Previous Paper Questions

1. Q.Id: 159256

Find the suitable method from the following to prepare amines without the loss of carbons.

A) Gabriel method

B) Alkylation method

C) Hoffmann bromide method

D) Stephen method

2. Q.Id: 159255

Which of the below reactions produce carboxylic acids ?

I. $HC \equiv C-CH= \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} -CH_2OH \xrightarrow[CH_3COCH_3]{MnO_2}$

II. $Ph-CCl_3 \xrightarrow[(ii)\ H_2O/H^{\oplus}]{(i)\ aq.NaOH}$

III. $C_2H_5Br \xrightarrow[(ii)\ CO_2]{(i)\ Mg} \xrightarrow{(iii)\ H_2O/\ H^{\oplus}}$

IV. $CH_3CH=CHCH_3 \xrightarrow[\Delta]{K_2Cr_2O_7/H_2SO_4}$

A) I, II, III

B) II, III, IV

C) I, III, IV

D) I, II, IV

3. Q.Id: 159254

The compound that does not undergo halo formreaction is

A) CH_3CHO

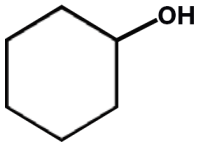
B) CH_3CH_2OH

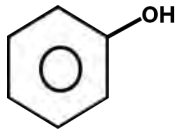
C) CH_3COCH_3

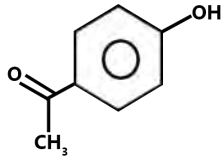
D) $C_2H_5COCH_2CH_3$

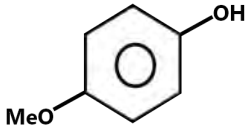
4. Q.Id: 159253

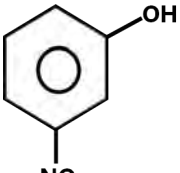
Find the correct order of acid strengths of the following compounds :

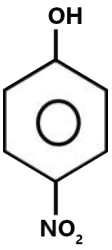
A. 

B. 

D. 

C. 

E. 

F. 

A) F>D>E>B>C>A

B) D>F>E>C>B>A

C) D>E>F>B>C>A

D) F>E>D>B>C>A

5. Q.Id: 159252

Which one of the following is used to obtain the maximum percentage of terminal alkene by dehydro halogenation of $CH_3CH_2C(CH_3)_2Br$ **?**

A) Sodium ethoxide in ethanol

B) Potassium ethoxide in ethanol

C) Potassium tert - butoxide in tert - butyl alcohol

D) Potassium alkoxide derived from 3 - ethyl - 3 - pentanol in $HO-C(C_2H_5)_3$

6. Q.Id: 159251

Match the following :

List1	List2
A. Analgesic	I. Phenelzine
B. Tranquilizer	II. Terfenadine
C. Antibiotic	III. Codeine
D. Antihistamine	IV. Prontosil

A) A - III, B - II, C - IV, D - I **B)** A - III, B - I, C - IV, D - II

C) A - II, B - III, C - I, D - IV **D)** A - II, B - III, C - IV, D - I

7. Q.Id: 159250

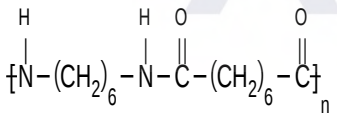
The enzyme responsible for the conversion of proteins to α-amino acids is

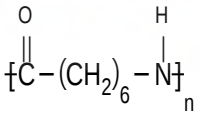
A) Pepsin **B)** Trypsin

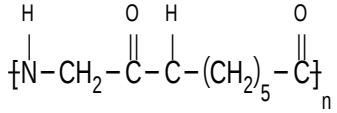
C) Maltase **D)** Amylase

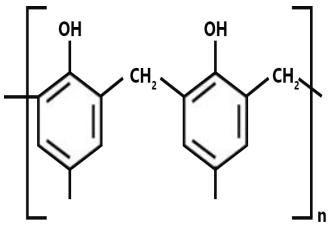
8. Q.Id: 159249

Which one of the following is a biodegradable polymer ?

A) 

B) 

C) 

D) 

9. Q.Id: 159248

The IUPAC name of the compound $(NH_4)_2\left[Ni(C_2O_4)_2(H_2O)_2\right]$ is

A) Nickel (II) diaminodioxalato diaquate **B)** Dioxalatodiammino diaquo nickelate (II)

C) Ammonium diaquabis (oxalato) nickelate (II) **D)** Ni dioxalato diaque (II) aminate

10. Q.Id: 159247

The elements with the highest and lowest enthalpy of atomisation, respectively for first row transitionelements are

A) Sc, Zn

B) Ti, Ni

C) V, Zn

D) Cr, Mn

11. Q.Id: 159246

Name the gaseous products from the following A and B reactions respectively.

A. Hydrochloric acid is added to sodium sulphide

B. Conc. sulphuric acid is added to a mixture of sodium chloride and manganese dioxide.

The correct answer is :

A) Cl_2, Cl_2

B) H_2, HCl

C) H_2S, O_2

D) H_2S, Cl_2

12. Q.Id: 159245

Which is the correct equation for the reaction of $AgCl$ **with** NH_4OH

A) $AgCl + NH_4OH \rightarrow AgOH + NH_4^+ + Cl^-$

B) $AgCl + 2NH_4OH \rightarrow \left[Ag(NH_3)_2\right]^+ + Cl^- + 2H_2O$

C) $AgCl + 4NH_4OH \rightarrow \left[Ag(NH_3)_4\right]^+ + Cl^- + 4H_2O$

D) $2AgCl + NH_4OH \rightarrow Ag_2O + NH_4^+ + H^+ + 2Cl^-$

13. Q.Id: 159244

In the preparation of chlorine by the electrolysis of brine, the reaction taking place at the anode is

A) $Cl^-(aq) \rightarrow \frac{1}{2}Cl_2(g) + e^-$

B) $Na^+(aq) + e^- \rightarrow Na(s)$

C) $O_2(g) + 4H^+ + 4e^- \rightarrow 4H_2O(l)$

D) $H^+(aq) + e^- \rightarrow \frac{1}{2}H_2(g)$

14. Q.Id: 159243

The mass of haemoglobin in mg required to protect from coagulation of 50 mL of a gold sol on adding 5 mL of 10 % NaCl solution is (gold number of haemoglobin = 0.03)

A) 0.03

B) 0.75

C) 0.30

D) 0.15

15. Q.Id: 159242

The following results have been obtained during the kinetic studies of reaction : $2NO + 2H_2 \rightarrow N_2 + 2H_2O$

Expt	$\frac{-d[NO]}{dt}$ mol L^{-1} s^{-1}	[NO] mol L^{-1}	$[H_2]$mol L^{-1}
1.	4.8×10^{-5}	1×10^{-2}	1×10^{-3}
2.	4.32×10^{-5}	3×10^{-2}	1×10^{-3}
3.	86.4×10^{-5}	3×10^{-2}	2×10^{-3}

The rate law is :

A) $\frac{-d[NO]}{dt} = k[NO]^2[H_2]$

B) $\frac{-d[NO]}{dt} = k[NO]^2[H_2]^{\frac{1}{2}}$

C) $\frac{-d[NO]}{dt} = k[NO][H_2]^2$

D) $\frac{-d[NO]}{dt} = k[NO][H_2]$

16. Q.Id: 159232

An electrolyte of a polymer - salt complex of poly (ethylene oxide) $LiCF_3SO_3$ **is shaped into a free standing circular film of 20 mm diameter and a thickness of** $20\ \mu m$**. When it is sandwiched between 2 stainless steel circular electrodes of the same diameter, this cell exhibits a conductance of** $\frac{314}{5}$ S**. What is the specific conductivity of the electrolyte ?**

A) $4\ m\ S\ cm^{-1}$

B) $0.4\ S\ cm^{-1}$

C) $40\ m\ S\ cm^{-1}$

D) $0.004\ S\ cm^{-1}$

17. Q.Id: 159231

If 0.1 M Solution of NaCl is isotonic with 1.1 w% urea solution, the degree of ionisation of NaCl is (molar masses of urea and NaCl are 60 and 58.5 $g\ mol^{-1}$ **respectively)**

A) 2

B) 0.83

C) 1

D) 1.83

18. Q.Id: 159230

How many grams of glucose are required to prepare an aqueous solution of glucose having a vapour pressure of 23.324 mm Hg at $25^\circ C$ **in 100 g of water? The vapour pressure of pure water at** $25^\circ C$ **is 23.8 mm Hg. (Molar mass of glucose** $= 180\ g\ mol^{-1}$**)**

A) 20.4

B) 10.3

C) 5.4

D) 7.4

19. Q.Id: 159229

$NaCl$ is a fcc lattice, where Na^+ ions are at corner and face centre position. Chloride ions are at edge centres and body centre positions. How many $NaCl$ formula units will be in an unit cell ?

