SHIKSHA CLASSES, BHANDARA

FULL TEST-3

CHEMISTRY , PHYSICS, MATHEMATICS

Time : - 3 Hours **Max. Marks:- 300** **Date : .....**

INSTRUCTIONS :

1. The test is of 3 hours duration.
2. The Test Booklet consists of 90 questions. The maximum marks are **300.**
3. There are three parts in the question paper A, B, C consisting of Chemistry, Physics and Mathematics having **30questions** in each part of equal weightage. **20 questions** will be **MCQs** and **10 questions** (**ATTEMPT ANY FIVE QUESTIONS OUT OF 10**)will have answer to be filled as **numerical value**.
   Marking Scheme for MCQs
   Correct Answer Four mark (+4), Incorrect Answer Minus one mark (–1), Unanswered No mark (0)
   Marking Scheme for questions for which answer is a **Numerical value**
   Correct Answer Four mark (+4), Incorrect Answer No mark (0), Unanswered No mark (0)
4. There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly.

Always desire to learn something Useful.

Wake up every morning with the thought that something Wonderful is about to happen.

The difference between ordinary and eXtraordinary is that little extra.

Name : .....

Address : .....

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Phone/Mobile No. .....

Roll No. .....

PART A – CHEMISTRY

SECTION - 1 (Q.1 - Q.20)

Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

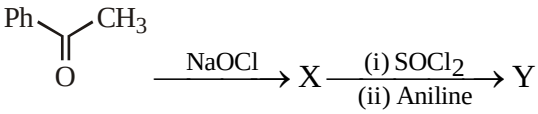
Q.1 Cyclopentanol on reaction with NaH followed by CS_2 and CH_3I produces a/an

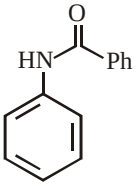
(1) ketone (2) alkene
(3) ether (4) xanthate

Q.2 The crystal field stabilization energy (CFSE) of $[Fe(H_2O)_6]Cl_2$ and $K_2[NiCl_4]$, respectively, are

(1) $-0.4\ \Delta_0$ and $-0.8\ \Delta_t$
(2) $-0.4\ \Delta_0$ and $-1.2\ \Delta_t$
(3) $-2.4\ \Delta_0$ and $-1.2\ \Delta_t$
(4) $-0.6\ \Delta_0$ and $-0.8\ \Delta_t$

Q.3 The major product 'Y' in the following reaction is:-





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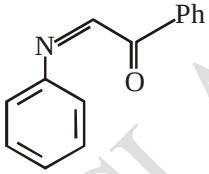

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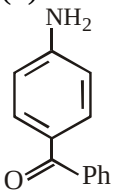

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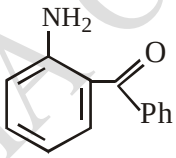


(4)

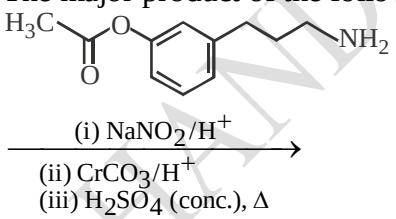
Q.4 What is the work function of the metal if the light of wavelength 4000 Å generates photoelectrons of velocity 6×10^5 m/s form it ?
(Mass of electron = 9×10^{-31} kg
Velocity of light = 3×10^8 ms^{-1}
Planck's constant = 6.626×10^{-34} Js
Charge of electron = 1.6×10^{-19} JeV^{-1})

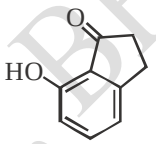
(1) 0.9 eV (2) 4.0 eV
(3) 2.1 eV (4) 3.1 eV

Q.5 A compound of formula A_2B_3 has the hcp lattice. Which atom forms the hcp lattice and what fraction of tetrahedral voids is occupied by the other atoms

(1) hcp lattice-A, 2/3 Tetrachedral voids-B
(2) hcp lattice-B, 1/3 Tetrachedral voids-A
(3) hcp lattice-B, 2/3 Tetrachedral voids-A
(4) hcp lattice-A, 1/3 Tetrachedral voids-B

Q.6 The major product of the following reaction is:





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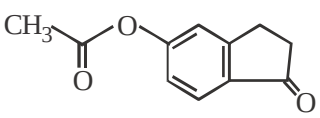

