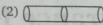# Indraprastha CET
Engineering Entrance Exam
Solved Paper 2011

Physics

1. Light of wavelength λ strikes a photo emissive surface and electrons are ejected with kinetic energy E. If the kinetic energy is to be increased to $2E$, then the wavelength must be changed to λ', where
   (a) $\lambda' = \lambda / 2$
   (b) $\lambda' = 2\lambda$
   (c) $\lambda / 2 < \lambda' < \lambda$
   (d) $\lambda' > \lambda$

2. By increasing the temperature, the specific resistance of a conductor and a semiconductor
   (a) increases for both
   (b) decreases for both
   (c) increases, decreases
   (d) decreases, increases

3. The least count of a stop watch is 0.5 s. The time of 40 oscillations of the pendulum is found to be 40 s. The percentage error in the time period is
   (a) 0.25%
   (b) 0.5%
   (c) 0.75%
   (d) 1.25%

4. The process of separating radio signal from the modulated wave is known as
   (a) superimposition
   (b) amplification
   (c) demodulation
   (d) modulation

5. A moving coil galvanometer has a coil of effective area A and number of turns N. The magnetic field B is radial. If a current I is passed through the coil, the torque acting on the coil is
   (a) NA^2B^2I
   (b) $NABI^2$
   (c) N^2ABI
   (d) $NABI$

6. If an ammeter is to be used in place of a voltmeter, then we must connect with the ammeter
   (a) a low resistance in parallel
   (b) a high resistance in parallel
   (c) a high resistance in series
   (d) a low resistance in series

7. When a man is standing, rain drops appear to him falling at $60°$ from the horizontal from his front side. When he is travelling at 5 km/h on a horizontal road, they appear to him falling at $30°$ from the horizontal from his front side. The actual speed of the rain in km/h is
   (a) 3
   (b) 4
   (c) 5
   (d) 6

8. Suppose the gravitational force varies inversely as the nth power of distance, then the time period of a planet in circular orbit of radius R around the sun will be proportional to
   (a) $R^{\frac{n+1}{2}}$
   (b) $R^{\frac{n-2}{2}}$
   (c) R^n
   (d) $R^{\frac{n-1}{2}}$

9. A liquid is kept in a cylindrical jar, which is rotated about the cylindrical axis. The liquid rises at its ends. The radius of the jar is r and speed of rotation is ω. The difference in height at the centre and the sides of jar is
   (a) $\dfrac{r^2\omega^2}{g}$
   (b) $\dfrac{r^2\omega^2}{2g}$
   (c) $\dfrac{g}{r^2\omega^2}$
   (d) $\dfrac{2g}{r^2\omega^2}$

10. Two rods of same lengths, radius and material transfer a given amount heat in 12 s. When they are joined as shown in Fig. (1). But when they are joined as shown in the Fig. (2), then they will transfer same heat in same conditions in

(1)   (2)

(a) 24 s   (b) 13 s
(c) 15 s   (d) 48 s

11. The force F is given in terms of time t and displacement x by the equation $F = A \cos Bx + C \sin Dt$. The dimensional formula of D/B is

(a) $[M^0 L^0 T^0]$ (b) $[M^0 L^0 T^{-1}]$
(c) $[M^0 L^{-1} T^0]$ (d) $[M^0 L T^{-1}]$

12. A particle is moving eastwards with a velocity of 5 m/s. In 10 s, the velocity changes to 5 m/s northwards. The average acceleration in this time is

(a) zero

(b) $\frac{1}{\sqrt{2}}$ m/s² towards north-west

(c) $\frac{1}{\sqrt{2}}$ m/s² towards north-east

(d) $\frac{1}{2}$ m/s² towards north

13. An iron chain lies on a rough horizontal table. It starts sliding when one-fourth of its length hangs over the edge of the table. The coefficient of static friction between the chain and surface of the table is

(a) 1/2   (b) 1/3
(c) 1/4   (d) 1/5

14. A boy pulls a 5 kg block along a 20 m long horizontal surface at a constant velocity by applying a horizontal force F. If the coefficient of kinetic friction is 0.2, how much work does the boy do on the block? ($g = 10$ ms⁻²)

(a) 100 J   (b) 300 J
(c) 200 J   (d) 400 J

15. For a given surface the Gauss's law is stated as $\int E \cdot ds = 0$. From this we can conclude that

(a) E is necessarily zero on the surface
(b) E is perpendicular to the surface at every point
(c) the total flux through the surface is zero
(d) the flux is only going out of the surface

16. The resistance of a conductor is

(a) inversely proportional to the length
(b) directly proportional to the square of the radius
(c) inversely proportional to the square of the radius
(d) directly proportional to the square root of the length

17. The resistance of a bulb filament is 100 Ω at a temperature of 100°C. If its temperature coefficient of resistance be 0.005/°C. Its resistance will become 200 Ω at a temperature of

(a) 300°C   (b) 400°C
(c) 500°C   (d) 200°C

18. To supply maximum current, cells should be arranged in

(a) series
(b) parallel
(c) mixed grouping
(d) depends on the internal and external resistance

19. The angle if minimum deviation measured with a prism is 30° and the angle of prism is 60°. The refractive index of prism material is

(a) $\sqrt{2}$ (b) 2
(c) 3/2   (d) 4/3

20. If the refractive index of a material of equilateral prism is $\sqrt{3}$, then angle of minimum deviation of the prism is

(a) 30°   (b) 45°   (c) 60°   (d) 75°

21. A car travels from A to B at a speed of 20 km/h and returns at a speed of 30 km/h. The average speed of the car for the whole journey is

