

UP-CPMT - 2002

Paper-2

Physics

1. The energy of X-ray photons coming out of coolidge tube depends on :
 - 1) kinetic energy of incident electrons
 - 2) intensity of incident electrons
 - 3) both (1) and (2)
 - 4) neither (1) nor (2)

2. If $C_p \rightarrow C_v$ are molar heats at constant pressure and constant volume respectively and R is gas constant for 1 mole, then the correct relation is :
 - 1) $C_p - C_v = R$
 - 2) $C_p - C_v < R$
 - 3) $C_p - C_v > R$
 - 4) $C_p - C_v = 0$

3. The value of acceleration due to gravity g at distance r from earth's centre such that $r < R$ depend on r according to relation : (R = radius of earth)
 - 1) $g \propto (1/r^2)$
 - 2) $g \propto (1/r)$
 - 3) $g \propto r$
 - 4) $g \propto r^2$

4. In a system of units, the units of mass, length and time are 1 quintal, 1 km and 1 h respectively. In this system 1 N force will be equal to :
 - 1) 50 new unit
 - 2) 129.6 new unit
 - 3) 100.7 new unit
 - 4) 10^4 new unit

5. If F_{pp} , F_{nn} and F_{pn} represent nuclear forces between proton-proton, neutron-neutron and proton-neutron respectively, then the correct relation is :
 - 1) $F_{pp} > F_{pn} = F_{nn}$
 - 2) $F_{pp} = F_{nn} = F_{pn}$
 - 3) $F_{pp} > F_{pn} > F_{nn}$
 - 4) $F_{pp} < F_{pn} < F_{nn}$

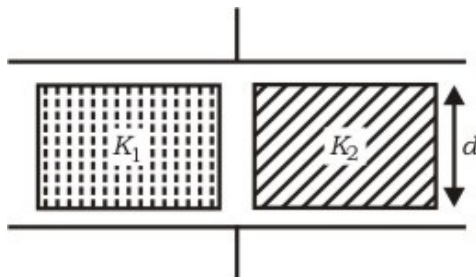
6. When ordinary light is made incident on a quarter wave plate, the emergent light is :

- 1) linearly polarised
- 2) circularly polarised
- 3) elliptically polarised
- 4) unpolarised

7. The ratio of masses of three wires is 1 : 2 : 3 and that of their lengths is 3 : 2 : 1. If the wires are made of same material, the ratio of their resistances will be :

- 1) 1 : 1 : 1
- 2) 1 : 4 : 3
- 3) 9 : 4 : 1
- 4) 27 : 6 : 1

8. Two dielectrics of dielectric constants K_1 and K_2 are filled in the gap of parallel plate capacitor as shown in figure. The capacitor has plate each of area A and separation d . The capacitance of the capacitor is :



- 1) $(\epsilon_0(K_1 + K_2)/2d)$
- 2) $((\epsilon_0 A/2d) (K_1 + K_2)/(K_1 K_2))$
- 3) $((\epsilon_0 A/d) (K_1 K_2)/(K_1 + K_2))$
- 4) $((2\epsilon_0 A/d) (K_1 K_2)/(K_1 + K_2))$

9. The triple point of water is :

- 1) 273.16°C
- 2) 273.16K
- 3) 273.16°F
- 4) 373K

10. The similar magnets of magnetic moments M_1 and M_2 are taken and vibrate in a vibration magnetometer with their (i) like poles together (ii) unlike poles together. If the ratio of the time periods is $(1/2)$, then the ratio of M_1 and M_2 (i.e., (M_1/M_2)) is :

- 1) 0.5
- 2) $4/3$
- 3) $5/3$
- 4) $2/3$

11. If the first one-third of a journey is traveled at 20 km/h, next one-third at 40 km/h and the last one-third at 60 km/h. The average speed of whole journey will be :

