AMU ENGINEERING
Mock Test Paper

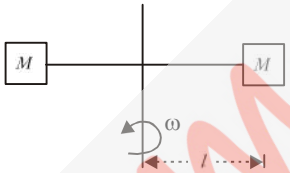
Exam Date 28th May

PHYSICS

1. The dimension of $\frac{1}{2}\varepsilon_0 E^2$ (ε_0 = permittivity of free space ; E = electric field) is
(a) MLT^{-1} (b) ML^2T^{-2}
(c) $ML^{-1}T^{-2}$ (d) ML^2T^{-1}.

2. A ball of mass 150 g starts moving at 20 m s^{-1} and hit by a force which acts on it for 0.1 seconds. Then, the impulsive force is
(a) 75 N (b) 300 N
(c) 3 N (d) 30 N

3. Two blocks each of mass M are connected to the ends of a light frame as shown in figure. The frame is rotated about the vertical line of symmetry. The rod breaks if the tension in it exceeds T_0. The maximum frequency with which the frame may be rotated without breaking the rod will be



(a) $\frac{1}{2\pi}\left[\frac{T_0}{Ml}\right]^{1/2}$ (b) $\frac{1}{2\pi}\left[\frac{Ml}{T_0}\right]^{1/2}$
(c) $\frac{1}{2\pi}\left[\frac{MT_0}{l}\right]^{1/2}$ (d) $\frac{1}{2\pi}\left[\frac{l}{MT_0}\right]^{1/2}$

4. H^+, He^+ and O^{++} all having the same kinetic energy pass through a region in which there is a uniform magnetic field perpendicular to their velocity. The masses of H^+, He^+ and O^{++} are 1 a.m.u., 4 a.m.u. and 16 a.m.u. respectively. Then
(a) H^+ will be deflected most
(b) O^{++} will be deflected most
(c) He^+ and O^{++} will be deflected equally
(d) all will be deflected equally.

5. Imagine a light planet around a very massive star in a circular orbit of radius R with a period of revolution T. If the gravitational force of attraction between the planet and the star is proportional to $R^{-5/2}$, then T^2 is proportional to
(a) R^3 (b) $R^{7/2}$
(c) $R^{3/2}$ (d) $R^{3.75}$.

6. A long horizontal rod has a bead which can slide along its length and initially placed at a distance L from one end A of the rod. The rod is set in angular motion about A with constant angular acceleration α. If the coefficient of friction between the rod and the bead is μ and gravity is neglected, then the time after which the bead start slipping is

(a) $\sqrt{(\mu/\alpha)}$ (b) $\mu/\sqrt{\alpha}$
(c) $1/\sqrt{\mu\alpha}$ (d) infinitesimal.

7. A large open tank has two holes in the wall. One is square hole of side L at a depth y from the top and the other is a circular hole of radius R at a depth $4y$ from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then, R is equal to
(a) $L/\sqrt{2\pi}$ (b) $2\pi L$
(c) L (d) $L/2\pi$.

8. The Young's modulus of a wire of length L and radius r is Y newton per square metre. If the length is reduced to $L/2$ and radius $r/2$, its Young's modulus will be
(a) $Y/2$ (b) Y
(c) $2Y$ (d) $4Y$.

9. A transverse wave is described by the equation $y = y_0 \sin 2\pi(ft - x/\lambda)$. The maximum particle velocity is equal to four times the wave velocity if
(a) $\lambda = \pi y_0/4$ (b) $\lambda = \pi y_0/2$
(c) $\lambda = \pi y_0$ (d) $\lambda = 2\pi y_0$.

10. A number of tuning forks are arranged in the order

of increasing frequency and any two successive tuning forks produce 4 beats per second, when sounded together. If the last tuning fork has a frequency octave higher than that of the first tuning fork and the frequency of the first tuning fork is 256 Hz, then the number of tuning forks is

(a) 63 (b) 64
(c) 65 (d) 66.

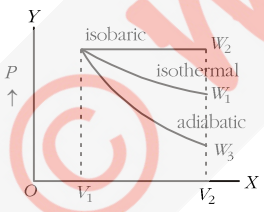
11. Two vibrating strings of same material but lengths l and $2l$ have radii $2r$ and r respectively. They are stretched under the same tension. Both the strings vibrate in their fundamental modes, the one of length l with frequency n_1 and the other with frequency n_2. The ratio of n_1/n_2 is given by

(a) 2 (b) 4
(c) 8 (d) 1.

12. A metal ball immersed in alcohol weights W_1 at 0°C and W_2 at 59°C. The coefficient of cubical expansion of the metal is less than that of alcohol. Assuming that the density of the metal is large compared to that of alcohol, it can be shown that

(a) $W_1 > W_2$ (b) $W_1 = W_2$
(c) $W_1 < W_2$ (d) $W_2 = (W_1/2)$.

13. Starting from the same initial conditions, an ideal gas expands from volume V_1 to V_2 in three different ways. The work done by the gas is W_1, if the process is purely isothermal, W_2 if purely isobaric and W_3 if purely adiabatic. Then

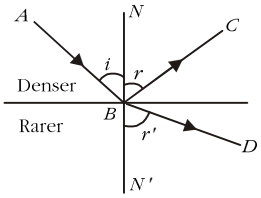


(a) $W_2 > W_1 > W_3$ (b) $W_2 > W_3 > W_1$
(c) $W_1 > W_2 > W_3$ (d) $W_1 > W_3 > W_2$.

14. A point source of heat of power P is placed at the centre of a spherical shell of mean radius R. The material of the shell has thermal conductivity K. If the temperature difference between the outer and inner surfaces of the shell is not to exceed T, then the thickness of the shell should not be less than

(a) $4\pi KTR^2/P$ (b) $4\pi PK/TR^2$
(c) $P/4\pi KTR^2$ (d) $4\pi TR^2/KP$.

15. A ray of light from a denser medium strikes a rarer medium at angle of incidence i. The reflected and refracted rays make an angle of 90° with each other. The angles of reflection and refractions are r and r'. The critical angle is



(a) $\sin^{-1}(\tan r)$ (b) $\sin^{-1}(\cot i)$
(c) $\tan^{-1}(\sin r)$ (d) $\tan^{-1}(\sin i)$.

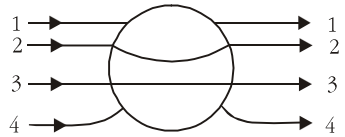
16. An astronomical telescope has an angular magnification of magnitude 5 for distant objects. The separation between the objective and the eyepiece is 36 cm and the final image is formed at infinity. The focal length f_o of the objective and the length f_e of the eyepiece are

(a) f_o = 45 cm and f_e = –9 cm
(b) f_o = 50 cm and f_e = 10 cm
(c) f_o = 7.2 cm and f_e = 5 cm
(d) f_o = 30 cm and f_e = 6 cm.

17. A non-conducting ring of radius 0.5 m carries a total charge of 1.11×10^{-10} C distributed non-uniformly on its circumference producing an electric field $\vec{E}$ everywhere in space. The value of the line integral $\int_{l=\infty}^{l=0} -\vec{E}\cdot d\vec{l}$ (l = 0 being centre of the ring) in volt is

(a) +2 (b) –1
(c) –2 (d) zero.

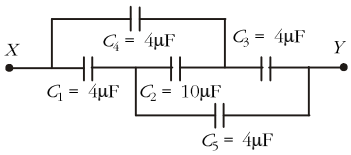
18. A metallic solid sphere is placed in a uniform electric field.



The lines of force follow the path(s) shown in figure as

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

19. The effective capacitance between points X and Y shown in the figure, is



(a) 8 μF (b) 6 μF
(c) 2.5 μF (d) 4 μF.

