AMUEEE Question Paper 2016

Duration : 3 : 00 Hrs

| Exam | | Total Questions | | |
AMUEEE		150		
Marks for Correct Answer	Negative Marks	Physics	Chemistry	Mathematics
1	0.25	50	50	50

Physics

1. The nearest star to our solar system is 4.3 light years away. The distance of this star in Parsec is (Mean distance between the earth and the sun = 1.5×10^{11} m and one light year = 9.46×10^{15} m)
(a) 1.3
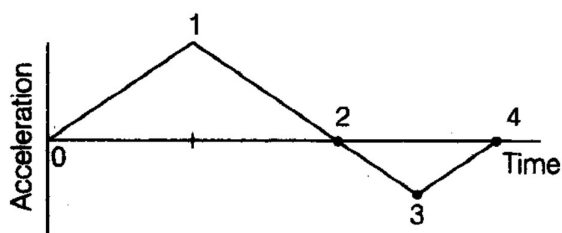(b) 8.0
(c) 13.0
(d) 33×10^4

Correct: a

2. A particle has initial velocity $(2\hat{i} + 3\hat{j})$ and acceleration $(0.3\hat{i} + 0.2\hat{j})$. The magnitude of velocity after 10 seconds will be
(a) $5\sqrt{2}$ units
(b) $7\sqrt{2}$ units
(c) $9\sqrt{2}$ units
(d) 9 units

Correct: a

3. Acceleration-time graph of a body moving in a straight line is as shown in figure. The body started its motion from rest.

At what point is the body moving with the largest speed?
(a) 1

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

Correct: b

4. A balloon has a mass of 10 gram in air. The air escapes from the balloon at a uniform rate with a velocity of 5 cm/s and the balloon shrinks completely in 2.5 s. The average force acting on the balloon will be
(a) 200 dyne
(b) 20 dyne
(c) 20 Newton
(d) 2000 dyne

Correct: b

5. The relation between time t and distance x for a moving particle is $t = ax^2 + \beta x$, where α and β are constants. If v is the velocity at distance X, then the retardation of the particle is
(a) $20v^3$
(b) $2\beta v^3$
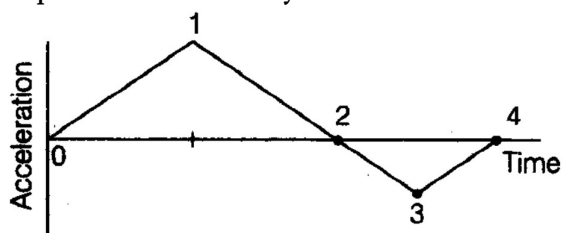(0) $2\alpha\beta v^3$
(d) $2\beta^2 v^2$

Correct: a

6. If a particle of mass m is moving in a horizontal circle of radius r with a centripetal force $\left(-\frac{K}{r^2}\right)$ total energy is
(a) $-\frac{K}{2r}$
(b) $-\frac{K}{t}$
(c) $-\frac{2K}{t}$
(d) $-\frac{4K}{t}$

Correct: a

7. Figure represents the position-time graph of a body of mass 4 kg. Impulse $(kgms^{-1})$ imparted to the body at t = 0 is

(a) 6
(b) 4
(c) 3

(d) 0

Correct: a

8. A body of mass m accelerates uniformly from rest to v_1 in the time t_1. The instantaneous power delivered to the body as a function of time

(a) $\dfrac{mv_1^2 t}{t_1}$

(b) $\dfrac{mv_1 t}{t_1}$

(c) $\dfrac{mv_1 t^2}{t_1}$

(d) $\dfrac{mv_1^2 t}{t_1^2}$

Correct: d

9. A man throws a ball of mass 3.0 kg with a speed of 5.0 m/s. His hand is in contact with the ball for 0.2 s. If he throws 4 balls in 2 seconds, the average force exerted by him in 1 second is:
(a) 15 N
(b) 30 N
(c) 150 N
(d) 75 N
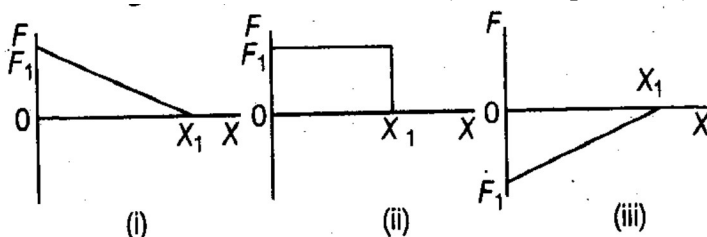
Correct: b

10. Two bodies of masses m and 4m are placed at a distance r. The gravitational potential at a point on the line joining them where the gravitational field is zero is in

(a) $-\dfrac{4Gm}{r}$

(b) $-\dfrac{6Gm}{r}$

(c) $-\dfrac{9Gm}{r}$

(d) zero

Correct: c

11. The graphs below show the magnitude of the force on a particle as it moves along the positive X-axis from the origin to $X = X_1$. The force is parallel to the X-axis and conservative. The maximum magnitude F_1 has the same
value for all graphs. Rank the situations according to the change in the potential energy associated with the force, least (or most positive) to greatest (or most positive)

(a) (i), (ii), (iii)
(b) (i), (iii), (ii)

(c) (iii), (ii),(i)
(d) (ii), (i), (iii)

Correct: d

12. The freezer in a refrigerator is located at the top section so that
(a) the entire chamber of the refrigerator is cooled quickly due to convection
(b) the motor is not heated
(c) the heat gained from the environment is high
(d) the heat gained from the environment is low

Correct: a

13. The time period of a physical pendulum is $2\pi\sqrt{I/mgd}$, where I is the moment of inertia of the pendulum about the axis of rotation .
and d is perpendicular distance between the axis of rotation and the centre of mass of the pendulum. A circular ring hängs from a nail on a wall.
The mass of the ring is 3 kg and its radius is 20 cm. If the ring is slightly displaced, the time of resulting oscillations will be
(a) 1.0 s
(b) 1.3 s
(c) 1.8 s
(d) 2.1 s

Correct: b

14. Two non-reactive monatomic ideal gases have their atomic masses in the ratio 2:3. The ratio of their partial pressures, when enclosed in a vessel kept at a constant temperature is 4:3. The ratio of their densities is
(a) 1:4
(b) 1:2
(c) 6:9
(d) 8:9

Correct: d

15. A block is released from rest on a 45° smooth incline and slide a distance d. The time taken to slide the same distance is n times as much to slide on a 45° rough incline than on the smooth incline. The coefficients of friction for the rough incline is
(a) $\sqrt{1 - \frac{1}{n^2}}$
(b) $1 - \frac{1}{n^2}$
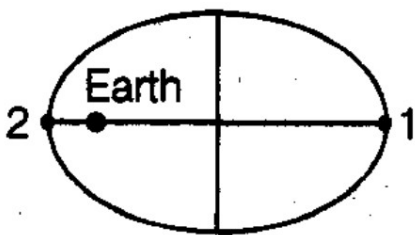(c) $\sqrt{1 - \frac{1}{2n^2}}$
(d) $1 - \frac{1}{2n^2}$

