CUSAT 2022 : Shift 4

Solved Paper

Question 1

The diameter of a circle is 2.486m. Its area with due regard to significant figures is (Given π = 3.142)

Options:

A. $4.85454m^2$

B. $4.8545m^2$

C. $4.584m^2$

D. $4.855m^2$

Answer: D

Solution:

Solution:

Question 2

The position of a particle as a function of time t is given by $x(t) = at + bt^2 - ct^3$ where, a, b and c are constants. When the particle attains zero acceleration, then its velocity will be

Options:

A. $a + \frac{b^2}{4c}$

B. $a + \frac{b^2}{3c}$

C. $a + \frac{b^2}{c}$

D. $a + \frac{b^2}{2c}$

Answer: B

Solution:

Solution:

Question 3

A particle moves in a circular arc of radius r. In half the period of revolution, its displacement and distance covered are

Options:

A. 2r and 2πr

B. 2r and πr

C. r and πr

D. r and 2πr

Answer: B

Solution:

Solution:

Question 4

In a tug of war contest, two men pull a horizontal rope from opposite sides. The winner will be the

man who

Options:

A. exerts greater force on the rope

B. exerts greater force on the ground

C. exerts force on the rope which is greater than the tension in the rope

D. makes a smaller angle with the vertical

Answer: B

Solution:

Solution:

Question 5

If m is the mass of a body and E its kinetic energy, then its linear momentum is

Options:

A. $\sqrt{2mE}$

B. $2\sqrt{mE}$

C. $\sqrt{mE}$

D. mE

Answer: A

Solution:

Solution:

Question 6

A rubber sheet is introduced between two charges separated by a distance. Then the force between them will

Options:

A. increase

B. decrease

C. remains the same

D. be reduced to zero

Answer: B

Solution:

Solution:

Question 7

What is the potential difference acquired by an alpha particle accelerated through a potential difference of 10^6V ?

Options:

A. zero

B. 3.2×10^{-13}J

C. 1.6×10^{-19}J

D. 1 eV

Answer: B

Solution:

Solution:

Question 8

A stone is dropped into a lake from a tower of 500m high. The sound of the splash will be heard at the top of the tower approximately after (given velocity of sound = 330m / s)

Options:

A. 11.5 seconds

B. 1.5 seconds

C. 10 seconds

D. 14 seconds

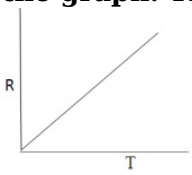
Answer: A

Solution:

Solution:

Question 9

The variation of resistance (R) as a function of temperature (T) for a certain material is shown in the graph. The material is most likely to be



Options:

A. pure metal

B. impure metal

C. semiconductor

D. superconductor

Answer: A

Solution:

Solution:

Question 10

A certain liquid taken in a watch glass is placed on closely spaced pole pieces of a magnet. The liquid then moves towards the pole pieces causing a depression at its center as shown. The liquid is most likely to be

Options:

A. paramagnetic

B. ferromagnetic

C. diamagnetic

D. ferrimagnetic

Answer: C

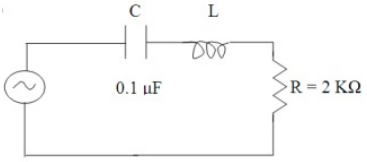
Solution:

Solution:

Question 11

The following series resonant LCR circuit has a quality factor (Q-factor) of 0.4 and a bandwidth of

1.3 KHz. The value of inductance is then



Options:

A. 0.1H

B. 0.94H

C. 2H

D. 10H

Answer: B

Solution:

Solution:

Question 12

Semiconductors have

Options:

A. positive temperature coefficient of resistance

B. negative temperature coefficient of resistance

C. zero temperature coefficient of resistance

D. positive temperature coefficient at lower temperature and negative temperature coefficient at higher temperatures

Answer: B

Solution:

Solution:

Question 13

If the average time between collisions of electrons in Copper is 2.5×10^{-14} s and the average speed of the free electrons is 1.6×10^{6}m / s, then the mean free path of the electrons will be

Options:

A. 4×10^{-8}m

B. 4×10^{-8} cm

C. 4×10^{8}m

D. 4m

Answer: A

Solution:

Solution:

Question 14

Which one of the following is an example of non-Ohmic resistance?

Options:

A. Copper wire

B. Tungsten wire

C. Diode

D. Carbon resistance

Answer: C

Solution:

Solution:

Question 15

In a circuit containing two unequal resistors connected in parallel

Options:

A. the current is the same in both the resistors

B. a large current flows through the larger resistor

C. the voltage drop across both the resistances is same

D. the smaller resistance has smaller conductance

Answer: C

Solution:

Solution:

Question 16

Two identical fuses are rated at 10 A. If they are connected

Options:

A. in parallel, the combination acts as a fuse of rating 10 A

B. in parallel, the combination acts as a fuse of rating 20 A

C. in series, the combination acts as a fuse of rating 20 A

D. in series, the combination acts as a fuse of rating 5 A

Answer: B

Solution:

Solution:

Question 17

The number of electrons in 1 Coulomb of charge is

Options:

A. 6.25×10^{18}

B. 62.5×10^{18}

C. 6.023×10^{23}

D. 1.6×10^{-19}

Answer: A

Solution:

Solution:

Question 18

In a hydrogen atom, which of the following electronic transitions would involve the maximum energy change?

Options:

A. n = 2 to n = 1

B. n = 3 to n = 1

C. n = 4 to n = 2

D. n = 3 to n = 2

Answer: B

Solution:

Solution:

Question 19

Numerical aperture of an optical fiber is a measure of

Options:

A. attenuation of light signals in the fiber

B. difference between the refractive indices of core and the cladding

C. light gathering power of the fiber

D. signal distortion in the fiber

Answer: C

Solution:

Solution:

Question 20

Shearing stress causes change in

Options:

A. Length

B. Area

C. Volume

D. Shape

Answer: D

Solution:

Solution:

Question 21

A liquid will not wet the surface of a solid if the angle of contact is

Options:

A. 0°

B. 45°

C. greater than 90°

D. 60°

Answer: C

Solution:

Solution:

Question 22

If two liquids of same volume but different densities ρ_1 and ρ_2 respectively are mixed, then the

density of the mixture is

Options:

A. $\rho_1 + \rho_2$

B. $\frac{\rho_1 + \rho_2}{2}$

C. $\frac{\rho_1\rho_2}{\rho_1 + \rho_2}$

D. $\frac{2\rho_1\rho_2}{\rho_1 + \rho_2}$

Answer: B

Solution:

Solution:

Question 23

The wings or fins of aircraft are so designed that the speed of air

Options:

A. on the topside is more than on the lower side

B. on the topside is less than on the lower side

C. is same on both side

D. is turbulent

Answer: A

Solution:

Solution:

Question 24

A black body at high temperature T radiates energy at a rate of E W / m^2. When the temperature falls to one-half of its initial value, the radiated energy will be

Options:

A. $\frac{E}{4}$

B. $\frac{E^2}{4}$

C. 2E

D. $\frac{E}{16}$

Answer: D

Solution:

Solution:

Question 25

The efficiency of the reversible heat engine is η_R and that of irreversible heat engine is η_I. Which one of the following relations is correct?

Options:

A. $\eta_R > \eta_I$

B. $\eta_R < \eta_I$

C. $\eta_R = \eta_I$

D. $\eta_R > 1$ and $\eta_I < 1$

Answer: A

Solution:

Solution:

Question 26

The molar specific heat at constant pressure of an ideal gas is (7 / 2)R, where R is gas constant. The ratio of specific heat at constant pressure to constant volume is

Options:

A. 9 / 7

B. 7 / 5

C. 8 / 7

D. 5 / 7

Answer: B

Solution:

Solution:

Question 27

If P, V and T are the pressure, volume and temperature of a gas in jar A, and 2P, V / 4 and 2T are the pressure, volume and temperature of another gas in jar B, then the ratio of the number of molecules in the jar A and B will be

Options:

A. 1 : 1

B. 1 : 2

C. 2 : 1

D. 4 : 1

Answer: D

Solution:

Solution:

Question 28

The volume of the cubic cell is $10^{-30}m^3$. Then its lattice parameter is

Options:

A. 10^{-30}m

B. 10^{-10}m

C. $\frac{1}{3} \times 10^{-30}$m

D. $\frac{3}{4\pi} \times 10^{-30}$m

Answer: B

Solution:

Solution:

Question 29

The doping of the base of a transistor is

Options:

A. Equal to the emitter or collector

B. Slightly more than that of emitter or collector

C. Less than that of emitter or collector

D. Much more than that of emitter or collector

Answer: C

Solution:

Solution:

Question 30

A source is moving away with a velocity 0.2v, where v is the velocity of sound. If the source sounds a frequency of 800 Hz, what is the apparent frequency heard by the stationary listener?