- 1) 32.7 km/h

- 2) 35.7 km/h
3) 40.7 km/h
4) 43.7 km/h
12. If force F , length L and time T are taken as fundamental units, the dimensional formula for mass will be :
- 1) $[FL^{-1}T^2]$
2) $[FL^{-1}T^{-1}]$
3) $[FL^{-1}T^{-3}]$
4) $[ML^2T^2]$
13. Which of the following is wrongly matched ?
- 1) Raman effect—scattering of light
2) Thomson effect—thermoelectricity
3) Hall effect—work function
4) Photoelectric effect—quantum nature of light
14. A circular disc of mass M and radius R is rotating with an angular velocity ω about an axis passing through its centre and perpendicular to the plane of the disc. A small point like part of mass m detaches from the rim of the disc and continues to move with same angular speed. The angular velocity of remaining disc just after detaching will become :
- 1) $((M - 1/2m)/(M + m)) \omega$
2) $((M + 1/2m)/(M + m)) \omega$
3) $((M - 2m)/(M - m)) \omega$
4) $((M + 2m)/(M - m)) \omega$
15. Two identical metallic balls, whose temperatures are 200°C and 400°C respectively, are placed in an enclosure at 27°C . The ratio of heat-loss of the balls will be :
- 1) 1 : 1
2) 1 : 3
3) $\frac{(473)^4 - (300)^4}{(673)^4 - (300)^4}$
4) $\frac{(200)^4 - (27)^4}{(400)^4 - (27)^4}$
16. A point source of light is placed at a distance of 0.5 m from a caesium photocell and under saturation conditions the number of emitted photoelectrons is n . If the source is now placed 1 m from the cell, the number of emitted electrons will be :
- 1) $2n$ 2) $4n$ 3) $n/2$ 4) $n/4$
17. The radius of a spherical drop of water is 1 mm. If surface tension of water be 70×10^{-3} N/m, the pressure difference inside and outside the drop will be :

- 1) 35 N/m^2
- 2) 210 N/m^2
- 3) 280 N/m^2
- 4) zero

18. For coulomb force to be operative the least size of atom will be :

- 1) 10^{-18} m
- 2) 10^{-15} m
- 3) 10^{-12} m
- 4) 10^{-9} m

19. The energy of stars is due to :

- 1) combustion of coal
- 2) nuclear fission
- 3) nuclear fusion
- 4) gravitational contraction

20. The universal property among all substances is :

- 1) diamagnetism
- 2) paramagnetism
- 3) ferromagnetism
- 4) non-magnetism

21. The frequency of vibrating air column in closed organ pipe is n . If its length be doubled and radius halved, its frequency will be nearly :

- 1) $n/4$
- 2) $n/2$
- 3) $2n$
- 4) $4n$

22. In a sample of radioactive substance, what percentage decays in one mean life time ?

- 1) 32%
- 2) 64%
- 3) 70%
- 4) 72%

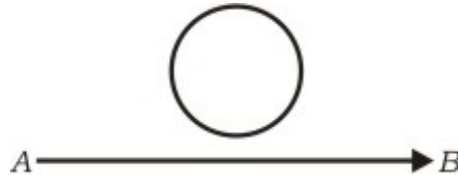
23. Doppler's effect in sound takes place when source and observer are :

- 1) stationary
- 2) moving with same velocity
- 3) in relative motion
- 4) none of the above

24. When a body of mass M is hung from a spring, the spring extends by 1 cm. If the body of mass $2M$ be hung from the same spring, the extension of spring will be :

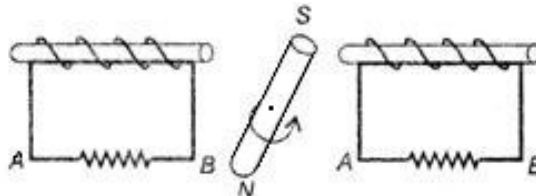
- 1) 1 cm 2) 2 cm 3) 3 cm 4) 5 cm

25. The current in a AB is increasing in magnitude. The direction of current induced in the loop (in any) will be :



- 1) clockwise
2) anticlockwise
3) arbitrary
4) no current

26. The magnet in figure rotates as shown on a pivot through its centre. At the instant shown, what are the directions of the induced currents ?