(a) 5 km/h   (b) 24 km/h
(c) 25 km/h   (d) 50 km/h

22. A dancer is rotating on smooth horizontal floor with an angular momentum L. The dancer folds her hands so that her moment

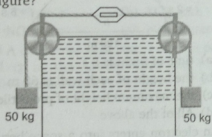of inertia decreases by 25%. The new angular momentum is

(a) $\dfrac{3L}{4}$

(b) $\dfrac{L}{4}$

(c) $\dfrac{L}{2}$

(d) L

3. Match the following.

	List I		List II
(A)	Magnetic field intensity	(E)	Wb/m
(B)	Magnetic flux	(F)	Wb/m^2
(C)	Magnetic potential	(G)	Wb
(D)	Magnetic inductor	(H)	Am^{-1}

(a) A-H, B-G, C-E, D-F

(b) A-G, B-H, C-E, D-F

(c) A-E, B-H, C-G, D-F

(d) A-F, B-G, C-H, D-E

4. What is the reading of spring balance shown in figure?

(a) 50 kg

(b) 100 kg

(c) 75 kg

(d) Zero

5. The inherent property of all matter is

(a) diamagnetism

(b) paramagnetism

(c) ferromagnetism

(d) Both (a) and (b)

6. In an AC circuit V and I is given by

$$V = 1000 \sin(1000\,t)\ \text{volt}$$

$$I = 100 \sin\left(1000\,t + \frac{\pi}{6}\right)\ \text{mA}$$

The power dissipation in the circuit in one complete cycle is

(a) 25 W

(b) $25\sqrt{3}$ W

(c) 100 W

(d) 10 W

7. The transition from the state $n = 5$ to $n = 1$ in a hydrogen atom results in UV radiation. Infrared radiation will be obtained in the transition

(a) $2 \rightarrow 1$

(b) $3 \rightarrow 2$

(c) $4 \rightarrow 3$

(d) $6 \rightarrow 2$

28. **Assertion (A)** Ductile metals are used to prepare thin wires.

Reason (R) In the stress strain curve of ductile metals, the length between the points representing elastic limit and breaking point is very small.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

29. When water is heated from 0°C to 10°C its volume

(a) decreases continuously

(b) first decreases and then increases

(c) first increases and then decreases

(d) increases continuously

30. A combination of two magnets perform 10 oscillations per minute with similar poles together and 6 oscillation per min with dissimilar poles together. The ratio of magnetic moments is

(a) $8 : 17$

(b) $7 : 16$

(c) $5 : 18$

(d) $17 : 8$

31. Dimensional formula for angular momentum

(a) $[MLT]$

(b) $[ML^2T]$

(c) $[M^0LT^2]$

(d) $[M^0L^0T^0]$

32. A man is standing on a weighing machine placed in a lift. When stationary, his weight is recorded as 40 kg. If the lift is accelerated upward with an acceleration of 2 m/s^2, then the weight recorded in the machine will be ($g = 10$ m/s^2)

(a) 48 kg

(b) 32 kg

(c) 42 kg

(d) 40 kg

33. The length of a second pendulum at the surface of earth is 1 m. The length of second pendulum at the surface of moon, where g is 1/6 th that of earth's surface

(a) 1/6 m

(b) 6 m

(c) 1/36 m

(d) 36 m

Specific heat at constant volume (C_V) and at constant pressure (C_p) of an ideal gas have been reported as shown below. Which of the following sets are most reliable? The unit is cal mol^{-1}K^{-1}.

(a) $C_V = 5; C_p = 3$ (b) $C_V = 3; C_p = 4$
(c) $C_V = 5; C_p = 7$ (d) $C_V = 3; C_p = 5$

. A ray is reflected in turn by three plane mirrors mutually at right angles to each other. The angle between the incident and the reflected rays is

(a) $180°$ (b) $0°$ (c) $90°$ (d) $45°$

. If yellow light emitted by sodium lamp in Young's double slit experiment is replaced by monochromatic blue light of same intensity, keeping other parameters constant the new fringe width will

(a) remain unchanged
(b) increase
(c) decrease
(d) Can't be predicted

7. The best instrument for accurate measurement of emf of a cell

(a) potentiometer
(b) meter bridge
(c) voltmeter
(d) ammeter and voltmeter

8. The sensitivity of moving coil galvanometer can be increased by decreasing

(a) number of turns of the coil
(b) magnetic field
(c) area of the coil
(d) coupler per unit twist of suspension

9. When an electron moves in a transverse magnetic field its path becomes

(a) circular   (b) straight line
(c) parallel   (d) parabolic

0. The escape velocity on a planet is v. If the radius of the planet contracts to $1/4$th of present value without any change in its mass, the escape velocity will be
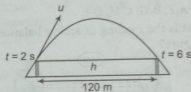
(a) halved
(b) doubled
(c) quadrupled
(d) becomes one-fourth

41. A point object is located at a point Q is in a glass slab as shown in the figure. The distance of the object as measured by an observer at P will be ($\mu = 1.5$)
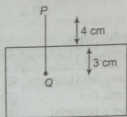
(a) 7 cm   (b) 6 cm   (c) 5 cm   (d) 7.5 cm

42. If a projectile crosses two walls of equal height h symmetrically as shown in figure. Choose the correct statement ($g = 10$ ms^{-2})


(a) time of flight is 8 s
(b) the height of each wall is 60 m
(c) the maximum height of projectile is 80 m
(d) All of the above

43. An electron enters into a space between the plates of parallel plate capacitor at an angle to α with the plates and leaves at an angle of β to the plates. The ratio of its KE while entering the capacitor will be

(a) $\left(\dfrac{\cos\alpha}{\cos\beta}\right)^2$ (b) $\left(\dfrac{\cos\beta}{\cos\alpha}\right)^2$

