi x}{(n+1)!}\right)$ is

(A) $2n!$

(B) $n!$

(C) $2(n+1)!$

(D) $(n+1)!$

156. If $f(x) = \begin{cases} \frac{\sin(\cos x) - \cos x}{(\pi - 2x)^2}, & x \neq \frac{\pi}{2} \\ k, & x = \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$ then $k =$

(A) 0

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

(C) 1

(D) -1

157. On the interval $[0,1]$, the function $x^{25} \cdot (1-x)^{75}$ takes its maximum value at the point

- (A) $\frac{1}{4}$
- (B) 0
- (C) $\frac{1}{2}$
- (D) $\frac{1}{3}$

158. Solutions of the equation $3^{x^2-x} + 4^{x^2-x} = 25$ are

- (A) $-1, -2$
- (B) $-1, 2$
- (C) $1, -2$
- (D) $1, 2$

159. $\int_{-\pi/2}^{\pi/2} (x^3 + x \cos x + \tan^5 x + 1) dx =$

- (A) 0
- (B) 2
- (C) π
- (D) 1

160. If $a_i > 0$ for $i = 1, 2, \dots, n$ and $a_1 a_2 \dots a_n = 1$, then the minimum value of

$(1+a_1)(1+a_2)\dots(1+a_n)$ is

- (A) $2^{n/2}$
- (B) 2^n
- (C) 2^{2n}
- (D) 1

161. If $\log_4 5 = a$ and $\log_5 6 = b$, then $\log_3 2$ is equal to

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

(B) $\frac{1}{2b+1}$

(C) $2ab+1$

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

162. For positive numbers a, b, c , the least value of $(a^2 + b^2 + c^2) \left(\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} \right)$ is

(A) 3

(B) 9

(C) $\frac{27}{4}$

(D) $\frac{27}{2}$

163. The value of $4 + 5 \left(-\frac{1}{2} + i\frac{\sqrt{3}}{2} \right)^{334} - 3 \left(\frac{1}{2} + i\frac{\sqrt{3}}{2} \right)^{365}$ is equal to

(A) $1 - i\sqrt{3}$

(B) $-1 + i\sqrt{3}$

(C) $4\sqrt{3}i$

(D) $-i\sqrt{3}$

164. For the equation $3x^2 + px + 3 = 0$, $p > 0$, if one of the root is square of the other, then p is equal to

(A) $\frac{1}{3}$

(B) 1

(C) 3

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

165. If the roots of the cubic equation $x^3 - px^2 + qx - r = 0$ are in G.P., then
- (A) $q^3 = p^3 r$
 - (B) $p^3 = q^3 r$
 - (C) $pq = r$
 - (D) $pr = q$
166. If $H_n = 1 + \frac{1}{2} + \dots + \frac{1}{n}$, then the value of $1 + \frac{3}{2} + \frac{5}{3} + \dots + \frac{2n-1}{n}$ is
- (A) $H_n + n$
 - (B) $2n - H_n$
 - (C) $(n-1) + H_n$
 - (D) $H_n + 2n$
167. A student read common difference of an A.P. as -3 instead of 3 and obtained the sum of first 10 terms as -30 . Then, the actual sum of the first 10 terms is equal to
- (A) 120
 - (B) 240
 - (C) 180
 - (D) 300
168. If the roots of the equation $x^2 - 2kx + k^2 + k - 3 = 0$ are real and less than 3, then
- (A) $k > 4$
 - (B) $2 \leq k \leq 3$
 - (C) $3 < k \leq 4$
 - (D) $k < 2$
169. Let $x = 2 + 2^{1/3} + 2^{2/3}$. Then the value of $x^3 - 6x^2 + 6x$ is
- (A) 1
 - (B) 3
 - (C) 2
 - (D) 4

170. The average age of A , B and C , whose ages are integers x , y and z ($x \leq y \leq z$) respectively, is 30. If the age of B is exactly 5 more than that of A , then the minimum possible value of z is
- (A) 31
 - (B) 33
 - (C) 35
 - (D) 37
171. If the median of 21 observations is 40 and if the observations greater than the median are increased by 5, then the median of the new data will be
- (A) 45
 - (B) 40
 - (C) $40 + \frac{50}{21}$
 - (D) $40 - \frac{50}{21}$
172. Let a, b, c , be positive numbers such that $a + b + c = 1$ and $(1 - a)(1 - b)(1 - c) \geq kxyz$. Then k is equal to
- (A) 4
 - (B) 8
 - (C) 6
 - (D) 0
173. The inverse of the point $(1, 2)$ with respect to the circle $x^2 + y^2 - 4x - 6y + 9 = 0$, is
- (A) $\left(1, \frac{1}{2}\right)$
 - (B) $(2, 1)$
 - (C) $(0, 1)$
 - (D) $(1, 0)$

