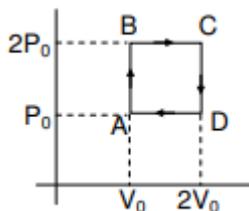


4. An electromagnetic wave in vacuum has the electric and magnetic fields E and B , which are always perpendicular to each other. The direction of polarisation is given by X and that of wave propagation by k . Then,
- (a) $X \parallel B$ and $X \parallel B \times E$ (b) $X \parallel E$ and $k \parallel E \times B$
(c) $X \parallel B$ and $k \parallel E \times B$ (d) $X \parallel E$ and $k \parallel B \times E$
5. If a simple pendulum has significant amplitude (upto a factor of $1/e$ of original) only in the period between $t = 0$ s to $t = \tau$ s, then τ may be called the average life of the pendulum. When the spherical bob of the pendulum suffers a retardation (due to viscous drag) proportionality, the average life time of the pendulum is (assuming damping is small) in seconds
- (a) $\frac{0.693}{b}$ (b) b
(c) $\frac{1}{b}$ (d) $\frac{2}{b}$
6. Hydrogen atom is excited from ground state to another state with principal quantum number equal to 4. Then, the number of spectral lines in the emission spectra will be
- (a) 2 (b) 3
(c) 5 (d) 6
7. A coil is suspended in a uniform magnetic field with the plane of the coil parallel to the magnetic lines of force. When a current is passed through the coil, it starts oscillating; it is very difficult to stop. But if an aluminium plate is placed near to the coil, it stops. This is due to
- (a) development of air current when the plate is placed
(b) induction of electrical charge on the plate
(c) shielding of magnetic lines of force as aluminium is a paramagnetic material
(d) electromagnetic induction in the aluminium plate giving rise to electromagnetic damping
8. The mass of a spaceship is 1000 kg. It is to be launched from the earth's surface out into free space. The value of g and R (radius of earth) are 10 m/s^2 and 6400 km respectively. The required energy for this work will be
- (a) $6.4 \times 10^{11} \text{ J}$ (b) $6.4 \times 10^8 \text{ J}$
(c) $6.4 \times 10^9 \text{ J}$ (d) $6.4 \times 10^{10} \text{ J}$
9. Helium gas goes through a cycle ABCDA (consisting of two isochoric and isobaric lines) as shown in figure. Efficiency of this cycle is nearly (Assume the gas to be close to ideal gas)

