Entrance Exam

2024



QUESTION PAPER

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FINAL ANSWER KEY

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1. If the displacement of a body moving on a horizontal surface is 151.25 cm in a time interval of 2.25 s, then the velocity of the body in the correct number of significant figures in cm s^{-1} is

A) 6722
B) 67.22
C) 67.222
D) 0.672
E) 67.2

Correct Answer : Option E

2. The dimensions of the torque is

A) $[M^0L^3T^{-2}]$
B) $[ML^3T^{-1}]$
C) $[M^{-1}L^3T^{-2}]$
D) $[ML^2T^{-2}]$
E) $[M^0L^0T^{-1}]$

Correct Answer : Option D

3. A particle is projected at an angle θ with the x axis is in the xy plane with a velocity $\vec{v} = 6\hat{i} - 4\hat{j}$. The velocity of the body on reaching the x axis again is

A) $6\hat{i} - 4\hat{j}$
B) $12\hat{i} - 8\hat{j}$
C) $3\hat{i} - 2\hat{j}$
D) $3\hat{i} + 2\hat{j}$
E) $6\hat{i} + 4\hat{j}$

Correct Answer : Option E

4. The displacement (x) – time (t) graph for the motion of a body is a straight line making an angle 45° with the time axis. Then the body is moving with

A) uniform velocity
B) uniform acceleration
C) non-uniform acceleration
D) decreasing velocity
E) increasing velocity

Correct Answer : Option A

5. A ball is thrown up vertically at a speed of 6.0 m s^{-1}. The maximum height reached by the ball (Take g = 10 m s^{-2}.) is ;

A) 80 m
B) 100 m
C) 18 m
D) 1.8 m
E) 1 m

Correct Answer : Option D

6. The INCORRECT statement is

A) Forces in nature always occur between pair of bodies
B) Action and reaction forces are simultaneous forces
C) Coefficient of static friction is greater than the coefficient of kinetic friction
D) Force is always in the direction of motion
E) Centripetal force acts towards the centre of a circle

Correct Answer : Option D

7. A bullet of 10 g, moving at 250 ms^{-1} penetrates 5 cm into a tree limb before coming to rest. Assuming uniform force being exerted by the tree limb, the magnitude of the force is:

A) 12.5 N
B) 625 N
C) 62.5 N
D) 125 N
E) 6250 N

Correct Answer : Option E

8. A block of mass M is kept on the floor of a lift at the centre. The acceleration with which the lift should descend so that the block exerts a force of $\frac{Mg}{4}$ on the floor of the lift is:

A) g
B) $\frac{g}{4}$
C) $\frac{g}{3}$
D) $\frac{3}{2g}$
E) $\frac{3g}{4}$

Correct Answer : Option E

9. A particle of mass 40 g executes simple harmonic motion of amplitude 2.0 cm. If the time period of oscillation is $\pi/20$ s, then the total mechanical energy of the system is :

A) 128 J
B) 128 mJ
C) 12.8 mJ

D) 256 mJ

E) 2.56 mJ

Correct Answer : Option C

10. The kinetic energy of a body is increased by 21 %. The percentage increase in the magnitude of its linear momentum is :

A) 10 %

B) 11 %

C) 1 %

D) 20 %

E) 21 %

Correct Answer : Option A

11. A tennis ball of mass 50g thrown vertically up at a speed of 25 m s^{-1} reaches a maximum height of 25 m. The work done by the resistance forces on the ball is :

A) 12.5 J

B) 50 J

C) 62.5 J

D) 25 J

E) 31.25 J

Correct Answer:-Question Cancelled

12. The radius of gyration of a circular disc of radius R, rotating about its diameter is

A) R

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

C) $\frac{R}{4}$

D) $\frac{R}{\sqrt{12}}$

E) $\frac{R}{3}$

Correct Answer : Option B

13. For a smoothly running analog clock, the angular velocity of its second hand in rad s^{-1} is

A) $\frac{\pi}{1540}$

B) $\frac{\pi}{720}$

C) $\frac{\pi}{360}$

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

E) $\frac{\pi}{30}$

Correct Answer : Option E

14. If the acceleration due to gravity on the surface of a planet is 2.5 times that on earth and radius, 10 times that of the earth, then the ratio of the escape velocity on the surface of a planet to that on earth is

A) 1:1
B) 1:2
C) 2:1
D) 1:5
E) 5:1

Correct Answer : Option E

15. The time period of revolution of a planet around the sun in an elliptical orbit of semi-major axis a is T. Then

A) $T^2 \propto a^2$
B) $T \propto a^3$
C) $T^2 \propto a^3$
D) $T \propto \frac{1}{a^3}$
E) $T^2 \propto \frac{1}{a^3}$

Correct Answer : Option C

16. In an incompressible liquid flow, mass conservation leads to

A) equation of continuity
B) Bernoulli's law
C) Stoke's law
D) Toricelli's law
E) Pascal's law

Correct Answer : Option A

17. The maximum velocity of a fluid in a tube for which the flow remains streamlined is called its

A) terminal velocity
B) critical velocity
C) turbulent velocity
D) streamlined velocity
E) surface velocity

Correct Answer : Option B

18. Coefficient of linear expansion of aluminum is $2.5 \times 10^{-5}\ K^{-1}$. Its coefficient of volume expansion in K^{-1} is

A) 1.25×10^{-5}
B) 5.0×10^{-5}
C) 7.5×10^{-5}
D) 1×10^{-4}
E) 4.0×10^{-5}

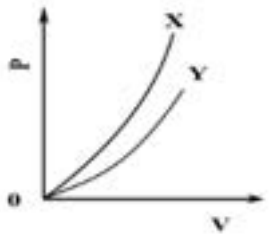
Correct Answer : Option C

19. The efficiency of a carnot engine operating between steam point and ice point is

A) 100 %
B) 50 %
C) 77 %
D) 27 %
E) 11 %

Correct Answer : Option D

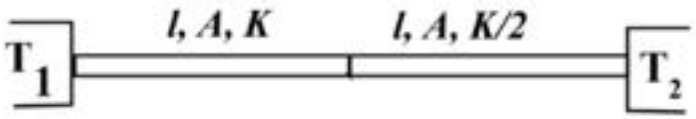
20. The processes depicted by the following PV diagram for the two systems X and Y, respectively, are



