1. At what temperature will the rms speed of oxygen molecules become just sufficient for escaping from the earth's atmosphere? (Given: Mass of oxygen molecule (m)=2.76x10^{-26} kg. Boltzmann's constant K_B=1.38x10^{-23} JK^{-1}).

   a) 5.016x10^4K b) <u>8.360x10^4K</u> c) 2.508x10^4K d) 1.254x10^4K

   Solution: V_{escape}=11200 m/s

   $\sqrt{\frac{3K_BT}{mO_2}}$=11200 m/s

   on substituting the values

   T=8.360x10^4K

2. The efficiency of an ideal heat engine working between the freezing point and boiling point of water is _____.

   a) 6.25% b) 20% c) <u>26.8%</u> d) 12.5%

   Solution: Efficiency of heat engine $\eta=1-\frac{T_2}{T_1}$; T_2=sink temperature, T_1=source temperature

   % in $\eta=\left(1-\frac{T_2}{T_1}\right)$x100

   $=\left(1-\frac{273}{373}\right)$x100$\Rightarrow\left(\frac{100}{373}\right)$x100

   η=26.8%

3. A carbon resistor of (47$\pm$4.7)kΩ is to be marked with rings of different colours for its identification. The colour code sequence will be _____.

   a) Yellow-Green-Violet-Gold b) <u>Yellow-Violet-Orange-Silver</u>

   c) Violet-Yellow-Orange-Silver d) Green-Orange-Violet-Gold

   Solution: (47$\pm$4.7)kΩ=47x$10^3$$\pm$10%

   $\therefore$ Yellow-Violet-Orange-Silver

4. In Young's double slit experiment the separation d between 2 slits is 2mm, the wavelength λ of the light used is 5896Å and distance 'D' between the screen and slits is 100cm. It is found that the angular width of the fringes is 0.20^0. To increase the fringe angular width is 0.21^0. (with same λ and D) the separation between the slits needs to be changed to _____.

   a) 2.1mm b) <u>1.9mm</u> c) 1.8mm d) 1.7mm

   Solution: Angular width=$\frac{\lambda}{d}$

   $0.20^0=\frac{\lambda}{2mm}$ ⟶ (1); $0.21^0=\frac{\lambda}{d}$ ⟶ (2)

   Dividing we get, $\frac{0.20}{0.21}=\frac{d}{2mm}$

   d=1.9mm

5. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom is _____.

   a) 2:-1 b) <u>1:-1</u> c) 1:1 d) 1:-2

   Solution: Kinetic energy=-(total energy)

   So K.E : T:E=1:-1

6. From a disc of radius R and mass M, a circular hole of diameter R, whose rim passes through the centre is cut. What is the moment of inertia of the remaining part of the disc about a perpendicular axis, passing through the centre?

   a) 15 $MR^2/32$ b) <u>13 $MR^2/32$</u> c) $\frac{11}{32}$ MR^2 d) $\frac{9}{32}$ MR^2

   $I_{Total\ disc}=\frac{MR^2}{2}$

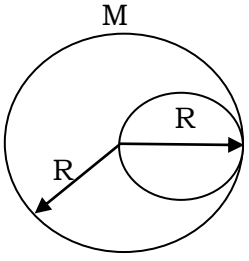
   $M_{Removed}=\frac{M}{4}$ (Mass α area)

   $I_{Removed}$ (about same perpendicular axis)

   $=\frac{M}{4}\frac{(R12)^2}{2}+\frac{M}{4}\frac{(R)^2}{2}\Rightarrow\frac{3MR^2}{32}$

   $I_{Remaining\ disc}=I_{Total}-I_{Removed}$

   $=\frac{MR^2}{2}-\frac{3}{32}$ $MR^2\Rightarrow I=\frac{13}{32}$ MR^2



7. What height from the surface of the earth the gravitation potential and the value of g are -5.4×10^7 JKg^{-2} and $6ms^{-2}$ respectively? Take the radius of earth as 6400 km.

a) 2600 km b) 1600 km c) 1400 km d) 2000 km

Solution: $V=\frac{-GM}{R+h}=-5.4\times10^7 \longrightarrow (1)$ $g=\frac{GM}{(R+h)^2}=6 \longrightarrow (2)$

$\div$ (1) and (2) $\Rightarrow \frac{5.4\times10^7}{(R+h)}=6$

R+h=900 km $\therefore$h=2600 km

8. Out of the following options which one can be used to produce a propagating electromagnetic wave?

a) A charge moving at constant velocity b) A stationary charge c) A chargeless particle d) An accelerating charge

Solution: To generate electromagnetic waves we need accelerating charge particle.

9. A refrigerator works between 4^0c and 30^0c . It is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerated space constant. The power required is: (Take 1cal=4.2 Joules)

a) 2.365W b) 23.65 W c) 236.5 W d) 2365 W

Solution: $\beta=\frac{\theta_2}{\omega}=\frac{T_2}{T_{1-T_2}}$ (where θ_2 is heat removed)

$\Rightarrow \frac{600\times4.2}{\omega}=\frac{277}{303-277}$

W=236.5 Joule

Power=$\frac{W}{t}=\frac{236.5}{1\ sec}$ Joule

Power=236.5 watt

10. An air column, closed at one end and open at the other, resonates with a tuning fork when the smallest length of the column is 50cm. The next larger length of the column resonating with the same tuning fork is

a) 66.7 cm b) 100 cm c) 150 cm d) 200 cm

Solution: First minimum resonating length for closed organ pipe $=\frac{\lambda}{4}$=50cm

Next larger length of air column is $\frac{3\lambda}{4}$ =150cm

11. A disk and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first?

a) Disk b) Sphere c) Both reach at the same time d) Depends on their masses

Solution: $a=\frac{g\sin\theta}{1+\frac{K^2}{R^2}}$

for disc; $\frac{K^2}{R^2}=\frac{1}{2}$ =0.5

for sphere; $\frac{K^2}{R^2}=\frac{2}{5}$ =0.4

a (sphere) > a (disc)

$\therefore$ Sphere reaches first.

12. The angle of incidence for a ray of light at a refracting surface of a prism is 45^0. The angle of prism is 60^0. If the ray suffers minimum deviation through the prism, the angle of minimum deviation and refractive index material of the prism respectively are:

a) 45^0, $\frac{1}{\sqrt{2}}$ b) 30^0, $\sqrt{2}$ c) 45^0, $\sqrt{2}$ d) 30^0, $\frac{1}{\sqrt{2}}$

Solution: i=45^0; A=60^0; δ_m=2i-A

A=30^0

$\mu=\frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin\frac{A}{2}}=\frac{\sin 45^0}{\sin 30^0}=\frac{1}{\sqrt{2}}\times\frac{2}{1}=\sqrt{2}$

13. When an α-particle of mass 'm' moving with velocity 'v' bombards on a heavy nucleus of charge '2e'. Its distance of closet approach from the nucleus depends on m as

a) $\frac{1}{m}$ b) $\frac{1}{\sqrt{m}}$ c) $\frac{1}{m^2}$ d) m

Solution: At closet distance of approach, the kinetic energy of the particle will convert completely into electrostatic potential energy.

$\frac{1}{2}mv^2=\frac{k\theta_q}{d}=d\ \alpha\ \frac{1}{m}$

14. The molecules of a given mass of a gas have r.m.s velocity of 200 ms^{-1} at 27^0c and 1.0 x 10^5 Nm^{-2} pressure. When the temperature and pressure of the gas are respectively 127^0 and 0.05 x 10^5 Nm^{-2}, the r.m.s velocity of its molecules in ms^{-1} is

a) $100\sqrt{2}$ b) $\frac{400}{\sqrt{3}}$ c) $\frac{100\sqrt{2}}{3}$ d) $\frac{100}{3}$

Solution: $V \alpha \sqrt{T} \Rightarrow \frac{V}{200} = \sqrt{\frac{400}{300}}$

$V=\frac{200\times 2}{\sqrt{3}}$ m/s $V=\frac{400}{\sqrt{3}}$ m/s

15. What is the minimum velocity with which a body of mass 'm' must enter a velocity loop of radius R so that it can complete the loop?

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

Solution: The minimum speed of body is $\sqrt{5gR}$

16. A astronomical telescope has objective and eyepiece of focal lengths 40cm and 4cm respectively. To view an object 200 cm away from the objective, the lenses must be separated by a distance

a) 37.3 cm b) 46.0 cm c) 50 cm d) 54 cm

Solution: Using lens formula for objective lens,

$\frac{1}{v_0} - \frac{1}{u_0} = \frac{1}{f_0} \Rightarrow \frac{1}{v_0} = \frac{1}{f_0} + \frac{1}{u_0} \Rightarrow \frac{1}{v_0} = \frac{1}{40} + \frac{1}{-200}$

$= \frac{+5-1}{200} \Rightarrow v_0$=50cm

Tube length $\ell = |v_0| + f_0$=50 + 4=54cm

17. The ratio of escape velocity at earth (v_e) to the escape velocity at a planet (v_p) whose radius and mean density are twice as that of earth is

a) 1 : 2 b) 1 : $2\sqrt{2}$ c) 1 : 4 d) 1 : $\sqrt{2}$

Solution: $V_e=\sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G}{R}\left(\frac{4}{3}\pi R^3\rho\right)}\ \alpha\ R\sqrt{\rho}$

∴Ration = 1 : $2\sqrt{2}$

18. A long wire carrying a steady current is bent into a circular loop of one turn. The magnetic field at the centre of the loop is B. It is then bent into a circular coil of 'n' turns. The magnetic field at the centre of this coil of 'n' turns will be _____.

a) 2nB b) $2n^2B$ c) nB d) n^2B

Solution: $\ell = 2\pi R = n(2\pi R) \Rightarrow r=\frac{R}{n}$

For one turn $B=\frac{\mu_0 i}{2R}$ &

For n turn $B^1=\frac{\mu_0 ni}{2r}$

$B^1=\frac{\mu_0 n^2 i}{2R} \Rightarrow n^2B$

19. A bar magnet is hung by a thin cotton thread in a uniform horizontal magnetic field and is in equilibrium state. The energy required to rotate it by 60^0 is W. Now the torque required to keep the magnet in their new position is _____.

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

Solution: τ = MB sin $60^0 \longrightarrow$ (1)

w=MB (1-cos 60^0) $\longrightarrow$ (2)

(1) & (2) $\frac{\tau}{w} = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} \Rightarrow \tau=\frac{w}{\sqrt{3}}$

20. An electron is moving in a circular path under the influence of a transverse magnetic field of 3.57 x 10^{-2}T. If the value of e/m is 1.76x10^{11} c/kg, the frequency of revolution of the electron is _____.

a) 62.8 MHz b) 6.28 MHz c) 1 GHz d) 100 MHz

Solution: $f=\frac{eB}{2\pi m} \Rightarrow f=1.76 \times 10^{11} \times \frac{3.57\times 10^{-2}}{2\times 3.14}$ Hz ∴ F=10^9 Hz or 1GHz

21. A person can see clearly objects only when they lie between 50cm and 400cm from his eyes. In order to increase the maximum distance of distinct vision to infinity, the type and power of the connecting lens, the person has to use, will be _____.

a) Concave, -0.2 diopler b) Convex, +0.15 diopler c) Convex, +2.25 diopler

d) Concave, -0.25 diopler

Solution: As we want to correct myopin, so far point must go to infinity.

v=-4m; u=-∞; p=?