Correct: b

16. A circuit is shown in the figure. The e.m.f. of the battery is a
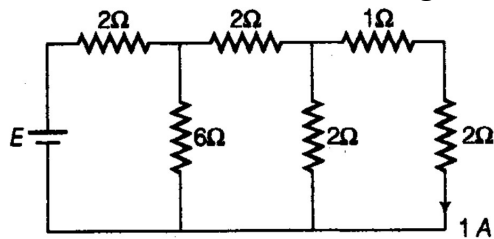
(a) 4 V
(b) 6 V
(c) 12 V
(d) 8 V

Correct: c

17. A small satellite is in elliptical orbit around the earth as shown in figure, L denotes the magnitude of its angular momentum and K denotes its kinetic energy. If 1 and 2 denote two positions of the satellite, then

(a) $L_2 = L_1, K_2 = K_1$
(b) $L_2 = L_1, K_2 > K_1$
(c) $L_2 > L.K_2 < K_1$
(d) $L_2 = L_1, K_2 < K_1$

Correct: b

18. Substances, when placed in a magnetic field acquire feeble magnetisation in the direction opposite to that of the applied field are called
(a) diamagnetic substances
(b) ferromagnetic substances
(c) paramagnetic substances
(d) ferro magnetisation

Correct: a

19. A piece of ice is tied using a string to the bottom of bucket A. The bucket is filled with water with ice completely submerged in it.' Another bucket B is filled with water and a piece of ice is released in water. If floats on the surface of water (see Fig.). What would be the impact on the level of water in the two buckets, when ice pieces melt away completely?
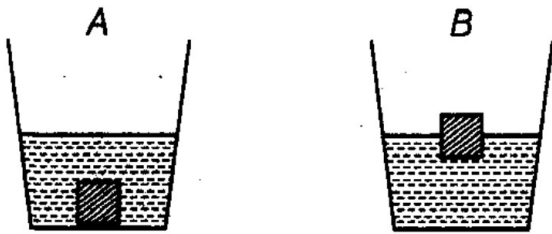
(a) Level of water remain unchanged in both the buckets.
(b) Level of water will go down in bucket A, but will remain unchanged in bucket B.
(c) Level of water will go down in bucket, A but will go up in bucket B.
(d) Level of water will remain unchanged in bucket A, but will go up in bucket B.

Correct: b

20. Consider the following thermodynamical variables
(i) Pressure
(ii) Internal Energy
(ii) Volume
(iv) Temperature
Out of these, the intensive variable(s) is (are)
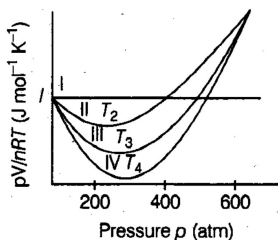(a) (i) only
(b) (i), (iv)
(c) (i), (ii)
(d) (i), (ii), (iv)

Correct: b

21. On stretching a wire its length is increased by 0.2%, its resistance will
(a) increase by 0.1%
(b) decrease by a 1%
(c) increase by 0.2%
(d) increase by 0.4%

Correct: d

22. Different curves in the figures show the behaviour of gases

(i) Curve I represent ideal gas behaviour
(ii) Curves II, III and IV also represents ideal gas behaviour at different temperatures T_2, T_3 and T_4
(iii) Curves II, III and IV represents behaviour of a real gas at different temperatures T_2, T_3 and T_4
(iv) $T_2 > T_3 > T_4$

(v) $T_2 < T_3 < T_4$
The correct statements are
(a) (i), (ii),(iv)
(b) (i). (iii), (iv)
(c) (i) (iii), (v)
(d) (i), (ii), (v)

Correct: b

23. Sound waves from a loudspeaker reach a point P via two paths which differ in length by 1.8 m. When the frequency of sound is gradually increased, the resultant intensity at P is found to be maximum the frequency is 1000 Hz. At what next higher frequency will a maximum be detected?
(velocity of sound= 360 m/s)
(a) 1200 Hz
(b) 1400 Hz
(c) 1600 Hz
(d) 1800 Hz

Correct: a

24. In a series LCR circuit with an alternating voltage source of frequency f, the current leads the voltage by 45°. The value of C is
(a) $\dfrac{1}{\pi f(2\pi fL-R)}$
(b) $\dfrac{1}{2\pi f(2\pi fL-R)}$
(c) $\dfrac{1}{\pi f(2\pi fL+R)}$
(d) $\dfrac{1}{2\pi f(2\pi fL-R)}$

Correct: d

25. The air pressure at sea level is 101325 Pa. At the centre of a rarefaction of a sound wave in air, the pressure is 91000 Pa. Which is the most likely pressure at the centres of a compression of the same wave?
(a) 91000 Pa
(b) 101000 Pa
(c) 111650 Pa
(d) 121000 Pa

Correct: c

26. Four charges each equal to (-Q) are placed at the four corners of a square and a charge q is placed at its centre. If the system of charges is in equilibrium, the value of q is
(a) $\dfrac{Q}{4}(2\sqrt{2}-1)$
(b) $\dfrac{Q}{4}(2\sqrt{2}+1)$

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

(d) $\frac{Q}{2}R\sqrt{2}+1$

Correct: b

27. The electric field associated with an electromagnetic wave in vacuum is given by
$\mathbf{E} = \hat{i}40\cos(kz - 6 \times 10^8 t)$ where E, z and t are Volt/m, metre and second respectively. The value of wave vector k is

(a) $2m^{-1}$

(b) $0.5\mathrm{m}^{-1}$

(c) $6\mathrm{m}^{-1}$

(d) $3\mathrm{m}^{-1}$

Correct: a

28. An electron is placed on X-axis where the electric potential depends on x as shown in figures (the potential does not depend on y and z). What is the electric force on the electron ?
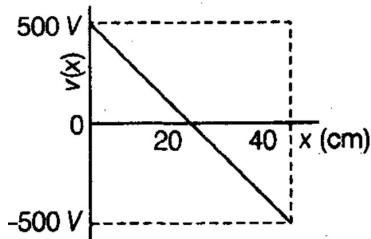
(a) $40 \times 10^{-18}\mathrm{N}$

(b) $80 \times 10^{-16}\mathrm{N}$

(c) $3.2 \times 10^{-56}\mathrm{N}$

(d) $40 \times 10^{-16}\mathrm{N}$

Correct: d

29. The charging current for a capacitor at any instant is 0.78 A. The displacement current across the capacitor plates at that instant is