A) isothermal and isobaric
B) Isothermal and Adiabatic
C) isobaric and isochoric
D) isochoric and isobaric
E) Adiabatic and isothermal

Correct Answer:-Question Cancelled

21. Two similar metallic rods of same length l and area of cross section A are joined and maintained at temperatures T_1 and T_2 ($T_1 > T_2$) at one of their ends as shown in the figure. If their thermal conductivities are K and $\frac{K}{2}$ respectively. The temperature at the joining point in the steady state is



A) $\frac{T_1+T_2}{2}$
B) $\frac{2(T_2-T_1)}{3}$
C) $\frac{2T_1+T_2}{3}$
D) $\frac{T_2-T_1}{2}$
E) $\frac{3(T_2-T_1)}{2}$

Correct Answer : Option C

22. According to equipartition principle, the energy contributed by each translational degree of freedom and rotational degree of freedom at a temperature T are respectively (k_B =Boltzmann constant)

A) $\frac{1}{2}k_BT, \frac{1}{2}k_BT$

B) $k_BT, \frac{1}{2}k_BT$

C) k_BT, k_BT

D) $\frac{1}{2}k_BT, k_BT$

E) $\frac{3}{2}k_BT, \frac{1}{2}k_BT$

Correct Answer : Option A

23. The kinetic energy of 3 moles of a diatomic gas molecules in a container at a temperature T is same as that of kinetic energy of n moles of monoatomic gas molecules in another container at the same temperature T. The value of n is

A) 3

B) 4

C) 2.5

D) 5

E) 3.5

Correct Answer : Option D

24. A string of length L is fixed at both ends and vibrates in its fundamental mode. If the speed of waves on the string is v, then the angular wave number of the standing wave is:

A) $\frac{2}{\pi L}$

B) $\frac{1}{\pi L}$

C) $\frac{2\pi}{L}$

D) $\frac{\pi}{L}$

E) $\frac{\pi}{2L}$

Correct Answer : Option D

25. Ratio between the frequencies of the third harmonics in the closed organ pipe and open organ pipe of same length is

A) 2:1

B) 1:2

C) 1:4

D) 4:1

E) 1:5

Correct Answer : Option B

26. A tuning fork vibrating at 300 Hz, initially in air, is then placed in a trough of water. The ratio of the wavelength of the sound waves produced in air to that in water is (Given that the velocity of sound in water and in air at that place are 1500 ms^{-1} and 350 ms^{-1} respectively)

A) 1:1
B) 37:23
C) 30:7
D) 7:30
E) 23:37

Correct Answer : Option D

27. The ratio of the magnitudes of electrostatic force between an electron and a proton separated by a distance r to that between a proton and an alpha particle separated by the same distance r is

A) 1:1
B) 1:4
C) 4:1
D) 2:1
E) 1:2

Correct Answer : Option E

28. The electric field due to a an infinitely long thin wire with linear charge density λ at a radial distance r is proportional to

A) $\frac{\lambda^2}{r}$
B) $\frac{\lambda}{r}$
C) $\frac{\lambda}{r^2}$
D) $\sqrt{\frac{\lambda}{r}}$
E) $\frac{\lambda}{\sqrt{r}}$

Correct Answer : Option B

29. A spherical metal shell A of radius R_A and a solid metal sphere B of radius R_B ($< R_A$) are kept far apart and each is given charge +Q. If they are connected by a thin metal wire and Q_A and Q_B are the charge on A and B, respectively, then

A) $Q_A = Q_B = 0$
B) $Q_A = Q_B = Q$
C) $Q_A < Q_B$
D) $Q_A = -Q_B$
E) $Q_A > Q_B$

Correct Answer : Option E

30. If the number of electron-hole pairs per cm^3 of an intrinsic Si wafer at temperature 300 K is 1.1×10^{10} and the mobilities of electrons and holes at 300 K are 1500 and 500 cm^3 per volt, respectively, then the conductivity of the Si wafer at this temperature (in μmho cm^{-1}) is nearly:

A) 352
B) 35.2
C) 3.52
D) 70.4
E) 17.6

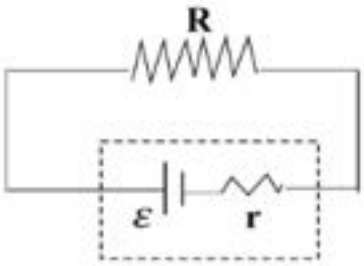
Correct Answer : Option C

31. Magnitude of drift velocity per unit electric field is known as

A) displacement current
B) mobility
C) electric resistance
D) electrical conductivity
E) relaxation time

Correct Answer : Option B

32. The y-intercept of the graph between the terminal voltage V with load resistance R along y and x – axis, respectively, of a cell with internal resistance r, as shown, is



A) ε
B) $-\varepsilon$
C) $\frac{\varepsilon}{R}$
D) εR
E) $-\varepsilon R$

Correct Answer : Option A

33. A charged particle will continue to move in the same direction in a region, where (E- Electric field, B – Magnetic field)

A) $E=0, B=0$
B) $E\neq0, B\neq0$
C) $E=0, B\neq0$
D) $E\neq0, B=0$
E) $E=B\neq0$

Correct Answer:-Question Cancelled

34. When an α particle and a proton are projected into a perpendicular uniform magnetic field, they describe circular paths of same radius. The ratio of their respective velocities is

A) 1:1
B) 1:4
C) 2:1
D) 1:2
E) 4:1

Correct Answer : Option D

35. An electric appliance draws 3A current from a 200 V, 50 Hz power supply. The amplitude of the supply voltage is nearly:

A) 140 V
B) 200 V
C) 283 V
D) 67 V
E) 600 V

Correct Answer : Option C

36. The oscillating magnetic field in a plane electromagnetic wave is given by $B_y = (8 \times 10^{-6}) \sin [2 \times 10^{-11} t + 200 \pi x]$ tesla. Then the wavelength of the electromagnetic wave (in cm) is:

A) 1
B) 2
C) 3
D) 4
E) 5

Correct Answer : Option A

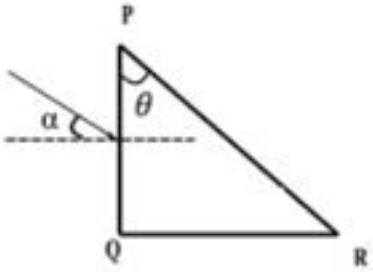
37. A path length of 1m in air medium is equal to a path length of x m in a medium of refractive index 1.5. Then the value of x (in metre) is

A) $\frac{1}{3}$
B) 1
C) $\frac{3}{5}$
D) $\frac{2}{3}$
E) $\frac{1}{2}$

Correct Answer : Option D

A parallel beam of light is incident from air at an angle α on the side PQ of a right-angled triangular prism of refractive index $\mu = \sqrt{2} = 1.414$. The beam of light undergoes total internal reflection in the prism at the face PR when α has a minimum value of 45°. The angle θ of the prism is

38.