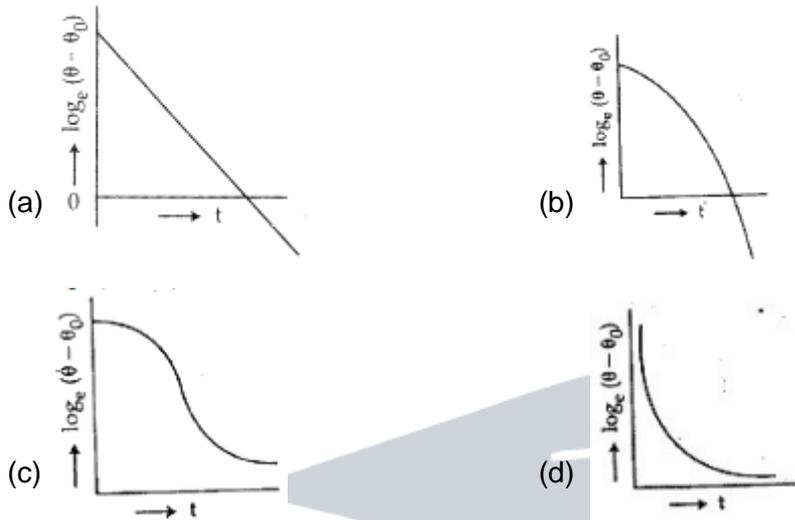


- (a) 15.4% (b) 9.1%
(c) 10.5% (d) 12.5%

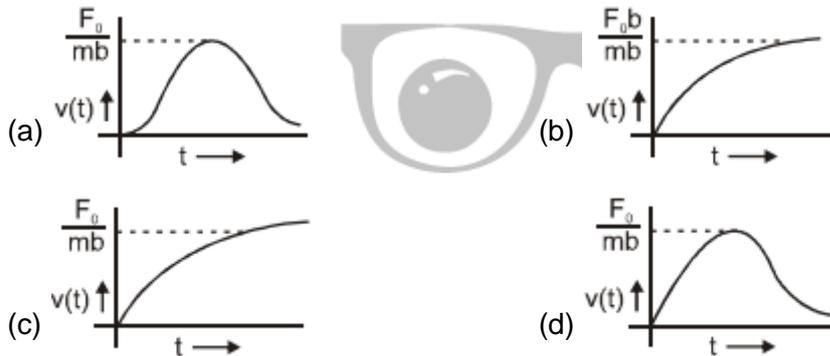
10. In Young's double slit experiment, one of the slit is wider than other, so that amplitude of the light from one slit is double of that from other slit. If I_m be the maximum intensity, the resultant intensity I when they interfere at phase difference Φ , is given by

- (a) $I_m (4 + \cos \Phi)$ (b) $I_m/3 (1 + 2 \cos^2 \Phi/2)$
(c) $I_m/5 (1 + 4 \cos^2 \Phi/2)$ (d) $I_m/9 (1 + 8 \cos^2 \Phi/2)$

11. A liquid in a beaker has temperature (θ) at time t and is temperature of surroundings, then according to Newton's law of cooling, the correct graph between $\log_e (\theta - \theta_0)$ and t is



12. A particle of mass m is at rest at the origin at time $t = 0$. It is subjected to a force $F(t) = F_0 e^{-bt}$ in the x direction. Its speed $v(t)$ is depicted by which of the following curves?



13. Two electric bulbs marked 25 W-220 V and 100 W-220 V are connected in series to a 440 V supply. Which of the bulbs will fuse?

- (a) Both (b) 100 W
(c) 25 W (d) Neither

14. Resistance of a given wire is obtained by measuring the current flowing I it and the voltage difference applied across it. If the percentage errors in the measurement of the current and the voltage difference are 3% each, then error in the value of resistance of the wire is

- (a) 6% (b) zero
(c) 1% (d) 3%

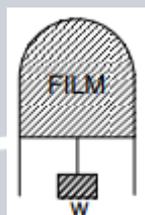
15. A boy can throw a stone upto a maximum height of 10 m. The maximum horizontal distance that the boy can throw the same stone up to will be
- (a) $20\sqrt{2}$ m (b) 10m
(c) $10\sqrt{2}$ m (d) 20m

16. This question has statement I and statement II of the four choices given the statements, choose the one that describes the two statements.

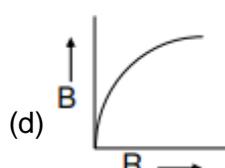
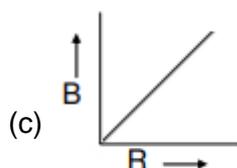
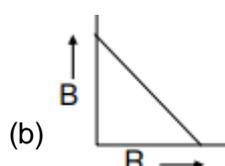
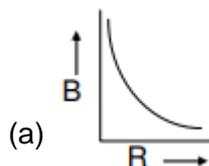
Statement I Davisson-Germer experiment established the wave nature of electrons.

Statement II If electrons have wave nature, they can interfere and show diffraction.

