AMUEEE Question Paper 2018

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

Physics

1. Consider the following statements about the four fundamental forces in nature.
(i) The strong nuclear force binds protons and neutrons in a nucleus.
(ii) The strong nuclear force is about 10 times the electromagnetic force in strength.
(iii) The weak nuclear force is the weakest of all the four fundamental forces.
(iv) The range of the weak nuclear is about
10^{-16}m
The correct statement(s) is (are)
(a) (i) only
(b) (ii) and (iii)
(c) (iii) and (iv)
(d) (i), (ii) and (iv)

Correct: a

2. A particle moving with an initial velocity ums^{-1} is retarded by a force at the rate of a=-k$\sqrt{v}$, where k is a positive constant and v is the instantaneous velocity. The particle comes to rest in a time given by
(a) $\frac{2\sqrt{u}}{k}$
(b) $k\sqrt{u}$
(c) $\frac{\sqrt{2u}}{k}$
(d) $\frac{\sqrt{u}}{2k}$

Correct: a

3. The expression of the trajectory of a projectile is given as $y = px - qx^2$, where y and x are respectively the vertical and horizontal displacements and p and q are constants. The time of flight of the projectile is
(a) $\frac{p^2}{4q}$
(b) $\frac{p^2}{2q}$
(c) $\sqrt{\frac{2p}{qg}}$
(d) $p\sqrt{\frac{2}{qg}}$

Correct: d

4. The displacement x of a body varies with time as
$x = -\frac{1}{3}t^2 + 16t + 3,$
where x is in metres and t is in seconds. The time taken by the body to come to rest is
(a) 12 s
(b) 24 s
(c) 30 s
(d) 36 s

Correct: b

5. If a particle's position is given by $x = 4 - 12t + 3t^2$ where t is in the seconds and x in meters. What is its velocity at t=1s? Whether the particle is moving in positive x direction or negative x direction?
(a) - 6 m/s, + x direction
(b) - 6 m/s, - x direction
(c) 6 m/s, + x direction
(d) 4 m/s, - x direction

Correct: b

6. Three particles P, Q and R are at rest at the vertices of an equilateral triangle of side s. Each of the particles starts moving with constant speed v ms^{-1}. P is moving along PQ, Q along QR and R along RP. The particles will meet each other at time t given by
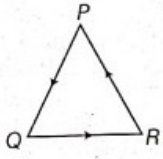
(a) s/v
(b) 3s/v
(c) 3s/2v
(d) 2s/3v

Correct: d

7. Two cars are in a race. The white car passed the finishing point with a velocity vms^{-1} more and took time t s less than the red car. If both the cars start from rest and travel with constant accelerations a_w and a_r respectively, v/t is given
(a) $a_w a_t$
(b) $\sqrt{\frac{a_w}{a_t}}$
(c) $\sqrt{a_w a_r}$
(d) $\sqrt{\frac{a_r}{a_w}}$

Correct: c

8. Starting from origin, a body moves along x-axis. Its velocity at any time is given by $v = 4t^3 - 2t$ m/s. Acceleration of the particle when it is 2 m away from the origin is
(a) $28 ms^{-2}$
(b) $12 ms^{-2}$
(c) $22 ms^{-2}$
(d) $14 ms^{-2}$

Correct: c

9. The kinetic energy of a particle of mass m kg is half of that of another particle of mass m/2 kg. If the speed of heavier particle is increased by 3 ms^{-1}, its kinetic energy becomes equal to the original kinetic energy of the lighter particle. The original speeds of the heavier and lighter particles are
(a) $3 ms^{-1}, 6 ms^{-1}$
(b) $2 ms^{-1}, 4 ms^{-1}$
(c) $2 ms^{-1}, 6 ms^{-1}$
(d) $4 ms^{-1}, 8 ms^{-1}$

Correct: a

10. A man who weighs 670 N runs the first 7.0 m in 1.6 s, starting from rest and accelerating uniformly. What is the average power does the man generate during the 1.6 s time interval?
(a) 3.2 kW
(b) 16 kW
(c) 0.9 kW
(d) None of these

Correct: b

11. If the moment of inertia of a disc about an axis tangential and parallel to its surface be I, then the moment of inertia about an axis tangential but perpendicular to the surface will be
(a) $\frac{6}{5}l$
(b) $\frac{3}{4}l$
(c) $\frac{3}{2}l$
(d) $\frac{5}{4}l$

Correct: a

12. If S is the stress and Y is Young's modulus of material of a wire, the energy stored in the wire per unit volume is
(a) S/2Y
(b) 2Y/S

(c) $\frac{S^2}{2Y}$

(d) $2S^{2Y}$

Correct: c

13. The torque acting on a body about a given point is given by $\tau = \hat{\mathbf{A}} \times \hat{\mathbf{L}}$ where $\hat{A}$ is a constant vector and $\hat{L}$ is the angular momentum of the body about this point. It follows that

(a) the magnitude of $\hat{L}$ does not change with time

(b) the component of $\hat{L}$ in the direction of $\hat{A}$ does not

change with time

(c) $\frac{d\hat{L}}{dt}$ is perpendicular to $\hat{L}$ at all instants of time (d) All of the above choices are correct

Correct: d

14. Find the x and y-coordinates of the centre of inass of the three particle system (as shown).
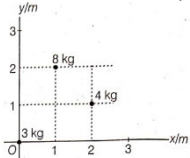
(a) 1.0 m, 1.0 m

(b) 1.3 m, 0.9 m

(c) 1.1 m; 1.3 m

(d) 1.3, 1.1 m

Correct: c

15. The density of a newly discovered planet is twice that of earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of the earth. If the radius of the earth is R, the radius of the planet would be

(a) 4R

(b) 2

(c) R/2

(d) R/4

Correct: c

16. An asteroid of mass $2 \times 10^{-4} M_e$, where M_e is the mass of the earth, revolves in a circular orbit around the sun at a distance that is twice earth's distance from the sun. Find the ratio of the kinetic energy of the asteroid to that of earth.

