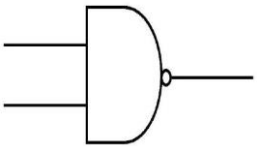
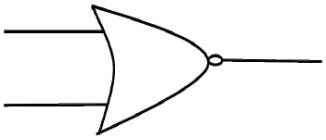
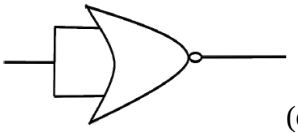
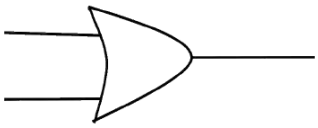
PART-I PHYSICS

1. **Which of the following gives reversible operation?**

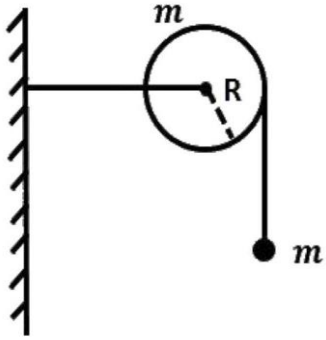
(a) 

(b) 

(c) 

(d) 

2. **A 60HP electric motor lifts an elevator with a maximum total load capacity of 2000 kg. If the frictional force on the elevator is 4000 N, the speed of the elevator at full load is close to (Given $1\text{HP} = 746\ \text{W}, g = 10\ \text{m/s}^2$)**
   (a) 1.9 m/s (b) 1.7 m/s
   (c) 2 m/s (d) 1.5 m/s
3. **A LCR circuit behaves like a damped harmonic oscillator. Comparing it with a physical spring-mass damped oscillator having damping constant b, mass m and oscillating with a force constant k, the correct equivalence will be**
   (a) $L \leftrightarrow m, C \leftrightarrow \frac{1}{k}, R \leftrightarrow b$
   (b) $L \leftrightarrow \frac{1}{b}, C \leftrightarrow \frac{1}{m}, R \leftrightarrow \frac{1}{k}$
   (c) $L \leftrightarrow k, C \leftrightarrow b, R \leftrightarrow m$
   (d) $L \leftrightarrow m, C \leftrightarrow k, R \leftrightarrow b$
4. **As shown in the figure, a bob of mass m is tied by a massless string whose other end portion is wound on a flywheel (disc) of radius R and mass m. When released from the rest, the bob starts falling vertically. When it has covered a distance h, the angular speed of the wheel will be (there is no slipping between string and wheel)**



(a) $\frac{1}{R}\sqrt{\frac{4gh}{3}}$ (b) $\frac{1}{R}\sqrt{\frac{2gh}{3}}$
(c) $R\sqrt{\frac{2gh}{3}}$ (d) $R\sqrt{\frac{4gh}{3}}$

5. **Three- point particles of mass 1 kg, 1.5 kg and 2.5 kg are placed at corners of a right triangle of sides 4 cm, 3 cm and 5 cm as shown. The centre of mass of the system with respect to 1 kg mass is at the point**
   (a) 0.6 cm to the right of 1 kg and 2 cm above 1 kg mass
   (b) 0.9 cm to the right of 1 kg and 2 cm above 1 kg mass
   (c) 0.9 cm to the right of 1 kg and 2 cm below 1 kg mass
   (d) 0.9 cm to the right of 1 kg and 1.5 cm above 1 kg mass

6. **A parallel plate capacitor has plates of area A separated by distance ' d '. It is filled with a dielectric which has a dielectric constant varies as $k(x) = k(1 + \alpha x)$, where ' x ' is the distance measured from one of the plates. If $(\alpha d \ll 1)$, the capacitance of the system is**

(a) $\frac{A\varepsilon_0 k}{d}\left[1 + \left(\frac{\alpha d}{2}\right)^2\right]$ (b) $\frac{A\varepsilon_0 k}{d}\left[1 + \left(\frac{\alpha^2 d^{d2}}{2}\right)\right]$

(c) $\frac{A\varepsilon_0 k}{d}[1 + \alpha d]$ (d) $\frac{A\varepsilon_0 k}{d}\left[1 + \left(\frac{\alpha d}{2}\right)\right]$