- (a) Statement I is false, Statement II is true
(b) Statement I is true, Statement II is false
(c) Statement I is true, Statement II is true, Statement II is the correct explanation for Statement I
(d) Statement I is true, Statement II is true, Statement II is not the correct explanation for Statement I
17. A thin liquid film formed between a U shaped wire and a light slider supports a weight of 1.5×10^{-2} N (see figure). The length of the slider is 30 cm and its weight negligible. The surface tension of the liquid film is



- (a) 0.0125 Nm^{-1} (b) 0.1 Nm^{-1}
(c) 0.05 Nm^{-1} (d) 0.025 Nm^{-1}
18. A charge Q is uniformly distributed over the surface of non-conducting disc of radius R . The disc rotates about an axis perpendicular to its plane and passing through its centre with an angular velocity ω . As a result of this rotation, a magnetic field of induction B is obtained at the centre of the disc. If we keep both the amount of charge placed on the disc, and its angular velocity to be constant and vary the radius of the disc, then the variation of the magnetic induction at the centre of the disc will be represented by the figure



- (b) Statement I is true, Statement II is false
(c) Statement I is true, Statement II is true, Statement II is the correct explanation for Statement I
(d) Statement I is true, Statement II is true, Statement II is not the correct explanation for Statement I
24. Two cars of masses m_1 and m_2 are moving in circles of radii r_1 and r_2 , respectively. Their speeds are such that they make complete circles in the same time t . the ratio of their centripetal acceleration is
(a) $m_1 r_1 : m_2 r_2$ (b) $m_1 : m_2$
(c) $r_1 : r_2$ (d) $1 : 1$
25. A cylindrical tube, open at both ends, has a fundamental frequency f in air. The tube is dipped vertically in water so that half of it is in water. The fundamental frequency of the air-column is now
(a) f (b) $f/2$
(c) $3f/4$ (d) $2f$
26. An object 2.4 m in front of a lens forms a sharp image on a film 12 cm behind the lens. A glass plate 1 cm thick, of refractive index 1.50 is interposed between lens and film with its plane faces parallel to film. At what distance (from lens) should object shifted to be in sharp focus on film?
(a) 7.2 m (b) 2.4 m
(c) 3.2 m (d) 5.6 m
27. A diatomic molecule is made of two masses m_1 and m_2 which are separated by a distance r . if we calculate its rotational energy by applying Bohr's rule of angular momentum quantisation, its energy will be given by (n is an integer)
(a) $(m_1 + m_2)^2 n^2 \hbar^2 / 2 m_1^2 m_2^2 r^2$ (b) $n^2 \hbar^2 / 2 (m_1 + m_2) r^2$
(c) $2 n^2 \hbar^2 / (m_1 + m_2) r^2$ (d) $(m_1 + m_2) n^2 \hbar^2 / 2 m_1 m_2 r^2$
28. A spectrometer gives the following reading when used to measure the angle of a prism.
Main scale reading : 58.5 degree
Vernier scale reading : 09 divisions
Given that 1 division on main scale corresponds to 0.5 degree. Total divisions to 0.5 degree. Total divisions on the vernier scale is 30 and match with 29 divisions of the main scale.
The angle of the prism from the above data is
(a) 58.59 degree (b) 58.77 degree
(c) 58.65 degree (d) 59 degree



29. This question has Statement I and Statement II. Of the four choices given after the statements, choose the one that best describes the two statements.

An insulating solid sphere of radius R has a uniform positive charge density ρ . As a result of this uniform charge distribution there is a finite value of electric potential at the centre of the sphere, at the surface of the sphere and also at a point outside the sphere. The electric potential at infinite is zero.

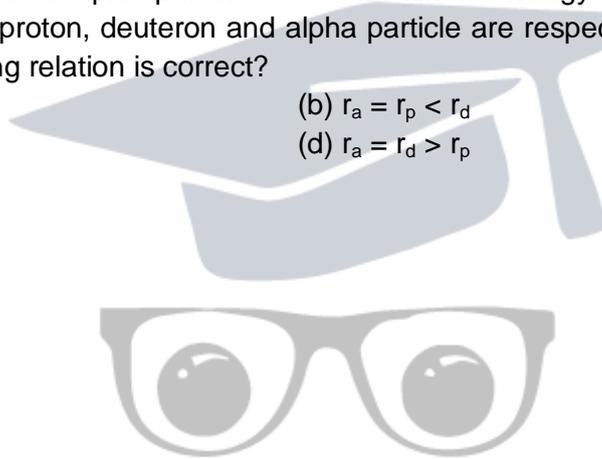
Statement I When a charge q is taken from the center of the surface of the sphere its potential energy changes by $qp/3\epsilon_0$.