A) 2

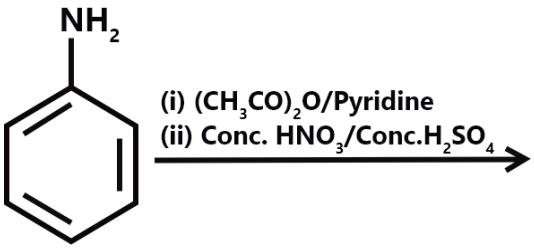
B) 4

C) 3

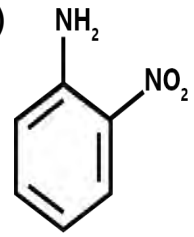
D) 1

20. Q.Id: 159228

The major product formed in the following reaction sequence is

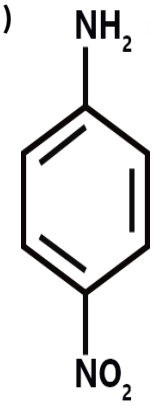


A)

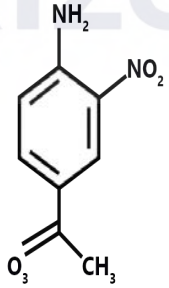


B)

C)



D)



21. Q.Id: 159227

The Boiling point (in K) of cis but-2-ene and dipole moment (in D) of trans but-2-ene are respectively

A) 274, 0.00

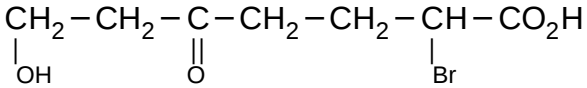
B) 277, 0.00

C) 277, 0.33

D) 274, 0.33

22. Q.Id: 159226

Find the suitable IUPAC name of the compound given below :



A) 2 - bromo - 7 - hydroxy - 5 - oxo heptanoic acid

B) 1 - hydroxy - 3 - keto - 6 - bromo heptanoic acid

C) 2 - bromo - 5 - keto - 7 - hydroxy heptanoic acid

D) 5 - oxo - 7 - hydroxy - 2 bromo heptanoic acid

23. Q.Id: 159223

Match the following :

List1	List2
A. SO_2	I. Photochemical smog
B. PAN	II. Acid rain
C. Smoke	III. Stratospheric
D. CF_2Cl_2	IV. Particulate

A) A - IV, B - III, C - I, D - II

B) A - III, B - I, C - IV, D - II

C) A - IV, B - I, C - III, D - II

D) A - II, B - I, C - IV, D - III

24. Q.Id: 159213

Identify the correct statements from the following :

I. Quartz is a piezoelectric material.

II. All group 14 tetra chlorides except CCl_4 are easily hydrolysed by water

III. The $C-C$ bond distance within the layer of graphite is 154 pm.

IV. SiO_2 is soluble in aqueous HCl solution

A) I, III

B) I, II

C) III, IV

D) II, IV

25. Q.Id: 159211

Which one among the following statements is correct about a solution of borax in water ?

A) It is acidic because it contains H_3BO_3 and $NaOH$

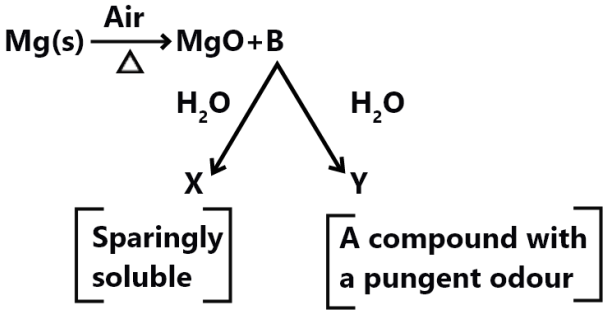
B) It dissociates into $NaBO_2$ and B_2O_3

C) it is neutral because it contains $NaOH$ and H_3BO_3

D) It is alkaline because it contains $NaOH$ and H_3BO_3

26. Q.Id: 159210

Identify X and Y respectively in the following reactions



A) MgO; C

B) $Mg(OH)_2$; MgO

C) MgO; NH_3

D) $Mg(OH)_2$; NH_3

27. Q.Id: 159208

What are the types of crystal structures shown by ice at different pressures ?

A) Hexagonal and mono clinic

B) Cubic and mono clinic

C) Hexagonal and tetragonal

D) Cubic and hexagonal

28. Q.Id: 159207

A solution of 0.1 mole of $CH_3NH_2 (K_b = 5 \times 10^{-4})$ **and 0.08 mole of HCl is diluted to one litre, then the pOH of the solution is** $(\log 1.25 = 0.1)$

A) 10.1

B) 3.9

C) 4.9

D) 9.9

29. Q.Id: 159205

Match the following :

List 1 : (Reaction)

List 2 : (K_p)

List1	List2
A. $2SO_2(g)+O_2(g) \rightleftharpoons 2SO_3(g)$ at 298 K	I. 0.98
B. $2SO_2(g)+O_2(g) \rightleftharpoons 2SO_3(g)$ at 700 K	II. 3.0×10^4
C. $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ at 298 K	III. 1700
D. $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ at 500 K	IV. 4.0×10^{24}
E. .	V. $6.8 \times \times 10^{-5}$

A) A - I, B - V, C - II, D - III

B) A - V, B - III, C - IV, D - II

C) A - IV, B - II, C - I, D - III

D) A - IV, B - V, C - II, D - III

30. Q.Id: 159204

Which of the following does not follows first law of thermodynamics ? (W = work, q = heat, ΔU = change in internal energy)

A) $W>0, q>0, \Delta U<0$

B) $W=0, q=0, \Delta U=0$

C) $W>0, q=0, \Delta U<0$

D) $W<0, q<0, \Delta U<0$

31. Q.Id: 159202

While combusting in air 4 g of H_2 gas was completely converted into water. If 36 μ mole of CO_2 from air is dissolved into that water, what is the concentration of CO_2 ?

A) 1 μM

B) 1 mM

C) 1 nM

D) 1000 mM

32. Q.Id: 159201

What is the equivalent weight of methanol, if one mole of CH_3OH is combusted to form CO and H_2O ?

A) 8

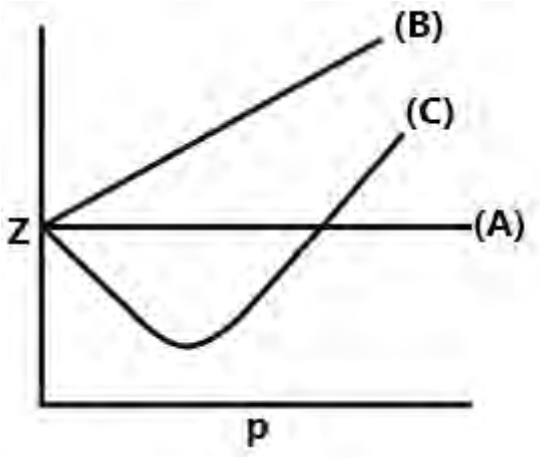
B) 5.33

C) 4

D) 10.66

33. Q.Id: 159200

The variation of compressibility factor (Z) with pressure (p in bar) for some gases are shown in the figure below. Identify the gases (A), (B) and (C) respectively



A) Real gas, N_2, CO_2

B) Ideal gas, H_2, CO_2

C) Ideal gas, CO_2, H_2

D) Real gas, H_2, CO_2

34. Q.Id: 159199

Diffusion of CH_4 (g) and O_2 (g) occurs under similar condition's, then the ratio of their rates of diffusion is

A) 1.414

B) 0.707

C) 2.312

D) 1.732

35. Q.Id: 159198

Which of the following ions has tetrahedral geometry and sp^3 – hybridisation for its central atom ?

A) BH_4^-

B) NH_2^-

C) CO_3^{2-}

D) H_3O^+

36. Q.Id: 159197

How many ions of the following have bond order of 2.5 ?