(a) $\frac{0.78}{\epsilon_0}A$

(b) $0.78\mu_0 A$

(c) $\frac{0.78}{2}A$

(d) 0.78 A

Correct: d

30. Figure shows a potentiometer. Length of the potentiometer wire AB is 100 cm and its resistance is 100Ω. EMF of the battery E is 2V. A resistance R of 50Ω draws current from the potentiometer. What is the voltage across R when the sliding contact C is at the mid-point of AB?
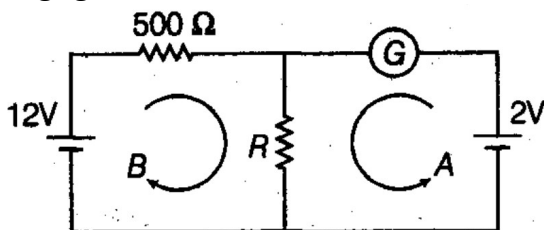
(a) 2/3v

(b) 1 V

(c) 4/3V

(d) 3/2V
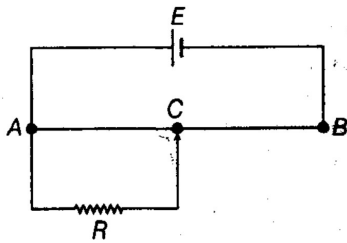
Correct: a

31. Which of the following colour suffers maximum deviation in a prism?

(a) blue

(b) yellow

(c) green

(d) orange

Correct: a

32. In the circuit, the galvanometer G shows zero deflection. If the batteries A and B have negligible internal resistance, then the value of R is

(a) 100Ω

(b) 200Ω

(c) 500Ω

(d) 1000Ω

Correct: a

33. A cyclotron's oscillator frequency is 10 MHz. What should be the operating magnetic field for accelerating protons?

(mass of the proton = 167 x 10-27 kg)

(a) 0.33 T

(b) 0.66 T

(c) 1.5 T

(d) 3.0 T

Correct: b

34. The human eye has a lens which has a
(a) soft portion at its centre
(b) hard surface
(c) varying refractive index
(d) constant refractive index

Correct: c

35. In a certain mass spectrometer, an ion beam passes through a velocity filter consisting of mutually perpendicular fields E and B. The beam then enters a region of another magnetic field B', perpendicular to the beam. The radius of curvature of the resulting ion beam is proportional to
(a) EB'/B
(b) EB/B'
(c) BB'/E
(d) E/BB'

Correct: d

36. The wavelength of 1 keV photon is 1.24×10^{-9} m. What is the frequency of 1 MeV photon?
(a) 1.24×10^{15} Hz
(b) 2.4×10^{20} Hz
(c) 1.24×10^{18} Hz
(d) 2.4×10^{23} Hz

Correct: b

37. Two different coils have self-inductance $L_1 = 9$ mH and $L_2 = 3$ mH. At a certain instant, the current in the two coils is increasing at the same rate and the power supplied to the coils is also the same. The ratio of the energy stored in the two coils (U_1/U_2) at that instant is
(a) ⅓
(b) 1
(c) 3
(d) 27

Correct: a

38. Density of nuclear matter is nearly
(a) 10^{26} kg/m^3
(b) 10^{24} kg/m^3
(c) 10^{17} kg/m^3
(d) 10^{3} kg/m^3

Correct: c

39. In electromagnetic waves travelling in vacuum
(i) The electric field E is always perpendicular to the magnetic field B.
(ii) The cross product E x B always gives the direction in which the waves travel.
(iii) The field E and B vary sinusoidally.
(iv) There is a phase difference of $\frac{\pi}{2}$ between E and B.

The correct statement(s) (are)
(a) (i), (iii)
(b) (i), (iii), (iv)
(c) (i), (ii), (iii), (iv)
(d) (i), (ii), (iii)

Correct: a

40. Which of the series of hydrogen atom spectrum lies in the visible region of electromagnetic spectrum?
(a) Lyman series
(b) Balmer series
(c) Pfund series
(d) Brackett series

Correct: b

41. The angle of prism and refractive index of the material of the prism are A and $\cot \frac{A}{2}$, respectively. The angle of minimum deviation of the prism is
(a) $\frac{\pi}{2} - A$
(b) $\pi - A$
(c) $\pi - \frac{A}{2}$
(d) $\pi - 2A$

Correct: d

42. Assume that the light of wavelength is 6000 Å coming from a star. What is the time resolution of a telescope whose objective has a diameter of 100 inch?
(a) 3.66×10^{-7} rad
(b) 1.44×10^{-7} rad
(c) 2.9×10^{-7} rad
(d) 5.8×10^{-7} rad

Correct: c

43. The relation between force acting on the electron and principle quantum number in hydrogen atom is
(a) $F \propto n^4$
(b) $F \propto n^2$

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

(d) $F \propto \frac{1}{n^4}$

Correct: d

44. When a beam of 10.6 eV photons of intensity $2.0 \text{W}/\text{m}^2$ falls on a metallic surface of area $1 \times 10^{-4}\text{m}^2$, 0.53% of the incident photons eject photoelectrons. What is the number of photoelectrons emitted per second?
(a) 1.18×10^{16}
(b) 6.25×10^{11}
(c) 6.25×10^{13}
(d) 6.25×10^{15}

Correct: b

45. The band gap in Ge and Si in eV respectively is
(a) 0.7, 1.1
(b) 1.1, 0.7
(c) 1.1, 0
(d) 0, 1.1

Correct: a

46. Identify the correct statement(s) from among the following
(i) The constancy of the binding energy per nucleon in the range 30 < A < 170 is a consequence of the fact that the nuclear force is short ranged.
(ii) The nuclear force does not depend on the charge of nucleons.
(iii) The nuclear force is repulsive when distance between two nucleons is less than 0.8 fm.
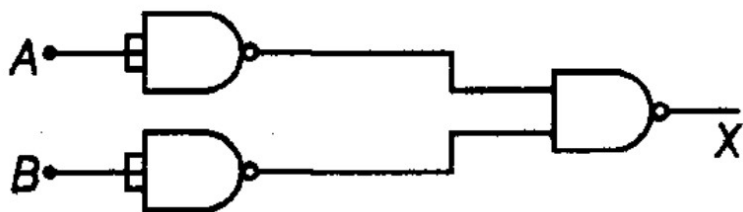(a) (i) only
(b) (i), (iii)
(c) (i), (ii)
(d) (i), (i), (ii)

Correct: d

47. A 100 m long antenna is mounted on a 500 m tall building. The complex can become a transmission tower for waves with λ
(a) $= 400\text{m}$
(b) $= 25\text{m}$
(c) $= 150\text{m}$
(d) $= 2400\text{m}$