Options:

A. 660 Hz

B. 867 Hz

C. 667 Hz

D. 956 Hz

Answer: C

Solution:

Solution:

Question 31

The change in potential energy, when a body of mass m is raised to a height nR from the earth's surface is (R = radius of earth)

Options:

A. $\mathrm{mgR}\left(\frac{\mathrm{n}}{\mathrm{n}-1}\right)$

B. nmgR

C. $\mathrm{mgR}\left(\frac{\mathrm{n}^2}{\mathrm{n}^2+1}\right)$

D. $\mathrm{mgR}\left(\frac{\mathrm{n}}{\mathrm{n}+1}\right)$

Answer: D

Solution:

Solution:

Question 32

If the decay constant of certain radioactive sample is 0.113 per minute, then the half-life of the sample is

Options:

A. 6.13 min

B. 0.078 min

C. 0.163 min

D. 8.85 min

Answer: A

Solution:

Solution:

Question 33

A certain radioactive substance has a disintegration constant of 0.0231 per day. Then the time taken for $\frac{1}{8^{th}}$ of the original number of atoms to remain unchanged is

Options:

A. 39 days

B. 9 days

C. 90 days

D. 3.9 days

Answer: C

Solution:

Solution:

Question 34

If Δm is the mass defect of a nucleus and A its mass number, then the packing fraction is

Options:

A. Δm/A

B. Δm.A

C. A/Δm

D.

Δmc^2

E.

Answer: A

Solution:

Solution:

Question 35

Which one of the following statements about Peltier effect is INCORRECT?

Options:

A. Peltier effect occurs only at the junction

B. Peltier effect is irreversible

C. Peltier effect is reversible

D. In Peltier effect, heat evolved or absorbed depends on the nature of the metals and temperature

Answer: B

Solution:

Solution:

Question 36

The magnetic field at any point on a straight current carrying conductor is

Options:

A. $\frac{\mu_o I}{4\pi r^2}$

B. $\frac{\mu_o I}{4r}$

C. Zero

D. $\frac{\mu_o I}{2\pi r}$

Answer: C

Solution:

Solution:

Question 37

A coil has an inductance of 0.04 Henry. The e.m.f. induced in it when the current flowing through the coil is changing at the rate of 100A / s is

Options:

A. Zero

B. 4V

C. -4V

D. 2.5 KV

Answer: C

Solution:

Solution:

Question 38

The current in a coil is changing at a rate of 10A / s. Then an e.m.f. of 4V is induced in a neighboring coil. The mutual inductance of the pair of coils is then

Options:

A. 40H

B. 0.4H

C. 2.5H

D. 4H

Answer: B

Solution:

Solution:

Question 39

One atomic mass unit (amu) is equivalent to

Options:

A. 931 eV

B. 931 MeV

C. 931 keV

D. 931 milli eV

Answer: B

Solution:

Solution:

Question 40

If Z is the atomic number and n is the principal quantum number, then the total energy of an electron in the n^{th} orbit of an atom is given by

Options:

A. $\frac{13.6Z^2}{n^2}$ eV

B. $-\frac{13.6Z^2}{n^2}$ eV

C. $-\frac{13.6}{n^2}$ eV

D. $-\frac{13.6Z^2}{n}$ eV

Answer: B

Solution:

Solution:

Question 41

If m is the mass of the particle, its de Broglie wavelength λ is proportional to

Options:

A. $\sqrt{m}$

B. $\frac{1}{m}$

C. $\frac{1}{\sqrt{m}}$

D. m

Answer: B

Solution:

Solution:

Question 42

The number of photons emitted per second from a lamp radiating a power of 10 Watt at a wavelength of 6000A˚ is about

Options:

A. 3×10^{18} per sec

B. 3×10^{10} per sec

C. 3×10^{8} per sec

D. 1×10^{24} per sec

Answer: B

Solution:

Solution:

Question 43

Photometer is an instrument used for

Options:

A. counting the number of photons

B. measuring the photoconductivity of a substance

C. measuring the luminous intensities of light sources

D. studying photoelectric effect

Answer: C

Solution:

Solution:

Question 44

When light passes from one medium to another medium, then the physical property which does not change is

Options:

A. Velocity

B. Frequency

C. Wavelength

D. Refractive index

Answer: B

Solution:

Solution:

Question 45

Two thin lenses with focal lengths f_1 and f_2 have materials with dispersive powers ω_1 and ω_2 respectively. Then to form an achromatic combination of these lenses, essential condition is that

Options:

A. $\frac{\omega_1}{f_1} - \frac{\omega_2}{f_2} = 0$

B. $\frac{\omega_1}{f_1} + \frac{\omega_2}{f_2} = 0$

C. $\omega_1 + \omega_2 = 0$

D. $f_1 + f_2 = 0$

Answer: B

Solution:

Solution:

Question 46

The refractive indices for red and violet colours for crown glass are 1.5155 and 1.5245 respectively. Then the dispersive power of the crown glass is

Options:

A. 0.009

B. 3.04

C. 0.0045

D. 1.52

Answer: D

Solution:

Solution:

Question 47

For a given material of the glass, the refractive index of the glass prism depends on

Options:

A. the angle of the prism

B. the angle through which it deviates an incident beam of light

C. the wavelength of the light

D. the intensity of the incident light

Answer: C

Solution:

Solution:

Question 48

Which one of the following phenomena is NOT common to both sound and light waves?

Options:

A. Interference

B. Polarization

C. Diffraction

D. Reflection

Answer: B

Solution:

Solution:

Question 49

If i is the polarizing angle and r is the angle of refraction, then

Options:

A. $i - r = 90^{\circ}$

B. $i + r = 60^{\circ}$

C. $i + r = 90^{\circ}$

D. $i = r$

Answer: C

Solution:

Solution:

Question 50

If the refractive index of glass is 1.5 , the speed of light in glass is (Velocity of light in vacuum is $3 \times 10^{8} m / s$)

Options:

A. $3 \times 10^{8} m / s$

B. $3 \times 10^{10} m / s$

C. $0.5 \times 10^{8} m / s$

D. $2 \times 10^{8} m / s$

Answer: D

Solution:

Solution:

Question 51

If the coefficient of absorption and transmission of a surface are 0.73 and 0.23 respectively, then the coefficient of reflection will be

Options:

A. 0.06

B. 0.04

C. 0.96

D. 0.24

Answer: B

Solution:

Solution:

Question 52

Which one of the following statements about Poisson's ratio (σ) is INCORRECT?