N_2^-, NO^-, C_2^-, N_2^+, C_2^{2-}, CN^+

A) 4 **B)** 3

C) 2 **D)** 5

37. Q.Id: 159195

The correct increasing order of basic character of $Ce(OH)_3$, $Gd(OH)_3$ **and** $Nd(OH)_3$ **is**

A) $Ce(OH)_3 < Nd(OH)_3 < Gd(OH)_3$ **B)** $Gd(OH)_3 < Ce(OH)_3 < Nd(OH)_3$

C) $Gd(OH)_3 < Nd(OH)_3 < Ce(OH)_3$ **D)** $Ce(OH)_3 < Gd(OH)_3 < Nd(OH)_3$

38. Q.Id: 159193

Among the iso electronicions $(O^{2-}, N^{3-}, Mg^{2+}, Na^+)$**, the ions with least and highest ionic radius are respectively**

A) Mg^{2+}, N^{3-} **B)** Mg^{2+}, O^{2-}

C) Na^+, N^{3-} **D)** Na^+, O^{2-}

39. Q.Id: 159192

The product of uncertainty in the position and uncertaintyin velocity of a particle is $5.79 \times 10^{-5}\ m^2\ s^{-1}$**/ If uncertainty in the position is 1 nm, what is the uncertainty in the measurement of its velocity in** $m\ s^{-1}$ **?**

A) 5.79×10^7 **B)** $5.79 \times \times 10^5$

C) 5.79×10^{-5} **D)** $5.79 \times \times 10^4$

40. Q.Id: 159190

The radius of th 2nd orbit of B^{4+} **ion is**

A) $4.23\ \mathring{A}$ **B)** $0.2340\ \mathring{A}$

C) $0.4232\ \mathring{A}$ **D)** $0.3241\ \mathring{A}$

41. Q.Id: 159181

The transmitting antenna placed at the top of a tower has a height of 45 m from the ground. The distance between receiving and transmitting antennas is 40 km and the radius of the earth is 6400 km. The minimum height (in m) at which the receiving antenna is to be placed for satisfactory communication is LOS made, is

A) 5 **B)** 15

C) 20 **D)** 25

42. Q.Id: 159179

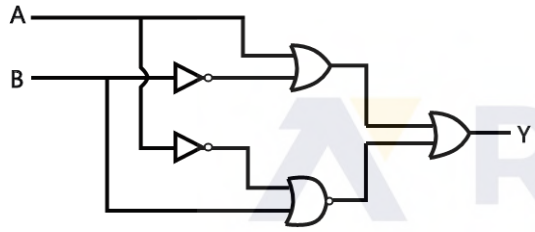
In a transistor circuit, the collector current is changed by 8.9 mA. if the emitter current is changed to 9.0 mA. The value of current amplification factorβ is

A) 89 **B)** 92

C) 84 **D)** 96

43. Q.Id: 159177

The truth table for the given logic circuit is



A)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

B)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

C)

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

D)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

44. Q.Id: 159176

In one average life - time of a radioactive nuclei,

A) More than half the active nucleidecay **B)** half the active decay

C) less than half the active nuclei decay **D)** All the nuclei decay

45. Q.Id: 159175

To excite the spectral line of wavelength $4960\ \mathring{A}$ of an atom, an activation energy of 7.7 eV is required. The ground state energy of the atom is 10.5 eV.

The energies of two levels involved in the emission of $4960\ \mathring{A}$ line are : (Assume $hc = 1240\ eV - nm$ where h is planck's constant and c is the speed of light)

A) 14.2 eV and 16.1 eV

B) 12.2 eV and 18.2 eV

C) 15.7 eV and 20.5 eV

D) 15.7 eV and 18.2 eV

46. Q.Id: 159174

A photo diodesensor is used to measure the output of a 300 W lamp kept 10 m away. The sensor has an opening of 2 cm in diameter. How many photons enter the sensor if the wavelength of the light is 660 nm and the exposure time is 100 ms. (Assume that all the energy of the lamp is given off as light and $h = 6.6 \times 10^{-34}$ Js)

A) 3.6×10^{13}

B) 2.8×10^{13}

C) 2.5×10^{13}

D) 1.8×10^{13}

47. Q.Id: 159172

The concept of displacement current solves an ambiguity in

A) Gauss's law

B) Faraday's law

C) Ampere's law

D) Coulomb's law

48. Q.Id: 159171

A sinusoidal voltage with a frequency of 50 Hz is applied to a series LCR circuit with a resistance of $5\ \Omega$ inductance of 20 mH and a capacitance of $500\ \mu F$. The magnitude of impedance of the circuit is closed to

A) 19.2 Ω

B) 14.4 Ω

C) 9.6 Ω

D) 5 Ω

49. Q.Id: 159167

A conducting wire bent but in the shape of semicircle has length L and moves in its plane with constant velocity v. A uniform magnetic field B exists in the direction perpendicular to the plane of the wire. The velocity makes an angle 45° to diameter joining free ends and the emf induced between the ends of the wire is $\phi = \alpha(BvL)$. The value of constant α is

A) $\sqrt{2}$

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

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

D) $\frac{\sqrt{2}}{\pi}$

50. Q.Id: 159165

A toroid has an iron core with an internal magnetic field of $10\ \pi$ mT, when the current in the winding of 1500 turns per meter is 10 A. Determine the field due to magnetisation ($\mu_0 = 4\pi \times 10^{-7}\ Hm^{-1}$)

A) (4π) mT

B) (10π) mT

C) $(8/\pi)$ mT

D) $(\pi/4)$ mT

51. Q.Id: 159162

A proton accelerated by a potential difference 500 kV flies through a uniform transverse magnetic filed 0.1 T. The field is spread on a region of 1.0 cm thickness. The angle through which the proton gets deviated from its original direction is :(mass of proton $= 1.6 \times 10^{-27}$ kg and charge of proton $= 1.6 \times 10^{19}$ C)

A) 0.01 rad

B) 0.1 rad

C) 0.05 rad

D) 0.08 rad

52. Q.Id: 159158

A metal disc of radius a = 10 cm rotates with a constant angular speed of $\omega = 200$ rad/s about its axis. The potential difference between the centre and the rim of the disc under a uniform magnetic field, $B = 5$ mT directed perpendicular to the disc is

A) 2 mV

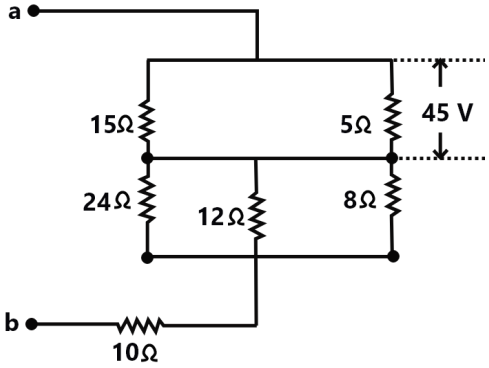
B) 5 mV

C) 10 mV

D) 15 mV

53. Q.Id: 159155

Find the potential difference between a and b, as shown in the below circuit



A) 165 V

B) 198 V

C) 213 V

D) 224 V

54. Q.Id: 159154

Estimate the magnitude of current that passes through a wire, if 0.1 mol of electrons flow though it in 40 min (Assume, Avogadro'snumber $= 6.0 \times 10^{23}$)

A) 4 A

B) 9 A

C) 12 A

D) 14 A

55. Q.Id: 159152

A capacitor of capacitance $4\ \mu F$ **is charged to a potential difference of 6 V with a battery. The battery is removed and it in its place another capacitor of capacitance is** $8\ \mu F$ **introduced and the circuit is closed. The potential difference attained by each of the capacitors in V is**

A) 2

B) 4

C) 6

D) 8

56. Q.Id: 159147

An infinite line of charge with uniform line charge density of 1 C/m is placed along the y - axis. A charge of 1C is placed on the x - axis at a distance of d = 3m from the origin. At what distance r from the origin on the x - axis, the total electic field is zero (Assume $0 < r < d$)

A) 1 m

B) 2 m

C) 2.5 m

D) 1.75 m

57. Q.Id: 159145

In a Young's double slit experiment, a thin sheet of refractive index 1.6 is used to cover one slit while a thin the sheet of refractive index 1.3 is used to cover the second slit. The thickness of both the sheets are same and the wavelength of light used is 600 nm. if the Central point on the screen is now occupied by what had been the 10th bright fringe (m = 10), then the thickness of covering sheets is

A) 50 μm

B) 8 μm

C) 20 μm

D) 40 μm

58. Q.Id: 159141

Three lenses of focal length +10 cm, -10 cm and +30 cm are placed at distance of 30 cm, 35 cm and 45 cm, respectively from an object. The distance between the object and the image formed is

A) 100 cm

B) 75 cm

C) 30 cm

D) 45 cm

59. Q.Id: 159140

A musician on a moving vehicle plays a tone at 880 Hz note. When the vehicle was approaching a listener, he receives it as 888 Hz tone. The speed of the vehicle is (Assume the velocity of sound is 333 m/s)

A) 6 m/s

B) 5 m/s

C) 3 m/s

D) 1 m/s

60. Q.Id: 159138

Which of the following equation represents a simple harmonic motion ? (ω is the angular frequency, A is amplitude of oscillation and $i = \sqrt{-1}$)

A) $\frac{dx}{dt} = i\omega\sqrt{x^2 - A^2}$

B) $\frac{d^2x^2}{dt^2} = \omega^2 x$

C) $\frac{d^2x}{dt^2} = i\omega\sqrt{x^2 - A^2}$

D) $\frac{d^2x}{dt^2} = \omega x^2$

61. Q.Id: 159136

An ideal gas is placed in a tank at $27^\circ C$. The pressure is initially 600 kPa. One fourth of the gas is then released from the tank and thermal equilibrium is established. What will be the pressure if the temperature is $327^\circ C$?