(c) $\left(\dfrac{\sin\alpha}{\sin\beta}\right)^2$ (d) $\left(\dfrac{\sin\beta}{\sin\alpha}\right)^2$

44. The effective resistance between points P and Q of electrical circuit in the figure is
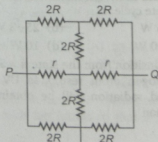
(a) $\dfrac{2Rr}{R+r}$ (b) $\dfrac{8R(R+r)}{3R+r}$

(c) $2r + 4R$ (d) $\dfrac{5R}{2} + 2r$

45. The maximum number of possible interference maxima for slip separation equal to twice the wavelength in young's double slit experiment is
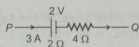
(a) infinite (b) five
(c) three (d) zero

46. The combination of the gates shown below produces where G_1 to G_4 are NOR gates
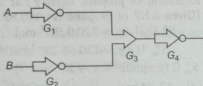
(a) AND gate (b) XOR gate
(c) NOR gate (d) NAND gate

47. If 3 A of current is flowing between points P and Q in the circuit, then the potential difference between P and Q is

(a) 30 V (b) 22 V
(c) 20 V (d) 15 V

48. A metal conductor of length 1 m rotates vertically about one of its ends at angular velocity 5 rad/s. If the horizontal component of earths magnetic field is 0.2×10^{-4} T, then the emf developed between the two ends of the conductor is

(a) $5\mu V$ (b) $50\mu V$
(c) 5 mV (d) 50 mV

49. The angle at which reflected light is totally polarized for reflection from air to glass (refractive index μ) is

(a) $\sin^{-1}(\mu)$ (b) $\sin^{-1}(1/\mu)$
(c) $\tan^{-1}(1/\mu)$ (d) $\tan^{-1}(\mu)$

50. In L-C-R series circuit, the capacitor is changed from C to $4C$. For the same resonant frequency, the inductance should be changed from L to

(a) $2L$ (b) $\dfrac{L}{2}$ (c) $\dfrac{L}{4}$ (d) $4L$

Chemistry

51. Assertion (A) The radial probability distribution curves of $1s$, $2p$, $3d$-orbitals are identical in shape.
**Reason (R)** The number of nodal planes present in these orbitals are different.

(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
(c) (A) is true and (R) is false.
(d) (A) is false but (R) is true.

52. Which one of the following have largest mass?

(a) 5.6 L CO_2 at STP
(b) 2 g H_2 gas
(c) 6×10^{22} molecules of H_2 gas
(d) 1.0 g-atom of He gas

53. The correct statement is

(a) most probable velocity of gas molecules increases with increase in temperature
(b) the fraction of gas molecules having most probable speed decreases with the rise in temperature
(c) at a given temperature, the rms speed of the gas is maximum while most probable speed is minimum
(d) All of the above

54. $CH_3-C\equiv C-CH_3$

$\xrightarrow{\text{Birch reduction}} X$

$\xrightarrow{\text{Lindlar catalyst}} Y$
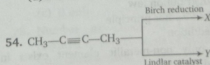
X and Y are respectively.

(a) *trans*-but-2-ene, *cis*-but-2-ene
(b) *cis*-but-2-ene, *trans*-but-2-ene
(c) *trans*-but-2-ene, *trans*-but-2-ene
(d) *cis*-but-2-ene, *cis*-but-2-ene

55. $CH_3-CH=CH_2 + HCl \xrightarrow[\text{peroxide}]{\text{Organic}} A$ (Major),
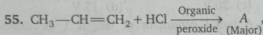
The product A is

(a) $CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3$

(b) $CH_3-CH_2-CH_2-Cl$

(c) $\underset{\underset{Cl}{|}}{CH_2}-CH=CH_2$

(d) $CH_3-CH=CH-Cl$

56. Which of the following is not an *anti* ferromagnetic?
(a) V_2O_3 (b) Ti_2O_3
(c) Fe_2O_3 (d) Mn_2O_3

57. A compound of A and B crystallises in a cubic lattice in which the A atoms occupy the lattice points at the corners of the cube. The B atoms occupy the centre of each fcc of the cube. The probable formula of the compound is
(a) A_3B (b) AB
(c) AB_3 (d) AB_2

58. The average molecular mass of colloids can be determined by
(a) Tyndall effect
(b) Brownian movement
(c) osmotic pressure
(d) flocculation

59. Cottrell smoke precipitator works on the principle of
(a) neutralisation
(b) distribution law
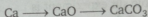(c) Le-Chatlier principle
(d) addition

60. The only non-metallic element exists in liquid state is
(a) F_2 (b) Br_2
(c) Cl_2 (d) Hg

61. Which of the following set of elements mostly occur as sulphide ores?
(a) Zn, Cu, Na   (b) Zn, Cu, Pb
(c) Fe, Al, Ti   (d) Cu, Ag, Au

62. The maximum amount of $CaCO_3$ that can be obtained from 4 g of calcium as per the sequence of reactions is

$$Ca \longrightarrow CaO \longrightarrow CaCO_3$$

(a) 20 g   (b) 40 g
(c) 10 g   (d) 80 g

63. The standard Gibbs energy change for the formation of propane $C_3H_8(g)$ is
[Given ΔH_f° of propane is -103.85 kJ/mol;
$S_m^{\circ} \ C_3H_8(g) = 270.0 \ JK^{-1} \ mol^{-1}$;
$S_m^{\circ} \ H_2(g) = 130.68 \ JK^{-1} mol^{-1}$;
$S_m^{\circ} \ C \ (graphite) = 5.79 \ JK^{-1} mol^{-1}$]
(a) -12.34 kcal   (b) -10.98 kcal
(c) 12.34 kcal   (d) 10.98 kcal