174. The differential equation of all straight lines touching the circle $x^2 + y^2 = a^2$ is

(A) $\left(y - \frac{dy}{dx}\right)^2 = a^2 \left[1 + \left(\frac{dy}{dx}\right)^2\right]$

(B) $\left(y - x \frac{dy}{dx}\right)^2 = a^2 \left[1 + \left(\frac{dy}{dx}\right)^2\right]$

(C) $\left(y - x \frac{dy}{dx}\right) = a^2 \left[1 + \frac{dy}{dx}\right]$

(D) $\left(y - \frac{dy}{dx}\right) = a^2 \left[1 - \frac{dy}{dx}\right]$

175. If $f(x) = |x - 2|$ and $g(x) = f[f(x)]$, then $g'(x)$ for $x > 20$ is

(A) ∞

(B) 1

(C) 2

(D) -1

176. The complex number z satisfying the equations $|z| - 4 = |z - i| - |z - 5i| = 0$ is

(A) $\sqrt{3} - i$

(B) $2\sqrt{3}$

(C) $-2\sqrt{3} - 2i$

(D) 0

177. An ellipse has OB as semi-minor axis, F and F' its foci and the angle FBF' is a right angle. Then, the eccentricity of the ellipse is

(A) $\frac{1}{\sqrt{3}}$

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

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

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

178. If $\int_1^2 e^{x^2} dx = a$, then the value of $\int_e^{e^4} \sqrt{\log_e x} dx$ is

- (A) $e^4 - e$
- (B) $e^4 - a$
- (C) $2e^4 - a$
- (D) $2e^4 - e - a$

179. Given that the curves $x^2 + y^2 + kx + 4y + 2 = 0$ and $2(x^2 + y^2) - 4x - 3y + k = 0$ cut orthogonally. Then the value of k is

- (A) 1
- (B) $\frac{1}{3}$
- (C) $\frac{10}{3}$
- (D) $-\frac{10}{3}$

180. Let a, b, c be three positive real numbers such that $a + b \geq c$. Then

- (A) $\frac{a}{1+a} + \frac{b}{1+b} \geq \frac{c}{1+c}$
- (B) $\frac{a}{1+a} + \frac{b}{1+b} < \frac{c}{1+c}$
- (C) $\frac{a}{1+a} + \frac{b}{1+b} > \frac{1+c}{c}$
- (D) $\frac{a}{1+a} + \frac{b}{1+b} \leq \frac{1+c}{c}$

181. The centre of a regular hexagon is at the point $z = i$. If one of the vertices is at $2 + i$, then the adjacent vertices of $2 + i$ are at the points

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

182. If $y = f(t)\sin t + f'(t)\cos t$ and $x = f(t)\cos t - f'(t)\sin t$, then $\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2$ is equal to

(A) $[f(t) - f''(t)]^2$

(B) $[f(t) + f''(t)]^2$

(C) $[f(t) + f'(t)]^2$

(D) $[f(t) - f'(t)]^2$

183. The value of integer n for which the function $f(x) = \frac{\sin nx}{\sin \frac{x}{n}}$ has 4π as its period is

(A) 2

(B) 3

(C) 4

(D) 5

184. If $f(x) = 2x^3 + 9x^2 + \lambda x + 20$ is a decreasing function of x in the largest possible interval $(-2, -1)$, then λ is equal to

(A) 6

(B) -6

(C) 12

(D) -12

185. A seven digit number made up of all distinct digits 8, 7, 6, 4, 2, x and y is divisible by 3. Then possible number of ordered pair (x, y) is

(A) 2

(B) 4

(C) 6

(D) 8

186. If X follows a binomial distribution with parameters $n = 100$ and $p = \frac{1}{3}$, then $P(X = r)$ is maximum when r is equal to
- (A) 16
(B) 32
(C) 33
(D) 44
187. The value of $\sin \left[\tan^{-1}(-\sqrt{3}) + \cos^{-1}\left(\frac{-\sqrt{3}}{2}\right) \right]$ is
- (A) ∞
(B) -1
(C) 0
(D) 1
188. The slopes of the lines represented by $x^2 + 2hxy + 2y^2 = 0$ are in the ratio $1 : 2$. Then the value of h is
- (A) $\pm \frac{3}{2}$
(B) ± 3
(C) ± 1
(D) $\pm \frac{2}{3}$
189. The equation of the sphere described on the line joining the points $(2, -1, 4)$ and $(-2, 2, -2)$ as diameter is
- (A) $2x^2 - x + z = 0$
(B) $x^2 + y^2 + z^2 + x - y + z + 7 = 0$
(C) $x^2 + y^2 + z^2 - y - 2z - 14 = 0$
(D) $x^2 + y^2 + z^2 = 0$

