

TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT II

PHYSICS UG SHIFT II
(FINAL)

1. If the screw on a screw-gauge is given six rotations, it moves by 3 mm on the main scale. If there are 50 divisions on the circular scale, the least count of the screw gauge is
 - (A) 0.001 cm
 - (B) 0.01 cm
 - (C) 0.001 mm
 - (D) 1 mm

2. Which one of the following equations does **NOT** represent a true simple harmonic motion? (Symbols have usual meaning.)
 - (A) $x = A \sin (\omega t + \varphi)$
 - (B) $x = A \cos (\omega t - \varphi)$
 - (C) $x = A \sin \omega t + B \cos \omega t$
 - (D) $x = A \sin (\omega t + \varphi) + B \sin (2 \omega t + \varphi)$

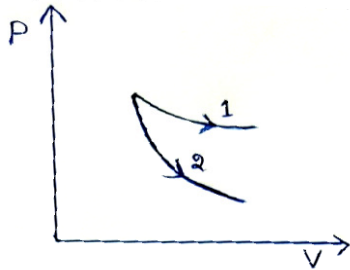
3. A wire fixed at the upper end and stretched by length l by applying a force F . The work done in stretching the wire is
 - (A) $F l$
 - (B) $2 F l$
 - (C) $\frac{F l}{2}$
 - (D) $\frac{F}{2 l}$

4. If the surface tension of a liquid is 5 Nm^{-1} , then the surface energy of this liquid film on a ring of area 0.15 m^2 is
 - (A) 0.75 J
 - (B) 1.5 J
 - (C) 2.25 J
 - (D) 3.0 J

5. For cooking purpose, it is desirable that the material of the utensil should have

- (A) low conductivity and low specific heat
- (B) high conductivity and low specific heat
- (C) low conductivity and high specific heat
- (D) high conductivity and high specific heat

6. The P-V plots for two gases (1 and 2) during adiabatic processes are shown below.



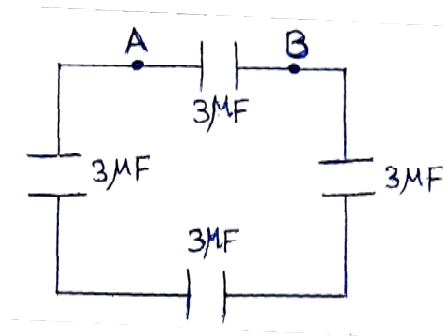
Then

- (A) 1 and 2 both should correspond to a diatomic gas
- (B) 1 corresponds to diatomic and 2 corresponds to monoatomic gas
- (C) 1 and 2 both should correspond to a monoatomic gas
- (D) 1 should correspond to monoatomic and 2 should correspond to diatomic gas

7. The average depth of Indian Ocean is about 3000 m. If the bulk modulus of ocean water is $2 \times 10^9 \text{ Nm}^{-2}$, the fractional compression $\frac{\Delta V}{V}$ of water at the bottom of the ocean will be (assume $g = 9.81 \text{ ms}^{-2}$)

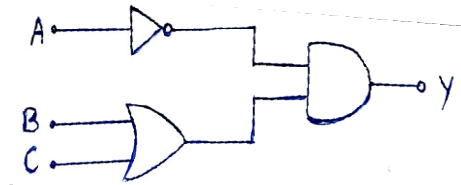
- (A) 1.36%
- (B) 1.47%
- (C) 1.8%
- (D) 2%

8. In the following circuit, the capacitance between the points A and B will be



- (A) $3 \mu\text{F}$
(B) $12 \mu\text{F}$
(C) $4 \mu\text{F}$
(D) $1 \mu\text{F}$
9. Which one of the following is most suitable for making permanent magnet?
- (A) Steel
(B) Soft iron
(C) Copper
(D) Nickel
10. A step down transformer has a 10 V secondary tapping. If the primary at 220 V draws a current of 5 A , and the secondary draws a current of 88 A , what is the efficiency of the transformer?
- (A) 8.8%
(B) 88%
(C) 80%
(D) 8%
11. If the uncertainty in the measurement of position of an electron is 10^{-10} m , what is the uncertainty in the measurement of its momentum?
- (A) $3.33 \times 10^{-24} \text{ kgms}^{-1}$
(B) $1.65 \times 10^{-25} \text{ kgms}^{-1}$
(C) $6.6 \times 10^{-24} \text{ kgms}^{-1}$
(D) $6.6 \times 10^{-20} \text{ kgms}^{-1}$

12. The Boolean expression for the circuit below is



- (A) $Y = \bar{A} \cdot B + C$
(B) $Y = \bar{A} \cdot (\bar{B} + \bar{C})$
(C) $Y = \bar{A} \cdot (B + \bar{C})$
(D) $Y = \bar{A} \cdot (B + C)$
13. Which one of the following utilizes the phenomenon of total internal reflection?
- (A) Formation of mirage
(B) Formation of rainbow
(C) Light propagation in optical fibers
(D) All of the above
14. Three stars A , B and C have surface temperature of T_A , T_B and T_C respectively. If A appears bluish, B appears reddish and C appears yellowish, then
- (A) $T_A > T_C > T_B$
(B) $T_A > T_B > T_C$
(C) $T_B > T_C > T_A$
(D) $T_C > T_B > T_A$
15. A stone of mass 200 g is tied to the end of a string of length 0.5 m. It is whirled in a circle with a frequency of 0.5 Hz. What is the tension in the string?
- (A) $\frac{\pi^2}{2}$ N
(B) $\frac{\pi^2}{4}$ N
(C) $\frac{\pi^2}{5}$ N
(D) $\frac{\pi^2}{10}$ N

16. If the gravitational force of attraction between two bodies varies as $\frac{1}{r^3}$, the period of revolution of a planet around the sun would vary as
- (A) r
 - (B) r^2
 - (C) \sqrt{r}
 - (D) $r^{3/2}$
17. Two waves $y_1 = 0.2 \sin 320t$ and $y_2 = 0.2 \sin 314t$ are propagating along the same direction. The number of beats produced per second are
- (A) $\frac{\pi}{3}$
 - (B) $\frac{3}{\pi}$
 - (C) $\frac{\pi}{2}$
 - (D) $\frac{2}{\pi}$
18. The shift in wavelength due to Doppler's effect is 0.2 \AA for a star producing wavelength of 3000 \AA . The velocity of recession of the star will be
- (A) 5 km/s
 - (B) 10 km/s
 - (C) 20 km/s
 - (D) 30 km/s
19. If the light is polarised by reflection, then the angle between reflected and refracted light is
- (A) 36°
 - (B) 45°
 - (C) 90°
 - (D) 180°

20. The ratio of the slope of isothermal and adiabatic curves is
- (A) γ
 - (B) $\frac{1}{\gamma}$
 - (C) 1
 - (D) $\frac{3}{2}$
21. Two dipoles of charges of magnitude ' e ' are placed inside a cube. What will be the total electric flux coming out of the cube?
- (A) $\frac{4e}{\epsilon_0}$
 - (B) $\frac{2e}{\epsilon_0}$
 - (C) $\frac{e}{\epsilon_0}$
 - (D) Zero
22. The ratio of magnetic field at the centre of a current carrying circular coil to its magnetic moment is r . If the current and the radius both are halved, then the new ratio becomes
- (A) $\frac{r}{2}$
 - (B) $2r$
 - (C) $\frac{r}{8}$
 - (D) $8r$
23. Lenz's law is a consequence of the law of conservation of
- (A) energy
 - (B) charge
 - (C) electric flux
 - (D) linear momentum