A) 15°

B) 30°

C) 45°

D) 60°

E) 90°

Correct Answer : Option A

39. The wavelength of the de Broglie wave (in metre) associated with a particle of mass m moving with $\frac{1}{10}$th of the velocity of light is (h = Planck's constant, c = velocity of light)

A) $\frac{5h}{mc}$

B) $\frac{h}{mc}$

C) $\frac{10h}{mc}$

D) $\frac{2h}{mc}$

E) $\frac{4h}{mc}$

Correct Answer : Option C

40. For a given radioactive material of mean life τ and half-life, $t_{1/2}$,

A) $t_{1/2} = \frac{\ln 2}{\tau}$

B) $t_{1/2} = \tau \ln 2$

C) $t_{1/2} = \tau$

D) $t_{1/2} = 2\tau$

E) $t_{1/2} = \frac{\tau}{\ln 2}$

Correct Answer : Option B

41. The constancy of the binding energy per nucleon in medium sized nucleus is due to

A) short range nature of nuclear force
B) attractive nature of nuclear force
C) saturation of nuclear force
D) charge independent nature of nuclear forces
E) strongest nature of nuclear forces

Correct Answer : Option A

42. In a radioactive decay, fraction of the number of atoms left undecayed after time t is

A) $e^{-\lambda t+1}$
B) $e^{-\lambda t}$
C) $e^{+\lambda t}$
D) $e^{\lambda t-1}$
E) $e^{\lambda t+1}$

Correct Answer : Option B

43. In the electron emission process, ${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + e^{-} + q$, the particle q emitted along with the electron is

A) neutron
B) neutrino
C) antineutrino
D) proton
E) positron

Correct Answer : Option C

44. The current flowing from p to n side in a pn junction diode irrespective of biasing is termed

A) drift current
B) diffusion current
C) net current
D) displacement current
E) biasing current

Correct Answer : Option B

45. The energy required by the electron to cross the forbidden band for Germanium is

A) 0.72 eV
B) 1.1 eV
C) 0.5 eV
D) 1.5eV
E) 0.65 eV

Correct Answer : Option A

46. The molarity of sodium hydroxide in the solution prepared by dissolving 6 g in 600 mL of water is (molar mass of NaOH = 40 g mol^{-1})

A) 0.5 M
B) 0.4 M
C) 0.25 M
D) 0.1 M
E) 0.2 M

Correct Answer : Option C

47. The volume of ethanol required to prepare 3 L of 0.25 M aqueous solution is (density of ethanol= 0.36 kg L^{-1}, molar mass = 60 g mol^{-1})

A) 125 mL
B) 25mL
C) 75mL
D) 50mL
E) 12.5mL

Correct Answer : Option A

48. Which of the following statement is incorrect about Bohr's model of atom?

A) It fails to account for the finer details of the hydrogen atom spectrum.
B) Unable to explain the splitting of spectral lines in the presence of magnetic field.
C) The angular momentum of electron is quantised.
D) The ability of atoms to form molecule by chemical bonds.
E) Unable to explain the splitting of spectral lines in the presence of electric field.

Correct Answer : Option D

49. The decreasing order of first ionisation enthalpy of the following elements is

A) N>O>C>Be
B) O>N>C>Be
C) Be>C>O>N
D) O>N>Be>Ce
E) N>O>Be>C

Correct Answer : Option A

50. The hybridisation involved in the metal atom of $[CrF_6]^{3-}$ is

A) d^2sp^3
B) dsp^2
C) sp^3d
D) sp^3
E) sp^3d^2

Correct Answer : Option A

51. The valence electron MO configuration of C2(atomic number of C = 6) molecule is

A) $(\sigma_{2s})^3(\sigma^*_{2s})^3\ (\pi_{2p})^2$

B) $(\sigma_{2s})^2(\sigma^*_{2s})^2\ (\pi_{2p})^4$

C) $(\sigma_{2s})^2(\sigma^*_{2s})^3\ (\pi_{2p})^3$

D) $(\sigma_{2s})^2(\sigma^*_{2s})^4\ (\pi_{2p})^2$

E) $(\sigma_{2s})^2(\sigma^*_{2s})^1\ (\pi_{2p})^5$

Correct Answer : Option B

52. Which of the following is used as anode in mercury cell?

A) Paste of NH_4Cl and $ZnCl_2$

B) Manganese dioxide and carbon

C) Paste of HgO and carbon

D) Paste of KOH and ZnO

E) Zinc-Mercury amalgam

Correct Answer : Option E

53. Which of the following is true for a reaction is spontaneous only at high temperature?

A) $\Delta_rH^\ominus < 0, \Delta_rS^\ominus > 0, \Delta_rG^\ominus < 0$

B) $\Delta_rH^\ominus > 0, \Delta_rS^\ominus > 0, \Delta_rG^\ominus > 0$

C) $\Delta_rH^\ominus > 0, \Delta_rS^\ominus > 0, \Delta_rG^\ominus < 0$

D) $\Delta_rH^\ominus > 0, \Delta_rS^\ominus < 0, \Delta_rG^\ominus < 0$

E) $\Delta_rH^\ominus < 0, \Delta_rS^\ominus < 0, \Delta_rG^\ominus < 0$

Correct Answer : Option C

54. In a process, 600 J of heat is absorbed by a system and 375 J of work is done by the system. The change in internal energy of the process is