20. The electron of hydrogen atom is considered to be revolving round a proton in circular orbit of radius $\hbar^2/me^2$ with velocity $e^2/\hbar$ where $\hbar = h/2\pi$. The current i is

(a) $\frac{4\pi^2 me^5}{h^3}$ (b) $\frac{4\pi^2 me^2}{h^3}$
(c) $\frac{4\pi^2 m^2 e^2}{h^3}$ (d) $\frac{4\pi^2 me^5}{h^2}$.

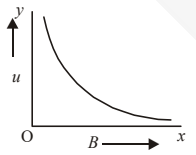
21. A constant voltage is applied between the two ends of a uniform metallic wire. Some heat is developed in it. The heat developed is doubled if

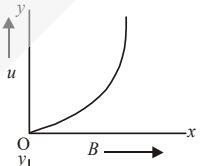
(a) both the length and radius of the wire are halved
(b) both the length and radius of the wire are doubled
(c) the radius of the wire is doubled
(d) the length of the wire is doubled.

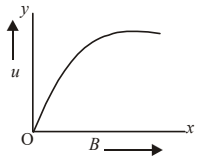
22. A planet of mass m moves around the sun of mass M in an elliptical orbit. The maxinum distance and minimum distance from the sun are r_1 and r_2 respectively. The time period of the planet is proportional to

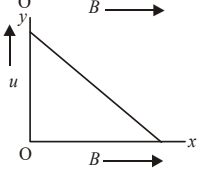
(a) $r_1^{3/2}$ (b) $r_2^{3/2}$
(c) $(r_1 + r_2)^{3/2}$ (d) $(r_1 - r_2)^{3/2}$.

23. Let B and u denote induction to magnetic field and energy density at midpoint of a long solenoid carrying a current i. The graph between u and B will be

(a) 

(b) 

(c) 

(d) 

24. Two thin long parallel wires separated by a distance b are carrying a current i ampere each. The magnitude of the force per unit length exerted by one wire on the other is

(a) $\mu_0 i^2/b^2$ (b) $\mu_0 i^2/2\pi b$
(c) $\mu_0 i/2\pi b$ (d) $\mu_0 i/2\pi b^2$.

25. The maximum kinetic energy of photoelectrons emitted from a surface when photons of energy 6 eV fall on it is 4 eV. The stopping potential in volts is

(a) 2 (b) 4
(c) 6 (d) 10.

26. _____ $3E$
_____ $5E/3$
_____ E
The figure shows the energy levels of certain atom. When the electron de-excites from $3E$ to E, an electromagnetic wave of wavelength λ is emitted. What is the wavelength of the electromagnetic wave emitted, when the electron de-excites from $\frac{5E}{3}$ to E?

(a) 3λ (b) 2λ
(c) 5λ (d) $\frac{3\lambda}{5}$

27. In Bohr model of hydrogen atom

(a) the radius of n^{th} orbit is proportional to n
(b) the total energy of electron in n^{th} orbit is proportional to n
(c) the angular momentum of the electron in an orbit is an integral multiple of $h/2\pi$
(d) the magnitude of the potential energy of an electron in any orbit is lower than its kinetic energy.

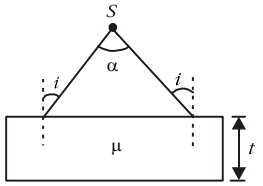
28. Two radioactive materials X_1 and X_2 have decay constants 10λ and λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be $1/e$ after a time

(a) $1/(10\lambda)$ (b) $1/(11\lambda)$
(c) $11/(10\lambda)$ (d) $1/(9\lambda)$.

29. A particle of mass M at rest decays into two particles of masses m_1 and m_2, having non-zero velocities. The ratio of the de Broglie wavelengths of the particles, λ_1, λ_2 is

(a) m_1/m_2 (b) m_2/m_1
(c) 1.0 (d) $\sqrt{m_2}/\sqrt{m_1}$.

30. A diverging beam of light from a point source S having divergence angle α, falls symmetrically on a glass slab as shown. The angles of incidence of the two extreme rays are equal. If the thickness of the glass slab is t and the refractive index is μ, then the divergence angle of emergent beam is



(a) zero (b) α
(c) $\sin^{-1}(1/\mu)$ (d) $2\sin^{-1}(1/\mu)$.

31. The period of oscillation of a simple pendulum is T in a stationary lift. If the lift moves upwards with an acceleration $5g$, the period will
(a) remain the same (b) increases by 3/5
(c) decrease by $T/2$ (d) none of these.

32. A stationary body of mass m explodes into three parts having masses in the ratio 1 : 3 : 3; its two fractions have equal mass moving at right angles to each other with a velocity of 15 ms^{-1}. What is the velocity of the third body?
(a) $\sqrt{2}$ ms^{-1} (b) 5 ms^{-1}
(c) $5\sqrt{32}$ ms^{-1} (d) none of these.

33. A sphere collides with another sphere of identical mass. After collision the two spheres move. The collision is inelastic. Then the angle between the directions of the two spheres is
(a) 90° (b) 0°
(c) 45° (d) none of these.

34. At what height over the earth's pole, the free fall acceleration decreases by 1%?
(a) 32 km (b) 320 km
(c) 3.2 km (d) 6.4 km.

35. The resistance to the motion of a body through a fluid depends on the
(a) shape of the body (b) speed of the body
(c) density of the fluid (d) all of these.

36. A Carnot engine takes heat from a reservoir at 627°C and rejectes heat to a sink at 27°C. Calculate its efficiency.
(a) 200/209 (b) 3/5
(c) 1/3 (d) 2/3.

37. A square wire of side 3.0 cm is placed 25 cm away from a concave mirror of focal length 10 cm. What is the area enclosed by the image of the wire? (The centre of the wire on the axis of the mirror with its two sides normal to the axis)
(a) 4.0 cm^2 (b) 9.0 cm^2
(c) 4.5 cm^2 (d) 20.25 cm^2.

38. The critical angle of a medium is 45°. Its refractive index is
(a) $1/\sqrt{2}$ (b) $\sqrt{2}$
(c) $\sqrt{3}/2$ (d) $2/\sqrt{3}$.

39. Stationary waves are formed by the superposition of two waves having the same frequency, amplitude and
(a) different wavelengths travelling in opposite direction
(b) the same wavelength travelling in the same direction
(c) the same wavelength travelling in opposite direction
(d) none of these.

40. Fringe width observed in Young's double slit experiment is β. If the frequency of the source is doubled, the fringe width will
(a) become 2β (b) become $3\beta/2$
(c) remain as β (d) become $\beta/2$.

41. Point charges +50 μC, +100 μC and –75 μC are placed on the circumference of a circle of radius 0.5 m to form an equilateral triangle ABC. The potential at the centre of the circle is
(a) 150 μC/m (b) 450 μC/m
(c) –150 μC/m (d) none of these.

42. A condenser having a capacity 2 μF is charged to 200 V and then the plates of the capacitor are connected to a resistance wire. The heat produced in joules will be
(a) 4×10^4 (b) 4×10^{10}
(c) 4×10^{-2} (d) 2×10^{-2}.

43. The e.m.f of a cell is 1.5 V. When it is connected to an external resistance of 2 ohm, the current in the circuit is 0.6 A. The internal resistance of the cell is
(a) 0.25 ohm (b) 0.5 ohm
(c) 1 ohm (d) 2 ohm.

44. You are sitting in a room in which a uniform magnetic field is present in the vertically downward direction. When the electron is projected in horizontal direction, it will be moving in a circular path with constant speed
(a) clockwise in vertical plane
(b) clockwise in horizontal plane
(c) anticlockwise in horizontal plane
(d) anticlockwise in vertical plane.

45. Positively charged particles are passed through a magnetic field. The direction of the magnetic field is along the direction of motion. The particles will
(a) not be deflected
(b) be deflected but their speed will not change
(c) be deflected and their speed will change
(d) none of these.