24. The monochromatic light is refracted from air into glass of refractive index μ . The ratio of the wavelengths of the incident and refractive waves is
- (A) 1 : 1
 - (B) μ : 1
 - (C) 1 : μ
 - (D) μ^2 : 1
25. A nucleus (atomic number 100 and mass number 200) emits four α -particles and the resultant nucleus emits five β -particles. The atomic and mass number of the final nucleus are
- (A) 191, 92
 - (B) 186, 87
 - (C) 186, 97
 - (D) 191, 97
26. A compass needle suffers a deflection when placed near a wire carrying an electric current. This was observed by
- (A) Hans Christian Oersted
 - (B) Hendrik Antoon Lorentz
 - (C) Gustav Robert Kirchhoff
 - (D) Georg Simon Ohm
27. $\oint \mathbf{B} \cdot d\mathbf{A} = 0$ is representation of
- (A) Gauss's Law for electricity
 - (B) Gauss's Law for magnetism
 - (C) Faraday's Law
 - (D) Ampere – Maxwell Law
28. In the formation of rainbows, the violet light emerges at an angle of
- (A) 10°
 - (B) 20°
 - (C) 30°
 - (D) 40°
29. In Pfund series, the value of principal quantum number ' n ' starts from
- (A) $n = 2, 3, 4, \dots$
 - (B) $n = 4, 5, 6, \dots$
 - (C) $n = 5, 6, 7, \dots$
 - (D) $n = 6, 7, 8, \dots$

30. The atomic mass of chlorine atom is
- (A) 17.23 u
 - (B) 35.47 u
 - (C) 71.47 u
 - (D) 3.547 u
31. If the total energy of the reactants is more than the products of the reaction, heat is released and the reaction is said to be an
- (A) exothermic
 - (B) endothermic
 - (C) elongate
 - (D) amplitude
32. Ultrasonic waves in air produced by a vibrating quartz crystal are
- (A) longitudinal waves
 - (B) transverse waves
 - (C) gravity waves
 - (D) electromagnetic waves
33. A point source of light is placed at a distance of $2f$ from a converging lens of focal length f . The intensity on the other side of the lens is maximum at a distance
- (A) f
 - (B) $2f$
 - (C) more than $2f$
 - (D) between f and $2f$
34. Tesla is the unit of
- (A) electric flux
 - (B) magnetic flux
 - (C) electric field
 - (D) magnetic induction
35. If the water falls from a dam into a turbine wheel 19.6 m below, then the velocity of the water at the turbine is
- (A) 9.8 m/sec
 - (B) 32.6 m/sec
 - (C) 58.8 m/sec
 - (D) 19.6 m/sec

36. A constant torque of 31.4 Nm is exerted on a pivoted wheel. If the angular acceleration of wheel is $4\pi \text{ rad/s}^2$, then the moment of inertia will be
- (A) 2.5 kgm^2
 - (B) 4.5 kgm^2
 - (C) 3.5 kgm^2
 - (D) 5.5 kgm^2
37. If the velocity of a particle is $v = At + Bt^2$ where A and B are constants. Then the distance travelled by it between 1 s and 2 s is
- (A) $\frac{3}{2}A + 4B$
 - (B) $3A + 7B$
 - (C) $\frac{3}{2}A + \frac{7}{3}B$
 - (D) $\frac{1}{2}A + \frac{1}{3}B$
38. The magnetic field in a travelling electromagnetic wave has a peak value of 35 nT. The peak value of electric field strength is
- (A) 6 V/m
 - (B) 8.3 V/m
 - (C) 10.5 V/m
 - (D) 12.5 V/m
39. The slits in Young's double slit experiment are having equal width and the source is placed symmetrically with respect to the slits. The intensity at the central fringe is I_0 . If one of the slit is closed, the intensity at this point will be
- (A) I_0
 - (B) $\frac{I_0}{4}$
 - (C) $\frac{I_0}{2}$
 - (D) $4I_0$

40. To increase the angular magnification of a simple microscope, one should increase the
- (A) focal length of the lens
 - (B) power of the lens
 - (C) aperture of the lens
 - (D) object size
41. Three capacitors of capacitances $6\mu F$ each are available. The minimum and maximum capacitances, which may be obtained are
- (A) $6\mu F, 18\mu F$
 - (B) $3\mu F, 12\mu F$
 - (C) $2\mu F, 12\mu F$
 - (D) $2\mu F, 18\mu F$
42. Consider the spectral line resulting from the transition $n = 2 \rightarrow n = 1$ in the atoms and ions given below. The shortest wavelength is produced by
- (A) hydrogen atom
 - (B) deuterium atom
 - (C) singly ionized helium
 - (D) doubly ionized lithium
43. If a pn diode is reverse biased then the resistance measured by an ohmmeter will be
- (A) zero
 - (B) low
 - (C) high
 - (D) infinite
44. An open pipe is suddenly closed at one end with the result that the frequency of the third harmonic of the closed pipe is found to be higher by 100 Hz than the fundamental frequency of the open pipe. Then the fundamental frequency of the open pipe is
- (A) 100 Hz
 - (B) 150 Hz
 - (C) 200 Hz
 - (D) 400 Hz

45. A light and a heavy body have equal kinetic energy. Which one has a greater momentum?
- (A) The heavy body
 - (B) The light body
 - (C) Both (A) and (B)
 - (D) Cannot be said
46. Internal energy per mole of gas depends on
- (A) viscosity
 - (B) density
 - (C) temperature
 - (D) thermal conductivity
47. If a sound wave enters water from air, then what remains unchanged?
- (A) Frequency
 - (B) Amplitude
 - (C) Velocity
 - (D) Wavelength
48. To convert a galvanometer into an ammeter, we should connect
- (A) a low resistance in series
 - (B) a low resistance in parallel
 - (C) a high resistance in series
 - (D) a high resistance in parallel
49. If a stationary charge is put inside a magnetic field, the charge will
- (A) move in a straight line
 - (B) move in circle
 - (C) remain stationary
 - (D) move in a helix
50. Two plane mirrors are inclined at an angle of 60° . An object is placed symmetrically between the mirrors. The total number of images formed by the two mirrors is
- (A) 4
 - (B) 6
 - (C) 5
 - (D) 7
51. What is the voltage gain in a common emitter amplifier where input resistance is 3Ω and load resistance 24Ω , $\beta = 0.6$?

- (A) 8.4
- (B) 4.8
- (C) 2.4
- (D) 480

52. Consider the following two statements (I) and (II) and identify the correct choice.

- (I) The characteristic X-ray spectrum depends on the nature of the material of the target.
- (II) The short wavelength limit of the continuous X-ray spectrum varies inversely on the potential difference applied to the X-ray tube.