A) 975 J

B) -225 J

C) -975 J

D) 985 J

E) 225 J

Correct Answer : Option E

55. The value of K_c for the equilibrium reaction

$$2NO_{2\,(g)} \rightleftharpoons N_2O_{4(g)}$$

is 2×10^{-40} mol^{-1} dm^3 at 298 K. If the equilibrium concentration of NO_2 is 2×10^{-2}M, the concentration of N_2O_4 is

A) 6×10^{-42} M

B) 12×10^{-44} M

C) 8×10^{-44} M

D) 2×10^{-44} M

E) 4×10^{-44} M

Correct Answer : Option C

56. The quantity of electricity required to produce 18 g of Al from molten Al_2O_3 is (Atomic mass of Al = 27)

A) 2F
B) 4F
C) 5F
D) 6F
E) 1.5F

Correct Answer : Option A

57. The average oxidation state of sulphur in the tetrathionate ion is

A) +3
B) +2.5
C) +5
D) +3.5
E) +1.5

Correct Answer : Option B

58. The mass percentage of glucose in acetonitrile when 6 g of glucose is dissolved in 294 g of acetonitrile is

A) 6 %
B) 10 %
C) 8 %
D) 4 %
E) 2 %

Correct Answer : Option E

59. The rate constant of a first order reaction is $4.606 \times 10^{-3}\ s^{-1}$. The time taken to reduce 20 g of reactant into 2 g is

A) 300 s
B) 500 s
C) 150 s
D) 400 s
E) 250 s

Correct Answer : Option B

60. The rate law for the reaction, A+B → Product is,

$rate = [A]\,[B]^{3/2}$.

The total order of the reaction is

A) 3
B) 2.5
C) 3.5
D) 1.5
E) 2

Correct Answer : Option B

61. Which of the following mixture forms azeotrope?

A) Phenol-aniline
B) Nitric acid-water

C) Ethanol-acetone
D) Chloroform-acetone
E) CS_2-acetone

Correct Answer:-Question Cancelled

62. A coordination compound of cobalt acts as antipernicious anaemia factor is

A) cyanocobalamine
B) carboxypeptidase
C) $[Co(NH_3)_6]^{3+}$
D) haemoglobin
E) myoglobin

Correct Answer : Option A

63. The type of d-d transition of the electron occurs in $[Ti(H_2O)_6]^{3+}$ is

A) $t_{2g}^2 e_g^1 \rightarrow t_{2g}^1 e_g^2$
B) $t_{2g}^1 e_g^0 \rightarrow t_{2g}^1 e_g^0$
C) $t_{2g}^1 e_g^0 \rightarrow t_{2g}^0 e_g^1$
D) $t_{2g}^0 e_g^1 \rightarrow t_{2g}^1 e_g^0$
E) $t_{2g}^2 e_g^0 \rightarrow t_{2g}^1 e_g^1$

Correct Answer : Option C

64. The increasing order of field strength of ligands in the spectrochemical series is

A) $CO < H_2O < Cl^- < I^-$
B) $Cl^- < H_2O < CO < I^-$
C) $H_2O < CO < I^- < Cl^-$
D) $H_2O < I^- < Cl^- < CO$
E) $I^- < Cl^- < H_2O < CO$

Correct Answer : Option E

65. The reaction, $2I^- + S_2O_8^{2-} \rightarrow I_2 + 2SO_4^{2-}$, is catalysed by

A) Iron(II)
B) Manganese(VI)
C) Iron(III)
D) Vanadium(V)
E) Cobalt(III)

Correct Answer : Option C

66. Which of the following is used in the treatment of lead poisoning?

A) EDTA
B) DMG
C) Cupron
D) α-nitroso-β-naphthol
E) $[(Ph_3P)_3RhCl]$

Correct Answer : Option A

67. The increasing order of acid strength of the following carboxylic acids is

(i) $(CH_3)_3C$-COOH (ii) $(CH_3)_2CH$-COOH (iii) CH_3CH_2COOH

A) (ii)< (i) < (iii)
B) (i)< (iii) < (ii)
C) (ii)< (iii) < (i)
D) (iii)< (ii) < (i)
E) (i)< (ii) < (iii)

Correct Answer : Option E

68. The decreasing order of stability of the following carbocations is

(i) $(CH_3)_3C^+$ (ii) $(CH_3)_2C$-CH_2^+ (iii) CH_3CH^+-CH_2CH_3

A) (ii)> (i) > (iii)
B) (iii)> (ii)>(i)
C) (ii)> (iii)>(i)
D) (i)> (iii)>(ii
E) (i)> (ii) >(iii)

Correct Answer : Option D

69. The number of unpaired electrons in $[CoF_6]^{3-}$ is

A) one
B) four
C) zero
D) two
E) three

Correct Answer : Option B

70. One mole of an alkene on ozonolysis gives a mixture of one mole pentan-3-one and one mole methanal. The alkene is

A) 3-ethylbut-1-ene
B) 2-methylpent-1-ene
C) 2-ethylbut-1-ene
D) 4-methylpent-2-ene
E) 4-methylpent-1-ene

Correct Answer : Option C

71. A tertiary alkyl halide (X), C_4H_9Br, reacted with alc.KOH to give compound(Y). Compound(Y) reacted with HBr in presence of peroxide to give compound(Z). The compounds (Y) and (Z) are respectively

A) propene and tert.butylbromide
B) 2-methyl-1-propene and 1-bromo-2-methylpropane
C) but-1-ene and 2-bromopropane
D) but-2-ene and 2-methylpropane
E) but-2-ene and 3-methylpropane

Correct Answer : Option B

72. The major products formed when one mole of CH_3-CH_2-$CH(CH_3)$- CH_2-O-CH_2-CH_3 is treated with one mole of HI are

A) 2-methylbutan-1-ol and iodoethane
B) ethanol and 2-methyliodobutane
C) 2-methylbutan-2-ol and iodoethane
D) 2-methylbutan-2-ol and iodomethane
E) 2-methylbutan-1-ol and ethene