46. Metallic solids are always opaque because
(a) solids reflects the incident light
(b) incident light is readily absorbed by free electrons
(c) incident light is scattered by solid molecules
(d) energy band traps the incident light.

47. Consider light of given intensity and frequency falling on a substance that emits photoelectrons. The intensity is decreased to one-third of its value and the frequency increased by three times. Consequently the velocity of the photoelectrons will
(a) remain the same
(b) increase or decrease depending on the exact values of the new intensity and frequency
(c) decrease
(d) increase.

48. When a point source of light is 1 m away from a photoelectric cell, the photoelectric current is found to be I mA. If the same source is placed at 3 m from the same photoelectric cell, the photoelectric current will be
(a) $I/9$ mA (b) $I/3$ mA
(c) $3I$ mA (d) $9I$ mA.

49. Hydrogen atom emits light when it changes from $n = 5$ energy level to $n = 2$ energy level. Which colour of light would the atom emit?
(a) red (b) yellow
(c) green (d) violet.

50. The half-life of a radioactive element is 10 minutes. If 100 g of the radioactive substance is taken, how much of it will remain radioactive at the end of 1 hour?
(a) 100 g (b) 16.7 g
(c) zero (d) 1.56 g

CHEMISTRY

51. In a reaction, 4 mol of electrons are transferred to one mol of HNO_3. The possible product obtained due to reduction is
(a) 0.5 mol N_2 (b) 0.5 mol N_2O
(c) 1 mol NO_2 (d) 1 mol of NH_3.

52. Oxidation number of P in $Ba(H_2PO_2)_2$ is
(a) +3 (b) +2
(c) +1 (d) –1

53. Atomic weight of barium is 137.34. The equivalent weight of barium in $BaCrO_4$ used as
(a) 137.34 (b) 45.78
(c) 114.45 (d) 68.67

54. A gaseous mixture contains oxygen and nitrogen in the ratio 1 : 4 by weight therefore, the ratio of the number of molecules is
(a) 1 : 4 (b) 1 : 8
(c) 7 : 32 (d) 3 : 16

55. (Cl – C) bond in $CH_2 = CH - Cl$ (vinyl chloride) is stabilized in the same way as in
(a) benzyl chloride (b) benzoyl chloride
(c) chlorobenzene (d) allyl chloride.

56. Arrange the following compounds in increasing dipole moment.
I. Toluene II. *m*-Dichlorobenzene
III. *o*-Dichlorobenzene IV. *p*-Dichlorobenzene.
(a) I < IV < II < III (b) IV < I < II < III
(c) IV < I < III < II (d) IV < II < I < III.

57. Which one of the following species is paramagnetic ?
(a) NO (b) O_2^{2-}
(c) CN^- (d) CO.

58. $MgSO_4$ is soluble in water while $BaSO_4$ is not. This is because
(a) lattice energy of $BaSO_4$ is greater than $MgSO_4$
(b) $BaSO_4$ is more covalent than $MgSO_4$
(c) hydration energy of Mg^{2+} is more than $BaSO_4$
(d) lattice energy of $MgSO_4$ is more than $BaSO_4$.

59. The hybridisation and geometry of BrF_3 molecules are
(a) sp^3d and trigonal bipyramidal
(b) sp^3d^2 and tetragonal
(c) sp^3d and bent (d) none of these.

60. Complete hydrolysis of one mole of peroxo-disulphuric acid produces
(a) two mole of sulphuric acid and one mol hydrogen peroxide
(b) two mole of peroxo monosulphuric acid
(c) one mole each of sulphuric acid and hydrogen peroxide
(d) one mole each of sulphuric acid, peroxomonosulphuric acid and hydrogen peroxide.

61. The bond angles in the following compounds are such that
(a) $TeH_2 > SeH_2 > SH_2 > OH_2$
(b) $TeH_2 > SH_2 > SeH_2 > OH_2$
(c) $OH_2 > SH_2 > SeH_2 > TeH_2$
(d) $SH_2 > SeH_2 > TeH_2 > OH_2$.

62. Zeise's salt is
(a) $[Pt(NH_3)_2Cl_2]$ (b) $K[PtCl_3(C_2H_4)]$
(c) $Fe(C_5H_5)_2$ (d) none of these.

63. The number of α and β particles lost when $^{238}_{92}U$ changes to $^{206}_{82}Pb$
(a) 8α, 6β (b) 6α, 6β
(c) 6α, 8β (d) 4α, 4β

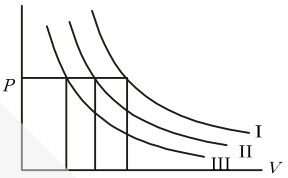
64. For an α-emitting isotope, the value of disintegration constant is 0.49×10^{-10} per year. The amount of the isotope of a given sample will reduce to half its value after a period (in years) of nearly
(a) 0.45×10^{10} (b) 0.9×10^{10}
(c) 1.41×10^{10} (d) 2.82×10^{10}

65. The ratio of the energy of the electron in ground state of hydrogen to that of the electron in first excited state of Be^{3+} is
(a) 1 : 4 (b) 1 : 8
(c) 1 : 16 (d) 16 : 1

66. If the shortest wavelength of H atom in Lyman series is x, then longest wavelength in Balmer series of He^+ is
(a) $9x/5$ (b) $36x/5$
(c) $x/4$ (d) $5x/9$

67. A gas at a pressure of 5.0 atm is heated from 0° to 546°C and simultaneously compressed to one-third of its original volume. Hence final pressure is
(a) 10.0 atm (b) 30.0 atm
(c) 45.0 atm (d) 5.0 atm.

68. I, II, III are three isotherms respectively at T_1, T_2 and T_3. Temperature will be in order
(a) $T_1 = T_2 = T_3$
(b) $T_1 < T_2 < T_3$
(c) $T_1 > T_2 > T_3$
(d) $T_1 > T_2 = T_3$



69. Spark plugs are not necessary in a diesel engine because
(a) compression of the gases heats them above the ignition temperature of the fuel
(b) diesel is more volatile than petrol
(c) there is deposition of carbon in the spark plug which is difficult to remove
(d) diesel is easily ignited.

70. The temperature to which a gas must be cooled before it can be liquefied by compression is called
(a) Boyle's temperature
(b) critical temperature
(c) liquefecation temperature
(d) inversion temperature.

71. Osmotic pressure of blood is 7.40 atm at 27°C. Number of mole of glucose to be used per L for an intravenous injection that is to have the same osmotic pressure as blood, is
(a) 0.3 (b) 0.2
(c) 0.1 (d) 0.4

72. A relative decrease in vapour pressure is 0.4 for a solution containing 1 mol of NaCl in 3 mol of H_2O. NaCl is ..... ionised.
(a) 60% (b) 50%
(c) 100% (d) 40%

73. $aA + bB \rightarrow$ Product, $\left(\frac{dx}{dt}\right) = k[A]^a[B]^b$.
If concentration of A is doubled, rate is four times. If concentration of B is made four times, rate is doubled. What is relation between rate of

disappearance of A and that of B?

(a) $-\frac{d[A]}{dt} = -\frac{d[B]}{dt}$ (b) $-\frac{d[A]}{dt} = -4\frac{d[B]}{dt}$

(c) $-4\frac{d[A]}{dt} = \frac{d[B]}{dt}$ (d) none of these.

74. $A \rightarrow$ product, $[A]_0 = 2$ M. After 10 minutes reaction is 10% completed. If $\frac{d[A]}{dt} = k[A]$, then T_{50} is approximately

(a) 0.693 min (b) 69.3 min

(c) 66.0 min (d) 0.0693 min.

75. Carnot's cycle is said to have 25% efficiency when it operates between T (source) and 300 K (sink). Temperature T is

(a) 300 K (b) 350 K

(c) 375 K (d) 400 K.