- 1) A to B and C to D
2) B to A and C to D
3) A to B and D to C
4) B to A and D to C

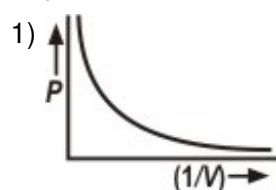
27. The temperatures of cold and hot junctions of a thermocouple are 0° and $T^\circ\text{C}$ respectively. The thermo emf produced is

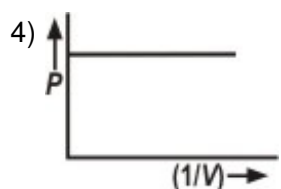
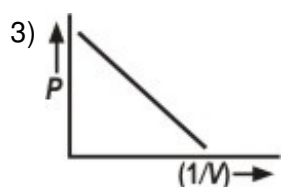
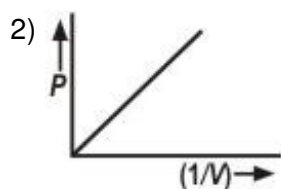
$$E = AT - (1/2) BT^2$$

If $A = 16$, $B = 0.08$, the temperature inversion will be :

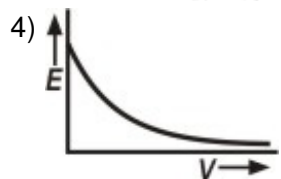
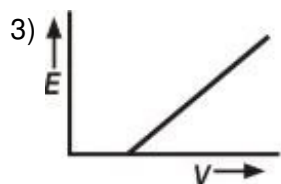
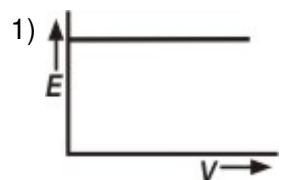
- 1) 100°C
2) 200°C
3) 400°C
4) 600°C

28. The graph of pressure P and $(1/\text{Volume}, (1/V))$ of 1 mole of an ideal gas at constant temperature is :





29. The correct graph representing the relation between energy (E) of photoelectrons and frequency (ν) of incident light is :



30. The emissive power of a black body is proportional to : (T = absolute temperature)

1) $E \propto T^0$

2) $E \propto T^2$

3) $E \propto T^4$

4) $E \propto T^6$

31. An object is placed at a distance of 0.5 m in front of a plane mirror. The distance between object and image will be :

- 1) 0.25 m
- 2) 0.5 m
- 3) 1.0 m
- 4) 4.0 m

32. A laser beam is coherent because it contains :

- 1) waves of several wavelengths
- 2) incoherent waves of a single wavelength
- 3) coherent waves of several wavelength
- 4) coherent waves a single wavelength

33. A particle executes SHM of amplitude A. If T_1 and T_2 are the times taken by the particle to traverse from 0 to $(A/2)$ and from $(A/2)$ to A respectively, then (T_1/T_2) will be equal to :

- 1) 1
- 2) $1/2$
- 3) $1/4$
- 4) 4

34. When high energetic cathode rays strike a heavy target of high melting point, then the rays produced are :

- 1) X-rays
- 2) γ -rays
- 3) α -rays
- 4) β -rays

35. The currents and voltage in AC circuit are given by $I = 5 \sin (100t - (\pi/2))$ amp, $V = 200 \sin (100t)$ volt. The power dissipated in the circuit will be :

- 1) 20 W
- 2) 50 W
- 3) 100 W
- 4) zero

36. When a ray of light enters from one medium to another, its velocity is doubled. The critical angle for the ray for total internal reflection will be :

- 1) 30°
- 2) 45°
- 3) 90°
- 4) information is incomplete

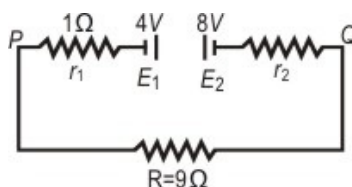
37. The dimensional formula for emf e in MKS system will be :