7. **The time period of revolution of an electron in its ground state orbit in a hydrogen atom is $1.6 \times 10^{-16} s$. The frequency of the electron in its first excited state (in s^{-1}) is:**

(a) 7.8×10^{14} (b) 7.8×10^{16}

(c) 3.7×10^{14} (d) 3.7×10^{16}

8. **The current (i_1) (in A) flowing through 1Ω resistor in the following circuit is**

(a) 0.20 A (b) 0.30 A

(c) 0.50 A (d) $0.25A$

9. **A rocket of mass m is launched vertically upward with an initial speed u from the surface of the earth. After it reaches height R (R = radius of earth), it ejects a satellite of mass $m/10$ so that subsequently the satellite moves in a circular orbit. The kinetic energy of the satellite is (G = gravitational constant; M is the mass of earth)**

(a) $\frac{3m}{8}\left[u + \sqrt{\frac{5GM}{6R}}\right]^2$ (b) $\frac{m}{20}\left[u - \sqrt{\frac{2GM}{3R}}\right]^2$

(c) $5m\left[u^2 - \frac{119}{200}\frac{GM}{R}\right]$ (d) $\frac{m}{20}\left[u^2 + \frac{113}{200}\frac{GM}{R}\right]$

10. **A long solenoid of radius R carries a time (t) dependent current $I(t) = I_0 t(1 - t)$. A ring of radius $2R$ is placed coaxially to the middle. During the time instant $0 \le t \le 1$, the induced current (I_R) and the induced EMF (V_R) in the ring changes as**

(a) Current will change its direction and its emf will be zero at $t = 0.25$sec.

(b) Current will not change its direction and its emf will be maximum at $t = 0.5$sec.

(c) Current will not change direction and emf will be zero at $t = 0.25$sec.

(d) Current will change its direction and its emf will be zero at $t = 0.5$sec.

11. **The radius of gyration of a uniform rod of length l about an axis passing through a point $l/4$ away from the center of the rod and perpendicular to its axis is**

(a) $\sqrt{\frac{7}{48}}l$ (b) $\sqrt{\frac{5}{48}}l$

(c) $\sqrt{\frac{7}{24}}l$ (d) $\sqrt{\frac{19}{24}}l$

12. **Two moles of an ideal gas with $\frac{C_p}{C_v} = 5/3$ are mixed with 3 moles of another ideal gas with $\frac{C_p}{C_v} = 4/3$. The value of $\frac{C_p}{C_v}$ for the mixture is**

(a) 1.38 (b) 1.42

(c) 1.50 (d) 1.70

13. **1 liter dry air at STP expands adiabatically to a volume of $3L$. If $\gamma = 1.4$, the work done by air is $(3^{1.4} = 4.655)$ (take air to be an ideal gas)**

(a) 100.8 J (b) 90.5 J

(c) 45 J (d) 18 J

14. **Given magnetic field equation is $\vec{B} = 3 \times 10^{-8}\sin(\omega t - kx + \phi)\hat{j}$ then appropriate equation for electric field $(\vec{E})$ will be**

(a) $20 \times 10^{-9}\sin(\omega t - kx + \phi)\hat{k}$

(b) $9\sin(\omega t - kx + \phi)\hat{k}$

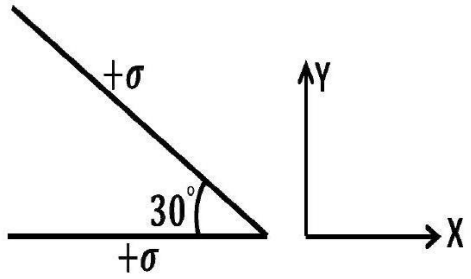
(c) $16 \times 10^{-9}\sin(\omega t - kx + \phi)\hat{k}$

(d) $3 \times 10^{-9}\sin(\omega t - kx + \phi)\hat{k}$

15. **A polarizer analyzer set is adjusted such that the intensity of light coming out of the analyzer is just 10% of the original intensity. Assuming that the polarizer analyzer set does not absorb any light, the angle by which the analyzer needs to be rotated further to reduce the output intensity to be zero is**
    (a) 45° (b) 71.6°
    (c) 90° (d) 18.4^0