$P=\frac{1}{f}=\frac{1}{v}-\frac{1}{u}\Rightarrow\frac{1}{-4}-\frac{1}{\infty}=$-0.25 D

22. Electrons of mass m with de-broglie wavelength λ fall on the target in an x-ray tube. The cutoff wavelength (λ_0) of the emitted x-ray is _____.

a) $\lambda_0=\frac{2m^2c^2\lambda^2}{h^2}$ b) $\lambda_0=\lambda$ c) $\lambda_0=\frac{2mc\lambda^2}{h}$ d) $\lambda_0=\frac{2h}{mc}$

Solution: $\lambda=\frac{h}{P}\Rightarrow P=\frac{h}{\lambda}$

K.E of electrons = $E=\frac{P^2}{2m}=\frac{h^2}{2m\lambda^2}$

Also in x-ray $\lambda_0=\frac{hc}{E}\Rightarrow\lambda_0=\frac{2mc\lambda^2}{h}$

23. A given sample of an ideal gas occupies a volume v at a pressure P and absolute temperature T. The mass of each molecule of the gas is m. Which of the following gives the density of a gas?

a) $\frac{P}{KTV}$ b) mKT c) $\frac{P}{KT}$ d) $\frac{Pm}{KT}$

Solution: $\frac{P}{\rho}=\frac{RT}{M_w}$ (ideal gas equation)

$\rho=\frac{PM_w}{RT}\Rightarrow\frac{P\times(mN_A)}{KN_AT}=\frac{Pm}{KT}$

24. A body of mass m is attached to the lower end of a spring whose upper end is fixed. The spring has negligible mass. When the mass m is slightly pulled down and released, it oscillates with a time period of 3s. When the mass m is increased by 1kg, the time period of oscillations becomes 5s. The value of m in kg is _____.

a) $\frac{16}{9}$ b) $\frac{9}{16}$ c) $\frac{3}{4}$ d) $\frac{4}{3}$

Solution: $T=2\pi\sqrt{\frac{m}{K}}$

$3=2\pi\sqrt{\frac{m}{K}}\longrightarrow(1)$

$5=2\pi\sqrt{\frac{m+1}{K}}\longrightarrow(2)$

$\frac{(1)^2}{(2)^2}\Rightarrow\frac{9}{25}=\frac{m}{m+1}\Rightarrow m=\frac{9}{16}$

25. An electric dipole is placed at an angle of 30^0 with an electric field intensity $2x10^5$ N/c. It experiences a torque equal to 4 Nm. The charge on the dipole, if the dipole length is 2cm is

a) 5mc b) 7μc c) 8mc d) 2mc

Solution: $\tau=p\in\sin\theta$

$\tau=q\,l\in\sin\theta$

$4=q\times2\times16^{-3}\times2\times10^5\sin30^0$

q=2mc

26. A person walks up a stationary escalator in time t_1. If he remains stationary on the escalator, then it can take him up in time t_2. How much time would it take him to walk up the moving escalator?

a) $\frac{t_1+t_2}{2}$ b) $\sqrt{t_1t_2}$ c) $\frac{t_1t_2}{t_1+t_2}$ d) t_1+t_2

Solution: Let L be the length of escalator

$V_{mc}=\frac{L}{t_1}$ (speed of man w.r.t escalator)

Speed of escalator is $V_{mc}=\frac{L}{t_2}$

$V_m=V_{mc}+V_c=L\left(\frac{1}{t_1}+\frac{1}{t_2}\right)$, $t=\frac{L}{V_m}=\frac{t_1t_2}{t_1+t_2}$

27. A particle moves in xy plane according to the law x=4 sin 6t and y=4(1-cos 6t). The distance traversed by the particle in 4s is (x and y are in metres).

a) 96m b) 48m c) 24m d) 108m

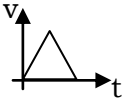
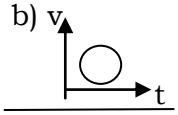
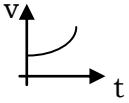
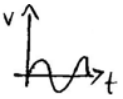
Solution: x=4 sin6t, y=4(1-cos 6t)

$V_x=\frac{dx}{dt}=\frac{d}{dt}(4\ sin6t) = 24\ cos6t$, $V_y=\frac{dy}{dt}=\frac{d}{dt}\ 4(1-cos\ 6t) =24\ sin6t$

$V=\sqrt{V_x^2+V_y^2}=\sqrt{(24\ cos6t)^2+(24\ sin6t)^2}$ =24ms^{-1}

S=vt=(24x4)m=96m

28. Which of the following curves does not represent motion in one dimension?

a)  b)  c)  d) 

Explanation: In one dimensional motion, the body can have at a time one value of velocity.

29. A man in a balloon rising vertically with an acceleration of 4.9 ms^{-2} releases a stone 2 seconds after the balloon is let go from the ground. The greatest height above the ground reached by the stone is _____. (g=9.8 ms^{-2})

a) 14.7m b) 19.6m c) 9.8m d) 24.5m

Solution:a=4.9 ms^{-2}, t=2s, u=0 $S=ut+\frac{1}{2}at^2$

$S=0+\frac{1}{2}$ x 4.9 x $(2)^2$=9.8m

30. A body travels a distance of 20m in the 7th second and 24m in 9th second. How much distance shall travel in the 15th second?

a) 10m b) 16m c) 24m d) 36m

Solution: D_7=20m, D_9=24m, D_{15}=?

u=initial velocity, a=acceleration

$D_4=u+\frac{a}{2}(2n-1)$ $\therefore D_7=u+\frac{a}{2}(2x7-1)$

(or) $20=u+\frac{13a}{2}$ ⟶ (1) $D_9=u+\frac{9}{2}(2x9-1)$ (or) $24=u+\frac{17a}{2}$ ⟶ (2)

sub eqn (1) & (2) we get, 4=2a, a=2ms^{-2}

sub a=2 in eqn (1) ⇒ u=20-13=7 ms^{-1}

so, $D_{15}=u+\frac{a}{2}(2x15-1)$ = $7+\frac{2}{2}$ x 29=36m

31. A body starting from rest moves with constant acceleration. The ratio of distance covered by the body during the 5th second to that covered in 5 seconds is _____.

a) $\frac{9}{25}$ b) $\frac{3}{25}$ c) $\frac{25}{9}$ d) $\frac{1}{25}$

Solution: Distance covered in 5th second is,

$D_5=0+\frac{a}{2}(2x5-1)=\frac{9a}{2}$, $S_5=0+\frac{1}{2}$ x a x $5^2=\frac{25a}{2}$

$\frac{D_5}{S_5}=\frac{9}{25}$

32. The component of vector $\vec{A}=2\hat{\imath}+3\hat{\jmath}$ along the direction of $(\hat{\imath}+\hat{\jmath})$ is _____.

a) $\frac{1}{\sqrt{2}}$ b) $\frac{3}{\sqrt{2}}$ c) $\frac{5}{\sqrt{2}}$ d) $\frac{7}{\sqrt{2}}$

Solution: $\vec{A}=2\hat{\imath}+3\hat{\jmath}$ $\vec{B}=\hat{\imath}+\hat{\jmath}$

Component of $\bar{A}$ along the direction $\vec{B}$ is $=\frac{\bar{A}.\bar{B}}{|\vec{B}|}=\frac{(2\hat{\imath}+3\hat{\jmath}).(\hat{\imath}+\hat{\jmath})}{\sqrt{(1)^2+(1)^2}}=\frac{5}{\sqrt{2}}$

33. If the scalar and vector products of two vectors $\bar{A},\bar{B}$ are equal in magnitude, then the angle between the two vectors is _____.

a) 45^0 b) 90^0 c) 180^0 d) 360^0

Solution: $|\vec{A}\times\vec{B}|=|\bar{A}.\bar{B}|$, A$\not{B}$ sinθ = A$\not{B}$ cosθ

(θ be angle between vectors $\bar{A}$ *and* $\bar{B}$

$\frac{\sin\theta}{\cos\theta}$ =1, tan θ =1, θ=45^0

34. A gramophone record is revolving with an angular velocity ω. A coin is placed at a distance r from the centre of the record. The static co-efficient of friction is μ, where r=_____.

a) r= $\mu g\,\omega^2$ b) r<$\frac{\omega^2}{\mu g}$ c) r≤ $\frac{\mu g}{\omega^2}$ d) r≥ $\frac{\mu g}{\omega^2}$

Solution: The coin will revolve with the record, if force of friction ≥ centrifugal force $\mu mg \geq \mu r\,\omega^2$ (or) $r \leq \frac{\mu g}{\omega^2}$

35. A large force is acting on a body for a short time. The impulse imparted is equal to the change in _____.
    a) acceleration b) momentum c) energy d) velocity

36. A 4kg mass and a 1kg mass are moving with equal kinetic energies. The ratio of their momenta is _____.
    a) 1 : 2 b) 1 : 4 c) 2 : 1 d) 1 :1

    Solution: $k_1=k_2$, $\frac{P_1^2}{2m_1}=\frac{P_2^2}{2m_2}$

    $\frac{P_1}{P_2}=\sqrt{\frac{m_1}{m_2}}=\sqrt{\frac{4}{1}}=2:1$

37. A body of mass 10kg initially at rest acquires velocity $10ms^{-1}$, what is the work done?
    a) -500 J b) 500 J c) 50 J d) -50 J

    Solution: By Work-Energy theorem, $w=\Delta k=\frac{1}{2}\times 10\times(10)^2 = 500J$

38. When a long spring is stretched by 2cm, its potential energy is U. If the spring is stretched by 10cm, the potential energy in it will be _____.
    a) 10U b) 25U c) $\frac{U}{5}$ d) 5U

    Solution: Potential energy in a stretched spring is $U=\frac{1}{2}kx^2$

    $\frac{U_1}{U_2}=\left(\frac{x_1}{x_2}\right)^2 \therefore \frac{U_1}{U_2}=\left(\frac{0.02}{0.1}\right)^2=\frac{1}{25}$ $U_2=25U_1=25U$

39. The ratio of tensile stress to the longitudinal strain is defined as _____.
    a) bulk modulus b) Young's modulus c) Shear modulus d) Compressibility

40. For most materials the Young's modulus is n times the modulus of rigidity, where n is _____
    a) 2 b) 3 c) 4 d) 5

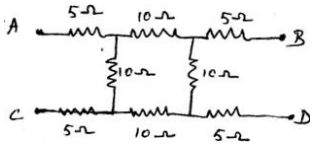
    Solution: $\eta=\frac{1}{3}\gamma$ (or) $\gamma=3\eta$ $\therefore \eta=3$

41. The magnitude of maximum acceleration is π times that of maximum velocity of a simple harmonic oscillator. The time period of the oscillation in seconds is _____.
    a) 4 b) 2 c) 1 d) 0.5

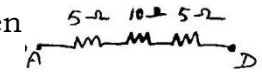
    Solution: $a_{max}=\omega^2 A$, $\vartheta_{max}=\omega A$, $a_{max}=\pi\vartheta_{max}$

    $\omega^2 A=\pi(\omega A)$, $\omega=\pi$, $T=\frac{2\pi}{\omega}=\frac{2\pi}{\pi}=2s$ $\therefore T=2s$

42. The equivalent resistance between the terminals A and D in the following circuit is _____.



    a) 10 Ω b) 20 Ω c) 5 Ω d) 30 Ω

    Solution: Equivalent circuit is taken 

    =5 Ω + 10 Ω + 5 Ω=20 Ω

43. If the number of turns per unit length of a coil of solenoid is doubled, the self inductance of the solenoid will _____.
    a) remain unchanged b) be halved c) be doubled d) become four times

    Solution: Self inductance of a solenoid=$\mu_0 n^2 A\ell$, $L\alpha n^2$

    So L is 4 times when n is doubled.