Correct Answer : Option A

73. The reagent used for the conversion of but-2-ene to ethanal is

A) anhydrous CrO_3
B) DIBAL-H
C) PCC
D) O_3/H2O-Zn dust
E) anhydrous $AlCl_3$

Correct Answer : Option D

74. Which of the following is used as insect attractant?

A) Propan-1-amine
B) N,N-Dimethylmethanamine
C) Propan-2-amine
D) N, N-dimethylbutan-1-amine
E) Ethanamine

Correct Answer : Option B

75. Lactose is composed of

A) α-D-glucose and β-D-galactose
B) two units of α-D-glucose
C) β-D-galactose and β-D-glucose
D) α-D-glucose and β-D-fructose
E) two units of β-D-galactose

Correct Answer : Option C

76. If A and B are two sets, such that A has 20 elements, $A \cup B$ has 32 elements and $A \cap B$ has 10 elements, the number of elements in the set B is

A) 22
B) 12
C) 32
D) 42
E) 52

Correct Answer : Option A

77. Let a relation R on the set $\mathbb{N}$ of natural numbers be defined by $(x,y)\in R$ if and only if $x^2-4xy+3y^2=0$ for all $x,y\in\mathbb{N}$. Then the relation is

A) reflexive
B) symmetric
C) transitive
D) reflexive and symmetric but not transitive
E) an equivalence relation

Correct Answer : Option A

78. If $f(x)=\begin{cases}x^2 & x<0\\ 5x-3 & 0\le x\le 2\\ x^2+1 & x>2\end{cases}$, then the positive value of x for which $f(x)=2$ is

A) $\frac{3}{5}$
B) $\frac{1}{2}$
C) $\frac{3}{4}$
D) 1
E) 0

Correct Answer : Option D

79. Let X and Y be subsets of $\mathbb{R}$. If $f:X\to Y$ given by $f(x)=-8(x+5)^2$ is one-to-one,then the codomain Y is

A) $(-\infty,0]$
B) $(-\infty,5]$
C) $(-\infty,-5]$
D) $[0,\infty)$
E) $[-5,\infty)$

Correct Answer : Option A

80. Let z be a complex number satisfying $|z+16|=4|z+1|$. Then

A) $|z|=2$
B) $|z|=4$
C) $|z|=8$
D) $|z|=10$
E) $|z|=16$

Correct Answer : Option B

81. If $2z = 7 + i\sqrt{3}$, then the value of $z^2 - 7z + 4$ is

A) $-\frac{39}{4}$

B) $\frac{39}{4}$

C) -9

D) 17

E) 9

Correct Answer : Option C

82. If $\left(\frac{1-i}{1+i}\right)^{10} = a + ib$, then the values of a and b are, respectively,

A) 1 and 0

B) 0 and 1

C) -1 and 0

D) 0 and -1

E) 1 and -1

Correct Answer : Option C

83. If z_1 and z_2 are two complex numbers with $|z_1| = 1$, then $\left|\frac{z_1 - z_2}{1 - z_1\overline{z}_2}\right|$ is equal to

A) 0

B) $\frac{1}{4}$

C) $\frac{1}{2}$

D) 1

E) 2

Correct Answer : Option D

84. The second term of G.P. is 4, then the product of first three terms is

A) 16

B) 32

C) 48

D) 64

E) 128

Correct Answer : Option D

85. The common ratio of a G.P. is $\frac{1}{2}$. If the product of first three terms is 64, then the sum of first 10 terms is

A) $\frac{1023}{128}$

B) $\frac{1023}{256}$

C) $\frac{511}{128}$

D) $\frac{511}{256}$

E) $\frac{511}{512}$

Correct Answer : Option A

86. The numbers a,b,c,d are in G.P. with common ratio r. If $\frac{1}{a^3+b^3}, \frac{1}{b^3+c^3}, \frac{1}{c^3+d^3}$ are also in G.P., then the common ratio is

A) r

B) r^2

C) r^3

D) $\frac{1}{r^2}$

E) $\frac{1}{r^3}$

Correct Answer : Option E

87. The minimum value of $f(x)=7x^4+28x+31$ is

A) 12

B) 10

C) 38

D) 76

E) 56

Correct Answer : Option B

88. $\binom{10}{1}+\binom{10}{2}+\ldots+\binom{10}{10}=$

A) 1023

B) 1024

C) 511

D) 2047

E) 612

Correct Answer:-Question Cancelled

89. The coefficient of x^3 in the binomial expansion of $\left(\frac{1}{\sqrt{x}}-x\right)^6$ is

A) 12

B) 15
C) 10
D) 30
E) 20

Correct Answer : Option B

90. If ${}^{n}P_{r} = 480$ and ${}^{n}C_{r} = 20$, then the value of r is equal to

A) 2
B) 3
C) 4
D) 5
E) 6

Correct Answer : Option C

91. The constant term in the expansion of $\left(x^3 + \frac{1}{x^2}\right)^{10}$ is

A) 210
B) 240
C) 140
D) 120
E) 320

Correct Answer : Option A

92. If $2\begin{bmatrix} 3 & 4 \\ 5 & x \end{bmatrix} + \begin{bmatrix} 1 & y \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 7 & 0 \\ 10 & 5 \end{bmatrix}$, then the value of $x - y$ is

A) 1
B) 3
C) 5
D) 10
E) 20

Correct Answer : Option D

93. If $B = \begin{pmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{pmatrix}$ is the adjoint of 3×3 matrix A and $|A| = 4$, then the value of α is

A) 4
B) 7
C) 9
D) 11
E) 13

Correct Answer : Option D

94. If the points $(2,-3), (\lambda,-1)$ and $(0,4)$ are collinear, then the value of λ is equal to

A) 0

B) $\frac{1}{7}$

C) $\frac{3}{10}$

D) $\frac{7}{10}$

E) $\frac{10}{7}$

Correct Answer : Option E

95. The solution set for the inequalities $-5 \le \frac{2-3x}{4} \le 9$ is

A) $\left(\frac{-34}{2}, \frac{-22}{3}\right)$

B) $\left(\frac{22}{2}, \frac{34}{3}\right)$

C) $\left(\frac{-34}{3}, \frac{22}{3}\right)$

D) $(-34, -22)$

E) $\left(\frac{11}{3}, \frac{22}{3}\right)$

Correct Answer:-Question Cancelled

96. If $\begin{vmatrix} x & 1 & 2 \\ 4 & 1 & x \\ 1 & -1 & 3 \end{vmatrix} = -10$, then the values of x are

A) -2 and -6

B) 2 and 6

C) 1 and 4

D) -1 and -4

E) 2 and -6

Correct Answer : Option E

97. Let $A = (a_{ij})$ be a square matrix of order 3 and let M_{ij} be the minors of a_{ij}. If $M_{11} = -40$, $M_{12} = -10$, $M_{13} = 35$ and $a_{11} = 1$, $a_{12} = 3$, $a_{13} = -2$ then the value of $|A|$ is equal to

