1. In the travelling plane wave equation given by $y = A \sin \omega \left(\dfrac{x}{v} - t \right)$, where ω is the angular velocity and v is the linear velocity. The dimension of ωt is

A) $LM°T^{-1}$

B) $L°M°T°$

C) $L°M°T$

D) LMT

E) LMT^{-2}

Correct Answer : Option B

2. Add 2.7×10^{-5} to 4.5×10^{-4} with due regard to significant figures

A) 4.8×10^{-4}

B) 4.7×10^{-5}

C) 4.8×10^{-5}

D) 4.7×10^{-4}

E) 5.0×10^{-4}

Correct Answer : Option A

3. The length of second's hand in a watch is 1 cm. The magnitude of the change in the velocity of its tip in 30 seconds (in cms^{-1}) is

A) $\dfrac{\pi}{30}$

B) $\dfrac{\sqrt{2}\pi}{30}$

C) $\dfrac{\sqrt{2}\pi}{15}$

D) $\dfrac{\pi}{15}$

E) $\dfrac{\pi}{30\sqrt{2}}$

Correct Answer : Option D

4. If the slope of the velocity-time graph of a moving particle is zero, then its acceleration is

A) constant but not zero

B) zero

C) constant and is in the direction of velocity

D) not a constant.

E) constant and is opposite to the direction of velocity

Correct Answer : Option B

5. A projectile is projected with a velocity of 20 ms^{-1} at an angle 45° to the horizontal. After sometime its velocity vector makes an angle of 30° to the horizontal. Its speed at this instant (in ms^{-1}) is

A) $10\sqrt{\dfrac{2}{3}}$

B) $\dfrac{20}{\sqrt{3}}$

C) $20\sqrt{\dfrac{2}{3}}$

D) $10\sqrt{2}$

E) $10\sqrt{3}$

Correct Answer : Option C

6. A boy sitting in a bus moving at a constant velocity throws a ball vertically up into air. The ball will fall

A) in the bus in front of the boy

B) in the bus on the side of the boy

C) outside the bus

D) in the hands of the boy

E) in the bus behind the boy

Correct Answer : Option D

7. A machine gun fires a bullet of mass 25 g with a velocity of 1000 ms^{-1}. If the man holding the gun can exert a maximum force of 100 N on the gun, the maximum number of bullets that he can fire per second is

A) 4

B) 12

C) 8

D) 6

E) 3

Correct Answer : Option A

8. When a vehicle moving with kinetic energy *K* is stopped in a distance *d* by applying a stopping force *F* given by

A) $F = \dfrac{K}{d}$

B) $F = Kd$

C) $F = \dfrac{1}{Kd}$

D) $F = \dfrac{d}{K}$

E) $F = \dfrac{d}{K^2}$

Correct Answer : Option A

9. In moving a body of mass m down a smooth incline of inclination θ with velocity v, the power required is (g = acceleration due to gravity)

A) $mg\,v$

B) $(mg\cos\theta)v$

C) $(mg\sin\theta)v$

D) $\dfrac{mg\sin\theta}{v}$

E) $\dfrac{mg\cos\theta}{v}$

Correct Answer : Option C

10. The torque required to increase the angular speed of a uniform solid disc of mass 10 kg and diameter 0.5 m from zero to 120 rotations per minute in 5 sec. is

A) $\dfrac{\pi}{4}$ Nm

B) π Nm

C) $\dfrac{\pi}{2}$ Nm

D) $\dfrac{\pi}{3}$ Nm

E) $\dfrac{3\pi}{4}$ Nm

Correct Answer : Option A

11. Radius of gyration K of a hollow cylinder of mass M and radius R about its long axis of symmetry is

A) $2R$

B) $\dfrac{R}{2}$

C) R

D) $\dfrac{R}{4}$

E) $\dfrac{3R}{4}$

Correct Answer : Option C

12. The value of escape velocity v_e for a planet depends on

A) the mass of the body thrown from the planet

B) the direction of projection of the body

C) the angle of projection

D) only on the mass of the planet

E) its mass M, density ρ and radius of the planet

Correct Answer : Option E

13. The slope of the graph plotted between square of time period of a planet T^2 and the cube of its mean distance from the sun r^3 is

(G = Gravitational constant, M = Mass of the planet)

A) $\dfrac{4\pi^2}{GM}$

B) $4\pi\, GM$

C) $\dfrac{4\pi\, G}{M}$

D) $\dfrac{4\pi^2 M}{G}$

E) Zero

Correct Answer : Option A

14. If n small identical liquid drops, each having terminal velocity v merge together, then the terminal velocity of the bigger drop is

A) $n^2 v$

B) $n^{1/3} v$

C) $\dfrac{v}{n}$

D) nv

E) $n^{2/3} v$

Correct Answer : Option E

15. A fluid has stream line flow through a horizontal pipe of variable cross-sectional area. Then

A) its velocity is minimum at the narrowest part of the tube and the pressure is minimum at the widest point

B) its velocity and pressure both are maximum at the widest point

C) its velocity and pressure both are minimum at the narrowest point

D) its velocity is maximum at the narrowest point and the pressure is maximum at the widest part

E) its velocity is maximum and pressure is minimum at the narrowest point

Correct Answer : Option E

16. A metal rod of length 1 m at 20°C is made up of a material of coefficient of linear expansion 2×10^{-5} /°C. The temperature at which its length is increased by 1 mm is

A) 45 °C

B) 70 °C

C) 65 °C

D) 60 °C

E) 50 °C

Correct Answer : Option B

17. The ends of a metallic rod are at temperatures T_1 and T_2 and the rate of flow of heat through it is Q Js^{-1} . If all the dimensions of the rod are halved keeping the end temperatures constant, the new rate of flow of heat will be

A) $2Q$

B) $\dfrac{Q}{8}$

C) $\dfrac{Q}{4}$

D) $\dfrac{Q}{2}$

E) Q

Correct Answer : Option D

18. The rate of emission of a perfectly black body at temperature 27°C is E_1. If the temperature of the body is raised to 627°C, its rate of emission becomes E_2. The ratio of $\dfrac{E_1}{E_2}$ is

A) $\dfrac{1}{81}$

B) $\dfrac{1}{16}$

C) $\dfrac{1}{25}$

D) $\dfrac{1}{36}$

E) $\dfrac{1}{49}$

Correct Answer : Option A

19. A monoatomic ideal gas of 'n' moles heated from temperature T_1 to T_2 under two different conditions (i) at constant pressure (ii) at constant volume. The change in the internal energy of the gas is

A) more in process (ii)
B) more in process (i)
C) same in both the processes
D) zero
E) proportional to $\dfrac{T_1 + T_2}{2}$

Correct Answer : Option C

20. The ratio between the root mean square velocities of O_2 and O_3 molecules at the same temperature is

A) $3 : 2$
B) $2 : 3$
C) $1 : 1$
D) $\sqrt{3} : \sqrt{2}$
E) $\sqrt{2} : \sqrt{3}$

Correct Answer : Option D

21. A particle is executing linear simple harmonic oscillation with an amplitude of A. If the total energy of oscillation is E, then its kinetic energy at a distance of 0.707 A from the mean position is

A) $\dfrac{E}{2}$

B) $\dfrac{E}{4}$

C) $\dfrac{3E}{4}$

D) $\dfrac{E}{4}$

E) E

Correct Answer : Option A

22. The equation of a stationary wave is given by

$$y = 5\sin\dfrac{\pi x}{2}\cos 10\pi t \ cm$$

The distance between two consecutive nodes (in *cm*) is

A) 5
B) 2
C) 8
D) 1
E) 6

Correct Answer : Option B

23. A thin spherical shell of radius 12 cm is charged such that the potential on its surface is 60 V. Then the potential at the centre of the sphere is

A) 5 V
B) Zero
C) 30 V
D) 120 V
E) 60 V

Correct Answer : Option E

24. A stationary body of mass 5 g carries a charge of $5\,\mu C$. The potential difference with which it should be accelerated to acquire a speed of 10 ms^{-1} is

A) 4 kV
B) 25 kV
C) 50 kV
D) 40 kV
E) 2 kV

Correct Answer : Option C

25. An electric dipole of dipole moment p is kept in a uniform electric field E such that it is aligned parallel to the field. The energy required to rotate it by 45° is

A) pE

B) $pE\dfrac{(\sqrt{2}+1)}{\sqrt{2}}$

C) $pE\dfrac{(\sqrt{2}-1)}{\sqrt{2}}$

D) $\dfrac{pE}{\sqrt{2}}$

E) $\sqrt{2}\,pE$

Correct Answer : Option C

26. A steady current of 2A is flowing through a conducting wire. The number of electrons flowing per second in it is

A) 1.25×10^{7}

B) 1.25×10^{19}

C) 2.50×10^{10}

D) 0.125×10^{25}

E) 2.5×10^{17}

Correct Answer : Option B

27. If the voltage across a bulb rated 220V – 60 W drops by 1.5% of its rated value, the percentage drop in the rated value of the power is

A) 0.75%
B) 1.5%
C) 4.5%
D) 3%
E) 2.5%

Correct Answer : Option D

28. The terminal potential difference of a cell in the open circuit is 2 V. When the cell is connected to a 10Ω resistor, the terminal potential difference falls to 1.5 V. The internal resistance of the cell is

A) $\dfrac{10}{3}\Omega$

B) $\dfrac{10}{9}\Omega$

C) $\dfrac{20}{7}\Omega$

D) $\dfrac{15}{6}\Omega$

E) $\dfrac{13}{2}\Omega$

Correct Answer : Option A

29. For a linear material, the relation between the relative magnetic permeability μ_r and magnetic susceptibility χ is (μ = magnetic permeability)

A) $\chi = \mu_r + 1$

B) $\chi = \mu_r - 1$

C) $\chi = \mu\mu_r$

D) $\mu - 1$

E) $\chi = \mu + 1$

30. The magnetic field at the centre of a circular coil having single turn of the wire carrying current I is B. The magnetic field at the centre of the same coil with 4 turns carrying the same current is

A) 16B

B) 8B

C) 4B

D) $\dfrac{B}{2}$

E) $\dfrac{B}{4}$

31. A current carrying square loop is suspended in a uniform magnetic field acting in the plane of the loop. If $\vec{F}$ is the force acting on one arm of the loop, then the net force acting on the remaining three arms of the loop is

A) $-3\vec{F}$

B) $3\vec{F}$

C) $\vec{F}$

D) $-\vec{F}$

E) $-\dfrac{1}{2}\vec{F}$

32. If the magnetic field energy stored in an inductor changes from maximum to minimum value in 5 ms, when connected to an a.c. source, the frequency of the a.c. source is

A) 200 Hz

B) 500 Hz

C) 50 Hz

D) 20 Hz

E) 100 Hz

33. In an LCR circuit, at resonance, the value of the power factor is

A) 1

B) 0

C) 0.5

D) 0.75

E) infinity

34. An electromagnetic wave is propagating in a medium with velocity $\vec{v} = v\hat{i}$. The instantaneous oscillating magnetic field of this electromagnetic wave is along positive z direction. Then the direction of oscillating electric field is in the

A) positive x direction
B) negative x direction
C) positive y direction
D) negative y direction
E) negative z direction

Correct Answer : Option C

35. When light is reflected from an optically rarer medium

A) its phase remains unchanged but its frequency increases
B) both its phase and frequency remain unchanged
C) its phase changes by π but the frequency remains unchanged
D) its phase remains the same but the frequency decreases
E) its phase changes by $\pi/2$ but the frequency remains unchanged

Correct Answer : Option B

36. Focal length of a convex lens of refractive index 1.5 is 3 cm. When the lens is immersed in water of refractive index $\frac{4}{3}$, its focal length will be

A) 3 cm
B) 10 cm
C) 12 cm
D) 1.5 cm
E) 6 cm

Correct Answer : Option C

37. A narrow single slit of width d is illuminated by white light. If the first minimum for violet light ($\lambda = 4500$ Å) falls at $\theta = 30°$, the width of the slit d in microns is (1 micron = 10^{-6} m)

A) 0.4
B) 0.5
C) 0.3
D) 0.7
E) 0.9

Correct Answer : Option E

38. Threshold frequency for photoelectric effect from a metallic surface corresponds to a wavelength of 6000 Å. The photoelectric work function for the metal is ($h = 6.6 \times 10^{-34}$ Js)

A) 1.5×10^{-19} J
B) 2.7×10^{-18} J
C) 5.4×10^{-18} J
D) 4.5×10^{-19} J

E) 3.3×10^{-19} J

Correct Answer : Option E

39. A proton and a photon have the same energy. Then the de-Broglie wavelength of proton λ_p and wavelength of photon λ_0 are related by

A) $\lambda_0 \propto \dfrac{1}{\sqrt{\lambda_p}}$

B) $\lambda_0 \propto \sqrt{\lambda_p}$

C) $\lambda_0 \propto \lambda_p$

D) $\lambda_0 \propto \lambda_p^2$

E) $\lambda_0 \propto \dfrac{1}{\lambda_p}$

Correct Answer : Option D

40. Bohr atom model is invalid for
A) Hydrogen atom
B) doubly ionized helium atom
C) deuteron atom
D) singly ionized helium atom
E) doubly ionized lithium atom

Correct Answer : Option B

41. The energy equivalent of 1 g of a substance in joules is

A) 9×10^{13}

B) 4.5×10^{13}

C) 1×10^{13}

D) 0.5×10^{13}

E) 2.25×10^{13}

Correct Answer : Option A

42. Mass numbers of two nuclei are in the ratio 2:3. The ratio of the nuclear densities would be

A) $2:3^{1/3}$

B) $3^{1/3}:2$

C) $2:3$

D) $3:2$

E) $1:1$

43. Four hydrogen atoms combine to form an $_2^4He$ atom with a release of 26.7 MeV of energy. This is

A) fission reaction

B) β^+ emission

C) β^- emission

D) γ emission

E) fusion reaction

44. In the circuit given below, the current is

A) 0.10 A

B) 10^{-3} A

C) 0.5 A

D) 1 A

E) 0A

45. Electric conduction in a semiconductor is due to

A) holes only

B) electrons only

C) neither holes nor electrons

D) both electrons and holes

E) recombination of electrons and holes

46. 260 g of an aqueous solution contains 60 g of urea (Molar mass = 60 g mol^{-1}). The molality of the solution is

A) 2m

B) 3m

C) 4m

D) 5m

E) 6m

47. Which of the following pair exhibits diagonal relationship?

A) Li and Mg

B) Li and Na

C) Mg and Al

D) B and P

E) C and Cl

Correct Answer : Option A

48. The molecule which has see saw in structure is

A) NH_3

B) SF_4

C) CCl_4

D) $SiCl_4$

E) BrF_5

Correct Answer : Option B

49. The quantum number which determines the shape of the subshell is

A) Principal quantum number

B) Magnetic quantum number

C) Azimuthal quantum number

D) Spin quantum number

E) Principal and magnetic quantum number

Correct Answer : Option C

50. The total enthalpy change when 1 mol of water at 100°C and 1 bar pressure is converted to ice at 0°C is ------------.

(Enthalpy of fusion of ice = 6.00 kJ mol^{-1}, heat capacity of water = 4.2 J K^{-1} g^{-1}, molar mass of H_2O = 18 g mol^{-1})

A) -7.56 kJ mol^{-1}

B) -6.00 kJ mol^{-1}

C) -13.56 kJmol^{-1}

D) -756 kJ mol^{-1}

E) -1.356 kJ mol^{-1}

Correct Answer : Option C

51. The balanced ionic equation for the reaction of $K_2Cr_2O_7$ with Na_2SO_3 in an acid solution is

A) $Cr_2O_7^{2-}(aq) + SO_3^{2-}(aq) + 8H^+ (aq) \rightarrow 2Cr^{3+} (aq) + SO_4^{2-} (aq) + 4H_2O (l)$

B) $Cr_2O_7^{2-}(aq) + 3SO_3^{2-}(aq) + 2H^+ (aq) \rightarrow 2Cr^{3+} (aq) + 3SO_4^{2-} (aq) + H_2O (l)$

C) $3Cr_2O_7^{2-}(aq) + 3SO_3^{2-}(aq) + 8H^+ (aq) \rightarrow 6Cr^{3+} (aq) + 3SO_4^{2-} (aq) + H_2O (l)$

D) $3Cr_2O_7^{2-}(aq) + 3SO_3^{2-}(aq) + 2H^+ (aq) \rightarrow 3Cr^{3+} (aq) + 3SO_4^{2-} (aq) + H_2O (l)$

E) $Cr_2O_7^{2-}(aq) + 3SO_3^{2-}(aq) + 8H^+ (aq) \rightarrow 2Cr^{3+} (aq) + 3SO_4^{2-} (aq) + 4H_2O (l)$

Correct Answer : Option E

52. The limiting molar conductances of NaCl, HCl and CH_3COONa at 300 K are 126.4, 425.9 and 91.0 S cm^2 mol^{-1} respectively. The limiting molar conductance of acetic acid at 300 K is

A) 266 S cm^2 mol^{-1}

B) 390.5 S cm^2 mol^{-1}

C) 461.3 S cm^2 mol^{-1}

D) 208 S cm^2 mol^{-1}

E) 108 S cm^2 mol^{-1}

Correct Answer : Option B

53. Which of the following liquid pair shows negative deviation from Raoult's law?

A) Phenol – Aniline

B) Acetone - Carbon disulphide

C) Benzene – Toluene

D) n-hexane – n-heptane

E) Bromoethane – Chloroethane

Correct Answer : Option A

54. The half-life period of a first order reaction is 1000 seconds. Its rate constant is

A) 0.693 sec^{-1}

B) 6.93 x 10^{-2} sec^{-1}

C) 6.93 x 10^{-3} sec^{-1}

D) 6.93 x 10^{-4} sec^{-1}

E) 6.93 x 10^{-1} sec^{-1}

Correct Answer : Option D

55. Which of the following material acts as a semiconductor at 298 K?

A) Iron

B) Copper oxide

C) Sodium

D) Graphite

E) Glass

Correct Answer : Option B

56. The resistance of a conductivity cell filled with 0.02 M KCl solution is 520 ohm at 298 K. The conductivity of the solution at 298 K is (Cell constant = 130 cm^{-1})

A) 0.50 S cm^{-1}

B) 1.25 S cm^{-1}

C) 0.025 S cm^{-1}

D) 0.25 S cm^{-1}

E) 0.75 S cm^{-1}

Correct Answer : Option D

57. For the equilibrium at 500 K, $N_{2 (g)}$ + $3H_{2 (g)}$ ⇌ $2NH_{3 (g)}$, the equilibrium concentrations of $N_{2 (g)}$, $H_{2 (g)}$ and $NH_{3 (g)}$ are respectively 4.0 M, 2.0 M and 2.0 M. The Kc for the formation of NH_3 at 500 K is

A) 1/16 mol^{-2} dm^6

B) 1/32 mol^{-2} dm^6

C) 1/8 mol^{-2} dm^6

D) 1/4 mol^{-2} dm^6

E) $1/2\ mol^{-2}\ dm^6$

Correct Answer : Option C

58. The molarity of a solution containing 8 g of NaOH (Molar mass = 40 g mol^{-1}) in 250 mL solution is
A) 0.8M
B) 0.4M
C) 0.2M
D) 0.5M
E) 0.6M

Correct Answer : Option A

59. Which of the following are the conditions for a reaction spontaneous at all temperatures?
A) $\Delta_r H > 0 ; \Delta_r S > 0$
B) $\Delta_r H < 0 ; \Delta_r S > 0$
C) $\Delta_r H < 0 ; \Delta_r S < 0$
D) $\Delta_r H = 0 ; \Delta_r S < 0$
E) $\Delta_r H = 0 ; \Delta_r S = 0$

Correct Answer : Option B

60. Transition elements act as catalyst because
A) their melting points are high
B) their ionization potential values are high
C) they have high density
D) they show variable oxidation state
E) they have high electronegativity

Correct Answer : Option D

61. Lanthanides (Ln) burn in O_2 to give
A) LnO
B) $Ln(OH)_3$
C) Ln_2O_3
D) LnO_2
E) LnO_3

Correct Answer : Option C

62. The IUPAC name of the coordination compound $Hg[Co(SCN)_4]$ is
A) Mercury (I) tetrathiocyanato-S-cobaltate (III)
B) Mercury (II) tetrathiocyanato-S-cobaltate(II)
C) Mercury (I) tetrathiocyanato-S-cobaltate (IV)
D) Mercury (II) tetraisocyanato-S-cobaltate (III)
E) Mercury (I) tetraisocyanato-N-cobaltate (III)

Correct Answer : Option A

63. In a combustion reaction, heat change during the formation of 40 g of carbon dioxide from carbon and dioxygen gas is (Enthalpy of combustion of carbon = -396 kJ mol^{-1})
A) 320 kJ

B) -320 kJ

C) -360 kJ

D) 360 kJ

E) 240 kJ

Correct Answer : Option C

64. Which of the following statement is incorrect?

A) Hyperconjugation is a permanent effect.

B) Tertiary carbocation is relatively more stable than a secondary carbocation.

C) F has stronger -I effect than Cl.

D) Inductive effect decreases with increasing distance.

E) When inductive and electromeric effects operate in opposite directions, the inductive effect predominates.

Correct Answer : Option E

65. Which of the following statement is incorrect with regard to ozonolysis?

A) It involves addition of ozone on alkene.

B) An unsymmetrical alkene gives two different carbonyl compounds.

C) It is used to identify the number of double bonds in starting material.

D) It cannot be used to detect the position of the double bonds.

E) Ozonide will undergo cleavage by Zn-H_2O.

Correct Answer : Option D

66. Which of the following statement is true?

A) Dehydration of alcohol takes place in presence of $HCl/ZnCl_2$.

B) Formation of ethene from ethyl iodide occurs on heating with aqueous KOH.

C) Hydrogenation of an unsymmetrical alkyne in presence of Pd/C gives *cis*- alkene.

D) Hydrogenation of an unsymmetrical alkyne in presence of Na/liq.NH_3 gives *cis*-alkene.

E) The order of reactivity of hydrogen halides towards alkenes is HI < HBr < HCl.

Correct Answer : Option C

67. An organic compound X (C_6H_6O) on reaction with zinc dust gives 'Y'. The product 'Y' reacts CH_3COCl in presence of anhydrous $AlCl_3$ to give 'Z' (C_8H_8O). The compounds X, Y and Z are respectively

A) benzaldehyde, benzene, methyl phenyl ketone

B) phenol, benzene, acetophenone

C) phenol, naphthalene, acetophenone

D) benzene, phenol, diphenyl ketone

E) cyclohexanol, cyclohexane, benzophenone

Correct Answer : Option B

68. The percentage amylose in starch is about

A) 40-50 %

B) 80-85 %

C) 60-80 %

D) 50-60 %

E) 15 – 20 %

Correct Answer : Option E

69. Which of the following statement is correct?

A) Bromination of phenol in CS_2 at low temperature give 2,4,6-tribromophenol.

B) Oxidation of phenol with chromic acid gives benzene.

C) Conversion of phenol into tribromophenol by bromine water is a nucleophilic substitution reaction.

D) p-Nitrophenol is steam volatile due to intermolecular hydrogen bonding.

E) The intermediate in Riemer-Tiemann reaction is substituted benzal chloride.

Correct Answer : Option E

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

A) cupric oxide

B) cuprous oxide

C) carboxylic acid

D) silver

E) copper acetate

Correct Answer : Option B

71. The decreasing order of basic strength of amines in aqueous medium is

A) $CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N > NH_3$

B) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$

C) $(CH_3)_2NH > (CH_3)_3N > CH_3NH_2 > NH_3$

D) $(CH_3)_2NH > NH_3 > (CH_3)_3N > CH_3NH_2$

E) $NH_3 > CH_3NH_2 > (CH_3)_3N > (CH_3)_2NH$

Correct Answer : Option B

72. Which of the following statement is correct?

A) Sucrose is laevorotatory.

B) Fructose is a disaccharide.

C) Sucrose on hydrolysis gives D(+)-glucose only.

D) Sucrose is made up of a glycosidic linkage between C1 of α-D-glucose and C2 of β-D-Fructose.

E) Sucrose is a reducing sugar.

Correct Answer : Option D

73. The structure of MnO_4^- ion is

A) square planar

B) octahedral

C) trigonal pyramid

D) pyramid

E) tetrahedral

Correct Answer : Option E

74. When benzene diazonium fluoroborate is heated with aqueous sodium nitrite solution in the presence of copper, the product formed is

A) fluorobenzene

B) benzene

C) aniline

D) nitrobenzene

E) phenol

Correct Answer : Option D

75. A fibrous protein present in muscles is

A) keratin

B) albumin

C) riboflavin

D) insulin

E) myosin

Correct Answer : Option E

76. Let *P* and *Q* be two finite sets having 3 elements each. The total number of mappings from *P* to *Q* is

A) 32

B) 516

C) 6

D) 9

E) 27

Correct Answer : Option E

77. If $f(x) = [x]$, where $[x]$ denotes the greatest integer function, and if the domain of f is $\{-3.01, 2.99\}$, then the range of f is

A) $\{-3, 3\}$

B) $\{-4, 3\}$

C) $\{-3, 2\}$

D) $\{-4, 2\}$

E) $\{-2, 3\}$

Correct Answer : Option D

78. The domain of the function $f(x) = \sqrt{7 - 8x + x^2}$ is

A) $(-\infty, 1] \cup (7, \infty)$

B) $(-\infty, 1] \cup [7, \infty)$

C) $(-\infty, 1) \cup [7, \infty)$

D) $(-\infty, -1] \cup [7, \infty)$

E) $(-\infty, -7] \cup [1, \infty)$

Correct Answer : Option B

79. The period of the function $\sin\left(\dfrac{\pi x}{4}\right)$ is

A) 4

B) 4π

C) 8π

D) 8

E) 2π

Correct Answer : Option D

80. If $f(x) = x + 8$, and $g(x) = 2x^2$, then $(g \circ f)(x)$ is equal to

A) $(2x + 8)^2$

B) $2(x + 8)^2$

C) $2x^2 + 8$

D) $2x^2 + 64$

E) $2x^3 + 8x$

Correct Answer : Option B

81. If $f(x) = \dfrac{x}{1-x}$, $x \neq 1$, then the inverse of f is

A) $\dfrac{1-x}{1+x}$, $x \neq -1$

B) $\dfrac{1}{1+x}$, $x \neq -1$

C) $\dfrac{1-x}{x}$, $x \neq 0$

D) $\dfrac{x}{1+x}$, $x \neq -1$

E) $\dfrac{1+x}{1-x}$, $x \neq 1$

Correct Answer : Option D

82. If the complex numbers $(2+i)x + (1-i)y + 2i - 3$ and $x + (-1+2i)y + 1 + i$ are equal, then (x, y) is

A) (1,-2)

B) (-1,2)

C) (2,-1)

D) (2,-2)

E) (2,1)

Correct Answer : Option E

83. If $x + iy = \dfrac{3+4i}{5-12i}$, then $x + y$ is equal to

A) $\dfrac{23}{169}$

B) $\dfrac{56}{169}$

C) $-\dfrac{15}{169}$

D) $\dfrac{15}{169}$

E) $\dfrac{71}{169}$

Correct Answer : Option A

84. If $z = 1+i$, then the maximum value of $|z+12+9i|$ is

A) 225
B) 265
C) 269
D) 200
E) $\sqrt{265}$

Correct Answer : Option C

85. If $\left|\dfrac{z-5i}{z+5i}\right| = 1,$ then

A) $\text{Re}(z)=0$

B) $|z|=10$

C) $|z|=25$

D) $|z|=5$

E) $\text{Im}(z)=0$

Correct Answer : Option E

86. The coefficient of x^7 in the expansion of $\left(\dfrac{1}{x}+x^2\right)^8$ is

A) 70
B) 28
C) 42
D) 56
E) 8

Correct Answer : Option D

87. If $a_1 = 3$ and $a_n = na_{n-1}$, for $n \geq 2$, then a_6 is equal to

A) 72
B) 144
C) 720
D) 2160
E) 4320

88. If $\dfrac{1}{\log_2 x}+\dfrac{1}{\log_3 x}+\dfrac{1}{\log_4 x}+\dfrac{1}{\log_5 x}+\dfrac{1}{\log_6 x}=1$, then the value of x is equal to

A) 18

B) 36

C) 120

D) 360

E) 720

89. The common ratio of a G.P. is 10. Then the ratio between its 11th term and its 6th term is

A) $10^6 :1$

B) $10^5 :1$

C) $10^4 :1$

D) $10^{11} :1$

E) $10^3 :1$

90. Let a, b, c be positive numbers. If $a+b+c \geq K\left[(a+b)(b+c)(c+a)\right]^{1/3}$, then the maximum value of K is

A) $\dfrac{3}{2}$

B) $\dfrac{1}{2}$

C) $\dfrac{1}{4}$

D) $\dfrac{1}{8}$

E) 1

91. If $A = \begin{bmatrix} 4 & -1 \\ 12 & x \end{bmatrix}$ and $A^2 = A$, then the value of x is

A) -8

B) -3

C) 0

D) 3

E) 8

92. If $A = \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix}$, then $A^2 (\text{adj} A)$ is

A) I

B) $4I$

C) $2A$

D) $3A$

E) A

Correct Answer : Option E

93. If $|x - 2| \le 4$, then x lies in the interval

A) $(-\infty, -2)$

B) $(-\infty, 0)$

C) $[-2, 6]$

D) $[-2, \infty)$

E) $(-2, 4)$

Correct Answer : Option C

94. If $\tan\left(\dfrac{\pi}{12} + 2x\right) = \cot 3x$, where $0 < x < \dfrac{\pi}{2}$, then the value of x is

A) $\dfrac{\pi}{12}$

B) $\dfrac{\pi}{3}$

C) $\dfrac{\pi}{4}$

D) $\dfrac{\pi}{6}$

E) $\dfrac{\pi}{24}$

Correct Answer : Option A

95. If $\cos\theta + \sin\theta = \sqrt{2}$, then $\cos\theta - \sin\theta$ is equal to.

A) 0

B) $-1/2$

C) $1/2$

D) $1/4$

E) 1

Correct Answer : Option A

96. The value of cos 26° + cos 54° + cos 126° + cos 206° + cos 240° is.

A) 0

B) 1

C) -1/2

D) 1/2

E) -1

Correct Answer : Option C

97. If $\cos x - \sin x = 0$, $0 \le x \le \pi$, then the value(s) of x is/are

A) $\dfrac{\pi}{4}, \dfrac{3\pi}{4}$

B) $\dfrac{\pi}{4}, \dfrac{5\pi}{4}$

C) $\dfrac{\pi}{4}$

D) $\dfrac{5\pi}{4}$

E) $\dfrac{3\pi}{4}$

Correct Answer : Option B

98. If $2\sin\left(\dfrac{\pi}{3} - 2x\right) - 1 = 0$, $0 < x < \dfrac{\pi}{2}$, then the value of x is

A) $\dfrac{\pi}{4}$

B) $\dfrac{\pi}{3}$.

C) $\dfrac{5\pi}{12}$

D) $\dfrac{\pi}{12}$

E) $\dfrac{\pi}{6}$

Correct Answer : Option D

99. Domain of the function $\sin^{-1}(2x-1)$ is

A) $[0,1]$

B) $[0,\infty]$

C) $[-\infty,1]$

D) $[1,\infty]$

E) $[-1,1]$

100. If $3\tan^{-1}x + \cot^{-1}x = \pi$ then $\sin^{-1}x$ is

A) $\dfrac{\pi}{12}$

B) $\dfrac{\pi}{3}$.

C) $\dfrac{\pi}{4}$

D) $\dfrac{\pi}{6}$

E) $\dfrac{\pi}{2}$

101. $\tan^{-1}2 - \tan^{-1}\left(\dfrac{1}{3}\right)$ is equal to

A) $\dfrac{\pi}{2}$

B) $\dfrac{\pi}{3}$

C) $\dfrac{\pi}{4}$

D) $\dfrac{\pi}{6}$

E) 0

102. $\sin^{-1}\left(\sin\left(\dfrac{5\pi}{6}\right)\right)$ is equal to

A) $\dfrac{5\pi}{6}$

B) $\dfrac{\pi}{6}$

C) $\dfrac{\pi}{3}$

D) $\dfrac{2\pi}{3}$

E) $\dfrac{\pi}{2}$

103. If $\sin x = \dfrac{3}{5}$, then the value of $\sec x + \tan x$ is equal to

A) -2
B) 3
C) 0
D) 2
E) -3

Correct Answer : Option D

104. If $P(-3,4)$ and $Q(3,1)$ are points on a straight line, then the slope of the straight line perpendicular to PQ is

A) 1
B) -2
C) 2
D) -1
E) $\sqrt{3}$

Correct Answer : Option C

105. The length of perpendicular from the origin to the line $\dfrac{x}{5} - \dfrac{y}{12} = 1$, is

A) $\dfrac{60}{13}$

B) $\dfrac{5}{12}$

C) $\dfrac{12}{5}$

D) $\dfrac{13}{12}$

E) $\dfrac{13}{60}$

Correct Answer : Option A

106. The equation of the straight line passing through the point $(1,1)$ and perpendicular to the line $x+y=5$, is

A) $x-y=2$

B) $x-y=0$

C) $x-y=-2$

D) $x+y=2$

E) $x+y=0$

Correct Answer : Option B

107. The area of the triangle formed by the coordinate axes and a line whose perpendicular from the origin makes an angle 45° with the x-axis is 50 square units. Then the equation of the line is

A) $x+y=10$

B) $x+2y=10$

C) $2x+y=5$

D) $x+y=25$

E) $x+y=5$

Correct Answer : Option A

108. The equation of the straight line, intersecting the coordinate axes x and y are respectively 1 and 2, is

A) x+y=3

B) x-2y=-3

C) 2x-y=0

D) 2x+y=2

E) x-y=-1

Correct Answer : Option D

109. If the sum of distances of a point from the origin and the line x =3 is 8, then its locus is

A) $y^2-10x+25=0$

B) $y^2+10x+25=0$

C) $y^2-10x-25=0$

D) $y^2-25x+10=0$

E) $y^2+25x-10=0$

Correct Answer : Option C

110. If the point $(2, k)$ lies on the circle $(x-2)^2+(y+1)^2=4$, then the value of k is

A) 1,3

B) 1,2

C) -1,3

D) 2,3

E) 1,-3

Correct Answer : Option E

111. The radius of the circle $x^2+y^2-2x-4y-4=0$ is

A) 2

B) 3

C) 4

D) 5

E) 6

112. The eccentricity of an ellipse is $\frac{1}{3}$ and its centre is at the origin. If one of the directrices is $x = 9$, then the equation of the ellipse is

A) $8x^2 + 9y^2 = 32$

B) $8x^2 + 9y^2 = 36$

C) $9x^2 + 8y^2 = 36$

D) $9x^2 + 8y^2 = 32$

E) $8x^2 + 9y^2 = 72$

113. If the parametric form of the circle is $x = 3\cos\theta + 3$ and $y = 3\sin\theta$, then the Cartesian form of the equation of the circle is

A) $x^2 + y^2 + 6x = 0$

B) $x^2 + y^2 - 6x = 9$

C) $x^2 + y^2 + 6x = 9$

D) $x^2 + y^2 - 6x = 0$

E) $x^2 + y^2 - 6x - 2y - 9 = 0$

114. A line makes angle α, β, γ with x, y and z-axis respectively. Then the value of $\sin^2\alpha + \sin^2\beta - \cos^2\gamma$ is

A) 3

B) 2

C) 1

D) $\frac{3}{2}$

E) 0

115. The direction ratios of the line joining the points (2, 3, 4) and (−1, 4, −3) is

A) $\pm(3, -1, 7)$

B) $\pm(-3, -1, 7)$

C) $\pm(3, 1, 7)$

D) $\pm(3, -1, -7)$

E) $\pm(-3, 1, 7)$

116. Equation of the line parallel to the line $\dfrac{x-2}{2} = \dfrac{y-2}{3} = \dfrac{z-1}{-2}$ and passing through the point $(3, 2, -1)$ is

A) $\dfrac{x-3}{2} = \dfrac{y-2}{3} = \dfrac{z+1}{2}$

B) $\dfrac{x+3}{2} = \dfrac{y+2}{3} = \dfrac{z-1}{-2}$

C) $\dfrac{x-3}{2} = \dfrac{y-2}{3} = \dfrac{z-1}{-2}$

D) $\dfrac{x-3}{2} = \dfrac{y-2}{3} = \dfrac{z+1}{-2}$

E) $\dfrac{x+3}{2} = \dfrac{y+2}{3} = \dfrac{z+1}{-2}$

Correct Answer : Option D

117. If the lines $\dfrac{x-1}{2} = \dfrac{y-2}{2} = \dfrac{z-3}{\alpha}$ and $\dfrac{x-1}{2} = \dfrac{y-2}{1} = \dfrac{z-3}{-2}$ are perpendicular, then the value of α is

A) 6

B) 4

C) 3

D) -3

E) -2

Correct Answer : Option C

118. If $\vec{a} = 2\vec{i} + 4\vec{j} + 7\vec{k}$ and $\vec{b} = 4\vec{i} + 7\vec{j} + 2\vec{k}$, then the angle between $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ is equal to

A) $\dfrac{\pi}{4}$

B) $\dfrac{\pi}{3}$

C) $\dfrac{\pi}{2}$

D) $\dfrac{2\pi}{3}$

E) $\dfrac{2\pi}{5}$

Correct Answer : Option C

119. A vector of magnitude 6 and perpendicular to $\vec{a} = 2\vec{i} + 2\vec{j} + \vec{k}$ and $\vec{b} = \vec{i} - 2\vec{j} + 2\vec{k}$, is

A) $\pm\left(2\vec{i} - \vec{j} - 2\vec{k}\right)$

B) $\pm 2\left(2\vec{i} - \vec{j} + 2\vec{k}\right)$

C) $\pm 3\left(2\vec{i} - \vec{j} - 2\vec{k}\right)$

D) $\pm 2\left(2\vec{i} + \vec{j} - 2\vec{k}\right)$

E) $\pm 2\left(2\vec{i} - \vec{j} - 2\vec{k}\right)$

Correct Answer : Option E

120. If $\vec{a}$ and $\vec{b}$ are non collinear unit vectors and $\left|\vec{a} + \vec{b}\right|^2 = 3$, then $\left(3\vec{a} + 2\vec{b}\right) \cdot \left(3\vec{a} - \vec{b}\right)$ is equal to

A) $\dfrac{32}{3}$

B) $\dfrac{17}{2}$

C) 15

D) 7

E) $\dfrac{17}{4}$

Correct Answer : Option B

121. If x_i, $i = 1, 2, 3, ..., n$ are n observations such that $\displaystyle\sum_{i=1}^{n} x_i^2 = 550$, mean $\bar{x} = 5$ and variance is zero, then the number of observations is equal to

A) 30

B) 25

C) 22

D) 16

E) 4

Correct Answer : Option C

122. If the mean of five observations x, $2x + 5$, 13, $2x - 7$, and 9 is 22, then the value of x is

A) 20

B) 15

C) 10

D) 12

E) 18

Correct Answer : Option E

123. If A and B are two independent events such that $P(A) = 0.4$ and $P(A \cup B) = 0.7$, then $P(B)$ is equal to

A) 0.3

B) 0.4

C) 0.5

D) 0.6

E) 0.7

124. The probability that at least one of A or B occurs is 0.6. If A and B occur simultaneously with probability 0.2, then $P(A')+ P(B')$ is

A) 0.7

B) 1.5

C) 1.1

D) 1.2

E) 0.3

125. $\lim\limits_{x\to 0}\left(\dfrac{\sin 5x}{\sin 3x} \right)$ is equal to

A) $\dfrac{3}{5}$

B) $\dfrac{5}{3}$

C) 1

D) 0

E) 5

126. The value of $\lim\limits_{x\to 1}\dfrac{x^2 +2x-3}{x-1}$ is equal to

A) 2

B) 4

C) 3

D) 1

E) 0

127. If $f(x)=\dfrac{1}{2-x}$, $g(x)=\dfrac{1}{1-x}$, then the point(s) of discontinuity of the function $g(f(x))$ is (are)

A) $x=2$

B) $x=3$

C) $x=2, x=3$

D) $x=2, x=1$

E) $x=1, x=-2$

128. Let $f(x)=\cos^{-1}\left(\dfrac{1-\tan^2 x}{1+\tan^2 x} \right)$. Then $f'\left(\dfrac{\pi}{2} \right)$ is equal to

A) -1

B) 2

C) 1

D) $\dfrac{\sqrt{3}}{2}$

E) $\sqrt{3}$

Correct Answer : Option B

129. If $x = r\cos\theta,\ y = r\sin\theta$, then $\dfrac{dy}{dx}$ at $\theta = \dfrac{\pi}{4}$, where r is a constant and θ is a parameter, is equal to

A) 0

B) 1

C) -1

D) $\sqrt{2}$

E) $\dfrac{1}{\sqrt{2}}$

Correct Answer : Option C

130. If $f(x) = \displaystyle\int_{0}^{x^3}(t+4)^2\,dt$, then is $f'(2)$ is equal to

A) 288

B) 432

C) 144

D) 216

E) 24

Correct Answer : Option B

131. $\displaystyle\lim_{x\to 0}\left(\dfrac{3\sin^2 2x}{x^2}\right)$ is equal to

A) 3

B) 2

C) 6

D) $\dfrac{3}{2}$

E) 12

Correct Answer : Option E

132. The function $f(x) = (x-4)^2(1+x)^3$ attains a local extremum at the point

A) $x = 2$

B) $x = -1$

C) $x = 0$

D) $x = 1$

E) $x = -2$

133. The derivative of $t^2 + t$ with respect to $t - 1$ at $t = -2$, is equal to

A) -4

B) 2

C) -1

D) -3

E) $-\dfrac{1}{2}$

134. If a continuous function f is defined as $f(x) = \begin{cases} ax+1, & x < 2 \\ x^2+7, & x \geq 2 \end{cases}$, then the value of a is

A) 7

B) 6

C) 5

D) 3

E) 2

135. If $f(x) = x|x|$, then $f'(-1) + f'(1)$ is equal to

A) 2

B) -2

C) 0

D) -4

E) 4

136. $\int \dfrac{1+x^2+x^4}{(1-x^3)(1+x^3)} dx$ is equal to

A) $\tan^{-1} x + C$

B) $\tan^{-1}(1+x^2) + C$

C) $\dfrac{1}{2}\log\dfrac{1+x}{1-x} + c$

D) $\log(1+x^3) + C$

E) $\log(1+x^2) + C$

137. A train starts from X towards Y at 3pm (time $t = 0$) with velocity $v(t) = 10t + 25$ kilometre per hour, where t is measured in hours. Then the distance covered by the train at 5pm (in km)

A) 70
B) 140
C) 35
D) 60
E) 55

Correct Answer : Option A

138. $\int \sqrt{1 + \sin 2x} \, dx =$

A) $\sin x - \cos x + C$

B) $\sin x - \operatorname{cosec} x + C$

C) $\tan x - \cot x + C$

D) $\cos x - \sec x + C$

E) $\tan x - \sec x + C$

Correct Answer : Option A

139. $\int xe^x \, dx$

A) $xe^x + e^x + C$

B) $e^x - xe^x + C$

C) $x + e^x + C$

D) $xe^x - e^x + C$

E) $xe^x - x^2e^x + C$

Correct Answer : Option D

140. $\int e^x \sec x (1 + \tan x) dx$

A) $e^x \sec x + C$

B) $e^x \tan x + C$

C) $e^x (\sec x + \tan x) + C$

D) $e^x \sec x \tan x + C$

E) $e^x \sec x + \tan x + C$

Correct Answer : Option A

141. $\int\limits_0^1 x(1-x)^{10} \, dx$ is equal to

A) $\dfrac{1}{110}$

B) $\dfrac{1}{132}$

C) $\dfrac{1}{156}$

D) $\dfrac{1}{90}$

E) $\dfrac{5}{156}$

Correct Answer : Option B

142. $\displaystyle\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \dfrac{\tan x + \sin x}{1+\cos^2 x}\, dx$ is equal to

A) 0

B) 2

C) $\sqrt{2}$

D) $2\sqrt{2}$

E) $-2\sqrt{2}$

Correct Answer : Option A

143. $\displaystyle\int_{5}^{10} [x]dx$ is equal to (where [x] denotes the greatest integer function)

A) 55

B) 45

C) 35

D) 26

E) 5

Correct Answer : Option C

144. $\displaystyle\int_{-2}^{4} x^2 |x|\, dx$ is equal to

A) 72

B) 68

C) 64

D) 48

E) 37

Correct Answer : Option B

145. $\displaystyle\int_{-1}^{1} x^2 \sin x\, dx$

A) 2sin1

B) 2

C) 4

D) -2sin1

E) 0

Correct Answer : Option E

146. The area of the region bounded by the curve $y = 3x^2$ and the x-axis, between $x = -1$ and $x = 1$, is

A) 2 sq. units.

B) 4 sq. units.

C) $\dfrac{55}{27}$ sq. units.

D) $\dfrac{55}{23}$ sq. units.

E) $\dfrac{1}{2}$ sq. units.

Correct Answer : Option A

147. The order and degree of the following differential equation $\dfrac{d^2y}{dx^2} - 2x = \sqrt{y + \dfrac{dy}{dx}}$ respectively, are

A) 2,2

B) 2,1

C) 1,2

D) 4,2

E) 1,1

Correct Answer : Option A

148. The solution of the differential equation $x + y\dfrac{dy}{dx} = 0$, given that at $x = 0, y = 5$ is

A) $x^2 + y^2 = 5y$

B) $x^2 + 5y^2 = 125$

C) $x^2 + y = 5$

D) $x^2 + y^2 = 25$

E) $2x^2 + y^2 = 25$

Correct Answer : Option D

149. The general solution of the differential equation $(x + y)^2 \dfrac{dy}{dx} = 1$ is

A) $y = \dfrac{1}{2}\tan^{-1}(x + y) + c$

B) $y = -(x + y)^{-1} + c$

C) $y = \dfrac{1}{3}(x+y)^3 + c$

D) $y = \sin^{-1}(x+y) + c$

E) $y = \tan^{-1}(x+y) + c$

Correct Answer : Option E

150. The equation of the curve passing through (1, 0) and which has slope $\left(1 + \dfrac{y}{x}\right)$ at (x, y), is

A) $y = xe^x$

B) $y = x + \log x$

C) $y = x - \log x$

D) $y = x + 2\log x$

E) $y = x\log x$

Correct Answer : Option E