Hints and Solutions

1. Ans. B
Given, a spring of spring constant K
Let us take length of spring as *l*
Also, given spring is cut into lengths of 1:2:3 ratio
So, lengths of each piece of spring is
$\frac{l}{6}, \frac{l}{3}, \frac{l}{2}$
We know,
$$Force\ constant\ (K)\ \alpha\ \frac{1}{length}$$
So, spring constants of segments are,
K1=6K, K2=3K, K3=2K
When these segments are connected in series, Equivalent spring constant = K'
Here, $\frac{1}{K'} = \frac{1}{6K} + \frac{1}{3K} + \frac{1}{2K}$
$\frac{1}{K'} = \frac{6}{6K}$
$\frac{1}{K'} = \frac{1}{K}$
So, K'=K ->1
When these segments are connected in parallel,
$K'' = K1 + K2 + K3$
$K'' = 6K + 3K + 2K$
So, K''=11K
$\frac{K'}{K''} = \frac{K}{11K} = \frac{1}{11}$

2. Ans. B
Given, two optical microscopes are exposed to two wavelengths $\lambda 1 = 4000A^0, \lambda 2 = 6000\ A^0$
Now we know, for an optical microscope
$$resolving\ power = \frac{2\mu \sin\theta}{\lambda}$$
$$resolving\ power\ (R)\ \alpha\ \frac{1}{\lambda}$$
So,
$\frac{R1}{R2} = \frac{\lambda 2}{\lambda 1}$
$\frac{R1}{R2} = \frac{6000\times10^{-10}}{4000\times10^{-10}} = \frac{3}{2}$
So, ratio of resolving powers of two microscopes = 3:2

3. Ans. A
Given a tube closed at one end and open at other end
Also given the two nearest harmonics of tube are 220 Hz and 260 Hz
For a tube closed at one end we know,
$$frequency\ (f) = \frac{(2n+1)V}{4L}$$
Here, V= velocity of sound in air,
n = an integer,
L = length of tube
From this we get, difference between two successive frequencies = $\frac{2(n+1)V}{4L} - \frac{2(n)V}{4L} = \frac{2V}{4L}$
From the given two frequencies,
$\frac{2V}{4L} = 260 - 220 = 40$
$\frac{V}{2L} = 40$
We know, fundamental frequency=
f1= $\frac{V}{4L} = \frac{1}{2}\times\frac{V}{2L} = \frac{1}{2}\times40 = 20\ Hz$

4. Ans. C
Given, a rain drop of mass 1g falls from a height of 1 km
V= 50 m/s = velocity of rain drop before it hits ground.
g=10 m/s^2
$Wg =$ mgh = Work done by gravitational force,
$Wa = work\ done\ by\ resistive\ force$
From work-energy theorem,
$Wg + Wa = \Delta K.E$
$mgh + Wa = \frac{1}{2}mVf^2 - \frac{1}{2}mVi^2$
$Wa = \frac{1}{2}m(50)^2 - \frac{1}{2}m(0)^2 - (m\times10\times1000)$
$Wa = \left[\frac{1}{2}\times0.001\times2500\right] - [0.001\times10000]$
$Wa = \frac{2.5}{2} - 10$
$Wa = -8.75\ J, and$
$Wg = mgh$
$Wg = 0.001\times10\times1000$
$Wg = 10J$

5. Ans. D
given, velocity (c), gravitational constant (G) and $\frac{e^2}{4\pi\varepsilon o}$
Then we have to express dimensions of length in terms of above quantities.
So, we have
dimension of c = $[M^0L^1T^{-1}]$
dimension of G is,
we know, $F = \frac{Gm1m2}{r^2}$
so, $G = \frac{Fr^2}{m1m2}$
here dimensions of G = $[M^{-1}L^3T^{-2}]$
dimensions of $\frac{e^2}{4\pi\varepsilon o}$,

we know, $F = \frac{q^2}{4\pi\varepsilon o}\frac{1}{r^2}$

so, $\frac{e^2}{4\pi\varepsilon o} = F \times r^2$

Here, dimensions of $\frac{e^2}{4\pi\varepsilon o} = [M^1L^3T^{-2}]$

Now, let dimensions of length in terms of given quantities is

Dimension of L = $c^x G^y \left(\frac{e^2}{4\pi\varepsilon o}\right)^z$

$L = [M^0L^1T^{-1}]^x[M^{-1}L^3T^{-2}]^y[M^1L^3T^{-2}]^z$

$[M^0L^1T^0] = [M^{-y+z}L^{x+3y+3z}T^{-x-2y-2z}]$

By comparing we get, y=z , x=-4y

And x+3y+3z = -4y+3y+3y = 1

So, y=$\frac{1}{2}$, x=-2, z= $\frac{1}{2}$

Finally dimension of L= $c^{-2}G^{\frac{1}{2}}\left(\frac{e^2}{4\pi\varepsilon o}\right)^{\frac{1}{2}}$

6. Ans. D

given two rods of same length with thermal conductivities K1 and K2 are combined together to form a composite rod,

We know, H=H1 + H2

So, $H = \frac{K1A(T1-T2)}{d} + \frac{K2A(T1-T2)}{d}$

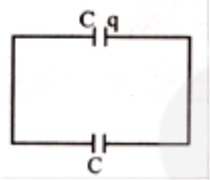
Here d = length of composite rod and T1 and T2 are temperatures at two ends of

rod $\frac{Keq2A(T1-T2)}{d} = \frac{K1A(T1-T2)}{d} + \frac{K2A(T1-T2)}{d}$

So, we get $Keq = \frac{K1+K2}{2}$

7. Ans. A

when battery is replaced by another uncharged capacitor



An uncharged capacitor is connected parallel

Potential stored in a capacitor of having charge q is $V = \frac{q}{C}$

So, C= 2C

We know $Vc = \frac{q1+q2}{C1+C2}$

$Vc = \frac{q+0}{C+C} = \frac{q}{2C} = \frac{V}{2}$

Initial energy of the system is,

$Ui = \frac{1}{2}CV^2 \rightarrow 1$

Final energy of the system is,

$Uf = \frac{1}{2}(2C)\left(\frac{V}{2}\right)^2 \rightarrow 2$

From equations 1 and 2.

$we\ have\ , Uf = \frac{Ui}{2}$

So, total electrostatic energy of the system decreases by a factor 2

8. Ans. B

Given, current gain

$\beta = 100, Rc = 3K\Omega, Rb = 2K\Omega$

Voltage gain $(Av) = \beta\frac{Rc}{Rb} = 100\frac{3}{2} = 150$

Power gain= $Av\beta$

Power gain=150(100) = 15000

9. Ans. A

Given curves are isothermal curves,

Process I volume is constant. Hence, it is isochoric

In process II, it follows the curve which is deviated from isothermal curve hence, it is adiabatic process

In process III, it is following the isothermal curve so, process is isothermal

In process IV, pressure is constant hence, it is isobaric

10. Ans. B

Δe is the difference between charges of proton and electron

According to question, the net electrostatic force (F_E) = gravitational force (F_G)

$F_E = F_G$

$or\ \frac{1}{4\pi\varepsilon o}\frac{\Delta e^2}{d^2} = \frac{Gm^2}{d^2}$

So, $\Delta e = m\sqrt{\frac{G}{K}}$

Here K=$\frac{1}{4\pi\varepsilon o} = 9\times10^9$

$\Delta e = 1.67\times10^{-27}\sqrt{\frac{6.67\times10^{-11}}{9\times10^9}}$

$\Delta e \approx 1.436\times10^{-37}C$

11. Ans. B

Given a wire is melted and stretched 'n' times its original length

We know that, R= $\frac{\rho l}{A}$

$R = \frac{\rho l^2}{Volume}$

So, $R\ \alpha\ l^2$

According to question $l2 = n\times l1$

$$\frac{R2}{R1} = \frac{n^2 l1^2}{l1^2} = \frac{n^2}{1}$$

$$\Rightarrow R_2 = n^2 R_1$$

12. Ans. B

$$y_1 = \overline{A+B}$$

$$y_2 = \overline{y_1 + y_2} = \overline{y}_1 = A + B$$

$$y = y_2 = \overline{A+B}$$ i.e., NOR gate

13. Ans. A
Given a neutron at temperature T, mass m
We know that,
de-Broglie wavelength,

$$K.E = \frac{p^2}{2m}$$

$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2m(K.E)}}$$

$$= \frac{3}{2} k\,T$$

K.E. of thermal wavelength

$$\lambda = \frac{h}{\sqrt{2m(\frac{3}{2}kT)}} = \frac{h}{\sqrt{3mkT}}$$

14. Ans. D

In forward bias, $V_1 > V_2$ i.e., in figure (iv) p-type semiconductor is at higher potential w.r.t. n-type semiconductor.

15. Ans. B
Given, a long solenoid has diameter 0.1m
has 2×10^4 turns per meter,
And a coil has,
no. of turns n= 100
Radius, r= 0.01 m
Resistance, R= 10 $\Pi^2\Omega$

$$e = -N\frac{d\emptyset}{dt}$$

As we know,

$$\frac{e}{R} = -\frac{N}{R}\frac{d\emptyset}{dt}\ So, \Delta I = -\frac{N}{R}\frac{d\emptyset}{dt}$$

$$\frac{\Delta q}{\Delta t} = -\frac{N}{R}\frac{d\emptyset}{dt}\ So, \Delta q = -\left[\frac{N}{R}\frac{d\emptyset}{dt}\right]\Delta t$$

-ve sign shows that induced emf opposes the change of flux

$$\Delta q = \frac{\mu o n i \pi r^2}{R},$$

$$\Delta q = \frac{4\pi\times10^{-7}\times100\times4\times\pi\times(0.01)^2}{10\pi^2},$$

$$\Delta q = 32\mu C$$

Magentic Flux and Faraday's Law of Induction

16. Ans. B
Velocity of preeti w.r.t elevator=

$$v1 = \frac{d}{t1}$$

Velocity of elevator w.r.t. ground=

$$v2 = \frac{d}{t2}$$

Then velocity of preeti w.r.t. Ground

$$v = v1 + v2,$$

$$\frac{d}{t} = \frac{d}{t1} + \frac{d}{t2},$$

$$\frac{1}{t} = \frac{1}{t1} + \frac{1}{t2},$$

$$t = \frac{t1t2}{(t1+t2)}$$

Here, t is time taken by Preeti to walk up on the moving escalator

17. Ans. C
Given, young's double slit experiment is conducted in two different mediums,
According to question
8th bright fringe in medium= 5th dark fringe in air

$$Y\,(8th\ bright\ in\ medium) = 8\frac{\lambda D}{\mu d}$$

$$Y(5th\ dark\ in\ air) = (2\times5-1)\frac{\lambda D}{2d} = \frac{9}{2}\frac{\lambda D}{d}$$

By equating both, we get

$$\frac{9}{2}\frac{\lambda D}{d} = 8\frac{\lambda D}{\mu d}$$

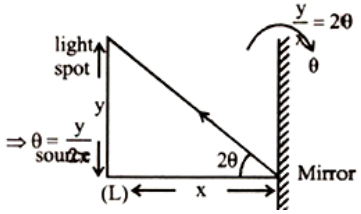
Or, refractive index

$$\mu = \frac{16}{9} = 1.78$$

18. Ans. D
Given, beam of light from source falls normally on a plane mirror which is at a distance of x from mirror.
Here, y= distance moved on the scale after the plane mirror is rotated

When mirror is rotated by angle θ

Reflected ray will be rotated by 2 θ.



So, $\tan 2\theta = 2\theta = \frac{y}{x}$

Hence, $\theta = \frac{y}{2x}$

19. Ans. D

If θ_1 and θ_2 are apparent angles of dip

Let α be the angle which one of the plane make with the magnetic meridian.

$$\tan\theta 1 = \frac{v}{H\cos\alpha},$$

$$cos\alpha = \frac{v}{H\tan\theta 1} \rightarrow 1$$

$$\tan\theta 2 = \frac{v}{H\sin\alpha},$$

$$\sin\alpha = \frac{v}{H\tan\theta 2} \rightarrow 2$$

Squaring and adding 1 and 2, we get

$$(\cos\alpha)^2 + (\sin\alpha)^2 = \left(\frac{v}{H}\right)^2\left(\frac{1}{(\tan\theta 1)^2} + \frac{1}{(\tan\theta 2)^2}\right),$$

$$i.e., 1 = \left(\frac{v}{H}\right)^2((\cot\theta 1)^2 + (\cot\theta 2)^2),$$

$$or\ \frac{H^2}{v^2} = (\cot\theta 1)^2 + (\cot\theta 2)^2$$

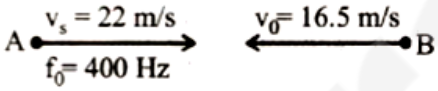
i.e., $(\cot\theta)^2 = (\cot\theta 1)^2 + (\cot\theta 2)^2$

20. Ans. C

Given, two cars are moving towards each other,
Speed of car1 = vs = 22 m/s
Speed of car2 = vo =16.5 m/s
Frequency of horn of car1 = 400 Hz
Velocity of sound in air = 340 m/s
As we know from Doppler's Effect

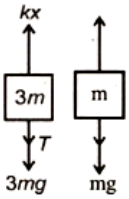
$$f\ (apparent) = fo\left[\frac{v+vo}{v-vs}\right] = 400\left[\frac{340+16.5}{340-22}\right]$$

$$f(apparent) = 448\ Hz$$



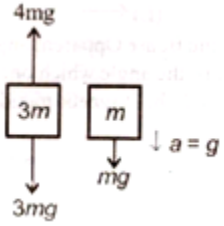
21. Ans. A

given, mass of block1 = 3m
Mass of block2 = m



Before cutting the string
Force equations are,
Kx= T+3 mg …. (i)
T= mg …. (ii)
Kx= 4 mg
After cutting the string T= 0

$$acceleration\ of\ block\ A = \frac{4mg-3mg}{3m}$$



$$acceleration\ of\ block\ A = \frac{g}{3}\ upward,$$

$$acceleration\ of\ block\ B = \frac{mg}{m} = g\ downward$$

22. Ans. A

Given refracting angle of prism is 10º and made of glass with refractive index $\mu = 1.42$

$$and\ it\ is\ combined\ with\ other\ glass\ with$$

$$\mu' = 1.7$$

For dispersion without deviation

$$(\mu-1)A1 + (\mu'-1)A2 = 0,$$

$$|(\mu-1)A1| = |(\mu'-1)A2|,$$

$$(1.42-1)\times 10^0 = (1.7-1)\times A2,$$

$$4.2 = 0.7\ A2,$$

$$A2 = 6^0$$

23. Ans. C

acceleration due to gravity Above earth surface, Below earth surface are respectively,

$$g(h) = g\left(1-\frac{2h}{Re}\right)\ and\ g(d) = g(1-\frac{d}{Re})$$

According to question, $g_h = g_d$

$$g\left(1-\frac{2h}{Re}\right) = g(1-\frac{d}{Re})$$

Clearly,
Here h=1km,

$$\boldsymbol{d = 2h = 2km}$$

24. Ans. B

Reading of potentiometer is accurate because while taking reading it does not draw any current from the circuit.

25. Ans. C

Given

$$\boldsymbol{r_1 = 12cm,, r_2 = 6cm}$$

$$\boldsymbol{T_1 = 500K and T_2 = 2\times 500 = 1000K}$$

$$\boldsymbol{P_1 = 450watt}$$

Rate of power loss

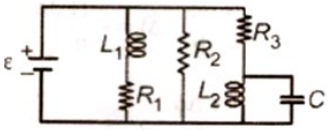
$$P\ \alpha\ r^2T^4,$$

$$\frac{P1}{P2} = \frac{(r1)^2(T1)^4}{(r2)^2(T2)^4},$$

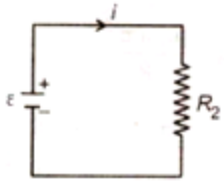
$$P2 = P1\,\frac{(r1)^2(T1)^4}{(r2)^2(T2)^4}$$

Solving we get, P_2= 1800 watt

26. Ans. B



At t=0, no current flows through R_1 and R_3



Current through battery just after the switch closed is

$$i = \frac{e}{R2} = \frac{18}{9} = 2A$$

27. Ans. A
Given,

$$\lambda(A) = 8\lambda\,, \lambda(B) = \lambda$$

$$N(B) = \frac{N(A)}{e}$$

$$Noe^{-\lambda t}B^t = No\,\frac{e^{-\lambda' t}A^t}{e}$$

$$e^{-\lambda t} = e^{-8\lambda t}e^{-1}, e^{-\lambda t} = e^{-8\lambda t-1}$$

Comparing both side powers
-λt = -8λt-1
-1=7λt
Hence,

$$t = -\frac{1}{7\lambda}$$

28. Ans. A
As the given regions are of the equi-potential, so Work done

$$W = q\Delta V$$

We can observe that, ΔV is same in all cases hence work done also be same in all the cases.

29. Ans. A
As it is gravitational free space so, there will be no other particles to exert gravitational force on astronauts and both the astronauts are in the condition of weightlessness.
Gravitational force between them pulls towards each other. Hence Astronauts move towards each other under mutual gravitational force.

30. Ans. B
Given: x and y- coordinates of a particle are

$$x = 5t - 2t^2\; y = 10t$$

$$so, v(x) = \frac{dx}{dt} = 5 - 4t\; v(y) = \frac{dy}{dt} = 10$$

$$also, a(x) = \frac{dv(x)}{dt} = -4\; a(y) = \frac{dv(y)}{dt} = 0$$

$$we\ have, a = a(x)i + a(y)j = -4i\ m/s^2$$

Hence, acceleration of particle at t $= 2s = -4m/s^2$

31. Ans. D
given a particle of mass m is connected to one end of string of length 'l' and other end to a peg on a smooth horizontal table.
Also given particle moves in circular motion with velocity 'v'
Net force on particle in uniform circular motion is centripetal force $\left[\frac{mv^2}{l}\right]$ which provided by tension in string so the net force will be equal to tension i.e., T.

32. Ans. B
Given, a particle executes S.H.M with following parameters
Amplitude A= 3cm
When particle is at x= 2cm, velocity =acceleration
We know, velocity and acceleration of a particle executing S.H.M at a point x are respectively

$$v = \omega\sqrt{A^2 - x^2}\ and\ a = x\omega^2$$

From, velocity= acceleration

$$\omega\sqrt{A^2 - x^2} = x\omega^2$$

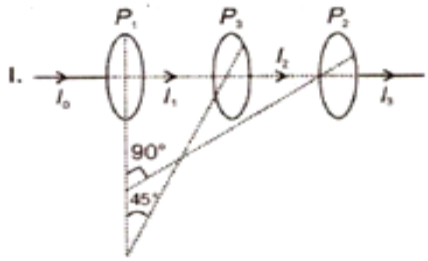
$$\sqrt{3^2 - 2^2} = 2(\omega)$$

$$but\ we\ know\ \omega = \frac{2\pi}{T}$$

$$so, 2\left(\frac{2\pi}{T}\right) = \sqrt{5}\,,$$

$$T = \frac{4\pi}{\sqrt{5}}$$

33. Ans. B
Given, two polaroid P1 and P2 are placed with their axis perpendicular to each other. Also a third polaroid is placed in between P1 and P2 making 45º with axis of P1.



According to malus law,

$$I = Io\,(\cos\theta)^2$$

$$I1 = \frac{Io}{2},$$

$$I2 = \frac{Io}{2}(\cos 45^0)^2 = \frac{Io}{2}\times\frac{1}{2} = \frac{Io}{4},$$

$$I3 = \frac{Io}{4}(\cos 45^0)^2 = \frac{Io}{8}$$

34. Ans. C
Given a spherical object with Bulk modulus 'B' and it is subjected to uniform pressure 'p'.
Bulk modulus is given by

$$B = \frac{P}{\frac{\Delta V}{V}},$$

$$now\ we\ get, \frac{\Delta V}{V} = \frac{P}{B}$$

$$3\frac{\Delta R}{R} = \frac{P}{B}$$

$$(here, \frac{\Delta R}{R} = fractional\ decrease\ in\ radius$$

$$\frac{\Delta R}{R} = \frac{P}{3B}$$

35. Ans. A
Given, $E\ rms = 6V/m$ of an electromagnetic wave,

$$we\ know, \frac{E\ rms}{B\ rms} = c$$

$$so, B\ rms = \frac{E\ rms}{c} \rightarrow 1$$

$$we\ have, B\ rms = \frac{Bo}{\sqrt{2}},$$

$$Bo = \sqrt{2}\,B\ rms,$$

$$from\ equation\ 1,$$

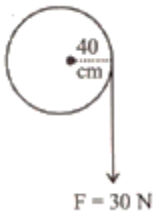
$$Bo = \sqrt{2}\times\frac{E\ rms}{C}$$

$$Bo = \sqrt{2}\times\frac{6}{3\times10^8} = 2.83\times10^{-8}\ T$$

36. Ans. B
Given, mass of cylinder m= 3kg
R= 40cm= 0.4 m

F= 30N; we need to find angular acceleration (α)

As we know, torque $\boldsymbol{\tau = I\alpha}$



$$F\times R = MR^2\,\alpha$$

$$\alpha = \frac{F\times R}{MR^2}$$

$$\alpha = \frac{30\times(0.4)}{3\times(0.4)^2} = 25\ rad/s^2$$

37. Ans. A
given two discs of same moment of inertial, let it be I.
and rotating with $\omega1\ and\ \omega2$ respectively about an axis passing through its center and perpendicular to plane of disc
Here, by conservation of angular momentum
We have, $I\omega1 + I\omega2 = 2I\omega$

$$\omega = \frac{\omega1 + \omega2}{2} \rightarrow 1$$

Also, we have energies of discs

$$K.E\ i = \frac{1}{2}I(\omega1)^2 + \frac{1}{2}I(\omega2)^2,$$

$$K.E\ f = \frac{1}{2}\times I\times\omega^2$$

$$from\ equation\ 1, we\ have$$

$$K.E\ f = \frac{1}{2}\times I\times\left(\frac{\omega1+\omega2}{2}\right)^2$$

$$loss\ in\ K.E = K.E\ f - K.E\ i = \frac{1}{4}I(\omega1-\omega2)^2$$

38. Ans. A
Both answers are correct because both answers are same
Given,

$$\lambda o = 3250\times10^{-10}m\,, \lambda = 2536\times10^{-10}m$$

$$\emptyset = \frac{hc}{\lambda o} = \frac{4.14\times10^{-15}\times3\times10^8}{3250\times10^{-10}} = 3.82\ eV$$

$$hv = \frac{hc}{\lambda} = \frac{4.14\times10^{-15}\times3\times10^8}{2536\times10^{-10}} = 4.89\ eV$$

According to Einstein's photoelectric equation,

$$K.E\ (maximum) = hv - \emptyset$$

$$K.E\ (maximum) = (4.89 - 3.82)eV = 1.077\ eV$$

$$\frac{1}{2}mV^2 = 1.077\times1.6\times10^{-19}$$

$$v = \sqrt{\frac{2\times1.077\times1.6\times10^{-19}}{9.1\times10^{-31}}}$$

$$v = 0.6\times10^{6}\frac{m}{s} \; or \; 6\times10^{5}\frac{m}{s}$$

39. Ans. D
Given a rectangular coil of length 2.1 cm and width 1.25 cm

Current through coil = 85 μA
No. of turns = 250
B= 0.85 T
Work done, W= MB$(\cos\theta 1 - \cos\theta 2)$
When it is rotated by angle 180^0 then
W= MB
$(\cos 0^0 - \cos 180^0) = MB(1+1) = 2MB$
W = 2(NIA)B
W=$2\times250\times85\times10^{-6}[1.25\times2.1\times10^{-4}]\times85\times10^{-2} = 9.1\mu J$

40. Ans. B
For last line of Balmer series: n_1= 2 and $n_2 = \infty$,

$$\frac{1}{\lambda(Balmer)} = RZ^2\left[\frac{1}{(n1)^2} - \frac{1}{(n2)^2}\right]$$

$$\frac{1}{\lambda(Balmer)} = R\times1^2\left[\frac{1}{2^2} - \frac{1}{\infty^2}\right]$$

$$\lambda(Balmer) = \frac{4}{R} \rightarrow 1$$

For last line of Lyman series: n_1= 2 and $n_2 = \infty$

$$\frac{1}{\lambda(Lyman)} = RZ^2\left[\frac{1}{(n1)^2} - \frac{1}{(n2)^2}\right]$$

$$\frac{1}{\lambda(Balmer)} = R\times1^2\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right]$$

$$\lambda(Lyman) = \frac{1}{R} \rightarrow 2$$

Dividing equation 1 and 2

$$\frac{\lambda(Balmer)}{\lambda(Lyman)} = \frac{\frac{4}{R}}{\frac{1}{R}} = \frac{4}{1}$$

Ratio of wavelength is

$$\frac{\lambda_B}{\lambda_L} = 4$$

41. Ans. A
Given, efficiency of engine,

$$n = \frac{1}{10}$$

Work done on system W= 10J
Coefficient of performance of refrigerator

$$\beta = \frac{Q_2}{W} = \frac{1-\eta}{\eta} = \frac{1-\frac{1}{10}}{\frac{1}{10}} = \frac{\frac{9}{10}}{\frac{1}{10}} = 9$$

Energy absorbed from reservoir

$$Q_2 = \beta w, Q_2 = 9\times10 = 90J$$

42. Ans. C
Internal energy of the system is given by

$$U = \frac{f}{2}nRT$$

Degree of freedom

$$F_{diatomic} = 5, f_{monoatomic} = 3$$

And, number of moles

$$n(O_2) = 2, n(Ar) = 4$$

$$U_{total} = \frac{5}{2}(2)RT + \frac{3}{2}(4)RT = 11RT$$

43. Ans. C
Force per unit length between two parallel current carrying conductors,

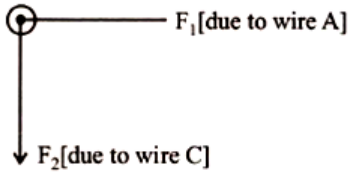
$$F = \frac{\mu_o i_1 i_2}{2\Pi d}$$

Since same current flowing through both the wires

$$i_1 = i_2 = i$$

$$F_1 = \frac{\mu_o i^2}{2\Pi d} = F_2$$

So



F_2 [due to wire C]
Magnitude of force per unit length on the middle wire 'B'

$$F_{net} = \sqrt{F_1^2 + F_2^2} = \frac{\mu_o i^2}{\sqrt{2\Pi d}}$$

44. Ans. C
Here,

$$h_{oil} \times \rho_{oil} \times g = h_{water} \times \rho_{water} \times g$$

$$\rho_o g \times 140 \times 10^{-3} = \rho_w g \times 130 \times 10^{-3}$$

$$\rho_{oil} = \frac{130}{140} \times 10^3 \approx 928 kg/m^3 [\because \rho_w = 1 kgm^{-3}]$$

45. Ans. D
Center of mass may or may not coincide with centre of gravity. Net torque of gravitational pull is zero about centre of mass.

$$\tau_g = \Sigma \tau_i = \Sigma r_i \times m_{ig} = 0$$

Mechanical advantage,

$$M.A. = \frac{Load}{Effort}$$

If $M.A. > 1 \Rightarrow Load > Effort$

46. Ans. A
Potassium permanganate (purple colored) on reacting with sulphur dioxide reacts loses its colour and the solution decolorizes.

$$5SO_2 + 2KMnO_4 + 2H_2O \rightarrow 2H_2SO_4 + 2MnSO_4 + K_2SO_4$$

47. Ans. C
The overall reaction rate depends on the rate of the slowest step.
i.e., The overall rate is equal to the rate of the slowest step (ii)
$=k[X][Y_2]$ …. (1)
K= rate constant
Assuming step (i) to be reversible, the equilibrium constant can be given as,

$$k_{eq} = \frac{[X]^2}{[X_2]} \Rightarrow [X]^2$$

$$= k_{eq}[X_2]; [X] = k_{eq}^{\frac{1}{2}} [X_2]^{\frac{1}{2}}$$

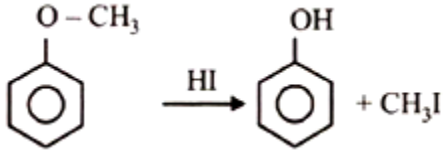
From eq (1) and (2)

Rate= $kk_{eq}^{\frac{1}{2}} [X_2]^{\frac{1}{2}} [Y_2]$

Overall order= $\frac{1}{2} + 1 = \frac{3}{2} = 1.5$

48. Ans. A
Z= 114 belongs to Group 14, carbon family
Electronic configuration
= $[Rn]5f^{14}6d^{10}7s^2p^2$

49. Ans. B
The Ar-O-R ethers on reacting with HI, gets cleaved at the weaker O-R bond and give phenol and alkyl iodide.

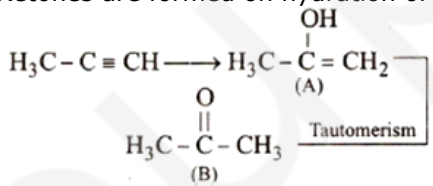


50. Ans. A
Correct order is

$$\underset{\text{(Two acidic hydrogens)}}{H-C \equiv C-H} > \underset{\text{(One acidic hydrogen)}}{H_3C-C \equiv C-H} > H_2C \equiv CH_2 > CH_3-CH_3$$

$$CH_2 = CH_2 > CH_3-CH = CH_2 > CH_3-C \equiv CH > CH \equiv CH$$

51. Ans. C
Ketones are formed on hydration of alkynes.



52. Ans. A

(i) $$N_2 + 3H_2 \rightleftharpoons 2NH_3; K_1 = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

(ii) $$N_2 + O_2 \rightleftharpoons 2NO; K_2 = \frac{[NO]^2}{[N_2][O_2]}$$

(iii) $$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O; K_3 = \frac{[H_2O]}{[H_2][O_2]^{1/2}}$$

Applying (II+3III-I) we will get

$$2NH_3 + \frac{5}{2}O_2 \rightleftharpoons 2NO + 3H_2O;$$

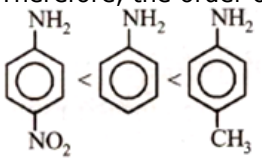
$$K = \frac{[NO]^2}{[N_2][O_2]} \times \frac{[H_2O]^3}{[H_2]^3 \times [O_2]^{3/2}} / \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$$\therefore K = K_2 \times K_3^3 / K_1$$

53. Ans. C
Electron withdrawing $-NO_2$ group has very strong –I and –R effects as they decrease the electron density fo the compounds and increase their acidic character. So, compound 3 will be most acidic.

54. Ans. C
$-NO_2$ group is an electron withdrawing group, therefore it has a strong –R effect. Whereas, $-CH_3$ group is electron donating in nature and shows +R effect.

Therefore, the order of basic strength is



55. Ans. C
Li^+ is smallest in size and therefore has maximum charge density.
Among all the alkali metal ions, it is most heavily hydrated because the effective size of Li^+ in aqueous solution is the largest. Therefore, Li^+ will move the slowest under electric field.

56. Ans. C
Due to the intramolecular hydrogen bonding in o-nitrophenol, steam distillation is one of the most suitable method of separation of 1:1 mixture of ortho and para nitrophenols.

57. Ans. B
When the solution containing $HgCl_2$, I_2 and I^- are mixed together, both $HgCl_2$ and I_2 are seen to compete for I^-.
The formation constant of $[HgI_4]^{2-}$ is very large (1.9×10^{30}) in comparison to the rate of formation of $I_3(K_f = 700)$

Therefore, I^- preferentially combines with $HgCl_2$ and forms $[HgI_4]^{2-}$.

$$HgCl_2 + 2I^- \longrightarrow \underset{\text{Red ppt}}{HgI_2}\downarrow + 2Cl^-$$

$$HgI_2 + 2I^- \longrightarrow \underset{\text{soluble}}{[HgI_4]^{2-}}$$

58. Ans. A
Dettol, an antiseptic, is a mixture of chloroxylenol and terpineol.

59. Ans. A
Grignard's reagent (RMgX) is a σ-bonded organometallic compound.

60. Ans. A
The half life for a first order reaction,

$$t_{1/2} = \frac{0.693}{K}\, So, t_{1/2} = \frac{0.693}{10^{-2}}\,\text{sec}$$

Also, for reducing 20g of the reactant to only 5g, two half lives will be required.
The time taken for 20g of the reactant to reduce to 5g,

$$t = 2\times\frac{0.693}{10^{-2}}\,\text{sec} = 138.6\,\text{sec}$$

61. Ans. A
XX'- Linear (e.g. ClF, BrF)
XX'_3- T-shape (e.g. ClF_3, BrF_3)
XX'_5- Square pyramidal (e.g. BrF_5IF_5)
XX'_7- Pentagonal bipyramidal (e.g. IF_7)

62. Ans. C

$$Ag_2C_2O_4(s) \rightleftharpoons 2Ag^+(aq) + C_2O_4^{2-}(aq)$$

$$K_{SP} = [Ag^+]^2[C_2O_4^{2-}]$$

$$[Ag^+] = 2.2\times10^{-4}M$$

Given that:

Concentration of $C_2O_4^{2-}$ ions,

$$[C_2O_4^{2-}] = \frac{2.2\times10^{-4}}{2}M = 1.1\times10^{-4}M$$

$$\therefore K_{SP} = (2.2\times10^{-4})^2(1.1\times10^{-4})$$

$$= 5.324\times10^{-14}$$

63. Ans. B
For cell,

$$Zn|ZnSO_4(0.01M)||CuSO_4(1.0M)|Cu$$

$$E_{cell} = E^\circ_{cell} - \frac{2.303RT}{nF}\frac{\log[Zn^{2+}]}{[Cu^{2+}]}$$

$$\therefore E_1 = E^\circ_{cell} - \frac{2.303RT}{2\times F}\times\log\frac{(0.01)}{1}$$

When the concentration of $ZnSO_4$ and $CuSO_4$ are changed, we can write

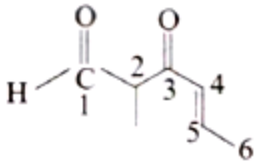
$$E_2 = E^\circ_{cell} - \frac{2.303RT}{2F}\times\log\frac{1}{0.01}\therefore E_1 > E_2$$

64. Ans. B

$$IBr_2^-, XeF_2$$

There are equal number of valence electrons present in both the species and both the species are seen to exhibit linear shape.

65. Ans. D



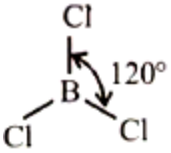
In the numbering of the principal carbon chain, the aldehydes get the higher priority over ketone and alkene.

66. Ans. C
In case of hydrogen atom, the energy of the 2s- orbital and 2p- orbital is equal.

67. Ans. D

$Fe_{0.93-0.96}O_{1.00}$ is a non- stoichiometric ferrous oxide which is formed due to the metal deficiency defect.

68. Ans. C
BCl_3 is sp_2 hydribised and is trigonal planar in shape and hence the bond angle is 120^0.



69. Ans. A
Given $\Delta H 35.5 kJmol^{-1}$

$\Delta S = 83.6 JK^{-1}mol^{-1} \therefore \Delta G = \Delta H - T\Delta S$

For a reaction to be spontaneous, $\Delta G = -ve$

i.e., $\Delta H < T\Delta S$

$$\therefore T > \frac{\Delta H}{\Delta S} = \frac{35.5\times10^3 mol^{-1}}{83.6 JK^{-1}}$$

Therefore, the given reaction will be spontaneous as T>425K

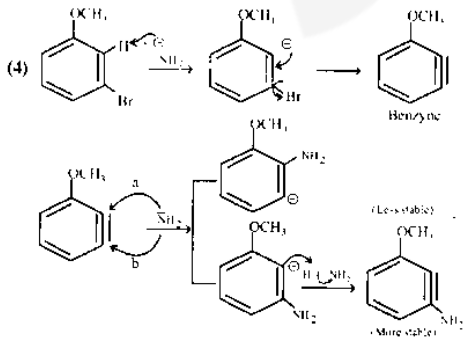
70. Ans. A
The microorganisms present in the soil is a sink for CO.

71. Ans. C
K_f (molal depression constant) is dependent on the nature of the solvent. It is independent of the concentration of the solution, therefore independent of molality.

72. Ans. A
Molarity depends on the volume of a solution which can be changed with change in temperature.

73. Ans. A
Both the forward and the backward reactions can be speeded up with the same rate in the presence of a catalyst. A catalyst will decrease the activation energies of the forward and the backward reactions to the same extent.
Therefore, there is no effect on the equilibrium constant in the presence of a catalyst at any given temperature.

74. Ans. D



The more stable negative charge is close to the electron withdrawing group and therefore gets stabilized.
This is because the incoming nucleophile is getting attached on the same 'C' on which the leaving group i.e. Br was present. Therefore, it is not a cine substitution reaction

75. Ans. B

$[Co(NH_3)_6]Cl_3 \xrightarrow{AgNO_3}$ 3 mol of AgCl

$[Co(NH_3)_5Cl]Cl_2 \xrightarrow{AgNO_3}$ 2 mol of AgCl

$[Co(NH_3)_4Cl_2]Cl \xrightarrow{AgNO_3}$ 1 mol of AgCl

Complexes are respectively $[Co(NH_3)_6]Cl_3$, $[Co(NH_3)_5Cl]Cl_2$ and $[Co(NH_3)_4Cl_2]Cl$