(a) 0.9 x 10-6

(b) 1.6 x 10-5

(c) 3.6 x 10-5

(d) 1.0 x 10-4

Correct: d

17. Two wires of equal cross-section but one made of steel and the other of copper, are joined end to end. When the combination is kept under tension, the elongations in the two wires are found to be equal. (Y for steel = $2 \times 10^{11} \text{N/m}^2$ and Y for copper = $1.1 \times 10^{11} \text{N/m}^2$). The ratio of the lengths of the two wires is

(a) 20:11

(b) 2:1

(c) 1:2

(d) 1:1

Correct: a

18. The density of air in atmosphere decreases with height and can be expressed by the relation $\rho = \rho_0 e^{-\alpha h}$, where ρ_0, is the density at sea level, α is a constant and h is the height. The atmospheric pressure at the sea level is

(a) $\frac{\rho_0 g}{\alpha}$

(b) $\frac{\rho_0 g h}{\alpha}$

(c) $\frac{\alpha h}{\rho_0 g}$

(d) $\frac{h}{\rho_0 \alpha}$

Correct: a

19. At 600 Hz, an inductor and capacitor have equal reactances, the ratio of the capacitive reactance to the inductive reactance at 60 Hz will be

(a) 100:1

(b) 200:1

(c) 300:1
(d) 400:1

Correct: a

20. Work done in increasing the size of a soap bubble from a radius of 3 cm to 5 cm is nearly (surface tension of soap solution = $0.03 \mathrm{Nm}^{-1}$).
(a) $4\pi \mathrm{mJ}$
(b) $0.4\pi \mathrm{mJ}$
(c) $0.2\pi \mathrm{mJ}$
(d) $2\pi \mathrm{mJ}$

Correct: b

21. A gas under constant pressure of $4.5 \times 10^5 P_a$ when subjected to 800 kJ of heat, changes the volume from $0.5 \mathrm{m}^3$ to $2.0 \mathrm{m}^3$. The change in internal energy of the gas is
(a) $6.75 \times 10^5 \mathrm{J}$
(b) $5.25 \times 10^5 \mathrm{J}$
(c) $3.25 \times 10^5 \mathrm{J}$
(d) $1.25 \times 10^5 \mathrm{J}$

Correct: d

22. A gas at pressure p, is contained in a vessel. If the masses of all the molecules are halved and their speeds doubled, the resulting pressure would be
(a) $4p_0$
(b) $2p_0$
(c) p_0
(d) $\frac{p_o}{2}$

Correct: b

23. The red shift observed for stars due to the natural expanding of universe is given by the expression
(a) $(\lambda' - \lambda) = \left(\frac{c+v}{C}\right)\lambda$
(b) $(\lambda' - \lambda) = \left(\frac{c-v}{C}\right)\lambda$
(c) $(\lambda' - \lambda) = \left(\frac{v\lambda}{c}\right)$
(d) $(\lambda' - \lambda) = \left(\frac{c\lambda}{v}\right)$

Correct: c

24. An ideal gas at pressure p is adiabatically compressed so that its density becomes n times the initial value. If $\gamma = C_p/C_v$, the final pressure of the gas will be
(a) $n^{(1-\gamma)p}$
(b) $n^{(t-y)p}$
(c) $n^{(-\gamma)p}$
(d) $n^{(\gamma)p}$

Correct: d

25. A quantity of a substance in a closed system is made to undergo a reversible process from an initial volume of $3\mathrm{m}^3$ and initial pressure $10^3 \mathrm{N/m}^2$ to a final volume of $5m^3$. If the pressure is proportional to the square of the volume (i.e. $p = AV^2$), the work done by the substance will be
(a) $3.6 \times 10^2 \mathrm{J}$
(b) $7.4 \times 10^3 \mathrm{J}$
(c) $2.2 \times 10^4 \mathrm{J}$
(d) $3.6 \times 10^5 J$

Correct: d

26. A photographic flash unit consists of a xenon filled tube. It gives a flash of average power 2000 W for 0.04 s. The flash is due to discharge of a fully charged capacitor of $40\mu F$. The voltage to which it is charged before a flash is given by the unit is
(a) $1.5 \times 10^3 \mathrm{V}$
(b) $2 \times 10^3 \mathrm{V}$
(c) $2.5 \times 10^3 \mathrm{V}$
(d) $3 \times 10^3 \mathrm{V}$

Correct: b

27. Three plates A, B and C each of area 50 cm^2 have separation 3 mm between A and B and 6 mm between B and C. The energy stored when the plates are fully charged by a 12 v battery is
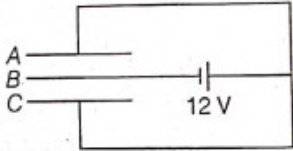
(a) 2μJ

(b) 1.6 nJ

(c) $5\mu J$

(d) 3.2 nJ

Correct: b

28. A point charge +q is placed at a distance d/2 directly above the centre of a square of side d. The magnitude of electric flux through the square is

(a) $\frac{Q}{6d}$

(b) $\frac{Q}{6\varepsilon_0}$

(c) $\frac{Qd}{6\varepsilon_0}$

(d) $\frac{Q\varepsilon_0}{6d}$

Correct: b

29. Three resistances P, Q and R, each of 2Ω an unknown resistance S form the four arms of a Wheatstone bridge circuit. When a resistance of 6Ω is connected in parallel to S, the bridge gets balanced. The value of S is

(a) 3Ω

(b) 6Ω

(c) 1Ω

(d) 2Ω

Correct: a

30. What is power dissipation in an a.c. circuit in which voltage and current are given by $V = 300\sin(\omega t + \pi/2), I = 5\sin\omega\theta$

(a) zero

(b) 300 units

(c) 150 units

(d) 75 units

Correct: a

31. Three batteries of emf 1 V and internal resistance 1ω each are connected as shown. Effective emf of the combination between the points P and Q is
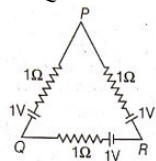
(a) zero

(b) 1 V

(c) 2 V

(d) $\frac{2}{3}V$

Correct: a

32. A wire is being drawn to make it thinner such that the length of the wire l increases and radius r decreases. Its resistance R will finally be proportional to

(a) $\frac{1}{r}$

(b) $\frac{1}{r^2}$

(c) $\frac{1}{r^3}$

(d) $\frac{1}{r^4}$

Correct: d

33. Two particles X and Y having equal charges, after being accelerated through the same potential difference enter a region of uniform

magnetic field and describe circular paths of radii R_1 and R_2 respectively. The ratio of masses of X and Y is

(a) $\left(\frac{R_1}{R_2}\right)^{1/2}$

(b) $\left(\frac{R_2}{R_1}\right)$

(c) $\left(\frac{R_1}{R_2}\right)^2$

(d) $\left(\frac{R_1}{R_2}\right)$

Correct: c

34. An ions with a charge of $+3.2 \times 10^{-19}$C is in a region where a uniform electric field of 5×10^4V/m is perpendicular to a uniform magnetic field of 0.8 T. If its acceleration is zero, then its speed must be

(a) 0

(b) 1.6×10^4m/s

(c) 4.0×10^4m/s

(d) 6.3×10^4m/s

Correct: d

35. A long straight wire of radius R carries a steady current I. The current is uniformly distributed across its cross-section. The ratio of magnetic field at R/2 and 2R is

(a) 1/2

(b) 2

(c) 1/4

(d) 1

Correct: d

36. Two circular coils 1 and 2 are made from the same wire but the radius of the first coil is twice that of the second coil. What potential difference ratio should be applied across them so that the magnetic field at their centres is the same?