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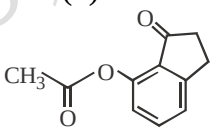

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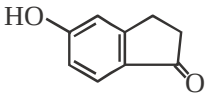
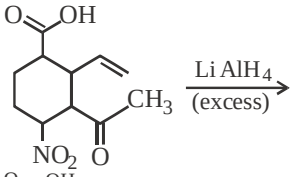
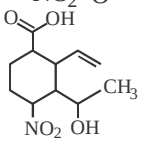


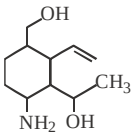
(4)

Q.7 The major product obtained in the following reaction is :





(1)



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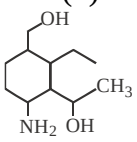

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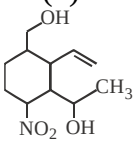


(4)

Q.8 Glucose and Galactose are having identical configuration in all the positions except position.

(1) C–3 (2) C–2 (3) C–4 (4) C–5

SPACE FOR ROUGH WORK

Q.9 The element with Z = 120 (not yet discovered) will be an/a :

(1) transition metal (2)inner-transition metal

(3) alkaline earth metal (4) alkali metal

Q.10 In the cell Pt(s) | H_2 (g, 1 bar | HCl (aq) | Ag (s) | Pt(s) the cell potential is 0.92 when a 10^{-6} molal HCl solution is used. The standard electrode potential of (AgCl/Ag,Cl^-) electrode is : Given, $\frac{2.303RT}{F}$ = 0.06V at 298 K

(1) 0.20 V (2) 0.76 V

(3) 0.40 V (4) 0.94 V

Q.11 Extraction of gold and silver involves leaching the metal with CN^- ion. The metal is recovered by –

(1) Displacement of metal by some other metal from the complex ion.

(2) Roasting of metal complex.

(3) Calcination.

(4) Thermal decomposition of metal complex.

Q.12 Identify reactions in which on heating diatomic gas is evolved leaving behind metallic residue :

(a) $NaN_3(s) \xrightarrow{\Delta}$ (b) $[Ni(CO)_4] \xrightarrow{250°C}$

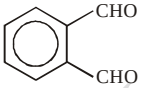
(c) $KClO_3(s) \xrightarrow{\Delta}$ (d) $HgO(s) \xrightarrow{\Delta}$

(e) $NH_4NO_2 \xrightarrow{\Delta}$

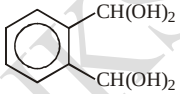
(1) a, b, c (2) a, b, d

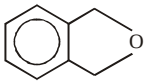
(3) a, c, d, e (4) a, b, d, e

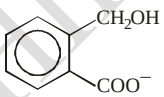
Q.13 The reaction,

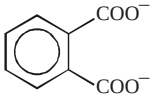


+ conc. NaOH → produce :

(1) 

(2) 

(3) 

(4) 

Q.14 Which of the following equation is **not correctly** matched :

(1) H_3BO_3 is a weak mono basic acid as it liberates hydrogen ions as

$H_3BO_3 \rightarrow H^+ + H_2BO_3^-$

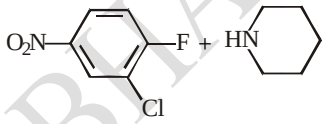
(2) $H_3BO_3 \xrightarrow{\Delta} \underset{\text{Meta Boric}}{HBO_2} \xrightarrow[\text{hot}]{\text{Red}} \underset{\text{Boric oxide}}{B_2O_3}$

(3) $2BN + 6H_2O \rightarrow 2H_3BO_3 + 2NH_3$

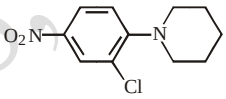
(4) $Na_2B_4O_7.10H_2O + 2HCl$

$\rightarrow 2NaCl + 4H_3BO_3 + 5H_2O$

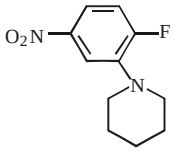
Q.15 The main product of following reaction will be



→ Product



(1)



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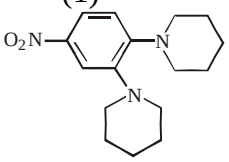