- (A) (I) is true and (II) is false
- (B) (I) is false and (II) is true
- (C) Both (I) and (II) are true
- (D) Both (I) and (II) false

53. Two vectors having equal magnitudes Y make an angle α with each other. The magnitude of the resultant is

- (A) Y
- (B) $2Y$
- (C) $2Y \cos\left(\frac{\alpha}{2}\right)$
- (D) $2Y \cos(\alpha)$

54. A block slides down an incline of angle 30° with an acceleration $\frac{g}{4}$. Find the kinetic friction co-efficient

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

55. The mass of moon is 7.4×10^{22} kg and its radius is 1740 km. The escape velocity from moon is

- (A) 1740 km/s

- (B) 870.4 km/s
(C) 2.38 km/s
(D) 1.7 km/s
56. A 50 cm long horizontally placed wire of mass 20 g is fixed to a wall at one end and supports a mass of 1.6 kg at the other end hanging downwards with the help of a pulley. The length of the wire between the wall and the pulley is 40 cm. The fundamental frequency of the string between the wall and the pulley is
- (A) 15 Hz
(B) 25 Hz
(C) 50 Hz
(D) 100 Hz
57. The pressure of the gas in a constant volume gas thermometer is 80 cm of mercury in melting ice at 1 atm. When the bulb is placed in a liquid, the pressure becomes 160 cm of mercury. The temperature of liquid is
- (A) 273.15 K
(B) 373.15 K
(C) 546.30 K
(D) 636.15 K
58. A parallel plate capacitor has plates of area 200 cm^2 and the separation between the plates 1.00 mm. What potential difference will be developed if a charge of 1.00 nC is given to the capacitor?
- (A) 0.17 V
(B) 1.00 V
(C) 5.65 V
(D) 11.30 V
59. Ultraviolet light of wavelength 280 nm is used in an experiment on photoelectric effect with lithium cathode whose work function is 2.5 eV. Find the maximum kinetic energy of the photoelectrons
- (A) 1.9 eV
(B) 2.5 eV
(C) 4.4 eV
(D) 7.5 eV
60. A cart of weight 72 kg, and a man of weight 65 kg move towards each other on a smooth horizontal surface. The velocity of the cart and the man are 3 km/h

and 6 km/h respectively. When the man reaches the cart, he jumps into it. Then the speed of the cart carrying the man is

- (A) 4.42 km/h
- (B) 3.23 km/h
- (C) 1.87 km/h
- (D) 1.27 km/h

61. If the linear momentum is increased by 50%, then kinetic energy will be increased by

- (A) 50%
- (B) 20%
- (C) 125%
- (D) 100%

62. A heater coil is cut into two equal parts and only one part is now used in the heater. The heat generated will now be

- (A) doubled
- (B) four times
- (C) one-fourth
- (D) halved

63. An electron is projected with uniform velocity along the axis of a current carrying long solenoid. Which of the following is true?

- (A) The electron will be accelerated along the axis
- (B) The electron path will be circular about the axis
- (C) The electron will experience a force at 45° to the axis and hence execute a helical path
- (D) The electron will continue to move with uniform velocity along the axis of the solenoid

64. The polarity of induced emf is given by

- (A) Ampere's circuital law
- (B) Biot-Savart law
- (C) Lenz's law
- (D) Fleming's right hand rule

65. In an n-type silicon, which of the following statement is true?
- (A) Electrons are the majority carriers and trivalent atoms are the dopants
 - (B) Electrons are the minority carriers and pentavalent atoms are the dopants
 - (C) Holes are the minority carriers and pentavalent atoms are the dopants
 - (D) Holes are the majority carriers and trivalent atoms are the dopants
66. The amplitude of the magnetic field of harmonic electromagnetic wave in vacuum is $B_0 = 450 \text{ nT}$. What is the amplitude of electric field part of the wave?
- (A) 140 N/C
 - (B) 135 N/C
 - (C) 130 N/C
 - (D) 145 N/C
67. There is no atmosphere on the Moon because
- (A) it is closer to the Earth
 - (B) it revolves around the Earth
 - (C) it gets light from the Sun
 - (D) the root mean square velocity of the gas molecules is more than the escape velocity from moon
68. Which one of the following is **NOT** a conservative force?
- (A) Magnetic force
 - (B) Force of friction
 - (C) Gravitational force
 - (D) Electrostatic force
69. The motion of holes and free electrons due to thermal agitation is called
- (A) diffusion
 - (B) drift
 - (C) translation
 - (D) conduction
70. The color of an LED can be changed by
- (A) increasing the charge carriers
 - (B) varying the doping level of the semiconductors
 - (C) increasing applied voltage
 - (D) by using different bandgap semiconductors

71. Consider a system of two identical particles. One of the particles is at permanent rest and the other has acceleration a . The centre of mass has acceleration
- (A) Zero
 - (B) $\frac{a}{2}$
 - (C) a
 - (D) $2a$
72. The unit of specific resistance is
- (A) Ω
 - (B) Ω^2
 - (C) Ω metre
 - (D) Ω/m
73. Streamline flow is more likely for liquid with
- (A) high density and high viscosity
 - (B) low density and low viscosity
 - (C) high density and low viscosity
 - (D) low density and high viscosity
74. In a nuclear reaction, which of the following is/are conserved?
- (A) Mass only
 - (B) Energy only
 - (C) Momentum only
 - (D) Mass, energy and momentum
75. Resistance of the metallic conductors
- (A) increases with rise in temperature
 - (B) decreases with rise in temperature
 - (C) remains unchanged with change in temperature
 - (D) becomes zero at very high temperature

CHEMISTRY (UG) – **SHIFT II**
(FINAL)

76. Which of the following sets of conditions makes a process spontaneous at all temperatures?
- (A) $\Delta H = 0; \Delta S > 0$
 - (B) $\Delta H = 0; \Delta S < 0$
 - (C) $\Delta H < 0; \Delta S > 0$
 - (D) $\Delta H < 0; \Delta S < 0$
77. The alkali hydrolysis of an ester represented by
 $\text{RCOOR}' + \text{OH}^- \longrightarrow \text{RCOO}^- + \text{R}'\text{OH}$
This reaction is,
- (A) bimolecular and second-order
 - (B) bimolecular but first-order
 - (C) bimolecular but not second-order
 - (D) second-order but not bimolecular
78. Which of the following can be used to measure pH?
- (A) Glass electrode
 - (B) Hydrogen electrode
 - (C) Quinhydrone electrode
 - (D) All of the above
79. Kinetic energy of a single molecule is given by the expression
- (A) RT
 - (B) RT/N
 - (C) kT
 - (D) $1.5RT/N$
80. In a reversible isothermal process change in internal energy
- (A) $\Delta U = 0$
 - (B) $\Delta U > 0$
 - (C) $\Delta U < 0$
 - (D) $\Delta U = P\Delta V$

81. Heat of formation of sulphur dioxide, $\Delta H = -297$ kJ. The heat liberated on burning 8 g of sulphur in oxygen is
- (A) 297 kJ
 - (B) 223 kJ
 - (C) 148.5 kJ
 - (D) 74.25 kJ
82. In physical adsorption, the forces of attraction are,
- (A) ionic
 - (B) covalent
 - (C) Van der Waal's
 - (D) H-bonding
83. In a second order reaction $2A \rightarrow$ products, if the concentration of A is doubled, $t_{1/2}$ of the reaction
- (A) doubled
 - (B) quadrupled
 - (C) halved
 - (D) unchanged
84. The ionic strength (μ) for 0.1 M BaCl_2 is given by
- (A) 0.3 M
 - (B) 0.1 M
 - (C) 0.2 M
 - (D) 0.6 M
85. If 60 calories are added to a system and system does work of 20 calories on the surroundings, the change in internal energy of system?
- (A) 20 calories
 - (B) 50 calories
 - (C) 40 calories
 - (D) 30 calories
86. For certain reaction $R \rightarrow P$, the value of ΔH and ΔS are 60 KJ and 80 JK^{-1} respectively. The temperature at which $\Delta G = 0$ is
- (A) 477°C
 - (B) 750°C
 - (C) 800°C
 - (D) 450°C