A) 900 kPa

B) 1000 kPa

C) 1050 kPa

D) 1250 kPa

62. Q.Id: 159134

One mole of ideal gas goes through a process pV^3 = Constant, where p and V are pressure and volume respectively. let W be the work done by the gas as its temperature is increased by ΔT. The value of $|W|$ is (R is the universal gas constant)

A) $R\Delta T$

B) $\frac{1}{3}R\Delta T$

C) $R^3\Delta T$

D) $\frac{R}{2}\Delta T$

63. Q.Id: 159132

A body cools from $70^\circ C$ to $40^\circ C$ in 5 min. Calculate the time it takes to cool from $60^\circ C$ to $30^\circ C$. The temperature of the surroundings is $20^\circ C$

A) 1 min

B) 7 min

C) 6 min

D) 15 min

64. Q.Id: 159129

Statement A : Convection involves flow of matter within a fluid due to unequal temperatures of its parts

Statement B : A hot bar placed under a running tap water loses heat due to effects of convection with in water

Statement C : Heat transfer always involves temperature different between two systems.

Identify the correct option.

A) A, B, C are correct

B) Only A and C are true

C) Only A and B are true

D) Only B and C are true

65. Q.Id: 159126

The surface tension of the soap water solution is $\frac{1}{10\pi}$ N/m. The free energy of the surface layer of a soap bubble of diameter 5 mm will be

_____

A) 2.5×10^{-6} J

B) 1×10^{-7} J

C) 8×10^{6} J

D) 5×10^{-6} J

66. Q.Id: 159124

A cylindrical tank with a large diameter is filled with water. Water drains out through a hole at a bottom of the tank. If the cross - sectional area of the hole is $6\ cm^2$ **then the drainagerate (in** m^3/s**) when the depth of the water is** $0.2\ m$**, is**

A) 1.0×10^{-3}

B) 8.2×10^{-2}

C) 2.2×10^{-3}

D) 1.2×10^{-3}

67. Q.Id: 159123

A copper wire of cross -sectional area $0.01\ cm^2$ **is under a tension of 22 N. Find the percentage change in the cross - sectional area (Young's modulus of copper** $=1.1\times10^{11}\ N/m^2$ **and Poisson's ratio = 0.32)**

A) 12.6×10^{-3}

B) 8.6×10^{-3}

C) 6.4×10^{-3}

D) 2.8×10^{-3}

68. Q.Id: 159121

If a satellite has to orbit the earth in a circular path energy 6 hrs, at what distance from the surface of the earth $R_e = 6400\ km$ **(Assume,** $\frac{GM}{4\pi^2}=8.0\times10^{12}\ N/m^2/kg$**) where G and M are gravitational constant and mass of earth and** $10^{1/3}=2.1$

A) 15100 km

B) 8720 km

C) 20600 km

D) 5560 km

69. Q.Id: 159118

A particle of mass 0.1 kg is executing simple harmonic motion of amplitude 0.1 m. When the particle passes through the mean position, its kinetic energy is $8\times10^{-3}\ J$**. If the initial phase is** $45°$**, the equation of its motion is (Assume x(t) as the position of the particle at time t.)**

A) $x(t)=0.1\sin\left(4t+\frac{\pi}{4}\right)$

B) $x(t)=0.1\sin\left(16t+\frac{\pi}{4}\right)$

C) $x(t)=0.1\sin\left(2\left(t+\frac{\pi}{4}\right)\right)$

D) $x(t)=0.1\sin\left(2t+\frac{\pi}{4}\right)$

70. Q.Id: 159116

A long cylinderical rod is welded to a thin circular disc of diameter 0.5 m at a point on its circumference. The rod is in the same plane as that of the disc and forms a tangent to the disc. The radius of gyration of the disc about the rod (in nm) is

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

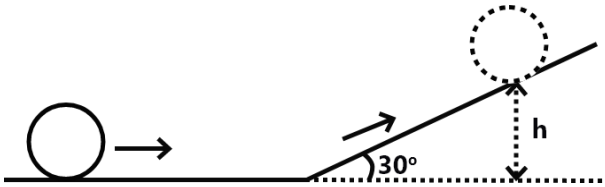
B) $\sqrt{\frac{5}{8}}$

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

D) $2\sqrt{2}$

71. Q.Id: 159114

A solid spherical ball rolls on a horizontal surface at 10 m/s and continues to roll up on an inclined surface as shown in the figure. If the mass of the ball is 11 kg and frictional losses are negligible, the value of h where the ball stop and starts rolling down the inclination is (Assume $g = 10\ m/s^2$**)**



A) 8 m

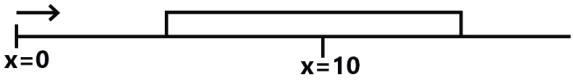
B) 6 m

C) 7 m

D) 10 m

72. Q.Id: 159112

A bullet of mass 1 kg fired with a speed $2\ ms^{-1}$ **from** $x = 0$ **passes through a block of wood whose centre is kept at a distance of 10 m from the origin as shown in the figure. The retarding force** F_r **on the bullet within the wooden block is** $-0.5/x$**. The maximum length of the block (up to one decimal digit) required to completely stop the bullet is (Assume** $e^4 = 55$**)**



A) 10.1 m

B) 9.2 m

C) 9.7 m

D) 19.3 m

73. Q.Id: 159110

A mass of 2 kg initially at a height of 1.2 m above an uncompressed spring with string constant $2 \times 10^4\ N/m$**, is released from rest to fall on the spring. Taking the acceleration due to gravity as** $10\ m/s^2$ **and neglecting the air resistance, the compression of the spring in mm is :**

A) 20

B) 40

C) 50

D) 60

74. Q.Id: 159108

A particle of mass m is moving along a circle of radius R such that its tangential acceleration a, varies with distance covered x as $a_t = ax^2$ where α is a constant. The kinetic energy, K of the particle varies with the distance as $K = \beta x^c$, where β and c are constants, the values of β and c are

A) $\beta = \frac{m\alpha}{3}, c = 3$

B) $\beta = \frac{m\alpha}{4}, c = 4$

C) $\beta = \frac{m\alpha}{2}, c = 4$

D) $\beta = \frac{m\alpha}{2}, c = 3$

75. Q.Id: 159106

A bar of mass m resting on a smooth horizontal plane starts moving due to force $|F| = \frac{mg}{9}$. The magnitude of the force remaining constant with time. The force vector makes an angle θ with the horizontal which varies with the distance covered as $\theta = Cx$. if the constant, $C = 10\left(\frac{\text{degree}}{\text{meter}}\right)$, then the speed of the bar, when θ becomes equal to $30°$ for the first time, is (Take $g = 10\ m/s^2$)

A) 0.33 m/s

B) 0.50 m/s

C) 1.0 m/s

D) 0.8 m/s

76. Q.Id: 159103

A ball is projected vertically up from ground Boy A standing at the window of first floor of a nearby building observes that the time interval between the ball crossing him while going down is 2s. Another boy B standing on the second floor notices that time interval between the ball passing him twice, during up motion and down motion is 1 s. Calculate the difference between the interval positions of boy B and boy A (Assume, acceleration due to gravity $g = 10\ m/s^2$)