16. **Speed of transverse wave of a straight wire having mass 6.0 g, length 60 cm and area of cross-section 1.0 mm^2 is 90 m/s. If the Young's modulus of wire is $1.6 \times 10^{11} Nm^{-2}$, the extension of wire over its natural length is**
    (a) 0.3 mm (b) 0.2 mm
    (c) 0.1 mm (d) 0.4 mm

17. **Two infinite planes each with uniform surface charge density $+\sigma C/m^2$ are kept in such a way that the angle between them is 30°. The electric field in the region shown between them is given by:**



(a) $\frac{\sigma}{2\epsilon_0}\left[\left(1-\frac{\sqrt{3}}{2}\right)\hat{y}-\frac{1}{2}\hat{x}\right]$ (b) $\frac{\sigma}{2\epsilon_0}\left[\left(1+\frac{\sqrt{3}}{2}\right)\hat{y}-\frac{1}{2}\hat{x}\right]$
(c) $\frac{\sigma}{2\epsilon_0}\left[\left(1-\frac{\sqrt{3}}{2}\right)\hat{y}+\frac{1}{2}\hat{x}\right]$ (d) $\frac{\sigma}{2\epsilon_0}\left[\left(1+\frac{\sqrt{3}}{2}\right)\hat{y}+\frac{1}{2}\hat{x}\right]$

18. **If we need a magnification of 375 from a compound microscope of tube length 150 mm and an objective lens of focal length 5 cm, the focal length of the eye-piece should be close to:**
    (a) 12 mm (b) 33 mm
    (c) 2 mm (d) 7 mm

19. **Visible light of wavelength 6000×10^{-8} cm falls normally on a single slit and produces a diffraction pattern. It is found that the second diffraction minima is at 60° from the central maxima. If the first minimum is produced at θ, then θ is close to**
    (a) 25° (b) 45°
    (c) 20° (d) 35°

20. **Consider a coil of wire carrying current *I*, forming a magnetic dipole placed in an infinite plane. If ϕ_i is the magnitude of magnatic flux through the inner region and ϕ_o is magnitude of magnetic flux through outer region then which of the following is correct?**
    (a) $\phi_i = -\phi_o$ (b) $\phi_i > \phi_o$
    (c) $\phi_i < \phi_o$ (d) $\phi_i = \phi_o$

21. **A particle of mass 1 kg slides down a frictionless track AOC starting from rest at A(height 2 m). After reaching C particle continues to move freely in air as a projectile. When it reaches its highest point P(h = 1 m) the kinetic energy of the particle (in *J*) is (take $g = 10\ m/s^2$)**

22. **A carnot engine operates between two reservoirs of temperature 900 K and 300 K. The engine performs 1200 *J* of work per cycle. The heat energy in (*J*) delivered by the engine to the low temperature reservoir in a cycle is**

23. **A loop ABCDEFA of straight edges has a six corner points A(0, 0, 0), B(5, 0, 0), C(5, 5, 0), D(0, 5, 0), E(0, 5, 5), F(0, 0, 5). The magnetic field in this region is $\vec{B} = (3\hat{i} + 4\hat{k})$T. The quantity of the flux through the loop ABCDEFA (in Wb) is**

24. **A beam of electromagnetic radiation of intensity $6.4 \times 10^{-5}\ W/cm^2$ is comprised of wavelength, $\lambda = 310$ nm. It falls normally on a metal (work function 2eV) of surface area 1 cm^2. If one in 10^3 photons**

ejects an electron, total number of electrons ejected in 1 s is 10^x ($hc = 1240\text{eV} - n$ m, $1\text{eV} = 1.6 \times 10^{-19}$ J), then the value of x is

25. A non- isotropic solid metal cube has coefficient of linear expansion as $5 \times 10^{-5}/^\circ\text{C}$ along the x-axis and $5 \times 10^{-6}/^\circ\text{C}$ along y-axis and z-axis. If the coefficient of volumetric expansion of the solid is $n \times 10^{-6}/^\circ\text{C}$ then the value of n is