76. C (diamond) $\rightarrow$ C (graphite),

$\Delta S_{300\,K} = 10$ cal mol^{-1}

C (diamond) + $O_2 \rightarrow CO_2$,

$\Delta H = -91$ kcal mol^{-1} at 300 K.

C (graphite) + $O_2 \rightarrow CO_2$, $\Delta H = x$ at 300 K, x is

(a) –81 kcal (b) 101 kcal

(c) –94 kcal (d) 88 kcal.

77. Standard molar enthalpy of formation of CO_2 is equal to

(a) zero

(b) the standard molar enthalpy of combustion of gaseous carbon

(c) the sum of standard molar enthalpies of CO and O_2

(d) the standard molar enthalpy of combustion of carbon.

78. Which is the set of amphiprotic species?

(a) H_3O^+, HPO_4^{2-}, HCO_3^-

(b) H_2O, HPO_3^{2-}, $H_2PO_2^-$

(c) HSO_4^-, $H_2PO_4^-$, $H_2PO_3^-$

(d) all of these.

79. At 4°C, $K_w = 1 \times 10^{-16}$. A solution with pH = 7.5 at 4°C will

(a) turn blue litmus red

(b) turn red litmus blue

(c) turn turmeric paper brown

(d) be neutral to litmus.

80. The following equilibrium is established when hydrogen chloride is dissolved in acetic acid.

$HCl + CH_3COOH \rightleftharpoons Cl^- + CH_3COOH_2^+$

The set that characterises the conjugate acid-base pair is

(a) (HCl, CH_3COOH) and ($CH_3COOH_2^+$, Cl^-)

(b) (HCl, $CH_3COOH_2^+$) and (CH_3COOH, Cl^-)

(c) $CH_3COOH_2^+$, HCl) and (Cl^-, CH_3COOH)

(d) (HCl, Cl^-) and ($CH_3COOH_2^+$, CH_3COOH).

81. Ionisation constant of water at 298 K ($K_w = 1 \times 10^{-14}$) is

(a) 1×10^{-14} (b) 1×10^{-7}

(c) 1.8×10^{-16} (d) 1.8×10^{-5}.

82. For the net cell reaction of the cell

$Zn_{(s)}|Zn^{2+}||Cd^{2+}|Cd_{(s)}$,

$\Delta G°$ in kilojoules at 25°C is ($E°_{cell} = 0.360$ V)

(a) 112.5 (b) 69.47

(c) –34.73 (d) –69.47.

83. Which of the following changes will increase the emf of the cell:

$Co_{(s)}|CoCl_2\ (M_1)||HCl\ (M_2)|Pt\ (H_{2(g)})$

(a) increase in the volume of $CoCl_2$ solution from 100 mL to 200 mL

(b) increase M_2 from 0.01 M to 0.50 M

(c) increase the pressure of the $H_{2(g)}$ from 1.00 to 2.00 atm

(d) increase M_1 from 0.01 M to 0.50 M.

84. Metal can be prevented from rusting by

(a) connecting iron to more electropositive metal $\rightarrow$ a case of cathodic protection

(b) connecting iron to more electropositive metal $\rightarrow$ a case of anodic protection

(c) connecting iron to less electropositive metal $\rightarrow$ a case of cathodic protection

(d) connecting iron to less electropositive metal $\rightarrow$ a case of anodic protection.

85. $2Ce^{4+} + Co \rightarrow 2Ce^{3+} + Co^{2+}$.

$E°_{cell} = 1.89$ V, $E°_{Co^{2+}/Co} = -0.277$ V. Hence $E°_{Ce^{4+}/Ce^{3+}}$ is

(a) 0.805 V (b) 1.61 V

(c) – 0.805 V (d) –1.61 V.

86. In octahedral void and tetrahedral void, radius ratio is (in closed packing)

(a) $\frac{0.414}{0.225}$ (b) $\frac{0.225}{0.414}$
(c) 0.225×0.414 (d) none of these.

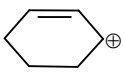
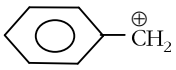
87. Which is true statement?
(a) all liquids have concave meniscus
(b) all liquids has convex and other liquids have concave meniscus
(c) mercury has convex and other liquids have concave meniscus
(d) mercury has concave and other liquids have convex meniscus.

88. 1 g of I_2 is in 10 mL $CHCl_3$. When 400 mL H_2O is added into it, concentration of I_2 in $CHCl_3$ falls to 0.80 g. Hence partition coefficient of I_2 in $CHCl_3$ and H_2O is
(a) 400 (b) 200
(c) 300 (d) 160.

89. In *lake-test* of Al^{3+} ion, there is formation of coloured floating-lake. It is due to
(a) adsorption of litmus by $Al(OH)_4^-$
(b) adsorption of litmus by $Al(OH)_3$
(c) adsorption of litmus by H_2O
(d) none of these.

90. Gold number of a lyophilic solution is such property that
(a) the larger its value, the greater is the peptising power
(b) the lower its value, the greater is the peptising power
(c) the lower its value, the greater is the protecting power
(d) the larger its value, the greater is the protecting power.

91. $HO-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-H$ will be named as (IUPAC)
(a) 2-ketoethanoic acid
(b) formyl methanoic acid
(c) glyoxalic acid (d) none of these.

92. Most stable carbonium ion is
(a) $CH_2=\overset{\oplus}{C}H$ (b) 
(c)  (d) $(CH_3)_3\overset{\oplus}{C}$.

93. Increasing order of the following for S_E

I II III
(a) I < II < III (b) III < II < I
(c) II < III < I (d) I < III < II.

94. Buna N is a polymer of
(a) vinyl chloride and styrene
(b) vinyl chloride and 1,3-butadiene
(c) vinyl cyanide and 1,3-butadiene
(d) 1,3-butadiene and styrene.

95. Increasing order of dehydrohalogenation is
(a) *R*F < *R*Cl < *R*Br < *R*I
(b) *R*I < *R*Br < *R*Cl < *R*F
(c) *R*Cl < *R*F < *R*Br < *R*I
(d) *R*F < *R*I < *R*Cl < *R*Br.

96. Glycerol $\xrightarrow{KHSO_4}$ *A* $\xrightarrow{LiAlH_4}$ *B*. *A* and *B* are
(a) acrolein, allyl alcohol
(b) glyceryl sulphate, acrylic acid
(c) allyl alcohol, acrolein
(d) only acrolein (*B* is not formed).

97. The reaction of elemental sulphur with Grignard reagent followed by acidification leads to the formation of
(a) mercaptan (b) sulphoxide
(c) thioether (d) sulphonic acid.

98. In case of Hofmann bromamide degradation reaction, intermediate RNCO is formed by
(a) intramolecular migration
(b) intermolecular migration
(c) hydrolysis of $RCONH_2$
(d) none of these.

99. Best method for preparing 1° amines from alkyl halide is by
(a) Hofmann-bromamide reaction
(b) reaction with NH_3
(c) Gabriel phthalimide reaction
(d) Sandmeyer reaction.

100. Chiral C-atoms in glucose and fructose are
(a) 4 in each
(b) 3 in each
(c) 4 in glucose and 3 in fructose
(d) 3 in glucose and 4 in fructose.