190. Consider the circle $|z - 5 - 5i| = 2$ in the complex plane (x, y) with $z = x + iy$. Then the minimum distance from the origin to the circle is
- (A) $5\sqrt{2} - 2$
 - (B) $5\sqrt{2}$
 - (C) $\sqrt{34}$
 - (D) $\sqrt{54}$
191. Given that two roots of the nonlinear equation $x^3 - 6x^2 + 11x - 6 = 0$ are 1 and 3. The third root will be
- (A) j
 - (B) $-j$
 - (C) 2
 - (D) -2
192. Let $A = \begin{pmatrix} 2 & 3 \\ x & y \end{pmatrix}$. If the eigen values of A are 4 and 8, then $(x, y) =$
- (A) (4,10)
 - (B) (5,8)
 - (C) (-3,9)
 - (D) (-4,10)
193. The value of $\oint_C \frac{z^2 + 8}{0.5z - 1.5j} dz$, where $j = \sqrt{-1}$ and C is described by $x^2 + y^2 = 16$, is
- (A) $4\pi j$
 - (B) $-4\pi j$
 - (C) $2\pi j$
 - (D) $-2\pi j$
194. If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$, then $(\text{div } \vec{r}, \text{curl } \vec{r})$ is
- (A) (0, 1)
 - (B) (3, 0)
 - (C) (3, 1)
 - (D) (1, 3)

195. The value of $\sqrt{6+\sqrt{6+\sqrt{6+\dots\infty}}}$ is
- (A) 3
 - (B) 6
 - (C) -4
 - (D) 2
196. The minimum height from any point on the curve $y = x^2 - 4x + 6$ to the x -axis is
- (A) 6
 - (B) 4
 - (C) 1
 - (D) 2
197. If $(\sqrt{8} + i)^{50} = 3^{49}(a + ib)$, then the value of $a^2 + b^2$ is
- (A) 3
 - (B) 9
 - (C) 27
 - (D) 81
198. If $4x + 3|y| = y$, then y as a function of x is
- (A) not continuous at $x = 0$
 - (B) not defined for all real x
 - (C) $\frac{dy}{dx} = \frac{1}{2}$ for $x < 0$
 - (D) differentiable at $x = 0$
199. If $f(x)$ be a differentiable function such that $f(xy) = f(x) + f(y)$ for all x and y , then $f(e) + f\left(\frac{1}{e}\right) =$
- (A) 1
 - (B) 0
 - (C) -1
 - (D) ∞

200. The order of differential equation $x = 1 + \left(\frac{dy}{dx}\right) + \frac{1}{2!}\left(\frac{dy}{dx}\right)^2 + \frac{1}{3!}\left(\frac{dy}{dx}\right)^3 + \dots + \frac{1}{n!}\left(\frac{dy}{dx}\right)^n$ is

- (A) 3
- (B) 1
- (C) n
- (D) not defined

201. If a straight line through $C(-\sqrt{8}, \sqrt{8})$ making an angle of 135° with the x -axis and cuts the circle $x = 5 \cos \theta$, $y = 5 \sin \theta$ at points A and B , then the length of AB is

- (A) 3
- (B) 7
- (C) 10
- (D) 5

202. If 25% of the items are less than 20 and 25% are more than 40, the quartile deviation is

- (A) 20
- (B) 30
- (C) 40
- (D) 10

203. The function $f(x) = \sec \left[\log \left(x + \sqrt{1+x^2} \right) \right]$ is

- (A) even
- (B) odd
- (C) constant
- (D) periodic

204. If $x^2 - x + 1 = 0$, then the value of x^{3n} is

- (A) 0
- (B) -1
- (C) 1
- (D) n

205. The remainder when $1! + 2! + 3! + \dots + 49!$ is divided by 10 is
- (A) 1
 - (B) 2
 - (C) 3
 - (D) 4
206. If a, b, c are positive numbers in A.P. such that their product is 64, then the minimum value of b is
- (A) 6
 - (B) 4
 - (C) 2
 - (D) 1
207. The number of zeros in the product $5^6 \cdot 6^7 \cdot 7^8 \cdot 8^9 \cdot 9^{10} \dots 30^{31}$ is
- (A) 130
 - (B) 132
 - (C) 137
 - (D) 136
208. The number of ways in which the number 94864 can be resolved as a product of two factors
- (A) 22
 - (B) 24
 - (C) 23
 - (D) 26
209. The maximum number of different elements required to form a symmetric matrix of order 12 is
- (A) 72
 - (B) 78
 - (C) 75
 - (D) 70
210. In a group of 8 girls, two girls are sisters. The number of ways in which the girls can sit so that two sisters are not sitting together, is
- (A) 48200
 - (B) 14106
 - (C) 28300
 - (D) 30240