87. Root mean square velocity of molecule A is four times greater than that of molecule B at same temperature. The ratio of molecular weight of A to B ($M_A : M_B$)
- (A) 1 : 4
(B) 2 : 1
(C) 4 : 1
(D) 1 : 16
88. The molecule which has zero dipole moment is
- (A) CH_2Cl_2
(B) BF_3
(C) NF_3
(D) ClO_2
89. Limiting molar conductivity of NH_4OH (i.e., $\Lambda_m^0(\text{NH}_4\text{OH})$) is equal to
- (A) $\Lambda_m^0(\text{NH}_4\text{Cl}) + \Lambda_m^0(\text{NaCl}) - \Lambda_m^0(\text{NaOH})$
(B) $\Lambda_m^0(\text{NaOH}) + \Lambda_m^0(\text{NaCl}) - \Lambda_m^0(\text{NH}_4\text{Cl})$
(C) $\Lambda_m^0(\text{NH}_4\text{OH}) + \Lambda_m^0(\text{NH}_4\text{Cl}) - \Lambda_m^0(\text{HCl})$
(D) $\Lambda_m^0(\text{NH}_4\text{Cl}) + \Lambda_m^0(\text{NaOH}) - \Lambda_m^0(\text{NaCl})$
90. If a spoon of copper metal is placed in a solution of ferrous sulphate, then
- (A) Cu will precipitate out
(B) Iron will precipitate
(C) Cu and Fe will precipitate
(D) no reaction will take place
91. The vapour pressure of two liquids P and Q are 80 and 60 Torr respectively. The total vapour pressure of the solution obtained by mixing three moles of P and two moles of Q would be
- (A) 68 Torr
(B) 72 Torr
(C) 140 Torr
(D) 20 Torr

92. $3A \rightarrow 2B$ then the rate of reaction $\frac{d[B]}{dt}$

(A) $-\frac{3}{2} \frac{d[A]}{dt}$

(B) $-\frac{2}{3} \frac{d[A]}{dt}$

(C) $-\frac{1}{3} \frac{d[A]}{dt}$

(D) $2 \frac{d[A]}{dt}$

93. Unit of third order reaction

(A) $L^2 \text{ mol}^{-2} \text{ t}^{-1}$

(B) $\text{mol}^{-1} L^{-1} \text{ t}^{-1}$

(C) $\text{mol} L^{-1} \text{ S}^{-1}$

(D) $\text{mol}^{-1} \text{ S}^{-1}$

94. A compound X has face centred cubic structure its density is 3.4 g cm^{-3} . The length of the unit cell is (molecular weight of X is 99 g/mol)

(A) 5.78 \AA

(B) 6.78 \AA

(C) 7.78 \AA

(D) 8.783 \AA

95. The orbital angular momentum of an electron in 2s orbital is

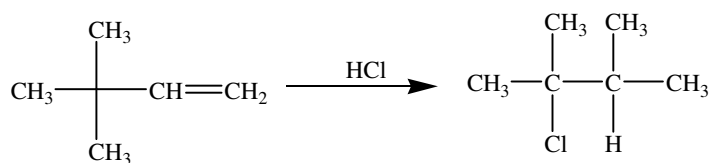
(A) zero


(B) one

(C) two

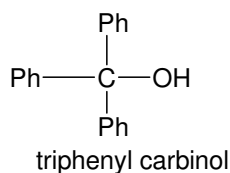
(D) three

96. Following reaction involves



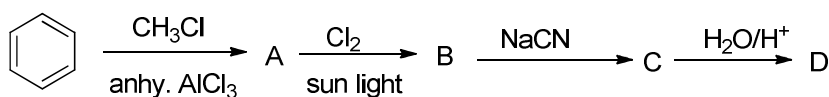
- (A) Anti Markovnikov addition and rearrangement
(B) Markovnikov addition and rearrangement
(C) Rearrangement followed by Markovnikov addition
(D) Rearrangement followed by anti Markovnikov addition
97. What is the function of heme in the human body?
- (A) It helps transport oxygen in the blood
(B) It helps to digest food in the stomach
(C) It is a structural component of cell membranes
(D) It is a cofactor in enzymes involved in DNA replication
98. What does a full “curved” arrow () signify while writing reaction mechanisms?
- (A) That two structures are enantiomers
(B) Represents movement of two electrons in the direction of the arrow
(C) Represents movement of an atom or a group in the direction of the arrow
(D) Resonating structures
99. How many distinct internal alkynes share the molecular formula C₆H₁₀ ?
- (A) 4
(B) 3
(C) 2
(D) 1
100. Which among the following *essential* amino acids has sulphur containing side chain?
- (A) Glycine
(B) Cysteine
(C) Methionine
(D) Tyrosine

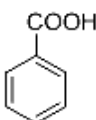
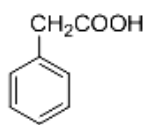
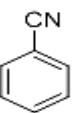
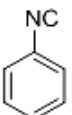
101. Triphenyl carbinol can be prepared in one pot by the reaction of two equivalents of phenylmagnesium bromide with



- (A) $\text{C}_6\text{H}_5\text{COOH}$ (benzoic acid)
(B) $\text{C}_6\text{H}_5\text{CN}$ (benzotrile)
(C) PhCOOCH_3 (methyl benzoate)
(D) PhCHO (benzaldehyde)
102. Which among the following reaction sequences would result in retention of configuration at the reaction centre?
- (A) $\text{S}_{\text{N}}1$ followed by $\text{E}1$
(B) $\text{S}_{\text{N}}2$ followed by $\text{E}2$
(C) $\text{S}_{\text{N}}2$ followed by another $\text{S}_{\text{N}}2$
(D) $\text{S}_{\text{N}}2$ followed by $\text{S}_{\text{N}}1$
103. Which among the following compounds is **NOT** formed in the positive test for nitrogen in Lassaigne's test for aniline?
- (A) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$
(B) $\text{Na}_3[\text{Fe}(\text{CN})_6]$
(C) $\text{Fe}(\text{CN})_3$
(D) $\text{Na}_3[\text{Fe}(\text{CN})_5\text{NOS}]$
104. An alkene on ozonolysis followed by hydrolysis gave acetaldehyde as the only product. This alkene can exhibit
- (A) optical isomerism
(B) geometrical isomerism
(C) both optical and geometrical isomerism
(D) neither optical nor geometrical isomerism

105. In the below sequence of reactions, 'D' is



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

106. Glucose and fructose are

- (A) optical isomers
(B) tautomers
(C) functional isomers
(D) chain isomers

107. In nucleic acids the phosphate diester bond links

- (A) two sugar units at the 5', 3' positions
(B) two nitrogen bases together
(C) one sugar unit with one nitrogen base
(D) two nucleic acid strands together

108. When injured, body generates prostaglandins as a warning signal. Prostaglandins stimulate inflammation in the tissue and cause sensation of pain. Which among the following drugs can inhibit the generation of prostaglandins?