A) -100

B) -80

C) 0

D) 60

E) 80

Correct Answer : Option B

98. $\frac{\sec^2 15^\circ - 1}{\sec^2 15^\circ} =$

A) $\frac{2-\sqrt{3}}{4}$

B) $\frac{2+\sqrt{3}}{4}$

C) $\frac{2-\sqrt{3}}{2}$

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

E) $\frac{1}{4}$

Correct Answer : Option A

99. The value of $\sin^2\left(\frac{3\pi}{8}\right)+\sin^2\left(\frac{7\pi}{8}\right)$ is

A) $\frac{1}{2}$

B) 1

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

D) $\frac{3}{4}$

E) $\frac{1}{4}$

Correct Answer : Option B

100. If $\sin\theta = \frac{b}{a}$, then $\sqrt{\frac{a+b}{a-b}}+\sqrt{\frac{a-b}{a+b}} =$

A) $\frac{2}{\cos\theta}$

B) $\frac{1}{\cos\theta}$

C) $\frac{2}{\sqrt{\cos\theta}}$

D) $\frac{1}{\sqrt{\cos\theta}}$

E) 1

Correct Answer : Option A

101. The period of $2\sin 4x\cos 4x$ is

A) $\frac{2\pi}{3}$

B) $\frac{2\pi}{4}$

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

D) $\frac{\pi}{4}$

E) π

Correct Answer : Option D

102. The domain of the function $f(x)=\frac{\sin^{-1}(x-3)}{\sqrt{9-x^2}}$ is

A) $[1,2]$

B) $[2,3]$

C) $[2,3)$

D) $[1,2)$

E) $(1,2)$

Correct Answer : Option C

103. If $\alpha=\tan^2 x+\cot^2 x,\ x\in\left(0,\frac{\pi}{2}\right)$, then α lies in the interval

A) $(-\infty,1)$

B) $(1,2)$

C) $(-\infty,1]$

D) $(-\infty,2)$

E) $[2,\infty)$

Correct Answer : Option E

104. The value of $\tan\left[\tan^{-1}\left(\frac{3}{4}\right)+\tan^{-1}\left(\frac{2}{3}\right)\right]$ is

A) $\frac{17}{6}$

B) $\frac{6}{17}$

C) $\frac{-17}{6}$

D) $\frac{-6}{11}$

E) 1

Correct Answer : Option A

105. If $3\sin\theta+5\cos\theta=5$, then the value of $5\sin\theta-3\cos\theta$ is

A) 0

B) 1

C) 3

D) 5

E) $\sqrt{10}$

Correct Answer : Option C

106. $\cos\left(\cot^{-1}\left(\frac{7}{24}\right)\right)=$

A) $\frac{24}{25}$

B) $\frac{7}{24}$

C) $\frac{7}{27}$

D) $\frac{7}{25}$

E) $\frac{24}{27}$

Correct Answer : Option D

107. If $\cos\theta=\frac{2\cos\alpha+1}{2+\cos\alpha}$, then $\tan^2\left(\frac{\theta}{2}\right)$ is equal to

A) $\frac{1}{3}\tan^2\left(\frac{\alpha}{2}\right)$

B) $\frac{1}{2}\tan^2\left(\frac{\alpha}{2}\right)$

C) $\frac{1}{3}\cos^2\left(\frac{\alpha}{2}\right)$

D) $\frac{1}{3}\cot^2\left(\frac{\alpha}{2}\right)$

E) $3\cot^2\left(\frac{\alpha}{2}\right)$

Correct Answer : Option A

108. If a vector makes angle $\frac{\pi}{3}$, $\frac{\pi}{4}$ and γ with $\hat{i}$, $\hat{j}$ and $\hat{k}$, respectively, where $\gamma \in \left(\frac{\pi}{2}, \pi\right)$, then the angle γ is

A) $\frac{3\pi}{4}$

B) $\frac{7\pi}{12}$

C) $\frac{11\pi}{12}$

D) $\frac{5\pi}{6}$

E) $\frac{2\pi}{3}$

Correct Answer : Option E

109. Let $\vec{u}, \vec{v}$ and $\vec{w}$ be vectors such that $\vec{u}+\vec{v}+\vec{w}=\vec{0}$. If $|\vec{u}|=3$, $|\vec{v}|=4$ and $|\vec{w}|=5$, then $\vec{u}\cdot\vec{v}+\vec{v}\cdot\vec{w}+\vec{w}\cdot\vec{u}$ is

A) 47
B) -25
C) 25
D) -47
E) 0

Correct Answer : Option B

110. Let $\vec{a}=\hat{i}-\hat{j}$, $\vec{b}=\hat{j}-\hat{k}$, $\vec{c}=\hat{k}-\hat{i}$, then the value of $\vec{b}\cdot(\vec{a}+\vec{c})$ is

A) 1
B) 0
C) -1
D) 2
E) -2

Correct Answer : Option E

111. Let $\vec{a}, \vec{b}$ and $\vec{c}$ are three vectors with magnitudes 4, 4, 2 respectively. If $\vec{a}$ is perpendicular to $(\vec{b}+\vec{c})$, $\vec{b}$ is perpendicular to $(\vec{c}+\vec{a})$ and $\vec{c}$ is perpendicular to $(\vec{a}+\vec{b})$, then the value of $|\vec{a}+\vec{b}+\vec{c}|$ is equal to

A) 3
B) 6

C) $\sqrt{6}$

D) $-\sqrt{6}$

E) -6

Correct Answer : Option B

112. If two vectors $\vec{a}=\cos\alpha\hat{i}+\sin\alpha\hat{j}+\sin\frac{\alpha}{2}\hat{k}$ and $\vec{b}=\sin\alpha\hat{i}-\cos\alpha\hat{j}+\cos\frac{\alpha}{2}\hat{k}$ are perpendicular, then the values of α are