(a) 2

(b) 3

(c) 4

(d) 6

Correct: c

37. A solenoid of inductance 50 mH and resistance 10 ω is connected to a battery of 6V. The time elapsed before the current acquires half of its steady state value is

(a) 2 ms

(b) 3.5 ms

(c) 5 ms

(d) 5.5 ms

Correct: b

38. A flat rectangular coil is placed in a uniform magnetic field and rotated about an axis passing through its centre, parallel to its shorter edges and perpendicular to the field. The maximum flux linked and maximum induced emf are ϕ and E, respectively. If the axis is shifted to coincide with one of the shorter edges, then

(a) Maximum flux and induced emf are $\phi/2$ and E/2

(b) Maximum flux and induced emf are $\phi/3$ and E/3

(c) Maximum flux and induced emf are $\phi/4$ and E/4

(d) Maximum flux and induced emf remain ϕ and E

Correct: d

39. In a series L-C-R circuit, the voltages across resistance, capacitance and inductance are 20 V each. If the capacitance is short-circuited, the voltage across the inductance will be

(a) $\frac{20}{\sqrt{2}}$v

(b) 20

(c) $20\sqrt{2}$v

(d) 40 V

Correct: a

40. Electromagnetic waves travel in a medium with a speed of 2×10^8m/s. If the relative permeability of the medium is 1, the relative permittivity will be

(a) 1.5
(b) 2.25
(c) 3.3
(d) 1.0

Correct: b

41. Two lenses have 10 D power each and they
are separated by a distance. Beyond which distance does the power of combination changes from positive to negative?
(a) 5 cm
(b) 10 cm
(c) 20 cm
(d) 50 cm

Correct: c

42. A vessel of depth d is half filled with a liquid of refractive index n, and the upper half is occupied by immiscible liquid of refractive index n. Viewing it from an eye in the upper liquid, the apparent depth of the lower liquid is
(a) $\frac{d}{2n_2}$
(b) $\frac{dn_1}{2n_2}$
(c) $\frac{d}{2}\left(\frac{n_2}{n_1}\right)$
(d) $\frac{d}{2}\left(\frac{n_1+n_2}{n_1 n_2}\right)$

Correct: c

43. Consider an optical system consisting of a concave mirror M_1, and convex mirror M_2, of radii of curvature 60 cm and 20 cm, respectively. Two mirrors are separated by a distance of 40 cm. An object O is placed at a distance 80 cm from P. The final image is formed at a distance
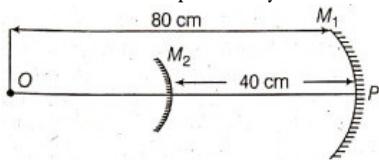
(a) 40 cm on the right of M_2
(b) 40 cm on the right of M_2
(c) 40 cm on the right of M_1
(d) 48 cm on the left of M_2

Correct: d

44. The spherical aberration is minimized in a reflecting telescope using
(a) a concave mirror as objective
(b) a convex mirror as objective
(c) a parabolic mirror as objective
(d) an elliptical mirror as objective

Correct: c

45. A radioisotope has a half-life of 5 yr. The fraction of atoms of this material, that would decay in 15 yr would be
(a) 1
(b) 3/4
(c) 7/8
(d) 5/8

Correct: c

46. Lines of Balmer series are emitted by the hydrogen atom when the electron jumps from the
(a) first (n = 1) orbit to any higher orbit
(b) second orbit (n = 2) to any higher orbit
(c) higher orbits to the first orbit
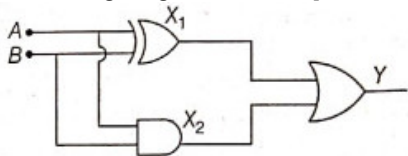(d) higher orbits to the second orbit

Correct: d

47. The half-life of radioactive nucleus is 100 years. The time interval between 20% and 80% decay of the parent nucleus is
(a) 100 years
(b) 200 years
(c) 300 years

(d) 400 years

Correct: b

48. The diagram given below is equivalent to a logic function of

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

Correct: a

49. In an n-p-n transistor circuit, the collector current is 10 mA. If 90% of the electrons emitted reach the collector, then
(a) the emitter current will be nearly 9 mA
(b) the emitter current will be nearly 11.1 mA
(c) the base current will be nearly 0.9 mA
(d) the base current will be nearly 0.3 mA

Correct: b

50. If the modulation index of an AM wave is changed from 0 to 1, the transmitted power is
(a) unchanged
(b) doubled
(c) increased by 50%
(d) zero

Correct: c

Chemistry

51. The antibiotic that contains arsenic is
(a) prontosil
(b) ofloxacin
(c) biothionol
(d) salvarsan

Correct: d

52. Pick out the electrophiles from the following BF_3, NH_3, $Me_3C^{\oplus}$, HCl
(a) BF_3, and NH_3
(b) $Me_3C^{\oplus}$ and HCl
(c) BF_3 and $Me_3C^{\oplus}$
(d) NH_3 and HCl

Correct: c
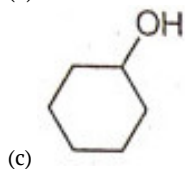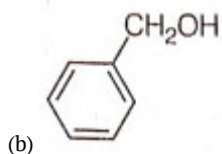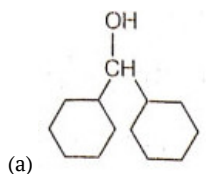
53. Classify the following reactions
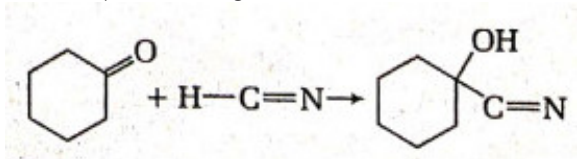
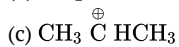(a) Substitution
(b) Addition
(c) Elimination
(d) Rearrangement

Correct: b

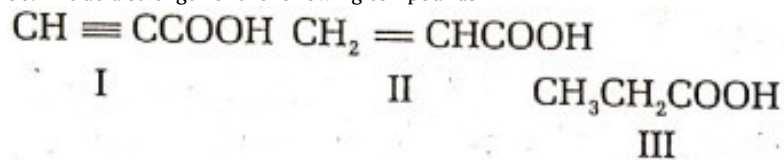54. Which of the following compounds has the most acidic nature?