211. If $a^2 - 2a \cos x + 1 = 674$ and $\tan\left(\frac{x}{2}\right) = 7$ then the integral value of a is
- (A) 25
(B) 49
(C) 67
(D) 74
212. If the length of the semi major axis of an ellipse is 68 and the eccentricity is $\frac{1}{2}$ then the area of the rectangle formed by joining the vertices of the latera recta of the ellipse is equal to
- (A) 6846
(B) 6936
(C) 6676
(D) 7244
213. If A and B are two distinct matrices such that $A^3 = B^3$ and $A^2B = B^2A$, then $\det(A^3 + B^3)$ is equal to
- (A) 1
(B) 2
(C) 0
(D) -1
214. If the point $(3, 4)$ lies on the locus of the point of intersection of the lines $x \cos \alpha + y \sin \alpha = a$ and $x \sin \alpha - y \cos \alpha = b$, (α is a variable), and the point (a, b) lies on the line $3x - 4y = 0$, then $9a^4 + 16b^4 + 34$ is equal to
- (A) 3634
(B) 3684
(C) 3845
(D) 3874
215. If A denotes the area enclosed by $3|x| + 4|y| \leq 12$, then $4A^2 + A + 1$ is equal to
- (A) 2341
(B) 2329
(C) 2420
(D) 2429

216. Suppose a matrix A satisfies $A^2 - 5A + 7I = 0$. If $A^8 = aA + bI$, then $a =$
- (A) 1265
(B) 5299
(C) 1259
(D) 5432
217. The largest term in the expansion of $(3+2x)^{50}$, where $x = \frac{1}{5}$ is
- (A) 5th
(B) 6th
(C) 8th
(D) 9th
218. If $\log_3 x + \log_3 y = 2 + \log_3 2$ and $\log_3(x+y) = 2$, then
- (A) $x = 1, y = 8$
(B) $x = 1, y = 1$
(C) $x = 3, y = 6$
(D) $x = 9, y = 3$
219. The equation of the circle which passes through the origin has its centre on the line $x + y = 4$ and cuts the circle $x^2 + y^2 - 4x + 2y + 4 = 0$ orthogonally, is
- (A) $x^2 + y^2 - 2x - 6y = 0$
(B) $x^2 + y^2 - 6x - 3y = 0$
(C) $x^2 + y^2 - 4x - 4y = 0$
(D) $x^2 + y^2 + 4x + 4y = 0$
220. The number of integral roots of the equation $x^4 + \sqrt{x^4 + 20} = 22$ is
- (A) 0
(B) 2
(C) 4
(D) 8

221. If $x = 9$ is the chord of contact of the hyperbola $x^2 - y^2 = 9$, then the equation of the corresponding pair of tangents is

(A) $9x^2 - 8y^2 + 18x - 9 = 0$

(B) $9x^2 - 8y^2 - 18x + 9 = 0$

(C) $9x^2 - 8y^2 - 18x - 9 = 0$

(D) $9x^2 - 8y^2 + 18x + 9 = 0$

222. The lines joining the origin to the points of intersection of $x^2 + y^2 + 2gx + c = 0$ and $x^2 + y^2 + 2fy - c = 0$ are at right angles. Then

(A) $g^2 + f^2 = c$

(B) $g^2 - f^2 = c$

(C) $g^2 - f^2 = 2c$

(D) $g^2 + f^2 = c^2$

223. If m is a natural number such that $m \leq 5$, then the probability that the quadratic equation $x^2 + mx + \frac{1}{2} + \frac{m}{2} = 0$ has real roots is

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

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

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

(D) $\frac{4}{5}$

224. The line $x + y = 1$ meets the lines represented by the equation $y^3 - xy^2 - 14x^2y + 24x^3 = 0$ at the points A, B, C . If O is the origin, then $OA^2 + OB^2 + OC^2$ is equal to