64. One molal aqueous solution of $PdCl_4 \cdot 6H_2O$ has a freezing point 269.28 K. Assuming 100% ionisation of complex, calculate the molecular formula of the complex.
[K_f for water $= 1.86$ K kg mol^{-1}] The salt is a hydrated complex.
(a) $[Pd(H_2O)_2Cl_4] \cdot 4H_2O$
(b) $[Pd(H_2O)_3Cl_3]Cl \cdot 3H_2O$
(c) $[Pd(H_2O)_4Cl_2]Cl_4 \cdot 2H_2O$
(d) $[Pd(H_2O)_6]Cl_4$

65. Standard reduction potential values for the electrodes are given below

$Mg^{2+} + 2e^- \longrightarrow Mg$; $E^{\circ} = -2.37$ V
$Zn^{2+} + 2e^- \longrightarrow Zn$; $E^{\circ} = -0.76$ V
$Fe^{2+} + 2e^- \longrightarrow Fe$; $E^{\circ} = -0.44$ V
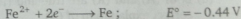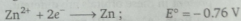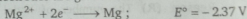
Which of the following statements is correct?
(a) Zinc will reduce Fe^{2+}
(b) Zinc will reduce Mg^{2+}
(c) Mg oxidizes Fe
(d) Zinc oxidizes Fe

66. Which of the following is true regarding periodicity of elements?
(a) Elements of same group are characterised by same valence shell electronic configuration.

(b) The most electropositive elements are positioned on right hand side of the Modern Periodic Table.

(c) On going from Li to F there would be decrease in ionisation energy.

(d) Reducing property of elements increases from Na to Cl in 3rd period elements.

67. Which of the following pairs have same EAN value?

(a) $[Ni(CO)_4]$, $[Fe(CN)_6]^{4-}$

(b) $[Ni(en)_2]$, $[Fe(H_2O)_6]^{2+}$

(c) $[Co(CN)_6]^{3-}$, $[Fe(CN)_6]^{4-}$

(d) All of the above
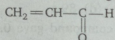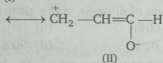
68. Relative stabilities of the following structures of $CH_2=CH-CHO$ are (in the decreasing order)
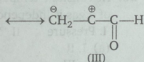
(a) II > I > III

(b) I > II > III

(c) III > II > I

(d) I > III > II

69. One mole of N_2 gas at 0.8 atm takes 38 s to diffuse through a pinhole, whereas one mole of an unknown gas at 1.6 atm takes 57 s to diffuse. MM of unknown gas is

(a) 126

(b) 64

(c) 252

(d) 80

70. Which of the following sets of quantum numbers are not possible?

I. $n = 0, l = 0, m = 0, s = +1/2$

II. $n = 1, l = 0$ $m = 0, s = -1/2$

III. $n = 3, l = 2$ $m = -3, s = +1/2$

IV. $n = 2, l = 1$ $m = 0, s = -1/2$

(a) II and III

(b) III and IV

(c) I and III

(d) I and IV

71. 2R, 3S – 2, 3-dihydroxybutanoic acid is
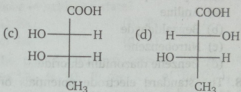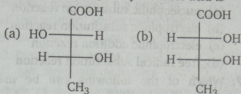
72. $Y \xleftarrow[300°C]{O_2/Ag} CH_2=CH_2 \xrightarrow{S_2Cl_2} X$

I. X is a war gas

II. X is a thiol

III. Y is heterocyclic, aromatic

IV. Y is an isomer of ethanal, correct statements are

(a) I, IV

(b) I, III, IV

(c) I, III

(d) I, II, III, IV

73. Regarding the mechanism of electrophilic substitution, the false statement is

(a) rate limiting step is formation of arenium ion

(b) arenium ion can stabilise through resonance

(c) arenium ion is aromatic

(d) initial step is generation of electrophile

74. Identify incorrect statements.

I. Halo group activates benzene ring by mesomeric effect and destabilises it by inductive effect

II. Halo group is deactivating group

III. Benzene is 10^4 times more reactive than nitrobenzene towards nueclophile

IV. $-CF_3$ is a strongly deactivating group

(a) I, II, III

(b) III only

(c) II only

(d) II, IV

75. Number of moles of hydrogen atoms required to get one mole of hydrazobenzene from nitrobenzene is

(a) 10

(b) 5

(c) 8

(d) 4

76. Fischer esterification is
    (a) nucleophilic substitution reaction
    (b) electrophilic substitution reaction
    (c) electrophilic addition reaction
    (d) free radical substitution reaction

77. Which of the following can be used in making floor polish?
    (a) Aniline
    (b) Benzaldehyde
    (c) Nitrobenzene
    (d) Benzene diazonium chloride

78. The standard electrode potentials of four elements P, Q, R and S are -2.65, -1.66, -0.80 and $+0.86$ V. The highest chemical activity will be exhibited by
    (a) Q (b) P
    (c) S (d) R

79. Ethylene glycol is used as coolant in car radiators, in order to prevent the solution from freezing at $-0.3°C$. The amount of ethylene glycol to be added to 5 kg of water is (For water $K_f = 1.86$ Km^{-1})
    (a) 20 g   (b) 50 g
    (c) 40 g   (d) 30 g

80. Electrolysis of dilute aqueous NaCl solution was carried out by passing 10 mA current. The time required to liberate 0.01 moles of H_2 gas at the cathode is
    (a) 9.65×10^4 s   (b) 19.3×10^4 s
    (c) 28.95×10^4 s   (d) 38.6×10^4 s

81. The half-life period of the first order chemical reaction is 6.93 min. The time required for the completion of 99% of the chemical reaction will be (log 2 = 0.3010)
    (a) 230.3 min   (b) 23.03 min
    (c) 46.06 min   (d) 460.6 min

82. Solutions A, B, C and D are respectively 0.1 M glucose, 0.05 M NaCl, 0.05 M $BaCl_2$ and 0.1 M AlF_3. Which one of the following pairs is isotonic?
    (a) A and C (b) B and C
    (c) A and B (d) A and D

83. pH of CH_3COOH and CH_3COONa buffer is 4.8. In which of the following conditions, the buffer capacity will be maximum?