MATHEMATICS

101. If $y = \text{cosec}^{-1}\frac{\sqrt{x}+1}{\sqrt{x}-1} + \cos^{-1}\frac{\sqrt{x}-1}{\sqrt{x}+1}$, then $\frac{dy}{dx}$ is equal to

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

(c) $\frac{1}{x-1}$ (d) 0

102. The derivative of $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ with respect to $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$ is

(a) –2 (b) –1

(c) 1 (d) 2

103. If $f(x) = \sin(\cos x)$, then $f'(x)$ is

(a) $\cos(\cos x)$ (b) $\sin(-\sin x)$

(c) $-\sin(\cos x)$ (d) $-\sin x \cos(\cos x)$

104. The second derivative of $f(e^x)$ with respect to x, where f is a polynomial, is

(a) $f''(e^x)\, e^x + f(e^x)$

(b) $f''(e^x)\, e^{2x} + f''(e^x)\, e^x$

(c) $f''(e^x)$

(d) $f''(e^x)\, e^{2x} + f'(e^x)\, e^x$

105. A real function f of a real variable x is defined as $f(x) = x - [x]$, where $[x]$ denotes the greatest integer $\le x$. On which one of the following sets f is monotonically increasing ?

(a) **R**, the set of reals (b) [0, 1)

(c) [0, 1] (d) (0, 1]

106. The maximum value of $\sin x + \cos x$ is equal to

(a) $-\sqrt{2}$ (b) $\sqrt{2}$

(c) 2 (d) $\sqrt{3}$

107. The value of k for which the integral of $\frac{3x^3+7x^2-2}{x} + \frac{3kx+1}{x^2}.(x \neq 0)$; may be a rational function, is

(a) 3/2 (b) 2/3

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

108. The value of the integral $\int\left(\frac{2+\sin 2x}{1+\cos 2x}\right)e^x\, dx$ is equal to

(a) $e^x \sin x$ (b) $e^x \cos x$

(c) $e^x \tan x$ (d) $e^x \cot x$

109. The value of $\int\frac{x^{e-1}+e^{x-1}}{x^e+e^x}\, dx$, is equal to

(a) x (b) $\log(x + e)$

(c) $\log(e^x + x^e)$ (d) $\log[(x^e + e^x)^{1/e}]$

110. If $I_1 = \int_e^{e^2}\frac{dx}{\log x}$ and $I_2 = \int_1^2\frac{e^x}{x}dx$, then

(a) $I_1 = I_2$ (b) $2I_1 = I_2$

(c) $I_1 + I_2 = 0$ (d) $I_1 = 2I_2$

111. The value of the integral $\int\frac{1}{x(x^7+1)}dx$, is equal to

(a) $\frac{1}{2}\log\left|\frac{x^7-1}{x^7+1}\right| + c$ (b) $\frac{1}{7}\log\left|\frac{x^7}{x^7+1}\right| + c$

(c) $\log\left|\frac{x^7+1}{7x}\right| + c$ (d) $7\log\left|\frac{x^7}{x^7+1}\right| + c$

112. The value of the integral $\int\frac{dx}{e^x-1}$ is equal to

(a) $\log(e^x - 1) + c$ (b) $\log(1 - e^{-x}) + c$

(c) $\log(1 - e^x) + c$ (d) $\log(e^{-x} - 1) + c$

113. The value of the integral $\frac{1}{8}\int\left[\text{cosec}\, h^2 x + \frac{x^3(\tan^{-1}x^4)}{1+8x}\right]dx$ is equal to

(a) $-\frac{1}{8}\coth x + \frac{1}{8}\tan^{-1}x^4 + c$

(b) $\frac{1}{8}\coth x + \frac{1}{8}\tan^{-1}x^4 + c$

(c) $\frac{1}{8}\coth x + \frac{1}{64}(\tan^{-1}x^4)^2 + c$

(d) $-\frac{1}{8}\coth x + \frac{1}{64}(\tan^{-1}x^4)^2 + c$

114. The value of integral $\int_0^{\sqrt{2}}[x^2]\, dx$, where $[x]$ is the greatest integer $\le x$, is given by

(a) $\sqrt{2} - 1$ (b) $1 - \sqrt{2}$

(c) $\frac{(\sqrt{2})^3}{3}$ (d) $2(\sqrt{2} - 1)$

115. Let $f : \mathbf{R} \to \mathbf{R}$ and $g : \mathbf{R} \to \mathbf{R}$ be two continuous functions, then the value $\int_{-a}^{a}[f(x)g(-x) - f(-x)g(x)]\, dx$ is equal to

(a) e^π (b) $2\int_0^a f(x)g(x)\, dx$

(c) 1 (d) 0

116. The area bounded by the curves $y = x^2$ and $y = 2|x|$ is equal to
(a) 4/3 (b) 8/3
(c) 2/3 (d) 1/3

117. If A is the area between the curve $y = \sin x$ and x-axis in the interval $[0, \pi/4]$, then in the same interval, area between the curve $y = \cos x$ and x-axis, is equal to
(a) A (b) $\frac{\pi}{2} - A$
(c) $1 - A$ (d) $2A$

118. The degree and order of the differential equation $\left\{1+\left(\frac{dy}{dx}\right)^2\right\}^{3/2} = \frac{d^2y}{dx^2}$, respectively are
(a) 3, 1 (b) 2, 2/3
(c) 1, 2 (d) 2, 2

119. Which one of the following differential equations is satisfied by the family of curves $y = 2 + c \cdot e^{-2x^2}$?
(a) $\frac{dy}{dx} = 8x$ (b) $\frac{dy}{dx} + 4xy = 8x$
(c) $\frac{dy}{dx} + 4xy = 0$ (d) $\frac{dy}{dx} - 4xy = 0$

120. The general solution of the differential equation $\frac{dy}{dx} + \frac{x}{y} = 0$ is given by
(a) $x^2 + y^2 = a^2$ (b) $(x-a)^2 + (y-a)^2 = 1$
(c) $x^2 + y^2 = axy$ (d) $x + y = a$

121. The solution of the differential equation $(2x \cos y + 3x^2y)dx + (x^3 - x^2 \sin y - y)\,dy = 0$, is given by
(a) $x^2 \cos y + x^3 y - \frac{y^2}{2} = \text{constant}$
(b) $x^2 \sin y + x^3 y - \frac{y^2}{2} = \text{constant}$
(c) $x^2 \sin y - x^3 y - \frac{y^2}{2} = \text{constant}$
(d) $x^2 \cos y - x^3 y - \frac{y^2}{2} = \text{constant}$

122. The solution of the differential equation $\frac{dy}{dx} = \frac{y^2}{1-3xy}$ is given by
(a) $y^3 x = \frac{y^2}{2} + c$ (b) $y^3 = \frac{xy^2}{2} + c$
(c) $x = \frac{(1+2cy)}{y^3}$ (d) $x = \frac{c}{y^3}$

123. The probability of solving a problem by three students X, Y and Z is $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$ respectively. The probability that the problem will be solved is
(a) 1/4 (b) 1/2
(c) 3/4 (d) 1/3

124. The projection of the vector $\vec{a} = \hat{i} - 2\hat{j} + \hat{k} = 0$ on the vector $\vec{b} = 4\hat{i} - 4\hat{j} + 7\hat{k}$ is equal to
(a) $\frac{\sqrt{6}}{9}$ (b) $\frac{19}{9}$
(c) $\frac{9}{19}$ (d) $\frac{\sqrt{6}}{19}$

125. Position vector of a point P is $\vec{r}$ from origin of co-ordinate axes. A force $\vec{F}$ passes through the point P. The moment of the force about the origin is
(a) $\vec{r} \times \vec{F}$ (b) $\vec{r} \cdot \vec{F}$
(c) $\vec{F} \times \vec{r}$ (d) zero

126. If $|\vec{a}| = 3, |\vec{b}| = 4$ and $|\vec{a} - \vec{b}| = 5$, then the value of $|\vec{a} + \vec{b}|$, is equal to
(a) 6 (b) $5\sqrt{2}$
(c) 5 (d) 4

127. If $\vec{a} \cdot \vec{b}$ are two unit vectors and θ is the angle between them, then the value of $\cos\frac{\theta}{2}$, is equal to
(a) $\frac{1}{2}|\vec{a} - \vec{b}|$ (b) $\frac{1}{2}(\vec{a} \cdot \vec{b})$
(c) $\frac{|\vec{a} \times \vec{b}|}{2|\vec{a}|\,|\vec{b}|}$ (d) $\frac{1}{2}|\vec{a} + \vec{b}|$