Options:

A. σ is the ratio of lateral strain to longitudinal strain

B. σ has no units and dimensions

C. Theoretically, σ lies between -1 and 1 / 2

D. For some substances, value of σ is negative

Answer: D

Solution:

Solution:

Question 53

A potential barrier of 0.50V exists across a $p-n$ junction. If the depletion region is 5.0×10^{-7}m wide, the intensity of the electric field in this region is

Options:

A. 1.0×10^{6}V / m

B. 1.0×10^{5}V / m

C. 2.0×10^{5}V / m

D. 2.0×10^{6}V / m

Answer: A

Solution:

Solution:

Question 54

If a semiconductor photodiode can detect a photon with a maximum wavelength of 400 nm, then its band gap energy is
(Given Planck's constant, h = 6.63×10^{-34}Js; Speed of light, c = 3×10^{8}m / s;
1 eV = 1.602×10^{-19}J)

Options:

A. 1.1 eV

B. 2.0 eV

C. 1.5 eV

D. 3.1 eV

Answer: D

Solution:

Solution:

Question 55

If the full wave rectifier is operating from 50 Hz mains, then the fundamental frequency in the ripple will be

Options:

A. 50 Hz

B. 60 Hz

C. 100 Hz

D. 25 Hz

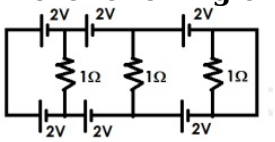
Answer: C

Solution:

Solution:

Question 56

In the following circuit, the current in each resistor is



Options:

A. 0.5A

B. 0A

C. 1A

D. 0.25A

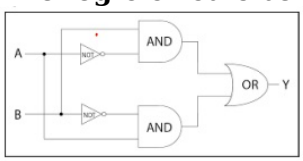
Answer: B

Solution:

Solution:

Question 57

The logic circuit below represents which one of the following gates?



Options:

A. XOR gate

B. NAND gate

C. XNOR gate

D. NOR gate

Answer: A

Solution:

Solution:

Question 58

The fundamental radio antenna is a metal rod which has a length equal to

Options:

A. λ in free space at the frequency of operation

B. λ / 2 in free space at the frequency of operation

C. λ / 4 in free space at the frequency of operation

D. 3λ / 4 in free space at the frequency of operation

Answer: C

Solution:

Solution:

Question 59

If the carrier power of a 100% modulated AM wave is suppressed, the percentage saving in power will be

Options:

A. 50%

B. 100%

C. 66.66%

D. 75%

Answer: C

Solution:

Solution:

Question 60

Parsec is the unit of

Options:

A. Time

B. Distance

C. Luminosity

D. Escape velocity

Answer: B

Solution:

Solution:

Question 61

The conclusion that every additional electron enters the orbital with lowest possible energy has been drawn from

Options:

A. Hund’s rule

B. Aufbau principle

C. Pauli’s exclusion principle

D. De-Broglie’s principle

Answer: B

Solution:

Solution:

Question 62

The cathode rays have same charge to mass ratio as

Options:

A. Anode rays

B. γ-particles

C. β-particles

D. α-particles

Answer: C

Solution:

Solution:

Question 63

The phenomenon of splitting of spectral lines under the influence of electric field is known as

Options:

A. Stark effect

B. Zeeman effect

C. Compton effect

D. Photoelectric effect

Answer: A

Solution:

Solution:

Question 64

The phenomenon of splitting of spectral lines under the influence of electric field is known as

Options:

A. Stark effect

B. Zeeman effect

C. Compton effect

D. Photoelectric effect

Answer: A

Solution:

Solution:

Question 65

Which of the following is NOT a state function?

Options:

A. Internal energy

B. Gibbs free energy

C. Work

D. Enthalpy

Answer: C

Solution:

Solution:

Question 66

In an isolated system, a liquid is in equilibrium with its vapour. Then the molar entropy of the vapour is

Options:

A. equal to that of liquid

B. less than that of liquid

C. more than that of liquid

D. equal to zero

Answer: A

Solution:

Solution:

Question 67

The rate constant for a first order reaction is $2.44 \times 10^{-3}\ s^{-1}$. Then the half-life for the reaction is

Options:

A. 264 s

B. 274 s

C. 284 s

D. 294 s

Answer: C

Solution:

Solution:

Question 68

Calculate the weight of Copper deposited at cathode when one Faraday of electricity is passed through $CuSO_4$ solution (Given: Atomic mass of Cu is 63.50 , and current efficiency for copper deposition is 100%).

Options:

A. 15.87g

B. 21.16g

C. 31.75g

D. 63.50g

Answer: C

Solution:

Solution:

Question 69

The potential of calomel electrode with 0.01M KCl is (E° for calomel electrode is 0.268V)

Options:

A. 0.150V

B. 0.268V

C. 0.327V

D. 0.386V

Answer: D

Solution:

Solution:

Question 70

For a reaction; aA → bB, the rate of reaction is doubled when the concentration of A is increased by four times. The order of the reaction is equal to

Options:

A. 0

B. 0.5

C. 1

D. 2

Answer: B

Solution:

Solution:

Question 71

The coordination number of Zn^{2+} and S^{2-} ions in the zinc blende (ZnS) type structure is

Options:

A. 4 : 4

B. 6 : 6

C. 8 : 8

D. 4 : 8

Answer: A

Solution:

Solution:

Question 72

The ionic strength of 0.01M solution of an electrolyte of the type M_2X_3 is

Options:

A. 0.01

B. 0.03

C. 0.06

D. 0.15

Answer: D

Solution:

Solution:

Question 73

The number of radial nodes in 5 s atomic orbital is

Options:

A. 5

B. 4

C. 3

D. 0

Answer: B

Solution:

Solution:

Question 74

Which of the following lines in the atomic spectrum of H appear in the visible region?

Options:

A. Lyman

B. Balmer

C. Paschen

D. Pfund

Answer: B

Solution:

Solution:

Question 75

Which among the following undergoes SN2 substitution at the fastest rate?

Options:

A. iodomethane

B. iodoethane

C. 2-iodopropane

D. 2-iodo-2-methylpropane

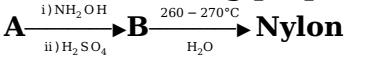
Answer: A

Solution:

Solution:

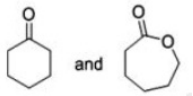
Question 76

In the following preparation of Nylon 6 , identify compounds A and B.

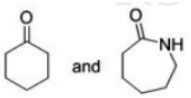


Options:

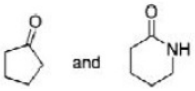
A.



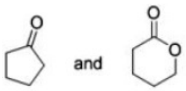
B.



C.



D.



Answer: B

Solution:

Solution:

Question 77

Phenol is more acidic than methanol due to

Options:

A. aromaticity of phenol

B. resonance stabilization of phenoxide ion

C. less efficient solvation of phenol

D. weaker hydrogen bonding between phenol molecules that enables easier removal of protons

Answer: B

Solution:

Solution:

Question 78

Which among the following methods is NOT suitable for the preparation of benzaldehyde?

Options:

A. Reaction of benzene with carbon dioxide and HCl in the presence of anhydrous aluminum chloride

B. Controlled reduction of methyl benzoate with DIBAL-H

C. Reaction of benzal chloride (a gem-dihalide) with water at 373 K

D. Reaction of benzonitrile with stannous chloride in the presence of HC1 followed by hydrolysis under acidic conditions

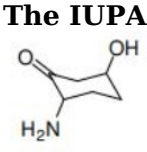
Answer: A

Solution:

Solution:

Question 79

The IUPAC name of the following compound is



Options:

A. 2-amino-5-hydroxycyclohexan-1-one

B. 2-hydroxy-5-aminocyclohexan-1-one

C. 1-amino-4-hydroxycyclohexan-2-one

D. 1-hydroxy-4-aminocyclohexan-3-one

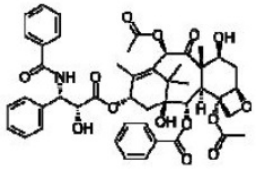
Answer: A

Solution:

Solution:

Question 80

Following organic compound is the structure of paclitaxel which is an anti-cancer chemotherapeutic drug. What are the functional groups present in paclitaxel?



Options:

A. Ester, Ether, Primary Alcohol and Alkene

B. Ester, Ketone, Secondary Alcohol, Aldehyde

C. Ketone, Amide, Ester, Alkene

D. Peptide linkage, tert-Alcohol, Ether, Ketone

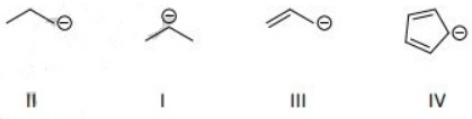
Answer: C

Solution:

Solution:

Question 81

What is the order of stability of the following carbanions?