(a)

(b)

(c)

(d)
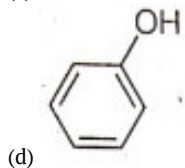
Correct: d

55. The most stable carbocation is

(a)

(b) $CH_2 = CH - \overset{\oplus}{C}H_2$

(c) $CH_3 \overset{\oplus}{C} HCH_3$

(d) $CH_3 \overset{\oplus}{C}H = CH_2$
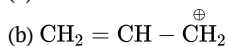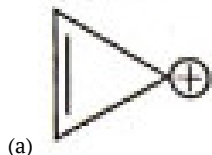
Correct: a

56. The acid strength of the following compounds

$$CH \equiv CCOOH \quad CH_2 = CHCOOH$$
$$\text{I} \qquad\qquad\qquad \text{II}$$
$$CH_3CH_2COOH$$
$$\text{III}$$

is in the order
(a) Il > I > III
(b) III > II > I
(c) I > III > II
(d) I > Il > III

Correct: d

57. Which of the following radioactive element is used in the treatment of cancer?
(a) Uranium
(b) Thorium
(c) Cerium
(d) Plutonium

Correct: b

58. p-hydroxyazobenzene is
(a) an orange dye
(b) a yellow dye
(c) a red dye
(d) an orange-red dye

Correct: a

59. Which one of the following compounds can exists in Zwitter ionic form?
(a) Amino acid
(b) Fat
(c) Carbohydrate
(d) Alcohol

Correct: a

60. The following reaction

$$R - Cl + NaI \xrightarrow{\text{Acetone}} R - I + NaC$$
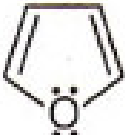
is known as
(a) Frankland reaction
(b) Swarts reaction
(c) Etard reaction
(d) Finkelstein reaction

Correct: d

61. Which of the following is aromatic compounds?

(a)

(b)

(c)

(d) All of these

Correct: d

62. Nylon 6 is obtained by the condensation of
(a) Terepthalic acid and ethylene glycol
(b) Adipic acid and styrene
(c) Caprolactum with water at high temperature
(d) Phenol and formaldehyde

Correct: c

63. Mention the catalyst and reaction condition in the given reaction

$$R—CH_2—COOH \xrightarrow{?} R—\underset{\underset{(where\ X = Cl,\ Br)}{X}}{CH}—COOH$$
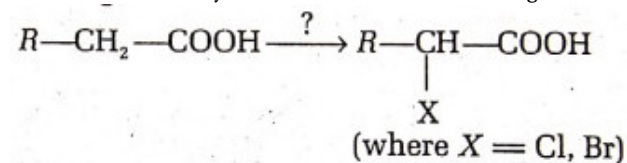
(a) $X_2/$ grey phosphorus, H_2O
(b) $X_2/$ red phosphorus, H_2O
(c) $X_2/$ white phosphorus, H_2O
(d) $X_2/$ blue phosphorus, H_2O

Correct: b

64. The intermediate product (X) formed in the following reaction is
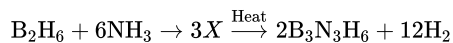
$$B_2H_6 + 6NH_3 \rightarrow 3X \xrightarrow{\text{Heat}} 2B_3N_3H_6 + 12H_2$$
(a) $\left[BH(NH_3)_3\right]^+ \left[BH_4\right]^-$
(b) $\left[BH_2OH_3)_4\right]^+ \left[BH_4\right]$
(c) $\left[BH(NH_3)_4\right]^+ \left[BH_4\right]$
(d) $\left[BH_2(NH_3)_2\right]^+ \cdot \left[BH_4\right]$

Correct: d

65. DDT is
(a) 2,2-di (p-chlorophenyl) - 1, 1, 1-trichloroethane
(b) 2,2-di (m-chlorophenyl) - 1, 1, 1-trichloroethane
(c) 2,2-di (o-chlorophenyl) - 1, 1, 1-trichloroethane
(d) 2,2-di (o-chlorophenyl) - 1, 1-dichloroethane

Correct: a

66. The carbocation formed in S_N1 reaction of alkyl halide in the slow step is:
(a) sp^3-hybridised
(b) sp^2-hybridised
(c) sp-hybridised
(d) sp^3d- hybridised

Correct: b

67. Which of the followings is invert sugar?
(a) Sucrose
(b) Cellulose
(c) Glucose
(d) Fructose

Correct: a

68. Select the correct ground state electronic configuration

Cr   Eu   Ti²⁺

(a)
[Ar] $3d^5\ 4s^1$ [Xe] $4f^7\ 5d^0\ 6s^2$ [Ar] $3d^2\ 4s^0$

(b)
[Ar] $3d^4\ 4s^2$ [Xe] $4f^7\ 5d^0\ 6s^2$ [Ar] $3d^2\ 4s^2$

(c)
[Ar] $3d^4\ 4s^2$ [Xe] $4f^6\ 5d^1\ 6s^2$ [Ar] $4s^2\ 4d^0$

(d)
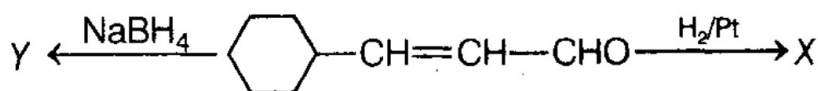[Ar] $3d^5\ 4s^1$ [Xe] $3f^6\ 5d^2\ 6s^1$ [Ar] $4s^1\ 3d^1$