A) 8.45 m

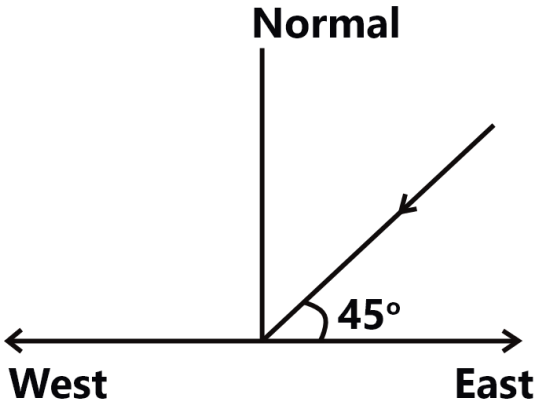
B) 3.75 m

C) 4.25 m

D) 2.50 m

77. Q.Id: 159101

A boy runs on a horizontal road with a speed of 4 m/s while it is raining. He sees that the rain is making an angle θ with the vertical while running from west to east, the angle is α. The rain is pouring down at and angle of 45° with the vertical normal and at a speed of 8 m/s as shown in the figure. The ratio $\frac{\tan\theta}{\tan\alpha} =$



A) $(1-\sqrt{2})^2$

B) $(1+\sqrt{2})^2$

C) $(1+\sqrt{2})$

D) $(\sqrt{2}-1)$

78. Q.Id: 159100

Consider a car initially at rest, starts to move along a straight road first with acceleration $5\ m/s^2$, then with uniform velocity and finally, decelerating at $5\ m/s^2$, before coming to a stop. Total time taken from start to end is $t = 25\ s$. If the average velocity during that time is 72 km/hr, the car moved with uniform velocity for a time of

A) 15 s

B) 30 s

C) 155 s

D) 2 s

79. Q.Id: 159098

Match the physical quantities given in List - I with dimensions in List - II.

List1	List2
A. Gravitational potential	I. $M^0L^2T^{-2}K^{-1}$
B. Stefan's constant	II. $M^{-1}L^3T^{-2}$
C. Permittivity	III. $ML^0T^{-3}K^{-4}$
D. Specific heat capacity	IV. $M^{-1}L^{-3}T^4I^2$

A) A - IV, B - I, C - III, D - II

B) A - I, B - IV, C - II, D - III

C) A - III, B - II, C - I, D - IV

D) A - II, B - III, C - IV, D - I

80. Q.Id: 159085

Which of the following represents fundamental forces of nature ?

A) Gravitational force; Coulomb's force; Strong surface tension force; weak van der Waal's force

B) Gravitational force; Electromagnetic force; Strong viscous force; weak nuclear force

C) Gravitational force; Magneto static force; Strong nuclear force; Weak frictional force

D) Gravitational force; Electromagnetic force; Strong nuclear force; weak nuclear force

81. Q.Id: 159080

The solution of the differential equation $(1+y^2)+\left(x+e^{\tan^{-1}y}\right)\frac{dy}{dx}=0$ **is**

A) $xe^{2\tan^{-1}y}-e^{\tan^{-1}y}=c$

B) $(x-2)e^{\tan^{-1}y}=c$

C) $2xe^{\tan^{-1}y}-e^{2\tan^{-1}y}=c$

D) $xe^{\tan^{-1}y}+2e^{2\tan^{-1}y}=c$

82. Q.Id: 159079

The solution of the differential equation $ydx-xdy+3x^2y^2e^{x^3}dx=0$ **satisfying** $y=1$ **when** $x=1$ **is**

A) $y\left(e^{x^3}-(1+2e)\right)-x=0$

B) $y\left(e^{x^3}-(1-e)\right)+x=0$

C) $y\left(e^{x^3}+(1+e)\right)-x=0$

D) $y\left(e^{x^3}-(1+e)\right)+x=0$

83. Q.Id: 159077

If the order of a differential equation $\frac{d^2y}{dx^2}-2\left(\frac{dy}{dx}\right)^3+\sin\left(\frac{dy}{dx}\right)+y=0$ is l and the degree of the differential equation $\left[1+\frac{d^2y}{dx^2}\right]^{2/3}=\left[2-\left(\frac{dy}{dx}\right)^3\right]^{3/2}$ is m, then the differential equation corresponding to the family of curves $y=Ax^l+Be^{mx}$, where A and B are arbitraryconstants is

A) $(4x^2-2x)y''+(16x^2-2)y'+(32x-8)y=0$

B) $(2x^2-x)y''+(8x^2-2)y'+(16x-4)y=0$

C) $(2x^2-4)y''+(8x^2-1)y'+(16x-4)y=0$

D) $(4x^2-2x)y''+(8x^2-1)y'+(16x-4)y=0$

84. Q.Id: 159075

The area of the region (in square units) bounded by the curve $y=x^3$, $y=x$ and $-1\le x\le 1$ is

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

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

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

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

85. Q.Id: 159073

If $\int_0^{2a} x^2\sqrt{2ax-x^2}\,dx=ka^4$, then $k:\pi=$

A) 1 : 8

B) 3 : 8

C) 5 : 8

D) 9 : 8

86. Q.Id: 159072

If $\int_0^3 (3x^2-4x+2)\,dx=k$, then a root of $3x^2-4x+2=\frac{3k}{5}$ that lies in the interval [0, 3] is

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

B) $\frac{7}{3}$

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

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

87. Q.Id: 159071

If $\int \frac{2x^2}{(2x^2+\alpha)(x^2+5)}\,dx=\frac{\sqrt{5}}{3}\tan^{-1}\frac{x}{\sqrt{5}}-\frac{\sqrt{2}}{3}\tan^{-1}\frac{1}{\sqrt{2}}+c$, then $\alpha=$

A) 1

B) 2

C) 3

D) 4

88. Q.Id: 159070

$\int (\log(\sin x) + x\cot x)\,dx =$

A) $x\log(\sin x)+c$

B) $x^2\log(\sin x)+c$

C) $-x\log(\sin x)+c$

D) $-x^2\log(\sin x)+c$

89. Q.Id: 159069

$\int \frac{x^2-1}{x^3\sqrt{2x^4-2x^2+1}}\,dx =$

A) $\sqrt{2x^2+2+\frac{3}{x^2}}+c$

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

C) $\sqrt{2x^2+x+2}+c$

D) $\frac{1}{2}\sqrt{2-\frac{2}{x^2}+\frac{1}{x^4}}+c$

90. Q.Id: 159068

$\int \sin^{-1}\sqrt{\frac{x}{a+x}}\,dx =$

A) $\text{cosec}^{-1}\left(\sqrt{\frac{x}{a+x}}\right)\left(\frac{x}{a}\right)+ax+c$

B) $\cos^{-1}\left(\sqrt{\frac{x}{a}}\right)(a+x)^2-\sqrt{ax}+c$

C) $\cos^{-1}\left(\sqrt{\frac{x}{a}}\right)(a+x)-\sqrt{ax}+c$

D) $\tan^{-1}\left(\sqrt{\frac{x}{a}}\right)(a+x)-\sqrt{ax}+c$

91. Q.Id: 159067

Let $f(x)=(x-3)^{2018}\,(2-x)^{2019}$, $x\in R$. **If f(x) is a relative maximum of f at** α, **then** $2\alpha+3\,f(\alpha)=$

A) $\frac{20186}{4037}$

B) $\frac{20186}{4037}-3\left(\frac{2018}{4037}\right)^{2018}\left(\frac{2019}{4037}\right)^{2019}$

C) 6

D) 9

92. Q.Id: 159066

Let $a, b, c\in R$ **be such that** $2a+3b+6c=0$ **and** $g(x)$ **be the anti derivative of** $f(x)=ax^2+bx+c$. **If the slopes of the tangents drawn to the curve** $y=g(x)$ **at** $(1, g(1))$ **and** $(2, g(2))$ **are equal, then**

A) $\frac{a}{3}=\frac{b}{-8}=\frac{c}{3}$

B) $\frac{a}{6}=\frac{b}{-18}=\frac{c}{7}$

C) $\frac{a}{3}=\frac{b}{-6}=\frac{c}{2}$

D) $a=b=c=-1$

93. Q.Id: 159064

The smaller side of the rectangle with the largest area, that can be inscribed inside a semi - circle of radius 2 units is of length

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

B) $\sqrt{3}$

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

D) $\sqrt{2}$

94. Q.Id: 159061

A right solid circular cylinder of given volume will have the least total surface area when

A) Its height is equal to its radius

B) Its height is equal to its diameter

C) Its height is independent of its radius

D) Its height is $\frac{3}{4}$ times of its radius

95. Q.Id: 159060

The derivative of $\cosh^{-1} x$ **with respect to log x at x = 5 is**

A) $\frac{5}{\sqrt{26}}$

B) $\frac{1}{\sqrt{26}}$

C) $\frac{1}{2\sqrt{6}}$

D) $\frac{5}{2\sqrt{6}}$

96. Q.Id: 159059

Suppose $f(x)=e^{-\sqrt{x}}+e^{-\frac{1}{x^2}}$ **. If** $f''(x)=\alpha\frac{e^{-\sqrt{x}}}{x}\left(1+\frac{1}{\sqrt{x}}\right)+\beta\frac{e^{-\frac{1}{x^2}}}{x^4}\left(3-\frac{2}{x^2}\right)$ **then** $(\alpha,\beta)=$