Correct: a

48. The combination of gates shown in figure yields

(a) NAND gate
(b) OR gate
(c) NOT gate
(d) XOR gate

Correct: b

49. For an amplitude modulated wave, the maximum amplitude is found to be 12 V while the minimum amplitude is found to be 4 V. The modulation index μ will be
(a) 0.25
(b) 0.50
(c) 0.75
(d) 1.00

Correct: b

50. An alpha particle accelerated through V volts is fired towards a nucleus. It distance of closest approach is r. If a proton accelerated through the same potential is fired towards the same nucleus, its distance of closest approach will be
(a) r
(b) 2r
(c) r/2
(d) r/4

Correct: a

Chemistry

51. Which of the following is not a reaction intermediate?
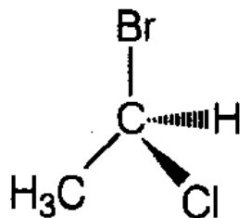(a) Carbenes
(b) Nitrenes
(c) Electrophiles
(d) Hydrophiles

Correct: d

52. Which of the following cations has the strongest tendency towards complex formation?

(a) Sm^{3+}
(b) Lu^{3+}
(c) Gd^{3+}
(d) Yb^{3+}

Correct: b

53. The configuration of the compound

(a) R
(b) S
(c) Z
(d) E

Correct: a

54. Which of the following metal ions is expected to be coloured?
(a) Zn^{2+}
(b) Ti^{3+}
(c) Sc^{3+}
(d) Ti^{4+}

Correct: b

55. The best reducing agent among the following is
(a) NH_3
(b) SbH_3
(c) PH_3
(d) AsH_3

Correct: b

56. The EAN value y $\left[Ti(\sigma - C_6H_5)_2(\pi - C_5H_S)_2\right]^{\circ}$ is
(a) 32
(b) 33
(c) 34
(d) 35

Correct: c

57. The major product of nitration of benzoic acid is

(a) 3-nitrobenzoic acid
(b) 4-nitrobenzoic acid
(c) 2-nitrobenzoic acid
(d) 2, 4-dinitrobenzoic acid

Correct: a

58. Which of the following complexes is optically active?
(a) $\left[Co(NH_3)_5Cl\right]^+$
(b) $[Co\,(NH_3)\,C_5]^{3-}$
(c) $cis - [Co(en)_2Cl_2]$
(d) $tans - [Co(en)_2Cl_2]$

Correct: c

59. Which of the following will exhibit highest boiling point?
(a) $CH_3CH_2OCH_2CH_3$
(b) $CH_3CH_2CH_2CH_2CH_2OH$
(c) $CH_3CH_2CH_2CH\,(CH_3)\,OH$
(d) $CH_2CH_2C(CH_3)_2OH$

Correct: b

60. The following reactions show the H_2O_2 behaviour in I and II reactions as:
1. $PbS(s) + 4H_2O_2(aq) \longrightarrow PbSO_4(s)$
$+4H_2O(l)$
2. $HOCl + H_2O_2 \longrightarrow H_3O^+ + Cl^- + O_2$
(a) Oxidising in acidic medium and reducing in basic medium
(b) Reducing in acidic medium and oxidising in basic medium
(c) Oxidising in acidic medium and reducing in acidic medium
(d) Reducing in acidic medium and oxidising in acidic medium
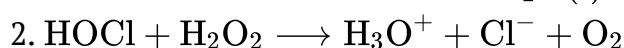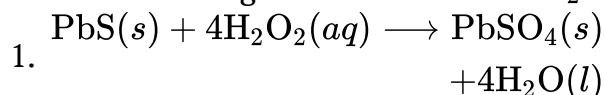
Correct: c

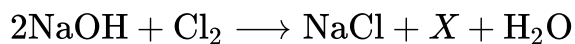61. The correct arrangement of following in their decreasing order of basic strength is
(a) $NH_3 > C_6H_5NH_2 > (C_2H_5)_2NH > C_2H_5NH_2$
(b) $C_2H_5NH_2 > (C_2H_5)_2NH > C_6H_5NH_2 > NH_3$
(c) $(C_2H_5)_2NH > C_2H_5NH_2 > NH_3 > C_6H_5NH_2$
(d) $C_6H_5NH_2 > NH_3 > C_2H_5NH_2 > (C_2H_5)_2NH$

Correct: c

62. Products (X and Y) of the following reactions
(I and II) are :
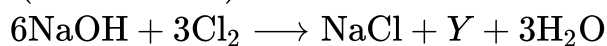
1. $2\text{NaOH} + \text{Cl}_2 \longrightarrow \text{NaCl} + X + \text{H}_2\text{O}$
   (Cold and di.)
2. $6\text{NaOH} + 3\text{Cl}_2 \longrightarrow \text{NaCl} + Y + 3\text{H}_2\text{O}$
   (Hot and conc.)
(a) $X = \text{NaClO}_3$ and $Y = \text{NaOCl}$
(b) $X = NaClO$ and $Y = NaOCl_3$
(c) $X = \text{NaHClO}_3$ and $Y = \text{NaOCl}$
(d) $X = \text{NaClO}_3$ and $Y = \text{NaHClO}_3$

Correct: b

63. The polymer used as a substitute for wool in making commercial fibres is
(a) glyptal
(b) novolac
(c) neoprene
(d) polyacrylonitrile

Correct: d

64. An example of non-stoichiometric hydride is
(a) sodium hydride
(b) beryllium hydride
(c) lanthanum hydride
(d) diborane

Correct: c

65. Which one of the following is not the use of SO_2?
(a) Preservative
(b) Anti-chlor
(c) Disinfectant
(d) Insecticide

Correct: d

66. Which of the following will not give iodoform test?
(a) Isopropyl alcohol
(b) Ethanol
(c) Ethanal
(d) Benzyl alcohol

Correct: d

67. Structure anions of acids HNO_3, H_3PO_4 and H_2SO_4 are, respectively
(a) tetrahedral, tetrahedral and trigonal bipyramidal
(b) angular, tetrahedral and trigonal bipyramidal

(c) tetrahedral, tetrahedral and angular
(d) planar, tetrahedral and tetrahedral

Correct: d

68. Which of the following will not give iodoform test?
(a) Isopropyl alcohol
(b) Ethanol
(c) Ethanal
(d) Benzyl alcohol

Correct: d

69. Aspartame is an
(a) alkaloid
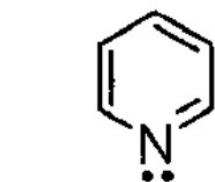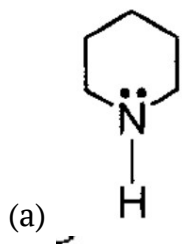(b) insecticide
(c) artificial sweetener
(d) antiseptic

Correct: c

70. Sodium hydroxide is manufactured by
(a) Solvay process
(b) Haber's process
(c) Castner-Kellner process
(d) Evaporating process

Correct: c

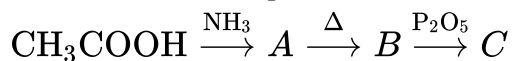71. The strongest base in the following is

