VITEEE SAMPLE PAPER 2025

Max. Marks : 125 **Time : 2½ hrs**

PART - I : PHYSICS

1. In a hollow spherical shell, potential (V) changes with respect to distance (s) from centre as

(a) 

(b) 

(c) 

(d) 

2. Four charges equal to -Q are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium the value of q is

(a) $-\frac{Q}{2}(1+2\sqrt{2})$ (b) $\frac{Q}{4}(1+2\sqrt{2})$

(c) $-\frac{Q}{4}(1+2\sqrt{2})$ (d) $\frac{Q}{2}(1+2\sqrt{2})$

3. The stored energy of Capacitor is W after giving a charge q. If we increase charge form q to 2q then stored energy is (The capacitance of capacitor is C)

(a) 2 W (b) W/2
(c) 4W (d) W/4

4. When air is replaced by a dielectric medium of force constant K, the maximum force of attraction between two charges, separated by a distance

(a) decreases K-times
(b) increases K-times
(c) remains unchanged
(d) becomes $\frac{1}{K^3}$ times

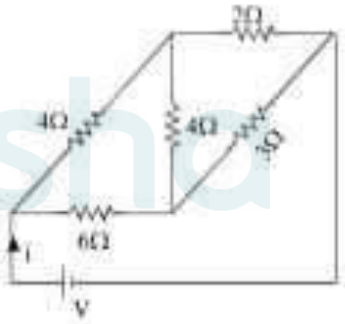
5. A steady current of 1.5 amp flows through a copper voltameter for 10 minutes. If the electrochemical equivalent of copper is 30×10^{-5} g coulomb^{-1}, the mass of copper deposited on the electrode will be

(a) 0.50 g (b) 0.67 g
(c) 0.27 g (d) 0.40 g.

6. Kirchhoff's first and second laws for electrical circuits are consequences of

(a) conservation of electric charge and energy respectively
(b) conservation of electric charge
(c) conservation of energy and electric charge respectively
(d) conservation of energy

7. For the network shown in the Fig. the value of the current i is



(a) $\frac{9V}{35}$ (b) $\frac{18V}{5}$

(c) $\frac{5V}{9}$ (d) $\frac{5V}{18}$

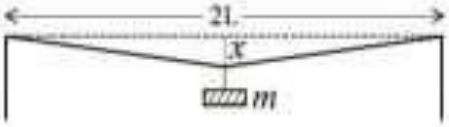
8. Two cells, having the same e.m.f., are connected in series through an external resistance R. Cells have internal resistances r_1 and r_2 ($r_1 > r_2$) respectively. When the circuit is closed, the potential difference across the first cell is zero. The value of R is

(a) $\frac{r_1 + r_2}{2}$ (b) $\frac{r_1 - r_2}{2}$

(c) $r_1 + r_2$ (d) $r_1 - r_2$

9. If 25W, 220 V and 100 W, 220 V bulbs are connected in series across a 440 V line, then
   (a) only 25W bulb will fuse
   (b) only 100W bulb will fuse
   (c) both bulbs will fuse
   (d) none of these

10. A mild steel wire of length 2L and cross-sectional area A is stretched, well within elastic limit, horizontally between two pillars. A mass m is suspended from the mid point of the wire. Strain in the wire is



(a) $\frac{x}{2L}$ (b) $\frac{x}{L}$

(c) $\frac{x^2}{L}$ (d) $\frac{x^2}{2L}$

11. An electron enters a region where magnetic field (B) and electric field (E) are mutually perpendicular, then
   (a) it will always move in the direction of B
   (b) it will always move in the direction of E
   (c) it always possesses circular motion
   (d) it can go undeflected also.

12. A wire carries a current. Maintaining the same current it is bent first to form a circular plane coil of one turn which produces a magnetic field B at the centre of the coil. The same length is now bent more sharply to give a double loop of smaller radius. The magnetic field at the centre of the double loop, caused by the same current is
   (a) 4B (b) B/4
   (c) B/2 (d) 2B

13. A coil of inductive reactance 31 Ω has a resistance of 8 Ω. It is placed in series with a condenser of capacitative reactance 25Ω. The combination is connected to an a.c. source of 110 volt. The power factor of the circuit is
   (a) 0.64 (b) 0.80
   (c) 0.33 (d) 0.56

14. The core of a transformer is laminated because
   (a) the weight of the transformer may be reduced
   (b) rusting of the core may be prevented
   (c) ratio of voltage in primary and secondary may be increased
   (d) energy losses due to eddy currents may be minimised

15. A step-up transformer operates on a 230 V line and supplies a load of 2 ampere. The ratio of the primary and secondary windings is 1 : 25. The current in the primary is
   (a) 25A (b) 50A
   (c) 15A (d) 12.5A

16. An inductance L having a resistance R is connected to an alternating source of angular frequency ω. The quality factor Q of the inductance is

(a) $\frac{R}{\omega L}$ (b) $\left(\frac{\omega L}{R}\right)^2$

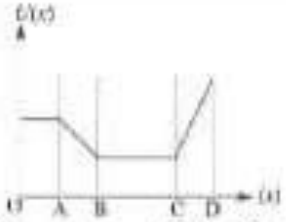
(c) $\left(\frac{R}{\omega L}\right)^{1/2}$ (d) $\frac{\omega L}{R}$

17. Assuming no heat losses, the heat released by the condensation of x g of steam at 100°C can be used to convert y g of ice at 0°C into water at 100°C, the ratio x : y is :
   (a) 1 : 1 (b) 1 : 2
   (c) 1 : 3 (d) 3 : 1

18. Interference is possible in
   (a) light waves only
   (b) sound waves only
   (c) both light and sound waves
   (d) neither light nor sound waves

19. Two sources of light are said to be coherent if they emit light
   (a) of equal amplitudes
   (b) having the same wavelength
   (c) having a constant phase relationship
   (d) having the same intensity

20. The figure gives the potential energy function $U(x)$ for a system in which a particle is in one-dimensional motion. In which region the magnitude of the force on the particle is greatest



(a) OA (b) AB
(c) BC (d) CD

21. The frequency of the radiation emitted by a hydrogen atom for the transition between n = 2 and n = 1 states is ν_0. What is the frequency of the radiation emitted by the hydrogen atom for transition between n = 4 and n = 1 states ?
(a) $3\nu_0/2$ (b) $2\nu_0$
(c) $4\nu_0$ (d) $5\nu_0/4$

22. Match List-I (Series Spectra of Hydrogen) with List-II (Region in which the series lies) and select the correct answer using the codes given below the Lists :

List-I (*Series spectra of Hydrogen*)	List-II (*Region in which the series lies*)
A. Lyman	1. Visible
B. Balmer	2. Infra red
C. Paschen	3. Ultra violet
D. Brackett	4. X-ray
	5. γ-ray

Codes :

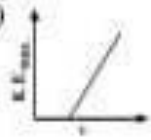
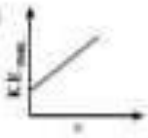
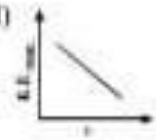
	A	B	C	D
(a)	3	1	2	2
(b)	1	3	2	4
(c)	3	1	4	5
(d)	1	2	3	5

23. In Millikan oil drop experiment a drop of charge Q and radius r is kept constant between two plates of potential difference of 800 volt. Then charge on other drop of radius 2 r which is kept constant with a potential difference of 3200 V is
(a) Q/2 (b) 2Q
(c) 4Q (d) Q/4

24. White X-rays are called white due to the fact that
(a) they are electromagnetic radiations having nature same as that of white light.
(b) they are produced most abundantly in X ray tubes.
(c) they have a continuous wavelength range.
(d) they can be converted to visible light using coated screens and photographic plates are affected by them just like light.

25. The photo electric work function for a metal surface is 4.125 eV. The cut-off wavelength for this surface is
(a) 4125 Å (b) 3000 Å
(c) 6000 Å (d) 2062 Å

26. The variation of maximum kinetic energy photoelectrons with applied frequency (v) is

(a) 
(b) 
(c) 
(d) 

27. If n bullets each of mass m are fired with a velocity v per second from a machine gun, the force required to hold the gun in position is
(a) $(n+1)mv$ (b) $\frac{mv}{n^2}$
(c) $\frac{mv}{n}$ (d) mnv

28. The ratio of de-Broglie wavelengths of proton and α -particle having same kinetic energy is
(a) $\sqrt{2}:1$ (b) $2\sqrt{2}:1$
(c) $2:1$ (d) $4:1$

29. Match List-I (Classification) with List-II (Elementary Particles) and select the correct answer using the codes given below the Lists :

List-I (*Classification*)	List-II (*Elementary particles*)
A. Baryons	1. Nucleon
B. Mesons	2. Neutrino
C. Leptons	3. Pion
D. Bosons	4. Photon

Codes :

	A	B	C	D
(a)	1	3	2	4
(b)	2	3	1	4
(c)	1	4	2	3
(d)	2	4	1	3

30. M_p is the mass of proton and m_n is the mass of neutron. If the mass of nucleus of an atom ${}_ZX^A$ is measured and found to be M, then the nuclear binding energy would be (c is the velocity of light):
(a) $\{Zm_p + (A-Z)m_n - M\}c^2$
(b) $\{Am_n + Zm_p + M\}c^2$
(c) $\{(Z-A)m_p + Am_n - M\}c^2$
(d) $\{M - Zm_p - (A-Z)m_n\}c^2$

31. When a radioactive element decays by gamma radiation
(a) its mass number will decrease by one unit with no change in atomic number
(b) its mass number will not change but the atomic number will increase by one unit
(c) both mass number and atomic number of the element change
(d) there will be no change in either mass number or atomic number of the element