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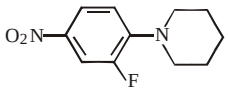
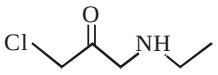
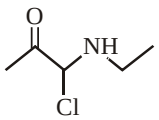


(4)

Q.16 Which is most reactive halide towards S_N1 reaction



(1)



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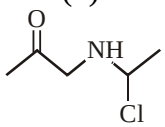

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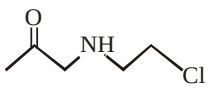


(4)

Q.17 Based on the following thermochemical equations

$H_2O(g) + C(s) \rightarrow CO(g) + H_2(g)$; $\Delta H = 131$ kJ

$CO(g) + ½\ O_2(g) \rightarrow CO_2(g)$; $\Delta H = -282$ kJ

$H_2(g) + ½\ O_2(g) \rightarrow H_2O(g)$; $\Delta H = -242$ kJ

SPACE FOR ROUGH WORK

$C(s) + O_2(g) \rightarrow CO_2(g)$; $\Delta H = x$ kJ

The value of x will be :

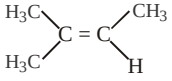
(1) –393 kJ (2) –655 kJ

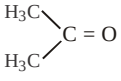
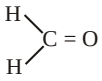
(3) +393 kJ (4) +655 kJ

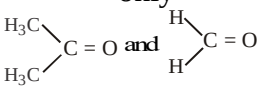
Q.18 In which of the following oxyacid, O–atom is not present between two central atoms?

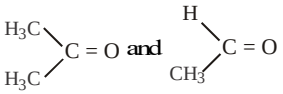
(1) $H_2S_2O_8$ (2) $H_4P_2O_7$

(3) $H_2S_2O_3$ (4) $(HPO_3)_3$

Q.19  $\xrightarrow[\text{(ii) } H_2O/Zn]{\text{(i) } O_2}$ Product is

(1)  only (2)  only

(3)  both

(4)  both

Q.20 Type of chemical covalent bond between carbon-carbon atom in C_2H_4 :

(1) sp^2–sp^2 - σ bond, 2pπ–2pπ bond

(2) 2p–2p - σ bond, 2pπ–2pπ bond

(3) sp^3–sp^3 - σ bond, 2pπ–2pπ bond

(4) None of these

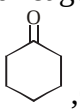
SECTION - 2 (Q.21 - Q.30)

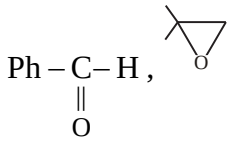
This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places. ranging from 0 to 9, both inclusive.

Q.21 A detergent ($C_{12}H_{25}SO_4Na$) solution becomes a colloidal solution at a concentration of 10^{-3}mol/lit. On an average 10^{13} colloidal particles are present in 1 mm^3. If on an average, number of $C_{12}H_{25}SO_4Na$ in one colloidal particle is 12 × a, find a.

Take $N_A = 6 \times 10^{23}$.

Q.22 How many of the following give 3° alcohol with excess Grignard reagent.

HCHO, CH_3CHO,  , $CH_3 - COOC_2H_5$,



Q.23 ICl_3 is an orange colored solid that dimerizes in solid state as I_2Cl_6. Based on VSEPR theory, number of ~90 degree Cl – I – Cl bond angles is ..... in the dimeric species.

Neglect any minor deviations from ideal bond angle.

Q.24 When 20 g of naphthoic acid ($C_{11}H_8O_2$) is dissolved in 50g of benzene ($K_f = 1.72 Kkgmol^{-1}$). If the Van't Hof factor of naphthoic acid is 0.5 then the value of depression in freezing point (K) will be

Q.25 A mixture of 1º amides (benzenoid) having molecular formula (C_8H_9NO) reacted with Br_2/NaOH. The number of 1º amines products formed will be :

Q.26 The value of n in the molecular formula $Be_nAl_2Si_6O_{18}$ is :

Q.27 The work function (ϕ) of some metals is listed below. The number of metals which will show photoelectric effect when light of 300 nm wavelength falls on the metal is

Metal	Li	Na	K	Mg	Cu
ϕ (eV)	2.4	2.3	2.2	3.7	4.8
Metal	Ag	Fe	Pt	W	
ϕ (eV)	4.3	4.7	6.3	4.75	

Q.28 In a gaseous system of the type,

AB(g) □ A(g) + B(g), at a given temperature 50% of AB is dissociated at equilibrium. The value of P at equilibrium in terms of the equilibrium constant is xK_p.Find the value of x.