	[CH_3COOH]	[CH_3COONa]
(a)	0.1 M,	0.2 M
(b)	0.2 M	0.1 M
(c)	0.34 M	0.34 M
(d)	0.34 M	0.30 M

84. 50 mL of sample of hard water gave good lather with 6 mL of standard soap solution (1 mL soap solutions = 1 mg $CaCO_3$). If the hardness is only due to $Mg(HCO_3)_2$, the weight of milk of lime required to remove the hardness completely from 100 kg of that sample of water is
    (a) 17.8 g   (b) 8.9 g
    (c) 178 g   (d) 89 g

85. 0.2 g of an organic compound gave 0.17 g NH_3 in Kjeldhal's method. The percentage weight of nitrogen in the given compound is
    (a) 60%   (b) 80%
    (c) 70%   (d) 90%

86. At constant temperature, the kinetic energy of a gas is independent on
    I. Pressure   II. Volume   III. Density
    (a) I, II   (b) II, III
    (c) I, III   (d) I, II, III

87. 33.6 L of water vapour at STP are condensed to liquid state. The volume occupied by it is approximately
    (a) 1 mL   (b) 18 mL
    (c) 27 mL   (d) 127 mL

88. A open vessel containing air at $27°$ is heated to $127°C$. The fraction of air originally present in the bottle that is expelled is
    (a) 50%   (b) 25%
    (c) 33%   (d) 40%

89. Which one is correct for $k = Ae^{-E_a/RT}$
    (a) E_a is energy of activation
    (b) R is Rydberg's constant
    (c) K is equilibrium constant
    (d) A is adsorption factor

90. A reaction involving two different reactants can never be

(a) unimolecular reaction

(b) I order reaction

(c) II order reaction

(d) bimolecular reaction

91. The number of $d\pi - p\pi$ bonds present respectively in SO_2, SO_3, ClO_4^- are

(a) 0, 1, 2   (b) 1, 2, 3

(c) 2, 3, 4   (d) 2, 3, 3

92. How many unit cells are present in a cubic shaped ideal crystal of NaCl of mass 1.0 g?

(a) 1.28×10^{21} (b) 1.71×10^{21}

(c) 2.57×10^{21} (d) 5.14×10^{21}

93. 20 mL of a sample of H_2O_2 gives 400 mL oxygen measured at NTP. The sample should be labelled as

(a) 5 V H_2O_2

(b) dil. H_2O_2

(c) anhy. H_2O_2

(d) 20 V H_2O_2

94. Identify the correctly matched lists.

	List I		List II
(i)	Total number of lines in H-spectrum for a transition $5 \to 1$	(A)	Decreases
(ii)	Intensity of spectral line in the spectrum, as n value increases	(B)	H-spectrum
(iii)	Band spectrum is due to	(C)	10
(iv)	The proof for the presence of energy levels in an atom	(D)	Rotations and vibrations of atoms in molecules in addition to electronic transition
		(E)	Increases

(a) (i)-A, (ii)-E, (iii)-D, (iv)-B

(b) (i)-E, (ii)-E, (iii)-D, (iv)-D

(c) (i)-C, (ii)-A, (iii)-D, (iv)-B

(d) (i)-C, (ii)-E, (iii)-D, (iv)-B

95. Between any two of the following molecules, hydrogen bonding is not possible

(a) two primary amine molecules

(b) two secondary amine molecules

(c) two tertiary amine molecules

(d) two ammonia molecules

96. Which of the following elements does not show +4 oxidation state?

(a) Zr   (b) Pt

(c) La   (d) Ti

97. The pH of saturated aqueous solution of $NaClO_4$ is 10. If the K_{sp} of $Ba(OH)_2$ is 5×10^{-13}, the concentration of Ba^{2+} ions in the solution is

(a) 1×10^{-2} (b) 1×10^{-3}

(c) 5×10^{-5} (d) 1×10^{-5}

98. $B \xleftarrow{Y}$ 2-butyne $\xrightarrow{X} A$. A and B are geometrical isomers. 'A' is more symmetrical than 'B'. 'B' has higher heat of hydrogenation than 'A'. Then 'X' and 'Y' are respectively

(a) Li/Liq NH_3, H_2/Lindlar's catalyst

(b) Li/Liq. NH_3, Na/Liq. NH_3

(c) H_2/Lindlar's catalyst, Na/Liq. NH_3

(d) H_2/Pt, H_2/Lindlar's catalyst

99. Pick the correct statements.

I. The repeating unit of polyacetylene contains $C = C$ bond

II. Acetylene ozonide involves $sp^3 - sp^3$ overlap

III. Alkyne with maximum number of acidic hydrogen atoms is ethyne

IV. Ozonolysis product of acetylene is a dial

(a) I, II, III   (b) II, III, IV

(c) I, II, IV   (d) I, IV

100. Regarding urea the correct statements are

A. it is a monoacidic base

B. dipole moment = 0

C. C—N bondorder is 1

D. it exhibits resonance

(a) A, D   (b) B, C, D

(c) A, B, D   (d) C, D

Mathematics

101. Let $f(x) = ax + b$, $a < 0$, then $f^{-1}(x) = f(x)$, $\forall x$ if and only if
   (a) $a = -1, b \in R$ (b) $a = -1, b = 4$
   (c) $a = -3, b \in R$ (d) None of these