128. If the sides of a parallelogram are $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\hat{i} + 2\hat{j} + 3\hat{k}$, then the unit vector parallel to one of the diagonals is equal to
(a) $\frac{1}{7}(3\hat{i} + 6\hat{j} - 2\hat{k})$ (b) $\frac{1}{7}(3\hat{i} - 6\hat{j} - 2\hat{k})$
(c) $\frac{1}{7}(-3\hat{i} + 6\hat{j} - 2\hat{k})$ (d) $\frac{1}{7}(3\hat{i} + 6\hat{j} + 2\hat{k})$

129. If $\vec{a} + \vec{b} + \vec{c} = 0$ and $|\vec{a}| = 6, |\vec{b}| = 8$ and $|\vec{c}| = 10$, then the value of $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$, is equal to
(a) 100 (b) –100
(c) 200 (d) –200

130. The magnitude of the displacement vector from position (2, 4, 2) to position(6, 1, 12) is
(a) $5\sqrt{5}$ (b) $2\sqrt{3}$
(c) $3\sqrt{7}$ (d) $3\sqrt{8}$

131. If $\vec{a}+2\vec{b}+3\vec{c}=0$ and $(\vec{a}\times\vec{b})+(\vec{b}\times\vec{c})+(\vec{c}\times\vec{a})=\lambda(\vec{b}\times\vec{c})$, then the value of λ is equal to
(a) 2 (b) 3
(c) 4 (d) 6

132. A particle moves along a circular path of radius r in xy - plane. The position vector $\vec{R}$ of this particle as a function of its y co-ordinate is
(a) $\sqrt{x^2-y^2}\,\hat{i}+y\hat{j}$ (b) $\sqrt{r^2-y^2}\,\hat{i}+y\hat{j}$
(c) $\sqrt{y^2-r^2}\,\hat{i}-y\hat{j}$ (d) $\sqrt{r^2-y^2}\,\hat{i}-y\hat{j}$

133. A ticket is drawn at random from the tickets numbered 1 to 10. The probability that the ticket has a number which is multiple either of 2 or 3 is
(a) 1/10 (b) 7/10
(c) 2/7 (d) 3/5

134. A card is drawn from a well-shuffled pack of 52 cards. The probability of its being a spade or a queen is
(a) 1/13 (b) 1/4
(c) 17/52 (d) 4/13

135. A die is thrown twice. The probability that atleast one of the two throws comes up with the number 3 is
(a) 5/12 (b) 11/36
(c) 1/12 (d) 7/24

136. The statistical data regarding production of food grains in India, available in a Government of India Publication, is
(a) primary (b) secondary
(c) primary as well as secondary
(d) neither primary nor secondary

137. In a frequency distribution, class marks are 37, 47, 57, 67. Its class boundaries are given by
(a) 34.5-44.5, 44.5-54.5, 54.5-64.5, ...
(b) 31.5-41.5, 41.5-51.5, 51.5-61.5, ...
(c) 32-42, 42-52, 52-62, ...
(d) 35-45, 45-55, 55-65, ...

138. The mean of 30 given numbers, when it is given that the mean of 10 of them is 12 and the mean of the remaining of 20 is 9, is equal to
(a) 11 (b) 10
(c) 9 (d) 5

139. If $n=20$, $\bar{x}=50$, and $\Sigma x^2=84{,}000$, then the variance is equal to
(a) 1500 (b) 1700
(c) 1750 (d) 1800

140. If for the variables x and y, the two regression lines are $3x+2y-25=0$ and $6x+y-30=0$, then the coefficient of correlation r is equal to
(a) 0.5 (b) –0.5
(c) 0.6 (d) –0.6

141. When the number of classes is increased indefinitely and the width of the classes is decreased indefinitely, then the frequency polygon becomes
(a) histogram (b) frequency curve
(c) pie-chart (d) line graph

142. If $S=\{x : x^2+1=0, x \text{ real}\}$, then S is
(a) 0 (b) {0}
(c) {ϕ} (d) ϕ

143. If $A=\{x \in \mathbf{N} : 3<x<12\}$ and $B=\{x \in \boldsymbol{N} : x \text{ is even}, x<15\}$, then
(a) $A \cup B=\{4, 6, 8, 10, 12, 14\}$
(b) $A \cap B=\{4, 6, 8, 10\}$
(c) $A \backslash B=\{5, 7, 9, 11, 13\}$
(d) $B \backslash A=\{2, 8, 12, 14\}$

144. Consider the following equations for any two sets A and B
(A) $(A-B)\cup B=A$ (B) $(A-B)\cup A=A$
(C) $(A-B)\cap B=\phi$ (D) $A \subseteq B \Rightarrow A \cup B=B$
Which of these are correct ?
(a) A, B and C (b) B, C and D
(c) A, C and D (d) A, B and D

145. The value of $x+y$ in the solution of the equations $\frac{x}{4}+\frac{y}{3}=\frac{5}{12}$ and $\frac{x}{2}+y=1$, is
(a) 3/2 (b) 1/2
(c) 2 (d) 5/2

146. Let A and B be subsets of X and let $C=(A \cup B') \cup (A' \cap B)$; then C is equal to
(a) $(A \cup B') \setminus (A \cap B')$
(b) $(A' \cup B) \setminus (A' \cap B)$
(c) $(A \cup B) \setminus (A \cap B)$
(d) $(A' \cup B') \setminus (A' \cap B')$

147. If $A = \{1, 2, 3, 4\}$ and $B = \{2, 3, 5\}$, then identify the correct relation, among the following from A to B given by xRy if and only if $x < y$.
(a) $R = \{(1, 2), (1, 3), (2, 2), (2, 3)\}$
(b) $R = \{(3, 2), (3, 3), (3, 4), (3, 5)\}$
(c) $R = \{(1, 2), (1, 3), (2, 3), (2, 5)\}$
(d) R = {(1, 3), (1, 5), (3, 2), (4, 2)}

148. If R be a relation on $N \times N$ defined by (a, b) R (c, d) if and only if $ad = bc$; then R is
(a) an equivalence relation
(b) symmetric and transitive but not reflexive
(c) reflexive and transitive but not symmetric
(d) reflexive and symmetric but not transitive

149. Let the points O, P, Q and R on the line correspond to the real numbers zero, p, q and r, where p is negative, q is reciprocal of a natural number and r is greater than $\sqrt{2}$. Then the relative positions of O, P, Q and R on the number line are
(a) P–O–R–Q (b) O–P–Q–R
(c) P–O–Q–R (d) P–Q–O–R

150. If the points P and Q represent the real numbers $0.8\vec{3}$ and $0.6\vec{2}$ on the number line, then the distance between P and Q is
(a) 21/90 (b) 19/90
(c) 21/100 (d) 56/90

151. The principle argument of $-1-i$ is
(a) $\frac{\pi}{4}$ (b) $-\frac{\pi}{4}$
(c) $-\frac{3\pi}{4}$ (d) $\frac{5\pi}{4}$

152. The value of $i^{1000} + i^{1001} + i^{1002} + i^{1003}$ is equal to
(a) 0 (b) i
(c) $-i$ (d) 1

153. The sum of the first n terms of the series $\frac{1}{2}+\frac{3}{4}+\frac{7}{8}+\frac{15}{16}+\ldots..$ is
(a) $2^n - n - 1$ (b) $1 - 2^{-n}$
(c) $n + 2^{-n} - 1$ (d) $2^n - 1$