44. If λ_v, λ_x and λ_m represent the wavelengths of visible light, x-rays and microwaves respectively, then _____.
    a) $\lambda_m > \lambda_x > \lambda_v$ b) $\lambda_v > \lambda_m > \lambda_x$ c) $\lambda_v > \lambda_x > \lambda_m$ d) $\lambda_m > \lambda_v > \lambda_x$

45. In an electrical circuit R, L, C and AC voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and current in the circuit is $\frac{\pi}{3}$. Instead if C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$. The power factor of the circuit is _____.
    a) $\frac{1}{2}$ b) $\frac{1}{\sqrt{2}}$ c) 1 d) $\frac{\sqrt{3}}{2}$

CHEMISTRY

46. How many primary, secondary, tertiary and quaternary carbons are present in the following hydrocarbon CH_3-CH(CH_3)-C(CH_3)$_2$-CH_2-CH(CH_3)-CH_2-CH_3

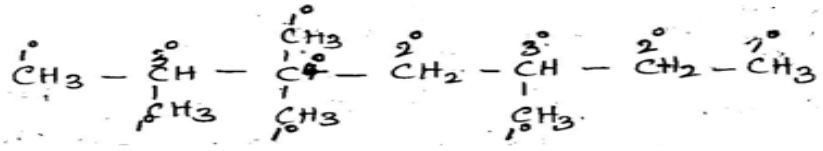
a) Primary-6, secondary-2, tertiary-2, quaternary-1

b) Primary-2, secondary-6, tertiary-3, quaternary-0

c) Primary-2, secondary-4, tertiary-3, quaternary-2

d) Primary-2, secondary-2, tertiary-4, quaternary-3

Soln:



1^0⇒primary-6, 2^0⇒secondary -2

3^0⇒tertiary-2, 4^0⇒quaternary-1

47. An element, x has the following isotopic composition: x^{200}:90%, x^{199}:8.0%, x^{202}:2.0%

The weighed average atomic mass of the naturally occurring element x is closest to _____.

a) 201 u b) 202 u c) 199 u d) 200 u

Soln: weight of x^{200}=0.90 x 200 = 180.00 u

weight of x^{199}=0.08 x 199 = 15.92 u

weight of x^{202}=0.02 x 202 = 4.04 u

Total weight = 199.96 ≈200 u

48. For which of the following sets of four quantum numbers, an electron will have the highest energy?

	n	f	m	s
a)	3	2	1	$\frac{1}{2}$
b)	4	2	-1	$\frac{1}{2}$
c)	4	1	0	$\frac{1}{2}$
d)	5	0	0	$\frac{1}{2}$

Soln: For n=3, l=2 the sub shell is 3d(n+l=5)

For n=4, l=2 the sub shell is 4d(n+l=6)

For n=4, l=1 the sub shell is 4p(n+l=5)

For n=5, l=0 the sub shell is 5s(n+l=5)

According to (n+l) rule greater the (n+1) value greater the energy is 6.

49. Be^{2+} is iso electronic with which of the following ions?

a) H^+ b) Li^+ c) Na^+ d) Mg^{2+}

Soln: Iso electronic species contain same number of electrons. Be^{2+} contains 2 electrons. Among the given options only Li^+ contains 2 electrons and it is iso electronic with Be^{2+}.

H^+→no e^-, Na^+→10e^- Li^+→2e^- Mg^{2+}→10e^-

50. If r is the radius of the first orbit, the radius of n^{th} orbit of H-atom is given by

a) rn^2 b) m c) $\frac{r}{n}$ d) r^2n^2

Sol: Radius of an orbit $r_n=\frac{n^2h^2}{4\pi^2me^2z}=\frac{0.529\,n^2}{z}A^0$

For H-atom z=1

If r_1=r, $r_n=\frac{r\times n^2}{1}$=$rn^2$

51. Which of the following is paramagnetic?

a) CO b) O_2^- c) CN^- d) NO^+

Sol: Molecular orbital configuration of the given species is as

CO(6+8=14)=$\sigma 1s^2\ \sigma^* 1s^2,\ \sigma 2s^2,\ \sigma^*\ 2s^2,\ \pi 2p_x^2=\pi 2p_y^2,\ \sigma^2\ 2p_z$

(All e^- are paired so diamagnetic)

CN^- (6+7+1=14) } same as CO

NO^+ (7+8-1=14) }

O_2^- (8+8+1=17)= $\sigma 1s^2,\ \sigma^* 1s^2\ \sigma 2s^2,\ \sigma^* 2s^2\ \sigma 2p_3^2,\ \pi 2p_x^2 = \pi 2p_y^2,\ \pi^*\ 2p_x^2,\ \pi^*\ 2p_y^1$

It contains one unpaired e-, so it is paramagnetic.

52. Which one of the following is the correct order of interactions?

a) Covalent < hydrogen bonding < Vander waals' < dipole-dipole

b) Vander waals' < hydrogen bonding < dipole-dipole < Covalent

c) Vander waals' < dipole-dipole < hydrogen bonding < Covalent

d) Dipole-dipole < Vander waals' < hydrogen bonding < Covalent

53. Which one of the following is incorrect for ideal solution?

a) $\Delta H_{mix}=0$ b) $\Delta U_{mix}=0$ c) $\Delta P=P_{ob}^{-}-P_{calculated}=0$ d) $\Delta G_{mix}=0$

Sol: $\Delta G_{mix}=\Delta H_{mix}-T\Delta S_{mix}$

For ideal gas

$\Delta H_{mix}=0$, $\Delta U_{mix}=0$, $\Delta S_{mix}\neq 0$

Putting all these values in the expression

$\Delta G_{mix}=\Delta H_{mix}-T\Delta S_{mix} \Rightarrow \Delta G_{mix}=0-T\Delta S_{mix}$

$\Delta G_{mix}\neq 0$

54. Blood cells retain their normal shape in solutions which are

a) hypotonic to blood b) isotonic to blood

c) hypertonic to blood d) equinormal to blood

Sol: When blood cells are placed in a solution of similar concentration as that of blood, then they neither swell or shrink it means the concentration of the solution is same as that of inside the blood cells, i.e they are isotonic to each other.

55. A gaseous mixture was prepared by taking equal moles of CO and N_2. If the total pressure of the mixture was found 1atm, the partial pressure of nitrogen (N_2) in the mixture is

a) 0.8 atm b) 0.9 atm c) 1 atm d) 0.5 atm

Sol: Equal moles of CO and N_2

$\therefore n_{CO}=n_{N2}$

According to ideal gas equation $P_{CO}=P_{N2}$

Given that $P_{CO}+P_{N2}=1$

$2P_{N2}=1$

$P_{N2}=1/2=0.5$ atm.

56. Correct gas equation is

a) $\frac{V_1T_2}{P_1}=\frac{V_2T_1}{P_2}$ b) $\frac{P_1T_1}{V_1}=\frac{P_2V_2}{T_2}$ c) $\frac{P_1V_1}{P_2V_2}=\frac{T_1}{T_2}$ d) $\frac{V_1V_2}{T_1T_2}=P_1P_2$

Sol: Ideal gas equation for two states can be written as

$P_1V_1=nRT_1$, $P_2V_2=nRT_2$

$\frac{P_1V_1}{T_1}=nR$ ———(i) $\frac{P_2V_2}{T_2}=nR$ ———(ii) (n is fixed moles)

On combining (i) and (ii)

$\frac{P_1V_1}{T_1}=\frac{P_2V_2}{T_2}$ ie $\frac{P_1V_1}{P_2V_2}=\frac{T_1}{T_2}$

57. Carbon-14 dating method is based on the fact that

a) c-14 fraction is same in all objects b) carbon-14 is highly insoluble

c) ratio of c-14 and c-12 is constant d) all of these

Sol: By carbon dating method

Age of wood$=\frac{2.303}{0.693}$ x $t_{\frac{1}{2}}$ $\log\left(\frac{N_0}{N}\right)$

$\frac{N_0}{N}=\frac{\text{Ratio of}\ \frac{c^{14}}{c^{12}}\ in\ living\ wood}{\text{Ratio of}\ \frac{c^{14}}{c^{12}}\ in\ dead\ wood}$

Hence, it is based upon the ratio of C^{14} and C^{12}.

58. If the equilibrium constant for $N_{2(g)}+\frac{1}{2}O_{2(g)}\rightleftharpoons NO_{(g)}$ will be

a) $K^{\frac{1}{2}}$ b) $\frac{1}{2}K$ c) K d) K^2

Sol: Equilibrium constant for the reaction, $N_{2(g)}+O_{2(g)} \rightleftharpoons 2NO_{(g)}$ is K

$K=\frac{[NO]^2}{[N_2][O_2]}$ ——(i)

Let the equilibrium constant for the reaction, $\frac{1}{2}N_{2(g)}+\frac{1}{2}O_{2(g)}\rightleftharpoons NO_{(g)}$ is K^1

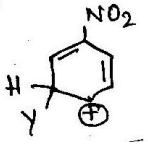
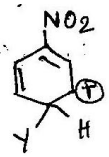
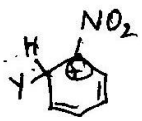
i.e $K^1=\frac{[NO]}{[N_2]^{\frac{1}{2}}[O_2]^{\frac{1}{2}}}$

On squaring both sides $K^{1^2}=\frac{[NO]^2}{[N_2][O_2]}$ ——— (ii)

On comparing eqn (i) and (ii) we get $K=K^{1^2}$ $K^1=\sqrt{K}$ or $K^{\frac{1}{2}}$

59. According to Le-chatlier's principle, adding heat to a solid ⇌ liquid equilibrium will cause the
    a) temperature to increase b) temperature to decrease
    c) amount of liquid to decrease d) <u>amount of solid to decrease</u>

Sol: When we add heat to the equilibrium between solid and liquid, then the equilibrium shifts towards liquid and hence the amount of solid decreases and amount of liquid increases.

60. Which of the following carbocations is expected to be most stable?
    a)  b)  c)  d) 

Sol: -NO_2 group exhibit-I effect and it decreases with increase in distance. In option (a) positive charge present on c atom at maximum distance so -I effect reaching to it is minimum and stability is maximum.

61. The strongest conjugate base is
    a) NO_3^- b) Cl^- c) SO_4^{2-} d) <u>CH_3COO^-</u>

Sol: Weak acid forms strong conjugate base. In HNO_3, Hcl, H_2SO_4 and CH_3COOH, CH_3COOH is the weakest acid. So its conjugate base is strongest.

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

62. For the ideal phase reaction $Pcl_{5(g)} \rightleftharpoons Pcl_{3(g)} + cl_{2(g)}$
    Which of the following conditions are correct?
    a) $\Delta H=0$ and $\Delta S<0$ <u>b) $\Delta H>0$ and $\Delta S>0$</u> c) $\Delta H<0$ and $\Delta S<0$ d) $\Delta H>0$ and $\Delta S<0$

Sol: From enthalpy equation $\Delta H=\Delta E+ngRT$

For the reaction $Pcl_5 \rightleftharpoons Pcl_3 + cl_2$

Δng=Product mole – reactant mole

=2-1=1

Thus ΔH is positive or >0

For spontaneous reaction $\Delta G<0$, since ΔH is >0

for negative value of ΔG, ΔS must be >0 i.e., $\Delta H>0$ $\Delta S>0$

63. The correct order of N-compounds in its decreasing order of oxidation states is
    a) HNO_3, NH_4Cl, NO, N_2 b) HNO_3, NO, NH_4Cl, N_2 c) <u>HNO_3, NO, N_2, NH_4Cl</u>
    d) NH_4Cl, NO, N_2, HNO_3

Sol: +5 +2 0 -3

HNO_3, NO, N_2, NH_4Cl

64. For the first order reaction, the half life period is independent of
    a) <u>initial concentration</u> b) cube root of initial concentration
    c) first power of initial concentration d) square root of initial concentration

Sol: $t_{\frac{1}{2}}$ of n^{th} order reaction $\alpha \frac{1}{a^{n-1}}$

Where a-initial concentration, n-order of reaction

$t_{\frac{1}{2}}$ of first order reaction n=1

$t_{\frac{1}{2}} \alpha \frac{1}{a^{1-1}}$, $t_{\frac{1}{2}} \alpha \frac{1}{a^0}$

So for 1^{st} order reaction $t_{\frac{1}{2}}$ is independent on initial concentration.