Statement II The electric field at a distance $r(r < R)$ from the centre of the sphere is $pr/3\epsilon_0$.

- (a) Statement I is false, Statement II is true
- (b) Statement I is true, Statement II is false
- (c) Statement I is true, Statement II is true, Statement II is the correct explanation for Statement I
- (d) Statement I is true, Statement II is true, Statement II is not the correct explanation for Statement I

30. Proton, deuteron and alpha particles of same kinetic energy are moving in magnetic field. The radii of proton, deuteron and alpha particle are respectively r_p, r_d and r_a . Which one of the following relation is correct?

- (a) $r_a = r_p = r_d$
- (b) $r_a = r_p < r_d$
- (c) $r_a > r_d > r_p$
- (d) $r_a = r_d > r_p$



CHEMISTRY

31. Which among the following will be named as dibromidobis (ethylenediamine) chromium (III) bromide?

- (a) $[\text{Cr}(\text{en})_3]\text{Br}_3$ (b) $[\text{Cr}(\text{en})_2\text{Br}_2]\text{Br}$
(c) $[\text{Cr}(\text{en})\text{Br}_4]^-$ (d) $[\text{Cr}(\text{en})\text{Br}_2]\text{Br}$

32. Which method of purification is represented by the following equation?



- (a) Zone refining (b) Cupellation
(c) Polling (d) van-Arkel

33. Lithium forms body-centred cubic structure. The length of the side of its unit cell is 351 pm. Atomic radius of the lithium will be

- (a) 75 pm (b) 300 pm
(c) 240 pm (d) 152 pm

34. The molecule having smallest bond angle is

- (a) NCl_3 (b) AsCl_3
(c) SbCl_3 (d) PCl_3

35. Which of the following compounds can be detected by Molisch's test?

- (a) Nitro compounds (b) Sugars
(c) Amines (d) Primary alcohols

36. The incorrect expression among the following is

- (a) $\frac{\Delta G_{\text{system}}}{\Delta S_{\text{total}}} = -T$ (b) In isothermal process, $w_{\text{reversible}} = -nRT \ln \frac{V_f}{V_i}$
(c) $\ln K = \frac{\Delta H^\circ - T\Delta S^\circ}{RT}$ (d) $K = e^{-\Delta G^\circ / RT}$

37. The density of a solution prepared by dissolving 120 g of urea (mol. Mass = 60 u) in 1000 g of water is 1.15 g/mL. the molarity of this solution is