154. Let T_r be the r^{th} term of an A.P., for $r = 1, 2, ...$ If for some distinct positive integers m, n; $T_m = \frac{1}{n}$ and $T_n = \frac{1}{m}$, then T_{mn} is equal to
(a) $\frac{1}{mn}$ (b) $\frac{1}{m}+\frac{1}{n}$
(c) 1 (d) 0

155. The positive value of m for which the roots of the equation $12x^2 + mx + 5 = 0$ are in the ratio 3 : 2, is
(a) $5\sqrt{10}$ (b) $\frac{5\sqrt{10}}{12}$
(c) 5/12 (d) 12/5

156. If $x^2 - px + 1 > 0$ for all real values of x, then $|p|$
(a) is less than 2 (b) is greater than 1
(c) is greater than 2 (d) can have any value

157. $x + 2$ is a common factor of expressions $(x^2 + ax + b)$ and $(x^2 + bx + a)$. The ratio $a : b$ is equal to
(a) 1 (b) 2
(c) 3 (d) 4

158. The number of triangles that can be formed by choosing the vertices from a set of 12 points, seven of which lie on the same straight line, is
(a) 185 (b) 175
(c) 115 (d) 105

159. If $S = \{2, 3, 4, 5, 7, 9\}$ then the number of different three-digit numbers (with all distinct digits) less than 400 that can be formed from S, is
(a) 20 (b) 40
(c) 80 (d) 120

160. The value of
${}^nC_0 - {}^nC_1 + {}^nC_2 - {}^nC_3 + ... + (-1)^n\ {}^nC_n$ is equal to
(a) 0 (b) $2^n - 1$
(c) 2^n (d) 2^{n-1}

161. If x is so small that its square and higher powers may be neglected, then $\left(\frac{1-x}{1+x}\right)^{1/2}$ is approximately equal to
(a) $1 - x$ (b) $1 + x$
(c) $2 - x$ (d) $1-\frac{1}{2}x$

162. If the logarithm of a number to the base $\sqrt{8}$ is 6, then the number is
(a) $\sqrt{48}$ (b) $\frac{\sqrt{8}}{6}$
(c) $6\sqrt{8}$ (d) 512

163. The value of $\log_{10}40000 - \log_{10}4$ is equal to
(a) 4 (b) 10000
(c) $\log_{10}39996$ (d) 39996

164. If A is a 2 × 3 matrix and AB is a 2 × 5 matrix, then B must be a
(a) 3×5 matrix (b) 5×3 matrix
(c) 3×2 matrix (d) 5×2 matrix

165. If $A=\begin{pmatrix}0 & 2 & 3\\ 2 & 1 & 4\end{pmatrix}$ and $B=\begin{pmatrix}7 & 6 & 3\\ 1 & 4 & 5\end{pmatrix}$, then $3A-2B$ is the matrix
(a) $\begin{pmatrix}-14 & 6 & -3\\ 4 & 5 & -2\end{pmatrix}$ (b) $\begin{pmatrix}14 & -6 & -3\\ -4 & -5 & -2\end{pmatrix}$
(c) $\begin{pmatrix}-14 & -6 & 3\\ 4 & -5 & 2\end{pmatrix}$ (d) $\begin{pmatrix}14 & 6 & -3\\ 4 & 5 & -2\end{pmatrix}$

166. If $A=\begin{bmatrix}i & 0\\ 0 & i\end{bmatrix}$, $i=\sqrt{-1}$, then A^n is equal to
(a) A for $n = 4$ (b) $-A$ for $n = 6$
(c) $-I$ for $n = 5$ (d) I for $n = 8$

167. If $A=\begin{bmatrix}1 & 2\\ 2 & 3\end{bmatrix}$, and $A^2 - kA - I_2 = 0$ then the value of k is
(a) 4 (b) – 4
(c) 8 (d) – 8

168. Consider the following statements :
1. If any two rows or columns of a determinant are identical, then the value of the determinant is zero.
2. If the corresponding rows and columns of a determinant are interchanged, then the value of determinant does not change.
3. If any two rows (or columns) of a determinant are interchanged, then the value of the determinant changes in sign.
Which of these are correct ?
(a) 1 and 2 (b) 1 and 3
(c) 2 and 3 (d) 1, 2 and 3

169. The value of the determinant $\begin{vmatrix}1 & 1 & 1\\ 2 & 3 & 4\\ 3 & 4 & 5\end{vmatrix}$ is equal to
(a) 1440 (b) 1
(c) – 1 (d) 0

170. If $\begin{vmatrix}1+x^3 & x^2 & x\\ 1+y^3 & y^2 & y\\ 1+z^3 & z^2 & z\end{vmatrix}=0$ and x, y, z are all different, then the value of xyz is
(a) $(x - y)(y - z)(z - x)$
(b) 0
(c) 1
(d) – 1

171. The value of the determinant $\begin{vmatrix}1+a & 1 & 1\\ 1 & 1+b & 1\\ 1 & 1 & 1+c\end{vmatrix}$ is
(a) $abc\left(1+\frac{1}{a}-\frac{1}{b}+\frac{1}{c}\right)$ (b) $abc\left(1-\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$
(c) $abc\left(1+\frac{1}{a}+\frac{1}{b}-\frac{1}{c}\right)$ (d) $abc\left(1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$

172. The value of the determinant of the inverse of the matrix $\begin{pmatrix}-4 & -5\\ 2 & 2\end{pmatrix}$ is
(a) $\frac{1}{2}$ (b) 2
(c) 3 (d) 4

173. The matrix $\begin{pmatrix}2 & 4\\ -8 & x\end{pmatrix}$ does have an inverse if x is equal to
(a) 16 (b) – 16
(c) 8 (d) – 8

174. The system of equations $2x + 3y = 5$ and $10x + 15y = 50$
(a) has a unique solution
(b) has infinitely many solutions
(c) is inconsistent
(d) is consistent and has exactly two solutions

175. If obtaining the solution of the system of equations $x + y + z = 7$; $x + 2y + 3z = 16$ and $x + 3y + 4z = 22$ by Cramer's rule, the value of y is given by $\frac{\Delta'}{\Delta}$, where $\Delta\equiv\begin{vmatrix}1 & 1 & 1\\ 1 & 2 & 3\\ 1 & 3 & 4\end{vmatrix}$, then the determinant Δ' is given by
(a) $\begin{vmatrix}1 & 1 & 1\\ 1 & 2 & 3\\ 1 & 3 & 4\end{vmatrix}$ (b) $\begin{vmatrix}1 & 1 & -7\\ 1 & 2 & -16\\ 1 & 3 & -22\end{vmatrix}$
(c) $\begin{vmatrix}1 & 1 & -7\\ 2 & 3 & -16\\ 3 & 4 & -22\end{vmatrix}$ (d) $\begin{vmatrix}1 & 1 & -7\\ 1 & 3 & -16\\ 1 & 4 & -22\end{vmatrix}$

176. The value of $e^{(\log_{10}\tan 1^\circ+\log_{10}\tan 2^\circ+\ldots+\log_{10}\tan 89^\circ)}$ is equal to

(a) 0 (b) 1

(c) e (d) $\frac{1}{e}$

177. If $1 + \sin x + \sin^2 x + \sin^3 x + \ldots + \infty = 4 + 2\sqrt{3}$ for $0 < x < \pi$; then the value of x is equal to

(a) $\frac{\pi}{6}$ or $\frac{2\pi}{3}$ (b) $\frac{\pi}{4}$ or $\frac{2\pi}{5}$

(c) $\frac{\pi}{3}$ or $\frac{\pi}{6}$ (d) $\frac{\pi}{3}$ or $\frac{2\pi}{3}$

178. If $\tan\theta + \sin\theta = m$ and $\tan\theta - \sin\theta = n$, then

(a) $m^2 - n^2 = 16\,mn$ (b) $m^2 + n^2 = 16\,mn$

(c) $(m^2 - n^2)^2 = 16\,mn$ (d) $(m^2 + n^2)^2 = 16\,mn$

179. If $\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2+}}}}\ldots\infty = \text{cosec}\,\theta$, then the value of $\sin\theta$ is equal to