102. The domain of $\cos^{-1}\dfrac{x-3}{2} - \log_{10}(4-x)$ is
   (a) $(1, 4)$ (b) $[1, 4]$
   (c) $(1, 4]$ (d) $[1, 4)$

103. If $f(x)$ is a polynomial function of the second degree such that $f(-3) = 6$, $f(0) = 6$ and $f(2) = 11$, then the graph of the function $f(x)$ cuts the ordinate $x = 1$ at the point
   (a) $(1, 8)$ (b) $(1, 4)$
   (c) $(1, -2)$ (d) None of these

104. Let A and B be two sets, then $(A \cup B) \cap (A' \cap B)$ is equal to
   (a) A' (b) A
   (c) B' (d) None of these

105. The mean of 10 observations is 16.3. By an error one observation id is registered as 32 instead of 23. Then, the correct mean is
   (a) 15.6   (b) 15.4   (c) 15.7   (d) 15.8

106. Mean deviation of 6, 8, 12, 15, 10, 9 through mean is
   (a) 10   (b) 2.33
   (c) 2   (d) None of these

107. The image of the point $(2, 1)$ w.r.t. the line $x + 1 = 0$ is
   (a) $(2, 5)$ (b) $(0, 5)$
   (c) $(-4, 1)$ (d) $(-2, -3)$

108. The value of x which satisfies $5^{1 + \cos x + \cos^2 x + \dots} = 64$ in $[-\pi, \pi]$ is
   (a) $\pm\dfrac{\pi}{2}, \pm\dfrac{\pi}{3}$ (b) $\pm\dfrac{\pi}{3}$
   (c) $\pm\dfrac{\pi}{2}, \pm\dfrac{\pi}{6}$ (d) $\pm\dfrac{\pi}{6}, \pm\dfrac{\pi}{3}$

109. If $\mathbf{d} = \lambda(\mathbf{a} \times \mathbf{b}) + \mu(\mathbf{b} \times \mathbf{c}) + v(\mathbf{c} \times \mathbf{a})$ is equal to and $[\mathbf{a}\ \mathbf{b}\ \mathbf{c}] = 1/8$, then $\lambda + \mu + v$
   (a) $\mathbf{d} \cdot (\mathbf{a} + \mathbf{b} + \mathbf{c})$ (b) $8\mathbf{d} \cdot (\mathbf{a} + \mathbf{b} + \mathbf{c})$
   (c) $4\mathbf{d} \cdot (\mathbf{a} + \mathbf{b} + \mathbf{c})$ (d) $8\mathbf{d} \cdot (\mathbf{a} + \mathbf{b} + \mathbf{c})$

110. The area of the triangle formed by the points whose position vectors are $3\mathbf{i} + \mathbf{j}, 5\mathbf{i} + 2\mathbf{j} + \mathbf{k}, \mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ is
   (a) $\sqrt{23}$ sq units
   (b) $\sqrt{21}$ sq units
   (c) $\sqrt{29}$ sq units
   (d) $\sqrt{33}$ sq units

111. If $(1, -2, -2)$ and $(0, 2, 1)$ are direction ratios of two lines, then the direction cosines of a perpendicular to both the lines are
   (a) $\left(\dfrac{1}{3}, -\dfrac{1}{3}, \dfrac{2}{3}\right)$
   (b) $\left(\dfrac{2}{3}, -\dfrac{1}{3}, \dfrac{2}{3}\right)$
   (c) $\left(-\dfrac{2}{3}, -\dfrac{1}{3}, \dfrac{2}{3}\right)$
   (d) $\left(\dfrac{2}{\sqrt{14}}, -\dfrac{1}{\sqrt{14}}, \dfrac{3}{\sqrt{14}}\right)$

112. The length of the normal to the curve $y = a\cosh\left(\dfrac{x}{a}\right)$ at any point varies as
   (a) ordinate
   (b) abscissa
   (c) square of the abscissa
   (d) square of the ordinate

113. The slope of the tangent to the curve $y = \displaystyle\int_0^x \dfrac{dx}{1 + x^3}$ at the point where $x = 1$ is
   (a) 1/4   (b) 1/2
   (c) 1   (d) None of these

114. If $f(x) = a\log_e |x| + bx^2 + x$ has extremum at $x = 1$ and $x = 3$, then
   (a) $a = -3/4, b = -1/8$
   (b) $a = -3/4, b = 1/8$
   (c) $a = -3/4, b = 1/8$
   (d) None of the above

115. In the expansion of $\left(x^3 - \dfrac{1}{x^2}\right)^n$, $n \in N$, if the sum of the coefficient of x^5 and x^{10} is 0, then n is
   (a) 25   (b) 20
   (c) 15   (d) None of these

116. Let z_1, z_2 be two roots of the equation $z^2 + az + b = 0$, z being complex number. Further assume that the origin, z_1 and z_2 form an equilateral triangle. Then,

(a) $a^2 = b$ (b) $a^2 = 2b$

(c) $a^2 = 3b$ (d) $a^2 = 4b$

117. A square is inscribed in the circle $x^2 + y^2 - 2x + 4y - 3 = 0$ with its sides parallel to the coordinate axes. One vertex of the square is

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

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

118. If $f : R \to R$ is continuous such that $f(x + y) = f(x) + f(y)$, $\forall x, y \in R$ and $f(1) = 2$, then $f(100)$ equals to