(a)

(b)

(c)

(d)

Correct: a

72. The oxidation number of Pt in $[Pt(C_2H_4)Cl_3F$ ion is
(a) + 1
(b) + 2
(c) + 3
(d) + 4

Correct: b

73. Name the end product in the following series of reactions
$$CH_3COOH \xrightarrow{NH_3} A \xrightarrow{\Delta} B \xrightarrow{P_2O_5} C$$
(a) Methane
(b) Methanol
(c) Acetonitrile
(d) Acetamide

Correct: c

74. Which one acts as refrigerant?
(a) CF_2Cl_2
(b) CF_4
(c) $CFCl_3$
(d) CF_3Cl

Correct: a

75. The correct sequence of bond order is
(a) $O_2^+ > O_2^- > O_2$
(b) $O_2 > O_2^- > O_2^+$
(c) $O_2^+ > O_2 > O_2^-$
(d) $O_2^- > O_2^+ > O_2$

Correct: c

76. The reactant 'P' in the following reaction is
(a) $CH_3CHOHCH_3$
(b) CH_3COCH_3
(c) CH_3CH_2OH
(d) CH_3COOH

Correct: a

77. A β - hydroxy carbonyl compound is obtained
by the action of NaOH on
(a) R_3CCHO
(b) C_6H_5CHO
(c) CH_3CHO
(d) $HCHO$

Correct: c

78. Correct formula for Wilkinson's catalyst is
(a) $\left[(Ph_3P)_3RhCl\right]$
(b) $\left[(Ph_3P)_2RhCl_2\right]$
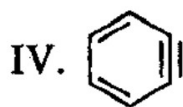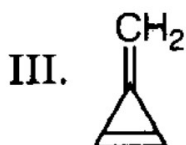(c) $\left[(Ph_3P)_3RuCl_3\right]$
(d) $\left[(Ph_3P)_2RuCI_2\right]$

Correct: a

79. Which of the following is used for the estimation of halogens in organic compounds?
(a) Carius method
(b) Duma's method
(c) Kjeldahl's method
(d) Newman method

Correct: a

80. Which of the following structures contain sp-hybridised carbon atom(s)?

I. $HC{\equiv}CH$ II. $H_2C{=}C{=}CH_2$

III.
$$\overset{CH_2}{\underset{\triangle}{\|}}$$

IV. (benzene ring with substituent)
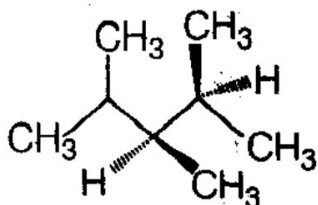
(a) I, II and III
(b) I, III and IV
(c) II, III and IV
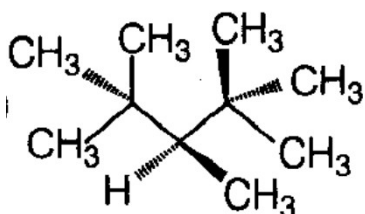(d) I, II and IV

Correct: d

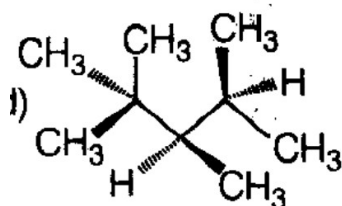81. Which of the following structures represents a chiral compound?
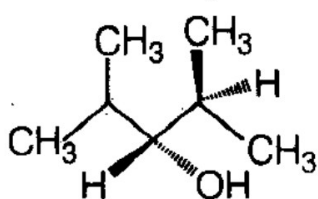
(a)

(b)

(c)

(d)

Correct: d

82. Which of the following oxides of nitrogen is blue in nature?
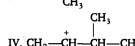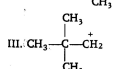(a) NO
(b) N_2O_3
(c) N_2O_5
(d) NO_2

Correct: b

83. Which of the following carbocations is most stable?
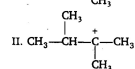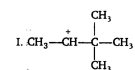
(a) I
(b) II

(c) III

(d) IV

Correct: b

84. On heating an aldehyde with Fehling's reagent, a reddish brown precipitate is obtained due to the formation of

(a) $RCOO^-$

(b) CuO

(c) Cu_2O

(d) RCH_2OH

Correct: c

85. What is the number of nitrogen-nitrogen bonds in N_2O_5?

(a) 1

(b) 0

(c) 1.5

(d) None of these

Correct: b

86. What will be the pH of solution formed by mixing 10 mL 0.1 M NaH_2PO_4 and 15 mL 0.1 M Na_2HPO_4.

[Given: $pK_1 = 2.12, pK_2 = 7.2$]

(a) 7.0

(b) 6.9

(c) 7.4

(d) 7.5

Correct: c

87. Which of the following has the highest coagulating power for As_2S_3 colloid?

(a) PO_4^{3-}

(b) SO_4^{2-}

(c) Al^{3+}

(d) Na^+

Correct: c

88. For the reaction

$$A + B \rightarrow P = -\frac{d[A]}{dt} = -\frac{d[B]}{dt} = k[A][B]$$
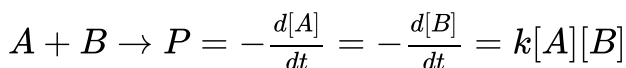
$kt = \frac{1}{[A]_0 - [B]_0} \ln \frac{[A][B]_0}{[B][A]_0}$ when , $[A]_0 \neq [B]_0$ and when, $[A]_0 \neq [B]_0$. If, $[A]_0 = [B]_0$ then the integrated rate law will be

(a) $kt = \ln \frac{[A]}{[B]}$

(b) $\frac{1}{[B]} = \frac{1}{[A]_0} + kt$

(c) $\frac{1}{[A]} = \frac{1}{[B]_0} + kt$

(d) $\frac{1}{[A]} = \frac{1}{[A_b]} + kt$ or $\frac{1}{[B]} = \frac{1}{[B]_0} + kt$

Correct: d

89. For a buffer of a mixture of 0.12molL^{-1}
CH_3COOH and 0.12molL^{-1} CH_3COONa the buffer capacity is
(a) 1.38
(b) 0.130
(c) 0.06
(d) 0.60

Correct: d

90. The standard emf of the cell (E°_{cell} and equilibrium constant (K_{eq}) of the following reaction of 298 K
$$Cd^{2+} + 4NH_3 \rightleftharpoons Cd(NH_3)_4^{2+}$$
(a) $E^\circ_{cell} = 1.0V, K_{eq} = 1.26 \times 10^7$
(b) $E^\circ_{cell} = 0.21V, K_{eq} = 1.26 \times 10^7$
(c) $E^\circ_{cell} = 1.0V_1 K_{eq} = 6.60 \times 10^{33}$
(d) $E^\circ_{cell} = 021V, K_{eq} = 6.60 \times 10^{33}$
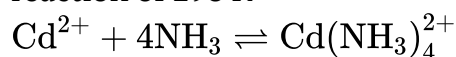
Correct: b