- (A) Meprobamate
(B) Dimetap
(C) Aspirin
(D) Salvarsan

109. Pick the statement that is **NOT** true for Freon refrigerant R-22.
- (A) It causes ozone depletion
 - (B) Its molecular formula is CCl_2F_2
 - (C) It is prepared from CHCl_3
 - (D) It is used for preparing tetrafluoroethene (C_2F_4)
110. Ethylmagnesium Iodide on treatment with water gives
- (A) Ethanol
 - (B) Ethene
 - (C) Ethane
 - (D) n-Butanol
111. Phenol reacts with bromine in water at room temperature to give
- (A) 4-bromophenol without the evolution of HBr
 - (B) a mixture of 2- and 4- bromophenols without the evolution of HBr
 - (C) the corresponding addition product 1,2,3,4,5,6-hexabromocyclohexanol
 - (D) 2,4,6-tribromophenol with the evolution of HBr
112. Base catalyst condensation between two molecules of acetaldehyde to give 3-hydroxybutanal is an example for
- $$\text{CH}_3\text{CHO} \xrightarrow{\text{OH}^-} \text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CHO}$$
- (A) Stobbe condensation
 - (B) Benzoin condensation
 - (C) Aldol condensation
 - (D) Perkin reaction
113. Hybridization and geometry of carbon in ethene are
- (A) sp^3 and Planar
 - (B) sp^2 and Planar
 - (C) sp and Linear
 - (D) sp^2 and Tetrahedral
114. Taj Mahal is being slowly disfigured and discoloured. This is primarily due to
- (A) acid rain
 - (B) deposition of soot from stubble burning
 - (C) increased exposure to UV light due to ozone depletion
 - (D) global warming

115. Major product formed in the reaction of toluene with N-Bromosuccinimide (NBS) in presence of benzoyl peroxide is
- (A) a mixture of 2- and 4-bromotoluene
 - (B) benzyl bromide
 - (C) 3-bromotoluene
 - (D) 4-bromotoluene
116. The correct order of the ionic radii of O^{2-} , N^{3-} , F^{-} , Mg^{2+} , Na^{+} and Al^{3+} is
- (A) $N^{3-} < O^{2-} < F^{-} < Na^{+} < Mg^{2+} < Al^{3+}$
 - (B) $Al^{3+} < Na^{+} < Mg^{2+} < O^{2-} < F^{-} < N^{3-}$
 - (C) $Al^{3+} < Mg^{2+} < Na^{+} < F^{-} < O^{2-} < N^{3-}$
 - (D) $N^{3-} < F^{-} < O^{2-} < Mg^{2+} < Na^{+} < Al^{3+}$
117. Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar?
- (A) $Ca < S < Ba < Se < Ar$
 - (B) $S < Se < Ca < Ba < Ar$
 - (C) $Ba < Ca < Se < S < Ar$
 - (D) $Ca < Ba < S < Se < Ar$
118. Among the following molecules/ions:
 C_2^{2-} , N_2^{2-} , O_2^{2-} , O_2 , which one is diamagnetic and exhibiting the highest bond length?
- (A) O_2
 - (B) N_2^{2-}
 - (C) C_2^{2-}
 - (D) O_2^{2-}
119. Which of the following has unpaired electron(s)?
- (A) N_2
 - (B) O_2^{-}
 - (C) O_2^{2+}
 - (D) O_2^{2-}

120. The number of protons, electrons and neutrons in a molecule of heavy water are respectively

- (A) 8,10,11
- (B) 10,10,10
- (C) 10,11,10
- (D) 11,10,10

121. Which of the following metals is used in photoelectric cell?

- (A) Na
- (B) Li
- (C) Rb
- (D) Cs

122. Strong heating of an aqueous solution of aluminium chloride to dryness will give

- (A) Al(OH)Cl_2
- (B) Al_2O_3
- (C) Al_2Cl_6
- (D) AlCl_3

123. The alloy used in the construction of aircrafts is

- (A) Mg-Al
- (B) Mg-Zn
- (C) Mg-Sn
- (D) Mg-Mn

124. Match the ores (Column A) with the metals (Column B):

(Column A)	(Column B)
(I) Siderite	(a) Zinc
(II) Kaolinite	(b) Copper
(III) Malachite	(c) Iron
(IV) Calamine	(d) Aluminium

- (A) (I) –(a); (II) – (b); (III) –(c); (IV) – (d)
- (B) (I) –(c); (II) – (d); (III) –(b); (IV) – (a)
- (C) (I) –(c); (II) – (d); (III) –(a); (IV) – (b)
- (D) (I) –(b); (II) – (c); (III) –(d); (IV) – (a)

125. Which one of the following substances has the highest proton affinity?
- (A) H_2S
 - (B) NH_3
 - (C) PH_3
 - (D) H_2O
126. Which of the following has maximum number of lone pairs associated with Xe?
- (A) XeF_4
 - (B) XeF_6
 - (C) XeF_2
 - (D) XeO_3
127. Which of the following does **NOT** show +4 oxidation state?
- (A) Dy
 - (B) Ce
 - (C) Eu
 - (D) Tb
128. Which one of the following is paramagnetic?
- (A) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
 - (B) $[\text{Ni}(\text{CN})_4]^{2-}$
 - (C) $[\text{Co}(\text{CN})_6]^{3-}$
 - (D) $[\text{Ni}(\text{CO})_4]$
129. The compound used in the treatment of lead poisoning is
- (A) D-penicillamine
 - (B) Desferrioxime B
 - (C) Cis-Platin
 - (D) EDTA
130. Which of the following gases will have least volume, if 5 g of each gas is taken at the same temperature and pressure?
- (A) N_2
 - (B) O_2
 - (C) HCl
 - (D) SO_2

131. What will be the standard molar volume of Ne, if its density is 0.8999 g/L at STP?
- (A) 11.2 L
(B) 5.6 L
(C) 2.8 L
(D) 22.4 L
132. How many electrons are associated with the quantum number $n = 4$?
- (A) 32
(B) 64
(C) 16
(D) 8
133. Salvarsan, which is used for the syphilis treatment, contains
- (A) phosphorus
(B) arsenic
(C) antimony
(D) iron
134. The crystal field stabilization energy (CFSE) for an octahedral complex; $[\text{CoCl}_6]^{4-}$ is 18000 cm^{-1} . The CFSE for tetrahedral $[\text{CoCl}_4]^{2-}$ will be
- (A) greater than that of $[\text{CoCl}_6]^{4-}$
(B) 15000 cm^{-1}
(C) equal to that of $[\text{CoCl}_6]^{4-}$
(D) 8000 cm^{-1}
135. Hybridization of $[\text{Fe}(\text{CN})_6]^{3-}$
- (A) $sp^3 d^2$
(B) $sp^3 d$
(C) $d^2 sp^3$
(D) dsp^3

MATHEMATICS UG
(SHIFT – II FINAL)

136. The number of words that can be formed from the letters a, b, c, d, e, f taken 3 at a time, each word continuing at least one vowel is
- (A) 84
(B) 96
(C) 102
(D) 112
137. The number of ordered triples (x, y, z) such that x, y, z are primes and $x^y + 1 = z$ is
- (A) 0
(B) 1
(C) 2
(D) 3
138. If n is an integer between 0 and 21, then the minimum value of $n!(21-n)!$ is
- (A) $9! 21!$
(B) $10! 11!$
(C) $20!$
(D) $21!$
139. The sum of the rational terms in the expansion of $(\sqrt{2} + \sqrt[5]{3})^{10}$ is
- (A) 9
(B) 31
(C) 32
(D) 41
140. Let p, q, r be three real numbers. Then the system $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1,$
 $\frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1, -\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ has
- (A) no solution
(B) unique solution
(C) finitely many solution
(D) infinitely many solution

141. The system of equations $kx + 2y - z = 1$, $(k - 1)y - 2z = 2$ and $(k + 2)z = 3$ have only one solution when

- (A) $k = -2$
- (B) $k = -1$
- (C) $k = 0$
- (D) $k = 1$

142. If $S = \sum_{n=0}^{\infty} \frac{(\log x)^{2n}}{(2n)!}$, then S is equal to

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

143. For $p, q \in \mathbb{Z}$, $p | q$ means p is a factor of q . Then ' $|$ ' is

- (A) reflexive and symmetric
- (B) symmetric and transitive
- (C) reflexive and not transitive
- (D) reflexive, transitive but not symmetric