(a) 100   (b) 50

(c) 200   (d) 0

119. $f(x) = x \sin \dfrac{1}{x}$ is

(a) continuous but not differentiable at $x = 0$

(b) discontinuous but differentiable at $x = 0$

(c) differentiable at $x = 0$

(d) cannot be determined

120. $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 - bc & b^2 - ca & c^2 - ab \end{vmatrix}$ equals to

(a) 0

(b) 1

(c) abc

(d) $(a - b)(b - c)(c - a)$

121. The sum $\cos 1° + \cos 2° + \cos 3° + \dots + \cos 179° + \cos 180°$ is equal to

(a) 0   (b) 1

(c) -1 (d) 2

122. If a, b, c are in GP and $a^{\frac{1}{x}} = b^{\frac{1}{y}} = c^{\frac{1}{z}}$, then x, y, z are in

(a) AP   (b) GP

(c) HP   (d) None of these

123. If A is a square matrix such that $A^2 = I$, then A^{-1} is equal to

(a) I (b) O

(c) A (d) $I + A$

124. 5th term from the end in the expansion of $\left(\dfrac{x^2}{2} - \dfrac{2}{x^2} \right)^{12}$ is

(a) $-7920x^{-4}$ (b) $7920x^4$

(c) $7920x^{-4}$ (d) $-7920x^4$

125. Which of the following is not a logical statement?

(a) 8 is less than 6

(b) every set is a finite set

(c) Kashmir is far from here

(d) the sun is a star

126. $\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3$ is equal to

(a) 0   (b) π

(c) $\dfrac{\pi}{2}$ (d) None of these

127. $\displaystyle\int_0^\infty \dfrac{1}{1 + e^x} \, dx$ is equal to

(a) $\log 2 - 1$ (b) $\log 4 - 1$

(c) $\log 2$ (d) $-\log 2$

128. If $|a| = 8, |b| = 3$ and $|a \times b| = 12$, then the value of $a \cdot b$ is

(a) 6 or -6 (b) $12\sqrt{3}$ or $-12\sqrt{3}$

(c) 8 or -8 (d) None of these

129. The value of ${}^nC_0 - {}^nC_1 + {}^nC_2 - \dots + (-1)^n {}^nC_n$ is

(a) 1   (b) 0

(c) 2^n (d) n

130. Coefficient of variation of two distribution are 50% and 60% and their arithmetic means are 30 and 25 respectively. Of their standard deviation is

(a) 1   (b) 1.5

(c) 2.5   (d) 0

131. If $\mathbf{i}, \mathbf{j}, \mathbf{k}$ are the usual three perpendicular unit vectors then the value of $\mathbf{i} \cdot (\mathbf{j} \times \mathbf{k}) + \mathbf{j} \cdot (\mathbf{i} \times \mathbf{k}) + \mathbf{k} \cdot (\mathbf{i} \times \mathbf{j})$ is

(a) 0   (b) -1

(c) 3   (d) 1

132. The solution of $y \, dx - x \, dy + \log x \, dx = 0$ is

(a) $y - \log x - 1 = Cx$

(b) $x + \log x + 1 = Cx$

(c) $y + \log x + 1 = Cx$

(d) $y + \log x - 1 = Cx$

133. Which of the following differential equation has $y = c_1 e^x + c_2 e^{-x}$ as the general solution?

(a) $\dfrac{d^2y}{dx^2} + y = 0$

(b) $\dfrac{d^2y}{dx^2} - y = 0$

(c) $\dfrac{d^2y}{dx^2} + 1 = 0$

(d) $\dfrac{d^2y}{dx^2} - 1 = 0$

134. $\displaystyle\int \dfrac{1}{\sin(x-a)\sin(x-b)}\,dx$ is equal to

(a) $\dfrac{1}{\sin(b-a)}\log\left|\dfrac{\sin(x+b)}{\sin(x+a)}\right| + C$

(b) $\dfrac{1}{\sin(b+a)}\log\left|\dfrac{\sin(x-b)}{\sin(x-a)}\right| - C$

(c) $\dfrac{1}{\sin(b-a)}\log\left|\dfrac{\sin(x-b)}{\sin(x-a)}\right| + C$

(d) None of the above

135. $\displaystyle\int \dfrac{dx}{x^2\sqrt{4-x^2}}$ is equal to

(a) $\dfrac{1}{4}\left(\dfrac{\sqrt{4-x^2}}{x}\right) + C$

(b) $\dfrac{1}{2}\left(\dfrac{\sqrt{4-x^2}}{x}\right) + C$

(c) $-\dfrac{1}{4}\left(\dfrac{\sqrt{4-x^2}}{x}\right) + C$

(d) $-\dfrac{1}{2}\left(\dfrac{\sqrt{4-x^2}}{x}\right) + C$

136. If $\tan^{-1}2$, $\tan^{-1}3$ are two angles of a triangle, then the third angle is

(a) $30°$
(b) $45°$
(c) $60°$
(d) $75°$

137. $\displaystyle\lim_{x\to 0}\left(\dfrac{16^x + 9^x}{2}\right)^{1/x}$ is equal to

(a) 25/2
(b) 12
(c) 1
(d) 1/4

138. Let $a = \min\{x^2 + 2x + 3, x \in R\}$ and $b = \displaystyle\lim_{\theta\to 0}\dfrac{1-\cos\theta}{\theta^2}$. The value of $\displaystyle\sum_{r=0}^{n} a^r \cdot b^{n-r}$ is

(a) $\dfrac{2^{n+1}-1}{3\cdot 2^n}$

(b) $\dfrac{2^{n+1}+1}{3\cdot 2^n}$

(c) $\dfrac{4^{n+1}-1}{3\cdot 2^n}$

(d) None of these

139. The matrix $A = \begin{bmatrix} 0 & 1 & -1 \\ -1 & 0 & 1 \\ 1 & -1 & 0 \end{bmatrix}$ is a

(a) diagonal matrix
(b) symmetric matrix
(c) skew-symmetric matrix
(d) identity matrix