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

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

180. If $\alpha + \beta + \gamma = 2\pi$, then the value of $\tan\frac{\alpha}{2}+\tan\frac{\beta}{2}+\tan\frac{\gamma}{2}$ is equal to

(a) $\tan\frac{\alpha}{2}\cdot\tan\frac{\beta}{2}\cdot\tan\frac{\gamma}{2}$

(b) $\tan\frac{\alpha}{2}\cdot\tan\frac{\beta}{2}+\tan\frac{\beta}{2}\cdot\tan\frac{\gamma}{2}+\tan\frac{\gamma}{2}\cdot\tan\frac{\alpha}{2}$

(c) $1-\tan\frac{\alpha}{2}\cdot\tan\frac{\beta}{2}\cdot\tan\frac{\gamma}{2}$

(d) $1+\tan\frac{\alpha}{2}\cdot\tan\frac{\beta}{2}\cdot\tan\frac{\gamma}{2}$

181. If $\sin\theta = \sin\alpha$, then

(a) $\frac{\theta+\alpha}{2}$ is any odd multiple of $\frac{\pi}{2}$ and $\frac{\theta-\alpha}{2}$ is any multiple of π

(b) $\frac{\theta+\alpha}{2}$ is any even multiple of $\frac{\pi}{2}$ and $\frac{\theta-\alpha}{2}$ is any multiple of π

(c) $\frac{\theta+\alpha}{2}$ is any multiple of $\frac{\pi}{2}$ and $\frac{\theta-\alpha}{2}$ is any odd multiple of π

(d) $\frac{\theta+\alpha}{2}$ is any multiple of $\frac{\pi}{2}$ and $\frac{\theta-\alpha}{2}$ is any even multiple of π

182. If for $A, B \in [0, \pi/2]$; $\sin(A + B) = 1$ and $\sin(A - B) = 1/2$ then the value of $\tan(A + 2B)\cdot\tan(2A + B)$ is equal to

(a) -1 (b) 0

(c) 1 (d) 2

183. Two ships leave a port at the same instant. One sails at 30 km per hour in the direction N 32ºE while the other sails at 20 km per hour in the direction S 58ºE. After 2 hours the ships are distant from each other by

(a) 100 km (b) 36.5 km

(c) $20\sqrt{13}$ km (d) $15\sqrt{6}$ km

184. The value of $\sin^{-1}\left(\frac{3}{5}\right)+\tan^{-1}\left(\frac{1}{7}\right)$ is equal to

(a) π (b) $\frac{\pi}{2}$

(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{8}$

185. The value of $\tan\left[\frac{1}{2}\cos^{-1}\left(\frac{\sqrt{5}}{3}\right)\right]$ is equal to

(a) $\frac{2}{5-\sqrt{5}}$ (b) $\frac{2}{5+\sqrt{5}}$

(c) $\frac{3+\sqrt{5}}{2}$ (d) $\frac{3-\sqrt{5}}{2}$

186. An observer measures angles of elevation of two towers of equal heights from a point between the towers. If the angles of elevation are 60º and 30º and distance of the nearer tower is 100 metres then the height of each tower and the distance between the towers, respectively are

(a) $\frac{100}{\sqrt{3}}$ m and 400 m (b) $\frac{100}{\sqrt{3}}$ m and 300 m

(c) $100\sqrt{3}$ m and 400 m (d) $100\sqrt{3}$ m and 300 m

187. If from the top of a light-house, 100 metres high, the angle of depression of a boat is $\tan^{-1}\left(\frac{5}{12}\right)$, then the distance in metres, between the boat and the light-house, is equal to

(a) $\frac{125}{3}$ (b) 120

(c) 240 (d) 260

188. If the vertices B and D of a square $ABCD$ be (2, 3) and (4, 1) respectively, then the length of its side is

(a) 1 unit (b) 2 units

(c) 3 units (d) 4 units

189. The x-intercept and the y-intercept of the line $5x - 7 = 6y$, respectively are

(a) $\frac{7}{5}$ and $\frac{7}{6}$ (b) $\frac{7}{5}$ and $\frac{-7}{6}$

(c) $\frac{5}{7}$ and $\frac{6}{7}$ (d) $\frac{-5}{7}$ and $\frac{6}{7}$

190. The perpendicular form of the straight line $\sqrt{3}x + 2y = 7$ is

(a) $y = \frac{\sqrt{3}}{2}x + \frac{7}{2}$ (b) $\frac{x}{7/\sqrt{3}} + \frac{y}{7/2} = 1$

(c) $\frac{\sqrt{3}}{\sqrt{7}}x + \frac{2}{\sqrt{7}}y = \sqrt{7}$ (d) $\frac{\sqrt{3}}{\sqrt{7}}x + \frac{2}{\sqrt{7}}y = 7$

191. If the points with coordinates $(-a, 0)$; $(ap^2, 2ap)$ and $(ap_1^2, 2ap_1)$ are collinear, then the value of pp_1 is

(a) 3 (b) 2

(c) 1 (d) – 1

192. If β is the acute angle between the lines $px + qy = p + q$; and $p(x - y) + q(x + y) = 2q$, then the value of $\sin \beta$ is

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

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

193. The Cartesian equation of the curve $x = 5 + 3\cos\alpha$ and $y = 7 + 3\sin\alpha$ is represented by

(a) $(x - 3)^2 + (y - 5)^2 = 6$

(b) $(x - 5)^2 + (y - 7)^2 = 9$

(c) $y = 3x + 7$

(d) $(y - 2) + (x - 7) = 5$

194. If r_1, r_2 and r_3 are the radii of the circles $x^2 + y^2 - 4x + 6y = 5$, $x^2 + y^2 + 6x - 4y = 3$ and $x^2 + y^2 - 2x + 4y = 8$, respectively, then

(a) $r_1 > r_2 > r_3$ (b) $r_2 > r_3 > r_1$

(c) $r_3 > r_1 > r_2$ (d) $r_1 > r_3 > r_2$

195. If a_1, b_1, c_1, f_1, g_1 and h_1 are real numbers such that $g_1^2 + f_1^2 > c_1 a_1$, then the equation $a_1x^2 + 2h_1xy + b_1y^2 + 2g_1x + 2f_1y + c_1 = 0$ represents a circle if and only if

(a) $a_1 = b_1$

(b) $a_1 = b_1$, $h_1 = 0$

(c) $a_1 = b_1$, $a_1 \neq 0$, $h_1 = 0$

(d) $a_1 = b_1$, $a_1 \neq 0$, $h_1 \neq 0$

196. The equation of the parabola whose focus is $(-3, 0)$ and the directrix $x + 5 = 0$, is

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

(c) $y^2 = 4(x - 4)$ (d) $y^2 = -4(x - 4)$

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

(a) $\frac{x^2}{3} + \frac{y^2}{5} = 1$ (b) $\frac{x^2}{36} + \frac{y^2}{11} = 1$

(c) $\frac{x^2}{36} + \frac{y^2}{9} = 1$ (d) $\frac{x^2}{11} + \frac{y^2}{36} = 1$

198. The equation $2x^2 - 3y^2 - 6 = 0$ respresents a

(a) circle (b) parabola

(c) ellipse (d) hyperbola

199. The equation of the axis of the parabola $x^2 - 4y + 8 = 0$, is

(a) $y = 0$ (b) $y = 2$

(c) $x = 0$ (d) $x = 2$

200. A straight line with direction cosines (0, 1, 0), is

(a) parallel to the x-axis

(b) parallel to the y-axis

(c) parallel to the z-axis

(d) equally inclined to the all axes

☺☺☺