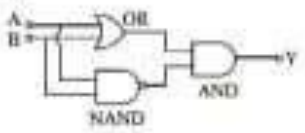
32. In the uranium radioactive series, the initial nucleus is ${}_{92}U^{238}$ and that the final nucleus is ${}_{82}Pb^{206}$. When uranium nucleus decays to lead, the number of α particles and β particles emitted are
(a) $8\alpha, 6\beta$ (b) $6\alpha, 7\beta$
(c) $6\alpha, 8\beta$ (d) $4\alpha, 3\beta$

33. In semiconductors at a room temperature
(a) the conduction band is completely empty
(b) the valence band is partially empty and the conduction band is partially filled
(c) the valence band is completely filled and the conduction band is partially filled
(d) the valence band is completely filled

34. The peak voltage in the output of a half-wave diode rectifier fed with a sinusoidal signal without filter is 10V. The d.c. component of the output voltage is
(a) $20/\pi$ V (b) $10/\sqrt{2}$ V
(c) $10/\pi$ V (d) 10V

35. An oscillator is nothing but an amplifier with
(a) positive feedback
(b) large gain
(c) no feedback
(d) negative feedback

36. The following configuration of gate is equivalent to



(a) NAND (b) XOR
(c) OR (d) NOR

37. A ball is thrown up at an angle with the horizontal. Then the total change of momentum by the instant it returns to ground is
(a) acceleration due to gravity × total time of flight
(b) weight of the ball × half the time of flight
(c) weight of the ball × total time of flight
(d) weight of the ball × horizontal range

38. A particle of mass m has momentum p. Its kinetic energy will be
(a) mp (b) p^2m
(c) $\frac{p^2}{m}$ (d) $\frac{p^2}{2m}$

39. The reading of Centigrade thermometer coincides with that of Fahrenheit thermometer in a liquid. The temperature of the liquid is
(a) $-40°C$ (b) $313°C$
(c) $0°C$ (d) $100°C$

40. If a rubber ball is taken at the depth of 200 m in a pool, its volume decreases by 0.1%. If the density of the water is 1×10^3 kg/m^3 and g = 10m/s^2, then the volume elasticity in N/m^2 will be
(a) 10^8 (b) 2×10^8
(c) 10^9 (d) 2×10^9

PART - II : CHEMISTRY

41. The alcohol which does not give a stable compound on dehydration is
(a) Ethyl alcohol (b) Methyl alcohol
(c) n-Propyl alcohol (d) n-Butyl alcohol

42. IR spectrum of an organic compound is found about 1715 cm^{-1}. The organic compound is
(a) An aliphatic ketone
(b) An aliphatic aldehyde
(c) α, β - unsaturated ketones
(d) Phenolic ketone

43. The most suitable method of separation of a mixture *ortho* and *para*-nitrophenols mixed in the ratio of 1 : 1 is
(a) Steam distillation
(b) Crystallisation
(c) Vapourization
(d) Colour spectrum

44. When diethyl ether is treated with excess of Cl_2 in the presence of sunlight, then the product formed is

(a) $CH_3CHCl-O-CH_2CH_3$

(b) $CH_3CHCl-O-CHClCH_3$

(c) $CCl_3CCl_2OCCl_2CCl_3$

(d) $CH_3CCl_2-O-CHClCH_3$

45. The ether that undergoes electrophilic substitution reactions is

(a) $CH_3OC_2H_5$ (b) $C_6H_5OCH_3$

(c) CH_3OCH_3 (d) $C_2H_5OC_2H_5$

46. What is the E°_{cell} for the reaction

$$Cu^{2+}_{(aq)} + Sn^{2+}_{(aq)} + \rightleftharpoons Cu_{(S)} + Sn^{4+}_{(aq)}$$

at 25°C if the equilibrium constant for the reaction is 1×10^6?

(a) 0.5328 V (b) 0.3552 V

(c) 0.1773 V (d) 0.7104 V

47. The ionic conductance of Ba^{2+} and Cl^- are respectively 127 and 76 ohm^{-1} cm^2 at infinite dilution. The equivalent conductance (in ohm^{-1} cm^2) of $BaCl_2$ at infinite dilution will be :

(a) 139.5 (b) 203

(c) 279 (d) 101.5

48. A solution of $[Ni(H_2O)_6^{2+}]$ is green due to

(a) d-d transition from $t_{2g} \rightarrow e_g$

(b) d-d transition from $e_g \rightarrow t_{2g}$

(c) d-d electronic transition from $t_{2g} \rightarrow e_g$ state associated with an amount of energy which comes under visible green region.

(d) d-d electronic transition from $t_{2g}^* \rightarrow e_g^*$

49. Prevention of corrosion of iron by Zn coating is called

(a) Galvanization

(b) Cathodic protection

(c) Electrolysis

(d) Photoelectrolysis

50. Indicate which of the nitrogen compounds amongst the following would undergo Hoffmann's reaction, i.e., reaction with Br_2 and strong KOH to furnish the primary amine ($R-NH_2$) ?

(a) $R-CO-NHCH_3$

(b) $R-CO-ONH_4$

(c) $R-CO-NH_2$

(d) $R-CO-NHOH$

51. Indicate which of the nitrogen compounds amongst the following would undergo Hoffmann's reaction, i.e., reaction with Br_2 and strong KOH to furnish the primary amine ($R-NH_2$) ?

(a) $R-CO-NHCH_3$

(b) $R-CO-ONH_4$

(c) $R-CO-NH_2$

(d) $R-CO-NHOH$

52. Benzaldehyde reacts with ethanoic KCN to give

(a) $C_6H_5CHOHCN$

(b) $C_6H_5CHOHCOC_6H_5$

(c) $C_6H_5CHOHCOOH$

(d) $C_6H_5CHOHCHOHC_6H_5$

53. Which of the following compound will undergo self aldol condensation in the presence of cold dilute alkali ?

(a) $CH_2=CH-CHO$

(b) $CH\equiv C-CHO$

(c) C_6H_5CHO

(d) CH_3CH_2CHO

54. $3CH_3COCH_3 \xrightarrow[-3H_2O]{HCl}$

(A)

$$(CH_3)_2C=CH-CO-CH=C(CH_3)_2$$

(B)

This polymer (B) is obtained when acetone is saturated with hydrogen chloride gas, B can be

(a) phorone

(b) formose

(c) diacetone alcohol

(d) mesityl oxide.

55. Formic acid is obtained when

(a) Calcium acetate is heated with conc. H_2SO_4

(b) Calcium formate is heated with calcium acetate

(c) Glycerol is heated with oxalic acid at 373 K

(d) Acetaldehyde is oxidised with $K_2Cr_2O_7$ and H_2SO_4.

56. In the Freidel Craft's acylation reaction, the effective electrophile is

(a) $RCOCl^{\oplus}$ (b) $AlCl_3$

(c) RCOCl (d) $RCO^{\oplus}$

57. The total number of possible isomers for the complex compound $[Cu^{II}(NH_3)_4][Pt^{II}Cl_4]$
(a) 3 (b) 6
(c) 5 (d) 4

58. Identify the incorrect statement among the following:
(a) Lanthanoid contraction is the accumulation of successive shrinkages.
(b) As a result of lanthanoid contraction, the properties of 4d series of the transition elements have no similarities with the 5d series of elements.
(c) Shielding power of 4f electrons is quite weak.
(d) There is a decrease in the radii of the atoms or ions as one proceeds from La to Lu.

59. Wooden artifact and a freshly cut down tree give 7.6 and 15.2 counts min^{-1} g^{-1} of carbon ($t_{1/2}$ = 5760 years) respectively. The age of the artifact is
(a) 5760 years
(b) 5760 × (7.6/15.2) years
(c) 5760 × (15.2/7.6) years
(d) 5760 × (15.2 – 7.6) years

60. Half-life of a radioactive particle is 1 second. The rate of dissociation of A is 1000 per second. Then after 3 sec, (A) will be
(a) 500 (b) 250
(c) 125 (d) 333

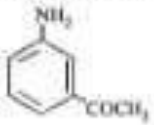
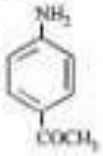
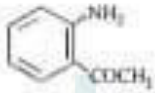
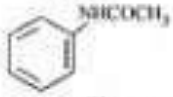
61. Half life of a first order reaction is 4 s and the initial concentration of the reactants is 0.12 M. The concentration of the reactant left after 16 s is
(a) 0.0075 M (b) 0.06 M
(c) 0.03 M (d) 0.015 M

62. When a biochemical reaction is carried out in laboratory in the absence of enzyme then rate of reaction obtained is 10^{-6} times, then activation energy of reaction in the presence of enzyme is
(a) $\frac{6}{RT}$
(b) Different from E_a obtained in laboratory
(c) P is required
(d) Can't say anything

63. The temperature dependence of rate constant (k) of a chemical reaction is written in terms of Arrhenius equation, $k = Ae^{-E_a^*/RT}$. Activation energy (E_a^*) of the reaction can be calculated by plotting
(a) $\log k$ vs $\frac{1}{\log T}$ (b) k vs T
(c) k vs $\frac{1}{\log T}$ (d) $\log k$ vs $\frac{1}{T}$

64. The activation energy for a simple chemical reaction $A \rightarrow B$ is E_a in forward direction. The activation energy for reverse reaction
(a) Is always double of E_a
(b) Is negative of E_a
(c) Is always less than E_a
(d) Can be less than or more than E_a

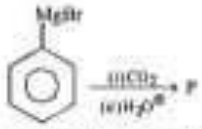
65. If α is the fraction of HI dissociated at equilibrium in the reaction, $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$, starting with 2 moles of HI, the total number of moles of reactants and products at equilibrium are
(a) 2 + 2α (b) 2
(c) 1 + α (d) 2 – α

66. Aniline is an activated system for electrophilic substitution. The compound formed on heating aniline with acetic anhydride is
(a) 
(b) 
(c) 
(d) 

67. Which of the following reagents will convert p-methylbenzenediazonium chloride into p-cresol?
(a) Cu powder (b) H_2O
(c) H_3PO_2 (d) C_6H_5OH

68. $[A] \xrightarrow{\text{reduction}} [B] \xrightarrow{CHCl_3+KOH}$
$[C] \xrightarrow{\text{reduction}}$ N – Methylaniline, A is
(a) Formaldehyde (b) Trichloromethane
(c) Nitrobenzene (d) Toluene

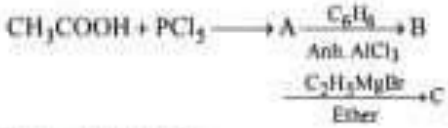
69. A nitro alkane reacts with HONO to give insoluble product in alkali which turns blue on treatment with an alkali. The nitric alkane is
(a) $CH_3CH_2NO_2$
(b) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2NO_2$
(c) $(CH_3)_2CHNO_2$
(d) $(CH_3)_3CNO_2$

70. 

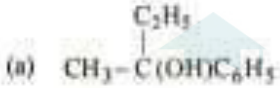
In the above reaction product 'P' is

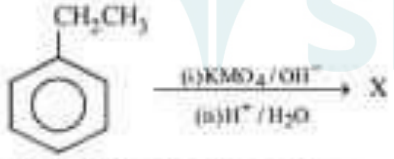
(a) 
(b) 
(c) 
(d) 

71. In a set of the given reactions, acetic acid yielded a product C.

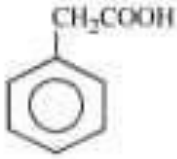


Product C would be -

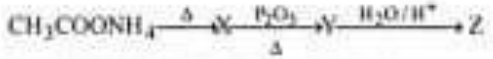
(a) 
(b) $CH_3CH(OH)C_2H_5$
(c) $CH_3COC_6H_5$
(d) $CH_3CH(OH)C_6H_5$

72. 

Predict 'X' in the above reaction

(a) 
(b) 
(c) 
(d) 

73. Indenfity Z in the sequence



(a) $CH_3CH_2CONH_2$ (b) CH_3CN
(c) CH_3COOH (d) $(CH_3CO)_2O$

74. Which of the following pairs of a chemical reaction is certain to result in a spontaneous reaction?
(a) Exothermic and increasing disorder
(b) Exothermic and decreasing disorder
(c) Endothermic and increasing disorder
(d) Endothermic and decreasing disorder

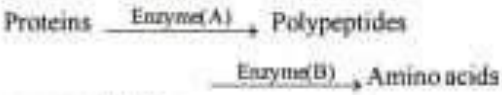
75. What is the entropy change (in JK^{-1} mol^{-1}) when one mole of ice is converted into water at 0° C? (The enthalpy change for the conversion of ice to liquid water is 6.0 kJ mol^{-1} at 0°C)
(a) 21.98 (b) 20.13
(c) 2.013 (d) 2.198

76. The densities of graphite and diamond at 298 K are 2.25 and 3.31 g cm^{-3}, respectively. If the standard free energy difference (ΔG°) is equal to 1895 J mol^{-1}, the pressure at which graphite will be transformed into diamond at 298 K is
(a) 9.92×10^5 Pa (b) 9.92×10^8 Pa
(c) 9.92×10^7 Pa (d) 9.92×10^6 Pa

77. In the fluorite structure, the coordination number of Ca^{2+} ion is :
(a) 4 (b) 6
(c) 8 (d) 3

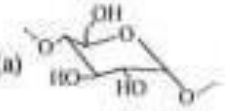
78. On doping Ge metal with a little of In or Ga, one gets
(a) p-type semi conductor
(b) n-tpe semi conductor
(c) insulator
(d) rectifier

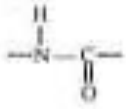
79. During the process of digestion, the proteins present in food materials are hydrolysed to amino acids. The two enzymes involved in the process



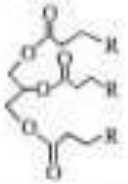
are respectively
(a) Diastase and Lipase
(b) Pepsin and Trypsin
(c) Invertase and Zymase
(d) Amylase and Maltase

80. Which one of the following chemical units is certainly to be found in an enzyme?

(a) 

(b) 

(c) 

(d) 

PART - III : MATHEMATICS

81. $\tan^{-1}\left[\cos\left(2\tan^{-1}\frac{3}{4}\right)+\sin\left(2\cot^{-1}\frac{1}{2}\right)\right]$ is

(a) not real (b) equal to $\frac{\pi}{4}$

(c) greater than $\frac{\pi}{4}$ (c) less than $\frac{\pi}{4}$

82. The general value of θ that satisfies the equation $2\cot^2\theta+2\sqrt{3}\cot\theta+4\operatorname{cosec}\theta+8=0$ is

(a) $n\pi-\frac{\pi}{6}$ (b) $n\pi+\frac{\pi}{6}$

(c) $2n\pi-\frac{\pi}{6}$ (d) $2n\pi+\frac{\pi}{6}$

83. Which of the following functions is NOT one-one ?

(a) $f: R \to R$ defined by $f(x)=6x-1$

(b) $f: R \to R$ defined by $f(x)=x^2+7$

(c) $f: R \to R$ defined by $f(x)=x^3$

(d) $f: R-\{7\} \to R$ defined by $f(x)=\frac{2x+1}{x-7}$

84. $\sin\left\{2\cos^{-1}\left(\frac{-3}{5}\right)\right\}$ is equal to

(a) $\frac{6}{25}$ (b) $\frac{24}{25}$

(c) $\frac{4}{5}$ (d) $-\frac{24}{25}$

85. Suppose that the number of elements in set A is p, the number of elements in set B is q and the number of elements in A × B is 7. Then $p^2+q^2=$

(a) 42 (b) 49

(c) 50 (d) 51

86. If $f(x)=\frac{\log_e(1+x^2\tan x)}{\sin x^3}$ for $x\neq 0$ is to be continuous at $x=0$, then f(0) must be defined as:

(a) 0 (b) 1

(c) $\frac{1}{2}$ (d) -1

87. If the eccentricity of the hyperbola $x^2-y^2\sec^2\theta=4$ is $\sqrt{3}$ times the eccentricity of the ellipse $x^2\sec^2\theta+y^2=16$, then the value of θ equals

(a) $\frac{\pi}{6}$ (b) $\frac{3\pi}{4}$

(c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

88. If A, B, C are points (1, 0, 4), (0, −1, 5) and (2, −3, 1) respectively, then the coordinates of foot of the perpendicular drawn from A to the line BC are

(a) $\left(\frac{1}{2},-\frac{1}{2},\frac{9}{2}\right)$ (b) (1, −2, 3)

(c) $\left(\frac{3}{2},-\frac{3}{2},\frac{5}{2}\right)$ (d) None of these

89. The value of $\int_{-1}^{1}\log\left(\frac{2-x}{2+x}\right)dx$ is

(a) 0 (b) 2

(c) $\log_e 2$ (d) $\pi\log_e 2$

90. The values of p, for which both the roots of equation $4x^2-20px+25p^2+15p-66=0$ are less than 2, belong to :

(a) $\left(\frac{4}{5},2\right)$ (b) $\left(-1,-\frac{4}{5}\right)$

(c) $(2,\infty)$ (d) $(-\infty,-1)$

91. Let $\vec{A}=2\hat{i}+\hat{k}$, $\vec{B}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{C}=4\hat{i}-3\hat{j}+7\hat{k}$. The vector $\vec{R}$ which satisfies the equations $\vec{R}\times\vec{B}=\vec{C}\times\vec{B}$ and $\vec{R}\cdot\vec{A}=0$ is given by

(a) $-2\hat{i}+\hat{k}$ (b) $-\hat{i}-8\hat{j}+2\hat{k}$

(c) $\frac{1}{\sqrt{6}}(\hat{i}-\hat{j}+2\hat{k})$ (d) None of these

92. Let A = {1, 2, 3, 4}. The function f: A → A and g: A → A are defined in the table given below.

x	1	2	3	4
f(x)	3	2	4	1
g(x)	4	3	2	2

The value of x, for which (fog)(x) = (gof)(x), is:
(a) 1 (b) 2
(c) 3 (d) 4

93. The population of a village increases continuously at the rate proportional to the number of its inhabitants present at any time. If the population of the village was 20, 000 in 1999 and 25000 in the year 2004, what will be the population of the village in 2009?
(a) 3125 (b) 31250
(c) 21350 (d) 12350

94. If a, b, c are sides of a triangle and

$$\begin{vmatrix} a^2 & b^2 & c^2 \\ (a+1)^2 & (b+1)^2 & (c+1)^2 \\ (a-1)^2 & (b-1)^2 & (c-1)^2 \end{vmatrix} = 0$$, then

(a) ΔABC cannot be equilateral triangle
(b) ΔABC is a right angled isosceles triangle
(c) ΔABC is an isosceles triangle
(d) None of these

95. Let A, B, C be three events. If the probability of occurring exactly one event out of A and B is 1 – a, out of B and C is 1 – 2a and out of C and A is 1 – a, and that of occurring three events simultaneously is a^2, then the probability that at least one out of A, B, C will occur is
(a) $\frac{1}{2}$ (b) $< \frac{1}{2}$
(c) $> \frac{1}{2}$ (d) none of these

96. The number of values of $x(-\pi < x \le \pi)$ which satisfy the equation

$8^{1+|\cos x|+|\cos x|^2+\ldots\infty} = 4^3$ is
(a) 2 (b) 4
(c) 6 (d) 8

97. If a point (h, k) satisfies an inequation $ax + by \ge 4$, then the half plane represented by the inequation is
(a) The half plane containing the point (h, k) but excluding the points on $ax + by = 4$
(b) The half plane containing the point (h, k) and the points on $ax + by = 4$
(c) Whole xy-plane
(d) None of these

98. The minimum value of $|z| + |z - i|$ is
(a) 0 (b) 1
(c) 2 (d) none

99. If $x^m y^n = (x+y)^{m+n}$ then $\frac{dy}{dx} =$
(a) $\frac{my}{nx}$ (b) $\frac{ny}{nx}$
(c) $\frac{y}{x}$ (d) none of these

100. If the system of equations $\lambda x + 2y - 2z = 1$, $4x + 2\lambda y - z = 2$, $6x + 6y + \lambda z = 3$ has a unique solution, then
(a) $\lambda \neq 1$ (b) $\lambda \neq 2$
(c) $\lambda \neq 3$ (d) None of these

101. A plane passes through a fixed point (a, b, c). The locus of the foot of the perpendicular to it from the origin is the sphere
(a) $x^2 + y^2 + z^2 - ax - by - cz = 0$
(b) $x^2 + y^2 + z^2 - 2ax - 2by - 2cz = 0$
(c) $x^2 + y^2 + z^2 - 4ax - 4by - 4cz = 0$
(d) None of these

102. The family of curves for which the area of the triangle formed by the x-axis, the tangent drawn at any point on the curve and radius vector of the point of tangency is constant equal to $2a^2$, is given by
(a) $x = cy \pm \frac{a^2}{y}$ (b) $y = cx \pm \frac{a^2}{x}$
(c) $x^2 \pm ay^2 = cy$ (d) $a^2x^2 \pm y^2 = cy$

103. Out of 7 consonants and 4 vowels, how many words can be made each containing 3 consonants and 2 vowels?
(a) 120 (b) 25200
(c) 4200 (d) None of these

104. The equation of normal to the curve $x + y = x^y$, where it cuts x-axis, is:
(a) $y = x$ (b) $y = x + 1$
(c) $y = x - 1$ (d) $x + y = 1$

105. If $\vec{a}$ is any vector, then

$\hat{i} \times (\vec{a} \times \hat{i}) + \hat{j} \times (\vec{a} \times \hat{j}) + \hat{k} \times (\vec{a} \times \hat{k})$ is equal to
(a) $\vec{a}$ (b) $2\vec{a}$
(c) $3\vec{a}$ (d) 0

106. Sum of the series

$$\frac{1}{1+1^2+1^4}+\frac{2}{1+2^2+2^4}+\frac{3}{1+3^2+3^4}+\ldots$$

up to n terms is equal to

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

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

107. There is 30% chance that it rains on any particular day. Given that there is at least one rainy day, then the probability that there are at least two rainy days is

(a) $\frac{\frac{14}{5}\times\left(\frac{7}{10}\right)^6}{1+\left(\frac{7}{10}\right)^7}$ (b) $\left(\frac{7}{10}\right)^6-\frac{14}{17}$

(c) $\frac{13}{5}\times\left(\frac{7}{10}\right)^6$ (d) $\frac{1-\frac{14}{15}\times\left(\frac{7}{10}\right)^6}{1-\left(\frac{7}{10}\right)^7}$

108. The logical expression X, in its simplest form for the truth table

a	b	X
1	0	0
1	1	1
0	1	0
0	0	0

is

(a) $X = a.b$ (b) $X = a + b$ (c) $X = a'.b$ (d) $X = a.b'$

109. $<N, +>$ where N is set of natural numbers is
(a) a semi group (b) a monoid group
(c) both (a) and (b) (d) none

110. The angle between the lines whose direction cosines are given by the equations $3l + m + 5n = 0$, $6mn - 2nl + 5lm = 0$ is

(a) $\cos^{-1}\left(\frac{1}{6}\right)$ (b) $\cos^{-1}\left(-\frac{1}{6}\right)$

(c) $\cos^{-1}\left(\frac{2}{3}\right)$ (d) $\cos^{-1}\left(-\frac{5}{6}\right)$

111. $\int\frac{(x^2-1)}{x\sqrt{x^4+3x^2+1}}dx$ is equal to

(a) $\log\left|x+\frac{1}{x}+\sqrt{x^2+\frac{1}{x^2}+3}\right|+C$

(b) $\log\left|x-\frac{1}{x}+\sqrt{x^2+\frac{1}{x^2}-3}\right|+C$

(c) $\log\left|x+\sqrt{x^2+3}\right|+C$

(d) None of these

112. Let $f(z) = \sin z$ and $g(z) = \cos z$. If * denotes a composition of functions, then the value of $(f+ig)*(f-ig)$ is :

(a) $ie^{-e^{-iz}}$ (b) $ie^{-e^{iz}}$

(c) $-ie^{-e^{-iz}}$ (d) None of these

113. Suppose that the probability that an item produced by a particular machine is defective equals 0.2. If 10 items produced from this machine are selected at random, the probability that not more than one defective is found is

(a) $\frac{1}{e^2}$ (b) $\frac{2}{e^2}$

(c) $\frac{3}{e^2}$ (d) none of these

114. Four distinct points (2k, 3k), (1, 0), (0, 1) and (0, 0) lie on a circle for
(a) only one value of k
(b) $0 < k < 1$
(c) $k < 0$
(d) all integral values of k

115. If $f(x)=\begin{cases}|x|+1, & x<0\\ 0, & x=0\\ |x|-1, & x>0\end{cases}$ then $\lim_{x\to a} f(x)$ exists for all

(a) $a \neq 1$ (b) $a \neq 0$
(c) $a \neq -1$ (d) $a \neq 2$

116. Area bounded by the parabola $y = x^2 - 2x + 3$ and tangents drawn to it from the point P(1, 0) is equal to

(a) $4\sqrt{2}$ sq. units (b) $\frac{4\sqrt{2}}{3}$ sq. units

(c) $\frac{8\sqrt{2}}{3}$ sq. units (d) $\frac{16}{3}\sqrt{2}$ sq. units

117. The length of the line segment joining the vertex of the parabola $y^2 = 4ax$ and a point on the parabola where the line segment makes an angle θ to the x-axis is $\frac{4am}{n}$. Here, m and n respectively are

(a) $\sin\theta, \cos\theta$ (b) $\cos\theta, \sin\theta$
(c) $\cos\theta, \sin^2\theta$ (d) $\sin^2\theta, \cos\theta$

118. A balloon ascends with uniform acceleration of $122\frac{5}{8}$ cm/sec units, at the end of half a minute a body is released from it. The time that elapses before the body reaches the ground in sec is :

(a) 10 (b) 15
(c) 20 (d) none

119. The domain of $f(x) = \frac{1}{\sqrt{2x-1}} - \sqrt{1-x^2}$ is:

(a) $\left]\frac{1}{2}, 1\right[$ (b) $[-1, \infty[$
(c) $[1, \infty[$ (d) None of these

120. The number of ways of selecting 8 books from a library which has 9 books each of Mathematics, Physics, Chemistry and English is :

(a) 165 (b) ${}^{27}C_8$
(c) 3^8 (d) None of these

PART - IV : ENGLISH

Direction (Qs. 121 - 123) Read the passage carefully and answer the questions given below

What needs to be set right is our approach to work. It is a common sight in our country of employees reporting for duty on time and at the same time doing little work. If an assessment is made of time they spent in gossiping, drinking tea, eating "pan" and smoking cigarettes, it will be shocking to know that the time devoted to actual work is negligible. The problem is the standard which the leadership in administration sets for the staff. Forgot the ministers because they mix politics and administration. What do top bureaucrats do? What do the below down officials do? The administration set up remains week mainly because the employees do not have the right example to follow and they are more concerned about being in the good books of the bosses than doing work.

121. The employees in our country

(a) are quite punctual but not duty conscious
(b) are not punctual, but somehow manage to complete their work
(c) are somewhat lazy but good natured
(d) are not very highly qualified

122. According to the writer, the administration in India

(a) is by and large effective
(b) is very strict and firm
(c) is affected by red tape
(d) is more or less ineffective

123. The word 'assessment' means

(a) enquiry
(b) report
(c) evaluation
(d) summary

124. Choose the word which is most dissimilar to the word given in bold.

Abate

(a) augment
(b) free
(c) provoke
(d) wane

125. Choose the best pronunciation of the word, Genre, from the following options.

(a) zhon-ruh (b) jen-ner
(c) zon-er (d) zon-ra

ANSWER KEY

1. B
2. C
3. A
4. C
5. A
6. D
7. D
8. A
9. A
10. D
11. A
12. B
13. D
14. B
15. D
16. C
17. C
18. C
19. D
20. D
21. A
22. B
23. C
24. B
25. B
26. D
27. C
28. A
29. A
30. D
31. A
32. C
33. C
34. A
35. B
36. C
37. D
38. A
39. D
40. B
41. A
42. A
43. C
44. B
45. C
46. A
47. C
48. A
49. C
50. C
51. B
52. D
53. A
54. C
55. D
56. D
57. B
58. A
59. C
60. A
61. B
62. D
63. D
64. B
65. D
66. B

67. C
68. C
69. B
70. A
71. C
72. C
73. A
74. A
75. B
76. C
77. A
78. B
79. B
80. B
81. C
82. C
83. B
84. C
85. B
86. B
87. D
88. A
89. D
90. B
91. C
92. B
93. C
94. C
95. B
96. B
97. B
98. C
99. B
100.A
101.A
102.B
103.C
104.B
105.B
106.D
107.A
108.A
109.B
110.A
111.B
112.C
113.A
114.B
115.C
116.C
117.B
118.A
119.A
120.A
121.D
122.C
123.A
124.A
125. A

VITEEE SAMPLE PAPER 2024

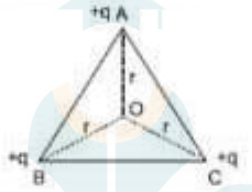
Max. Marks : 125 **Time : 2½ hrs**

PART - I : PHYSICS

1. At temperature T, the emissive power and absorption power of a body for certain wavelength are e_λ and a_λ respectively, then
   (a) $e_\lambda = a_\lambda$
   (b) $e_\lambda > a_\lambda$
   (c) $e_\lambda < a_\lambda$
   (d) there will not be any difinite relation between e_λ and a_λ

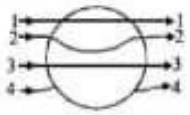
2. The work done in placing a charge of 8×10^{-18} coulomb on a condenser of capacity 100 micro-farad is
   (a) 3.1×10^{-26} joule
   (b) 4×10^{-10} joule
   (c) 32×10^{-32} joule
   (d) 16×10^{-232} joule

3. ABC is an equilateral triangle. Charges +q are placed at each corner as shown as fig. The electric intensity at centre O will be



   (a) $\frac{1}{4\pi\epsilon_0}\frac{q}{r}$ (b) $\frac{1}{4\pi\epsilon_0}\frac{q}{r^2}$
   (c) $\frac{1}{4\pi\epsilon_0}\frac{3q}{r^2}$ (d) zero

4. A metallic sphere is placed in a uniform electric field. The line of force follow the path (s) shown in the figure as



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

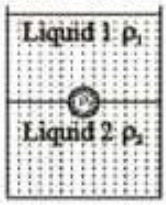
5. In an explosion, a body breaks up into two pieces of unequal masses. In this
   (a) both parts will have numerically equal momentum
   (b) lighter part will have more momentum
   (c) heavier part will have more momentum
   (d) both parts will have equal kinetic energy

6. When a wire of uniform cross-section a, length l and resistance R is bent into a complete circle, resistance between any two of diametrically opposite points will be

   (a) $\frac{R}{4}$ (b) 4R (c) $\frac{R}{8}$ (d) $\frac{R}{2}$

7. Three resistances P, Q, R each of 2Ω and an unknown resistance S form the four arms of a Wheatstone bridge circuit. When a resistance of 6Ω is connected in parallel to S the bridge gets balanced. What is the value of S?
   (a) 3Ω (b) 6Ω
   (c) 1Ω (d) 2Ω

8. A jar is filled with two non-mixing liquids 1 and 2 having densities ρ_1 and, ρ_2 respectively. A solid ball, made of a material of density ρ_3, is dropped in the jar. It comes to equilibrium in the position shown in the figure. Which of the following is true for ρ_1, ρ_1 and ρ_3?



   (a) $\rho_3 < \rho_1 < \rho_2$
   (b) $\rho_1 > \rho_3 > \rho_2$
   (c) $\rho_1 < \rho_2 < \rho_3$
   (d) $\rho_1 < \rho_3 < \rho_2$

9. In a mass spectrometer used for measuring the masses of ions, the ions are initially accelerated by an electric potential V and then made to describe semicircular path of radius R using a

(a) $V^1 \sin\theta = V \sin\theta$
(b) $V^1 \sin\theta' = -\sin\theta$
(c) $V^1 \cos\theta' = V \cos\theta$
(d) $V^1 \cos\theta' = -V \cos\theta$

20. Unpolarized light is incident on a glass plate having refractive index 1.5. The angle of incidence at which the plane polarised light obtained, is
(a) 52° (b) 57°
(c) 60° (d) 66°

21. If in the first Bohr orbit of a bydrogen atom, the total energy of the electron is -21.76×10^{-19} J, then its potential energy will be
(a) -43.52×10^{-19} J (b) -21.76×10^{-19} J
(c) -10.88×10^{-19} J (d) -13.60×10^{-19} J

22. Given that the formula for the various spectral series in the hydrogen atoms is given by $\frac{1}{\lambda} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$, where n_1 and n_2 are integers, match List-I with List-II and select the correct answer using the codes given below the Lists :

	List-I		List-II
A.	Balmer series	1.	$n_1 = 1$
B.	Brackett series	2.	$n_1 = 2$
C.	Paschen series	3.	$n_1 = 3$
D.	Lyman series	4.	$n_1 = 4$

Codes :

	A	B	C	D
(a)	2	1	3	4
(b)	2	4	3	1
(c)	2	4	1	2
(d)	4	3	2	1

23. To obtain laser from a system, the stimulating radiation must be
(a) an electromagnetic wave of any frequency with suitable phase
(b) an electromagnetic wave of any frequency with any phase
(c) an electromagnetic wave of suitable frequency
(d) any wave with suitable frequency

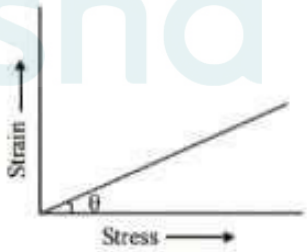
24. The X-rays of wavelength 0.5 Å are scattered by a target. What will be the energy of incident X-rays, if these are scattered at an angle of 72° ?
(a) 12.41 keV (b) 6.2 keV
(c) 18.6 keV (d) 24.82 keV

25. The momentum of photon whose frequency f is
(a) $\frac{hf}{c}$ (b) $\frac{hc}{f}$
(c) $\frac{h}{f}$ (d) $\frac{c}{hf}$

26. A proton and α-particle are accelerated through the same potential difference. The ratio of their de-Broglie wavelength will be
(a) 1 : 1 (b) 1 : 2
(c) 2 : 1 (d) $2\sqrt{2} : 1$

27. In a photoelectric effect measurement, the stopping potential for a given metal is found to be V_0 volt when radiation of wavelength λ_0 is used. If radiation of wavelength $2\lambda_0$ is used with the same metal then the stopping potential (in volt) will be
(a) $\frac{V_0}{2}$ (b) $2V_0$
(c) $V_0 + \frac{hc}{2e\lambda_0}$ (d) $V_0 - \frac{hc}{2e\lambda_0}$

28. The value of tan (90° – θ) in the graph gives



(a) Young's modulus of elasticity
(b) compressibility
(c) shear strain
(d) tensile strength

29. Which one of the following groups of particles is a Boson group ?
(a) Photon, muon, pion, proton
(b) Photon, pion, graviton, Kaon
(c) Pion, neutron, graviton, photon
(d) Electron, muon, neutrino, proton

30. A radioactive sample containing N_0 nuclei emits N α-particles per second on decaying. The half-life of the sample, in second is

(a) $0.693\left(\frac{N}{N_0}\right)$ (b) $\left(\frac{N}{N_0}\right)$

(c) $0.693\left(\frac{N}{N_0}\right)$ (d) $\left(\frac{N_0}{N}\right)$

31. Which one of the following nuclear reactions is not possible ?

(a) ${}^{7}_{3}Li + {}^{1}_{1}H = \left[{}^{8}_{4}Be\right] \rightarrow {}^{4}_{2}He + {}^{4}_{2}He$

(b) ${}^{7}_{3}Li + {}^{1}_{1}H = \left[{}^{8}_{4}Be\right] \rightarrow {}^{8}_{4}Be + \gamma$

(c) ${}^{7}_{3}Li + {}^{2}_{1}H = \left[{}^{9}_{4}Be\right] \rightarrow {}^{8}_{4}Be + {}^{1}_{0}n$

(d) ${}^{6}_{3}Li + {}^{1}_{0}n = \left[{}^{7}_{3}Li\right] \rightarrow {}^{2}_{1}H + {}^{4}_{2}He$

32. If a nucleus X emits an alpha particle and a beta particle, then the daughter nucleus will have which of the following configurations ?

1. A – 4 nucleons
2. Z – 2 protons
3. A – Z – 3 neutrons

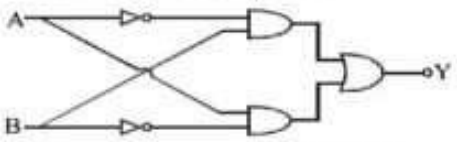
Select the correct answer using the codes given below :

(a) 1, 2 and 3 (b) 1 and 2
(c) 1 and 3 (d) 2 and 3

33. The cause of the potential barrier in a p-n diode is

(a) Depletion of positive charges near the junction
(b) Concentration of positive charges near the junction
(c) Depletion of negative charges near the junction
(d) Concentration of positive and negative charges near the junction

34. The following circuit represents



(a) OR gate (b) XOR gate
(c) AND gate (d) NAND gate

35. In the study of transistor as amplifier, if $\alpha = \frac{I_C}{I_E}$ and $\beta = \frac{I_C}{I_B}$ where I_C, I_B and I_E are the collector, base and emitter currents, then

(a) $\beta = \frac{(1+\alpha)}{\alpha}$ (b) $\beta = \frac{(1-\alpha)}{\alpha}$

(c) $\beta = \frac{\alpha}{(1-\alpha)}$ (d) $\beta = \frac{\alpha}{(1+\alpha)}$

36. A semi-conducting device is connected in a series circuit with a battery and a resistance. A current is found to pass through the circuit. If the polarity of the battery is reversed, the current drops to almost zero. The device may be

(a) a p-n junction
(b) an intrinsic semi-conductor
(c) a p-type semi-conductor
(d) an n-type semi-conductor

37. For sky wave propagation of a 10 MHz signal, what should be the minimum electron density in ionosphere

(a) $-1.2 \times 10^{12}\ m^{-3}$ (b) $-10^{6}\ m^{-3}$
(c) $-10^{14}\ m^{-3}$ (d) $-10^{22}\ m^{-3}$