91. 0.002 M solution of a weak acid has an equivalent conductance $(\Lambda)60$ ohm $^{-1}\text{cm}^2$ eq^{-1}
What will be the pH ?
(Given $\Lambda^\circ = 400$ ohm $^{-1}\text{cm}^2\text{eq}^{-1}$])
(a) 3.52
(b) 2.52
(c) 1.87
(d) 2.7

Correct: a

92. Benzene freezes at 5.6°C. Its value for K_f is 5.1. The value of f is ΔH_{fus}
(a) 30.24 cal
(b) 2358.72 cal
(c) 1179.36 cal
(d) 15.12 cal

Correct: b

93. The rate constant, the activation energy and the Arrhenius parameter of a chemical reaction at $25°C$ are $3.0 \times 10^{-4}s^{-1}$, $104.4kJmol^{-1}$ and $6.0 \times 10^{14}s^{-1}$ respectively. The value of the rate constant at $T \to \infty$ is

(a) $2.0 \times 10^{18}s^{-1}$
(b) $60 \times 10^{14}s^{-1}$
(c) $3.6 \times 10^{30}s^{-1}$
(d) Infinity

Correct: b

94. An ideal gas initially at temperature, pressure and volume, $27°C$, 1.00bar and 10L respectively is heated at constant volume until pressure is 10.0 bar ,it then undergoes a reversible isothermal expansion until pressure is 1.00 bar what is the total work W during the process?

(a) $-23.02 \times 10^3 J$
(b) $-14.0 \times 10^3 J$
(c) $14.0 \times 10^3 J$
(d) $Zero$

Correct: a

95. A better criterion for ideality of a gas than $\left(\frac{\partial U}{\partial V}\right)_T = 0$ is

(a) $\left(\frac{\partial H}{\partial p}\right)_T < 0$
(b) $\left(\frac{\partial H}{\partial \rho}\right)_T > 0$
(c) $\left(\frac{\partial H}{\partial p}\right)_T = 0$
(d) $\left(\frac{\partial H}{\partial p}\right)_T \neq 0$

Correct: c

96. The electrode potential, $E°$ for the reduction of MnO_4^- to Mn^{2+} in acidic medium is +1.51 V .Which of the following metal(s) will be oxidised? The reduction reaētions and standard electrode potentials for Zn^{2+}, Ag^+ and Au^+ are given as
$Zn^{2+}(aq) + 2e \longrightarrow Zn(s), E° = -0.762V$
$Ag^+(aq) + e \rightleftarrows Ag(s), E° = +0.80V$
$Au^+(aq) + e \rightleftharpoons Au(s), E° + 1.69V$
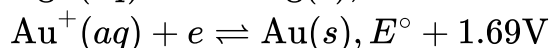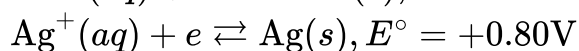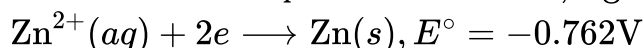
(a) Zn and Au
(b) Ag and Au
(c) Au
(d) Zn and Ag

Correct: d
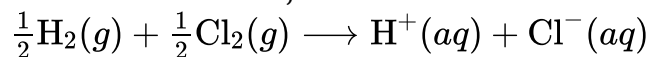
97. For the reaction,
$$\frac{1}{2}H_2(g) + \frac{1}{2}Cl_2(g) \longrightarrow H^+(aq) + Cl^-(aq)$$
$\Delta G^\circ_{\text{reaction}} = -131.23 \text{kJmol}^{-1}$
The value of $\Delta G^\circ_{\text{formation}}$ of $Ag^+(aq)$ shall be given by ,(if $\Delta G^\delta_f(H^+ aq) = 0$
(a) -54.12kJmol^{-1}
(b) $-131.23 \text{kJmol}^{-1}$
(c) $+77.11 \text{kJmol}^{-1}$
(d) $+5412 \text{kJmol}^{-1}$

Correct: b

98. For $NH_4HS(s) \longmapsto NH_3(g) + H_2S(g)$, the
observed pressure for the reaction mixture in equilibrium is 1.12 atm at 106°C. What is the value of K_p for the reaction?
(a) 0.56atm^2
(b) 0.3136atm^2
(c) 1.25atm^2
(d) 1.12atm^2

Correct: b

99. If χ_1 and χ_2 represent the mole fractions of a component A in the vapour phase and liquid mixture respectively, and p^0_A and $|p^\circ_B|$ represent vapour pressures of pure A and pure B, then total vapour pressure of liquid mixture is
(a) $\frac{p^\circ_A \chi_1}{\chi_2}$
(b) $\frac{p^\circ_A x_2}{\chi_1}$
(c) $\frac{p^\circ_B \chi_1}{\chi_2}$
(d) $\frac{p^\circ_B \chi_2}{\chi_1}$

Correct: b

100. Number of electrons present in 3.6 mg of NH_4^+ are
(a) 1.20×10^{21}
(b) 1.20×10^{20}
(c) 1.20×10^{22}
(d) 2×10^{-3}

Correct: a

Mathematics

101. The function $(x^2 - 9)|x^2 - 7x + 12| + \cos(|x|)$ is not differentiable at
(a) 4
(b) 3
(c) -3
(d) 0

Correct: a

102. Which statement is true for the line $\frac{x-4}{8} = \frac{y-2}{2} = \frac{z-3}{3}$ and plane having intercepts -4,2 and 3 of the following
(a) line is orthogonal to the plane
(b) line lies in the plane
(c) line makes an acute angle $(\neq 0°)$ with the plane
(d) None of the above

Correct: b

103. Let * be a binary operation on the set R of real numbers defined by $a*b = \frac{3ab}{7}$ then the identity element in R for '*' is
(a) 3/7
(b) 3/14
(c) 2/3
(d) None of these

Correct: d

104. For any three sets A, B and C the set $(A \cup B \cup C) \cap (A \cap B' \cap C')' \cap C'$ is equal to
(a) $B \cap C'$
(b) $B' \cap C'$
(c) $B \cap C$
(d) $A \cap B \cap C$

Correct: a

105. Let $f(x) = x^3 + x$, then the equation $\frac{2}{y-f(2)} + \frac{3}{y-f(3)} + \frac{4}{y-f(4)} = 0$, has
(a) both roots lying in (f(2), f(3))
(b) exactly one root lying in (f(3), f(4))
(c) exactly one root lying in $(-\infty, f(2))$
(d) exactly one root lying in $(f(4), \infty)$

Correct: b

106. If $f(x) = xe^{x(1-x)}$, then f(x) is

(a) increasing on [-½, 1]