- 1) $[ML^2T^{-2}Q^{-1}]$
- 2) $[ML^2T^{-1}Q]$
- 3) $[ML^{-2}Q^{-2}]$
- 4) $[ML^2T^{-2}Q^{-2}]$

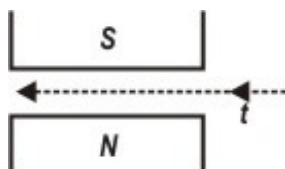
38. A stone tied at one end of a long string is rotated in a vertical circle about the other end. The minimum speed of the stone at the lowest point so, as to complete the circular path will be :
- 1) $\sqrt{7gr}$
 - 2) $\sqrt{10gr}$
 - 3) $\sqrt{3gr}$
 - 4) $\sqrt{5gr}$
39. If a capillary tube of radius R is immersed in water, the mass of water risen in capillary is M. If the radius of capillary be doubled, the mass of water risen in the capillary will be :
- 1) M/2
 - 2) M/4
 - 3) 2 M
 - 4) 4 M
40. When a triode valve is used as an amplifier the phase difference between input and output voltages is :
- 1) zero
 - 2) $\pi/6$
 - 3) $\pi/3$
 - 4) π
41. An X-ray tube is operated at 50kV. The minimum wavelength of X-rays produced is :
- 1) 0.25 Å
 - 2) 0.225 Å
 - 3) 2.25 Å
 - 4) 1 Å
42. The distance between the successive nodes is :
- 1) $\lambda/4$
 - 2) $\lambda/2$
 - 3) 2λ
 - 4) 4λ
43. The tension in vibrating stretched piano wire is 10 N. To double the frequency, the tension in wire must be :
- 1) 10 N
 - 2) 25 N
 - 3) 40 N
 - 4) 90 N
44. Two polarising sheets are placed parallel with their polarising axes. The intensity of emergent light is I_m . Now, one of the sheets is rotated through an angle θ , the intensity varies according to relation $I = I_m \cos^2 \theta$. If the intensity of emergent light is reduced to half (i.e., $(I_m/2)$) then the angle θ will be :
- 1) $\pm 60^\circ$ and $\pm 135^\circ$

- 2) $\pm 45^\circ$ and $\pm 120^\circ$
- 3) $\pm 30^\circ$ and $\pm 120^\circ$
- 4) $\pm 45^\circ$ and $\pm 135^\circ$

45. Two batteries of emf 4 V and 8 V with internal resistances 1Ω and 2Ω respectively are connected to an external resistance $R = 9\Omega$ as shown in figure. The current in circuit and the potential difference between P and Q respectively will be :



- 1) $(1/27)\text{A}$, 27V
 - 2) $(1/12)\text{A}$, 12V
 - 3) $(1/3)\text{A}$, 3V
 - 4) $(1/4)\text{A}$, 4V
46. In lithium vapour two lithium nuclei do not fuse to form a carbon nucleus at room temperature because :
- 1) carbon nuclei are unstable
 - 2) it is contrary to energy conservation
 - 3) lithium nuclei are bound with stronger forces than carbon nuclei
 - 4) lithium cannot come too close due to coulomb repulsion
47. The temperature of sink of a Carnot engine is 27°C . If the efficiency of engine be 25%, then the temperature of source must be :
- 1) 27°C
 - 2) 127°C
 - 3) 154°C
 - 4) 224°C
48. Cathode rays are passed between the poles of a magnet as shown in figure. The effect of magnetic field is :



- 1) to increase velocity of rays
 - 2) to deflect the rays towards S-pole
 - 3) to deflect the rays towards N-pole
 - 4) to deflect the rays perpendicular to the plane of paper, upwards
49. Two soap bubbles surface tension (T) coalesce to form a big bubble under isothermal

conditions. If in this process the change in volume be V and change in surface area be S , then the correct relation is :
(where P is atmospheric pressure)