A) 0 and $\frac{\pi}{2}$

B) $\frac{\pi}{4}$ and $\frac{\pi}{2}$

C) 0 and π

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

E) 0 and $\frac{\pi}{4}$

Correct Answer : Option C

113. If one end of a diameter of the circle $x^2+y^2-4x-6y+11=0$ is $(3,4)$, then the coordinate of the other end of the diameter is

A) $(1,1)$

B) $\left(\frac{1}{2},\frac{1}{2}\right)$

C) $(1,2)$

D) $(2,1)$

E) $(2,2)$

Correct Answer : Option C

114. If the focus of a parabola is $(0,-3)$ and its directrix is $y=3$, then its equation is

A) $x^2=12y$

B) $x^2=-12y$

C) $y^2=12x$

D) $y^2=-12x$

E) $y^2=x$

Correct Answer : Option B

115. The length of minor axis of the ellipse with foci $(\pm 2,0)$ and eccentricity $\frac{1}{3}$ is

A) 2

B) 3

C) $2\sqrt{2}$

D) $4\sqrt{2}$

E) $8\sqrt{2}$

Correct Answer : Option E

116. The equation of the line passing through the point $(1,2)$ and perpendicular to the line $x+y+1=0$ is

A) $x+y+1=0$

B) $y-x+1=0$

C) $y-x-1=0$

D) $y-x+2=0$

E) $y-x-2=0$

Correct Answer : Option C

117. The line $\frac{x}{5}+\frac{y}{b}=1$ passes through the point $(13,32)$ and parallel to the line $\frac{x}{c}+\frac{y}{3}=1$. Then the values of b and c are, respectively,

A) $-20, \frac{-3}{4}$

B) $20, \frac{3}{4}$

C) $\frac{3}{4}, 20$

D) $-\frac{3}{4}, 20$

E) $-20, \frac{3}{4}$

Correct Answer : Option A

118. A ray of light passing through the point $(1,2)$ is reflected on the x-axis at a point P and passes through the point $(5,6)$. Then the abscissa of the point P is

A) 3

B) $\frac{5}{2}$

C) 2

D) 4

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

Correct Answer : Option C

119. If the straight line $\frac{x-a}{1}=\frac{y-b}{2}=\frac{z-3}{-1}$ passes through $(-1,3,2)$, then the values of a and b are, respectively,

A) 2,-1
B) 1,3
C) -1,-3
D) -2,1
E) -1,1

Correct Answer : Option D

120. The lines $\frac{x+3}{-2}=\frac{y}{1}=\frac{z-4}{3}$ and $\frac{x}{\mu}=\frac{y-1}{\mu+1}=\frac{z}{\mu+2}$ are perpendicular to each other. Then the value of μ is

A) $\frac{-5}{3}$
B) 3
C) 4
D) $\frac{-1}{4}$
E) $\frac{-7}{2}$

Correct Answer : Option E

121. If the straight lines $\frac{x-3}{2}=\frac{y-4}{3}=\frac{z-6}{-1}$ and $\frac{x-2}{a}=\frac{y+3}{b}=\frac{z+4}{-1}$ are parallel, then $a^2+b^2=$

A) 1
B) 13
C) 24
D) 17
E) 3

Correct Answer : Option B

122. The angle between the lines $\frac{x}{1}=\frac{y}{1}=\frac{z}{1}$ and $\frac{x}{0}=\frac{y}{1}=\frac{z}{-1}$ is

A) $\frac{\pi}{2}$
B) 0
C) π
D) $\frac{\pi}{4}$

E) $\sin^{-1}\left(\sqrt{2}\right)$

Correct Answer : Option A

123. If three distinct numbers are chosen randomly from the first 50 natural numbers, then the probability that all of them are divisible by 2 and 3 is

A) $\frac{3}{350}$

B) $\frac{3}{175}$

C) $\frac{2}{175}$

D) $\frac{1}{175}$

E) $\frac{1}{350}$

Correct Answer : Option E

124. If $\frac{1+3p}{4}, \frac{1-p}{3}, \frac{1-3p}{2}$ are the probabilities of three mutually exclusive and exhaustive events, then value of p is

A) $\frac{1}{3}$

B) $\frac{12}{13}$

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

D) $\frac{1}{13}$

E) $\frac{2}{13}$

Correct Answer : Option D

125. The mean deviation of the numbers 3, 10, 10, 4, 7, 10 and 5 from the mean is

A) 2

B) 2.5

C) 2.57

D) 3

E) 3.75

Correct Answer : Option C

126. If $g(x) = -\sqrt{25-x^2}$, then $g'(1)$ is

A) $-\sqrt{24}$

B) $\sqrt{24}$

C) $\frac{1}{24}$

D) $\frac{1}{\sqrt{24}}$

E) $\frac{-1}{\sqrt{24}}$

Correct Answer : Option D

127. $\lim_{x\to 0}\frac{\sin 2x+\sin 5x}{\sin 4x+\sin 6x}=$

A) $\frac{2}{5}$

B) $\frac{7}{5}$

C) $\frac{2}{7}$

D) $\frac{7}{10}$

E) $\frac{5}{7}$

Correct Answer : Option D

128. If $f(x)=\begin{cases} mx+1, & \text{when } x\le\frac{\pi}{2} \\ \sin x+n, & \text{when } x>\frac{\pi}{2} \end{cases}$ is continuous at $x=\frac{\pi}{2}$, then

A) $m=1,\ n=0$

B) $m=0, n=1$

C) $n=\frac{m\pi}{2}$

D) $m=\frac{n\pi}{2}$

E) $m=n=\frac{\pi}{2}$

Correct Answer : Option C

129. Let $f(x)=x-[x],\ x\in(-1,2)$, where $[\cdot]$ denotes the greatest integer function. The number of points at which the function is not continuous is

A) 1
B) 2
C) 3
D) 4
E) 0

Correct Answer : Option B

130. If $f(x)=|\cos x-\sin x|,\ x\in\left(\frac{\pi}{4},\frac{\pi}{2}\right)$, then $f'\left(\frac{\pi}{3}\right)$ is equal to