Options:

A. IV > III > II > I

B. III > IV > II > I

C. IV > III > I > II

D. III > IV > I > II

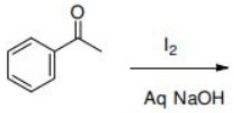
Answer: A

Solution:

Solution:

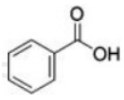
Question 82

Identify the yellow precipitate formed in the following reaction.



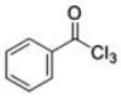
Options:

A. NaI

B. 

C. CHI_3

D.



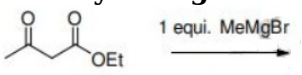
Answer: C

Solution:

Solution:

Question 83

One of the products of the following reaction is a gas under standard pressure and temperature. Identify that gaseous product.



Options:

A. H_2

B. CO_2

C. CH_4

D. CO

Answer: C

Solution:

Solution:

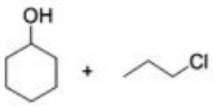
Question 84

Which pair will be the best suited for Williamson ether synthesis of propoxycyclohexane?

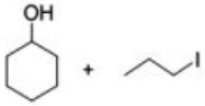
Options:

A.

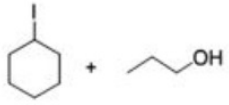
B.



C.



D.



Answer: C

Solution:

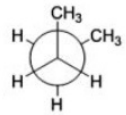
Solution:

Question 85

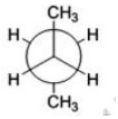
Which conformation of butane is most stable?

Options:

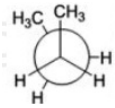
A.



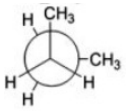
B.



C.



D.



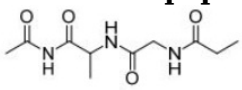
Answer: B

Solution:

Solution:

Question 86

Number of peptide bond(s) present in the following compound is,



Options:

A. 1

B. 2

C. 3

D. 4

Answer: A

Solution:

Solution:

Question 87

Which of the following combinations of enzyme, substrate and product is CORRECT?

Options:

A. Enzyme: Maltase, Substrate: Maltose, Product: Glucose + Fructose

B. Enzyme: Sucrase, Substrate: Sucrose, Product: Glucose + Fructose

C. Enzyme: Amylase, Substrate: Lactose, Product: Galactose + Fructose

D. Enzyme: Invertase, Substrate: Sucrose, Product: Glucose + Mannose

Answer: B

Solution:

Solution:

Question 88

Ethylenediaminetetraacetate (EDTA) ion is

Options:

A. hexadentate ligand with four " O ", and two " N " donor atoms

B. unidentate ligand

C. bidentate ligand with two " N " donor atoms

D. tridentate ligand with three " N " donor atoms

Answer: A

Solution:

Solution:

Question 89

Zr(Z = 40) and Hf(Z = 72) have similar atomic and ionic radii because of

Options:

A. belonging to same group

B. diagonal relationship

C. lanthanoid contraction

D. having similar chemical properties

Answer: C

Solution:

Solution:

Question 90

The INCORRECT statement among the following is

Options:

A. Actinoid contraction is greater for element to element than Lanthanoid contraction

B. Most of the trivalent lanthanoid ions are colourless in the solid state

C. Lanthanoids are good conductors of heat and electricity

D. Actinoids are highly reactive metals, especially when finely divided

Answer: B

Solution:

Solution:

Question 91

Identify the INCORRECT statement from the following

Options:

A. Pig iron contains about 4% carbon and many impurities in smaller amount and it can be moulded into a variety of shapes

B. Wrought iron is the purest form of iron

C. Vapour phase refining is carried out for nickel by Mond's process

D. Blister copper has blistered appearance due to evolution of CO_2

Answer: D

Solution:

Solution:

Question 92

The type of hybridization of boron in diborane is

Options:

A. sp-hybridization

B. sp^2 - hybridization

C. sp^3-hybridization

D. sp^3d - hybridization

Answer: C

Solution:

Solution:

Question 93

Which of the following diatomic molecular species has only π bonds according to Molecular Orbital Theory?

Options:

A. O_2

B. N_2

C. C_2

D. Be_2

Answer: C

Solution:

Solution:

Question 94

Identify the INCORRECT statement related to PCl_5 from the following

Options:

A. Three equatorial P − Cl bonds make an angle of 120˚ with each other

B. Two axial P-Cl bonds make an angle of 180˚ with each other

C. Axial P − Cl bonds are longer than equatorial P − Cl bonds

D. PCl_5 molecule is non-reactive

Answer: D

Solution:

Solution:

Question 95

The existence of two different coloured complexes with the composition of $[Co(NH_3)_4Cl_2]^+$ is due to

Options:

A. linkage isomerism

B. geometrical isomerism

C. coordination isomerism

D. ionization isomerism

Answer: B

Solution:

Solution:

Question 96

Which of the following statements is FALSE?

Options:

A. Ca^{2+} ions are important in blood clotting

B. Ca^{2+} ions are not important in maintaining the regular beating of the heart

C. Mg^{2+} ions are important in the green parts of plants

D. Mg^{2+} ions form a complex with ATP

Answer: B

Solution:

Solution:

Question 97

Bronze is an alloy of

Options:

A. Copper and Nickel

B. Copper and Iron

C. Copper and Tin

D. Copper and Aluminium

Answer: C

Solution:

Solution:

Question 98

Pure ozone is a

Options:

A. violet gas, dark blue liquid and pale blue solid

B. pale blue gas, dark blue liquid and violet-black solid

C. green gas, pale blue liquid and dark blue solid

D. pale green gas and dark blue solid and liquid

Answer: B

Solution:

Solution:

Question 99

Match the following.

i.	Gypsum	a.	PbS
ii.	Epsom salt	b.	$MgSO_4 \cdot 7H_2O$
iii.	Baryte	c.	$CaSO_4 \cdot 2H_2O$
iv.	Galena	d.	$BaSO_4$

Options:

A. i-c, ii-b, iii-d, iv-a

B. i-b, ii-d, iii-c, iv-a

C. i-d, ii-c, iii-a, iv-d

D. i-b, ii-c, iii-d, iv-a

Answer: A

Solution:

Solution:

Question 100

Which among the following is the correct formula of chloric acid?

Options:

A. $HOClO_2$

B. HOClO

C. $HOClO_3$

D. HOCl

Answer: A

Solution:

Solution:

Question 101

If n!, 3 × n! and (n + 1)! are in G.P, then n!, 5 × n! and (n + 1)! are

Options:

A. in A.P

B. not in A.P

C. in G.P

D. not in G.P

Answer: A

Solution:

Solution:

Question 102

The simplest form of $\frac{2}{\sqrt{2+\sqrt{2+\sqrt{2+2\cos 4x}}}}$ is

Options:

A. $\sec \frac{\pi}{2}$

B. secx

C. $\cos x$

D. 1

Answer: A

Solution:

Solution:

Question 103

Sum of two positive numbers is k and the sum of whose squares is minimum. Then the numbers are

Options:

A. $\frac{k}{2}, \frac{k}{2}$

B. $k-1, 1$

C. k, 0

D. $k, k-5$

Answer: A

Solution:

Solution:

Question 104

The differential equation of the family of circles with fixed radius 5 units and center on the line y = 2 is

Options:

A. $(y-2)^2y'^2 = 25-(y-2)^2$

B. $(x-2)^2y'^2 = 25-(y-2)^2$

C. $(y-2)y'^2 = 25-(y-2)^2$

D. $(x-2)y'^2 = 25-(y-2)^2$

Answer: A

Solution:

Solution:

Question 105

If $x^2 + 6x - 27 > 0$ and $x^2 - 3x - 4 < 0$, then

Options:

A. $x < 4$

B. $x > 3$

C. $3 < x < 4$

D. $x = \frac{7}{2}$

Answer: C

Solution:

Solution:

Question 106

If $\cos \frac{x}{a} = \sin \frac{x}{b}$, then $|a \cos 2x + b \sin 2x|$ is equal to

Options:

A. $\sqrt{a^2 b}$

B. $\sqrt{ab^2}$

C. $|b|$

D. $|a|$

Answer: C

Solution:

Solution:

Question 107

$\tan 5x \tan 3x \tan 2x$ is equal to

Options:

A. $\tan 5x + \tan 3x + \tan 2x$

B. 0

C. $\tan 5x - \tan 3x - \tan 2x$

D. 1

Answer: C

Solution:

Solution:

Question 108

Let 1, a_1, a_2, ..., a_{10} be the 11^{th} roots of unity. Then $(1 + a_1) \ldots (1 + a_{10})$ is equal to

Options:

A. 1

B. 2

C. 11

D. ∞

Answer: A

Solution:

Solution:

Question 109

The region of the argand diagram defined by $|z - i| < 3$ represents

Options:

A. interior of a circle with centre on x axis

B. interior of a circle with centre at origin

C. interior of a circle with centre on y axis

D. a pair of straight lines

Answer: A

Solution:

Solution:

Question 110

The first and last terms of an AP are 1 and 11. If the sum of its terms is 36 , then the number of terms will be

Options:

A. 3

B. 4

C. 5

D. 6

Answer: D

Solution:

Solution:

Question 111

Let $y = \cos^{-1}\left(\frac{2\cos x - 3\sin x}{\sqrt{13}}\right)$. Then $\frac{dy}{dx}$ is equal to

Options:

A. 0

B. x

C. 2x

D. 1

Answer: D

Solution:

Solution:

Question 112

△ABC has vertices (0, 0), (10, 20), and (40, 0). If the line y = kx cuts the triangle into two triangles of equal area, then k is equal to

Options:

A. $\frac{4}{5}$

B. $-\frac{5}{4}$

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

D. $\frac{1}{3}$

Answer: A

Solution:

Solution:

Question 113

The value of $\lim_{x \to 2} \frac{e^{3x-6} - 1}{\sin(2 - x)}$ is

Options:

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

B. 3

C. -3

D. -1

Answer: C

Solution:

Solution:

Question 114

$\int \frac{dx}{x(x+1)}$ is equal to

Options:

A. $\log \left| \frac{x+1}{x} \right| + c$

B. $\log \left| \frac{x}{x+1} \right| + c$

C. $\log \left| \frac{x-1}{x} \right| + c$

D. $\log \left| \frac{x-1}{x+1} \right| + c$

Answer: B

Solution:

Solution:

Question 115

If $\vec{a}$ and $\vec{b}$ are two non-zero, non-collinear vectors, then $2\left[\vec{a}, \vec{b}, \hat{i}\right]\hat{i} + 2\left[\vec{a}, \vec{b}, \hat{j}\right]\hat{j} + 2\left[\vec{a}, \vec{b}, \hat{k}\right]\hat{k} + \left[\vec{a}, \vec{b}, \vec{a}\right]$ is equal to

Options:

A. $2\left(\vec{a} \times \vec{b}\right)$

B. $\vec{a} \times \vec{b}$

C. $\vec{a} + \vec{b}$

D. $\vec{a} - \vec{b}$

Answer: A

Solution:

Solution:

Question 116

Solution of $\frac{dx}{dy} + mx = 0$, where $m < 0$

Options:

A. $x = ce^{my}$

B. $x = ce^{-my}$

C. $x = c + my$

D. $x = c$

Answer: B

Solution:

Solution:

Question 117

The sum of the infinite geometric series $1 + \frac{1}{4} + \frac{1}{16} + \frac{1}{64} + \ldots$ is

Options:

A. $\frac{3}{5}$

B. $\frac{3}{4}$

C. $\frac{5}{3}$

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

Answer: D

Solution:

Solution:

Question 118

If $\int_{1}^{b} (b - 4x)\,dx \geq 6 - 5b$ and $b > 1$, then b equals

Options:

A. 3

B. 2

C. 1

D. 4

Answer: B

Solution:

Solution:

Question 119

If the line $y = 3x + \lambda$ touches the hyperbola $9x^2 - 5y^2 = 45$, then the value of λ^2 is

Options:

A. 45

B. 36

C. 6

D. 15

Answer: A

Solution:

Solution:

Question 120

The unit vector parallel to the resultant of the vectors $2\vec{i} + 3\vec{j} - \vec{k}$ and $4\vec{i} - 3\vec{j} + 2\vec{k}$ is

Options:

A. $\frac{6\vec{i}+\vec{k}}{\sqrt{17}}$

B. $\frac{6\vec{j}+\vec{k}}{\sqrt{17}}$

C. $\frac{6\vec{i}-\vec{k}}{\sqrt{37}}$

D. $\frac{6\vec{i}+\vec{k}}{\sqrt{37}}$

Answer: D

Solution:

Solution:

Question 121

If $2f(x) = f'(x)$ and $f(0) = 3$, then $f(2)$ equals

Options:

A. $4e^3$

B. $3e^4$

C. $2e^3$

D. $3e^2$

Answer: B

Solution:

Solution:

Question 122

If the expression $\left(ax - 1 + \frac{1}{x}\right)$ is non-negative for all positive real x, then the minimum value of a must be

Options:

A. 0

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

C. $\frac{1}{4}$

D. $\frac{1}{3}$

Answer: C

Solution:

Solution:

Question 123

The differential equation for $y = A\cos\alpha x + B\sin\alpha x$, where A and B are arbitrary constants, is

Options:

A. $\frac{d^2y}{dx^2} - \alpha^2 y = 0$

B. $\frac{d^2y}{dx^2} + \alpha^2 y = 0$

C. $\frac{d^2y}{dx^2} - \alpha y = 0$

D. $\frac{d^2y}{dx^2} + \alpha y = 0$

Answer: B

Solution:

Solution:

Question 124

If $\vec{a}$, $\vec{b}$ and $\sqrt{3}\vec{a} - \vec{b}$ are unit vectors, then the angle between $\vec{a}$ and $\vec{b}$ is

Options:

A. $\frac{\pi}{6}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{2}$

Answer: A

Solution:

Solution:

Question 125

Suppose two cards are selected at random from a deck of 52 cards. Let X be the number of queens obtained. Then E (X) =

Options:

A. $\frac{1}{13}$

B. $\frac{2}{13}$

C. $\frac{5}{13}$

D. $\frac{37}{221}$

Answer: B

Solution:

Solution:

Question 126

If n is even, then the sum of n terms of the series $1^2 - 2^2 + 3^2 - 4^2 + 5^2 - 6^2 + \ldots$ is

Options:

A. $\frac{-n(n+1)}{2}$

B. $-n(n+1)$

C. $\frac{n(n+1)}{2}$

D. $\frac{n^2 - n}{4}$

Answer: A

Solution:

Solution:

Question 127

$\lim_{x \to 0} \frac{1 + x + x^2 - e^x}{x^2} =$

Options:

A. 1

B. 2

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

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

Answer: C

Solution:

Solution:

Question 128

A function y = f (x) has a second order derivatives $f''(x) = 6(x - 1)$. If its graph passes through the point (2, 1) and at that point the tangent to the graph is y = 3x − 5, then the function is

Options:

A. $(x - 1)^3$

B. $(x + 1)^3$

C. $(x - 1)^2$

D. $(x + 1)^2$

Answer: A

Solution:

Solution:

Question 129

The function f (y) = $\sin^{-1}(\tan y)$ is not differentiable at

Options:

A. y = 0

B. $y = -\frac{\pi}{6}$

C. $y = \frac{\pi}{6}$

D. $y = \frac{\pi}{4}$

Answer: D

Solution:

Solution:

Question 130

The angle between the curves $y = x^2$ and $y = (x - 2)^2$ at their point of intersection is

Options:

A. $\theta = \sin^{-1}\left(\frac{1}{2}\right)$

B. $\theta = \frac{\sin(\pi)}{\cos(0)}$

C. $\theta = \tan^{-1}\left(\frac{1}{2}\right)$

D. $\theta = \tan^{-1}\left(\frac{4}{3}\right)$

Answer: D

Solution:

Solution:

Question 131

If $n = 2^3 \times 3^4 \times 5^4 \times 7$, then the number of consecutive zeros in n is

Options:

A. 2

B. 3

C. 4

D. 7

Answer: B

Solution:

Solution:

Question 132

If A and B are two subsets of a set X, then $\{A \cap (X - B)\} \cup B$ is equal to

Options:

A. $A \cup B$

B. $A \cap B$

C. X

D. B

Answer: A

Solution:

Solution:

Question 133

Let m, n be real numbers. If α is the root of $x^2 + 3m^2x + 5n^2 = 0$, β is a root of $x^2 + 9m^2x + 15n^2 = 0$ and $0 < \alpha < \beta$, then the equation $x^2 + 6m^2x + 10n^2 = 0$, has a root γ that always satisfies

Options:

A. $\gamma = \frac{\alpha}{4} + \beta$

B. $\beta < \gamma$

C. $\alpha < \gamma < \beta$

D. $\gamma = \frac{\alpha}{2} + \beta$

Answer: C

Solution:

Solution:

Question 134

If A = $\cos^2 x + \sin^4 x$, then, for all values of x,

Options:

A. $1 \leq A \leq 2$

B. $\frac{3}{4} \leq A \leq 1$

C. $\frac{13}{16} \leq A \leq 1$

D. A = 3

Answer: B

Solution:

Solution:

Question 135

Let z_1 and z_2 be two different complex numbers such that $|z_1| = 1$ and $|z_2| = 1$.

Then $\left|\frac{z_2 - z_1}{1 - \bar{z}_1 z_2}\right|$ is equal to

Options:

A. 1

B. 1/2

C. 2

D. 0

Answer: A

Solution:

Solution:

Question 136

Let a > 1, b > 1, c > 1 be in Geometric Progression.
Then $\frac{1}{1+\log_e a}$, $\frac{1}{1+\log_e b}$, $\frac{1}{1+\log_e c}$ are

Options:

A. in Arithmetic Progression

B. in Geometric Progression

C. in Harmonic Progression

D. not in any progression

Answer: C

Solution:

Solution:

Question 137

Let n be an integer which leaves remainder one when divided by three. Then $(1 + \sqrt{3}i)^n + (1 - \sqrt{3}i)^n$ equals

Options:

A. 2^n

B. 2^{n+1}

C. $(-1)^{n+1}2^n$

D. -2^n

Answer: C

Solution:

Solution:

Question 138

Let P = $(-\sin(\beta-\alpha), -\cos\beta)$, Q = $(\cos(\beta-\alpha), \sin\beta)$ and R = $(\cos(\beta-\alpha+\theta), \sin(\beta-\theta))$, $\left(0 < \alpha, \beta, \theta < \frac{\pi}{4}\right)$ be the three points in a plane. Then

Options:

A. P, Q, R are non-collinear

B. Q lies on the line segment of RP

C. R lies on the line segment of PQ

D. P lies on the line segment of QR

Answer: A

Solution:

Solution:

Question 139

The image of the point P(2, 3) with respect to the line x = y is the point Q and the image of Q with respect to the line x = 0 is A(x, y). Then

Options:

A. $x = 3, y = -2$

B. $x = -3, y = 2$

C. $x = 3, y = 2$

D. $x = -3, y = -2$

Answer: B

Solution:

Solution:

Question 140

All chords of the curve $3x^2 - y^2 - 2x + 4y = 0$ that subtends a right angle at the origin, pass through a fixed point whose coordinates are

Options:

A. $(1, -2)$

B. $(-1, -2)$

C. $(1, 2)$

D. $(-1, 2)$

Answer: A

Solution:

Solution:

Question 141

The locus of the middle points of chords of the parabola $y^2 = 8x$ drawn through the vertex is a parabola whose

Options:

A. focus is (2, 0)

B. latus rectum $= 4$

C. latus rectum $= 8$

D. focus is $(0, -1)$

Answer: B

Solution:

Solution:

Question 142

The equation of the common tangent touching the circle $(x - 3)^2 + y^2 = 9$ and parabola $y^2 = 4x$ below the x-axis is

Options:

A. $\sqrt{3}y = -x + \sqrt{3}$

B. $\sqrt{3}y = x + \sqrt{3}$

C. $\sqrt{3}y = x - \sqrt{3}$

D. $\sqrt{3}y = 2x - \sqrt{3}$

Answer: A

Solution:

Solution:

Question 143

It is given that the tangent at the point $(2\sec\theta, 3\tan\theta)$ of the hyperbola $\frac{x^2}{4} - \frac{y^2}{9} = 1$ is parallel to the line $3x - y + 4 = 0$. Then the value of θ is

Options:

A. 90°

B. 60°

C. 45°

D. 30°

Answer: D

Solution:

Solution:

Question 144

A common tangent to $9x^2 - 16y^2 = 144$ and $x^2 + y^2 = 9$ is

Options:

A. $y = \frac{3x}{\sqrt{7}} + \frac{15}{\sqrt{7}}$

B. $y = \frac{3x}{\sqrt{7}} - \frac{15}{\sqrt{7}}$

C. $y = 3x\sqrt{\frac{2}{7}} + \frac{15}{\sqrt{7}}$

D. $y = 3\frac{3x}{\sqrt{7}} - \frac{15}{\sqrt{7}}$

Answer: C

Solution:

Solution:

Question 145

Let $(x + iy)^{1/3} = a + ib$. Then $\frac{x}{a} + \frac{y}{b}$ is equal to

Options:

A. $a^2 - b^2$

B. $4(a^2 - b^2)$

C. $6(a^2 - b^2)$

D. $8(a^2 - b^2)$

Answer: B

Solution:

Solution:

Question 146

If $z = -2 + 2\sqrt{3}i$, then $z^{2n} + 2^{2n}.z^n + 2^{4n}$ may be equal to

Options:

A. 1

B. 0, n is a multiple of 3

C.

2^{2n}, n is not a multiple of 3

D.

3.4^{2n}, n is a multiple of 3

Answer: D

Solution:

Solution:

Question 147

Assume that $\sum_{n=1}^{n} n$, $\frac{\sqrt{10}}{3}$, $\sum_{n=1}^{n} n^2$, $\sum_{n=1}^{n} n^3$ are in a geometric progression. Then the value of n is

Options:

A. 12

B. 14

C. 6

D. 4

Answer: D

Solution:

Solution:

Question 148

If $s_n = \sum_{k=1}^{n} \frac{1 + 2 + 2^2 + \ldots \text{ to k terms}}{2^k}$, then s_n is equal to

Options:

A. $n - 1 + \frac{1}{2^n}$

B. $1 - \frac{1}{2^n}$

C. $2^n - (n + 1)$

D. $2^n - 1$

Answer: A

Solution:

Solution:

Question 149

If a, b, c, d , e, f are in Arithmetic Progression, then e − c is equal to

Options:

A. 2(b − c)

B. f − d

C. 2(d − c)

D. 2(f − d)

Answer: C

Solution:

Solution:

Question 150

The sum of the infinite series $\left(\frac{1}{3}\right)^2 + \frac{1}{3}\left(\frac{1}{3}\right)^4 + \frac{1}{5}\left(\frac{1}{3}\right)^6 + \ldots$ is equal to

Options:

A. $\frac{1}{4}\log 2$

B. $\frac{1}{6}\log 2$

C. $\frac{1}{4}\log 3$

D. $\frac{1}{6}\log 3$

Answer: B

Solution:

Solution:

Question 151

If y = sin x, then $\frac{d^2}{dy^2}(\cos^7 x)$ is equal to

Options:

A. $35\cos^3 x - 42\cos^5 x$

B. $35\cos^3 x + 42\cos^5 x$

C. $42\cos^3 x - 35\cos^5 x$

D. $42\cos^3 x + 35\cos^5 x$

Answer: A

Solution:

Solution:

Question 152

Let g(x) be the inverse function f (x) and $f'(x) = \frac{1}{1+x^3}$, then $g'(x)$ is equal to

Options:

A. $\frac{1}{1+(g(x))^3}$

B. $\frac{1}{1+(f(x))^3}$

C. $1 + (g(x))^3$

D. $1 + (f(x))^3$

Answer: B

Solution:

Solution:

Question 153

The domain of the function $f(x) = \sin^{-1}\left(\frac{4}{3+2\cos x}\right)$ is

Options:

A. $2n\pi - \frac{\pi}{6} \le x \le 0$, n is an integer

B. $2n\pi - \frac{\pi}{6} \le x \le 2n\pi + \frac{\pi}{6}$, n is an integer

C. $0 \le x \le 2n\pi + \frac{\pi}{6}$, n is an integer

D. $2n\pi - \frac{\pi}{3} \le x \le 2n\pi + \frac{\pi}{3}$, n is an integer

Answer: D

Solution:

Solution:

Question 154

Let [,] be the greatest integer function. If [x + [2x]] < 3, then

Options:

A. $x \in (-\infty, 1)$

B. $x \in [0, 1)$

C. $x \in [-\infty, 3/2)$

D. $x \in [0, 3/2)$

Answer: A

Solution:

Solution:

Question 155

Let $f : R \to R$ be defined by $f(x) = (x+1)^2 - 1, x \geq -1$. Then the set of values of x for which $f(x) = f^{-1}(x)$ is given by

Options:

A. $\{0\}$

B. $\{0, -1\}$

C. $\{0, 1\}$

D. $\{0, \infty\}$

Answer: B

Solution:

Solution:

Question 156

$\lim_{x \to \infty} \left(\frac{x^2 + 5x + 3}{x^2 + x + 2} \right)^x$ **equals**

Options:

A. e^2

B. e^3

C. e^4

D. e^5

Answer: C

Solution:

Solution:

Question 157

$\lim_{x \to \infty}(\sin \sqrt{x+1} - \sin \sqrt{x})$ is equal to

Options:

A. 1

B. -1

C. 0

D. ∞

Answer: C

Solution:

Solution:

Question 158

If $f(x) = \begin{cases} \frac{1 - \cos x}{x} & x \neq 0 \\ k & x = 0 \end{cases}$. is continuous at x = 0, then the value of k is

Options:

A. 0

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

C. $\frac{1}{4}$

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

Answer: A

Solution:

Solution:

Question 159

Let f be a function which is continuous and differentiable for all real x. If f (2) = −4 and f′(x) ≥ 6 for all x ∈ [2, 4], then

Options:

A. f (4) ≤ 8

B. f (4) ≥ 8

C. f (4) ≥ 12

D. f (4) ≤ 12

Answer: B

Solution:

Solution:

Question 160

Let f (x) = $\frac{x^2-1}{x^2+1}$ for every real number x. Then the minimum value of f

Options:

A. does not exist because f is unbounded

B. is not attained even though f is bounded

C. is equal to 1

D. is equal to -1

Answer: D

Solution:

Solution:

Question 161

The set of all values of a satisfying $\log_2(ax^2 + x + a) \geq 1$ for all x ∈ R, is

Options:

A. $\left(0, 1 + \frac{\sqrt{5}}{2}\right)$

B. $\left(1 + \frac{\sqrt{5}}{2}, \infty\right)$

C. $\left(0, 1 - \frac{\sqrt{5}}{2}\right)$

D. $\left(1 - \frac{\sqrt{5}}{2}, 1 + \frac{\sqrt{5}}{2}\right)$

Answer: B

Solution:

Solution:

Question 162

If the roots of the equation $(a^2 + b^2)y^2 - 2(ac + bd)y + c^2 + d^2 = 0$ are equal, then

Options:

A. $ab = dc$

B. $ac = bd$

C. $ad = -bc$

D. $ad = bc$

Answer: D

Solution:

Solution:

Question 163

The number of integers k such that $1 \leq k \leq 100$ and $2^k + 3^k + 5^k$ is divisible by 4 is

Options:

A. 47

B. 48

C. 49

D. 50

Answer: C

Solution:

Solution:

Question 164

The number of ways of arranging letters of the word BACANA so that C and N do not appear together is

Options:

A. 30

B. 40

C. 60

D. 80

Answer: D

Solution:

Solution:

Question 165

The system of equations
$2x\cos^2\theta + y\sin 2\theta - 2\sin\theta = 0$
$x\sin 2\theta + 2y\sin^2\theta = -2\cos\theta$
$x\sin\theta - y\cos\theta = 0$ for all values of θ, can

Options:

A. can have a unique non-trivial solution

B. cannot have a solution

C. can have infinite number solutions

D. can have only trivial solution

Answer: B

Solution:

Solution:

Question 166

$\frac{1}{n!} + \frac{1}{2!(n-2)!} + \frac{1}{4(n-4)!} + \ldots + \infty$ is equal to

Options:

A. $\frac{2^n}{n!}$

B. $\frac{2^n}{(n+1)!}$

C. $\frac{2^{n-1}}{n!}$

D. $\frac{2^{n-2}}{(n+1)!}$

Answer: C

Solution:

Solution:

Question 167

An elevator starts with m passengers and steps at n floors (m ≤ n). The probability that no two passengers alight at the same floor is

Options:

A. $\frac{{}^{n}P_{m}}{m^{n}}$

B. $\frac{{}^{n}C_{m}}{m^{n}}$

C. $\frac{{}^{n}C_{m}}{n^{m}}$

D. $\frac{{}^{n}P_{m}}{n^{m}}$

Answer: D

Solution:

Solution:

Question 168

10 different books and 2 different pens are given to 3 boys so that each gets equal number of things. The probability that the same boy does not receive both the pens is

Options:

A. $\frac{7}{11}$

B. $\frac{5}{11}$

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

D. $\frac{5}{11}$

Answer: B

Solution:

Solution:

Question 169

If $\tan^2\theta = 2\tan^2\varphi + 1$, then $\cos 2\theta + \sin^2\varphi$ is equal to

Options:

A. -1

B. 0

C. 1

D. 2

Answer: B

Solution:

Solution:

Question 170

If $\sin\theta = 3\sin(\theta + 2\alpha)$, then the value of $\tan(\theta + \alpha) + 2\tan\alpha$ is

Options:

A. 3

B. 2

C. 1

D. 0

Answer: D

Solution:

Solution:

Question 171

If P is a point on the altitude AD of the triangle ABC such that $\angle CDP = \frac{B}{3}$, then AP is equal to

Options:

A. $2a\sin\frac{C}{3}$

B. $2b\sin\frac{C}{3}$

C. $2c\sin\frac{B}{3}$

D. $2c\sin\frac{C}{3}$

Answer: C

Solution:

Solution:

Question 172

The equation of the family of curves which intersect the hyperbola xy = 2 orthogonally is

Options:

A. $y = \frac{x^2}{4} + C$

B. $y = \frac{x^3}{6} + C$

C. $y = -\frac{x^3}{6} + C$

D. $y = -\frac{x^2}{4} + C$

Answer: B

Solution:

Solution:

Question 173

A normal at any point (x, y) to the curve y = f (x) cuts triangle of unit area with the axes. The equation of the curve is

Options:

A. $y^2 - x^2\left(\frac{dy}{dx}\right)^2 = 4\frac{dy}{dx}$

B. $x^2 - y^2\left(\frac{dy}{dx}\right)^2 = \frac{dy}{dx}$

C. $x + y\frac{dy}{dx} = y$

D. $x^2 + 2xy\frac{dy}{dx} + y^2\left(\frac{dy}{dx}\right)^2 = 2\frac{dy}{dx}$

Answer: D

Solution:

Solution:

Question 174

Let z and w be two complex numbers such that |z| ≤ 1, | w | ≤1 and |z + iw| = | z − $\overline{w}$i | = 2. Then z is equal to

Options:

A. 1 or i

B. -1 or i

C. 1 or -1

D. -1 or −i

Answer: C

Solution:

Solution:

Question 175

The distance between the foci of the hyperbola $x^2 - 3y^2 - 4x - 6y - 11 = 0$ is

Options:

A. 2

B. 4

C. 6

D. 8

Answer: D

Solution:

Solution:

Question 176

If $\begin{vmatrix} g(y) & g'(y) \\ g'(y) & g''(y) \end{vmatrix}$ = 0, g(0) = 1 and g′(0) = 2, then g(1) belongs to the interval

Options:

A. [5, 7]

B. [8, 10]

C. [9, 12]

D. [6, 9]

Answer: D

Solution:

Solution:

Question 177

Let M be a 3 × 4 real matrix and M X = N be an inconsistent system of equations. Then the highest possible rank of M is

Options:

A. 4

B. 3

C. 2

D. 1

Answer: C

Solution:

Solution:

Question 178

The function f (x) = | x + 1| on the interval [−2, 0] is

Options:

A. differentiable but not continuous

B. continuous and differentiable

C. continuous but not differentiable

D. neither continuous nor differentiable

Answer: C

Solution:

Solution:

Question 179

The value of cos 105° is equal to

Options:

A. $\frac{1}{4}(\sqrt{2} - \sqrt{3})$

B. $\frac{1}{\sqrt{2}}(2 - \sqrt{6})$

C. $\frac{1}{4}(\sqrt{2} - \sqrt{6})$

D. $\frac{\sqrt{6}}{4}$

Answer: C

Solution:

Solution:

Question 180

Let $[A]_{3\times1}$, $[B]_{3\times3}$, $[C]_{3\times5}$, $[D]_{5\times3}$, $[E]_{5\times5}$ and $[F]_{5\times1}$ be real matrices where [B] and [E] are symmetric. The following statements are made with respect to these matrices.
Statement (i) Matrix product $[D]^T[F][D]$ is always symmetric.
Statement (ii) Matrix product $[F]^T[C]^T[B][C][F]$ is a scalar.
Then

Options:

A. statement (i) is true but statement (ii) is false

B. statement (i) is false but statement (ii) is true

C. both the statements are true

D. both the statements are false

Answer: B

Solution:

Solution:

Question 181

The standard deviation of a uniformly distributed random variable between 0 and 1 is

Options:

A. $\frac{7}{\sqrt{12}}$

B. $\frac{5}{\sqrt{12}}$

C. $\frac{1}{\sqrt{3}}$

D. $\frac{1}{\sqrt{12}}$

Answer: D

Solution:

Solution:

Question 182

For every real number t, let f (t) = $\frac{t}{1!} + \frac{3}{2!}t^2 + \frac{7}{3!}t^3 + \frac{15}{4!}t^4 + \ldots$ Then the equation f (t) = 0 has

Options:

A. no real solution

B. infinite number of real solutions

C. exactly two real solutions

D. exactly one real solution

Answer: D

Solution:

Solution:

Question 183

Let $z^3 = \bar{z}$, where z is a complex number not equal to zero. Then z is a solution of the equation

Options:

A. $z^2 = 1$

B. $z^3 = 1$

C. $z^4 = 1$

D. $z^9 = 1$

Answer: C

Solution:

Solution:

Question 184

The equation of the line normal to the function $f(x) = (x-8)^{\frac{2}{3}} + 1$ at the point (0, 5) is

Options:

A. $y = 3x - 5$

B. $3y = x + 15$

C. $3y = x - 15$

D. $y = 3x + 5$

Answer: D

Solution:

Solution:

Question 185

The fifth term of a G.P is 2 . Then the product of first 9 terms is

Options:

A. 128

B. 512

C. 256

D. 64

Answer: B

Solution:

Solution:

Question 186

If the non-zero numbers x, y, z are in A.P, and $\tan^{-1}x$, $\tan^{-1}y$, $\tan^{-1}z$ are also in A.P, then

Options:

A. $x = y = z$

B. $xy = yz$

C. $x^2 = yz$

D. $z^2 = xy$

Answer: A

Solution:

Solution:

Question 187

Let f (x) = m + nx | +l x|^2, where m, n, and l are real constants. Then f$'$(0) exists if

Options:

A. n = 0

B. l = 0

C. m = 0

D. n = m

Answer: A

Solution:

Solution:

Question 188

From a pack of playing cards, two cards are drawn at random. The probability that both cards will be a king, if the first card is not replaced is

Options:

A. $\frac{1}{221}$

B. $\frac{1}{169}$

C. $\frac{1}{52}$

D. $\frac{1}{26}$

Answer: A

Solution:

Solution:

Question 189

$\lim_{x \to 0} \frac{|x|}{x}$

Options:

A. is zero

B. is infinity

C. does not exist

D. is -1

Answer: C

Solution:

Solution:

Question 190

Consider the region 5x + y ≤ 100, x + y ≤ 60, x ≥ 0, y ≥ 0. In this region, the point (26, 39)

Options:

A. lies inside

B. lies outside

C. lies on the boundary

D. is the only point in the region

Answer: B

Solution:

Solution:

Question 191

If $C_n = a^n + b^n$, $a + b = 1$, $ab = -1$, $C_{n-1} = 11$, $C_{n+1} = 29$, where $n \in$ □, then $(C_n)^2 =$

Options:

A. 98

B. 246

C. 324

D. 420

Answer: C

Solution:

Solution:

Question 192

The value of $\lim_{x \to 8} \frac{x^{1/3} - 2}{x - 8}$ is

Options:

A. $\frac{1}{16}$

B. $\frac{1}{12}$

C. $\frac{1}{8}$

D. $\frac{1}{4}$

Answer: D

Solution:

Solution:

Question 193

Assume that the duration in minutes of a telephone conversation follows the exponential distribution $f(x) = \frac{1}{5}e^{x/5}$, $x \geq 0$. The probability that the conversation will exceed five minutes is

Options:

A. $\frac{1}{e}$

B. $1 - \frac{1}{e}$

C. $\frac{1}{e^2}$

D. $1 - \frac{1}{e^2}$

Answer: A

Solution:

Solution:

Question 194

Let t_n denote the n^{th} term of the infinite series $\frac{1}{1!} + \frac{10}{2!} + \frac{21}{3!} + \frac{34}{4!} + \frac{49}{5!} + \ldots$ Then $\lim_{n \to \infty} t_n$ is

Options:

A. 0

B. e

C. e^2

D. 1

Answer: A

Solution:

Solution:

Question 195

Let $\vec{v}$ be a differentiable vector function and f be a differentiable scalar function. Then curl$\left(f\vec{v}\right)$ =

Options:

A. $\vec{0}$

B. f curl$\left(\vec{v}\right)$

C. (grad f) $\times \vec{v}$

D. (grad f) $\times \vec{v}$ + $\left(f \text{ curl}\left(\vec{v}\right)\right)$

Answer: D

Solution:

Solution:

Question 196

If |z| = | z − 1|, then

Options:

A. Re(z) = 1

B. Re(z) = $\frac{1}{2}$

C. Im(z) = 1

D. Im(z) = $\frac{1}{2}$

Answer: B

Solution:

Solution:

Question 197

If θ is an acute angle such that $\tan^2\theta = \frac{8}{7}$, then the value of $\frac{(1+\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(1-\cos\theta)}$ is

Options:

A. $\frac{8}{7}$

B. $\frac{7}{8}$

C. $\frac{7}{4}$

D. $\frac{64}{49}$

Answer: B

Solution:

Solution:

Question 198

Let R be a relation defined on the set Z of all integers and xRy when x + 2y is divisible by 3 . Then

Options:

A. R is not transitive

B. R is symmetric only

C. R is an equivalence relation

D. R is not an equivalence relation

Answer: D

Solution:

Solution:

Question 199

The range of the function f (x) = $\sqrt{\frac{x}{1+x}}$ is

Options:

A. $(0, \infty)$

B. $(0, \infty]$

C. $(0, \infty] - \{1\}$

D. $[0, \infty)$

Answer: C

Solution:

Solution:

Question 200

If tangent to the curve $y^2 + 3x - 7 = 0$ at the point (a, b) is parallel to the line $x - y = 4$, then the value of b is

Options:

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

B. $-\frac{2}{3}$

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

D. $-\frac{3}{2}$

Answer: D

Solution:

Solution:
