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JEE • NEET • MHT-CET

2023_JEE Actual Paper_31 Jan_2nd Shift

FULL SYLLABUS

Date : 31-1-2023

Marks : 300

PHYSICS

1) **The H amount of thermal energy is developed by a resistor in 10 s when a current of 4A is passed through it. If the current is increased to 16A. the thermal energy developed by the resistor in 10 s will be :**

a) H b) $\frac{H}{4}$

c) 4H d) 16H

2) **The radius of electron's second stationary orbit in Bohrs atom is R. The radius of 3rd orbit will be**

a) 3R b) 9R

c) $\frac{R}{3}$ d) 2.25R

3) **For a solid rod, the Young's modulus of elasticity is 3.2×10^{11} Nm^{-2} and density is 8×10^3 kg m^{-3}. The velocity of longitudinal wave in the rod will be**

a) 6.32×10^3 ms^{-1} b) 18.96×10^3 ms^{-1}

c) 3.65×10^3 ms^{-1} d) 145.75×10^3 ms^{-1}

4) **A body of mass 10 kg is moving with an initial speed of 20 m/s. The body stops after 5 s due to friction between body and the floor. The value of the coefficient of friction is: (Take acceleration due to gravity g = 10 ms^{-2})**

a) 0.4 b) 0.2

c) 0.3 d) 0.5

5) **Given below are two statements :**

Statement I: For transmitting a signal, size of antenna (l) should be comparable to wavelength of signal (at least l = $\lambda/4$ in dimension)

Statement II: In amplitude modulation, amplitude of carrier wave remains constant (unchanged).

In the light of the above statements, choose the most appropriate answer from the options given below.

a) Both Statement I and Statement II are correct

b) Both Statement I and Statement II are incorrect

c) Statement I is incorrect but Statement II is correct

d) Statement I is correct but Statement II is incorrect

6) **A stone of mass 1 kg is tied to end of a massless string of length 1 m. If the breaking tension of the string is 400 N, then maximum linear velocity, the stone can have without breaking the string, while rotating in horizontal plane, is :**

a) $10ms^{-1}$ b) $20ms^{-1}$

c) $400ms^{-1}$ d) $40ms^{-1}$

7) **A microscope is focused on an object at the bottom of a bucket. If liquid with refractive index 5/3 is poured inside the bucket, then microscope have to be raised by 30 cm to focus the object again. The height of the liquid in the bucket is :**

a) 50cm b) 12cm

c) 18cm d) 75cm

8) **A body is moving with constant speed, m a circle of radius 10 m. The body completes one revolution in 4 s. At the end of 3rd second, the displacement of body (in m) from its starting point is :**

a) 5π b) 30
c) $10\sqrt{2}$ d) 15π

9) Match List I with List II

	List I		**List II**
1.	Angular momentum	(a)	$[ML^2T^{-2}]$
2.	Torque	(b)	$[ML^{-2}T^{-2}]$
3.	Stress	(c)	$[ML^2T^{-1}]$
4.	Pressure gradient	(d)	$[ML^{-1}T^{-2}]$

Choose the correct answer from the options given below:

a) A-IV, B - II , C - I , D-III b) A -I, B - IV, C - III, D- II
c) A – II, B - III, C - IV, D -I d) A - III, B-I, C-IV, D- II

10) **A body weight W, is projected vertically upwards from earth's surface to reach a height above the earth which is equal to nine times the radius of earth. The weight of the body at that height will be :**

a) $\frac{W}{91}$ b) $\frac{W}{9}$
c) $\frac{W}{3}$ d) $\frac{W}{100}$

11) **A long conducting wire having a current I flowing through it. is bent into a circular coil of N turns. Then it is bent into a circular coil of n turns. The magnetic field is calculated at the centre of coils in both the cases. The ratio of the magnetic field in first case to that of second case is :**

a) N : n b) n : N
c) $N^2 : n^2$ d) $n^2 : N^2$

12) Given below are two statements :

Statement I: In a typical transistor, all three regions emitter, base and collector have same doping level.

Statement II: In a transistor, collector is the thickest and base is the thinnest segment.

In the light of the above statements, choose the most appropriate answer from the options given below.

a) Statement I is correct but Statement II is incorrect
b) Both Statement I and Statement II are correct
c) Statement I is Incorrect but Statement II is correct
d) Both Statement I and Statement II are incorrect

13) **Heat energy of 735 J is given to a diatomic gas allowing the gas to expand at constant pressure. Each gas molecule rotates around an internal axis but do not oscillate. The increase in the internal energy of the gas will be :**

a) 525J b) 441J
c) 572J d) 735J

14) **Match List I with List II**

	List I		**List II**
A.	Microwaves	I.	Physiotherapy
B.	UV rays	B.	Treatment of cancer
C.	Infra-red light	C.	Lasik eye surgery
D.	X-ray	D.	Aircraft navigation

Choose the correct answer from the options given below:

a) A - IV B - I, C – II, D - III
b) A - III, B – II, C – I, D - IV
c) A – IV, B – III, C -I, D - II
d) A - II, B - IV, C – III, D -I

15) **Considering a group of positive charges, which of the following statements is correct ?**

a) Both the net potential and the net electric field cannot be zero at a point
b) Net potential of the system at a point can be zero but net eiectric field can't be zero at that point.
c) Net potential of the system cannot be zero at a point but net electric field can be zero at that point.
d) Both the net potential and the net field can be zero at a point.

16) **The number of turns of the coil of a moving coil galvanometer is increased in order to increase current sensitivity by 50%. The percentage change in voltage sensitivity of the galvanometer will be :**

a) 0% b) 75%
c) 100% d) 50%

17) **A hypothetical gas expands adiabatically such tliat its volume changes from 08 litres to 27 litres. If the ratio of final pressure of the gas to initial pressure of the gas is $\frac{16}{81}$. Then the ratio of $\frac{C_p}{C_v}$ will be.**

a) $\frac{1}{2}$ b) $\frac{4}{3}$
c) $\frac{3}{1}$ d) $\frac{3}{2}$

18) **If the two metals A and B are exposed to radiation of wavelength 350 mn. The work functions of metals A and B are 4.8 eV and 2.2 eV. Then choose the correct option.**

a) Both metals A and B will emit photo-electrons
b) Metal B will not emit photo-electrons
c) Metal A will not emit photo-electrons
d) Both metals A and B will not emit photo-electrons

19) **An alternating voltage source V = 260 sin (628t) is connected across a pure inductor of 5 mH. Inductive reactance in the circuit is :**

a) 6.28Ω b) 3.14Ω
c) 0.318Ω d) 0.5Ω

20) **Under the same load, wire A having length 5.0 m and cross section 2.5×10^{-5} m^2 stretches uniformly by the same amount as another wire B of length 6.0 m and a cross section of 3.0×10^{-5} m^2 stretches. The ratio of the Young's modulus of wire A to that of wire B will be :**

a) 1 : 2 b) 1 : 4
c) 1 : 10 d) 1 : 1

21) The displacement equations of two interfering waves are given by $y_1 = 10\sin\left(\omega t + \frac{\pi}{3}\right)cm$, $y_2 = 5\left[\sin\omega t + \sqrt{3}\cos\omega t\right]cm$ respectively. The amplitude of the resultant wave is _____ cm.

)

22) A series LCR circuit consists of R = 80Ω, X_L = 100 Ω, and X_C = 40Ω. The input voltage is 2500 cos(100 π)V. The amplitude of current, in the circuit, is _____ A.

)

23) A ball is dropped from a height of 20 m. If the coefficient of restitution for the collision between ball and floor is 0.5, after hitting the floor, the bail rebounds to a height of _____ m.

)

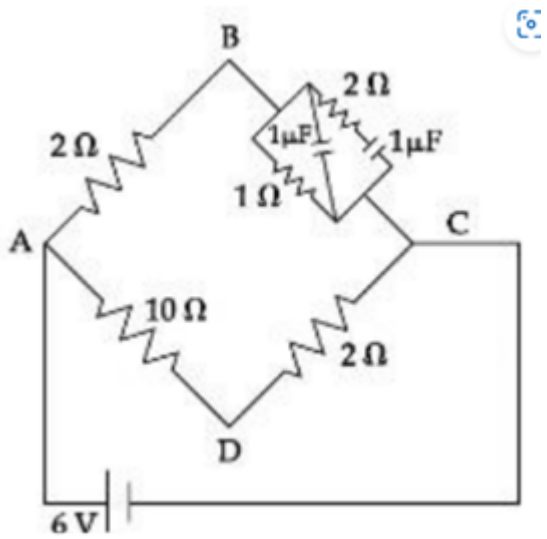
24) Two light waves of wavelengths 800 and 600 nm are used in Young's double slit experiment to obtain interference fringes on a screen placed 7 m away from plane of slits. If the two slits are separated by 0.35 mm, then shortest distance from the central bright maximum to the point where the bright fringes of the two wavelength coincide will be _____ mm.

)

25) Two parallel plate capacitors C_1 and C_2 each having capacitance of 10 μF are individually charged by a 100 V D.C. source. Capacitor C_1 is kept connected to the source and a dielectric slab is inserted between it plates. Capacitor C_2 is disconnected from the source and then a dielectric slab is inserted in it. Afterwards the capacitor C_1 is also disconnected from the source and the two capacitors are finally connected in parallel combination. The common potential of the combination will be _____ V. (Assuming Dielectric constant = 10)

)

26) For the given circuit, in the steady state, $|V_B - V_D|$ = _____ V



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27) A water heater of power 2000 W is used to heat water. The specific hent capacity of water is 4200 J kg K^{-1}. The efficiency of heater is 70%. Time required to heat 2 kg of water from 10°C to 60°C is _____ s.

(Assume that the specific heat capacity of water remains constant over the temperature range of the water).

)

28) Two discs of same mass and different radii are made of different materials such that their thicknesses are 1 cm and 0.5 cm respectively. The densities of materials are in the ratio 3 : 5, The moment of inertia of these discs respectively about their diameters will be in the ratio of x/6. The value of x is _____ .

)

29) Two bodies are projected from ground with same speeds 40 ms^{-1} at two different angles with respect to horizontal. The bodies were found to have same range. If one of the body was projected at an angle of 60°, with horizontal then sum of the maximum heights, attained by the two projectiles, is _____ m. (Given g = 10ms^{-2})

)

30) If the binding energy of ground state election in a hydrogen atom is 13.6 eV, then, the energy required to remove the electron from the second excited state of Li^{2+} will be : $x \times 10^{-1}$ eV. The value of x is _____

)

CHEMISTRY

31) **A hydrocarbon 'X' with formula C_6H_8 uses two moles of H_2 on catalytic hydrogenation of its one mole. On ozonolysis. 'X' yields two moles of methane dicarbaldehyde. The hydrocarbon 'X' is :**

a) cyclohexa-1, 4-diene
b) hexa-1, 3, 5-triene
c) 1-methylcyclopenta-1, 4-diene
d) cyclohexa – 1, 3 - diene

32) **Arrange the following orbitals in decreasing order of energy.**

A. n = 3, l = 0, m = 0

B. n = 4, l = 0, m = 0

C. n = 3 , l = 1 , m = 0

D. n = 3 , l = 2, m = 1

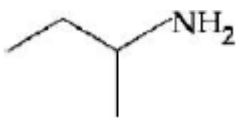
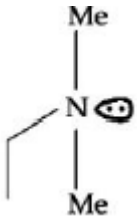
The correct option for the order is :

a) A > C > B > D
b) D > B > C > A
c) D > B > A > C
d) B > D > C > A

33) **In Dumas method for the estimation of N_2, the sample is heated with copper oxide and the gas evolved is passed over :**

a) Copper oxide
b) Ni
c) Copper gauze
d) Pd

34) **An organic compound [A]($C_4H_{11}N$), shows optical activity and gives N_2 gas on treatment with HNO_2. The compound [A] reacts with $PhSO_2Cl$ producing a compound which is soluble in KOH. The structure of A is :**

a) 
b) 
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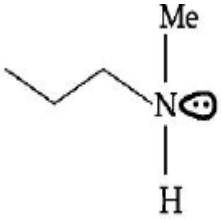
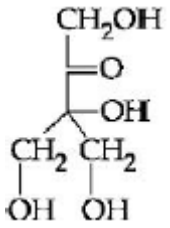
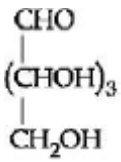
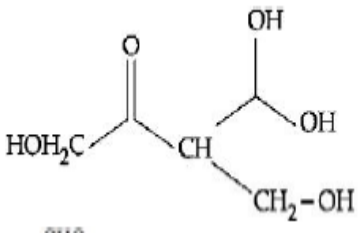
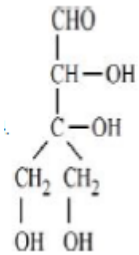
d) 

35) **The element playing significant role in neuromuscular function and interneuronal transmission is :**

a) Li
b) Be
c) Mg
d) Ca

36) **Compound A, $C_5H_{10}O_5$, given a tetraacetate with AC_2O and oxidation of A with $Br_2 - H_2O$ gives an acid, $C_5H_{10}O_6$. Reduction of A with HI gives isopentane. The possible structure of A is :**

a) 
b) 
c) 
d) 

37) **The normal rain water is slightly acidic and its pH value is 5.6 because of which one of the following ?**

a) $2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$
b) $CO_2 + H_2O \rightarrow H_2CO_3$
c) $4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$
d) $N_2O_5 + H_2O \rightarrow 2HNO_3$

38) **Which one of the following statements is incorrect ?**

a) Cast iron is obtained by melting pig iron with scarp iron and coke using hot air blast

b) van Arkel method is used to purify tungsten

c) The malleable iron is prepared from cast iron by oxidising impurities in a reverberatoly furnace

d) Boron and Indium can be purified by zone refilling method

39) **Which of the following elements have half-filled f-orbitals in their ground state ?**

(Given : atomic number Sm = 62; Eu = 63; Tb = 65: Gd = 64, Pm = 61)

A. Sm **B.Eu**

C.Tb **D. Gd**

E. Pin

Choose the correct answer from the options given below :

a) A and E only b) A and B only

c) C and D only d) B and D only

40) **The Lewis acid character of boron tri halides follows the order :**

a) $BCl_3 > BF_3 > BBr_3 > BI_3$

b) $BF_3 > BCl_3 > BBr_3 > BI_3$

c) $BBr_3 > BI_3 > BCl_3 > BF_3$

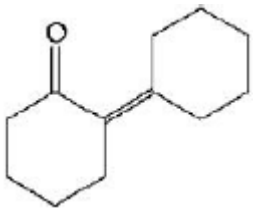
d) $BI_3 > BBr_3 > BCl_3 > BF_3$

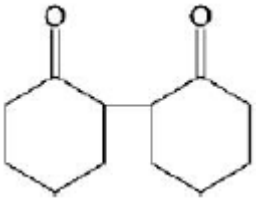
41) **In the following halogenated organic compounds the one with maximum number of chlorine atoms in its structure is :**

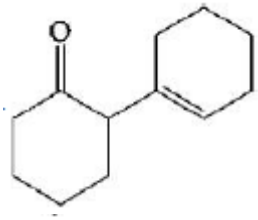
a) Gammaxene b) Freon-12

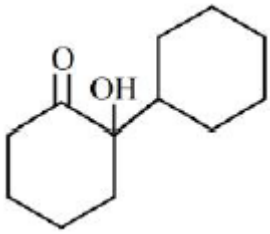
c) Chloral d) Chloiopicrin

42) **Cyclohexylamine when treated with nitrous acid yields (P). On treating (P) with PCC: results in (Q). When (Q) is heated with dil. NaOH we get (R) The final product (R) is :**

a) 

b) 

c) 

d) 

43) Given below are two statements :

Statement I: H_2O_2 is used in the synthesis of Cephalo sporin

Statement II: H_2O_2 is used for the restoration of aerobic conditions to sewage wastes.

In the light of the above statements, choose the most appropriate answer from the options given below :

a) Both Statement I and Statement II are incorrect

b) Both Statement I and Statement II are correct

c) Statement I is incorrect but Statement II is correct

d) Statement I is correct but Statement II is incorrect

44) **Which of the following compounds are not used as**

disinfectants ?

A. Chloroxylenol **B. Bithional**

C. Veronal **D. Prontosil**

E. Terpineol

Choose the correct answer from the options given below:

a) C, D b) A, B

c) B, D, E d) A, B, E

45) **When a hydrocarbon A undergoes complete combustion it requires 11 equivalents of oxygen and produces 4 equivalents of water. What is the molecular formula of A ?**

a) $C_{11}H_4$ b) C_9H_8

c) C_5H_8 d) $C_{11}H_8$

46) Given below are two statements :

Statement I: Upon heating a borax bead dipped in cupric sulphate in a luminous flame, the colour of the bead becomes green

Statement II: The green colour observerd is due to the formation of copper(I) metaborate

In the light of the above statements, choose the most appropriate answer from the options given below :

a) Statement I is false but Statement II is true

b) Both Statement I and Statement II are true

c) Statement I is true but Statement II is false

d) Both Statement I and Statement II are false

47) Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : The first ionization enthalpy of 3d series elements is more than that of group 2 metals

Reason (R) : In 3d series of elements successive filling of d-orbitals takes place.

In the light of the above statements, choose the correct answer from the options given below :

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

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

c) Both (A) and (R) are true and (R) is the correct explanation of (A)

d) Both (A) and (R) are tine but (R) is not the correct explanation of (A)

48) Evaluate the following statements for their correctness.

A. The elevation in boiling point temperature of water will be same for 0.1 M NaCl and 0.1 M urea.

B. Azeotropic mixtures boil without change in their composition.

C. Osmosis always takes place from hypertonic to hypotonic solution.

D. The density of 32% H_2SO_4 solution having molarity 4.09 M is approximately 1.26 g mL^{-1}.

E. A negatively charged sol is obtained when KI solution is added to silver nitrate solution.

Choose the correct answer from the options given below :

a) A, B and D only b) B, D and E only

c) B and D only d) A and C only

49) **Incorrect statement for the use of indicators in acid-base titration is :**

a) Methyl orange may be used for a weak acid vs weak base titration.

b) Phenolphtlialein is a suitable indicator for a weak acid vs strong base titration

c) Phenolphthalein may be used for a strong acid vs strong base titration

d) Methyl orange is a suitable indicator for a strong acid vs weak base titration

50) **Match List I with List II**

	Column I		**Column II**
A.	Physisorption	I.	Single Layer Adsorption
B.	Chemisorption	II.	$20 - 40 kJmol^{-1}$
C.	$N_2(g) + 3H_2(g) \xrightarrow{Fe} 2NH_3(g)$	III.	Chromatography
D.	Analytical Application of Adsorption	IV.	Heterogeneous catalysis

Choose the correct answer from, the options given below:

a) A - III, B – IV, C - I, D - II

b) A – II, B - I, C - IV, D - III

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

d) A – IV, B - II, C - III, D -I

51) The rate constant for a first order reaction is 20 min^{-1}. The time required for the initial concentration of the reactant to reduce to its 1/32 level is _____ $\times$ 10 $^{-2}$min. (Nearest integer)

(Given : In 10 = 2.303

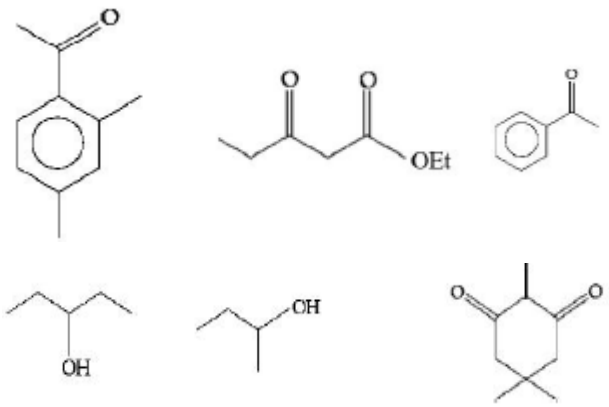
log 2 =03010)

)

52) A sample of a metal oxide has formula $M_{0.83}O_{1.00}$. The metal M can exist in two oxidation states +2 and +3. In the sample of $M_{0.83}O_{1.00}$, the percentage of metal ions existing in +2 oxidation state is _____ %. (nearest integer)

)

53) The number of molecules which gives haloform test among the following molecules is _____



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54) If the CFSE of $[Ti(H_2O)_6]^{3+}$ is – 96.0 kJ/mol, this complex will absorb maximum at wavelength _____nm. (nearest integer)

Assume Planck's constant (h) = 6.4×10^{-34} Js, Speed of light (c) = 3.0×10^{-8} m/s and Avogadro's Constant (N_A) = 6×10^{23}/mol.

)

55) The resistivity of a 0.8 M solution of an electrolyte is 5×10^{-3} Ωcm. Its molar conductivity is

_____ $\times$ $10^4 \Omega^{-1} cm^2 mol^{-1}$. (Nearest integer)

)

56) Assume carbon burns according to following equation :

$2C_{(s)} + O_{2(g)} \rightarrow 2CO(g)$

when 12 g carbon is burnt in 48 g of oxygen, the volume of carbon monoxide produced is _____ $\times 10^{-1}$ L at STP [nearest integer]

[Given : Assume CO as ideal gas , Mass of C is 12 g mol^{-1}, Mass of O is 16 g mol^{-1} and molar volume of an ideal gas at STP is 22.7 L mol^{-1}]

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57) Amongst the following, the number of species having the linear shape is _____ .

XeF_2, I_3^+, C_3O_2, , I_3^-, CO_2, SO_2, $BeCl_2$ and BCl_3^-

)

58) Enthalpies of formation of $CCl_4(g)$. $H_2O(g)$, $CO_2(g)$ and HCl(g) are –105, – 242, – 394 and – 92 kJ mol^{-1} respectively. The magnitude of enthalpy of the reaction given below is _____ kJ mol^{-1} . (nearest integer)

$CCl_4(g) + 2H_2O(g) \rightarrow CO_2(g) + 4HCl(g)$

)

59) At 298 K, the solubility of silver chloride in water is 1.434×10^{-3} g L^{-1}. The value of – log K_{sp} for silver chloride is _____ (Given mass of Ag is 107.9 g mol^{-1} and mass of Cl is 35.5 g mol^{-1})

)

60) The number of alkali metal(s). from Li, K, Cs, Rb having ionization enthalpy greater than 400 kJ mol^{-1} and forming stable super oxide is _____

)

MATHEMATICS

61) **Let $a_1, a_2 a_3, \ldots$ be an A.P. If $a_7 = 3$, the product a_1a_4 is minimum and the sum of its first n terms is zero, then $n! - 4a_{n(n+2)}$ is equal to :**

a) 9 b) 24

c) $\frac{381}{4}$ d) $\frac{33}{4}$

62) **If a point P(α, β, γ) satisfying**

$$\begin{pmatrix} \alpha & \beta & \gamma \end{pmatrix} \begin{pmatrix} 2 & 10 & 8 \\ 9 & 3 & 8 \\ 8 & 4 & 8 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 \end{pmatrix}$$

lies on the plane 2x + 4y + 3z = 5, then $6\alpha + 9\beta + 7\gamma$ is equal to

a) $\frac{11}{5}$ b) $\frac{5}{4}$

c) -1 d) 11

63) Let : $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = \hat{i} - \hat{j} + 2\hat{k}$ and $\vec{c} = 5\hat{i} - 3\hat{j} + 3\hat{k}$ be three vectors. If $\vec{r}$ is a vector such that, $\vec{r} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{r} . \vec{a} = 0$, then $25\left|\vec{r}\right|^2$ is equal to

a) 336 b) 449

c) 560 d) 339

64) **Let y = y(x) be the solution of the differential equation $(3y^2 - 5x^2)y\,dx + 2x(x^2 - y^2)\,dy = 0$ such that y(1) = 1. Then $|(y(2))^3 - 12y(2)|$ is equal to :**

a) $16\sqrt{2}$ b) 64

c) 32 d) $32\sqrt{2}$

65) **S= {(a, b) : a, b $\in$ R – {0}, 2 + $\frac{a}{b}$ > 0} and T = {(a, b) : a, b $\in$ R, $a^2 - b^2 \in Z$],**

a) both S and T are symmetric b) neither S nor T is transitive

c) T is symmetric but S is not d) S is transitive but T is not

66) **Let P be the plane, passing through the point (1, – 1, – 5) and perpendicular to the line joining the points (4, 1, – 3) and (2, 4, 3). Then the distance of P from the point (3, – 2, 2) is**

a) 7 b) 6

c) 5 d) 4

67) **Let (a, b) $\subset$ (0, 2π) be the largest interval for which $\sin^{-1}(\sin\theta) - \cos^{-1}(\sin\theta) > 0$, $\theta \in (0, 2\pi)$, holds. If $\alpha x^2 - \beta x + \sin^{-1}(x^2 - 6x + 10) + \cos^{-1}(x^2 - 6x + 10) =$ and $\alpha - \beta = b - a$, then α is equal to :**

a) $\frac{\pi}{8}$ b) $\frac{\pi}{12}$
c) $\frac{\pi}{48}$ d) $\frac{\pi}{16}$

68) **The set of all values of a^2 for which the line x + y = 0 bisects two distinct chords drawn from a point $P\left(\frac{1+a}{2}, \frac{1-a}{2}\right)$ on the circle $2x^2 + 2y^2 - (1+a)x - (1-a)y = 0$, is equal to :**

a) (2, 12] b) (8,∞)
c) (4,∞) d) (0, 4]

69) **Let $\alpha > 0$. If $\int_0^{\alpha} \frac{x}{\sqrt{x+\alpha}-\sqrt{x}}dx = \frac{16+20\sqrt{2}}{15}$, then α is equal to :**

a) $\sqrt{2}$ b) 4
c) 2 d) $2\sqrt{2}$

70) **The number of values of r $\in$ {p, q, ~ p, ~q} for which $((p \wedge q) \Rightarrow (r \vee q)) \wedge ((p \wedge r) \Rightarrow q)$ is a tautology, is :**

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

71) **The foot of perpendicular from the origin O to a plane P which meets the co-ordinate axes at the points A, B, C is (2, a, 4), a $\in$ N. If the volume of the tetrahedron OABC is 144 unit^3 , then which of the following points is NOT on P ?**

a) (3, 0,4) b) (0,6, 3)
c) (2,2,4) d) (0,4,4)

72) **The absolute minimum value, of the function $f(x) = |x^2 - x + 1| + [x^2 - 1 + 1]$ where [t] denotes the greatest integer function, in the interval [–1, 2], is:**

a) $\frac{5}{4}$ b) $\frac{1}{4}$
c) $\frac{3}{4}$ d) $\frac{3}{2}$

73) **Let H be the hyperbola, whose foci are $\left(1 \pm \sqrt{2}, 0\right)$ and eccentricity is $\sqrt{2}$. Then the length of its lams rectum is _____ .**

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

74) **If $\phi\left(x\right) = \frac{1}{\sqrt{x}}\int_{\frac{\pi}{4}}^{x}\left(4\sqrt{2}\sin t - 3\phi'\left(t\right)\right)dt$, x > 0, then $\phi'\left(\frac{\pi}{4}\right)$ is equal to**

a) $\frac{4}{6+\sqrt{\pi}}$ b) $\frac{4}{6-\sqrt{\pi}}$
c) $\frac{8}{\sqrt{\pi}}$ d) $\frac{8}{6+\sqrt{\pi}}$

75) **Let f : R – {2, 6} $\rightarrow$ R be real valued function defined as f(x) = $\frac{x^2+2x+1}{x^2-8x+12}$. Then range of f is**

a) $\left(-\infty, -\frac{21}{4}\right] \cup [0, \infty)$ b) $\left(-\infty, -\frac{21}{4}\right] \cup \left[\frac{21}{4}, \infty\right)$

c) $\left(-\infty, -\frac{21}{4}\right] \cup [1, \infty)$ d) $\left(-\infty, -\frac{21}{4}\right) \cup (0, \infty)$

76) **Let the mean and standard deviation of marks of class A of 100 students be respectively 40 and α (> 0), and the mean and standard deviation of marks of class B of n students be respectively 55 and 30 – α. If the mean and variance of the marks of the combined class of 100 + n students are respectively 50 and 350, then the sum of variances of classes A and B is**

a) 650 b) 500
c) 900 d) 450

77) **The equation $e^{4x} + 8e^{3x} + 13e^{2x} - 8e^{x} + 1 = 0$, $x \in R$ has :**

a) two solutions and only one of them is negative
b) no solution
c) four solutions two of which are negative
d) two solutions and both are negative

78) $\lim\limits_{x\to\infty} \frac{\left(\sqrt{3x+1}+\sqrt{3x-1}\right)^6+\left(\sqrt{3x+1}-\sqrt{3x-1}\right)^6}{\left(x+\sqrt{x^2-1}\right)^6+\left(x-\sqrt{x^2-1}\right)^6}x^3$

a) does not exist b) is equal to 27

c) is equal to 9 d) is equal to $\frac{27}{2}$

79) **Let the plane P : 8x + a_1y + a_2z + 12 = 0 be parallel to the line L : $\frac{x+2}{2}=\frac{y-3}{3}=\frac{z+4}{5}$. If the intercept of P on the y-axis is 1, then the distance between P and L is :**

a) $\sqrt{\frac{2}{7}}$ b) $\sqrt{14}$

c) $\sqrt{\frac{7}{2}}$ d) $\frac{6}{\sqrt{14}}$

80) **The complex number $z=\frac{i-1}{\cos\frac{\pi}{3}+i\sin\frac{\pi}{3}}$ is equal to**

a) $\cos\frac{\pi}{12}-i\sin\frac{\pi}{12}$

b) $\sqrt{2}i\left(\cos\frac{5\pi}{12}-i\sin\frac{5\pi}{12}\right)$

c) $\sqrt{2}\left(\cos\frac{5\pi}{12}+i\sin\frac{5\pi}{12}\right)$

d) $\sqrt{2}\left(\cos\frac{\pi}{12}+iin\frac{\pi}{12}\right)$

81) If the constant term in the binomial expansion of $\left(\frac{x^{\frac{5}{2}}}{2}-\frac{4}{x^l}\right)^9$ is – 84 and the coefficient of x^{-3l} is $2^\alpha\beta$, where $\beta < 0$ is an odd number, then $|\alpha l-\beta|$ is equal to _____

)

82) The sum $1^2 - 2.3^2 + 3.5^2 - 4.7^2 + 5.9^2 - \ldots + 15.29^2$ is _____

)

83) Let A = $[a_{ij}]$, $a_{ij} \in Z \cap [0, 4]$, $1 \le i, j \le 2$. The number of matrices A such that the sum of all entries
is a prime number p ∈ (2, 13) is _____ .

)

84) The coefficient of x^{-6}, in the expansion of $\left(\frac{4x}{5}+\frac{5}{2x^2}\right)^9$, is _____

)

85) Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be three vectors such that $\left|\vec{a}\right|=\sqrt{31},\ 4\vec{b}\left|=\right|\vec{c}\right|=2$ and $2\left(\vec{a}\times\vec{b}\right)=3\left(\vec{c}\times\vec{a}\right)$. If the angle between $\vec{b}$ and $\vec{c}$ is $\frac{2\pi}{3}$, then $\left(\frac{\vec{a}\times\vec{c}}{\vec{a}.\vec{b}}\right)^2$ is equal to

_____

)

86) Let A be a n × n matrix such that |A| = 2. If the determinant of the matrix Adj(2·Adj($2A^{-1}$)). Is 2^{84}, then n is equal to _____

)

87) Let A be the event that the absolute difference between two randomly choosen real numbers in the sample space[0, 60] is less than or equal to a . If P(A) = $\frac{11}{36}$, then a is equal to _____

)

88) Let S be the set of all a ∈ N such that the area of the triangle formed by the tangent at the point P(b, c). b, c ∈ N, on the parabola $y^2 = 2ax$ and the lines x = b, y = 0 is 16 unit^2, then $\sum_{a\in s} a$ is equal to _____

)

89) Let the area of the region $\{(x, y) : |2x - 1| \le y \le |x^2 - x|, 0 \le x \le 1\}$ be A. Then$(6A + 11)^2$ is equal to _____

)

90) If $^{2n+1}P_{n-1} : {}^{2n-1}P_n = 11 : 21$, then $n^2 + n + 15$ is equal to

)