A) $\sqrt{3}+1$
B) $\frac{\sqrt{3}+1}{4}$
C) $\frac{\sqrt{3}+1}{2}$
D) $\frac{\sqrt{3}-1}{2}$
E) $\frac{\sqrt{3}-1}{4}$

Correct Answer : Option C

131. If $f(x)=\sin^{-1}(\cos x)$, then $\frac{d^2y}{dx^2}$ at $x=\frac{\pi}{4}$ is

A) $\frac{-1}{4}$
B) -1
C) 1
D) $\frac{1}{2}$
E) 0

Correct Answer : Option E

132. If $y=\tan^{-1}\left[\frac{\cos x-\sin x}{\cos x+\sin x}\right],\ -\frac{\pi}{2}<x<\frac{\pi}{2}$, then $\frac{dy}{dx}$ is equal to

A) $\tan x$
B) $\cos x$
C) $\sin x$
D) -1
E) 0

Correct Answer : Option D

133. If $y=\frac{x^2}{x-1}$, then $\frac{dy}{dx}$ at $x=-1$ is

A) $\frac{1}{4}$

B) $\frac{-1}{4}$

C) $\frac{1}{2}$

D) $\frac{-1}{2}$

E) $\frac{3}{4}$

Correct Answer : Option E

134. The function $f(x)=2x^3+9x^2+12x-1$ is decreasing in the interval

A) $[-1,\infty)$

B) $(-2,-1)$

C) $(-\infty,-2]$

D) $[-1,0]$

E) $(-1,1)$

Correct Answer : Option B

135. The maximum value of $y=12-|x-12|$ in the range $-11\le x\le 11$ is

A) 12
B) 11
C) 10
D) 9
E) 35

Correct Answer : Option B

136. $\lim_{x\to 10}\frac{x-10}{\sqrt{x+6}-4}$ is equal to

A) 4
B) 8
C) 10
D) 16
E) 12

Correct Answer : Option B

137. $\int \frac{dx}{1+e^{-x}} =$

A) $e^x + C$

B) $\log\left|1+e^x\right| + C$

C) $\log\left|1+e^{-x}\right| + C$

D) $\log\left|1-e^{-x}\right| + C$

E) $\log\left|1-e^x\right| + C$

Correct Answer : Option B

138. $\int x\cos x dx =$

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

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

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

D) $x\sin x + \cos x + C$

E) $\sin x + \cos x + C$

Correct Answer : Option D

139. $\int xe^{x^2} dx =$

A) $\frac{e\left(e^3-1\right)}{2}$

B) $\frac{e\left(1-e^2\right)}{2}$

C) $\frac{e\left(e^3+1\right)}{2}$

D) $e\left(e^3+1\right)$

E) $e\left(e^3-1\right)$

Correct Answer:-Question Cancelled

140. If $\int \frac{dx}{\sqrt{16-9x^2}} = A\sin^{-1}\left(Bx\right) + C$, where C is an arbitrary constant, then $A+B =$

A) 4

B) 0

C) $\frac{3}{4}$

D) 1

E) $\frac{1}{4}$

Correct Answer:-Question Cancelled

141. $\int \frac{dx}{x^2\left(x^4+1\right)^{3/4}} =$

A) $-\left(x^4+1\right)^{1/4}+C$

B) $\left(x^4+1\right)^{1/4}+C$

C) $-\left(\frac{x^4+1}{x^4}\right)^{1/4}+C$

D) $\left(\frac{x^4+1}{x^4}\right)+C$

E) $\left(\frac{x^4+1}{x^4}\right)^{3/4}+C$

Correct Answer : Option C

142. $\int \frac{e^{6\log x}-e^{5\log x}}{e^{4\log x}-e^{3\log x}}dx =$

A) e^x+C

B) $\frac{x^2}{2}+C$

C) $x+C$

D) $\frac{x^3}{3}+C$

E) xe^x+C

Correct Answer : Option D

143. $\int_0^1 \log\left(\frac{1}{x}-1\right)dx =$

A) $\frac{1}{4}$

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

C) -1

D) 1

E) 0

Correct Answer : Option E

144. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^9 x\cos^2 x dx =$

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

B) 1

C) $\frac{1}{11}$

D) $\frac{7\pi}{6}$

E) 0

Correct Answer : Option E

145. The area bounded by the curves $y = 2x$ and $y = x^2$ (in square units) is

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

B) $\frac{1}{3}$

C) $\frac{4}{3}$

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

E) 0

Correct Answer : Option C

146. The area of the smaller segment cut-off from the circle $x^2 + y^2 = 25$ by $x = 3$ is (in Sq. units)

A) $75\cos^{-1}\left(\frac{3}{5}\right) - 12$

B) $25\cos^{-1}\left(\frac{3}{5}\right) - 24$

C) $25\cos^{-1}\left(\frac{3}{5}\right) - 12$

D) $25\cos^{-1}\left(\frac{3}{5}\right) - 6$

E) $50\cos^{-1}\left(\frac{3}{5}\right) - 12$

Correct Answer : Option C

147. The differential equation $y\frac{dy}{dx} + x = A$ (where A is constant) represents

A) a family of circles having centre on the x -axis.

B) a family of circles having centre on the y -axis

C) a family of all circles having centre at the origin

D) a family of ellipses

E) a family of hyperbolas

Correct Answer : Option A

148. The general solution of $\frac{dy}{dx}+y=5$ is

A) $-\log|5-y|=x+C$

B) $-\log|5-y|=e^{x}+C$

C) $(5-y)^{2}=2x+C$

D) $y=\log|x+C|$

E) $\log|x|+C$

Correct Answer : Option A

149. The degree of the differential equation $(y''')^{2}+(\sin y')^{4}+y=0$ is

A) 1

B) 2

C) 3

D) 4

E) not defined

Correct Answer : Option E

150. Given the Linear Programming Problem:

Maximize $z=11x+7y$

subject to the constraints: $x\le 3,\ y\le 2,\ x,y\ge 0$.

Then the optimal solution of the problem is

A) (3,2)

B) (3,0)

C) (0,2)

D) (1,0)

E) (0,1)

Correct Answer : Option A

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