SPACE FOR ROUGH WORK

Q.29 Three moles of B_2H_6 are completely reacted with methanol. The number of moles of boron containing product formed is

Q.30 The total number of cyclic structural as well as stereo isomers possible for a compound with the molecular formula C_5H_{10} is

PART B – PHYSICS

SECTION - 1 (Q.31 - Q.50)

Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.31 A small spherical body of radius r and density ρ moves with the terminal velocity v in a fluid of coefficient of viscosity η and density σ. What will be the net force on the body ?

(1) $\frac{4\pi}{3} r^3 (\rho - \sigma) g$ (2) $6\pi\eta rv$

(3) Zero (4) Infinity

Q.32 A rocket has to be launched from earth in such a way that it never returns. If E is the minimum energy delivered by the rocket launcher, what should be the minimum energy that the launcher should have if the same rocket is to be launched from the surface of the moon ? Assume that the density of the earth and the moon are equal and that the earth's volume is 64 times the volume of the moon :

(1) E / 4 (2) E / 16

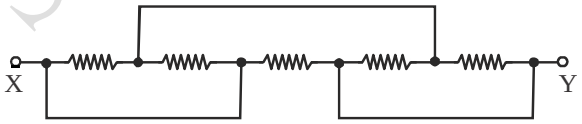
(3) E / 32 (4) E / 64

Q.33 In the formula $X = 5YZ^2$, X and Z have dimensions of capacitance and magnetic field, respectively. What are the dimensions of Y in SI units ?

(1) $[M^{-2} L^{-2} T^6 A^3]$ (2) $[M^{-1} L^{-2} T^4 A^2]$

(3) $[M^{-3} L^{-2} T^8 A^4]$ (4) $[M^{-2} L^0 T^{-4} A^{-2}]$

Q.34 In the network shown in the figure the equivalent resistance between points X & Y will be – Value of each resistance is 2Ω.



(1) 2 Ω (2) 4 Ω

(3) 1 Ω (4) 2/3 Ω

Q.35 A particle 'P' is formed due to a completely inelastic collision of particles 'x' and 'y' having de-Broglie wavelengths 'λ_x' and 'λ_y' respectively. If x and y were moving in opposite directions, then the de-Broglie wavelength of 'P' is :-

(1) $\lambda_x + \lambda_y$ (2) $\frac{\lambda_x \lambda_y}{\lambda_x + \lambda_y}$

(3) $\frac{\lambda_x \lambda_y}{|\lambda_x - \lambda_y|}$ (4) $\lambda_x - \lambda_y$

Q.36 A parallel plate capacitor in series with a resistance of 100Ω, an inductor of 20 mH and an AC voltage source of variable frequency shows resonance at a frequency of $\frac{1250}{\pi}$ Hz. If this capacitor is charged by a DC voltage source to a voltage 25 V, what amount of charge will be stored in each plate of the capacitor?

(1) 0.02 mC (2) 2 mC

(3) 0.2 mC (4) 0.2 C

Q.37 A person of mass m is, sitting on a swing of length L and swinging with an angular amplitude θ_0. If the person stands up when the swing passes through its lowest point, the work done by him, assuming that his centre of mass moves by a distance ℓ ($\ell << L$), is close to :

(1) $mg\ell$ (2) $mg\ell (1 + \theta_0^2)$

(3) $mg\ell (1 - \theta_0^2)$ (4) $mg\ell \left(1 + \frac{\theta_0^2}{2}\right)$

Q.38 A plano convex lens of refractive index μ_1 and focal length f_1 is kept in contact with another plano concave lens of refractive index μ_2 and focal length f_2. If the radius of curvature of their spherical faces is R each and $f_1 = 2f_2$, then μ_1 and μ_2 are related as

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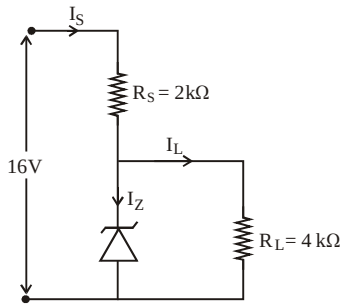
(1) $\mu_1 + \mu_2 = 3$ (2) $2\mu_1 - \mu_2 = 1$

(3) $2\mu_2 - \mu_1 = 1$ (4) $3\mu_2 - 2\mu_1 = 1$

Q.39 Figure shown a DC voltage regulator circuit, with a Zener diode of breakdown voltage = 6V. If the unregulated input voltage varies between 10 V to 16 V, then what is the maximum Zener current ?