A) $\left(\frac{1}{4},2\right)$

B) $\left(\frac{1}{4},-2\right)$

C) $\left(-\frac{1}{4},2\right)$

D) $\left(-\frac{1}{4},-2\right)$

97. Q.Id: 159058

If $f(x)=\begin{cases} ax+b, & \text{if } x\le 1 \\ ax^2+c, & \text{if } 1<x\le 2 \\ \frac{dx^2+1}{x}, & \text{if } x\ge 2 \end{cases}$ **is differentiable on R, then** $ad-bc=$

A) 0

B) 1

C) -1

D) 2

98. Q.Id: 159057

If the function defined by $f(x)=\begin{cases}\left(x^{-1}+e^{\frac{1}{2-x}}\right)^{-1}, & \text{for } x\neq 2\\ k, & \text{for } x=2\end{cases}$ is right continuous at $x=2$, then $k=$

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

B) 0

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

D) 1

99. Q.Id: 159055

If $[x]$ is the greatest integer function, then $\lim_{x\to 2^+}\left(\frac{[x]^3}{3}-\left[\frac{x}{3}\right]^3\right)=$

A) 0

B) $\frac{64}{27}$

C) $\frac{8}{3}$

D) $\frac{7}{3}$

100. Q.Id: 159054

π_1 is a plane passing through the point (1, 2, 3) and perpendicular to the planes $x+2y+3z-6=0$, $x+2y+2z-5=0$. If $(-1, 2, -3)$ is the foot of the perpendicular drawn from the point (1, 3, 2) on to a plane π_2, then the angle between the planes π_1 and π_2 is

A) $\cos^{-1}\left(\frac{9}{\sqrt{255}}\right)$

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

C) $\cos^{-1}\left(\frac{\sqrt{6}}{10}\right)$

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

101. Q.Id: 159045

If A (3, 2, 3), B (1, 4, 6) and C (7, 4, 5) are the three vertices of parallelogram ABCD, then the angle between its diagonal through D and the side DC is

A) $\cos^{-1}\left(\frac{16}{\sqrt{357}}\right)$

B) $\cos^{-1}\left(\frac{5}{\sqrt{126}}\right)$

C) $\cos^{-1}\left(\frac{5}{\sqrt{21}}\right)$

D) $\cos^{-1}\left(\frac{2}{\sqrt{357}}\right)$

102. Q.Id: 159040

The length of the projection of the line segment joining the points (3, 4, 5) and (4, 6, 3) on the line joining the points (-1, 2, 4) and (1, 0, 5) is

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

B) $\frac{5}{4}$

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

D) 1

103. Q.Id: 159034

The distance between the tangents to the hyperbola $\frac{x^2}{20}-\frac{3y^2}{4}=1$ **which are parallel to the line** $x+3y=7$ **is**

A) $4\sqrt{5}$

B) $\frac{4}{\sqrt{5}}$

C) $\frac{2}{\sqrt{5}}$

D) $2\sqrt{5}$

104. Q.Id: 159033

The locus of the mid - points of the portion of the tangents of the ellipse $\frac{x^2}{2}+\frac{y^2}{1}=1$ **intercepted between the coordinate axes is**

A) $\frac{1}{4x^2}+\frac{1}{2y^2}=1$

B) $2x^2+y^2=4$

C) $\frac{1}{2x^2}+\frac{1}{4y^2}=1$

D) $x^2+2y^2=4$

105. Q.Id: 159029

If OT is the semi - minor axis of an ellipse. A and B are its foci and $\angle ATB$ **is a right angle, then the eccentricity of that ellipse is :**

A) 1

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

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

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

106. Q.Id: 159026

Consider the curves $C_1: y^2 = 4x$ **and** $C_2: x^2 + y^2 - 6x + 1 = 0$

Assertion (A) :The common tangents to the curves C_1 **and** C_2 **are orthogonal**

Reason (R) : $x - y + 1 = 0$ **and** $x + y + 1 = 0$ **are the common tangents to the curves** C_1 **and** C_2

The correct answer is :

A) (A) is true, (R) is true and (R) is the correct explanation of (A).

B) (A) is true, (R) is true but (R) is not the correct explanation of (A).

C) (A) is true but (R) is false

D) (R) is true but (A) is false

107. Q.Id: 159023

The vertex of the parabola $(y-1)^2 = 8(x-1)$ **is at the centre of a circle and the parabola cuts that circle at the ends of its latus rectum. Then the equation of that circle is**

A) $x^2 + y^2 - 2x - 2y - 18 = 0$

B) $x^2 + y^2 - 2x - 2y + 18 = 0$

C) $x^2 + y^2 + 2x + 2y - 16 = 0$

D) $x^2 + y^2 - 2x - 2y + 16 = 0$

108. Q.Id: 159021

If the line $x + y + 1 = 0$ **intersects the circle** $x^2 + y^2 + x + 3y = 0$ **at two points A and B, then the centre of the circle which passes through the points A, B and the point of intersection of the tangents drawn at A and B to the given circle is**

A) $\left(\frac{5}{8}, \frac{5}{8}\right)$

B) $(1, -1)$

C) $\left(\frac{3}{4}, -\frac{1}{4}\right)$

D) $(3, -4)$

109. Q.Id: 159018

if the equation of the circle which passes through the point (1, 1) and cuts both the circles $x^2 + y^2 - 4x - 6y + 4 = 0$ **and** $x^2 + y^2 + 6x - 4y + 15 = 0$ **orthogonally is** $x^2 + y^2 + 2gx + 2fy + c = 0$**, then** $5g + 2f + c = 0$

A) 0

B) 1

C) 3

D) 2

110. Q.Id: 159017

The condition for the circles $x^2+y^2+ax+4=0$ and $x^2+y^2+by+4=0$ to touch each other is

A) $\frac{1}{a^2}-\frac{1}{b^2}=\frac{1}{16}$

B) $a^2+b^2=16$

C) $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{16}$

D) $\frac{1}{a^2}+\frac{1}{b^2}=4$

111. Q.Id: 159014

The equation of the circle that touches the Y - axis at a distance of 4 units from the origin and cut off an intercept of 6 units on the X - axis is

A) $x^2+y^2\pm5x-8y+16=0$

B) $x^2+y^2\pm2x-4y=0$

C) $x^2+y^2\pm3x-2y-8=0$

D) $x^2+y^2\pm10x-8y+16=0$

112. Q.Id: 159010

The lines represented by $5x^2-xy-5x+y=0$ are normals to a circle $S=0$. If this circle touches the circle $S'\equiv x^2+y^2-2x+2y-7=0$ externally, then the equation of the chord of contact of centre of $S'=0$ with respect to $S=0$ is

A) $2y-7=0$

B) $x-1=0$

C) $3x+4y-7=0$

D) $x+y=5$

113. Q.Id: 159005

The ratio in which the line $x+y-1=0$ divides the line segment joining the origin and the point of intersection of the lines represented by $2x^2-13xy-7y^2+x+23y-6=0$ is

A) $15:11$

B) $-11:15$

C) $7:3$

D) $7:19$

114. Q.Id: 158991

If θ is the angle between the lines joining the origin to the points of intersection of the and the point of intersection of the curve $2x^2+3y^2=6$ and the line $x+y=1$, then $\sin\theta=$

A) 1

B) $\sqrt{\frac{7}{145}}$

C) $\sqrt{\frac{96}{145}}$

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

115. Q.Id: 158989

If a straight line passes through the point $(-5, 4)$ and makes an intercept of length $\frac{2}{\sqrt{5}}$ between the lines $x+2y-1=0$, then the equation of that line is

A) $5x+6y+1=0$

B) $2x+3y-2=0$

C) $3x+4y-1=0$

D) $2x-y+14=0$

116. Q.Id: 158987

The distance between the circumcentre and the centroid of the triangle formed by the vertices $(1, 2)$, $(3, -1)$ and $(4, 0)$ is

A) $\frac{11\sqrt{2}}{30}$

B) 2

C) $\frac{7\sqrt{2}}{15}$

D) $\frac{9\sqrt{2}}{5}$

117. Q.Id: 158981

If $x\cos\alpha+y\sin\alpha=p$ is the normal form of the equation of a straight line $x+\sqrt{3}y+4=0$ and a, b are respectively X, Y - intercepts of this line, then $\sqrt{3}\pi bp-3a\alpha=$