(A) $\frac{22}{9}$

(B) $\frac{85}{72}$

(C) $\frac{181}{72}$

(D) $\frac{221}{72}$

225. By definition $a * b = b * a = 1, \forall a, b \in R$. Also $(a * b) * c = (1 * c) = 1$ and $a * (b * c) = a * (1) = 1, \forall a, b, c \in R$. Then R is

- (A) only commutative
- (B) only associative
- (C) reflexive and commutative
- (D) commutative and associative

FOR REFERENCE ONLY - CUSAT

| FINAL ANSWER KEY | | | | | | | | | |
|--|-----|--------|-----|--------|-----|--------|-----|--------|-----|
| TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT III | | | | | | | | | |
| SI No. | Key | SI No. | Key | SI No. | Key | SI No. | Key | SI No. | Key |
| 1 | A | 31 | C | 61 | C | 91 | C | 121 | B |
| 2 | B | 32 | A | 62 | D | 92 | A | 122 | C |
| 3 | A | 33 | B | 63 | D | 93 | A | 123 | A |
| 4 | D | 34 | B | 64 | B | 94 | D | 124 | D |
| 5 | A | 35 | C | 65 | B | 95 | B | 125 | C |
| 6 | A | 36 | D | 66 | A | 96 | A | 126 | D |
| 7 | A | 37 | D | 67 | D | 97 | B | 127 | C |
| 8 | D | 38 | B | 68 | C | 98 | A | 128 | D |
| 9 | D | 39 | C | 69 | B | 99 | D | 129 | C |
| 10 | B | 40 | C | 70 | B | 100 | A | 130 | A |
| 11 | D | 41 | C | 71 | C | 101 | D | 131 | B |
| 12 | C | 42 | B | 72 | A | 102 | B | 132 | A |
| 13 | D | 43 | B | 73 | B | 103 | D | 133 | B |
| 14 | D | 44 | C | 74 | B | 104 | B | 134 | C |
| 15 | C | 45 | D | 75 | C | 105 | B | 135 | A |
| 16 | D | 46 | C | 76 | B | 106 | A | 136 | C |
| 17 | C | 47 | D | 77 | B | 107 | B | 137 | C |
| 18 | A | 48 | C | 78 | D | 108 | A | 138 | A |
| 19 | B | 49 | B | 79 | A | 109 | A | 139 | A |
| 20 | D | 50 | C | 80 | C | 110 | C | 140 | D |
| 21 | B | 51 | C | 81 | D | 111 | D | 141 | C |
| 22 | A | 52 | C | 82 | B | 112 | D | 142 | A |
| 23 | B | 53 | C | 83 | B | 113 | A | 143 | C |
| 24 | A | 54 | C | 84 | A | 114 | C | 144 | C |
| 25 | D | 55 | B | 85 | A | 115 | D | 145 | C |
| 26 | C | 56 | C | 86 | B | 116 | B | 146 | D |
| 27 | A | 57 | C | 87 | C | 117 | C | 147 | C |
| 28 | A | 58 | A | 88 | A | 118 | C | 148 | B |
| 29 | A | 59 | C | 89 | A | 119 | B | 149 | D |
| 30 | A | 60 | A | 90 | C | 120 | C | 150 | B |

| SI No. | Key | SI No. | Key | SI No. | Key |
|--------|-----|--------|-----|--------|-----|
| 151 | B | 181 | D | 211 | A |
| 152 | C | 182 | B | 212 | B |
| 153 | D | 183 | A | 213 | C |
| 154 | A | 184 | C | 214 | A |
| 155 | C | 185 | D | 215 | B |
| 156 | A | 186 | C | 216 | A |
| 157 | A | 187 | D | 217 | B |
| 158 | B | 188 | A | 218 | C |
| 159 | C | 189 | C | 219 | C |
| 160 | B | 190 | A | 220 | B |
| 161 | D | 191 | C | 221 | B |
| 162 | B | 192 | D | 222 | C |
| 163 | C | 193 | B | 223 | C |
| 164 | C | 194 | B | 224 | D |
| 165 | A | 195 | A | 225 | D |
| 166 | B | 196 | D | | |
| 167 | B | 197 | B | | |
| 168 | D | 198 | C | | |
| 169 | C | 199 | B | | |
| 170 | B | 200 | B | | |
| 171 | B | 201 | C | | |
| 172 | B | 202 | D | | |
| 173 | C | 203 | A | | |
| 174 | B | 204 | C | | |
| 175 | B | 205 | A | | |
| 176 | C | 206 | B | | |
| 177 | D | 207 | C | | |
| 178 | D | 208 | C | | |
| 179 | D | 209 | B | | |
| 180 | A | 210 | D | | |