Correct: a

69. Which of the following complexes can also represent facial (fac) and meridional (mer) isomers?
(a) $\left[Co(NH_3)_3NO_2Cl\right]$
(b) $\left[Co(NH_3)_2(NO_2)_2Cl_2\right]$
(c) $\left[Co(NH_3)_2(NO_2)_2C_2\right]$
(d) $\left[Co(NH_3)_3(NO_2)_3\right]$

Correct: d

70.

$$Y \xleftarrow{NaBH_4} \langle \rangle - CH = CH - CHO \xrightarrow{H_2/Pt} X$$

What are 'X' and 'Y ?
(a)

(b)

(c)

$CH=CH-CH_2OH$ in both cases

in both cases

(d)

$CH_2CH_2CH_2OH$ in both cases
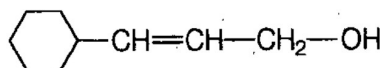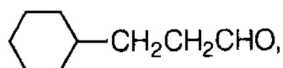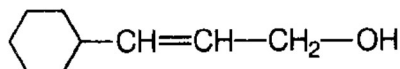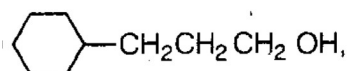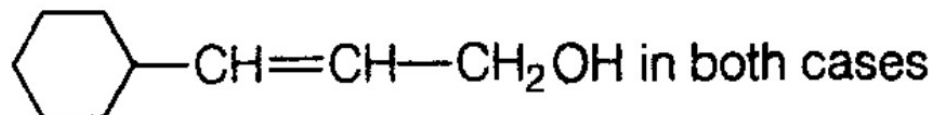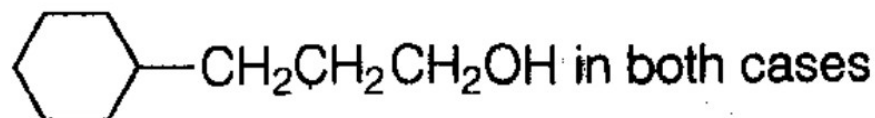
in both cases

Correct: b

71. The purple colour of $KMnO_4$ can be attributed to
(a) d-d transitions
(b) charge transfer transition
(c) n - π transitions
(d) None of these

Correct: b

72. The spin only magnetic moment (μ_s) of a complex $[Mn(Br_4)]^{4-}$ is 5.9 BM. The geometry of the complex will be
(a) tetrahedral
(b) square planar
(c) square pyramidal
(d) tetragonal

Correct: a

73. Which of the following complexes would give white precipitate with excess of $AgNO_3$ sol?
(a) $[CO(NH_3)_2C_2]NO_3$
(b) $[CO(NH_3)_5SO_4]Cl$
(c) $[CO(NH_3)_4Cl_2]$
(d) $[CO(NH_3)_5NO_3]NO_3$

Correct: b

74. Which of the following complexes does not show geometrical isomerism?
(a) $[Pt(NH_3)_2Cl_2]$
(b) $[CO(NH_3)_4Cl_2]$
(c) $[COCl_2(en)_2]$
(d) $[Ni(CO)_4]$

Correct: d

75. The molecule which is linear is
(a) N_2O
(b) NO_2
(c) SO_2
(d) H_2O

Correct: a

76.
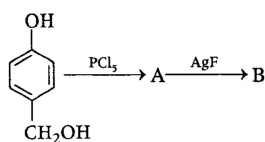
What is B in the above scheme?

(a)
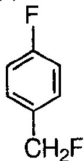
(b)
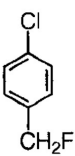
(c)
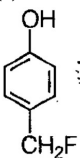
(d)
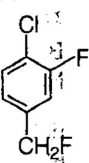
Correct: c

77. Chemical formula for 'inorganic benzene is
(a) $B_3N_3H_2Cl_3$
(b) $(BN)_x$
(c) $B_3N_3H_6$
(d) $B_3P_3H_6$

Correct: c

78. Among LiCI, RbCI, $BeCl_2$, $MgCl_2$ the compounds which greater and least ionic character respectively are
(a) LiCl and RbCI
(b) RbCl and $BeCl_2$
(c) RbCl and $MgCl_2$
(d) $MgCl_2$ and BeC_2

Correct: b

79. Which of the following statements is false for alkali metals?
(a) Lithium is the strongest reducing agent
(b) Na is amphoteric in nature
(c) Li^+ is exceptionally small
(d) All alkali metals give blue solution in liq. Ammonia

Correct: b

80. The correct order of bond angles (smallest first) in H_2S, NH_3, BF_3 and SiH_4 is
(a) $H_2S < SiH_4 < NH_3 < BF_3$
(b) $NH_3 < H_2S < SiH_4 < BF_3$
(c) $H_2S < NH_3 < SiH_4 < BF_3$
(d) $H_2S < NH_3 < BF_3 < SiH_4$

Correct: c

81. The number of P-O-P bonds in cyclic metaphosphoric acid is
(a) zero
(b) two
(c) three
(d) four

Correct: c

82. Among the trihalides of nitrogen which one is the least basic
(a) NF_3
(b) NCl_3
(c) NBr_3
(d) Nl_3

Correct: a

83. Among the following, the pair in which the two species are not isostructural is
(a) Sif, and SF.
(b) 10, and Xeo,
(c) BH and NH
(d) PF and SF :

Correct: a

84. The hybridisation and geometry of B and N in $[H_3B \leftarrow NH_3]$ are, respectively
(a) sp^3, tetrahedral and sp^3 pyramidal
(b) sp^3, pyramidal and sp^3 tetrahedral
(c) sp^3, pyramidal and sp^3 pyramidal
(d) sp^3, tetrahedral and sp^3 tetrahedral

Correct: c

85. Permanganate ions are
(a) tetrahedral and paramagnetic
(b) tetrahedral and diamagnetic
(c) octahedral and paramagnetic
(d) octahedral and diamagnetic

Correct: b

86. The half-life period of a radioactive element is 140 days. After 700 days, 1 g of the element will reduce to
(a) $\left(\frac{1}{2}\right) g$
(b) $\left(\frac{1}{4}\right) g$
(c) $\left(\frac{1}{8}\right) g$
(d) $\left(\frac{1}{32}\right) g$

Correct: d

87. There are certain properties related to adsorption:
I. reversible
II. formation of unimolecular layer
III. low heat of adsorption
IV. occurs at low temperature and decreases with increasing temperature.
Which of the above properties are for physical adsorption?
(a) I, II, III
(b) I, III, IV
(c) II, III, IV
(d) I, III