144. Let \sim be the binary relation defined on \mathbb{R} defined by $a \sim b$ if and only if $a - b + \sqrt{3}$ is an irrational number. Then \sim is

- (A) an equivalence relation
- (B) transitive only
- (C) symmetric only
- (D) reflexive only

145. One ticket is selected at random from 50 tickets numbered 00,01,...,49. Then the probability that the sum of the digits on the selected ticket is 8, given that the product of these digits is zero, equals

(A) $\frac{1}{7}$

(B) $\frac{1}{14}$

(C) $\frac{5}{14}$

(D) $\frac{5}{7}$

146. A number n is chosen at random from $\{1,2,3,\dots,1000\}$. The probability that n is a number that bears remainder 1 when divided by 7 is

(A) $\frac{71}{500}$

(B) $\frac{143}{1000}$

(C) $\frac{72}{500}$

(D) $\frac{71}{1000}$

147. The value of $\cos A \cdot \cos(60^\circ - A) \cos(60^\circ + A)$ is

(A) $\frac{1}{2} \cos 3A$

(B) $\frac{\cos 3A}{4}$

(C) $\cos 3A$

(D) 1

148. If $\sin x + \cos x = \frac{\sqrt{7}}{2}$ where $x \in \left[0, \frac{\pi}{4}\right]$, then $\tan \frac{x}{2}$ is equal to

(A) $\frac{3 + \sqrt{7}}{2}$

(B) $\frac{3 - \sqrt{7}}{2}$

(C) $\frac{4 - \sqrt{7}}{3}$

(D) $\frac{\sqrt{7} - 2}{3}$

149. The maximum value of $\sin\left(x + \frac{\pi}{6}\right) + \cos\left(x + \frac{\pi}{6}\right)$ in the interval $\left(0, \frac{\pi}{2}\right)$ is attained at

(A) $\frac{\pi}{12}$

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

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

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

150. The number of values of $\theta \in [0, 5\pi]$ satisfying the equation $3 \cos 2\theta - 10 \cos \theta + 7 = 0$ is

(A) 1

(B) 2

(C) 6

(D) 8

151. Let ABC be a triangle with $\tan \frac{A}{2}$ and $\tan \frac{B}{2}$ are roots of $bx^2 - 5x + 1 = 0$. Then the triangle is

(A) equilateral

(B) isosceles

(C) right angled

(D) a triangle with the largest angle 70°

152. The lines of regression of y on x and x on y are respectively $y=x$ and $4x-y-3=0$ and the second moment about the origin of x is 2. The variance of y is

- (A) 9
- (B) 8
- (C) 5
- (D) 4

153. The ranges of k for which the circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 4kx + 9 = 0$ have two common tangents, are

- (A) $k < \frac{13}{8}$
- (B) $1 < k < \frac{13}{8}$
- (C) $k > \frac{13}{8}$ or $k < -\frac{13}{8}$
- (D) $k \in \left(-\frac{13}{8}, \frac{13}{8}\right)$

154. Let $f(x) = \sin x$, $g(x) = 2x$ and $h(x) = \cos x$. If $\phi(x) = (g \circ fh)(x)$, then $\phi''\left(\frac{\pi}{4}\right) =$

- (A) 2
- (B) -2
- (C) -4
- (D) 4

155. The inverse of the function $f(x) = \frac{3^x - 3^{-x}}{3^x + 3^{-x}}$ is

- (A) $\frac{1}{2} \log_3 \left(\frac{1-x}{1+x} \right)$
- (B) $\frac{1}{3} \log_e \left(\frac{1-x}{1+x} \right)$
- (C) $\frac{1}{2} \log_3 \left(\frac{1+x}{1-x} \right)$
- (D) $\frac{1}{3} \log_e \left(\frac{1+x}{1-x} \right)$

156. $\lim_{x \rightarrow 0} \frac{\log(1+x+x^2) + \log(1-x+x^2)}{\sec x - \cos x} =$

- (A) 0
- (B) ∞
- (C) 1
- (D) -1

157. The set of values of x for which $\log(1+x) < x$, is

- (A) $x < 0$
- (B) $x > 0$
- (C) $0 < x < 1$
- (D) $x > 1$

158. If $\int \log(1+x^2) dx = x \log(1+x^2) - k + c$, where c is a constant, then the value of k is

- (A) $2x + 2 \tan^{-1} x$
- (B) $-2x + 2 \tan^{-1} x$
- (C) $2x - 2 \tan^{-1} x$
- (D) $-2x - 2 \tan^{-1} x$

159. Let $I = \int_0^1 \frac{\sin t}{1+t} dt$. Then $\int_{4\pi-2}^{4\pi} \frac{\sin t/2}{4\pi+2-t} dt =$

- (A) $2I$
- (B) $-2I$
- (C) I
- (D) $-I$

160. The differential equation $\frac{dy}{dx} = \frac{x(1+y^2)}{y(1+x^2)}$ represents

- (A) straight line
- (B) hyperbola
- (C) circle
- (D) ellipse

161. The number of real solutions of the equation $\frac{6-x}{x^2-4} = 2 + \frac{x}{x+2}$ is

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

162. The number of integral solutions of $\frac{x+2}{x^2+1} > \frac{1}{2}$ is

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

163. If $3^{49}(x+iy) = \left(\frac{3}{2} + \frac{\sqrt{3}}{2}i\right)^{100}$ and $x = ky$, then k is

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

164. The equation **NOT** representing a circle is given by

(A) $\operatorname{Re}\left(\frac{1+z}{1-z}\right) = 0$

(B) $z\bar{z} + iz - i\bar{z} + 1 = 0$

(C) $\arg\left(\frac{z-1}{z+1}\right) = \frac{\pi}{2}$

(D) $\left|\frac{z-1}{z+1}\right| = 1$

165. If $\frac{1}{1^4} + \frac{1}{2^4} + \dots + \infty = \frac{\pi^4}{90}$, then $\frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \dots + \infty$ is equal to

(A) $\frac{\pi^4}{96}$

(B) $\frac{\pi^4}{45}$

(C) $\frac{89\pi^4}{90}$

(D) $\frac{\pi^4}{46}$

166. The sum of first n terms of the series $1^2 + 2 \cdot 2^2 + 3^2 + 2 \cdot 4^2 + 5^2 + 2 \cdot 6^2 + \dots$ is $\frac{n(n+1)^2}{2}$ when n is even. When n is odd, the sum is

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

(B) $\frac{n(n+1)^2}{2}$

(C) $\left[\frac{n(n+1)}{2}\right]^2$

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

167. The sum of the series $1 + \frac{3}{2} + \frac{7}{4} + \frac{15}{8} + \frac{31}{16} + \dots$ to n terms is equal to

(A) $2n - \frac{1}{2^n}$

(B) $2 + \frac{1}{2^n}$

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

(D) $2(n-1) + \frac{1}{2^{n-1}}$

168. If the value of k for which the equation $3x^2 + 2(k^2 + 1)x + (k^2 - 3k + 2) = 0$ possesses roots of opposite sign lies in

- (A) $(-\infty, 1)$
- (B) $(-\infty, 0)$
- (C) $(1, 2)$
- (D) $\left(\frac{3}{2}, 2\right)$

169. Let α and β be roots of the equation $x^2 + x\sqrt{\alpha} + \beta = 0$. Then

- (A) $\alpha = 1, \beta = -1$
- (B) $\alpha = 1, \beta = -2$
- (C) $\alpha = 2, \beta = 1$
- (D) $\alpha = 2, \beta = -2$