(1) 2.5 mA (2) 3.5 mA

(3) 7.5 mA (4) 1.5 mA

Q.40 In an experiment, brass and steel wires of length 1m each with areas of cross section $1mm^2$ are used. the wires are connected in series and one end of the combined wire is connected to a rigid support and other end is subjected to elongation. The stress required to produce a net elongation of 0.2 mm is

(Given, the Young's Modulus for steel and brass are respectively, 120×10^9 N/m^2 and $60\times10^9 N/m^2$)

(1) 0.2×10^6 N/m^2 (2) 8.0×10^6 N/m^2

(3) 1.8×10^6 N/m^2 (4) 1.2×10^6 N/m^2

Q.41 An excited He^+ ion emits two photons in succession, with wavelengths 108.5nm and 30.4nm, in making a transition to ground state. The quantum number n, corresponding to its initial excited state is (for photon of wavelength λ, energy $E = \dfrac{1240eV}{\lambda\ (\text{in nm})}$)

(1) n = 5 (2) n = 4

(3) n = 6 (4) n = 7

Q.42 Given below in the left column are different modes of communication using the kinds of waves given the right column.

a. Optical Fibre	P. Ultrasound
b. Radar	Q. Infrared Light
c. Sonar	R. Microwaves
d. Mobile Phones	S. Radio Waves

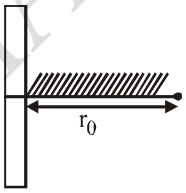
(1) a-S, b-Q, c-R, d-P

(2) a-R, b-P, c-S, d-Q

(3) a-Q, b-S, c-R, d-P

(4) a-Q, b-S, c-P, d-R

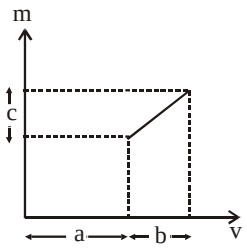
Q.43 A positive point charge is released from rest at a distance r_0 from a positive line charge with uniform density. The speed (v) of the point charge, as a function of instantaneous distance r from line charge, is proportional to :



(1) $v \propto e^{+r/r_0}$ (2) $v \propto \ln\left(\dfrac{r}{r_0}\right)$

(3) $v \propto \left(\dfrac{r}{r_0}\right)$ (4) $v \propto \sqrt{\ln\left(\dfrac{r}{r_0}\right)}$

Q.44 The graph shows how the magnification m produced by a thin lens varies with image distance v. What is the focal length of the lens used ?



(1) b^2c / a (2) b^2 / ac

(3) a / c (4) b / c

Q.45 A magnetic compass needle oscillates 30 times per minute at a place where the dip is 45°, and 40 times per minute where the dip is 30°. If B_1 and B_2 are respectively the total magnetic field

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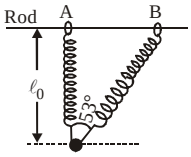
due to the earth at the two places, then the ratio B_1/B_2 is best given by :

(1) 2.2 (2) 1.8
(3) 0.7 (4) 3.6

Q.46 To which of the following quantities, the radius of the circular path of a charged particle moving at right angles to a uniform magnetic field is directly proportional ?

(1) energy of the particle
(2) magnetic field
(3) charge of the particle
(4) momentum of the particle

Q.47 A ring of mass m is attached to a horizontal spring of spring constant k and natural length ℓ_0. Other end of spring is fixed and ring can slide on a smooth horizontal rod as shown. Now the ring is shifted to position B and released, speed of ring when spring attains it's natural length is :



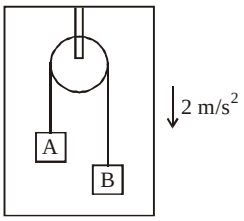
(1) $\frac{2\ell_0}{3}\sqrt{\frac{k}{m}}$ (2) $\frac{\ell_0}{3}\sqrt{\frac{k}{m}}$