140. A teacher takes 3 children from her class to the zoo at a time as often as she can, but she does not take the same three children to the zoo more than once. She finds that she goes to the zoo 84 times more than a particular child goes to the zoo. The number of children in her class is

(a) 12
(b) 10
(c) 60
(d) None of these

141. If $A = (-3, 4)$, $B = (-1, -2)$, $C = (5, 6)$, $D = (x, -4)$ are vertices of a quadrilateral such that $\triangle ABD = 2\,\triangle ACD$. Then, x is equal to

(a) 6
(b) 9
(c) 69
(d) 96

142. The area of the parallelogram formed by the points $(1, 1, 1)$, $(-1, 5, 5)$, $(2, 2, 5)$ is

(a) 81
(b) 9
(c) 36
(d) 18

143. If $f(x) = \dfrac{9^x}{9^x + 3}$, then

$f\left(\dfrac{1}{2012}\right) + f\left(\dfrac{2}{2012}\right) + \ldots + f\left(\dfrac{2011}{2012}\right)$ is equal to

(a) 1005
(b) 1005.5
(c) 1006
(d) 1006.5

144. $\sqrt{1-\sin^2 101°} \cdot \sec 101°$

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

145. $\tan^{-1}\left(\dfrac{1}{1+2}\right) + \tan^{-1}\left(\dfrac{1}{1+(2)(3)}\right)$

$\tan^{-1}\left(\dfrac{1}{1+(3)(4)}\right) + \ldots + \tan^{-1}\left(\dfrac{1}{1+n(n+1)}\right)$

$= \tan^{-1}\theta$

(a) $\dfrac{n}{n+1}$

(b) $\dfrac{n+1}{n+2}$

(c) $\dfrac{n+2}{n+1}$

(d) $\dfrac{n}{n+2}$

146. If $A_{3 \times 3}$ and det $(A) = 6$, then det $(2 \text{ adj } (A))$ is equal to

    (a) 48   (b) 8

    (c) 288   (d) 12

147. The probability that a leap year will have only 52 sundays is

    (a) $\dfrac{4}{7}$ (b) $\dfrac{5}{7}$

    (c) $\dfrac{6}{7}$ (d) $\dfrac{1}{7}$

148. If $\displaystyle\int \frac{2^x}{\sqrt{1 - 4^x}}\, dx = \lambda \sin^{-1}(2^x) + C,$ then λ equals to

    (a) log 2   (b) $\dfrac{1}{2}$ log 2

    (c) $\dfrac{1}{2}$ (d) $\dfrac{1}{\log 2}$

149. If S is circumcentre, G the centroid, O the orthocentre of $\triangle ABC$, then $\mathbf{SA} + \mathbf{SB} + \mathbf{SC}$ is equal to

    (a) $\mathbf{SG}$ (b) $\mathbf{OS}$

    (c) $\mathbf{SO}$ (d) $\mathbf{OG}$

150. The centre and radius of the sphere $r^2 - 2r(3i + 4j - 5k) + 1 = 0$ are

    (a) $3i + 4j - 5k, 1$ (b) $-3i - 4j + 5k, 7$

    (c) $-3i - 4j + 5k, 7$ (d) $3i + 4j - 5k, 7$

Answers

Physics

1. (a)	2. (c)	3. (d)	4. (c)	5. (d)	6. (d)	7. (d)	8. (a)	9. (b)	10. (a)
11. (d)	12. (b)	13. (b)	14. (c)	15. (c)	16. (c)	17. (a)	18. (a)	19. (a)	20. (c)
21. (c)	22. (a)	23. (a)	24. (b)	25. (b)	26. (b)	27. (c)	28. (d)	29. (b)	30. (d)
31. (*)	32. (a)	33. (a)	34. (d)	35. (a)	36. (c)	37. (b)	38. (a)	39. (d)	40. (d)
41. (*)	42. (d)	43. (d)	44. (a)	45. (a)	46. (c)	47. (c)	48. (b)	49. (d)	50. (c)

Chemistry

51. (b)	52. (a)	53. (d)	54. (a)	55. (a)	56. (b)	57. (c)	58. (c)	59. (a)	60. (b)
61. (b)	62. (c)	63. (*)	64. (b)	65. (a)	66. (a)	67. (d)	68. (b)	69. (c)	70. (c)
71. (d)	72. (a)	73. (c)	74. (b)	75. (c)	76. (a)	77. (c)	78. (b)	79. (b)	80. (b)
81. (c)	82. (c)	83. (c)	84. (b)	85. (c)	86. (c)	87. (c)	88. (b)	89. (a)	90. (a)
91. (b)	92. (c)	93. (d)	94. (c)	95. (c)	96. (c)	97. (c)	98. (a)	99. (c)	100. (a)

Mathematics

101. (a)	102. (b)	103. (a)	104. (d)	105. (b)	106. (b)	107. (c)	108. (b)	109. (d)	110. (d)
111. (b)	112. (d)	113. (b)	114. (a)	115. (c)	116. (c)	117. (b)	118. (c)	119. (a)	120. (a)
121. (c)	122. (a)	123. (c)	124. (c)	125. (c)	126. (a)	127. (c)	128. (b)	129. (b)	130. (d)
131. (d)	132. (c)	133. (b)	134. (c)	135. (c)	136. (b)	137. (b)	138. (c)	139. (c)	140. (d)
141. (c)	142. (d)	143. (b)	144. (b)	145. (c)	146. (c)	147. (b)	148. (b)	149. (c)	150. (d)

Note : * No option is correct.

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