170. Consider the region $5x + y \leq 100, x + y \leq 60, x \geq 0, y \geq 0$. Then the point $(25, 40)$

- (A) lies outside the region
- (B) is on the boundary
- (C) lies inside the region
- (D) is the only point in the region

171. If α and β are the roots of the equation $x^2 + x + 1 = 0$, then the equation whose roots are α^{19} and β^7 is

- (A) $x^2 - x + 1 = 0$
- (B) $x^2 + x - 1 = 0$
- (C) $x^2 + x + 1 = 0$
- (D) $x^2 - x - 1 = 0$

172. Let $(1 + i)(1 + 2i)(1 + 3i) \dots (1 + 20i) = a + ib$. Then $2.5 \cdot 10 \dots .401$ is equal to

- (A) $a - bi$
- (B) ab
- (C) $a^2 - b^2$
- (D) $a^2 + b^2$

173. If $f(x) = \log|x|$, $x \neq 0$ then $f'(x)$ equals

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

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

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

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

174. $\int \frac{dx}{x\sqrt{x^6-16}}$ is equal to

(A) $\frac{1}{3} \sec^{-1}\left(\frac{x^3}{4}\right) + c$

(B) $\cosh^{-1}\left(\frac{x^3}{4}\right) + c$

(C) $\frac{1}{12} \sec^{-1}\left(\frac{x^3}{4}\right) + c$

(D) $\sec^{-1}\left(\frac{x^3}{4}\right) + c$

175. The solution of the differential equation $x + y \frac{dy}{dx} = 0$ is a family of

(A) straight lines

(B) circles

(C) ellipses

(D) parabolas

176. Assume that z satisfies the condition that the imaginary part of $\frac{3z}{iz+1}$ is -1 . Then the locus of z is

(A) a point

(B) a circle

(C) a pair of straight lines

(D) an ellipse

177. Given that a, b, c are in Arithmetic Progression and $|a|, |b|, |c| < 1$.

Let $p = 1 + a + a^2 + \dots + \infty$, $q = 1 + b + b^2 + \dots + \infty$ and $r = 1 + c + c^2 + \dots + \infty$. Then p, q, r are in

- (A) AP
- (B) GP
- (C) HP
- (D) equal

178. The equation of the common tangent touching the circle $(x-3)^2 + y^2 = 9$ and the parabola $y^2 = 4x$ above the x -axis is

- (A) $\sqrt{3}y = 3x + 1$
- (B) $\sqrt{3}y = -(x + 3)$
- (C) $\sqrt{3}y = x + 3$
- (D) $\sqrt{3}y = -(3x + 1)$

179. Which of the following is a contradiction?

- (A) $p \vee q$
- (B) $p \wedge q$
- (C) $p \vee \sim p$
- (D) $p \wedge \sim p$

180. The length of the straight line $x - 3y - 1 = 0$ intercepted by the hyperbola $x^2 - 4y^2 = 1$ is

- (A) $\frac{6}{5}\sqrt{10}$
- (B) $\frac{6}{7}\sqrt{10}$
- (C) $\sqrt{10}$
- (D) $\frac{6}{5}$

181. If P represents $z = x + iy$ in the argand plane and $|z - 1|^2 + |z + 1|^2 = 4$, then the locus of P is
- (A) $x^2 + y^2 = 2$
 - (B) $x^2 + y^2 = 1$
 - (C) $x^2 + y^2 = 4$
 - (D) $x + y = 2$
182. If $y = x - x^2$, then the derivative of y^2 with respect to x^2 is
- (A) $2x^2 - 3x + 1$
 - (B) $2x^2 + 3x + 1$
 - (C) $2x^2 - 3x - 1$
 - (D) $2x^2 - 6x + 1$
183. The range of the function $e^x + e^{f(x)} = e$ is
- (A) $(-\infty, 1]$
 - (B) $[1, \infty)$
 - (C) $(1, \infty)$
 - (D) $(-\infty, 1)$
184. The points on the curve $y^2 = 4a \left(x + a + \sin \frac{x}{a} \right)$ at which the tangent is parallel to x -axis, lie on
- (A) a straight line
 - (B) a circle
 - (C) an ellipse
 - (D) a parabola
185. The least integer value of m such that $(m - 2)x^2 + 8x + m + 4 > 0$ for all $x \in R$ is
- (A) 10
 - (B) 2
 - (C) 12
 - (D) 5

186. Let $R = \{(3, 3), (6, 6), (9, 9), (12, 12), (6, 12), (3, 9), (3, 12), (3, 6)\}$ be a relation on the set $A = \{3, 6, 9, 12\}$. Then the relation R is
- (A) reflexive and transitive only
 - (B) an equivalence relation
 - (C) reflexive only
 - (D) reflexive and symmetric only
187. The total number of solutions of $\sin^4 x + \cos^4 x = \sin x \cdot \cos x$ in $[0, 2\pi]$ is equal to
- (A) 2
 - (B) 4
 - (C) 6
 - (D) 8
188. Let a, b, c be distinct non-negative numbers. If the vectors $a\hat{i} + a\hat{j} + c\hat{k}$, $\hat{i} + \hat{k}$ and $c\hat{i} + c\hat{j} + b\hat{k}$ lie in a plane, then c is
- (A) the harmonic mean of a and b
 - (B) equal to 0
 - (C) the arithmetic mean of a and b
 - (D) the geometric mean of a and b
189. The angle between the straight line $\vec{r} = (2\vec{i} + 3\vec{j} + \vec{k}) + t(\hat{i} - \hat{j} + \hat{k})$ and the plane $2x - y + z = 5$ is
- (A) $\sin^{-1}\left(\frac{2}{3\sqrt{3}}\right)$
 - (B) $\sin^{-1}\left(\frac{2\sqrt{3}}{3}\right)$
 - (C) $\cos^{-1}\left(\frac{3}{2\sqrt{3}}\right)$
 - (D) $\cos^{-1}\left(\frac{2}{3}\right)$

190. The number of variety of salads can be made from cucumber, tomatoes, apples, oranges and bananas is
- (A) 16
 - (B) 31
 - (C) 32
 - (D) 62
191. If the three points $U(1, 6)$, $V(3, -4)$ and $W(a, b)$ are collinear, then the equation satisfying by a and b is
- (A) $5a + b - 11 = 0$
 - (B) $5a + 13b + 5 = 0$
 - (C) $5a - 13b + 5 = 0$
 - (D) $13a - 5b + 5 = 0$
192. Two n bit binary strings, S_1 and S_2 are chosen randomly with uniform probability. The probability that the Hamming distance between these strings (the number of bit positions where the two strings differ) is equal to
- (A) $\frac{d}{2^n}$
 - (B) $\frac{nC_d}{2^d}$
 - (C) $\frac{nC_d}{2^n}$
 - (D) $\frac{1}{2^d}$
193. The value of the integral $\int_C \frac{\cos(2\pi z)}{(2z-1)(z-3)} dz$ where C is a closed curve given by $|z|=1$ is
- (A) πi
 - (B) $-\pi i$
 - (C) $\frac{\pi i}{5}$
 - (D) $\frac{2\pi i}{5}$

194. The angle between the line $\frac{x+1}{2} = \frac{y}{3} = \frac{z-3}{6}$ and the plane $3x + y + z = 7$ is

(A) $\sin^{-1}\left(\frac{7\sqrt{11}}{15}\right)$

(B) $\sin^{-1}\left(\frac{15}{7\sqrt{11}}\right)$

(C) $\cos^{-1}\left(\frac{7\sqrt{11}}{15}\right)$

(D) $\cos^{-1}\left(\frac{15}{7\sqrt{11}}\right)$

195. A solution to $\sqrt{x-5} - \sqrt{9-x} > 1$, $x \in \mathbb{Z}$ is

(A) 4

(B) 9

(C) 5

(D) 8

196. If α, β, γ are the roots of the equation $x^3 + 4x + 1 = 0$, then the value of $(\alpha + \beta)^{-1} + (\beta + \gamma)^{-1} + (\gamma + \alpha)^{-1}$ is

(A) 2

(B) -1

(C) 4

(D) 0

197. The locus of $\operatorname{Re}(z+1) = |z-1|$ is

(A) a straight line

(B) a circle

(C) a parabola

(D) an ellipse

198. The sum of the series $\sum_{k=1}^{360} \left(\frac{1}{k\sqrt{k+1} + (k+1)\sqrt{k}} \right)$ is
- (A) $\frac{17}{19}$
(B) $\frac{18}{19}$
(C) $\frac{16}{19}$
(D) $\frac{20}{19}$
199. Let $f(x)$ be a polynomial of degree 3 such that $f(3) = 1$, $f'(3) = -1$, $f''(3) = 0$ and $f'''(3) = 12$. Then the value of $f'(1)$ is
- (A) 12
(B) 23
(C) -13
(D) 0
200. The value of the integral $\int_a^{a+\frac{\pi}{2}} (|\sin x| + |\cos x|) dx$ is
- (A) $a\pi$
(B) $2a\pi$
(C) $\frac{a\pi}{2}$
(D) independent of a
201. Consider the equation $y - y_1 = m(x - x_1)$. In this equation, if m and x_1 are fixed and different lines are drawn for different values of y_1 , then
- (A) the lines will pass through a single point
(B) there will be one possible line only
(C) there will be a set of parallel lines
(D) there are at least two lines

202. If the standard deviation of a set of observations is 4 and if each observation is divided by 4, the standard deviation of the new set of observations will be
- (A) 4
 - (B) 3
 - (C) 2
 - (D) 1
203. The period of the function $f(x) = \sqrt{\tan x}$ is
- (A) π
 - (B) 2π
 - (C) $\frac{\pi}{2}$
 - (D) $\frac{\pi}{4}$
204. The number of solutions of the equation $z^2 + |z|^2 = 0$, where $z \in \mathbb{C}$, is
- (A) one
 - (B) two
 - (C) three
 - (D) infinitely many
205. If $n \in \mathbb{N}$, then $10^n + 3(4^{n+2}) + 5$ is divisible by
- (A) 7
 - (B) 5
 - (C) 9
 - (D) 17
206. Let $f(x+y) = f(x)f(y)$ for all x, y where $f(0) \neq 0$. If $f'(0) = 2$, then $f(x)$ is equal to
- (A) Ae^x
 - (B) Ae^{2x}
 - (C) $2x$
 - (D) Ae^{-2x}

207. The exponent of 3 in $100!$ is
- (A) 40
 - (B) 48
 - (C) 50
 - (D) 45
208. Out of 10 consonants and 4 vowels, the number of words that can be formed such that each containing 3 consonants and 2 vowels is
- (A) 86500
 - (B) 86800
 - (C) 86400
 - (D) 86300
209. The remainder when $x = 5^{5^{5^{\dots 5}}}$ (24 times 5), is divisible by 24, is
- (A) 4
 - (B) 24
 - (C) 5
 - (D) 6
210. If $ax^2 + bx + c = 0$, $a, b, c \in R$ has no real roots, and if $c < 0$, then
- (A) $a < 0$
 - (B) $a + b + c > 0$
 - (C) $a > 0$
 - (D) $a = c$
211. A pair of fair dice is rolled together till a sum of either 5 or 7 is obtained. If P denotes the probability that 7 comes before 5, then $15P$ is equal to
- (A) 8
 - (B) 1
 - (C) 3
 - (D) 9

212. If common chord of the circle C with centre at $(2, 1)$ and of radius r and the circle $x^2 + y^2 - 2x - 6y + 6 = 0$ is a diameter of the second circle, then value of r is
- (A) 3
(B) 2
(C) $\frac{3}{2}$
(D) 1
213. The ratio of the coefficient of x^{15} to the term independent of x in the expansion of $\left(x^2 + \frac{2}{x}\right)^{15}$ is
- (A) 1 : 8
(B) 1 : 12
(C) 1 : 16
(D) 1 : 32
214. Maximum value of $2997 \sin x + 3996 \cos x$ is equal to
- (A) 4998
(B) 4932
(C) 4900
(D) 4995
215. If $\alpha \in \left(0, \frac{\pi}{2}\right)$, then the expression $\sqrt{x^2 + x} + \frac{\tan^2 x}{\sqrt{x^2 + x}}$ is always greater than or equal to
- (A) $2 \tan \alpha$
(B) 2
(C) 1
(D) $\sec^2 \alpha$
216. The remainder when 2^{2003} is divided by 17 is
- (A) 1
(B) 2
(C) 8
(D) 3

217. The value of $\frac{\log_2 24}{\log_{96} 2} - \frac{\log_2 192}{\log_{12} 2}$ is
- (A) 3
(B) 0
(C) 2
(D) 1
218. If $z_n = (1 + i\sqrt{3})^n$, find the value of $\sqrt{3} \operatorname{Im}(z_5 \bar{z}_4)$
- (A) 1536
(B) 1436
(C) 1578
(D) 1565
219. The diagonal of a parallelogram $PQRS$ are along the lines $x + 3y = 4$ and $6x - 2y = 7$, then $PQRS$ must be a
- (A) rectangle
(B) square
(C) cyclic quadrilateral
(D) rhombus
220. A line is drawn through the point $P(3, 11)$ to cut the circle $x^2 + y^2 = 9$ at A and B . Then $PA \cdot PB$ is equal to
- (A) 9
(B) 121
(C) 205
(D) 139
221. $P(\sin \theta, \cos \theta)$ and $Q(\cos \theta, \sin \theta)$ are two points whose mid point is at the origin. $R(\sin 2\theta, \cos \theta)$ is a point on the plane whose distance from the origin is
- (A) $\frac{2}{3}$
(B) $\frac{3}{2}$
(C) $\sqrt{\frac{3}{2}}$
(D) $\frac{1}{\sqrt{2}}$

222. The number of points (p, q) such that $p, q \in \{1, 2, 3, 4\}$ and the equation $px^2 + qx + 1 = 0$ has real roots is
- (A) 7
 - (B) 8
 - (C) 9
 - (D) 16
223. If A and B are two square matrices such that $B = -A^{-1}BA$, then $(A + B)^2$ is equal to
- (A) 0
 - (B) $A^2 + B^2$
 - (C) $A^2 + 2AB + B^2$
 - (D) $A + B$
224. Vertices of a triangle are $(0, 0)$, $(41a, 37)$ and $(-37, 41b)$ where a and b are the roots of the equation $3x^2 - 16x + 15 = 0$. The area of the triangle is equal to
- (A) 4678
 - (B) 4356
 - (C) 4887
 - (D) 4879
225. Let R be a relation on the set L of lines defined by $l_1 R l_2$ if l_1 is perpendicular to l_2 . Then the relation R is
- (A) reflexive and symmetric
 - (B) symmetric and transitive
 - (C) an equivalence relation
 - (D) symmetric

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

FOR REFERENCE ONLY - CUSAT

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