(3) $\frac{3\ell_0}{2}\sqrt{\frac{k}{m}}$ (4) $\ell_0\sqrt{\frac{k}{m}}$

Q.48 A force of $(2\hat{i}+3\hat{j}+4\hat{k})$ N acts on a body for 4sec and produces a displacement of $(3\hat{i}+4\hat{j}+5\hat{k})$ m. The power used is :

(1) 4.5 W (2) 6.5 W
(3) 7.5 W (4) 9.5 W

Q.49 Block A and B of mass 2 kg and 4 kg are suspended through a string using a pulley, inside an elevator moving downward with constant acceleration 2 m/s^2. The tension in the string which is joining two blocks :



(1) (64/3) N (2) (32/3) N
(3) (8/3) N (4) (16/3) N

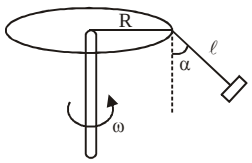
Q.50 Two particles A and B having equal charges +6C, after being accelerated through the same potential difference, enter in a region of uniform magnetic field and describe circular paths of radii 2 cm and 3 cm respectively. The ratio of mass of A to that of B is :

(1) 4/9 (2) 9/5
(3) 1/2 (4) 1/3

SECTION - 2 (Q.51 - Q.60)

This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places.

Q.51 With what angular velocity ω (in rad/s) should we rotate the disc so that a mass hanging on to the periphery by a thread of length ℓ = 35/24 m is deviated from the vertical by an angle $\alpha = 37°$ in steady state (fig)? Radius of the disc R = 1 m.



Q.52 Consider a long solenoid of radius R which has n turns per unit length. A time dependent current $I = I_0 \sin \omega t$ flows in solenoid, magnitude of electric field at a perpendicular distance r < R, from the axis of symmetry of solenoid is found to be

SPACE FOR ROUGH WORK

$E = (\alpha/4)\ \omega\mu_0\ nI_0\ r \cos \omega t$, where α is pure number and μ_0 is permeability of free space. Find α :

Q.53 The intensities of two sound sources are in the ratio 16 : 9. The ratio of the intensities of maxima to minima in the interference pattern is 7α. Find α.

Q.54 An unknown quantity x is measured using an experiment by measuring a length ℓ (in cm) from scale having least count of 1cm. Formula used is $x = R\dfrac{\ell}{100-\ell}$. R is known accurately. Find the percentage error in measurement of 'x' for ℓ = 50 cm.

Q.55 An ionisation counter is used to investigate the disintegration rate of a certain radioactive sample. At the start of the experiment, the counter gives 141 pulses in 20s. After 3 days it gives 100 pulses in 20 sec. Its half life is (in days).

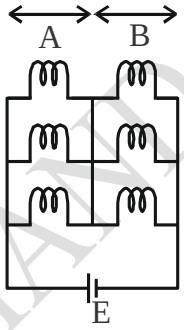
Q.56 A body weighs 72 N on the surface of the earth. What is the gravitational force(in N) on it, at a height equal to half the radius of the earth?

Q.57 The quantities of heat required to raise the temperature of two solid copper spheres of radii r_1 and r_2 ($r_1 = 1.5\ r_2$) through 1 K are in the ratio : $\dfrac{X}{8}$. Find the value of X.

Q.58 An open pipe is suddenly closed at one end, as a result of which the frequency of the third harmonic of the closed pipe is found to be higher by 100 Hz than the fundamental frequency of the open pipe. The fundamental frequency of the open pipe(in Hz) is

Q.59 An electron is accelerated through a potential difference of 10,000 V. Its de Broglie wavelength is, 12.2×10^{-x} m(nearly) .Find the value of X. ($m_e = 9 \times 10^{-31}$ kg)

Q.60 Six similar bulbs are connected as shown in the figure with a DC source of emf E and zero internal resistance. The ratio of power consumption by the bulbs when (i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing is $\dfrac{X}{4}$. Find the value of X.



PART C – MATHEMATICS

SECTION - 1 (Q.61 - Q.80)

Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.