(b) decreasing on R

(c) increasing on R

(d) decreasing on [-½, 1]

Correct: a

107. The image of the point (1,-1,1) in the plane
$x - 2y + 3z + 1 = 0$ is

(a) (2, -3,4)

(b) $\left(0, \frac{-1}{2}, \frac{-2}{3}\right)$

(c) $\left(\frac{-1}{6}, \frac{4}{3}, \frac{-5}{2}\right)$

(d) $\left(\frac{-7}{3}, \frac{-5}{6}, \frac{2}{3}\right)$

Correct: a

108. If $\sin(\alpha + \beta) = 1, \sin(\alpha - \beta) = \frac{1}{2}, \alpha, \beta \in \left[0, \frac{\alpha}{2}\right]$ then the value of
$\tan(\alpha + 2\beta) \tan(2\alpha + \beta)$ is

(a) 1/2

(b) 1

(c) 1/3

(d) 2

Correct: b

109. If $g(x) = x^2 + x - 2$ and $\frac{1}{2}(gof)x = 2x^2 - 5x + 2$ then f(x) is equal to

(a) 2x-3

(b) 2x + 3

(c) 3x -2

(d) 2x-2

Correct: a

110. The tangent of the angle between the lines whose intercepts on the axes are respectively

(a) $\pm\frac{2ab}{b^2-a^2}$

(b) $\pm\frac{ab}{2(b^2-a^2)}$

(c) $\pm\frac{b^2+a^2}{2ab}$

(d) $\pm\frac{b^2-a^2}{2ab}$

Correct: d

111. If four whole numbers taken at random are multiplied together, then the probability that the last digit in the product is 1, 3, 7, or 9, is
(a) 81/625
(b) 8/625
(c) 32/625
(d) 16/625

Correct: d

112. A region in the xy-plane is bounded by the curve $y = \sqrt{25 - x^2}$ and the line y = 0. If the point (a, a + 1) lies in the interior of the region, then
(a) $a \in (-4, 3)$
(b) $a \in (-\infty, -1) \cup (3, \infty)$
(c) $a \in (-1, 3)$
(d) None of these

Correct: c

113. If $A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & \alpha & 1 \end{pmatrix}$, $A^{-1} = \begin{pmatrix} \frac{1}{2} & -\frac{1}{2} & \frac{1}{2} \\ -4 & 3 & \beta \\ \frac{5}{2} & -\frac{3}{2} & \frac{1}{2} \end{pmatrix}$ then

(a) $\alpha = 2, \beta = -\frac{1}{2}$
(b) $\alpha = 1, \beta = -1$
(c) $\alpha = -1, \beta = 1$
(d) $\alpha = \frac{1}{2}, \beta = \frac{1}{2}$

Correct: b

114. If the sum of n terms of an AP is $nR + \frac{1}{2}n(n - 1)T$, where R and T are constants, then the common difference is
(a) R
(b) T
(c) R - T
(d) T - R

Correct: b

115. A straight line has its extremities on two fixed straight lines and cuts off from them a triangle of constant area C^2. Then the locus of the middle point of the line is
(a) $2xy = C^2$
(b) $xy + C^2 = 0$
(c) $4x^2y^2 = C$
(d) None of these

Correct: a

116. Coefficient of variation of two distributions maximum, when r is equal to are 60 and 70 and their standard deviations are 21 and 16 respectively. Then their AM's are
(a) 35 and 22, 85
(b) 36 and 40
(c) 50 and 30
(d) 22 and 36

Correct: a

117. The equation of the normal to the curve $y = e^x$ at (0,1) is
(a) 2x + y = 1
(b) y - x = 1
(c) x + y = 1
(d) None of these

Correct: c

118. Let A be an event that a family has children of both sexes and B be the event that the family has at most one boy. If the family has 3 children then the events A and B are
(a) dependent
(b) independent
(c) mutually exclusive
(d) None of these

Correct: b

119. A ray of light passing through the point (1, 2) reflects on the X-axis at point A and the reflected ray passes through the point (5, 3). The coordinate of A is
(a) $\left(\frac{5}{13}, 0 \right)$
(b) $\left(\frac{13}{5}, 0 \right)$
(c) $\left(\frac{-5}{13}, 0 \right)$
(d) $\left(\frac{-13}{5}, 0 \right)$

Correct: b

120. The area bounded by the curve $y = 2x - x^2$ and then straight line y = - x is given by
(a) 9/2
(b) 43/6
(c) 35/6
(d) 23/5

Correct: a

121. Consider the following relations in the real numbers
$R_1 = \{(x,y)|x^2 + y^2 \le 25\}$
$R_2 = \left\{(x,y)y \ge \frac{4x^2}{9}\right\}$
then the range of $R_1 \cap R_2$ is
(a) [0,5]
(b) [-3,3]
(c) [-5,5]
(d) [-3,5]

Correct: a

122. The solution of the inequality $|x^2 - 4x| < 5$ is
(a) (-1,5)
(b) (-4,5)
(c) (-5,4)
(d) (- 1,4)

Correct: a

123. If A and B are two events associated to some experiment E such that P(A) = 0.5, P(B) = 0.4, $P(A \cap B) = 0.3$, then $P\left(\frac{A^c}{B^c}\right)$ is equal to
(a) 1/3
(b) 1/2
(c) 2/3
(d) 3/4

Correct: c

124. The coefficient of x^{53} in the expansion
$\sum_{m=0}^{100} 10^0 C_m (x - 3)^{100-m} \cdot 2^m$
(a) $^{100}C_{47}$
(b) $^{10}C_{53}$
(c) $-100C_{53}$
(d) $-100C_{100}$

Correct: c

125. A fair coin is tossed n times. Let the random variable X denote the number of times the head occurs. If P[X = 1], P[X = 2) and P[X = 3] are in arithmetic progression (AP), then the number n of independent trial is
(a) 7
(b) 10

(c) 12

(d) 14

Correct: a

126. The minimum value of $z = 2x_1 + 3x_2$ subject to the constraints $2x_1 + 7x_2 \geq 22\, x_1 + x_2 \geq 6, 5x_1 + x_2 \geq 10$ and $x_1, x_2 \geq 0$ is

(a) 14

(b) 20

(c) 10

(d) 16

Correct: a

127. The most correct statement is

(a) Some optimal solution of a linear programming problem (LPP) is also a feasible solution of LPP