PART-II CHEMISTRY

26. The relative strength of inter-ionic/ intermolecular forces in the decreasing order is:
(a) ion-dipole > dipole-dipole > ion-ion
(b) dipole-dipole > ion-dipole > ion-ion
(c) ion-ion > ion-dipole > dipole-dipole
(d) ion-dipole > ion-ion > dipole-dipole

27. The oxidation number of K in K_2O, K_2O_2 and KO_2 respectively is:
(a) $+0.5, +4, +1$ (b) $+2, +1, +0.5$
(c) $+1, +1, +1$ (d) $+0.5, +1, +2$

28. At 35°C the vapour pressure of CS_2 is 512 mm of Hg and that of acetone is 344 mm of Hg. A solution of CS_2 in acetone has a total vapour pressure of 600 mm of Hg. The false statement among the following is:

(a) CS_2 and acetone are less attracted to each other than themselves.

(b) Heat must be absorbed in order to produce the solution at 35°C

(c) Raoult's law is not obeyed by this system

(d) A mixture of 100 mLCS_2 and 100 mL acetone has a volume less than 200 mL

29. The atomic radius of Ag is closest to:
(a) Ni (b) Cu
(c) Au (d) Hg

30. The dipole moments of CCl_4, $CHCl_3$ and CH_4 are in the order:
(a) $CH_4 > CCl_4 > CHCl_3$
(b) $CHCl_3 > CCl_4 > CH_4$
(c) $CHCl_3 > CCl_4 = CH_4$
(d) $CCl_4 = CH_4 > CHCl_3$

31. In comparison to the zeolite process for the removal of permanent hardness, the synthetic resins method is:

(a) Less efficient as it exchanges only anions

(b) More efficient as it can exchanges only cations

(c) Less efficient as the resins cannot be generated

(d) More efficient as it can exchange both cations and anions

32. Amongst the following statements, which was not proposed by Dalton:

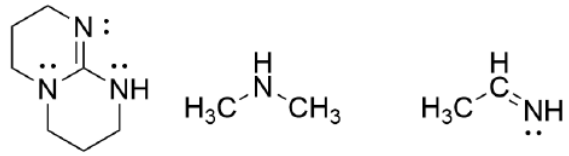
(a) Matter consists of indivisible atoms

(b) When gases combine or react in a chemical reaction, they do so in a simple ratio by volume provided all gases are maintained at the same temperature and pressure

(c) Chemical reactions involve reorganisation of atoms

(d) Atoms are neither created nor destroyed in a chemical reaction

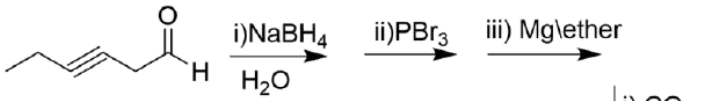
33. The increasing order of pK_b for the following compounds will be:

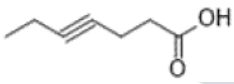


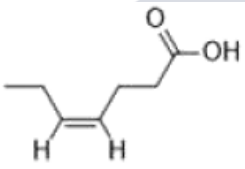
(i) (ii) (iii)

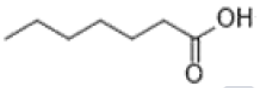
(a) i > ii > iii (b) iii > ii > i
(c) ii > i > iii (d) i < iii < ii

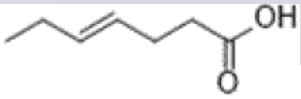
34. What is the product of the following reaction?



(a) 

(b) 

(c) 

(d) 

35. The number of orbitals associated with quantum number $n = 5, m_s = +1/2$ is:
(a) 50 (b) 16
(c) 25 (d) 30

36. The purest form of commercial iron is:
(a) Cast iron (b) Wrought iron
(c) Pig iron (d) None of these

37. The theory that can completely/ properly explain the nature of bonding in $[Ni(CO)_4]$ is:
(a) Werner's theory
(b) Crystal Field Theory
(c) Molecular Orbital Theory
(d) Valence Bond Theory