- 1) $PV + 2TS = 0$
- 2) $3PV + 4TS = 0$
- 3) $3PV + TS = 0$
- 4) $4PV + 3TS = 0$

50. The mass number of a nucleus is equal to number of :

- 1) neutrons in nucleus
- 2) protons in nucleus
- 3) electrons in nucleus
- 4) nucleons in nucleus

Chemistry

51. The relation of ΔH and ΔE is represented as :

- 1) $\Delta H = \Delta E - P\Delta V$
- 2) $\Delta E = \Delta H - P\Delta V$
- 3) $\Delta H = \Delta E + \Delta nRT$
- 4) $\Delta E = \Delta V + \Delta H$

52. The reagent used for Friedel-Craft's reaction is :

- 1) dry ether
- 2) $AlCl_3$
- 3) anhydrous $AlCl_3$
- 4) P_2O_5

53. The carboxylic acid which reduces Tollen's reagent is :

- 1) $HCOOH$
- 2) CH_3COOH
- 3) CH_3CH_2COOH
- 4) $CH_3CH_2CH_2COOH$

54. The dissociation constant of two acids HA_1 and HA_2 are 3.0×10^{-4} and 1.8×10^{-5} respectively. The relative strengths of the acids is :

- 1) 1 : 2
- 2) 1 : 4
- 3) 4 : 1
- 4) 2 : 1

55. The oil of winter green is :

- 1) ethyl salicylate
- 2) methyl salicylate
- 3) benzaldehyde
- 4) phenyl salicylate

56. The equivalent weight of KMnO_4 in acidic medium is :

- 1) 158
- 2) 48.65
- 3) 31.6
- 4) 72

57. The correct one for d-orbital is :

- 1) $(n - 1) d^{1-8} ns^1$
- 2) $(n - 1) d^{1-10} ns^{1-2}$
- 3) $(n - 1) d^{1-7}$
- 4) $(n - 1) d^{1-10} ns^2$

58. Butter is a colloidal solution of :

- 1) solid-solid
- 2) liquid-solid
- 3) solid-liquid
- 4) gas-solid

59. A compound (60g) on analysis produce carbon, hydrogen and oxygen 24g, 4g and 32g respectively. The empirical formula is :

- 1) $\text{C}_2\text{H}_2\text{O}_2$
- 2) $\text{C}_2\text{H}_4\text{O}_2$
- 3) CH_2O
- 4) $\text{C}_2\text{H}_4\text{O}_6$

60. Carbogen is a mixture of :

- 1) $\text{CO}_2 + \text{N}_2$
- 2) $\text{CO} + \text{O}_2$
- 3) $\text{CO}_2 + \text{O}_2$
- 4) $\text{C} + \text{H}_2 + \text{N}_2$

61. The electron affinity of Be is similar to :

- 1) He
- 2) B
- 3) Li
- 4) Na

62. The lightest gas is :

- 1) N_2
- 2) Ar
- 3) Rn
- 4) He

63. One mole of CH_4 contains :

- 1) 4 g atoms of hydrogen
- 2) 6.0 g atoms of carbon
- 3) 6.02×10^{23} atoms of hydrogen
- 4) 2.81×10^{23} molecules of CH_4

64. The oxidation state of M^{3+} after removing three electrons is :

- 1) zero
- 2) +3
- 3) +6
- 4) -3

65. Atom bomb is based on the principle of :

- 1) nuclear fusion
- 2) nuclear fission
- 3) nuclear transformation
- 4) carbon dating

66. The claisen condensation reaction is given by :

- 1) $CH_3COOC_2H_5$
- 2) CH_3CHO
- 3) C_6H_5Cl
- 4) $HCHO$

67. The osmotic pressure of 5% solution of cane-sugar at $150^\circ C$ is :

- 1) 2.47 atm
- 2) 5.07 atm
- 3) 3.09 atm
- 4) 8.03 atm

68. Formalin is :

- 1) $HCHO$
- 2) CH_3CHO
- 3) $HCOOH$
- 4) CH_3COOH

69. Nessler's reagent is :

- 1) NaHgCl_4
- 2) K_2HgI_4
- 3) $\text{Hg}(\text{NH}_3)_2\text{Cl}$
- 4) $\text{K}_2\text{HgI}_4 + \text{KOH}$