A) 0

B) 1

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

D) 8π

118. Q.Id: 158980

If $\theta_1, \theta_2, \theta_3$ are respectively the angles by which the coordinate axes are to be rotated to eliminate the xy term from the following equations, then the descending order of these angles is $A_1=3x^2+5xy+3y^2+2x+3y+4=0$, $A_2=5x^2+2\sqrt{3}xy+3y^2+6=0$, $A_3=4x^2+\sqrt{3}xy+5y^2-4=0$

A) $\theta_1, \theta_2, \theta_3$

B) $\theta_3, \theta_1, \theta_2$

C) $\theta_2, \theta_1, \theta_3$

D) $\theta_3, \theta_2, \theta_1$

119. Q.Id: 158972

The locus of all points that are at a distance of at least 2 units from $(-3, 0)$ is

A) $\{(x, y) \mid x^2+y^2+6x+7>0\}$

B) $\{(x, y) \mid x^2+y^2+6x+5\geq 0\}$

C) $\{(x+y) \mid x^2+y^2-6x+5>0\}$

D) $\{(x, y) \mid x^2+y^2-6x+5\leq 0\}$

120. Q.Id: 158968

In a communication network, 98% of messages are transmitted with no error. If a random variable X denotes the number of incorrectly transmitted messages, then the probability that at mostone message is transmitted incorrectly out of 500 messages sent, is :

A) $\frac{11}{e^{10}}$

B) $\frac{e^{10}-1}{e^{10}}$

C) $\frac{10}{e^{10}}$

D) $\frac{98}{e^{10}}$

121. Q.Id: 158966

As a business strategy, 20% of the new internal service subscribers selected randomly receive a special promotion. If a group of 5 such subscribers signs for the service. Then the probability that at least two of them get the special promotion is

A) $\frac{819}{3125}$

B) $\frac{821}{3125}$

C) $\frac{823}{3125}$

D) $\frac{817}{3125}$

122. Q.Id: 158963

Two dice A and B are rolled, If it is known that the number on B is 5, then the probability that the sum of the number on the two dice will be greater then 9 is :

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

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

C) $\frac{1}{5}$

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

123. Q.Id: 158962

Bag I contains 3 red and 4 black balls. Bag II contains 5 red and 6 black balls. If one ball is drawn at random from one of the bags and it is found to be red, then the probability that it was drawn from Bag II, is :

A) $\frac{33}{68}$

B) $\frac{35}{68}$

C) $\frac{37}{68}$

D) $\frac{41}{68}$

124. Q.Id: 158959

If A and B are two events such that $P(\overline{A}) = 0.3$, $P(B) = 0.4$ and $P(A \cap \overline{B}) = 0.5$, then $P(B / A \cup \overline{B}) =$

A) 0.3

B) 0.1

C) 0.25

D) 0.75

125. Q.Id: 158957

The approximate value of the mean deviation about the mean for the following data is

Class interval	Frequency
$0-2$	1
$2-4$	2
$4-6$	3
$6-8$	2
$8-10$	1

A) 3.56

B) 4.61

C) 2.19

D) 1.78

126. Q.Id: 158955

The variance of the data 2, 3, 5, 11, 13, 17, 19 is nearly

A) 6.258

B) 24.25

C) 4.95

D) 39.71

127. Q.Id: 158950

If r is the unit vector satisfying $r \times a = b$, $|a| = 2$ and $|b| = \sqrt{3}$, then one such r =

A) $\frac{1}{4}[2a + (b \times a)]$

B) $\frac{1}{4}[a - (2b \times a)]$

C) $\frac{1}{3}[a - (b \times a)]$

D) $\frac{1}{4}[a - (b \times a)]$

128. Q.Id: 158947

If $r = \hat{i} + \hat{j} + t(2\hat{i} - \hat{j} + \hat{k})$ and $r = 2\hat{i} - \hat{j} + \hat{k} + s(3\hat{i} - 5\hat{j} + 2\hat{k})$ are the vector equations of two lines L_1 and L_2, then the shortest distance between them is

A) $\frac{9}{\sqrt{59}}$

B) $\frac{10}{\sqrt{59}}$

C) $\frac{11}{\sqrt{59}}$

D) 0

129. Q.Id: 158942

Let a be a non zero vector. If $x=\hat{i}\times(a\times\hat{i})$, $y=j\times(a\times\hat{j})-a$ and $z=\hat{k}\times(a\times\hat{k})-a$, then $[\,x\ y\ z\,]=$

A) $|a|$ **B)** $2|a|$

C) 0 **D)** 1

130. Q.Id: 158938

A vector a of length 2 units is making an angle 60° with each of the X - axis and Y - axis, If another vector b of length $\sqrt{2}$ units is making an angle 45° with each of the Y - axis and Z - axis, then $a\times b=$

A) $(1-\sqrt{2})\hat{i}-\hat{j}+\hat{k}$ **B)** $\hat{i}-\sqrt{2}\hat{j}+\hat{k}$

C) $\sqrt{2}\hat{i}-\hat{j}+2\hat{k}$ **D)** $\hat{i}-2\hat{j}+(1-\sqrt{2})\hat{k}$

131. Q.Id: 158909

If $OA=\hat{i}+2\hat{j}+3\hat{k}$ and $OA=4\hat{i}+\hat{k}$ are the position vectors of the points A and B, then the position vector of a point on the line passing through B and parallel to the vector $OA\times OB$ which is at a distance of $\sqrt{189}$ units from B is

A) $6\hat{i}+11\hat{j}-7\hat{k}$ **B)** $4\hat{i}+11\hat{j}-8\hat{k}$

C) $2\hat{i}-11\hat{j}+8\hat{k}$ **D)** $-2\hat{i}-11\hat{j}+8\hat{k}$

132. Q.Id: 158908

Vectors a, b, c, d are such that $(a\times b)\times(c\times d)=0$, P_1 and P_2 are two planes determined by vectors a, b and c, d respectively. Then the angle between the planes P_1 and P_2 is

A) 0 **B)** $\frac{\pi}{4}$

C) $\frac{\pi}{3}$ **D)** $\frac{\pi}{2}$

133. Q.Id: 158907

If p_1, p_2, p_3 are the altitudes of a triangle ABC from the vertices A, B, C respectively, then with the usual notation, $\frac{1}{r_1^2}+\frac{1}{r_2^2}+\frac{1}{r_3^2}+\frac{1}{r^2}=$

A) $p_1\,p_2\,p_3$ **B)** $\frac{a^2b^2c^2}{4\Delta^2}$

C) $\frac{a^2b^2c^2}{\Delta^2}$ **D)** $4\left(\frac{1}{p_1^2}+\frac{1}{p_2^2}+\frac{1}{p_3^2}\right)$

134. Q.Id: 158905

If in triangle ABC, $a^2+2bc-(b^2+c^2)=ab\sin\frac{C}{2}\cos\frac{C}{2}$ **, then** $\cot(B+C)=$

A) $-\frac{8}{15}$

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

C) $-\frac{15}{8}$

D) 4

135. Q.Id: 158904

p_1, p_2, p_3 **are the altitudes of a triangle ABC drawn from the vertices A, B and C respectively. If** Δ **is the area of the triangle and 2s is the sum of its sides a, b and c then** $\frac{1}{p_1}+\frac{1}{p_2}-\frac{1}{p_3}=$

A) $\frac{s-a}{\Delta}$

B) $\frac{s-b}{\Delta}$

C) $\frac{s-c}{\Delta}$

D) $\frac{s}{\Delta}$

136. Q.Id: 158903

$\sinh\left[\log(2+\sqrt{5})\right]+\cosh\left[\log(2+\sqrt{3})\right]=$

A) 4

B) 3

C) 2

D) 1

137. Q.Id: 158902

If α **and** β **are the roots of the quadratic equation** $3x^2-16x+5=0$ **, then** $\tan^{-1}\alpha+\tan^{-1}\beta-\tan^{-1}\left(\frac{\alpha+\beta}{1+\alpha\beta}\right)=$