(b) Some optimal solution of a LPP is also a basic feasible solution of LPP

(c) No optimal solution of a LPP is a basic feasible solution of LPP

(d) No basic feasible solution is an optimal solution of LPP

Correct: b

128. The amplitude of the complex number $1 + \sin\alpha - i\cos\alpha$ is

(a) $\pi/4$

(b) $\alpha - \dfrac{\pi}{4}$

(c) $\dfrac{\alpha}{2} - \dfrac{\pi}{4}$

(d) $\dfrac{\pi}{4} - \alpha$

Correct: c

129. The points $z_1 = x + iy$ and $z_2 = \dfrac{1}{-x+iy}$ in the complex plane lie on

(a) a circle with centre origin

(b) a straight line through origin

(c) axis of X

(d) axis of Y

Correct: b

130. The area of the region defined by $||x| - |y|| \leq 1$ and $x^2 + y^2 \leq 1$ in the xy-plane is

(a) a

(b) 1

(c) 2

(d) None of these

Correct: a

131. If the sum of two unit vectors is again a unit vector, then magnitude of their difference is
(a) 0
(b) 1
(c) $\sqrt{3}$
(d) 2

Correct: c

132. If Sand S' are the foci of the ellipse $\frac{x^2}{25} + \frac{y^2}{26} = 1$ and P is any point on it then range of values of SP.S'P is
(a) $9 \leq f(\theta) \leq 16$
(b) $9 \leq f(\theta) \leq 25$)
(c) $16 \leq f(\theta) \leq 25$
(d) $1 \leq f(\theta) \leq 16$

Correct: c

133. The length of perpendicular from the point $\hat{i} + 2\hat{j} + 3\hat{k}$ to the line $\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$
(a) 6
(b) 7
(c) √17
(d) √14

Correct: b

134. The integrating factor of the D.E.
$(x \log x)\frac{dy}{dx} + y = 2 \log x$
(a) log(log x)
(b) e^x
(c) log x
(d) x

Correct: c

135. Let a, be the rth term of an AP, whose first term is a and common difference is d. If for some positive integers $m, n, m \neq n, \alpha_m = \frac{1}{n}$ and $\alpha_n = \frac{1}{m}$ then a – d equals
(a) $\frac{1}{mn}$
(b) 1
(c) 0
(d) $\frac{1}{m} + \frac{1}{n}$

Correct: c

136. The general solution of differential equation $\frac{dy}{dx} + 2xy = 2e^{-x^2}$ is

(a) $y = 2xe^{-x}$

(b) $y = (2x + C)e^{-x^2}$

(c) $y = 2xe^x$

(d) $y = (2x + C)e^{x^2}$

Correct: b

137. If A and B are disjoint sets, then $B \cap A'$ where A' is complement of A is equal to

(a) A

(b) B

(c) A'

(d) B'

Correct: b

138. Which of the following is an incorrect statement?

(a) $n^3 + 3n^2 + 5n + 3$ is divisible by 3 for all $n \epsilon IN$

(b) $n(n + 1)(2n + 1)$ is divisible by 6 for all $n \epsilon IN$

(c) $n^2 - n + 41$ is a prime number for all $n \epsilon IN$

(d) $7^n - 3^n$ is divisible by 4 for all $n \epsilon IN$ where IN denotes the set of all natural numbers.

Correct: c

139. The total revenue in rupees received from the sale of 'x' units of a product is given by $R(x) = 5x^2 + 20x + 7$. The marginal revenue, when x=8 is

(a) 60

(b) 100

(c) 360

(d) 487

Correct: b

140. The unit vector which is orthogonal to the vector $\hat{i} + \hat{j} + \hat{k}$ and is coplanar with vectors $\hat{i} + 2\hat{j} - \hat{k}$ and $2\hat{i} + \hat{j} + 3\hat{k}$, is

(a) $\frac{i + 5\hat{j} - 6\hat{k}}{\sqrt{62}}$

(b) $\frac{i + 3\hat{j} - \hat{k}}{\sqrt{11}}$

(c) $\frac{i + 7i}{\sqrt{50}}$

(d) $\frac{\hat{i} + 2\hat{j} + \hat{k}}{\sqrt{6}}$

Correct: a

141. The function $f(x) = \sqrt{|x| - x}$ is continuous for

(a) real numbers
(b) natural numbers
(c) rational numbers
(d) $[0, \infty)$

Correct: a

142. If the system of equations

2x + ay + 6z = 8

x + 2y + bz = 5

x + y + 32 = 4

has a unique solution then

(a) a = 2 or b = 3
(b) $a \neq 2$ or $b \neq 3$
(c) a = 1, b = 5
(d) a = 0, b = 5

Correct: b

143. The area bounded by the curve $y = \begin{cases} x^{1/\ln x} & x \neq 1 \\ e, & x = 1 \end{cases}$ and $y = |x - e|$ is

(a) $e^2/2$
(b) e^2
(c) $2e^2$
(d) 1

Correct: b

144. The distance of point of intersection of the line with the plane from the point with position vector is

(a) $\sqrt{14}$
(b) $\sqrt{42}$
(c) $3\sqrt{14}$
(d) $\sqrt{3}$

Correct: d

145. $\sin^{-1}\frac{8}{17} + \sin^{-1}\frac{3}{5}$ is equal to

(a) $\sin^{-1}\left(\frac{77}{85}\right)$

(b) $\tan^{-1}\left(\frac{77}{36}\right)$

(c) $\cos^{-1}\left(\frac{1}{36}\right)$

(d) Both (a) and (b)

Correct: d

146. The equation $\left|\,|x| + \left|\frac{x}{x-1}\right|\right| = \frac{x^2}{|x-1|}$ will be
always true for x, belonging to
(a) $[0, 1)$
(b) $\{0\} \cup (1, \infty)$
(c) $(-1, 1)$
(d) $(-\infty, \infty)$

Correct: b

147. Let $\frac{\sin(\theta-\alpha)}{\sin(\theta-\beta)} = \frac{a}{b}$, $\frac{\cos(\theta-\alpha)}{\cos(\theta-\beta)} = \frac{c}{d}$ .Then the value of $\cos(\alpha - \beta)$ equals
(a) $\frac{ac-bd}{ad+bc}$
(b) $\frac{ac+bd}{ad+bc}$
(c) $\frac{ac+bd}{ab+cd}$
(d) $\frac{ac-bd}{ab+cd}$

Correct: b

148. If $\cos^{-1}\sqrt{p} + \cos^{-1}\sqrt{1-p} + \cos^{-1}\sqrt{1-q} = \frac{3\pi}{4}$, then the value of q is
(a) $\frac{1}{\sqrt{2}}$
(b) 1
(c) 1/2
(d) 1/3

Correct: c

149. If a,b,c are the integers between 1 and 9 and a51, b41, c31 are three-digit numbers and
the value of determinant $D = \begin{vmatrix} \vdots 5 & 4 & 3 \\ a51 & b41 & c31 \\ a & b & i \end{vmatrix}$ is zero, then a,b,c are

(a) in GP
(b) in AP
(c) equal
(d) None of the above

Correct: b

150. If $^{n}P_4 = 20 \times ^{n}P_2$. Then, the value of n is
(a) 18

(b) 13
(c) 7
(d) 4

Correct: c