Q.61 Let f (x) > 0 for all x and f '(x) exists for all x. If f is the inverse function of h and $h'(x) = \dfrac{1}{1+\log x}$. Then f '(x) will be

(1) 1 + log (f (x)) (2) 1 + f (x)
(3) 1 – log (f (x)) (4) log f (x)

Q.62 Let $f(x) = e^x - x$ and $g(x) = x^2 - x$, $\forall\ x \in R$. Then the set of all $x \in R$, where the function h (x) = (fog) (x) is increasing, is :

(1) $\left[-1, \dfrac{-1}{2}\right] \cup \left[\dfrac{1}{2}, \infty\right)$ (2) $\left[0, \dfrac{1}{2}\right] \cup [1, \infty)$

(3) $\left[\dfrac{-1}{2}, 0\right] \cup [1, \infty)$ (4) $[0, \infty)$

Q.63 Let y = y (x) be the solution of the differential equation, $(x^2 + 1)^2 + 2x\ (x^2 + 1)\ y = 1$ such that y (0) = 0. If $\sqrt{ay}\ (1) = \dfrac{\pi}{32}$, then the value of 'a' is :

(1) 1/2 (2) 1/16
(3) 1/4 (4) 1

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Q.64 If a tangent to the circle $x^2 + y^2 = 1$ intersects the coordinate axes at distinct points P and Q, then the locus of the mid-point of PQ is
(1) $x^2 + y^2 - 2xy = 0$ (2) $x^2 + y^2 - 16x^2y^2 = 0$
(3) $x^2 + y^2 - 4x^2y^2 = 0$ (4) $x^2 + y^2 - 2x^2y^2 = 0$

Q.65 The negation of the boolean expression $\sim s \vee (\sim r \wedge s)$ is equivalent to :
(1) r (2) $s \wedge r$
(3) $s \vee r$ (4) $\sim s \wedge \sim r$

Q.66 If $a_1, a_2, a_3, \ldots\ldots\ldots, a_n$ are in A.P. and $a_1 + a_4 + a_7 + \ldots\ldots\ldots + a_{16} = 114$, then $a_1 + a_6 + a_{11} + a_{16}$ is equal to :
(1) 38 (2) 98
(3) 76 (4) 64

Q.67 The number of irrational terms in the expansion of $(3^{1/8} + 5^{1/4})^{84}$ is –
(1) 73 (2) 74
(3) 75 (4) 76

Q.68 If the tangents on the ellipse $4x^2 + y^2 = 8$ at the points (1, 2) and (a, b) are perpendicular to each other, then a^2 is equal to :
(1) 64/17 (2) 2/17
(3) 128/17 (4) 4/17

Q.69 The area (in sq. units) of the region $A = \{(x, y) : x^2 \le y \le x + 2\}$ is
(1) 10/3 (2) 9/2
(3) 31/6 (4) 13/6

Q.70 If $\int 2^{2^x} \cdot 2^x dx = A.2^{2^x} + c$, then A =
(1) $\frac{1}{\log 2}$ (2) log 2
(3) $(\log 2)^2$ (4) $\frac{1}{(\log 2)^2}$

Q.71 The magnitude of the projection of the vector $2\hat{i} + 3\hat{j} + \hat{k}$ on the vector perpendicular to the plane containing the vectors $\hat{i} + \hat{j} + \hat{k}$ and $\hat{i} + 2\hat{j} + 3\hat{k}$, is
(1) $\sqrt{3}/2$ (2) $\sqrt{3/2}$
(3) $\sqrt{6}$ (4) $3\sqrt{6}$

Q.72 $\lim_{x \to 0^+} (e^x + x)^{1/x}$
(1) Does not exist finitely (2) is 1
(3) is e^2 (4) is 2

Q.73 If $z = \frac{\sqrt{3}}{2} + \frac{i}{2}$ $(i = \sqrt{-1})$, then $(1 + iz + z^5 + iz^8)^9$ is equal to
(1) –1 (2) 1
(3) 0 (4) $(-1 + 2i)^9$

Q.74 If the standard deviation of the numbers –1, 0, 1, k is $\sqrt{5}$ where k > 0, then k is equal to
(1) $2\sqrt{\frac{10}{3}}$ (2) $2\sqrt{6}$
(3) $4\sqrt{\frac{5}{3}}$ (4) $\sqrt{6}$

Q.75 All possible numbers are formed using the digits 1, 1, 2, 2, 2, 2, 3, 4, 4 taken all at a time. The number of such numbers in which the odd digits occupy even places is :
(1) 175 (2) 162
(3) 160 (4) 180