65. Which one of the following statements is incorrect about enzyme catalysis?
    a) Enzymes are mostly proteinous in nature b) Enzyme action is specific
    c) Enzymes are denatured by uv-rays and at high temperature
    d) <u>Enzymes are least reactive at optimum temperature</u>

66. Match column I with column II and assign the correct code.

Column-I	Column-II	Codes: A B C D
A. Cyanide process	1. Ultra pure Ge	a) 2 3 1 5
B. Froth floatation process	2. Dressing of ZnS	b) 1 2 3 4
C. Electrolytic reduction	3. Extraction of Al	c) 3 4 5 1
D. Zone refining	4. Extraction of Au	d) 4 2 3 1
	5. Purification of Ni	

67. Among the element with following electronic configuration, which one may have the highest ionisation energy?

a) $[Ne]3s^23p^3$ b) $[Ne]3s^23p^2$ c) $[Ar]3d^{10}4s^24p^3$ d) $[Ne]3s^23p^1$

Sol: Electronic configuration Group

$[Ne]3s^23p^{3-}$	V
$[Ne]3s^23p^2$	IV
$[Ar]3d^{10}4s^24p^3$	V
$[Ne]3s^23p^1$	III

Since I.E increases in a period and decreased in a group $[Ne]3s^23p^3$ has the highest I.E

68. If the atomic number of an element is 33, it will be placed in the periodic table in the

a) first group b) third group c) fifth group d) seventh group

Sol: The E.C of element with atomic number 33 is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^3$. As its last shell have $5e^-$ its group is $10+5=15^{th}$ or VA.

69. Which of the following statements about hydrogen is incorrect?

a) hydrogen never acts as cation in ionic salts

b) hydronium ion, H_3O^+ exists freely in solution

c) Dihydrogen does not act as a reducing agent

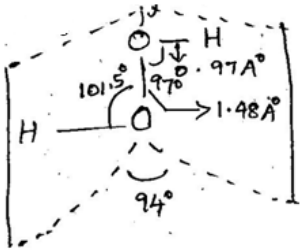
d) hydrogen has three isotopes of which tritium is the most common

Sol: Protium is the most common isotope of hydrogen.

70. The structure of H_2O_2 is

a) planar b) non-planar c) spherical d) linear

Sol: It has a half opened book like structure in which two OH groups lie on the two pages of the book.



71. Water gas is produced by

a) passing steam through a red hot coke bed

b) saturating hydrogen with moisture

c) mixing oxygen and hydrogen in the ratio of 1:2

d) heating mixture of CO_2 and CH_4 in petroleum refineries

Sol: $C_{(s)}+H_2O_{(g)} \rightarrow CO_{(g)}+ H_2O_{(g)}$

72. Glass is a

a) liquid b) solid c) super cooled liquid d) transparent-organic polymer

Sol: Glass is an example of amorphous solid. It has short range order of constituents.

73. Which of the following ions will exhibit colour in aqueous solutions?

a) $La^{3+}(z=57)$ b) $Ti^{3+}(z=22)$ c) $Lu^{3+}(z=71)$ d) $Sc^{3+}(z=21)$

Sol: $La^{3+}(z=57)=[Xe]4f^05d^06s^0$ (no unpaired e^-)

$Ti^{3+}(z=22)=[Ar]3d^14s^0$ (1 unpaired e^-)

$Lu^{3+}(z=71)=[Xe]\ 4f^{14}\ 5d^0\ 6s^0$ (no unpaired e^-)

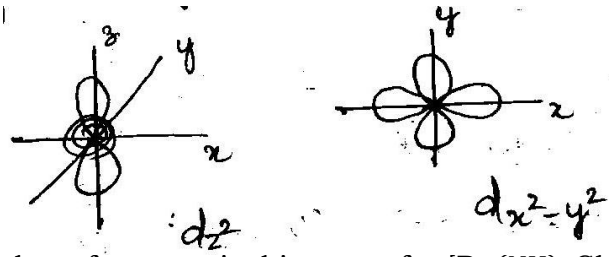
$Sc^{3+}(z=21)=[Ar]3d^04s^0$ (no unpaired e^-)

Due to the presence of unpaired e^- in Ti^{3+} it exhibit color in aqueous solution.

74. Which of the following pairs of d-orbitals will have electron density along the axis?

a) d_z2, d_{xz} b) d_{xz}, d_{yz} c) d_z2, $d_{x^2-y^2}$ d) d_{xy}, $d_{x^2-y^2}$

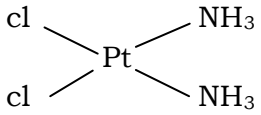
Sol:



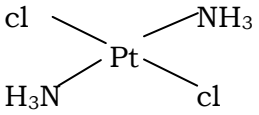
75. The number of geometrical isomers for $[Pt(NH_3)_3Cl_2]$ is

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

Sol:



cis=isomer



trans-isomer

76. The best method for the separation of naphthalene and benzoic acid from their mixture is

a) Chromatography b) crystallisation c) distillation d) Sublimation

Sol: Naphthalene is volatile and benzoic acid is non-volatile due to the formation of dimer via hydrogen bonding.

77. The pair of electron in the given carbanion, $CH_3C{\equiv}C^-$, is present in which orbitals?

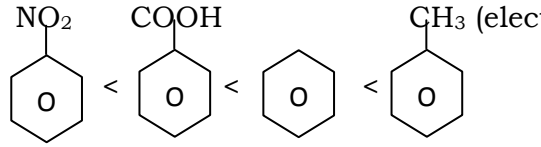
a) sp^3 b) sp^2 c) sp d) 2p

Sol: Hybridisation $=\frac{\text{no.of } \sigma \text{ electrons}}{2} = \frac{2+2(\text{negative ion})}{2}=2=sp$

78.Among the following compound one that is most reactive towards electrophilic nitration is

a) benzoic acid b) nitrobenze ne c) toluene d) benzene

Sol: (electron with drawing group)

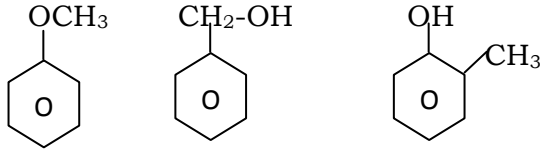


Nitro benzene | Benzoic acid | Benzene | Toluene

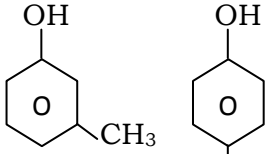
79. The number of possible isomers of the compound with molecular formula C_7H_8O is

a) 3 b) 5 c) 7 d) 9

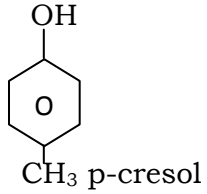
Sol:



anisole | Benzyl alcohol | o-cresol



m-cresol



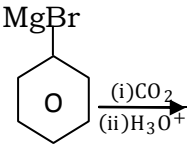
p-cresol

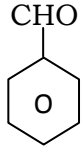
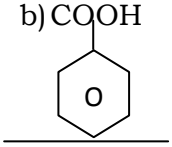
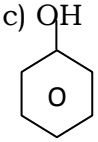
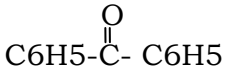
80. Which of the compounds has the lowest boiling point?

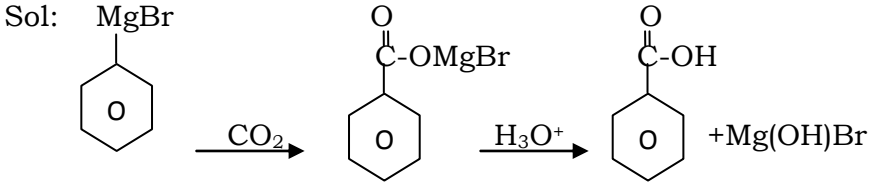
a) $CH_3\ CH_2\ CH_2\ CH_2\ CH_3$ b) $CH_3CH{=}CH\text{-}CH_2\ CH_3$ c) $CH_3CH{=}CH\text{-}CH{=}CH_2$

d) $CH_3\ CH_2\ CH_2\ CH_3$

Sol: Boiling points of alkanes increase as the number of carbon atom increases or molecular mass increases.

81.  P In this reaction Product P is

a) 
b) 
c) 
d) 

Sol: 

82. Lucas reagent is

a) Con.Hcl and anhy.$Zncl_2$ b) Con.HNO_3 and anhy.$Zncl_2$
c) Con.Hcl and hydrous $Zncl_2$ d) Con.HNO_3 and hydrous $Zncl_2$

Sol: Equimolar mixture of con.Hcl and anhydrous $Zncl_2$ is called Lucas reagent. It is used to distinguish 1^0, 2^0 and 3^0 alcohols.

83. Consider the nitration of benzene using mixed Con.H_2SO_4 and HNO_3. If a large amount of $KHSO_4$ is added to the mixture, the rate of the nitration will be

a) slower b) unchanged c) doubled d) faster

Sol: Con.HNO_3 and Con. H_2SO_4 produces the electrophile

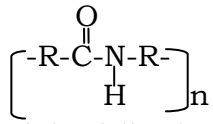
NO_2^+ $HNO_3 + H_2SO_4 \rightleftharpoons NO_2^+ + HSO_4^- + H_2O$

If $KHSO_4$ is added to the mixture more HSO_4^- ions furnishes and the concentration of NO_2^+ decreases according to Le-chatlier's principle.

84. Nylon is an example for

a) Polyester b) Polysaccharide c) Polyamide d) Polythene

Sol: The general structure of any nylon is



85. Which one of the following is used to make non-stick cookware?

a) PVC b) Polystyrene c) Polyethylene terephthalate d) Polytetrafluore ethylene

Sol: $(C=F_4)_n$ or teflon is used because it is a tough material, resistant to heat and also the bad conductor of electricity.

86. Which of the following statements is not correct?

a) Insulin maintains sugar level in the blood of a human body

b) Ovalbumin is a simple food ……. reserve in egg white

c) Blood proteins thrombin and fibrinogen are involved in blood clotting.

d) Denaturation makes the proteins more active

Sol: As a result of denaturation globules unfolds and hexix get uncoiled and protein loses its biological activity.

87. The central dogma of molecular genetics states that the genetic information flows from

a) amino acid → proteins → DNA b) DNA →RNA→Proteins
c) DNA→Carbohydrates→Proteins d) DNA→RNA→Carbohydrates

Sol: The central dogma of molecular genetics states that

DNA $\xrightarrow{\text{Transcription}}$ RNA $\xrightarrow{\text{Transition}}$ Protein

88. Green chemistry means such reactions which

a) produce colour during reactions

b) reduce the use and production of hazardous chemicals

c) are related to the depletion of ozone layer

d) study the reactions in plants

89. The helical structure of protein is stabilized by

a) dipeptide bonds b) hydrogen bonds c) ether bonds d) peptide bond

90. Suppose the elements x and y combine to form two compounds xy_2 and x_3y_2 .When 0.1 mole of xy_2 weighs 10g and 0.05 mole of x_3y_2 weighs 9g, the atomic weights of x and y are

a) 40, 30 b) 60, 40 c) 20, 30 d) 30, 20

Sol: For xy_2, $n_{xy2}=0.1=\frac{10}{Ax+2Ay}$ or $A_x+2A_y=100 \longrightarrow$ (i)

For x_3y_2, $nx_3y_2=0.05=\frac{9}{3Ax_3+2Ay}$ (or) $3Ax_3+2Ay=180 \longrightarrow$(ii)

On solving eq(1) and (2) $A_x=40g\ mol^{-1}$ $A_y=30g\ mol^{-1}$

BIO – BOTANY

91. Manganese is required in _____.

a) plant cell wall formation b) Photolysis of water during photosynthesis

c) Chlorophyll synthesis d) Nucleic acid synthesis

92. Nitrogen fixation in root nodules of sinus is brought about by _____.

a) Frankia b) Azorihizobium c) Brudyrhizobium d) clostridium

93. Findout the correctly matched pair

Nutrients		Functions
a) Zinc	-	Helps to maintain the ribosome structure
b) Magnesium	-	Needed during the formation of mitotic spindle
c) Calcium	-	Plays a role in the opening and closing of stomata
d) Manganese	-	Needed in splitting of water to liberate O_2 during photosynthesis

94. Which of the following is correct set of micronutrients for plants.

a) Mg, Si, Fe, Cu, Ca b) Cu, Fe, Zn, B, Mn c) Mg, Fe, Zn, B, Mn d) Mo, Zn, Cl, Mg, Ca

95. Which of the following formula describes N_2 fixation.

a) $N_2+3H_2 \rightarrow 2NH_3$ b) $2NH_3 \rightarrow N_2+3H_2$

c) $2N{H_4}^{4+} + 2O_2 + 8e^- \rightarrow N_2+4H_2O$ d) $2N_2$ + glucose → 2 aminoacids

N_2 fixation is incorporation of atmospheric N_2 to form Nitrogenous compounds.

96. The exclusive constituents of chlorophyll molecules are _____

a) Fe ands b) N ands c) Mg ands d) Mg & N

Mg^{2+} is a central metalion and N is the composition of pyrrolering

97. Deficiency of chlorine in plant causes _____.

a) stunted growth b) necrosis c) wilting d) all of these

98. Who proposed chemisomotic theory?

a) Hatch & Slack b) Calvin c) Peter Mitchell d) Arnon

99. In C_4 plants Co_2 combines with _____.

a) Phosphoenol pyruvate b) Phospho glycerol denyde

c) Phosphoglycericacid d) Ribulose diphosphate

100. RUBISCO is an enzyme for _____.

a) Co_2 fixation in dark reaction b) Photorespiration

c) Regeneration of RUBP d) Photolysis of water

RUBISCO – Ribulose 1,5, B's Phosphate carboxylase

101. The requirement of assimilatory power to fix 6 molecules of Co_2 is _____.
a) 6ATP 6NADPH b) 12ATP 18NADPH c) 18STP 18 NADDH d) 18ATP 12NADPH
This is required for the production of one molecule of glucose

102. In Mosophyll of C_4 plant cells which of the following cycle takes places
a) C_1 b) C_3 c) C_2 d) C_4

103. The 700nm (P700) is reaction centre of _____.
a) PSI b) PSII c) both a and b d) none of these
This lies in the stroma thylakoids of chloroplast

104. Which of the following inhibits O_2release in light phase.
a) PMA b) Zeatin c) DCMU d) None of these

105. In photorespiration, glycerine enters from _____.
a) chloroplast to peroxisome b) peroxisome to mitochondrion
c) mitochondrion to peroxisome d) chloroplast to mitochondrion

106. Photo synthetic bacteria contains
a) quantosome b) PSI & PSII c) PSII d) PSI

107. Who first demonstrated that light absorption by chloroplast releases O_2?
a) Hill b) Ingenhousz c) Blackmann d) Engleman
Since it was demonstrated by him the light reaction is also called as Hills reaction.

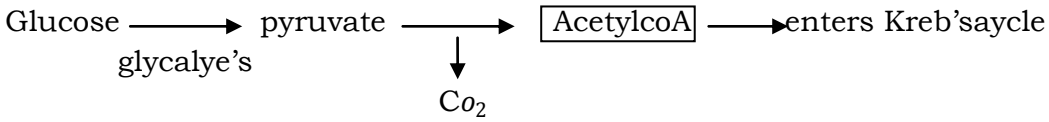
108. In sugarcane plant 14Co_2 is fixed in Malicard in which the enzyme that fixes Co_2 is
a) RUBP carboxylase b) PEP carboxylase
c) Fructose Phosphotase d) Ribulose Phosphate Kinase

109. In glycolysis, formation of ATP during the reactions 1,3 Bisphosphoglycericacid → 3 phosphoglyceicacid and PEP → Pyruvate is _____.
a) respiratory phosphorylation b) oxidative phosphorylation
c) substrate level phosphorylation d) chemical phosphorylastren
Since ATP is liberated directly from the substrate

110. Glycolysis consists of
a) ten – enzymatic reaction where glucose is converted to pyruvate with 8ATP (Eight ATP)
b) eight – enzymatic reaction where glucose is converted to pyrovate with 10ATP
c) ten eneymatic reaction where glucose is converted to PEP with 10ATP.
d) eight enzymatic reaction where glucose is converted to PEP with 8ATP.

111. Acetylcas is produced from pyruvate by _____.
a) oxidative decarboxylation b) photorespiration
c) oxidative photophosphorylation d) oxidative hydrogenation

112. Which is the key intermediate linking glycoclysisto the kreb's cycle.
a) ATP b) NADD c) Molicacid d) AcetylcoA



113. R-Q is infinite in
a) aerobic respiration b) anaerobic respiration c) Carbohydrate d) None of these
R-Q – Respiratory Quotient = $\frac{Volume\ of\ Co_2 evolved}{Volume\ of\ O_2\ Consumed}$
In anaerobic respiration No O_2 is utilized

114. How many ATP is produced when $FADH_2$ ENTERS etc.,
a) 2 b) 3 c) 1 d) 4

115. Select the wrong statement
a) RQ of tripalmitin is 0.7
b) Inter mediate of glycolysis & TCAcycle is malicacid
c) Glycodysis is also called as EMP Pathway
d) Fermentation yields 2STP Intermodiate is Acetylcos

116. Name the enzyme located in inner mitochondrial membrane .
a) citrate synthase b) α – KG dehyduogenase
c) Scrccinate dlehydrogenase d) Malate dehydrogenase

117. During movement electron through DTC
a) P^H of Matrix increase b) electrons are transported by active transport
c) electrons are resonated d) electrons show florescence

118. The mobile electron carrier of mitochondrial merbrane is _____.
a) $cyta_3$ b) Fes c) CoQ d) cytc$_1$co-Q-Coenszyme Q

119. Last electron acceptor in respiration is _____.
a) O_2 b) H_2 c) Co_2 d) NADH
O_2 is converted to H_2O ∴ Human body contains 70% of water.

120. Pynovate dehydragenase action resembles
a) ZDH b) α KG DH c) SDH d) allthothree
α KG DH- α Keto deheydrogenase in TCA Cycle converts α Keto glutarate to succinylcos

121. Aerobic respiratory pathway is appropriately termed as _____.
a) parabolic b) amphibolic c) anabolic d) catabolic

122. FAD act as electron acceptor in between
a) Fumaric and Malic acid b) Succinic and fumaric acid c) Malic and oxaloacetic acid
d) citric and isocitric acid

123. Hormone working antagonistic to ABA is _____.
a) giberellin b) cytokinin c) ethylene d) all of these

124. Which of the following phytohormones is not naturally occurring?
a) IAA b) Gibberlic acid c) 2,4-Dichloro phenoxy acetic acid d) 6-furfuryl amino purine

125. Auxin is synthesized in which part of plant?
a) Apical b) nodal c) Internodal d) Axillary
eg: Auxin promotes elongation of shoots.

126. The common N_2 fixer in paddy fields is _____.
a) Rhizobium b) Azospirillum c) oscillatoria d) Frankia

127. Vegetative propagation in pistia occurs by _____.
a) stolon b) offset c) runner d) sucker

128. Choose the correct pair:
a) coconut, cucurbits – dioeclous b) Rotifers – parthenogenesis
c) Algae – External fertilization d) Sucker – Ginger

129. Stock and Scion are used in _____.
a) cutting b) grafting c) layering d) Micro propagation

130. Air layering is preformed incase of _____.
a) Jasmine b) Grapevine c) Gooseberry d) Litchi

131. Which one of the following fruit is parthenocarpic?
a) Jack fruit b) Banana c) Brinjal d) Apple

132. Primary endosperm Nucleus is formed by the fusion of _____.
a) 2 polar nuclei + 1 synergid cell nucleus
b) 1 polar nucleus + 1 anti podal cell nucleus +1synergid cell nucleus
c) 2 polar nuclei + 1 male gamete nucleus
d) 2 antipodal cell nuclei + 1 male gamete nucleus

133. The poly embryony commonly occurs in _____.
a) tomato b) potato c) citrus d) turmeric

134. Ruminate endosperm is found in _____.
a) Cruci ferae b) Asteraceae c) Euphorbiaceae d) Annonaceae

135. Under water pollination occurs in _____.
a) Nymphea b) Zostera c) Vallisneria d) Ottelia

BIO-ZOOLOGY

136. Old age people become sick due to the absence of the hormone _____.
a) FSH b) STH c) LH d) Thymosin
Reason: The thymus gland starts degenerating after 12th year of age, so less thymosin is secreted by thymus, which is important for immune response.

137. The regulatory substance Renin is secreted by _____.

a) Muscles b) WBC c) Juxta glomerular apparatus d) lymph node

Reason: The Juxta glomerular apparatus is found is found in Juxta glomerular Nephron, which is a special tissue which secretes Renin when the Blood pressure goes low so that glomerular filteration is made effective.

138. Erythropoietin is secreted by JMN when there is a _____.

a) decrease in RBC number b) Increase in RBC number

c) Acute mountain sickness d) When there is a decrease in RBC and AMS

Reason: JMN senses the RBC level and increases the RBC level in Blood by producing erythropoietin which is a Hormone which increase RBC production and also in AMS when there is less O_2. The increase in RBC compensates the demand for O_2.

139. Diabetes insipidus is caused by _____.

a) Hyposecretion of Insulin b) Hyper secretion of Insulin

c) Hyposecretion of ADH d) Hyper recreation of ADH

Reason: ADH is secreted by Neurohypophysis which makes the urine conc., by increasing water reabsorption

140. Hypothyroidism in adults causes myxodema which is referred also as _____.

a) Turner's Syndrome b) Grave's disease c) Gull's disease d) Cretinism

Reason: Less secretion of Thyroxine in Adults causes less BMR, Memory loss, coarse skin etc.

141. Adenohypophypis is formed from invagination of pharyngeal epithelium called as

a) Parstubaralis b) Pars intermedia c) Rathke'spouch d) Neurohypophysis

Reason: The anterior and posterior region of pituitary are obtained from different regions during embryonic development.

142. Vasodialation is promoted by _____.

a) Zinc b) angiotensin-II c) Natriuretic peptide d) Sulphate

Reason: The Right auricle of heart senses the high blood pressure and to reduce blood pressure produces Natriuretic pepside which brings about dialation of Blood vessels.

143. Brunner's gland is located in _____.

a) small intestine b) duodenum c) large intestine d) Oesophagus

Reason: Brunner's gland plays a endocrine role in digestive system by producing CCK when food is rich in fat, CCK stimulates Gall bladder to secrete Bile. (CCK – Cholecystokinin)

144. Luteinizing hormone stimulates _____.

a) Thyroid b) Leydigcells c) Kidney d) Para thyroid

Reason: Luteinizing hormone is a gonadotropin which stimulates Leydigcells present in Male testis to produce Testosterone

145. The hormones which are referred as catecholamines are _____.

a) Adrenalon and Aldosterone b) TSH c) FSH d) Adrenalin and nor adrenalin

Reason: Adrenal medulla secretes the emergency hormones adrenalin and nor adrenalin

146. Histamine is secreted by one of the WBC which is a granulocyte_____?

a) Neutrophil b) Eosinophil c) Platelets d) Basophil

Reason: Histamine is a chemical alarm and is produced as inflammatory barrier during infection on entry of germs.

147. Podocytes in Bowman's capsule play a role in _____.

a) increasing filtration b) decreasing filtration

c) increasing net filtration pressure d) holding the glomeruli

Reason: The foot process of podocytes cling to the Glomeruli and helps in filteration.

148. Addison's disease is caused by _____.

a) Hyposecretion of Glucorticoids

b) Hypersecretion of Glucocorticoids

c) Hyposeeretion of Mineralocorticoids

d) Hyposecretion of gluco corticoids and Mineralocorticoids

Reason: Adrenal cortex secretes glucocorticoids and mineralocorticoids and when there is less secretion of these hormones it causes Addison's disease

149. The most common endocrine disorder of pancreas is _____.

a) hypoglycemia b) hypocalcemia c) hyperglycemia d) hypercalcemia

Reason: Insulin reduces blood sugar absence or less secretion of Insulin by pancreas β cells causes increase in blood sugar. Which is indication of diabetes mellitus.

150. Select the correct sequence of the following.

a) Rhodopsin bleaching → retinene + energy + scotopsin + nerve impulse

b) Rhodopsin bleaching → retinene + scotopsin + energy + nerve impulse

c) Rhodopsin bleaching → nerve impulse + scotopsin + energy + retinene

d) Scotopsin → retinene + energy + Rhodopsin bleaching + nerve impulse

Reason: Rods get bleached when exposed to dim light, Rod cells are formed of Retinene, Rod composed of Vitamin-A and protein scotopsin, Rods disintegrate to produce the vitamin & protein causing energy difference which is transmitted as nerve impulse.

151. A chemical signal that has both endocrine and neural role _____.

a) melatonin b) calcitonin c) epinephrine d) cortisol

Reason: epinephrine is secreted by Adrenal medulla and it is an emergency hormone enabling a person to face stressful issues and it also is a stimulatory hormone stimulating sympathetic Nervous system.

152. The term applied to rapid heartbeat or pulse rate is _____.

a) Brady cardia b) tachycardia c) cardiac cycle d) palpitation

Reason: The Normal heart beat range is 72-80 per minute, when it exceeds beyond this limit it is referred as tachycardia

153. Which one of the following animals has two separate circulatory path ways?

a) Snake b) Fish c) Whale d) Frog

Reason: Mammals have prominent double circulation and whale is an aquatic mammals

154. Drones are formed from _____ cells.

a) Diploid b) Haploid c) Aneuploid condition d) None

Reason: Drones are male Honey Bees and they are formed from unfertilized egg cells which have only half of the number of chromosomes

155. Antheraea assamensis produces _____ silk.

a) Mulberry silk b) Tussar c) Eri d) Muga

Reason: Antheraea assamensis is a endemic species of assam which produces an exclusive silk Muga Silk

156. Which is referred as endemic goitre _____.

a) Exopthalmic goitre b) Simple goitre c) Cretinism d) Myxodema

Reason: endemic goitre is caused by iodine deficiency in a particular region.

157. Fertilization in human usually takes place in _____.

a) Uterus b) Graffian follicle c) Ovary d) Fallopian tube

Reason: Recent research has proved that fertilization is at its maximum when the ova is in Fallopian Tube.

158. Sertoli cells are found in the _____.

a) Adrenal cortex and secrete adrenaline

b) Seminiferous tubules and provide nutrition to germ cells

c) Pancreas and secrete progesterone

d) Ovaries and secrete progesterone

Reason: Sertoli cells are also called as nurse cells because they provide nutrition to sperm cells.

159. Which hormone is responsible of parturition?

a) Relaxin b) Oxytocin c) Progesterone d) Oesterogen

Reason: Oxytocin is secreted by posterior pituitary and brings about rapid birth of baby by causing the uterus muscle to contract.

160. Find out the internal parasite.
a) Nereis b) Hirudinaria c) Aedes d) Ancylostoma
Reason: Ancylostoma is Hookworm which lives in the intestine.
161. Which one is an accessory excretory organ?
a) Liver b) Stomach c) Testis d) Heart
Reason: Liver converts the toxic pigments and Nitrogenous products into water soluble products.
Eg: Bilirubin → Urobilinogen
NH_3 → Urea
162. Classify the excretory order of animals given below.
Snakes : human : fish
a) aminotelic : uricotelic : ureotelic
b) uricotelic : aminotelic : ureotelic
c) uricotelic : ureotelic : aminotelic
d) ureotelic : aminotelic : uricotelic
Reason: Snakes : uricotelic excretes uric acid, human-ureotelic excretes urea, frog aminotelic excretes Ammonia.
163. GFR of kidney is
a) 125 ml/min b) 120 ml/min c) 115 ml/min d) 130 ml/min
Reason: Glomerular capillary causes filtration due to blood pressure is 125 ml/min
164. Which is the principal site for concentration of urine?
a) Loop of Henle b) glomerulus c) PCT d) DCT
Reason: DCT – Distal convoluted tubule – because active absorption of Na^+ is seen and ADH increase reabsorption of water.
165. The process of filtering the blood of a damaged kidney is _____.
a) Haemodialysis b) Haemostasis c) Haemopoiekionesis d) osmoregulation
Reason: It is the process separates removes large molecules from small molecules by a semi-permeable membrane.
166. Bowman's capsule is found in _____.
a) glomerulus b) uriniferous tubule c) nephron d) Malphigian capsule
Reason: It is cup shaped structure where blood capillaries enters through the glomerulus.
167. Increased excretion of urine is named as _____.
a) Polyuria b) Palyphagia c) Polylypsia d) Dysuria
Reason: This condition is observed in Nephritis and Diabetes.
168. The apparatus used to record muscle contraction.
a) Polygraph b) Kymograph c) ECG d) EEG
Reason: Action of actin and troponin is recorded in the form of the graph.
169. I band is also called as _____.
a) light band b) dark band c) myofibrils d) H-Zone
Ans: I band stands for Isotropic band rich in myosin filament.
170. The ions responsible for muscular contraction.
a) Ca^{2+} b) Fe^{2+} c) Cu^{2+} d) Mg^{2+}
Reason: Ca^{2+} is pumped from sarcoplasm for the movement of myosin head.
171. Atpase is the enzyme located in _____.
a) F-Actin b) Myosin c) Troponin d) G-actin
Reason: This enzyme hydrolyses Myosin and therefore sliding action occurs.
172. Which protein is globular in nature?
a) Myosin b) Actin c) Troponin d) Keratin
Reason: Actin is spherical in nature due to the presence of disulfide bonds.
173. Which is the functional unit of contraction?
a) M-Line b) E-line c) Z-line d) F-Line
Reason: Myofibril between Z-line is called as sacromere.

174. The pigment present in muscle is known as _____.
a) Haemoglobin b) Ferritin c) Myoglobin d) Cytochrome
Reason: Myoglobin give reddish appearance to muscles.

175. Hcl is secreted by _____.
a) Zymogen cell b) Pepticells c) Oxyntic cells d) None of these

176. The chief function of bile is _____.
a) Digestion b) Excretion c) Hydrolysis d) Emulsification

177. Ileum is characterised by _____.
a) Brunner's gland and villi (leaf shape) b) Brunner's gland and club shaped villi
c) Club shaped villi & peyer's patches d) Peyer's patches & Brunner's gland

178. Cholecystokinin stimulates _____.
a) Pancreas b) Kidney c) Gall bladder d) Liver

179. Among mammals a significant role in the digestion of milk is played by _____.
a) Invertase b) Rennin c) Amylase d) Intestinal bacteria

180. Pancreatic amylase is related to the digestion of _____.
a) carbohydrate b) fat c) protein d) None of these

MATHEMATICS

91. Let ω be a complex cube root of unity with $\omega \neq 1$ and $P=(P_{ij})$ be a $n\times n$ matrix with $P_{ij}=\omega^{i+j}$. Then $P^2\neq 0$, when n=_____.
a) 55, 56, 58 b) 55, 57, 58 c) 55, 56, 57 d) 56, 57, 58

92. If $3^x=4^{x-1}$, then x=_____
A) $\frac{2log\frac{2}{3}}{2log\frac{2}{3}-1}$ B) $\frac{2}{2-log\frac{3}{2}}$ C) $\frac{1}{1-log\frac{3}{4}}$ D) $\frac{2log\frac{3}{2}}{2log\frac{3}{2}-1}$
a) A,B,C b) A,C,D c) A,B,D d) B,C,D

93. Two lines L_1:x=5, $\frac{y}{3-\alpha}=\frac{z}{-2}$ and L_2=x= α, $\frac{y}{-1}=\frac{z}{2-\alpha}$ are coplanar. Then α can take values
a) 1, 2 b) 2, 4 c) 3, 2 d) 1, 4

94. Circle(s) touching x-axis at a distance 3 from the origin and having an intercept of length $2\sqrt{7}$ on y-axis is (are)
a) $x^2+y^2-6x+8y+9=0$ b) $x^2+y^2-6x+7y+9=0$ c) $x^2+y^2-6x-8y+9=0$ d) $x^2+y^2-6x-7y+9=0$

Read the following paragraph and answer for the question (95) and (96)

Let PQ be a focal chord of the parabola $y^2=4ax$. The tangents to the parabola at P and Q meet at a point lying on the line y=2x+a, a>0

95. Length of chord PQ is _____.
a) 7a b) 5a c) 2a d) 3a

96. If chord PQ subtends an angle θ=a the vertex of $y^2=4ax$, then $\tan\theta=2$
a) $\frac{2}{3}\sqrt{7}$ b) $\frac{-2}{3}\sqrt{7}$ c) $\frac{2}{3}\sqrt{5}$ d) $\frac{-2}{3}\sqrt{5}$

Read the following paragraph and answer for the question (97) and (98)

A box B_1 contains 1 white ball, 3 red balls and 2 black balls. Another box B_2 contains 2 white balls, 3 red balls and 4 black balls. A third box B_3 contains 3 white balls, 4 red balls and 5 black balls.

97. If one ball is drawn from each of the boxes B_1, B_2 and B_3, the probability that all 3 drawn balls are of the same colour is _____.
a) $\frac{82}{648}$ b) $\frac{90}{648}$ c) $\frac{558}{648}$ d) $\frac{566}{648}$

98. If 2 balls are drawn (without replacement) from a randomly selected box and one of the balls is white and the other ball is red, the probability that there 2 balls are drawn from box B_2 is

a) $\frac{116}{181}$ b) $\frac{126}{181}$ c) $\frac{65}{181}$ d) $\frac{55}{181}$

99. Volume of parallelepiped determined by vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ is 2. Then the volume of parallelepiped determined by vectors $2(\vec{a}x\vec{b}).3(\vec{b}x\vec{c})$ and $(\vec{c}x\vec{a})$ is _____.

a) 100 b) 30 c) 24 d) 60

100. Volume of parallelepiped determined by vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ is 5. Then the volume of parallelepiped determined by vectors $3(\vec{a}+\vec{b})$ $(\vec{b}+\vec{c})$ and $2(\vec{c}+\vec{a})$ is _____.

a) 24 b) 60 c) 100 d) 30

101. Area of triangle with adjacent sides determined by vectors $\vec{a}$ and $\vec{b}$ is 20. Then the area of the triangle with adjacent sides determined by vectors $(2\vec{a}+3\vec{b})$ and $\vec{a}-\vec{b}$ is

a) 24 b) 60 c) 100 d) 30

102. Area of parallelogram with adjacent sides determined by vectors $\vec{a}$ and $\vec{b}$ is 30. Then the area of the parallelogram with adjacent sides determining by vectors $(\vec{a}+\vec{b})$ and $\vec{a}$ is _____.

a) 60 b) 100 c) 30 d) 24

103. Consider the lines L_1: $\frac{x-1}{2}=\frac{y}{-1}=\frac{z+3}{1}$, L_2: $\frac{x-4}{1}=\frac{y+3}{1}=\frac{z+3}{2}$ and the planes P_1: 7x+y+2z=3, P_2=3x+5y-6z=4. Let ax+by+cz=d be the equation of the plane passing through the point of intersection of lines L_1 and L_2 and perpendicular to planes P_1 and P_2 Match List-I with List-II

select the correct answer using the code given below the lists.

	List I	List II	P	Q	R	S
P	a=	1. 13	a) 3	2	4	1
Q	b=	2. -3	b) 1	3	4	2
R	c=	3. 1	c) 3	2	1	4
S	d=	4. -2	d) 2	4	1	3

104. $\left\{\frac{1}{y^2}\left(\frac{\cos\left(tan^{-1}y\right)+y\sin\left(tan^{-1}y\right)}{\cot\left(sin^{-1}y\right)+tan\left(sin^{-1}y\right)}\right)^2+y^4\right\}^{\frac{1}{2}}$ takes value _____.

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

105. If $\cot(\sin^{-1}\sqrt{1-x^2}) = \sin(\tan^{-1}(x\sqrt{6}))$, $x\neq0$, then possible value of x is _____.

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

106. If cos x+cos y +cos z=0=sin x+sin y+sin z then possible value of $\cos\left(\frac{x-y}{2}\right)$ is _____.

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

107. Equation of the plane containing the straight line $\frac{x}{2}=\frac{y}{3}=\frac{z}{4}$ and perpendicular to the plane containing the straight lines $\frac{x}{3}=\frac{y}{4}=\frac{z}{2}$ and $\frac{x}{4}=\frac{y}{2}=\frac{z}{3}$ is _____.

a) x+2y-2z=0 b) 3x+2y-2z=0 c) x-2y+z=0 d) 5x+2y-4z=0

108. If the angles A, B and C of a triangle are in an arithmetic progression and if a, b and c denote the lengths of the sides opposite to A, B and C respectively, then the value of the expression $\frac{a}{c}\sin 2C + \frac{c}{a}\sin 2A$ is _____.

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

109. Let ω be a complex cube root of unity with $\omega \neq 1$. A fair dice is thrown three times. If r_1, r_2 and r_3 are the numbers obtained on the die, then the probability that $\omega^{r_1}+\omega^{r_2}+\omega^{r_3}=0$ is

a) $\frac{1}{18}$ b) $\frac{1}{9}$ c) $\frac{2}{9}$ d) $\frac{1}{36}$

110. Let P, Q, R and S be the points on the plane with position vectors $-2\vec{i}-\vec{j}$, $4\vec{i}$, $3\vec{i}+3\vec{j}$ and $-3\vec{i}+2\vec{j}$ respectively. The quadrilateral PQRS must be a _____.

a) parallelogram, which is neither a rhombus nor a rectangle

b) square c) rectangle, but not a square d) rhombus, but not a square

111. The number of 3x3 matrices A whose entries are either 0 or 1 and for which the system $A\begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}1\\0\\0\end{pmatrix}$ has exactly two distinct solutions is _____.

a) 0 b) 2^9-1 c) 168 d) 2

112. Let ABC be a triangle such that $\angle ACB=\frac{\pi}{6}$ and let a, b and c denote the lengths of the sides opposite to A, B and C respectively. The values of x for which $a=x^2+x+1$, $b=x^2-1$ and $c=2x+1$ is (are)

a) $-(2+\sqrt{3})$ b) $1+\sqrt{3}$ c) $2+\sqrt{3}$ d) $4\sqrt{3}$

113. The value of $\int_0^1 \frac{x^4(1-x)^4}{1+x^2}\,dx$ is _____

a) $\frac{22}{7}-\pi$ b) $\frac{2}{105}$ c) 0 d) $\frac{71}{15}-\frac{3\pi}{2}$

Read the following line and answer for the question (114) and (115)

The circle $x^2+y^2-8x=0$ and hyperbola $\frac{x^2}{9}-\frac{y^2}{4}=1$ intersect at the points A and B.

114. Equation of a common tangent with positive slope to the circle as well as to the hyperbola is

a) $2x-\sqrt{5}y-20=0$ b) $2x-\sqrt{5}y+4=0$ c) $3x-4y+8=0$ d) $4x-3y+4=0$

115. Equation of the circle with AB as its diameter is _____.

a) $x^2+y^2-12x+24=0$ b) $x^2+y^2+12x+24=0$ c) $x^2+y^2+24x-12=0$ d) $x^2+y^2-24x-12=0$

116. If $\vec{a}$ and $\vec{b}$ are vectors in space given by $\vec{a}=\frac{\vec{i}-2\vec{j}}{\sqrt{5}}$ and $\vec{b}=\frac{2\vec{i}+\vec{j}+3\vec{k}}{\sqrt{14}}$ then the value of $(2\vec{a}+\vec{b}).[(\vec{a}\times\vec{b})\times(\vec{a}-2\vec{b})$

a) -25 b) 25 c) 5 d) -5

117. The line $2x+y=1$ is the tangent to the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$. If this line passes through the point of intersection of the nearest directrix and the x-axis then the eccentricity of the hyperbola is _____.

a) $\sqrt{3}$ b) $\sqrt{2}$ c) 2 d) 3

118. If the distance between the plane $x-2y+z=d$ and the plane containing the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ is $\sqrt{6}$, then $|\vec{a}|$ is _____.

a) 6 b) $\sqrt{6}$ c) 36 d) -36

119. Let ω be the complex number $\cos\frac{2\pi}{3}$ + i $\sin\frac{2\pi}{3}$ then the number of distinct complex numbers z satisfying $\begin{vmatrix} z+1 & \omega & \omega^2 \\ \omega & z+\omega^2 & 1 \\ \omega^2 & 1 & z+\omega \end{vmatrix}$=0 is equal to _____.

a) 1 b) 0 c) 2 d) 3

120. Let (x_0, y_0) be solution of the equations $(2x)^{\ln 2}=(3y)^{\ln 3}$, $3^{\ln x}=2^{\ln y}$ then x_0 is _____.

a) $\frac{1}{6}$ b) $\frac{1}{3}$ c) $\frac{1}{2}$ d) 6

121. Let P=$\left\{\frac{\theta}{\sin\theta-\cos\theta=\sqrt{2}\cos\theta}\right\}$ and Q=$\left\{\frac{\theta}{\sin\theta+\cos\theta=\sqrt{2}\sin\theta}\right\}$ be two sets. Then _____

a) P$\subset\theta$ and θ-P$\neq\varphi$ b) $\theta\notin$P c) P$\not\subset$Q d) P=Q

122. Let $\vec{a}=\vec{\imath}+\vec{\jmath}+\vec{k}, \vec{b}=\vec{\imath}+\vec{\jmath}+\vec{k}$ and $\vec{c}=\vec{\imath}-\vec{\jmath}-\vec{k}$ be three vectors. A vector $\vec{v}$ in the plane of $\vec{a}$ and $\vec{b}$, whose projection on $\vec{c}$ is $\frac{1}{\sqrt{3}}$ is given by

a) $\vec{\imath}-3\vec{\jmath}+3\vec{k}$ b) $-3\vec{\imath}-3\vec{\jmath}+\vec{k}$ c) $3\vec{\imath}-\vec{\jmath}+3\vec{k}$ d) $\vec{\imath}+3\vec{\jmath}-3\vec{k}$

123. The value of $\int_{\sqrt{\ln 2}}^{\sqrt{\ln 3}} \frac{x\sin x^2}{\sin x^2+\sin(\ln 6-x^2)}$ dx is

a) $\frac{1}{4}\ln\frac{3}{2}$ b) $\frac{1}{4}\ln\frac{3}{2}$ c) $\ln\frac{3}{2}$ d) $\frac{1}{6}\ln\frac{3}{2}$

124. A straight line L through the point (3, -2) is inclined at an angle 60^0 to the line $\sqrt{3}$x+y=1. If L also intersects the x-axis, then the equation of L is _____.

a) y+$\sqrt{3}$x+2-3$\sqrt{3}$=0 b) y-$\sqrt{3}$x+2+3$\sqrt{3}$=0 c) $\sqrt{3}$y-x+3+2$\sqrt{3}$=0 d) $\sqrt{3}y$+x-3+2$\sqrt{3}$=0

125. Let α and β be the roots of x^2-6x-2=0 with $\alpha>\beta$. If $a_n=\alpha^n-\beta^n$ for n≥1 then the value of $\frac{a_{10}-2a_8}{2a_9}$ is _____.

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

126. The vector(s) which is/are coplanar with vectors $\vec{\imath}+\vec{\jmath}+2\vec{k}$ and $\vec{\imath}+2\vec{\jmath}+\vec{k}$ and perpendicular to the vector $\vec{\imath}+\vec{\jmath}+\vec{k}$ is/are _____.

a) $\vec{\jmath}-\vec{k}$ b) $-\vec{\imath}+\vec{\jmath}$ c) $\vec{\imath}-\vec{\jmath}$ d)u

127. Let M and N be two 3x3 non-singular skew symmetric matrices such that MN=NM. If P^T denotes the transpose of P then $M^2N^2(M^TN)^{-1}(MN^{-1})^T$ is _____.

a) M^2 b) $-N^2$ c) $-M^2$ d) MN

Read the following line and answer for the question (128), (129) and (130)

Let a, b and c be three real numbers satisfying (a b c) $\begin{pmatrix} 1 & 9 & 7 \\ 8 & 2 & 7 \\ 7 & 3 & 7 \end{pmatrix}$=(0 0 0)

128. If the point P(a, b, c) with reference to (E), lies on the plane 2x+y+z=1, then the value of 7a+b+c is _____.

a) 0 b) 12 c) 7 d) 6

129. Let ω be a solution of x^3-1=0 with Im(ω)>0. If a=2 with b and c satisfying (E), then the value of $\frac{3}{\omega^a}+\frac{1}{\omega^b}+\frac{3}{\omega^c}$ = _____

a) -2 b) 2 c) 3 d) -3

130. Let b=6, with a and c satisfying (E). If α and β are the roots of the quadratic equation ax^2+bx+c=0 then $\sum_{n=0}^{\infty}\left(\frac{1}{\alpha}+\frac{1}{\beta}\right)^n$ is _____.

a) 6 b) 7 c) $\frac{6}{7}$ d) ∞

131. If a_1, a_2, a_3 ..... be in harmonic progression with $a_1=5$ and $a_{20}=25$. The least positive integer n for which $a_n<0$

a) 22 b) 23 c) 24 d) 25

132. The equation of a plane passing through the line of intersection of the planes x+2y+3z=2 x-y+z=3 and at a distance $\frac{2}{\sqrt{3}}$ from the point (3, 1, -1) is

a) 5x-11y+z=17 b) $\sqrt{2}$x+y=$3\sqrt{2}-1$ c) x+y+z=$\sqrt{3}$ d) x-$\sqrt{2}$y=1-$\sqrt{2}$

133. Let PQR be a triangle of area Δ with a=2, b=$\frac{7}{2}$ and c=$\frac{5}{2}$ where a, b and c are the lengths of the sides of the triangle opposite to the angles at P, Q and R respectively. Then $\frac{2\sin P-\sin 2P}{2\sin P+\sin 2P}$=_____

a) $\frac{3}{4\Delta}$ b) $\frac{45}{4\Delta}$ c) $\left(\frac{3}{4\Delta}\right)^2$ d) $\left(\frac{45}{4\Delta}\right)^2$

134. If $\vec{a}$ and $\vec{b}$ are vectors such that $|\vec{a}+\vec{b}|=\sqrt{29}$ and $\vec{a}\times(2\vec{\imath}+3\vec{\jmath}+4\vec{k})=(2\vec{\imath}+3\vec{\jmath}+4\vec{k})\times\vec{b}$, then a possible value of $(\vec{a}+\vec{b}).(-7\vec{\imath}+2\vec{\jmath}+3\vec{k})$ is _____.

a) 0 b) 3 c) 4 d) 8

135. If P is a 3x3 matrix such that $P^T=2P+I$ where P^T is the transpose of P and I is the 3x3 identity matrix then there exists a column matrix X=$\begin{pmatrix}x\\y\\z\end{pmatrix}\neq\begin{pmatrix}0\\0\\0\end{pmatrix}$ such that

a) PX=$\begin{pmatrix}0\\0\\0\end{pmatrix}$ b) PX=X c) PX=2X d) PX=-X

136. The value of the integral $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}}\left(x^2+\ln\frac{\pi+x}{\pi-x}\right)\cos x$

a) 0 b) $\frac{\pi^2}{2}$-4 c) $\frac{\pi^2}{2}$+4 d) $\frac{\pi^2}{2}$

137. If the straight lines $\frac{x-1}{2}=\frac{y+1}{k}=\frac{z}{2}$ and $\frac{x+1}{5}=\frac{y+1}{2}=\frac{z}{k}$ are coplanar, then the plane(s) containing there two lines is (are)

a) y+2z=-1 b) y+z=-1 c) y-z=-1 d) y-2z=-1

138. If the adjoint of a 3x3 matrix P is $\begin{pmatrix}1&4&4\\2&1&7\\1&1&3\end{pmatrix}$, then the possible value(s) of the determinant of P is (are) _____.

a) -2 b) -1 c) 1 d) 2

139. Let x and y be two events such that P$\left(\frac{x}{y}\right)=\frac{1}{2}$, P$\left(\frac{y}{x}\right)=\frac{1}{3}$ and P(x∩y)=$\frac{1}{6}$. Which of the following is (are) correct?

a) P(x∪y)=$\frac{2}{3}$ b) x and y are independent c) x and y are not independent

d) P($x^c\cap y$)=$\frac{1}{3}$

140. Let P=$\begin{pmatrix}1&0&0\\4&1&0\\16&4&1\end{pmatrix}$ and I be the identity matrix of order 3. If $\theta=(q_{ij})$ is a matrix such that P^{50}-Q=I then $\frac{q_{31}+q_{32}}{q_{21}}$=_____

a) 52 b) 103 c) 201 d) 205

141. Let P be the image of the point (3, 1, 7) with respect to the plane passing through P and containing the straight line $\frac{x}{1}=\frac{y}{2}=\frac{z}{1}$ is _____.

a) x+y-3z=0 b) 3x+z=0 c) x-4y+7z=0 d) 2x-y=0

142. Distance between two parallel planes 2x+y+2z=8 and 4x+2y+4z+5=0 is _____.

a) $\frac{3}{2}$ b) $\frac{5}{2}$ c) $\frac{7}{2}$ d) 9/2

143. At present a firm is manufacturing 2000 items. It is estimated that the rate of change of production P w.r.t additional number of workers x is given by $\frac{dP}{dx}$=100-12$\sqrt{x}$. If the firm employs 25 more workers, then the new level of production of items is _____.

a) 2500 b) 3000 c) 3500 d) 4500

144. Let A and B be two sets containing 2 elements and 4 elements respectively. The number of subsets of AxB having 3 or more elements is _____.

a) 256 b) 220 c) 219 d) 211

145. If the lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar, then k can have _____.

a) any value b) exactly one value c) exactly two values d) exactly three values

146. If the vector $\overrightarrow{AB}$=3$\vec{\imath}$+4$\vec{k}$ and $\overrightarrow{AC}$=5$\vec{\imath}$-2$\vec{\jmath}$+4$\vec{k}$ are the sides of a triangle ABC, then the length median through A is _____.

a) $\sqrt{18}$ b) $\sqrt{72}$ c) $\sqrt{33}$ d) $\sqrt{45}$

147. The real number k for which the equation $2x^3+3x+k=0$ has two distinct real roots in (0, 1) _____.

a) lies between 1 and 2 b) lies between 2 and 3 c) lies between -1 and 0

d) does not exist

148. The sum of first 20 terms of the sequence 0.7, 0.77, 0.777 ..... is _____.

a) $\frac{7}{81}(179-10^{-20})$ b) $\frac{7}{9}(99-10^{-20})$ c) $\frac{7}{81}(179+10^{-10})$ d) $\frac{7}{9}(99+10^{-20})$

149. A ray of lighting along x+$\sqrt{3}$y=$\sqrt{3}$ gets reflected upon reacting x-axis, the equation of the reflected ray is _____.

a) y=x+$\sqrt{3}$ b) $\sqrt{3}$y=x-$\sqrt{3}$ c) y=$\sqrt{3}$x-$\sqrt{3}$ d) $\sqrt{3}$y=x-1

150. The number of values of k, for which the system of equations (k+1)x+8y=4k, kx+(k+3)y=3k-1 has no solution, is _____.

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

151. If the equations $x^2+2x+3=0$ and $ax^2+bx+c=0$, a,b,c∈R, have a common root, then a:b:c is

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

152. The circle passing through (1, -2) and touching the axis of x at (3, 0) also passes through the point _____.

a) (-5, 2) b) (2, -5) c) (5, -2) d) (-2, 5)

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

a) x = y = z b) 2x=3y=6z c) 6x=3y=2z d) 6x=4y=3z

154. The statement 1: (p∧~q) ∧ (~p∧q) is a fallacy, statement 2: (p→q)↔(q→ ~p) is a tautology

a)Statement-I is true; Statement-II is true. Statement-II is a correct explanation for statement I.

b) Statement-I is true, Statement-II is true. Statement-II is not a correct explanation for statement I.

c) Statement-I is true; statement-II is false

d) Statement-I is false; statement-II is true

155. $\lim_{x\to 0} \frac{(1-\cos 2x)(3+\cos x)}{x \tan 4x}$= _____

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

156. Statement-I: $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{\tan x}}=\frac{\pi}{6}$; Statement-II $\int_a^b f(x)\,dx=\int_a^b f(a+b-x)dx$

a)Statement-I is true; Statement-II is true. Statement-II is a correct explanation for statement I.

b) Statement-I is true, Statement-II is true. Statement-II is not a correct explanation for statement I.

c) Statement-I is true; statement-II is false

d) Statement-I is false; statement-II is true

157. The equation of the circle passing through the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ and having centre at (0, 3) is _____.

a) $x^2+y^2-6y-7=0$ b) $x^2+y^2-6y+7=0$ c) $x^2+y^2-6y-5=0$ d) $x^2+y^2-6y+5=0$

158. A multiple choice examination has 5 questions. Each question has three alternative answers of which exactly one is correct. The probability that a student will get 4 or more correct answers just by guessing is _____.

a) $\frac{17}{3^5}$ b) $\frac{13}{3^5}$ c) $\frac{11}{3^5}$ d) $\frac{10}{3^5}$

159. The x-coordinate of the incentre of the triangle that has the coordinates of midpoints of its sides as (0, 1) (1, 1) and (1, 0) is _____.

a) $2+\sqrt{2}$ b) $2-\sqrt{2}$ c) $1+\sqrt{2}$ d) $1-\sqrt{2}$

160. The term independent of x in expansion of $\left(\frac{x+1}{x^{\frac{2}{3}}-x^{\frac{1}{3}}+1}-\frac{x-1}{x-x^{\frac{1}{2}}}\right)^{10}$ is

a) 4 b) 120 c) 210 d) 310

161. The area (in square units) bounded by the curves $y=\sqrt{x}$, 2y-x+3=0, x-axis and lying in the first quadrant is _____.

a) 9 b) 36 c) 18 d) $\frac{27}{4}$

162. Let T_n be the number of all possible triangles formed by joining vertices of a n-sided regular polygon. If $T_{n+1}-T_n=10$ then the value of n is _____.

a) 7 b) 5 c) 10 d) 8

163. If Z is a complex number of unit modulus and argument θ, then arg $\left(\frac{1+z}{1+\bar{z}}\right)$ equals

a) $-\theta$ b) $\frac{\pi}{2}-\theta$ c) θ d) $\pi-\theta$

164. If $P=\begin{pmatrix}1 & \alpha & 3\\ 1 & 3 & 3\\ 2 & 4 & 4\end{pmatrix}$ is the adjoint of 3x3 matrix and |A|=4, then α is equal to

a) 4 b) 11 c) 5 d) 0

165. The intercepts on x-axis made by tangents to the curve $y=\int_0^x ltl\,dt$, x∈R, which are parallel to the line y=2x are equal to _____.

a) ± 1 b) ± 2 c) ± 3 d) ± 4

166. If $y=\sec(\tan^{-1}x)$, then $\frac{dy}{dx}$ at x=1 is _____.

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

167. The expression $\frac{\tan A}{1-\cot A}+\frac{\cot A}{1-\tan A}$ can be written as _____.

a) sinA cosA +1 b) secA cosecA +1 c) tan A + cot A d) sec A + cosec A

168. All the students of a class performed poorly in Mathematics. The teacher decided to give grace marks of 10 to each of the students. Which of the following statistical measures will not change even after the grace marks were given?

a) mean b) median c) mode d) variance

169. A circle S passes through the point (0, 1) and is orthogonal to the circles $(x-1)^2+y^2=16$ and $x^2+y^2=1$

a) radius of S is 8 b) radius of S is 7 c) centre of S is (-7, 1) d) centre of S is (-8, 1)

170. The slope of the tangent to the curve $(y-x^5)^2 = x(1+x^2)^2$ at the point (1, 3) is _____.

a) 7 b) 8 c) 6 d) 5

171. The value of $\int_0^1 4x^3 \left\{\frac{d^2}{dx^2}(1-x^2)^5\right\}$ is _____.

a) 2 b) 3 c) 4 d) 10

172. Let a, b, c be positive integers such that $\frac{b}{a}$ is an integer. If a, b, c are in geometric progression and the arithmetic mean of a, b, c is b+2, then the value of $\frac{a^2+a-14}{a+1}$ is _____.

a) 5 b) 8 c) 4 d) 3

173. Let a, b, c be such that b(a+c)≠0. If $\begin{vmatrix} a & a+1 & a-1 \\ -b & b+1 & b-1 \\ c & c-1 & c+1 \end{vmatrix} + \begin{vmatrix} a+1 & b+1 & c-1 \\ a-1 & b-1 & c+1 \\ (-1)^{n+2}a & (-1)^{n+1}b & (-1)^n c \end{vmatrix} = 0$ then the value of n is _____.

a) zero b) any even integer c) any odd integer d) any integer

174. If the mean deviation of the numbers 1, 1+d, 1+2d, ...1+100d from their mean is 255, then the d is _____.

a) 10.0 b) 20.0 c) 10.1 d) 20.2

175. If A, B and C are three sets such that A∩B=A∩C and A∪B=A∪C then _____.

a) A=B b) A=C c) B=C d) A∩B=φ

176. If $\vec{u}$, $\vec{v}$, $\vec{w}$ are non-coplanar vectors and p, q are real number, then the equality $[3\vec{u}, p\vec{v}, p\vec{w}] - [p\vec{v}, \vec{w}, q\vec{u}] - [2\vec{w}, q\vec{v}, q\vec{u}]=0$ holds for

a) exactly one value of (p, q) b) exactly two values of (p, q)

c) more than two but not all values of (p, q) d) all values of (p, q)

177. Let the line $\frac{x-2}{3}=\frac{y-1}{-5}=\frac{z+2}{2}$ lie in the plane $x+3y-\alpha z+\alpha=0$. Then (α, β) equals _____.

a) (6, -17) b) (-6, 7) c) (5, -15) d) (-5, 5)

178. The projection of a vector on the three coordinate axis are 6, -3, 2 respectively. The direction cosines of the vector are _____.

a) 6, -3, 2 b) $\frac{6}{5}, \frac{-3}{5}, \frac{2}{5}$ c) $\frac{6}{7}, \frac{-3}{7}, \frac{2}{7}$ d) $\frac{-6}{7}, \frac{-3}{7}, \frac{2}{7}$

179. If $\left|z-\frac{4}{z}\right|=2$, then the maximum value of $|z|$ is equal to _____.

a) $\sqrt{3}+1$ b) $\sqrt{5}+1$ c) 2 d) $2\sqrt{2}$

180. Let A be a 2x2 matrix. Statement-1: adj (adjA)=A, Statement-2: $|adj\ A|=|A|$

a) Statement-I is true; statement-2 is true. Statement-2is a correct explanation for statement-1.

b) Statement-1 is true; Statement-2 is true. Statement-2 is not a correct explanation for statement I.

c) Statement-1 is true; statement-2 is false

d) Statement-1 is false; statement-2 is true