70. The oxidation number of sulphur in $\text{Na}_2\text{S}_2\text{O}_3$ is :

- 1) +1
- 2) +2
- 3) +3
- 4) -1

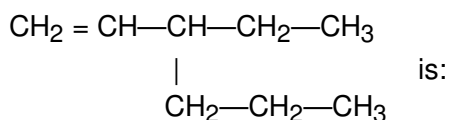
71. ${}_{90}\text{Th}^{232} \rightarrow {}_{82}\text{Pb}^{208}$ The number of α and β particles emitted during the above reaction is :

- 1) 3α and 2β
- 2) 2α and 3β
- 3) 4α and 2β
- 4) 6α and 4β

72. For converting a solution of 100 mL KCl of 0.4 M concentration into a solution of KCl 0.05 M concentration. The quantity of water added is :

- 1) 1000 mL
- 2) 700 mL
- 3) 400 mL
- 4) 100 mL

73. The IUPAC name of



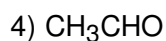
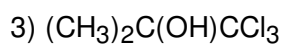
- 1) 3-propyl pentene-1
- 2) 3-ethyl penten-1
- 3) 4-ethyl hexene-1
- 4) 3-ethyl hexene-1

74. The moderator used in nuclear reactor is :

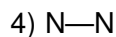
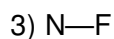
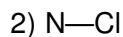
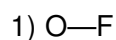
- 1) TEL
- 2) D_2O
- 3) H_2O_2
- 4) $\text{R}-\text{O}-\text{R}$

75. Acetone and chloroform reacts to produce :

- 1) CH_3COOH
- 2) $\text{CH}_3-\text{O}-\text{CH}_3$



76. The most polar bond is :



77. Picric acid is :

1) trinitrotoluene

2) trinitrobenzene

3) trinitrophenol

4) trinitroaniline

78. The *cis* and *trans* isomers are represented by :

1) pent-1-ene

2) but-2-ene

3) prop-1-ene

4) but-1-ene

79. ${}_{19}\text{K}^{40}$ and ${}_{20}\text{Ca}^{40}$ are known as :

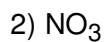
1) isotopes

2) isobars

3) isotones

4) isodiaphers

80. The species responsible for nitration is :



4) all of these

81. Glycerol on oxidation with bismuth nitrate produce :

1) glyceric acid

2) glyoxalic acid

3) oxalic acid

4) meso-oxalic acid

82. The incorrect statement for d-block element is :

1) It shows magnetic property

- 2) It has variable valency
- 3) It has tendency for formation of coloured ions
- 4) It has complete d-orbitals

83. The phenomenon of mutation is :

- 1) chemical change in DNA molecule
- 2) production of antibodies
- 3) synthesis of macromolecules
- 4) invasion of foreign micro-organism

84. The number of double bonds in gammexane is :

- 1) 0
- 2) 1
- 3) 2
- 4) 3

85. Bronze is a mixture of :

- 1) Pb + Sn
- 2) Cu + Sn
- 3) Cu + Zn
- 4) Pb + Zn

86. Benzaldehyde is converted to benzyl alcohol by :

- 1) Wurtz reaction
- 2) Cannizaro reaction
- 3) Fittig reaction
- 4) Wurtz-Fittig reaction

87. The hybridisation present in IF_3 is :

- 1) sp^3d
- 2) sp^3
- 3) sp^3d^2
- 4) sp^3d^3

88. The ore of aluminium is :

- 1) carnallite
- 2) malachite
- 3) galena
- 4) bauxite

89. The number of σ and π bonds present in $\text{CH} \equiv \text{C}-\text{CH}_2-\text{CH}=\text{CH}_2$ is :

- 1) $10\sigma, 3\pi$
- 2) $10\sigma, 2\pi$
- 3) $8\sigma, 2\pi$

4) $12\sigma, 3\pi$

90. The incorrect statement for 14g of CO is :

- 1) It occupies 2.24 L at NTP
- 2) It corresponds to $(1/2)$ mole of CO
- 3) It corresponds to same mole of CO and N_2
- 4) It corresponds to 6.01×10^{23} molecules of CO

91. The process of zinc-plating on iron sheet is known as :

- 1) annealing
- 2) roasting
- 3) galvanization
- 4) smelting

92. The correct order of relative acidity is :

- 1) $HClO > HClO_2 > HClO_3 > HClO_4$
- 2) $HClO_4 > HClO_3 > HClO_2 > HClO$
- 3) $HClO > HClO_4 > HClO_2 > HClO_3$
- 4) $HClO_3 > HClO_2 > HClO_4 > HClO$

93. The half-life period of radium is 1580 yr. It remains $1/16$ after the years :

- 1) 1480 yr
- 2) 3260 yr
- 3) 4840 yr
- 4) 6320 yr

94. Aniline reacts with chloroform in presence of alcoholic KOH to produce bad smelling compound. The compound produced is :

- 1) C_6H_5NC
- 2) C_6H_5CN
- 3) C_6H_5Cl
- 4) $C_6H_5NHC_6H_5$

95. $NH_4Cl(s) \rightarrow NH_3(g) + HCl(g)$

When the above reaction occurs, the entropy :

- 1) remains same
- 2) decreases
- 3) increases
- 4) none of these

96. The laboratory method for the preparation of H_2O_2 is by :

- 1) H_2SO_4
- 2) NH_4HSO_4
- 3) $\text{Na}_2\text{O}_2 + \text{H}_2\text{SO}_4$
- 4) all of these

97. The indicator used for the titration of weak base and strong acid is :

- 1) thymol blue
- 2) methyl orange
- 3) phenolphthalein
- 4) fluorescein

98. Sindoor is represented by :

- 1) $\text{Pb}(\text{NO}_3)_2$
- 2) $\text{PbCO}_3 \cdot \text{Pb}(\text{OH})_2$
- 3) $\text{Pb}(\text{OH})_2 \cdot 4\text{PbCO}_3$
- 4) Pb_3O_4

99. Duralumin is an alloy of :

- 1) Al + Mn
- 2) Al + Mg + Ni + Mn
- 3) Al + Mg + Ni
- 4) Al + Mg + Mn + Cu

100. The oxygen obtained from 72 kg of water is :

- 1) 72 kg
- 2) 36 kg
- 3) 48 kg
- 4) 64 kg

Answer Key

1) 1	2) 1	3) 1	4) 2	5) 2	6) 4	7) 4	8) 1	9) 2	10) 3
11) 1	12) 1	13) 3	14) 3	15) 3	16) 4	17) 3	18) 2	19) 3	20) 1
21) 2	22) 2	23) 3	24) 2	25) 1	26) 1	27) 3	28) 2	29) 3	30) 3
31) 3	32) 4	33) 2	34) 1	35) 4	36) 1	37) 1	38) 4	39) 3	40) 4
41) 1	42) 2	43) 3	44) 4	45) 3	46) 4	47) 2	48) 4	49) 2	50) 4
51) 3	52) 3	53) 1	54) 3	55) 2	56) 3	57) 2	58) 2	59) 3	60) 3
61) 1	62) 4	63) 1	64) 3	65) 2	66) 1	67) 2	68) 1	69) 4	70) 2
71) 4	72) 2	73) 4	74) 2	75) 3	76) 3	77) 3	78) 2	79) 2	80) 1
81) 4	82) 4	83) 1	84) 1	85) 2	86) 2	87) 1	88) 4	89) 1	90) 1
91) 3	92) 2	93) 4	94) 1	95) 3	96) 3	97) 2	98) 4	99) 4	100) 4