- (a) 0.50 M (b) 1.78 M
(c) 1.02 M (d) 2.05 M

38. The species which can best serve as an initiator for the cationic polymerisation is

- (a) LiAlH_4 (b) HNO_3
(c) AlCl_3 (d) BaLi

39. Which of the following on thermal decomposition yields a basic as well as acidic oxide?

- (a) NaNO_3 (b) KClO_3
(c) CaCO_3 (d) NH_4NO_3

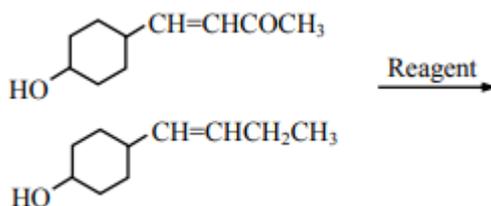


40. The standard reduction potentials for $\text{Zn}^{2+} / \text{Zn}$, $\text{Ni}^{2+} / \text{Ni}$ and $\text{Fe}^{2+} / \text{Fe}$ are -0.76, -0.23 and -0.44 V respectively. The reaction $\text{X} + \text{Y}^{2+} \rightarrow \text{X}^{2+} + \text{Y}$ will be spontaneous when
- (a) $\text{X} = \text{Ni}$, $\text{Y} = \text{Fe}$ (b) $\text{X} = \text{Ni}$, $\text{Y} = \text{Zn}$
(c) $\text{X} = \text{Fe}$, $\text{Y} = \text{Zn}$ (d) $\text{X} = \text{Zn}$, $\text{Y} = \text{Ni}$
41. According to Freundlich adsorption isotherm, which of the following is correct?
- (a) $x/m \propto p^0$
(b) $x/m \propto p^1$
(c) $x/m \propto p^{1/n}$
(d) All of the above are correct for different range of pressure
42. The equilibrium constant (K_c) for the reaction, $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}(\text{g})$ at temperature T is 4×10^{-4} . The value of K_c for the reaction $\text{NO}(\text{g}) \rightarrow \frac{1}{2} \text{N}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g})$ at the same temperature is
- (a) 0.02 (b) 2.5×10^2
(c) 4×10^{-4} (d) 50.0
43. The compressibility factor for a real gas at high pressure is
- (a) $1 + RT/pb$ (b) 1
(c) $1 + pb/RT$ (d) $1 - pb/RT$
44. Which one of the following statements is correct?
- (a) All amino acids except lysine are optically active.
(b) All amino acids are optically active
(c) All amino acids except glycine are optically active
(d) All amino acids except glutamic acid are optically active
45. Aspirin is known as
- (a) acetyl salicylic acid (b) phenyl salicylate
(c) acetyl salicylate (d) methyl salicylic acid
46. Ortho-nitrophenol is less soluble in water than p and m-nitrophenols because
- (a) o-nitrophenol is more volatile steam than those of m and p-isomers.
(b) o-nitrophenol shows intramolecular H-bonding
(c) o-nitrophenol shows intermolecular H-bonding
(d) melting point of o-nitrophenol is lower than those of m and p-isomers
47. How many chiral compounds are possible on monochlorination of 2-methyl butane?
- (a) 8 (b) 2
(c) 4 (d) 6
48. Very pure hydrogen (99.9) can be made by which of the following processes?
- (a) Reaction of methane with steam
(b) Mixing natural hydrocarbons of high molecular weight
(c) Electrolysis of water
(d) Reaction of salts like hydrides with water

49. The electrons identified by quantum numbers n and l
- (a) $n = 4, l = 1$ (b) $n = 4, l = 0$
(c) $n = 3, l = 2$ (d) $n = 3, l = 1$
50. For a first order reaction, $(A) \rightarrow \text{products}$ the concentration of A changes from 0.1 M to 0.025 M in 40 min . The rate of reaction when the concentration of A is 0.01 M is
- (a) $1.73 \times 10^{-5} \text{ M/min}$ (b) $3.47 \times 10^{-4} \text{ M/min}$
(c) $3.47 \times 10^{-5} \text{ M/min}$ (d) $1.73 \times 10^{-4} \text{ M/min}$
51. Iron exhibits $+2$ and $+3$ oxidation states. Which of the following statements about iron is incorrect?
- (a) Ferrous oxide is more basic in nature than the ferric oxide
(b) Ferrous compounds are relatively more ionic than the corresponding ferric compounds
(c) Ferrous compounds are less volatile than the corresponding ferric compounds
(d) Ferrous compounds are more easily hydrolysed than the corresponding ferric compounds.
52. The pH of a 0.1 molar solution of the acid HQ is 3 . The value of the ionisation constant, K_a of the acid is
- (a) 3×10^{-1} (b) 1×10^{-3}
(c) 1×10^{-5} (d) 1×10^{-7}
53. Which branched chain isomer of the hydrocarbon with molecular mass 72 u gives only one isomer of mono substituted alkyl halide?
- (a) Tertiary butyl chloride (b) Neopentane
(c) Isohexane (d) Neohexane
54. K_f for water is $1.86 \text{ K kg mol}^{-1}$. If your automobile radiator holds 1.0 kg of water how many grams of ethylene glycol ($C_2H_6O_2$) must you add to get the freezing point of the solution lowered to -2.8°C ?
- (a) 72 g (b) 93 g
(c) 39 g (d) 27 g
55. What is DDT among the following
- (a) Green house gas (b) A fertiliser
(c) Biodegradable pollutant (d) Non-biodegradable pollutant
56. The increasing order of ionic radii of the given isoelectronic species is
- (a) $Cl^-, Ca^{2+}, K^+, S^{2-}$ (b) $S^{2-}, Cl^-, Ca^{2+}, K^+$
(c) $Ca^{2+}, K^+, Cl^-, S^{2-}$ (d) $K^+, S^{2-}, Ca^{2+}, Cl^-$
57. 2-hexyne gives trans-2-hexene on treatment with
- (a) Pt/H_2 (b) Li/NH_3
(c) $Pd/BaSO_4$ (d) $LiAlH_4$



58. Iodoform can be prepared from all except
(a) ethyl methyl ketone (b) isopropyl alcohol
(c) 3-methyl-2-butanone (d) isobutyl alcohol
59. In which of the following pairs, the two species are not isostructural?
(a) CO_3^{2-} and NO_3^- (b) PCl_4^+ and SiCl_4
(c) PF_5 and BrF_5 (d) AlF_6^{3-} and SF_6
60. In the given transformation, which of the following is the most appropriate reagent?



- (a) $\text{NH}_2\text{NH}_2, \text{OH}$ (b) Zn-Hg/HCl
(c) Na, Liq. NH_3 (d) NaBH_4



MATHEMATICS

61. The equation $e^{\sin x} - e^{-\sin x} - 4 = 0$ has
(a) infinite number of real roots (b) no real root
(c) exactly one real root (d) exactly four real roots
62. Let a and b be two unit vectors. If the vectors $c = a + 2b$ and $d = 5a - 4b$ are perpendicular to each other, then the angle between a and b is
(a) $\pi/6$ (b) $\pi/2$
(c) $\pi/3$ (d) $\pi/4$
63. A spherical balloon is filled with 4500π cu m of helium gas. If a leak in the balloon causes the gas to escape at the rate of 72π cu m/min, then the rate (in m/min) at which the radius of the balloon decreases 49 min after the leakage began is
(a) $9/7$ (b) $7/9$
(c) $2/9$ (d) $9/2$
64. **Statement I** The sum of the series $1 + (1 + 2 + 4) + (4 + 6 + 9) + (9 + 12 + 16) + \dots + (361 + 380 + 400)$ is 8000.
Statement II $\sum_{k=1}^n [k^3 - (k-1)^3] = n^3$, for any natural number n .
(a) Statement I is false, Statement II is true
(b) Statement I is true, Statement II is true; Statement II is a correct explanation for Statement I
(c) Statement I is true, Statement II is true; Statement II is not a correct explanation for Statement I
(d) Statement I is true, Statement II is false
65. The negation of the statement "If I become a teacher, then I will open a school", is
(a) I will become a teacher and I will not open a school
(b) Either I will not become a teacher or I will not open a school
(c) Neither I will become a teacher nor I will open a school
(d) I will not become a teacher or I will open a school
66. If the integral $\int 5 \tan x / \tan x - 2 dx = x + a \log |\sin x - 2 \cos x| + k$, then a is equal to
(a) -1 (b) -2
(c) 1 (d) 2



67. **Statement I** An equation of a common tangent to the parabola $y^2 = 16\sqrt{3}x$ and the ellipse $2x^2 + y^2 = 4$ is $y = 2x + 2\sqrt{3}$.

Statement II If the line $y = mx + \frac{4\sqrt{3}}{m}$, ($m \neq 0$) is a common tangent to the parabola $y^2 = 16\sqrt{3}x$ and the ellipse $2x^2 + y^2 = 4$, then m satisfies $m^4 + 2m^2 = 24$.

- (a) Statement I is false, Statement II is true
 (b) Statement I is true, Statement II is true; Statement II is a correct explanation for Statement I
 (c) Statement I is true, Statement II is true; Statement II is not a correct explanation for Statement I
 (d) Statement I is true, Statement II is false

68. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$. If u_1 and u_2 are column matrices such that $Au_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ and $Au_2 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$ then $u_1 + u_2$ is equal to

(a) $\begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix}$

(b) $\begin{bmatrix} -1 \\ 1 \\ -1 \end{bmatrix}$

(b) $\begin{bmatrix} -1 \\ -1 \\ 0 \end{bmatrix}$

(d) $\begin{bmatrix} 1 \\ -1 \\ -1 \end{bmatrix}$

69. If n is a positive integer, then $(\sqrt{3} + 1)^{2n} - (\sqrt{3} - 1)^{2n}$ is

- (a) an irrational number
 (b) an odd positive integer
 (c) an even positive number
 (d) a rational number other than positive integers

70. If 100 times the 100th term of an AP with non-zero common difference equals the 50 times its 50th term, then the 150th term of this AP is

- (a) -150
 (b) 150 times its 50th term
 (c) 150
 (d) zero

71. In a ΔPQR , if $3 \sin P + 4 \cos Q = 6$ and $4 \sin Q + 3 \cos P = 1$, then the angle R is equal to

- (a) $\frac{5\pi}{6}$
 (b) $\frac{\pi}{6}$
 (c) $\frac{\pi}{4}$
 (d) $\frac{3\pi}{4}$

72. A equation of a plane parallel to the plane $x - 2y + 2z - 5 = 0$ and at a unit distance from the origin is

- (a) $x - 2y + 2z - 3 = 0$
 (b) $x - 2y + 2z + 1 = 0$
 (c) $x - 2y + 2z - 1 = 0$
 (d) $x - 2y + 2z + 5 = 0$

73. If the line $2x + y = k$ passes through the point which divides the line segment joining the points $(1,1)$ and $(2,4)$ in the ratio $3 : 2$, then k equals
- (a) $\frac{29}{5}$ (b) 5
(c) 6 (d) $\frac{11}{5}$

74. Let x_1, x_2, \dots, x_n be n observations and \bar{x} be their arithmetic mean and σ^2 be the variance.

Statement I Variance of $2x_1, 2x_2, \dots, 2x_n$ is $4\sigma^2$.

Statement II Arithmetic mean $2x_1, 2x_2, \dots, 2x_n$ is $4\bar{x}$.

- (a) Statement I is false, Statement II is true
(b) Statement I is true, Statement II is true; Statement II is a correct explanation for Statement I
(c) Statement I is true, Statement II is true; Statement II is not a correct explanation for Statement I
(d) Statement I is true, Statement II is false
75. The population $p(t)$ at time t of a certain mouse species satisfies the differential equation $\frac{dp(t)}{dt} = 0.5(t) - 450$. If $p(0) = 850$, then the time at which the population becomes zero is
- (a) $2 \log 18$ (b) $\log 9$
(c) $\frac{1}{2} \log 18$ (d) $\log 18$

76. Let $a, b \in \mathbb{R}$ be such that the function f given by $f(x) = \log |x| + bx^2 + ax$, $x \neq 0$ has extreme values at $x = -1$ and $x = 2$.

Statement I f has local maximum at $x = -1$ and at $x = 2$.

Statement II $a = \frac{1}{2}$ and $b = \frac{-1}{4}$.

- (a) Statement I is false, Statement II is true
(b) Statement I is true, Statement II is true; Statement II is a correct explanation for Statement I
(c) Statement I is true, Statement II is true; Statement II is not a correct explanation for Statement I
(d) Statement I is true, Statement II is false

77. The area bounded between the parabolas $x^2 = \frac{y}{4}$ and $x^2 = 9y$ and the straight line $y = 2$ is

- (a) $20\sqrt{2}$ (b) $\frac{10\sqrt{2}}{3}$
(c) $\frac{20\sqrt{2}}{3}$ (d) $10\sqrt{2}$

78. Assuming the balls to be identical except for difference in colours, the number of ways in which one or more balls can be selected from 10 white, 9 green and 7 black balls, is

- (a) 880 (b) 629
(c) 630 (d) 879



79. If $f : \mathbb{R} \rightarrow \mathbb{R}$ is a function defined by $f(x) = [x] \cos (2x - \frac{1}{2})\pi$, where $[x]$ denotes the greatest integer function, then f is
- continuous for every real x
 - discontinuous only at $x = 0$
 - discontinuous only at non-zero integral values of x
 - continuous only at $x = 0$
80. If the line $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ intersect, then k is equal to
- 1
 - $\frac{2}{9}$
 - $\frac{9}{2}$
 - 0
81. Three numbers are chosen at random without replacement from $\{1, 2, 3, \dots, 8\}$. The probability that their minimum is 3, given that their maximum is 6, is
- $\frac{3}{8}$
 - $\frac{1}{5}$
 - $\frac{1}{4}$
 - $\frac{2}{5}$
82. If $z \neq 1$ and $z^2 / z - 1$ is real, then the point represented by the complex number z lies
- either on the real axis or on a circle passing through the origin
 - on a circle with centre at the origin
 - either on the real axis or on a circle not passing through the origin
 - on the imaginary axis
83. Let P and Q be 3×3 matrices $P \neq Q$. If $P^3 = Q^3$ and $P^2Q = Q^2P$, then determinant of $(P^2 + Q^2)$ is equal to
- 2
 - 1
 - 0
 - 1
84. If $g(x) = \int_0^x \cos 4t \, dt$, then $g(x + \pi)$ equals
- $\frac{g(x)}{g(\pi)}$
 - $g(x) + g(\pi)$
 - $g(x) - g(\pi)$
 - $g(x) \cdot g(\pi)$
85. The length of the diameter of the circle which touches the X-axis at the point $(1, 0)$ and passes through the point $(2, 3)$ is
- $\frac{10}{3}$
 - $\frac{3}{5}$
 - $\frac{6}{5}$
 - $\frac{5}{3}$
86. Let $X = \{1, 2, 3, 4, 5\}$. The number of different ordered pairs (Y, Z) that can be formed such that $Y \subseteq X, Z \subseteq X$ and $Y \cap Z$ is empty, is
- 2^5
 - 3^5
 - 2^5
 - 5^3

87. An ellipse is drawn by taking a diameter of the circle $(x - 1)^2 + y^2 = 1$ as its semi-minor axis and a diameter of the circle $x^2 + (y - 2)^2 = 4$ is semi-major axis. If the centre of the ellipse is at the origin and its axes are the coordinate axes, then the equation of the ellipse is

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

(b) $x^2 + 4y^2 = 8$

(c) $4x^2 + y^2 = 8$

(d) $x^2 + 4y^2 = 16$

88. Consider the function, $f(x) = |x - 2| + |x - 5|$, $x \in \mathbb{R}$.

Statement I $f'(4) = 0$

Statement II f is continuous in $[2, 5]$, differentiable in $(2, 5)$ and $f(2) = f(5)$.

(a) Statement I is false, Statement II is true

(b) Statement I is true, Statement II is true; Statement II is a correct explanation for Statement I

(c) Statement I is true, Statement II is true; Statement II is not a correct explanation for Statement I

(d) Statement I is true, Statement II is false

89. A line is drawn through the point $(1, 2)$ to meet the coordinate axes at P and Q such that it forms a ΔOPQ , where O is the origin, if the area of the ΔOPQ is least, then the slope of the line PQ is

(a) $-\frac{1}{4}$

(b) -4

(c) -2

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

90. Let ABCD be a parallelogram such that $AB = q$, $AD = p$ and $\angle BAD$ be an acute angle. If r is the vector that coincides with the altitude directed from the vertex B to the side AD, then r is given by

(a) $r = 3q - \frac{3(p \cdot q)}{(p \cdot p)}p$

(b) $r = -q + (p \cdot q/p \cdot p)p$

(c) $r = q - (p \cdot q/p \cdot p)p$

(d) $r = -3q + \frac{3(p \cdot q)}{(p \cdot p)}p$