A) 0

B) π

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

D) $-\pi$

138. Q.Id: 158900

The general solution of $\cos 2x-2\tan x+2=0$ **is**

A) $(2n+1)\frac{\pi}{3}, n\in Z$

B) $(n+1)\frac{\pi}{3}, n\in Z$

C) $n\pi+\frac{\pi}{3}, n\in Z$

D) $n\pi+\frac{\pi}{4}, n\in Z$

139. Q.Id: 158898

If $A+B+C=270^{\circ}$, **then** $\cos 2A+\cos 2B+\cos 2C+4\sin A\sin B\sin C=$

A) 3 **B)** 2

C) 1 **D)** -1

140. Q.Id: 158897

If $0<A<B<\frac{\pi}{4}$, $\cos(A+B)=\frac{11}{61}$ **and** $\sin(A-B)=\frac{24}{25}$, **then** $\sin 2A+\sin 2B=$

A) $\frac{684}{1525}$ **B)** $\frac{156}{1525}$

C) $\frac{168}{305}$ **D)** $\frac{137}{305}$

141. Q.Id: 158895

Maximum value of $(2\cos^2 18^{\circ}-\sin 18^{\circ})\left(\cos\theta+3\sqrt{2}\cos\left(\theta+\frac{\pi}{4}\right)+3\right)$ **is**

A) $5\sqrt{2}$ **B)** $4\sqrt{5}$

C) 3 **D)** 12

142. Q.Id: 158893

If $\frac{2x+7}{(x^2+4)(x^2+9)(x^2+16)}=\frac{Ax+l}{x^2+4}+\frac{Bx+m}{x^2+9}+\frac{Cx+n}{x^2+16}$, **then** $\frac{1}{A}+\frac{1}{B}+\frac{1}{C}=$

A) 0 **B)** 27

C) $\frac{105}{2}$ **D)** $\frac{109}{2}$

143. Q.Id: 158891

For $|x|<\frac{4}{3}$, **the approximate value of** $\frac{1}{(4-3x)^{\frac{1}{2}}}$ **is**

A) $\frac{1}{4}-\frac{2x}{3}+\frac{12x^2}{39}$ **B)** $1-\frac{3x}{16}-\frac{15}{256}x^2$

C) $\frac{1}{2}+\frac{3x}{16}+\frac{27x^2}{256}$ **D)** $\frac{1}{2}-\frac{3x}{16}+\frac{15}{256}x^2$

144. Q.Id: 158887

Consider the following statements :

A. Number of ways of placing 'n' objects in k bins $\{k \le n\}$ **such that no bin is empty is** ${}_{n-1}C_{k-1}$

B. Number of ways of writing a positive integer 'n' into a sum of k positive integers is ${}_{n-1}C_{k-1}$

C. Number of ways of placing 'n' objects in k bins such that at least one bin is non - empty is ${}_{n-1}C_{k-1}$

D. ${}_{n}C_{k} - {}_{n-1}C_{k} = {}_{n-1}C_{k-1}$

A) All the four statements

B) (iii) and (iv) only

C) All except (iii)

D) All except (i)

145. Q.Id: 158885

The number of values of $n \in N$ **for which** ${}_{n+2}C_2 : {}_{n+3}C_1 = 4 : 2$ **is**

A) 0

B) 1

C) 2

D) 3

146. Q.Id: 158883

The number of non - constant functions f from $X = \{0, 1, 2\}$ **to** $Y = \{1, 2, 3, 4, 5, 6, 7, 8\}$ **such that** $f(i) \le f(j)$ **for** $i, j \in X$ **and** $i < j$ **is**

A) 120

B) 92

C) 56

D) 112

147. Q.Id: 158881

Assume that α, β, γ **are the roots of** $2x^3 + 5x^2 + 5x + 2 = 0$ **for** $h \in R$**, if** $\alpha + h, \beta + h, \gamma + h$ **are roots of** $a(h)x^3 + b(h)x^2 + c(h)x + d(h) = 0$**, then**

A) $c(h) \neq 0, \forall\, h \in R$

B) $b\left(-\frac{5}{6}\right) = 0$

C) $c(-2) = 0$

D) d(h) vanishes for three distinct real values of h

148. Q.Id: 158878

One of the real roots of the equation $x^3 - 6x^2 + 6x - 2 = 0$ **is**

A) -1

B) 2

C) $\dfrac{2^{\frac{1}{3}}}{2^{\frac{1}{3}} - 1}$

D) $\dfrac{2^{\frac{1}{3}}}{2^{\frac{1}{3}} + 1}$

149. Q.Id: 158876

The solution set of the inequation $3^x + 3^{1-x} - 4 < 0$ is

A) $(0, 1)$ **B)** $(0, 2)$

C) $(1, 2)$ **D)** $(1, 3)$

150. Q.Id: 158875

If α and β are the roots of the equation $x^2 - 2x + 4 = 0$, then $\alpha^{12} + \beta^{12} =$

A) 2^{12} **B)** 2^{10}

C) 2^{13} **D)** -2^{13}

151. Q.Id: 158872

Imaginary part of $(\sqrt{3} - i)^{2016} + (-\sqrt{3} - i)^{2019}$ is

A) 2^{2016} **B)** -2^{2016}

C) -2^{2019} **D)** 2^{2019}

152. Q.Id: 158869

If the complex cube roots of $(-i)$ are α, β, γ then $\alpha^2 + \beta^2 + \gamma^2 =$

A) 1 **B)** -1

C) $-i$ **D)** 0

153. Q.Id: 158867

If the point $\left(\frac{k-1}{k}, \frac{k-2}{k}\right)$ lies on the locus of z satisfying the inequality $\left|\frac{z+3i}{3z+i}\right| < 1$, then the interval in which k lies is

A) $(-\infty, 2) \cup (3, \infty)$ **B)** $[2, 3]$

C) $[1, 5]$ **D)** $(-\infty, 1) \cup (5, \infty)$

154. Q.Id: 158864

If the amplitude of $(z - 1 - 2i)$ is $\frac{\pi}{3}$, then the locus of z is

A) $y = \sqrt{3}x + (2 - \sqrt{3})$ **B)** $y = \sqrt{3}x - \sqrt{3}$

C) $x = \sqrt{3}y + (2 - \sqrt{3})$ **D)** $y = \sqrt{3}x + 2$

155. Q.Id: 158862

Consider the following system of equations in matrix form $\begin{pmatrix}1\\2\\\lambda\end{pmatrix}(1\ 2\ \lambda)\begin{pmatrix}x\\y\\z\end{pmatrix}=0$ **. Then which one of the following statements is true ?**

A) $\forall\lambda\in(-\infty,\infty)$, the given system has non trivial solution

B) $\forall\lambda\in(-\infty,\infty)$, the given system has only trivial solution

C) For $\lambda\neq 0$, the given system does not have any solution

D) For $\lambda=0$, the given system is inconsistent

156. Q.Id: 158859

Suppose $n>1$ **and A is a** $n\times n$ **non singular matrix such that** $|\text{Adj } A|=|\text{Adj (Adj } A)|$**. Then the matrix whose rank is n, is**

A) $\begin{bmatrix}1&2&3\\4&5&6\\6&7&8\end{bmatrix}$

B) $\begin{bmatrix}2&2&2\\2&2&2\\2&2&2\end{bmatrix}$

C) $\begin{bmatrix}1&2&0&-1\\3&4&1&2\\-2&3&2&5\end{bmatrix}$

D) $\begin{bmatrix}1&4&-1\\2&3&0\\0&1&2\end{bmatrix}$

157. Q.Id: 158841

If the determinant of the matrix $A=\begin{bmatrix}0&a&b\\-a&0&\beta\\-b&\alpha&0\end{bmatrix}$ **is zero for all a, b then** $\alpha+\beta=$

A) 0

B) 1

C) -1

D) 2

158. Q.Id: 158839

For all $n\in N$**, if** $1^2+2^2+3^2+\ldots+n^2>x$**, then** $x=$

A) $\frac{n^3}{3}$

B) $\frac{n^3}{2}$

C) n^3

D) $\frac{n^4}{4}$

159. Q.Id: 158838

Let $f(x)=(x+1)^2-1,\ x\geq -1$**. Then** $\{x:f(x)=f^{-1}(x)\}=$

A) $\{0,1,-1\}$

B) $\left\{-1,\frac{-3+i\sqrt{3}}{2},\frac{-3-i\sqrt{3}}{2}\right\}$

C) $\{0,-1\}$

D) ϕ

160. Q.Id: 158836

If $f(x)$ **denotes the greatest integer** $\leq x$**, then the domain of the function** $f(x)=\sqrt{\frac{4-x^2}{[x]+2}}$ **is**

A) $(-\infty, -2)\cup[-1, 2)$

B) $(-\infty, -2)\cup[-1, 2]$

C) $(-\infty, -2)\cup(-1, 2)$

D) $(-\infty, -1]\cup[1, 2]$