Correct: b

88. Which for the following FCC structures contains cations in the alternate tetrahedral voids
(a) Na_2O
(b) Zns
(c) CAF_2
(d) CaO

Correct: b

89. One litre of water (molecular weight 18.06) weighs 0.9970 kg. The degree of ionisation of water is ...., if $K_w = 1.10 \times 10^{-14}$ at 25°C
(a) 1.05×10^{-7}
(b) 1.9×10^{-9}
(c) 101×10^{-11}
(d) 452×10^{-7}

Correct: b

90. The specific conductance of 0.01 M solution of acetic acid was found to be $0.0163Sm^{-1}$ 25°C. Molar conductance of acetic acid at infinite dilution is $390.7 \times 10^{-4}Sm^2mol^{-1}$ at 25°C. What will be the degree of dissociation of CH_3COOH?
(a) 0.4072
(b) 0.7402
(c) 0.2720
(d) 0.0472

Correct: d

91. For the cell $Ag(s)\left|Ag^+(aq)\right|\left|Cu^{2+}(aq)\right|Cu(s)$, the reduction potentials of the left and right hand electrodes are 0.337 and 0.799 volts, the cell emf is
(a) - 1.136 volt
(b) 1.136 volt
(c) - 0.462 volt
(d) 0.462 volt

Correct: d

92. 50% of a first order reaction is complete in 23 minutes. Calculate the time required to complete 90% of the reaction
(a) 70.4 minutes
(b) 76.4 minutes
(c) 38.7 minutes
(d) 35.2 minutes

Correct: b

93. The emf of the cell, $|CdCl_2$ (solution) $(1 \text{ atm })|$ $AgCl$ $(s)|Ag$ is 0.675 at $25°C$ .The temperature coefficient of the cell is $-6.5 \times 10^{-4}V$ degree $^{-1}$.Find the change in the heat content $\left(kJmol^{-1}\right)$ and entropy $\left(V \deg^{-1}\right)$ for the electrochemical reaction that occurs when 1 F of electricity is drawn for it
(a) $78.34, 83.83$
(b) $+62.43, 83.83$
(c) $-62.73, -83.83$
(d) $-78.34, +83.83$

Correct: c

94. 30.4 kJ is required to melt one mole of NaCl. The entropy change during melting is $28.4Jmol^{-i}K^{-1}$. What is the melting point of sodium chloride?
(a) 1070.4 K
(b) 535.2 K
(c) 273.1 K
(d) 1007.4 K

Correct: a

95. What weight of HCl is present in 155 ml of a 0.54 M solution?
(a) 3.06 g
(b) 6.12 g
(c) 1.53 g
(d) 0.30 g

Correct: a

96. When PCl_5, is heated it gasifies and dissociates into PCl_3 and Cl_2. The density of the gas mixture at 200°C is 70.2. What is the degree of dissociation of PCl, at 200°C.
(a) 0.485
(b) 0.242

(c) 0.845

(d) 0.542

Correct: a

97. What is the value of K_{sp}, for bismuth sulphide (Bi_2S_3) which has a solubility of $1.0 \times 10^{-15} \text{mol/L}$ at $25^\circ C$?

(a) 1.08×10^{-73}

(b) 1.08×10^{-74}

(c) 1.08×10^{-72}

(d) 1.08×10^{-75}

Correct: a

98. At 20°C the solubility of N_2 gas in water is 0.015 g/L when the partial pressure of N_2, is 580 torr. What is the solubility of N_2 in H_2O at 20°C when its partial pressure is 800 torr?

(a) 0.207 g/L

(b) 0.0207 g/L

(c) 0.414 g/L

(d) 0.0414 g/L

Correct: b

99. Which of the following is incorrect?

(a) Chemisorption is caused by bond formation

(b) Chemisorption is reversible process

(c) Chemisorption is specific in nature

(d) Chemisorption increases with increase in temperature

Correct: b

100. When a mixture of 10 moles of SO_2 and

16 moles of O_2 were passed over a catalyst, 8 moles of SO_3 were formed at equilibrium. The number of moles of SO_2 and O_2 remaining unreacted were

(a) 2, 12

(b) 12, 2

(c) 3, 10

(d) 10, 3

Correct: a

Mathematics

101. The area bounded by the circle $x^2 + y^2 = 4$ and the line $x = y\sqrt{3}$ in the first quadrant (in sq units) is

(a) π

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

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

(d) None of these

Correct: c

102. The value of the integral $\int_0^1 \frac{e^{5\log_e x} - e^{4\log_e x}}{e^{\log_e x^3} - e^{\log_e x^2}} dx$ is

(a) $\frac{1}{3}$

(b) 1

(c) $-\frac{1}{3}$

(d) - 1

Correct: a

103. $\int \frac{x^3 dx}{1+x^4}$ equals

(a) $\log(x^4 + 1) + C$

(b) $\frac{1}{4}\log(x^4 + 1) + C$

(c) $\frac{1}{2}\log(x^4 + 1) + C$

(d) None of these

Correct: b

104. The shortest distance between the parabolas
$2y^2 = 2x - 1, 2x^2 = 2y - 1$
(a) $2\sqrt{2}$
(b) $\frac{1}{2\sqrt{2}}$
(c) 4
(d) $\sqrt{\frac{36}{5}}$

Correct: b

105. The integral $\int \sqrt{16 - 9x^2}$ dx equals
(a) $\frac{x}{2}\sqrt{16 - 9x^2} + \frac{8}{3}\sin^{-1}\left(\frac{3x}{4}\right) + c$
(b) $\frac{3x}{2}\sqrt{16 - 9x^2} + 16\sin^{-1}\left(\frac{3x}{4}\right) + c$
(c) $\frac{\pi}{2}\sin^{-1}\left(\frac{3x}{4}\right) + \frac{9x}{2} + C$
(d) None of the above

Correct: a

106. The sum of two numbers is 10. Their product will be maximum when they are
(a) 3,7
(b) 4,6
(c) 5,5
(d) 8,2

Correct: c

107. The maximum value of $\frac{\log x}{x}$ is
(a) 1
(b) 2/e
(c) e
(d) 1/e

Correct: d

108. The function $f(x) = \cos^2 x$ is strictly decreasing on
(a) $\left[0, \frac{\pi}{2}\right]$
(b) $\left[0, \frac{\pi}{2}\right)$
(c) $\left(0, \frac{\pi}{2}\right)$
(d) $\left(0, \frac{\pi}{2}\right]$

Correct: c

109. Consider the following propositions :
p: I take medicine
q: I can sleep
Then, the compound statement-p -9 means
(a) If I do not take medicine, then I cannot sleep
(b) I take medicine if I can sleep
(c) If I do not take medicine, then I can sleep
(d) I take medicine iff I can sleep.

Correct: a

110. If $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is to be square root of the two rowed unit matrix, then α, β and γ should satisfy the relation
(a) $1 + \alpha^2 + \beta\gamma = 0$
(b) $1 - \alpha^2 - \beta\gamma = 0$
(c) $1 - \alpha^2 + \beta y = 0$
(d) $1 + \alpha^2 - \beta\gamma = 0$

Correct: b

111. If A and B are two square matrices such that AB = A and BA = B, then
(a) A and B are idempotent
(b) only A is idempotent
(c) only B is idempotent
(d) None of the above

Correct: a

112. If $A_i (i = 1, 2, \ldots, n)$ are n independent events, with $P(A_i) = 1 - \frac{1}{2^i}$ then the probability that at least one of the n events occurs, is
(a) $\frac{1}{2^{n(n+1)/2}}$
(b) $\frac{1}{2^{(n+1)/2}}$
(c) $1 - \frac{1}{2^{n(n+1)/2}}$
(d) $1 - \frac{1}{2^{(n+1)/2}}$

Correct: c

113. The determinant
$$\begin{vmatrix} xp+y & x & y \\ yp+z & y & z \\ 0 & xp+y & yp+z \end{vmatrix} = 0 \text{ if}$$
(a) x, y, z are in AP
(b) x, y, z are in GP
(c) x, y, z are in HP
(d) xy, yz, zx are in AP

Correct: b

114. Out of (2n + 1) consecutively numbered tickets, three tickets are drawn at random. The probability that the numbers on them are in arithmetic progression is
(a) $\frac{n}{4n^2-1}$
(b) $\frac{n^2}{4n^2-1}$
(c) $\frac{3n}{4n^2-1}$
(d) $\frac{3n^2}{4n^2-1}$

Correct: c

115. A certain item is manufactured by machine M_1 and M_2. It is known that machine M_1 turns out twice as many items as machine M_2. It is also known that 4% of the items produced by machine M_1 and 3% of the items produced by machine M_2 are defective. All the items produced are put into one stock pile and then one item is selected at random. The probability that the selected item is defective is equal to
(a) 10/300
(b) 11/300
(c) 10/200
(d) 11/200

Correct: b

116. If A and B are independent events such that P(B) = P(AUB) = 0.8, then
$P(B) = \frac{2}{7}, P(A \cup \overline{B}) = 0.8, \text{ then } P(A) =$
(a) 0.4
(b) 0.3
(c) 0.2
(d) 0.1

Correct: b

117. If A and B are independent events associated to some experiments E such that $P(A^C \cap B) = \frac{2}{15}$ and $P(A \cap B^C) = \frac{1}{6}$, then P(B) is equal to
(a) $\frac{1}{6}, \frac{1}{5}$
(b) $\frac{1}{6}, \frac{4}{5}$
(c) $\frac{4}{5}, \frac{1}{5}$
(d) $\frac{4}{5}, \frac{5}{6}$

Correct: b

118. The value of λ so that the vectors $a = 2\hat{i} - \hat{j} + \hat{k}$, $b = \hat{i} + 2\hat{j} - 3\hat{k}$ and $c = 3\hat{i} + \lambda\hat{j} + 5\hat{k}$ are coplanar is
(a) - 1
(b) -2
(c) - 3
(d) - 4

Correct: d

119. The differential equation of all parabolas whose axis of symmetry is parallel to X-axis is of order
(a) 2
(b) 3
(c) 1
(d) 4

Correct: b

120. If A is an orthogonal matrix, then
(a) $|A| = 0$
(b) $|A| = \pm 1$
(c) $|A| = \pm 2$
(d) $|A| = \pm\frac{1}{2}$

Correct: b

121. The equation $x^2 + y^2 + 4x + 6y + 13 = 0$ represents
(a) a pair of coincident lines
(b) a pair of concurrent straight lines
(c) a parabola
(d) a point circle

Correct: d

122. The two lines $ty = x + t^2$ and $y + tx = 2t + t^3$ intersect at the point lies on the curve whose equation is
(a) $y^2 = 4x$
(b) $y^2 = -4x$
(c) $x^2 = 4x$
(d) $x^2 = -4x$

Correct: a

123. The directrix of the parabola $4y^2 + 12x - 12y + 39 = 0$ is
(a) $x = \frac{3}{4}$
(b) $x = \frac{-7}{4}$
(c) $x = \frac{-5}{2}$
(d) $x = \frac{3}{2}$

Correct: b

124. A line perpendicular to the line segment joining the points (1,0) and (2,3) divides it in the ratio 1:n. The equation of the line is
(a) $3y + x = \frac{n+11}{n+1}$
(b) $3y - x = \frac{n+11}{n+1}$
(c) $3y + x = \frac{n-11}{n+1}$
(d) $3y - x = \frac{n+11}{n-1}$

Correct: a

125. If origin is the centroid of a ΔPQR with vertices P(2a, 2, 6), Q(-4, 3b, -10) and R(8, 14, 2c), then the value of a, b and c are respectively
(a) -2, 2, 2
(b) -2, 2, -16/3
(c) -2, -16/3, 2
(d) -16/3, -2, 2

Correct: c

126. The angle between the lines with direction ratios 4, -3, 5 and 3, 4, 5 is
(a) $\frac{\pi}{3}$

(b) $\frac{\pi}{4}$

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

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

Correct: a

127. Given that the points P(3,2,-4), Q(5, 4, -6) and R(9,8,- 10) are collinear, the ratio in which Q divides PR externally is

(a) 1:2

(b) 2:1

(c) 1:1

(d) 2:2

Correct: a

128. Let A and B be two points with position vectors $\vec{a}$ and $\vec{b}$ respectively and let C be a point dividing AB internally and the position vector of C on AB is $\vec{c} = \lambda\vec{a} + \mu\vec{b}$ then

(a) $\lambda + \mu = 0$

(b) $\lambda + \mu = 1$

(c) $\lambda + \mu < 1$

(d) $\lambda + \mu > 1$

Correct: b

129. The sum of n terms of the series

$1^2 + \left(1^2 + 2^2\right) + \left(1^2 + 2^1 + 3^2\right) + \ldots \ldots ....$ is

(a) $\frac{n(n+1)(n+2)}{12}$

(b) $\frac{n(n+1)(n+2)^2}{12}$

(c) $\frac{n^2(n+1)(n+2)}{12}$

(d) $\frac{m(n+1)^2(n+2)}{12}$

Correct: d

130. If $x^y = e^{x-y}$, then $\frac{dy}{dx}$ is equal to

(a) $\frac{1}{1+\log x}$

(b) $\frac{1}{(1+\log x)^2}$

(c) $\frac{\log x}{1+\log x}$

(d) $\frac{\log x}{(1+\log x)^2}$

Correct: d

131. If $x^2 + y^2 = t - \frac{1}{t}$ and $x^4 + y^4 = t^2 + \frac{1}{t^2}$, then $x^3 y \frac{dy}{dx}$ equals

(a) 0

(b) 1

(c) -1

(d) None of these

Correct: b

132. If $\lim_{x \to 0} \frac{\log(3+x) - \log(3-x)}{x} = K$, then K is equal to

(a) 2/5

(b) 2/3

(c) 1/2

(d) 5/2

Correct: b

133. If f(x) = $\frac{x}{2} - 1$, then on the interval $[0, \pi]$

(a) tan [f(x)] and 1/f(x) are both continuous

(b) tan [f(x)] and 1/f(x) are both discontinuous

(c) tan [f(x)] is continuous but 1/f(x) is not continuous

(d) tan [f(x)] is not continuous but 1/f(x) is continuous

Correct: c

134. If $y = \tan^{-1}\left(\sqrt{1+x^2} - x\right)$, then $\frac{dy}{dx}$ equals

(a) $\frac{1}{2(1+x^2)}$

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

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

(d) $\frac{2}{(1+x^2)}$

Correct: c

135. If $y = \sec\left(\tan^{-1}x\right)$, then $\frac{dy}{dx}$ at x = 1 is

(a) 1/2

(b) $\frac{1}{\sqrt{2}}$

(c) $\sqrt{2}$

(d) 1

Correct: b

136. If $f(x) = x^n \log x$ and f(0) = 0, then the value of α for which Rolle's theorem can be applied in [0, 1] is

(a) -1

(b) 1/2

(c) -1/2

(d) 0

Correct: b

137. An n-tuple (x₁, x₂, x₃,........... xₙ) which satisfies all the constraints of a linear programming problem and for which the objective function is maximum (compared to all n-tuples which satisfy all the constraints) is called

(a) a solution

(b) a feasible solution

(c) an optimal solution

(d) an actual solution

Correct: c

138. Given the LPP :
Minimize f = $2x_1 - x_2$

$$x_1 \geq 0, \; x_2 \geq 0$$
$$x_1 + x_2 \geq 5$$
$$-x_1 + x_2 \leq 1$$
$$5x_1 + 4x_2 \leq 40$$

The solution is

(a) 1

(b) -1

(c) 2

(d) -2

Correct: a

139. If 49^n + 16n + λ is divisible by 64 for all n $\in$ N, then the least negative integral value of λ is

(a) -1

(b) -2

(c) -3

(d) -4

Correct: a

140. If $y = \sqrt{\frac{1-x}{1+x}}$, then $\left(1 - x^2\right)\frac{dy}{dx} + y$ is

(a) 1

(b) 0

(c) -1

(d) 2

Correct: b

141. The greatest value of the term independent of x, as α varies over R, in the expansion of $\left(x \cos \alpha + \frac{\sin \alpha}{x} \right)^{10}$

(a) $^{10}C_5$

(b) $\left(\frac{1}{2} \right)^5 \cdot ^{10}C_5$

(c) $\left(\frac{1}{2} \right)^4 (^{10}C_5)$

(d) $\left(\frac{1}{2} \right)^3 (^{10}C_5)$

Correct: b

142. The value of $\left(\frac{1+i}{1-i} \right)^{100}$ is equal to

(a) 1

(b) -1

(c) i

(d) -i

Correct: a

143. The value of $\sum_{n=1}^{13} \left(i^n + i^{n+1} \right)$, where i = $\sqrt{-1}$ equals

(a) 0

(b) i

(c) -i

(d) i-1

Correct: d

144. An electrician can be paid under two schemes as follows:
I. ₽ 600 and ₽ 50 per hour
II. ₽ 170 per hour
If the job take n hours, for which values of n does the scheme I given the electrician better wages

(a) n > 5

(b) n > 4

(c) n < 5

(d) n < 4

Correct: c

145. If $X = \{4^n - 3n - 1 | n \in N\}$ and
$Y = \{9(n-1) | n \in N\}$, then

(a) $X \subset Y$

(b) $Y \subset X$

(c) X = Y

(d) None of these

Correct: a

146. The value of $\frac{\sin^3 3\theta}{\sin^2 \theta} - \frac{\cos^2 3\theta}{\cos^2 \theta}$

(a) $8 \cos 2\theta$

(b) $3 \sin 2\theta$

(c) $\frac{1}{8} \cos 2\theta$

(d) None of these

Correct: a

147. The value of the expression
$1 - \frac{\sin^2 y}{1+\cos y} + \frac{1+\cos y}{\sin y} - \frac{\sin y}{1-\cos y}$ to

(a) sin y

(b) cos y

(c) 0

(d) 1

Correct: b

148. The solution set of the equation
$\sin^{-1} x = 2 \tan^{-1} x$

(a) {1, 2}

(b) {-1, 2)
(c) {-1, 1, 0)
(d) {1, 1/2, 0}

Correct: c

149. A roots of the equation
$17x^2 + 17x \tan\left(2\tan^{-1}\frac{1}{5} - \frac{\pi}{4}\right) - 10 = 0$ is
(a) 10/17
(b) -1
(c) -7/17
(d) 1

Correct: d

150. If $A = \begin{bmatrix} k & 1 \\ m & n \end{bmatrix}$ and k.n lm, then the value of $A^2 - (k+n)A + (kn - lm)I$ equals
(a) The zero matrix of order 2 x 2
(b) A
(c) -A
(d) 2A
where / is the identity matrix of order 2 x 25

Correct: a