38. The IUPAC name of the complex $[Pt(NH_3)_2Cl(NH_2CH_3)]Cl$ is:

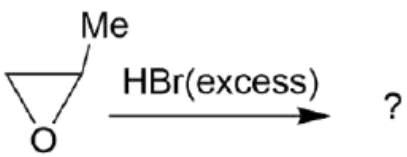
(a) Diamminechlorido methylamine platinum (II) chloride

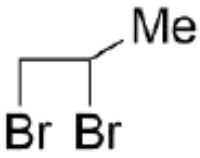
(b) Chlorido methanamine diamine platinum (II) chloride

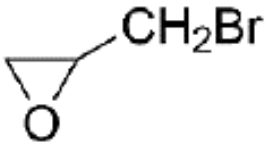
(c) Diammine chloride methylamine platinate (II) chloride

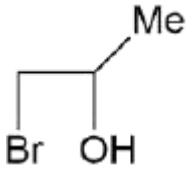
(d) None of these

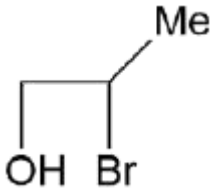
39.



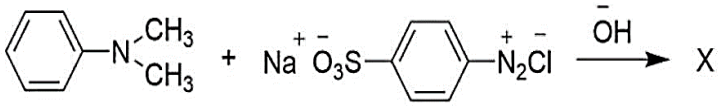
(a) 

(b) 

(c) 

(d) 

40. Consider the following reaction:



The product X is used:

(a) In protein estimation as an alternative to Ninhydrin

(b) As a food grade colourant

(c) In laboratory test for phenols

(d) In acid-base titration as an indicator

41.

List I	List II
i) Riboflavin	p) Beri beri
ii) Thiamine	q) Scurvy
iii) Ascorbic acid	r) Cheilosis
iv) Pyridoxine	s) Convulsions

	i	ii	iii	iv
a)	s	q	p	r
b)	r	p	q	s
c)	p	r	q	s
d)	s	r	q	p

42. Given that the standard potential; E° of Cu^{2+} | Cu and Cu^{+} | Cu are 0.340 V and 0.522 V respectively. The E° of Cu^{2+} | Cu^{+} is:

(a) 0.158 V (b) −0.158 V

(c) 0.182 V (d) −0.182 V

43. A solution of m-chloroaniline, m-chlorophenol, m-chlorobenzoic acid in ethyl acetate was extracted initially with a saturated solution of $NaHCO_3$ to give fraction A, the leftover organic phase was extracted with dil. NaOH to give fraction B. The final organic layer was labelled as fraction C. Fractions A, B and C contains respectively:

(a) m-chlorobenzoic acid, m-chlorophenol and m-chloroaniline

(b) m-chlorophenol, m-chlorobenzoic acid and m-chloroaniline

(c) m-chloroaniline, m-chlorophenol and m-chlorobenzoic acid

(d) m-chlorobenzoic acid, m-chloroaniline and m-chlorophenol

44. The electron gain enthalpy in kJ/mol of F, Cl, Br, and I respectively are:

(a) $-295, -324, -348, -333$

(b) $-348, -324, -333, -295$

(c) $-333, -348, -324, -295$

(d) $-348, -333, -295, -324$

45. Consider the following reactions:

(a) $(CH_3)_3CCH(OH)CH_3 \xrightarrow{Conc.H_2SO_4}$

(b) $(CH_3)_2CHCH(Br)CH_3 \xrightarrow{Alc.KOH}$

(c) $(CH_3)_2CHCH(Br)CH_3 \xrightarrow{(CH_3)_3C\overset{-}{O}\ K^{+}}$

(d) $(CH_3)_2C(OH)\text{-}CH_2CHO \xrightarrow{\Delta}$

Which of these reactions will not produce Saytzeff product?

46. Two solutions *A* and *B* each of 100 L was made by dissolving 4 g of NaOH and 9.8 g of H_2SO_4 in water respectively. The pH of the resulting solution obtained by mixing 40 L of Sol A and 10 L of Sol B is:

47. During the nuclear explosion, one of the products ^{90}Sr was absorbed in the bones of a newly born baby in place of Ca. How much time in years is required to reduce it by 90% if it is not lost metabolically?

$\left(T_{\frac{1}{2}} = 6.93 \text{ years}\right)$

48. Chlorine reacts with hot and conc. NaOH and produces compounds X and Y. Compound X gives a white precipitate with $AgNO_3$ soln. The average bond order between Cl and O atoms in Y is?

49. The number of chiral carbons in chloramphenicol is:

50. The reaction $A_{(l)} \rightarrow 2\ B_{(g)}$

$\Delta U = 2.1 kcal, \Delta S = 20 cal/K$ at 300 K, find ΔG in kcal.

PART-III MATHEMATICS

51. The area of the region enclosed by the circle $x^2 + y^2 = 2$ which is not common to the region bounded by the parabola $y^2 = x$ and the straight line $y = x$, is

(a) $\frac{1}{12}(24\pi - 1)$ (b) $\frac{1}{6}(12\pi - 1)$

(c) $\frac{1}{12}(6\pi - 1)$ (d) $\frac{1}{12}(12\pi - 1)$

52. If $g(x) = x^2 + x - 1$ and $(g \circ f)(x) = 4x^2 - 10x + 5$, then $f\left(\frac{5}{4}\right)$ is

(a) $\frac{1}{2}$ (b) $-\frac{1}{2}$

(c) $-\frac{1}{3}$ (d) $\frac{1}{3}$

53. If $y = y(x)$ is the solution of the differential equation $e^y\left(\frac{dy}{dx} - 1\right) = e^x$ such that $y(0) = 0$, then $y(1)$ is equal to

(a) $\ln 2$ (b) $2 + \ln 2$

(c) $1 + \ln 2$ (d) $3 + \ln 2$

54. If $y = mx + 4$ is a tangent to both the parabolas, $y^2 = 4x$ and $x^2 = 2by$, then b is equal to

(a) -64 (b) -32

(c) -128 (d) 16

55. If α and β are two real roots of the equation $(k+1)\tan^2 x - \sqrt{2}\lambda \tan x = 1 - k$, where $(k \neq 1)$ and λ are real numbers. If $\tan^2(\alpha + \beta) = 50$, then value of λ is

(a) 10 (b) 5

(c) 7 (d) 12

56. If the distance between the foci of an ellipse is 6 and the distance between its directrices is 12 , then the length of its latus rectum is

(a) 4 (b) $3\sqrt{2}$

(c) 9 (d) $2\sqrt{2}$

57. The logical statement $(p \rightarrow q) \wedge (q \rightarrow \sim p)$ is equivalent to

(a) $\sim p$ (b) p

(c) $p \wedge q$ (d) $p \vee q$

58. If the system of equations

$2x + 2ay + az = 0$

$2x + 3by + bz = 0$

$2x + 4cy + cz = 0,$

where $a, b, c \in R$ are non-zero and distinct, has non zero solution then

(a) $a + b + c = 0$ (b) a, b, c are in A.P

(c) $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P (d) a, b, c are in G.P

59. 5 numbers are in A.P whose sum is 25 and product is 2520. If one of these 5 numbers is $-\frac{1}{2}$, then the greatest number amongst them is

(a) $\frac{21}{2}$ (b) 16

(c) 27 (d) 7

60. If α is a root of the equation $x^2 + x + 1 = 0$ and $A = \frac{1}{\sqrt{3}}\begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha & \alpha^2 \\ 1 & \alpha^2 & \alpha \end{bmatrix}$ then A^{31} equal to

(a) A (b) A^2

(c) A^3 (d) A^4

61. Let $x^k + y^k = a^k$ where $a, k > 0$ and $\frac{dy}{dx} + \left(\frac{y}{x}\right)^{\frac{1}{3}} = 0$, then k is

(a) $\frac{1}{3}$ (b) $\frac{2}{3}$

(c) $\frac{4}{3}$ (d) 2

62. If real part of $\left(\frac{z-1}{2z+i}\right) = 1$ where $z = x + iy$, then the point (x, y) lies on

(a) straight line with slope 2

(b) straight line with slope $\frac{1}{2}$

(c) circle with diameter $\frac{\sqrt{5}}{2}$

(d) circle with diameter $\frac{1}{2}$

63. If $y(\alpha) = \sqrt{\frac{2(\tan\alpha+\cot\alpha)}{1+\tan^2\alpha} + \frac{1}{\sin^2\alpha}}$ where $\alpha \in \left(\frac{3\pi}{4}, \pi\right)$ then find $\frac{dy}{d\alpha}$ at $\alpha = \frac{5\pi}{6}$

(a) 4 (b) 2

(c)(3 (d) -4

64. Find the greatest integer k for which $49^k + 1$ is a factor of the given sum $49^{125} + 49^{124} + \cdots + 49^2 + 49 + 1$

(a) 63 (b) 65

(c) 32 (d) 60

65. If $A(1,1), B(6,5), C\left(\frac{3}{2}, 2\right)$ are the vertices of $\triangle ABC$. A point P is such that area of $\triangle PAB$,$\triangle PAC$ and $\triangle PBC$ are equal, then find the length of the line the segment PQ, where Q is the point $\left(-\frac{7}{6}, -\frac{1}{3}\right)$

(a) 2 (b) 3

(c) 4 (d) 5

66. If $\vec{a} = \alpha\hat{\imath} + 2\hat{\jmath} + \beta\hat{k}$ lies in plane of $\vec{b}$ and $\vec{c}$ where $\vec{b} = \hat{\imath} + \hat{\jmath}$ and $\vec{c} = \hat{\imath} - \hat{\jmath} + 4\hat{k}$ and $\vec{a}$ bisects the angle between $\vec{b}$ and $\vec{c}$, then

(a) $\vec{a}\cdot\hat{k} + 2 = 0$ (b) $\vec{a}\cdot\hat{k} + 4 = 0$

(c) $\vec{a}\cdot\hat{k} - 2 = 0$ (d) $\vec{a}\cdot\hat{k} + 5 = 0$

67. If $f(x)$ is continuous and differentiable in $x \in [-7, 0]$ and $f'(x) \leq 2 \forall x \in [-7, 0]$, also $f(-7) = -3$ then the range of $f(-1) + f(0)$ is

(a) $[-5, -7]$ (b) $(-\infty, 6]$

(c) $(-\infty, 20]$ (d) $[-5,3]$

68. Find the image of the point $(2, 1, 6)$ in the plane containing the points $(2, 1, 0)$, $(6, 3, 3)$ and $(5, 2, 2)$

(a) (6,5, −2) (b) (6, −5,2)

(c) (2, −3,4) (d) (2, −5,6)

69. If sum of all the coefficients of even powers in

$(1 - x + x^2 - x^3 \ldots . + x^{2n})(1 + x + x^2 + x^3 \ldots . + x^{2n})$ is 61 then n is equal to

(a) 30 (b) 32

(c) 28 (d) 36

70. An unbiased coin is tossed 5 times. Suppose that a variable X is assigned the value k when k consecutive heads are obtained for $k = 3, 4, 5$, otherwise X takes the value -1 . The expected value of X is

(a) $\frac{1}{8}$ (b) $-\frac{1}{8}$

(c) $\frac{3}{8}$ (d) $-\frac{3}{8}$

71. Given $f(a + b + 1 - x) = f(x) \forall x \in R$ then the value of $\frac{1}{(a+b)}\int_a^b x(f(x) + f(x+1))dx$ is equal to

(a) $\int_{a+1}^{b+1} f(x)dx$ (b) $\int_{a+1}^{b+1} f(x+1)dx$

(c) $\int_{a-1}^{b-1} f(x)dx$ (d) $\int_{a-1}^{b-1} f(x+1)dx$

72. Total number of six-digit numbers in which only and all the five digits 1, 3, 5, 7 and 9 appear, is

73. Evaluate $\lim_{x\to 2} \frac{3^x + 3^{x-1} - 12}{3^{\frac{-x}{2}} - 3^{1-x}}$

74. If variance of first N natural numbers is 10 and variance of first M even natural numbers is 16 then the value of $M + N$ is

75. If $f(x) = |2 - |x - 3||$ is non - differentiable in $x \in S$. Then, the value of $\sum_{x\in S}(f(f(x)))$ is