Q.76 If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, where a > 0, attains its maximum and minimum at p and q, respectively such that $p^2 = q$, then find the value of a.
(1) 2 (2) 1
(3) 3 (4) 4

Q.77 If $6P(A) = 8P(B) = 14P(A \cap B) = 1$, then the P (A'/B) =
(1) 3/7 (2) 4/7
(3) 3/5 (4) 2/5

Q.78 $\int_{-\pi/2}^{\pi/2} \frac{\cos^2 2x}{1 + 25^x} dx = ?$
(1) $\pi/4$ (2) $-\pi/2$
(3) $\pi/2$ (4) $-\pi/4$

Q.79 The image of the point A (1, 2, 3) relative to the plane π is B(3, 6, –1), the equation of plane π is –

SPACE FOR ROUGH WORK

(1) $x + 2y + 3z - 1 = 0$
(2) $x + 2y - 2z + 8 = 0$
(3) $x - 2y + 2z - 8 = 0$
(4) $x + 2y - 2z - 8 = 0$

Q.80 The locus of a point such that two tangents drawn from it to the parabola $y^2 = 4ax$ are such that the slope of one is double the other is -

(1) $y^2 = \frac{9}{2}ax$ (2) $y^2 = \frac{9}{4}ax$

(3) $y^2 = 9ax$ (4) $x^2 = 4ay$

SECTION - 2 (Q.81 - Q.90)

This section contains TEN (10) questions. ATTEMPT ANY FIVE (05) QUESTIONS. The answer to each question is NUMERICAL VALUE. If the numerical value has more than two decimal places truncate/round-off the value upto TWO decimal places.

Q.81 Matrix $A_r = \begin{bmatrix} r & r-1 \\ r-1 & r \end{bmatrix}$; r = 1, 2, 3, ...

If $\sum_{r=1}^{100} |A_r| = (\sqrt{10})^k$, then find the value of k.

($|A_r|$ = det (A_r))

Q.82 Number of values of 'x' in $(-2\pi, 2\pi)$ satisfying the equation $2^{\sin^2 x} + 4.2^{\cos^2 x} = 6$ is -

Q.83 If f is a real-valued differentiable function satisfying $|f(x) - f(y)| \le (x - y)^2$, $x, y \in R$ and f (0) = 0, then f (1) equals

Q.84 Let $f : R \to R$ be defined by $f(x) = \frac{x}{1+x^2}$, $x \in R$. Then the range of f is [–1/2, 1/A]. Find the value of A.

Q.85 Let Z be the set of integers. If
$A = \{x \in Z : 2(x + 2)(x^2 - 5x + 6)\} = 1$ and
$B = \{x \in Z : -3 < 2x - 1 < 9\}$, the number of subsets of the set A × B, is X^{15}. Find the value of X.

Q.86 Square is selected with all their vertices belonging to point (x_i, y_j) where
i, j ∈ (1, 2, ... 14, 15}.
If $x_{i+1} - x_i = y_{j+1} - y_j = 1$ unit, $\forall$ i, j ∈ (1, 2, ... 13, 14} then probability that length of side of selected square equals to integer is A/840. Find the value of A.

Q.87 Let $\vec{a} = -\hat{i} - \hat{k}, \vec{b} = -\hat{i} + \hat{j}$ and $\vec{c} = \hat{i} + 2\hat{j} + 3\hat{k}$ be three given 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 the value of $\vec{r}.\vec{b}$ is

Q.88 Let C be the curve passing through the point (1, 1) has the property that the perpendicular distance of the origin from the normal at any point P of the curve is equal to the distance of P from the x-axis. If the area bounded by the curve C and x-axis in the first quadrant is kπ/2 square units, then find the value of k.

Q.89 If $y = 2 \sin x + \sin 2x$ for $0 \le x \le 2\pi$, then the area enclosed by the curve and the x-axis is

Q.90 Let F (x) =

$$\begin{cases} -2x + \log_{1/2}(k^2 - 6k + 8), & -2 \le x < -1 \\ x^3 + 3x^2 + 4x + 1, & -1 \le x \le 3 \end{cases}$$

Find the sum of all possible positive integer(s) in the range of k such that F (x) has the smallest value at x = –1

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK