

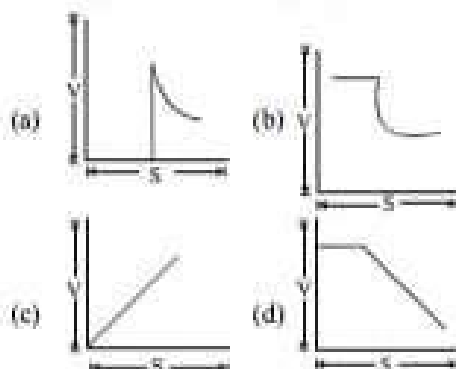
VITEEE 2025 Memory Based Question Paper PDF (April 24, 2025) (Shift 2)

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



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 from q to $2q$ then stored energy is (The capacitance of capacitor is C)

(a) $2W$ (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 $\frac{1}{K^2}$ times

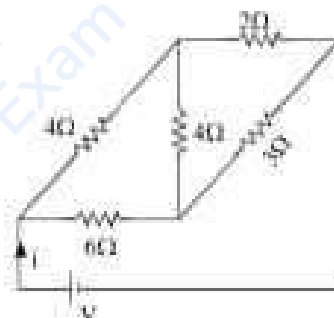
5. A steady current of 1.5 amp flows through a copper voltameter for 10 minutes. If the electrochemical equivalent of copper is $30 \times 10^{-5} \text{ g coulomb}^{-1}$, the mass of copper deposited on the electrode will be

(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

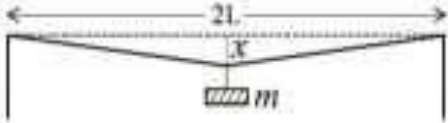
(a) conservation of electric charge and energy respectively
 (b) conservation of electric charge
 (c) conservation of energy and electric charge respectively
 (d) conservation of energy

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 31Ω has a resistance of 8Ω . It is placed in series with a condenser of capacitive 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) 25 A (b) 50 A
 (c) 15 A (d) 12.5 A
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)

- A. Lyman
B. Balmer
C. Paschen
D. Brackett

List-II
(Region in which the series lies)

1. Visible
2. Infra red
3. Ultra violet
4. X-ray
5. γ -ray

Codes :

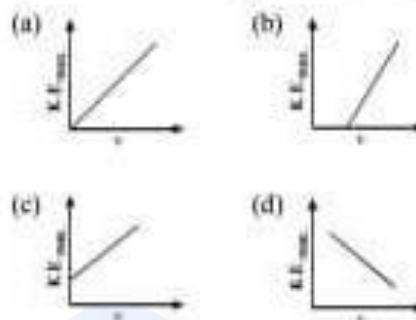
- | | A | B | C | D |
|-----|---|---|---|---|
| (a) | 3 | 1 | 2 | 2 |
| (b) | 1 | 3 | 2 | 4 |
| (c) | 3 | 1 | 4 | 5 |
| (d) | 1 | 2 | 3 | 5 |

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 $2r$ 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 (ν) is



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) $\frac{mv}{n}$
(c) $\frac{mv}{n}$ (d) nrv

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)

- A. Baryons
B. Mesons
C. Leptons
D. Bosons

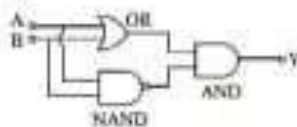
List-II
(Elementary particles)

1. Nucleon
2. Neutrino
3. Pion
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 ${}_Z^AX^A$ is measured and found to be M , then the nuclear binding energy would be (c is the velocity of light):
- $\{Zm_p + (A-Z)m_n - M\}c^2$
 - $\{Am_n + Zm_p + M\}c^2$
 - $\{(Z-A)m_p + Am_n - M\}c^2$
 - $\{M - Zm_p - (A-Z)m_n\}c^2$
31. When a radioactive element decays by gamma radiation
- its mass number will decrease by one unit with no change in atomic number
 - its mass number will not change but the atomic number will increase by one unit
 - both mass number and atomic number of the element change
 - 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 ${}_{92}^{238}\text{U}$ and that the final nucleus is ${}_{82}^{206}\text{Pb}$. When uranium nucleus decays to lead, the number of α particles and β particles emitted are
- $8\alpha, 6\beta$
 - $6\alpha, 7\beta$
 - $6\alpha, 8\beta$
 - $4\alpha, 3\beta$
33. In semiconductors at a room temperature
- the conduction band is completely empty
 - the valence band is partially empty and the conduction band is partially filled
 - the valence band is completely filled and the conduction band is partially filled
 - 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
- $20/\pi$ V
 - $10/\sqrt{2}$ V
 - $10/\pi$ V
 - 10V
35. An oscillator is nothing but an amplifier with
- positive feedback
 - large gain
 - no feedback
 - negative feedback
36. The following configuration of gate is equivalent to



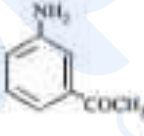
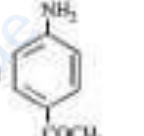
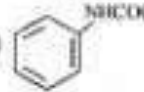
- NAND
 - XOR
 - OR
 - NOR
37. A ball is thrown up at an angle with the horizontal. Then the total change of momentum by the instant it returns to ground is
- acceleration due to gravity $\times$ total time of flight
 - weight of the ball $\times$ half the time of flight
 - weight of the ball $\times$ total time of flight
 - weight of the ball $\times$ horizontal range
38. A particle of mass m has momentum p . Its kinetic energy will be
- mp
 - p^2/m
 - $\frac{p^2}{m}$
 - $\frac{p^2}{2m}$
39. The reading of Centigrade thermometer coincides with that of Fahrenheit thermometer in a liquid. The temperature of the liquid is
- -40°C
 - 313°C
 - 0°C
 - 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 $1 \times 10^3 \text{ kg/m}^3$ and $g = 10 \text{ m/s}^2$, then the volume elasticity in N/m^2 will be
- 10^8
 - 2×10^8
 - 10^9
 - 2×10^9

PART - II : CHEMISTRY

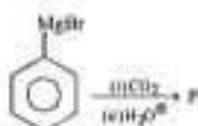
41. The alcohol which does not give a stable compound on dehydration is
- Ethyl alcohol
 - Methyl alcohol
 - n-Propyl alcohol
 - n-Butyl alcohol
42. IR spectrum of an organic compound is found about 1715 cm^{-1} . The organic compound is
- An aliphatic ketone
 - An aliphatic aldehyde
 - α, β - unsaturated ketones
 - Phenolic ketone
43. The most suitable method of separation of a mixture *ortho* and *para*-nitrophenols mixed in the ratio of 1 : 1 is
- Steam distillation
 - Crystallisation
 - Vapourization
 - Colour spectrum

44. When diethyl ether is treated with excess of Cl_2 in the presence of sunlight, then the product formed is
- $\text{CH}_3\text{CHCl}-\text{O}-\text{CH}_2\text{CH}_3$
 - $\text{CH}_3\text{CHCl}-\text{O}-\text{CHClCH}_3$
 - $\text{CCl}_3\text{CCl}_2\text{OCCl}_2\text{CCl}_3$
 - $\text{CH}_3\text{CCl}_2-\text{O}-\text{CHClCH}_3$
45. The ether that undergoes electrophilic substitution reactions is
- $\text{CH}_3\text{OC}_2\text{H}_5$
 - $\text{C}_6\text{H}_5\text{OCH}_3$
 - CH_3OCH_3
 - $\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$
46. What is the E°_{cell} for the reaction
- $$\text{Cu}^{2+}_{(\text{aq})} + \text{Sn}^{2+}_{(\text{aq})} \rightleftharpoons \text{Cu}_{(\text{s})} + \text{Sn}^{4+}_{(\text{aq})}$$
- at 25°C if the equilibrium constant for the reaction is 1×10^6 ?
- 0.5328 V
 - 0.3552 V
 - 0.1773 V
 - 0.7104 V
47. The ionic conductance of Ba^{2+} and Cl^- are respectively 127 and $76 \text{ ohm}^{-1} \text{ cm}^2$ at infinite dilution. The equivalent conductance (in $\text{ohm}^{-1} \text{ cm}^2$) of BaCl_2 at infinite dilution will be:
- 139.5
 - 203
 - 279
 - 101.5
48. A solution of $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ is green due to
- d-d transition from $t_{2g} \rightarrow e_g$
 - d-d transition from $e_g \rightarrow t_{2g}$
 - 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 electronic transition from $t_{2g}^* \rightarrow e_g^*$
49. Prevention of corrosion of iron by Zn coating is called
- Galvanization
 - Cathodic protection
 - Electrolysis
 - 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 ($\text{R}-\text{NH}_2$)?
- $\text{R}-\text{CO}-\text{NHCH}_3$
 - $\text{R}-\text{CO}-\text{ONH}_2$
 - $\text{R}-\text{CO}-\text{NH}_2$
 - $\text{R}-\text{CO}-\text{NHOH}$
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 ($\text{R}-\text{NH}_2$)?
- $\text{R}-\text{CO}-\text{NHCH}_3$
 - $\text{R}-\text{CO}-\text{ONH}_2$
 - $\text{R}-\text{CO}-\text{NH}_2$
 - $\text{R}-\text{CO}-\text{NHOH}$
52. Benzaldehyde reacts with ethanoic KCN to give
- $\text{C}_6\text{H}_5\text{CHOHCN}$
 - $\text{C}_6\text{H}_5\text{CHOHCOC}_2\text{H}_5$
 - $\text{C}_6\text{H}_5\text{CHOHCOOH}$
 - $\text{C}_6\text{H}_5\text{CHOHCHOHC}_2\text{H}_5$
53. Which of the following compound will undergo self aldol condensation in the presence of cold dilute alkali?
- $\text{CH}_2=\text{CH}-\text{CHO}$
 - $\text{CH}=\text{C}-\text{CHO}$
 - $\text{C}_6\text{H}_5\text{CHO}$
 - $\text{CH}_3\text{CH}_2\text{CHO}$
54. $3\text{CH}_3\text{COCH}_3 \xrightarrow[\text{-3H}_2\text{O}]{\text{HCl}}$
- (A)
- $$(\text{CH}_3)_2\text{C}=\text{CH}-\text{CO}-\text{CH}=\text{C}(\text{CH}_3)_2$$
- (B)
- This polymer (B) is obtained when acetone is saturated with hydrogen chloride gas, B can be
- phorone
 - formose
 - diacetone alcohol
 - mesityl oxide
55. Formic acid is obtained when
- Calcium acetate is heated with conc. H_2SO_4
 - Calcium formate is heated with calcium acetate
 - Glycerol is heated with oxalic acid at 373 K
 - Acetaldehyde is oxidised with $\text{K}_2\text{Cr}_2\text{O}_7$ and H_2SO_4
56. In the Friedel Craft's acylation reaction, the effective electrophile is
- $\text{RCOCl}^\oplus$
 - AlCl_3
 - RCOCl
 - $\text{RCO}^\oplus$

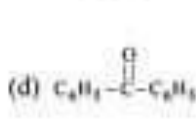
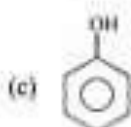
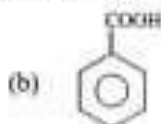
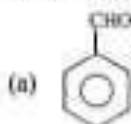
57. The total number of possible isomers for the complex compound $[\text{Cu}^{\text{II}}(\text{NH}_3)_4][\text{Pt}^{\text{II}}\text{Cl}_4]$
- (a) 3 (b) 6
(c) 5 (d) 4
58. Identify the incorrect statement among the following:
- (a) Lanthanoid contraction is the accumulation of successive shrinkages.
(b) 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 $\text{min}^{-1} \text{g}^{-1}$ of carbon ($t_{1/2} = 5760$ years) respectively. The age of the artifact is
- (a) 5760 years
(b) $5760 \times (7.6/15.2)$ years
(c) $5760 \times (15.2/7.6)$ years
(d) $5760 \times (15.2 - 7.6)$ 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, $2\text{HI}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \text{I}_2(\text{g})$, starting with 2 moles of HI, the total number of moles of reactants and products at equilibrium are
- (a) $2 + 2\alpha$ (b) 2
(c) $1 + \alpha$ (d) $2 - \alpha$
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) $\text{C}_6\text{H}_5\text{OH}$
68. $[\text{A}] \xrightarrow{\text{reduction}} [\text{B}] \xrightarrow{\text{CHCl}_3 + \text{KOH}} [\text{C}] \xrightarrow{\text{reduction}} \text{N-Methylaniline}$, 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 nitro alkane is
- (a) $\text{CH}_3\text{CH}_2\text{NO}_2$
(b) $\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2\text{NO}_2$
(c) $(\text{CH}_3)_2\text{CHNO}_2$
(d) $(\text{CH}_3)_3\text{CNO}_2$

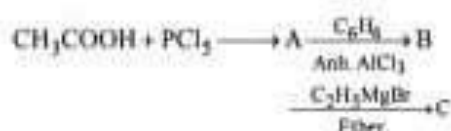
70.



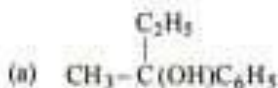
In the above reaction product 'P' is



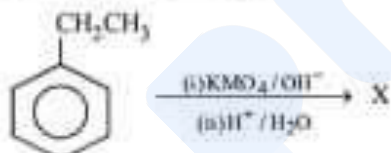
71. In a set of the given reactions, acetic acid yielded a product C.



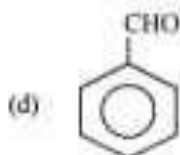
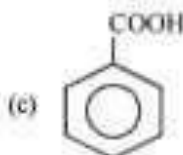
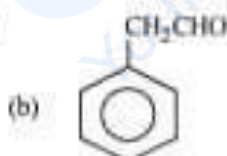
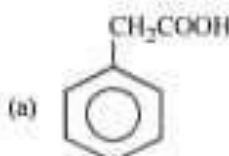
Product C would be -



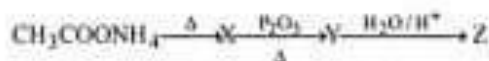
72.



Predict 'X' in the above reaction



73. Identify Z in the sequence



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 $\text{JK}^{-1} \text{mol}^{-1}$) 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) 20.13

(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) $9.92 \times 10^3 \text{ Pa}$

(b) $9.92 \times 10^4 \text{ Pa}$

(c) $9.92 \times 10^7 \text{ Pa}$

(d) $9.92 \times 10^6 \text{ Pa}$

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-type 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

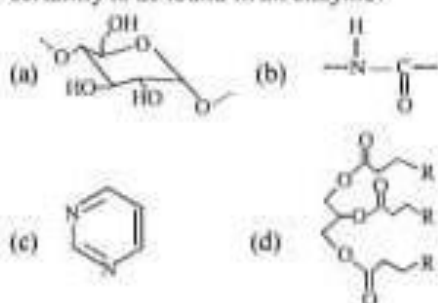
(a) Diastase and Lipase

(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?



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 $\frac{\pi}{4}$ (d) 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) $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 6x - 1$
 (b) $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x^2 + 7$
 (c) $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x^3$
 (d) $f: \mathbb{R} - \{7\} \rightarrow \mathbb{R}$ 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 $A \times B$ 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, ∞) (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 $f: A \rightarrow A$ and $g: A \rightarrow A$ 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 $(f \circ g)(x) = (g \circ f)(x)$, 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 ($-\pi < x \leq \pi$) which satisfy the equation
- $$g^{1+\cos x} + (\cos x)^2 + \dots + 30 = 4^3$$
- is
- (a) 2 (b) 4
(c) 6 (d) 8
97. If a point (h, k) satisfies an inequation $ax + by \geq 4$, 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) $\frac{my}{mx}$ (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) $a^2 x^2 \pm y^2 = cy$
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
- $$\vec{i} \times (\vec{a} \times \vec{i}) + \vec{j} \times (\vec{a} \times \vec{j}) + \vec{k} \times (\vec{a} \times \vec{k})$$
- is equal to
- (a) $\vec{a}$ (b) $2\vec{a}$
(c) $3\vec{a}$ (d) 0

106. Sum of the series

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

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) $\frac{14}{5} \times \left(\frac{7}{10}\right)^n$ (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) $X = a \cdot b$ (b) $X = a + b$ (c) $X = a' \cdot b$ (d) $X = a \cdot b'$

109. $\langle N, + \rangle$ 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

$$3l + m + 5n = 0, \quad 6nm - 2nl + 5lm = 0 \text{ is}$$

(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 $\lim_{x \rightarrow a} f(x)$ 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
- do? The administration set up remains weak 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-tier
 (c) zom-er (d) zom-ra

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. Forget the ministers because they mix politics and administration. What do top bureaucrats do? What do the below down officials