38. A hockey player is moving northward and suddenly turns westward with the same speed to avoid an opponent. The force that acts on the player is

(a) frictional force along westward
(b) muscles force along southward
(c) frictional force along south-west
(d) muscle force along south-west

39. For an ideal gas, the molar specific heat capacities at constant pressure and volume satisfy the relation

(a) $C_P + C_V = R$ (b) $C_P - C_V = R$

(c) $\frac{C_P}{C_V} = R$ (d) $\frac{C_V}{C_P} = R$

40. The position of a particle of mass 4 g, acted upon by a constant force is given by $x = 4t^2 + t$, where x is in metre and t in second. The work done during the first 2 seconds is

(a) 128 mJ (b) 512 mJ
(c) 576 mJ (d) 144 mJ

PART - II : CHEMISTRY

41. $3A \rightarrow B + C$, it would be a zero order reaction when
(a) the rate of reaction is proportional to square of concentration of A
(b) the rate of reaction remains same at any concentration of A
(c) the rate remains unchanged at any concentration of B and C
(d) the rate of reaction doubles if concentration of B is increased to double

42. The rate of a first order reaction is 1.5×10^{-2} mol L^{-1} min^{-1} at 0.5 M concentration of the reactant. The half life of the reaction is
(a) 0.383 min (b) 23.1 min
(c) 8.73 min (d) 7.53 min

43. Activation energy of a chemical reaction can be determined by
(a) evaluating rate constant at standard temperature
(b) evaluating velocities of reaction at two different temperatures
(c) evaluating rate constants at two different temperatures
(d) changing concentration of reactants

44. If the rate of the reaction is equal to the rate constant, the order of the reaction is
(a) 3 (b) 0
(c) 1 (d) 2

45. In a reversible reaction the energy of activation of the forward reaction is 50 kcal. The energy of activation for the reverse reaction will be
(a) < 50 kcal
(b) either greater than or less than 50 kcal
(c) 50 kcal
(d) > 50 kcal

46. If 0.01 M solution of an electrolyte has a resistance of 40 ohms in a cell having a cell constant of 0.4 cm^{-1}, then its molar conductance in ohm^{-1} cm^2 mol^{-1} is
(a) 10^2 (b) 10^4
(c) 10 (d) 10^3

47. E° for the cell, $Zn|Zn^{2+}(aq)||Cu^{2+}(aq)|Cu$ is 1.10 V at 25°C. The equilibrium constant for the cell reaction:
$Zn + Cu^{2+}(aq) \rightleftharpoons Cu + Zn^{2+}(aq)$,
is of the order of
(a) 10^{-18} (b) 10^{-37}
(c) 10^{18} (d) 10^{37}

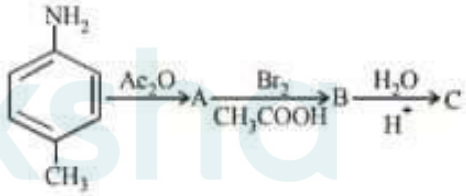
48. 4.5 g of aluminium (at. mass 27 amu) is deposited at cathode from Al^{3+} solution by a certain quantity of electric charge. The volume of hydrogen produced at STP from H^+ ions in solution by the same quantity of electric charge will be
(a) 44.8 L (b) 22.4 L
(c) 11.2 L (d) 5.6 L

49. Which one of the following is correct relation of the First Law of Thermodynamics
(a) $\Delta E = q - W$ (b) $\Delta E = q + W$
(c) $\Delta E = \Delta q + \Delta W$ (d) $\Delta E = \Delta q + W$

50. Which of the following is most basic in nature?
(a) NH_3 (b) CH_3NH_2
(c) $(CH_3)_2NH$ (d) $C_6H_5NHCH_3$

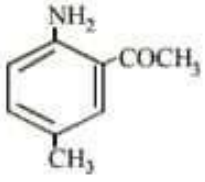
51. Intermediates formed during reaction of $RC(=O)NH_2$ with Br_2 and KOH are
(a) RNHBr and RCONHBr
(b) RNHCOBr and RNCO
(c) RCONHBr and RNCO
(d) $RCONBr_2$

52. The final product C, obtained in this reaction

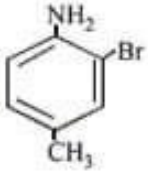


would be

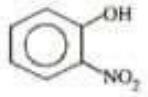
(a) 

(b) 

(c) 

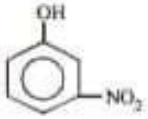
(d) 

53. Which of the following is the strongest acid?

(a) 

(b) 

(c) 

(d) 

54. A colourless liquid, at room temperature, reacts with soda-lime to form sodium salt of a carboxylic acid and ammonia gas. The liquid is
(a) propanoic acid
(b) formamide
(c) propanamide
(d) methyl enthanoate

55. 59 g of an amide obtained from a carboxylic acid, RCOOH, upon heating with alkali liberated 17 g NH_3. The acid is
(a) Formic acid (b) Acetic acid
(c) Propionic acid (d) Benzoic acid

56. The correct relationship between free energy and equilibrium constant K of a reaction is
(a) $\Delta G^\circ = -RT\ln K$ (b) $\Delta G = RT\ln K$
(c) $\Delta G^\circ = RT\ln K$ (d) $\Delta G = -RT\ln K$

57. The intermetallic compound LiAg crystallizes in a cubic lattice in which both lithium and silver atoms have coordination number of eight. To what crystal class does the unit cell belong ?
(a) Simple cubic
(b) Face-centred cubic
(c) Body-centred cubic
(d) None

58. Schottky defect in crystals is observed when
(a) an ion leaves its normal site and occupies an interstitial site
(b) unequal number of cations and anions are missing from the lattice
(c) density of the crystal is increased
(d) equal number of cations and anions are missing from the lattice

59. The pyknometric density of sodium chloride crystal is 2.165×10^3 kg m^{-3} while its X-ray density is 2.178×10^3 kg m^{-3}. The fraction of unoccupied sites in sodium chloride crystal is
(a) 5.96×10^{-3} (b) 5.96
(c) 5.96×10^{-2} (d) 5.96×10^{-1}

60. A reaction occurs spontaneously if
(a) $T\Delta S < \Delta H$ and both ΔH and ΔS are + ve
(b) $T\Delta S > \Delta H$ and ΔH is + ve and ΔS is – ve
(c) $T\Delta S > \Delta H$ and both ΔH and ΔS are + ve
(d) $T\Delta S = \Delta H$ and both ΔH and ΔS are + ve

61. Which one of the following is an inner orbital complex as well as diamagnetic in behaviour? (Atomic number: Zn = 30, Cr = 24, Co = 27, Ni = 28)
(a) $[Zn(NH_3)_6]^{2+}$ (b) $[Cr(NH_3)_6]^{3+}$
(c) $[Co(NH_3)_6]^{3+}$ (d) $[Ni(NH_3)_6]^{2+}$

62. $[Co(NH_3)_4(NO_2)_2]Cl$ exhibits
(a) linkage isomerism, ionization isomerism and geometrical isomerism
(b) ionization isomerism, geometrical isomerism and optical isomerism
(c) linkage isomerism, geometrical isomerism and optical isomerism
(d) linkage isomerism, ionization isomerism and optical isomerism

63. The d electron configurations of Cr^{2+}, Mn^{2+}, Fe^{2+} and Ni^{2+} are $3d^4$, $3d^5$, $3d^6$ and $3d^8$ respectively. Which one of the following aqua complexes will exhibit the minimum paramagnetic behaviour?
(a) $[Fe(H_2O)_6]^{2+}$ (b) $[Ni(H_2O)_6]^{2+}$
(c) $[Cr(H_2O)_6]^{2+}$ (d) $[Mn(H_2O)_6]^{2+}$
(At. No. Cr = 24, Mn = 25, Fe = 26, Ni = 28)

64. The radioactive isotope, tritium, (^3_1H) has a half-life of 12.3 years. If the initial amount of tritium is 32 mg, how many milligrams of it would remain after 49.2 years?
(a) 8 mg (b) 1 mg
(c) 2 mg (d) 4 mg

65. A human body required 0.01M activity of radioactive substance after 24 hours. Half life of radioactive substance is 6 hours. Then injection of maximum activity of radioactive substance that can be injected will be
(a) 0.08 M (b) 0.04 M
(c) 0.32 M (d) 0.16 M

66. The hypothetical complex chlorodiaquotriammine cobalt (III) chloride can be represented as
(a) $[CoCl(NH_3)_3(H_2O)_2]Cl_2$
(b) $[Co(NH_3)_3(H_2O)Cl_3]$
(c) $[Co(NH_2)_3(H_2O)_2Cl]$
(d) $[Co(NH_3)_3(H_2O)_3]Cl_3$

67. The basic character of the transition metal monoxides follows the order
(Atomic Nos., Ti = 22, V = 23, Cr = 24, Fe = 26)
(a) TiO > VO > CrO > FeO
(b) VO > CrO > TiO > FeO
(c) CrO > VO > FeO > TiO
(d) TiO > FeO > VO > CrO

68. The complex ion $[Co(NH_3)_6]^{3+}$ is formed by sp^3d^2 hybridisation. Hence the ion should possess
(a) Octahedral geometry
(b) Tetrahedral geometry
(c) Square planar geometry
(d) Tetragonal geometry.

69. Identify the correct order of boiling points of the following compounds :

$CH_3CH_2CH_2CH_2OH$ (1) $\quad CH_3CH_2CH_2CHO$ (2)

$CH_3CH_2CH_2COOH$ (3)

(a) 1 > 2 > 3 (b) 3 > 1 > 2
(c) 1 > 3 > 2 (d) 3 > 2 > 1

70. Glacial acetic acid is
(a) pure acetic acid at 100° C
(b) pure acetic acid at 0° C
(c) acetic acid mixed with methanol
(d) pure acetic acid at 16.6° C

71. 2-Phenylethanol may be prepared by the reaction of phenylmagnesium bromide with
(a) HCHO (b) CH_3CHO
(c) CH_3COCH_3 (d) 

72. Among acetic acid, phenol and n-hexanol, which of the following compounds well react with $NaHCO_3$ solution to give sodium salt and carbon dioxide ?
(a) Acetic acid
(b) n-Hexanol
(c) acetic acid and phenol
(d) Phenol.

73. Iodoform test is not given by
(a) 2-Pentanone (b) Ethanol
(c) Ethanal (d) 3-Pentanone

74. Acetaldehyde reacts with
(a) Electrophiles only
(b) Nucleophiles only
(c) Free radicals only
(d) Both electrophiles and nucleophiles.

75. Aldehydes and ketones will not form crystalline derivatives with
(a) Sodium bisulphite
(b) Phenylhydrazine
(c) Semicarbazide hydrochloride
(d) Dihydrogen sodium phosphate.

76. Reaction of phenylacetylene with dil. H_2SO_4 and $HgSO_4$ gives
(a) acetophenone
(b) 2-phenylethanol
(c) phenylacetaldehyde
(d) phenylacetic acid

77. A carbonyl compound reacts with hydrogen cyanide to form cyanohydrin which on hydrolysis forms a racemic mixture of α-hydroxy acid. The carbonyl compound is
(a) acetone (b) diethyl ketone
(c) formaldehyde (d) acetaldehyde

78. Among the following the strongest acid is
(a) CH_3COOH
(b) CH_2ClCH_2COOH
(c) $CH_2ClCOOH$
(d) CH_3CH_2COOH.

79. $[Ti(H_2O)_6]^{3+}$ shows purple colour due to
(a) $d_{yz} \rightarrow d_{x^2-y^2}$ electronic transition
(b) $d_{xz} \rightarrow d_{x^2-y^2}$ electronic transition
(c) $d_{xy} \rightarrow e_g[d_{x^2-y^2}, d_{z^2}]$ electronic transition
(d) $d_{xz} \rightarrow e_g[d_{x^2-y^2}, d_{z^2}]$ electronic transition

80. C – H rocking frequency is found to observed in _____. In case of only long chain alkanes.
(a) 725 - 720 cm^{-1}
(b) 745 - 795 cm^{-1}
(c) 790 - 760 cm^{-1}
(d) 720 - 700 cm^{-1}

PART - III : MATHEMATICS

81. If $2y\cos\theta = x\sin\theta$ and $2x\sec\theta - y\operatorname{cosec}\theta = 3$, then $x^2 + 4y^2 =$
(a) 2 (b) 4
(c) 1 (d) none

82. Range of the function
$$f(x) = \frac{x^2+x+2}{x^2+x+1}; x \in R \text{ is}$$
(a) $(1, \infty)$ (b) (1,11/7]
(c) (1, 7/3] (d) (1, 7/5]

83. If $\sin(\cot^{-1}(1+x)) = \cos(\tan^{-1}x)$, then x =
(a) $\frac{1}{2}$ (b) 1 (c) 0 (d) $-\frac{1}{2}$

84. If
$$\sin^{-1}\left(\frac{2\alpha}{1+\alpha^2}\right) + \sin^{-1}\left(\frac{2\beta}{1+\beta^2}\right) = 2\tan^{-1}x,$$
then x =
(a) α/β (b) β/α
(c) $\frac{\alpha+\beta}{1+\alpha\beta}$ (d) $\frac{\alpha+\beta}{1-\alpha\beta}$

85. Let A = {1, 2, 3, 4, 5} and the functions $f: A \to A$ and $g: A \to A$ be defined by
f(1)=3, f(2)=5, f(3)=3, f(4)=1, f(5)=2; g(1)=4, g(2)=1, g(3)=1, g(4)=2, g(5)=3. Then
(a) fog = {(1,1), (2, 3), (3, 2), (4, 5),}
(b) fog = {(1,1), (2,3), (3,3), (4,5), (5,3)}
(c) gof = {(1, 1), (2, 3), (3, 3), (4, 4), 5, 5)
(d) gof = {(2, 2), (2, 3), (3, 1), (4, 1), (5, 1)}

86. ABC is a triangle and P is any point on BC such that $\overrightarrow{PQ}$ is the resultant of the vectors $\overrightarrow{AP}$, $\overrightarrow{PB}$ and $\overrightarrow{PC}$, then
(a) the position of Q depends on position of P
(b) Q is a fixed point
(c) Q lies on AB or AC
(d) None of these

87. If A, B, C are the angles of a triangle such that angle A is obtuse, then tan B tan C will be less than
(a) $\frac{1}{\sqrt{3}}$ (b) $\frac{\sqrt{3}}{2}$
(c) 1 (d) none of these.

88. If a chord which is normal to the parabola at one end and subtends a right angle at the vertex, then slope of the chord is
(a) 1 (b) –2
(c) $\sqrt{2}$ (d) $\frac{1}{\sqrt{2}}$

89. P is a variable point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ whose vertex is A(a, 0) The locus of the middle point of AP is
(a) $\frac{(2x-a)^2}{a^2} - \frac{2y^2}{b^2} = 1$
(b) $\frac{(2x-a)^2}{a^2} - \frac{4y^2}{b^2} = 1$
(c) $\frac{(2x-a)^2}{a^2} - \frac{8y^2}{b^2} = 1$
(d) None of these

90. Two persons throw a die alternately till one of them gets a 'three' and wins the game. The ratio of their respective probabilities of winning is
(a) 6 : 5 (b) 4 : 5
(c) 3 : 2 (d) 3 : 5

91. If m men and n women are to be seated in a row so that no two women sit together. If m > n, then the number of ways in which they can be seated is
(a) $\frac{m!\,n!}{(m-n+1)!}$ (b) $\frac{(m+1)!\,(n+1)!}{(m-n+1)!}$
(c) $\frac{m!(m+1)!}{(m-n+1)!}$ (d) None of these

92. If $y = \sin^{-1}\left[\sqrt{x-ax} - \sqrt{a-ax}\right]$ then $\frac{dy}{dx} =$
(a) $\frac{1}{\sin\sqrt{a-ax}}$ (b) $\sin\sqrt{x}.\sin\sqrt{a}$
(c) $\frac{1}{2\sqrt{x}\sqrt{1-x}}$ (d) zero

93. If the roots of $z^3 + iz^2 + 2i = 0$ represent the vertices of a ΔABC in the Argand plane, then the area of the triangle is
(a) $\frac{3\sqrt{7}}{2}$ (b) $\frac{3\sqrt{7}}{4}$
(c) 2 (d) None

94. If the mean and variance of a binomial variate x are respectively $\frac{35}{6}$ and $\frac{35}{36}$, then the probability of $x > 6$ is :

(a) $\frac{1}{6^2}$ (b) $\frac{5^7}{6^7}$

(c) $\frac{1}{7^6}$ (d) $\frac{1}{6^7}+\frac{1}{6^7}$

95. Let $f(x) = |\sin x|$. Then
(a) f is everywhere differentiable
(b) f is everywhere continuous but not differentiable at $x = n\pi, n \in Z$
(c) f is everywhere continuous but not differentiable at $x = (2n+1)\frac{\pi}{2}, n \in Z$
(d) None of these

96. The locus of all 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 is :

(a) $y = 4a$ (b) $y = 4ax$

(c) $y^2 = 4ax$ (d) $y^2 = 4a^2\sin\frac{x}{a}$

97. In the set $\mathbf{N} \times \mathbf{N}$, the relation R is defined by $(a, b)\,R\,(c,d) \Leftrightarrow ad = bc$. Then R is
(a) partial order relation
(b) equivalence relation
(c) reflexive and transitive but not symmetric
(d) symmetric and transitive but not reflexive

98. If $\bar{a}, \bar{b}, \bar{c}$ are three unit vectors such that $\bar{b}$ is not parallel to $\bar{c}$ and $\bar{a} \times (\bar{b} \times \bar{c}) = \frac{1}{2}\bar{b}$, then the angle between $\bar{a}$ and $\bar{c}$ is

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{2}$

(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{4}$

99. If $A = \begin{bmatrix} 3 & 2 \\ 0 & 1 \end{bmatrix}$, then $(A^{-1})^3$ is equal to

(a) $\frac{1}{27}\begin{bmatrix} 1 & -26 \\ 0 & 27 \end{bmatrix}$ (b) $\frac{1}{27}\begin{bmatrix} -1 & -26 \\ 0 & 27 \end{bmatrix}$

(c) $\frac{1}{27}\begin{bmatrix} 1 & -26 \\ 0 & -27 \end{bmatrix}$ (d) $\frac{1}{27}\begin{bmatrix} -1 & -26 \\ 0 & -27 \end{bmatrix}$

100. The area (in sq. units) bounded by the curves $y = \sqrt{x}$, $2y - x + 3 = 0$ and x-axis lying in the first quadrant is

(a) 9 (b) 36

(c) 18 (d) $\frac{27}{4}$

101. The number of values of x in $[0, 2\pi]$ satisfying the equation $|\cos x - \sin x| \geq \sqrt{2}$, is

(a) 0 (b) 1
(c) 2 (d) 3

102. If one root of the equation $(l - m)x^2 + lx + 1 = 0$ is double of the other and if l is real then the greatest value of m is $(l \neq m)$:

(a) $\frac{1}{3}$ (b) $\frac{8}{9}$

(c) $\frac{9}{8}$ (d) 3

103. A sphere of constant radius 2k passes through the origin and meets the axes in A, B, C. The locus of the centroid of the tetrahedron OABC is

(a) $x^2 + y^2 + z^2 = 4k^2$

(b) $9(x^2 + y^2 + z^2) = 4k^2$

(c) $x^2 + y^2 + z^2 = k^2$

(d) None of these

104. The value of the integral $\int_0^{\frac{\pi}{2}} \sqrt{\cos\theta}\,\sin^3\theta\,d\theta$ is

(a) $\frac{8}{21}$ (b) $\frac{21}{8}$

(c) $\frac{2}{7}$ (d) none of these.

105. Number of 6-digit telephone numbers, which can be constructed with digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, if each number starts with 35 and no digit appears more than once is

(a) 1680 (b) 8!
(c) 6! (d) 6.6!

106. The diffrerential equation

$\frac{dy}{dx}+\frac{1}{x}\sin 2y = x^3\cos^2 y$ represents a family of curves given by the equation

(a) $x^6+6x^2 = C\tan y$

(b) $6x^2\tan y = x^6+C$

(c) $\sin 2y = x^3\cos^2 y + C$

(d) none of these

107. If the system of equations $x+\lambda y+2=0$, $\lambda x+y-2=0$, $\lambda x+\lambda y+3=0$ is consistent, then

(a) $\lambda = \pm 1$ (b) $\lambda = \pm 2$

(c) $\lambda = 1, -2$ (d) $\lambda = -1, 2$

108. A steam boat is moving at velocity V when steam is shut off. Given that the retardation at any subsequent time is equal to the magnitude of the velocity at that time. The velocity v in time t after steam is shut off is

(a) $v = Vt$ (b) $v = Vt - V$

(c) $v = Ve^t$ (d) $v = Ve^{-t}$

109. If the binary operation * is defined on the set Q^+ of all positive rational numbers by $a * b = \frac{ab}{4}$. Then $3 * \left(\frac{1}{5} * \frac{1}{2}\right)$ is equal to

(a) $\frac{3}{160}$ (b) $\frac{5}{160}$ (c) $\frac{3}{10}$ (d) $\frac{3}{40}$

110. P, Q, R, S are the points (–2, 3, 4), (–4, 4, 6), (4, 3, 5) and (0, 1, 2). Then projection of PQ on RS is

(a) 0 (b) $\sqrt{29}$

(c) $\frac{16}{\sqrt{29}}$ (d) none

111. If X follows Binomial distribution with mean 3 and variance 2, then $P(X \geq 8)$ is equal to :

(a) $\frac{17}{3^9}$ (b) $\frac{18}{3^9}$ (c) $\frac{19}{3^9}$ (d) $\frac{20}{3^9}$

112. Sum of the series

$\frac{1}{1.2.3.4}+\frac{4}{3.4.5.6}+\frac{9}{5.6.7.8}+\frac{16}{7.8.9.10}+\ldots\ldots =$

(a) $\frac{5}{2}-\log 2$ (b) $\frac{3}{2}-\log 2$

(c) $\frac{1}{6}\log 2-\frac{1}{24}$ (d) None of these

113. A rod AB 13 ft long moves with its ends A, B on two perpendicular lines OX and OY respectively. If the end A is 12 ft from O and is slipping away at $2\frac{1}{2}$ ft/sec. then the end B is moving at

(a) 5ft/sec. (b) 6ft/sec.

(c) 2.5ft/sec. (d) 3ft/sec.

114. Two common tangents to the circle $x^2+y^2=2a^2$ and parabola $y^2=8ax$ are

(a) $x=\pm(y+2a)$ (b) $y=\pm(x+2a)$

(c) $x=\pm(y+a)$ (d) $y=\pm(x+a)$

115. Children have been invited to a birthday party. It is necessary to give them return gifts. For the purpose, it was decided that they would be given pens and pencils in a bag. It was also decided that the number of items in a bag would be atleast 5. If the cost of a pen is ₹10 and cost of a pencil is ₹5, minimize the cost of a bag containing pens and pencils. Formulation of LPP for this problem is

(a) Minimize $C = 5x + 10y$ subject to $x + y \leq 10$, $x \geq 0, y \geq 0$

(b) Minimize $C = 5x + 10y$ subject to $x + y \geq 10$, $x \geq 0, y \geq 0$

(c) Minimize $C = 5x + 10y$ subject to $x + y \geq 5$, $x \geq 0, y \geq 0$

(d) Minimize $C = 5x + 10y$ subject to $x + y \leq 5$, $x \geq 0, y \geq 0$

116. The integral $\int \frac{\sin^2 x}{\cos^4 x}dx$ is

(a) a polynomial of degree 5 in sin x

(b) a polynomial of degree 4 in tan x

(c) a polynomial of degree 3 in tan x

(d) a polynomial of degree 5 in cos x

117. The equation of the ellipse with focus at (±5, 0) and $x = \frac{36}{5}$ as one directrix is

(a) $\frac{x^2}{36}+\frac{y^2}{25}=1$ (b) $\frac{x^2}{36}+\frac{y^2}{11}=1$

(c) $\frac{x^2}{25}+\frac{y^2}{11}=1$ (d) None of these

106. The differential equation

$\frac{dy}{dx}+\frac{1}{x}\sin 2y = x^3\cos^2 y$ represents a family of curves given by the equation

(a) $x^6+6x^2 = C\tan y$

(b) $6x^2\tan y = x^6+C$

(c) $\sin 2y = x^3\cos^2 y + C$

(d) none of these

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(c) Minimize $C = 5x+10y$ subject to $x+y\geq 5$, $x\geq 0, y\geq 0$

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(c) $\frac{x^2}{25}+\frac{y^2}{11}=1$ (d) None of these

118. If $\lim_{x\to 0}\frac{((a-n)nx-\tan x)\sin nx}{x^2}=0$, where n is non-zero real number, then a is equal to

(a) 0 (b) $\frac{n+1}{n}$

(c) n (d) $n+\frac{1}{n}$

119. The equation of the line passing through (1, 2, 3) and parallel to the planes $\vec{r}\cdot(\hat{i}-\hat{j}+2\hat{k})=5$ and $\vec{r}\cdot(3\hat{i}+\hat{j}+\hat{k})=6$ is

(a) $\vec{r}=(\hat{i}+2\hat{j}+3\hat{k})+\lambda(2\hat{i}+3\hat{j}+4\hat{k})$

(b) $\vec{r}=(-3\hat{i}+5\hat{j}+4\hat{k})+\lambda(\hat{i}+2\hat{j}+3\hat{k})$

(c) $\vec{r}=(\hat{i}+2\hat{j}+3\hat{k})+\lambda(-3\hat{i}+5\hat{j}+4\hat{k})$

(d) $\vec{r}=\lambda(-3\hat{i}+5\hat{j}+4\hat{k})$

120. Let p: Kiran passed the examination,
q: Kiran is sad
The symbolic form of a statement "It is not true that Kiran passed therefore he is said" is

(a) $(\sim p\rightarrow q)$ (b) $(p\rightarrow q)$

(c) $\sim(p\rightarrow\sim q)$ (d) $\sim(p\leftrightarrow q)$

PART - III : ENGLISH

Direction (Qs. 121 - 123) Read the passage carefully and answer the question given below.

But I did not want to shoot the elephant. I watched him beating his bunch of grass against his knees, with the preoccupied grandmotherly air that elephants have. It seemed to me that it would be murder to shoot him. I had never shot an elephant and never wanted to. (Somehow it always seems worse to kill large animal.) Besides, there was the beast's owner to be considered. But I had got to act quickly. I turned to some experienced-looking Burmans who had been there when we arrived, and asked them how the elephants had been behaving. They all said the same thing; he took no notice of you if you left him alone, but he might charge if you went too close to him.

121. The phrase 'Preoccupied grandmotherly air' signifies
(a) being totally unconcerned
(b) pretending to be very busy
(c) a very superior attitude
(d) calm, dignified and affectionate disposition

122. From the passage it appears that the author was
(a) an inexperienced hunter
(b) kind and considerate
(c) possessed with fear
(d) a worried man

123. The author did not want to shoot the elephant because he
(a) was afraid of it
(b) did not have the experience of shooting big animals
(c) did not wish to kill animal which was not doing anybody any harm
(d) did not find the elephant to be ferocious

124. Direction: Choose the word which is most similar to the word given in the bold. Foment
(a) interrogate (b) spoil
(c) spray (d) incite

125. Choose the best pronunciation of the word, Wednesday, from the following options.
(a) wed-ness-day (b) wed-nesh-day
(c) wenz-day (d) wens-day

ANSWER KEY

1. A
2. C
3. D
4. D
5. A
6. A
7. A
8. A
9. D
10. A
11. A
12. A
13. A
14. D
15. D
16. D
17. B
18. A
19. A
20. B
21. C
22. A
23. C
24. D
25. A
26. D
27. D
28. A
29. A
30. C
31. A
32. C
33. D
34. B
35. C
36. A
37. A
38. C
39. B
40. C
41. B
42. B
43. C
44. B
45. B
46. D
47. D
48. D
49. B
50. C
51. C
52. D
53. C
54. B
55. B
56. A
57. C
58. D
59. A
60. C
61. C
62. A
63. B
64. C
65. D
66. A
67. A
68. C
69. B
70. D
71. D
72. A
73. D
74. B
75. D
76. A
77. D
78. C
79. C
80. A
81. B
82. C
83. D
84. D

85. B
86. B
87. C
88. C
89. B
90. A
91. C
92. C
93. C
94. B
95. B
96. C
97. B
98. A
99. A
100. A
101. C
102. C
103. C
104. A
105. A
106. B
107. A
108. D
109. A
110. A
111. C
112. C
113. B
114. B
115. C
116. C
117. B
118. D
119. C
120. B
121. D
122. B
123. B
124. D
125. C