76. Ans. C
A fact.

77. Ans. B
The given system is in an isolated state. We know that,

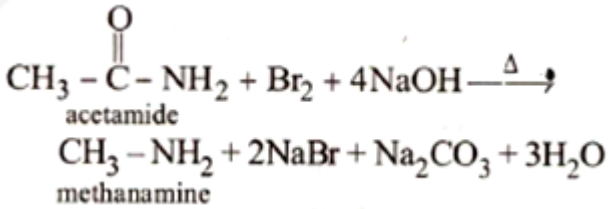
$\Delta U = q + w$

And for an adiabatic process, q= 0

$\Delta U = w = -p\Delta V = -2.5 atm \times (4.5 - 2.5) L$

$= -2.5 \times 2 L - atm = 5 \times 101.3 J = 506.5 J \approx 505 J$

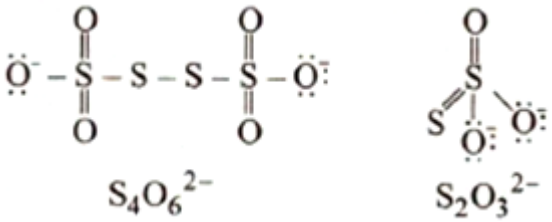
78. Ans. A



It is called Hoffman bromamide reaction.

79. Ans. C
No change takes place in the bond angles and the bond lengths of conformations of ethane. The only change taking place is the change in the dihedral angle.

80. Ans. A



81. Ans. D
The tendency of the outermost ns^2 electrons of the valence shell to remain unshared and unionized in the heavier p-block elements is termed as the inert pair effect.
Therefore, Pb(ll) is more stable than Pb(IV) and Sn(IV) is

more stable than Sn(II) due to inert pair effect.
Due to this Pb(IV) can be easily reduced to Pb(II) and acts as an oxidising agent whereas Sn(II) can be easily oxidised to Sn(IV) and acts as a reducing agent.

82. Ans. D
The order of the ligand according to the spectrochemical series is given below.

$$H_2O < NH_3 < en$$

The wavelength of the light absorbed is directly proportional to this order. Therefore,

$$[Co(H_2O)_6]^{+3} < [Co(NH_3)^6]^{3+} < [Co(en)_3]^{+3}$$

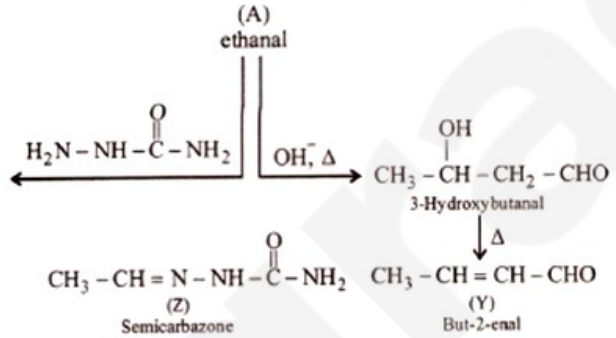
Therefore, the wavelength absorbed will be in the inverse order.

$$[Co(en)_3]^{3+}, [Co(NH_3)_6]^{3+} [Co(H_2O)_6]^{3+}$$

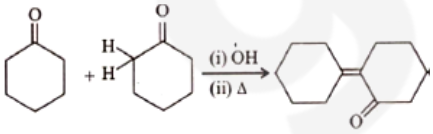
83. Ans. B
As given, a positive silver mirror test is attained with A therefore, A is an of α Hydroxyketone. Further, on reaction with dilute alkali (OH^-) i.e., aldol condensation, it is indicated that A is an aldehyde. This is because the aldol condensation of ketones is a reversible process and must be carried out under special conditions and in a special apparatus.

$$\underset{(X)}{CH_3 - CH_2OH} \xrightarrow[573K]{Cu} CH_3 - CHO$$

$$\xrightarrow[\Delta]{[Ag(NH_3)_2]^+}$$ Silver mirror observed



84. Ans. A



85. Ans. B
CN^- and CO have same number of electrons (i.e. 14) and have same bond order equal to 3.

86. Ans. C
Zn is more reactive than Ag and Au, therefore Zn will displace them.

$$4Ag + 8NaCN + 2H_2O + O_2 \xrightarrow{Leaching} 4Na[Ag(CN)_2] + 4NaOH$$

Soluble sodium dicyanoargenate(I)

To give metal by displacement, the soluble cyanide compound can be treated with Zn.

$$2Na[Ag(CN)_2] + Zn \xrightarrow{Displacement} Na_2[Zn(CN)_4] + 2Ag\downarrow$$

87. Ans. D
The maximum pressure of $CO_2$is equal to the pressure of CO_2 at equilibrium.
For the given reaction,

$$SrCO_3(s) \rightleftharpoons SrO(s) + CO_2$$

$K_p = PO_{CO_2} = 1.6 atm =$ maximum pressure of CO_2

At this stage, the volume of container is

$$V = \frac{nRT}{P} \quad \text{.... (i)}$$

As the container is sealed and the reaction was not at an equilibrium earlier.
n= constant

$$n = \frac{PV}{RT} = \frac{0.4 \times 20}{RT} \quad \text{.... (ii)}$$

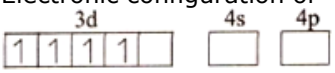
Put equation (ii) in equation (i)

$$V = \left[\frac{0.4 \times 20}{RT}\right]\frac{RT}{1.6} = 5L$$

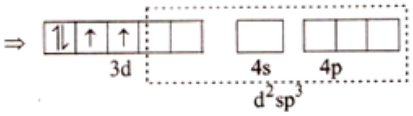
88. Ans. B
The oxidization state of Mn in the complex

$[Mn(CN)_6]^{3-}$ is +3.

Electronic configuration of $Mn^{+3} \rightarrow 3d^4$

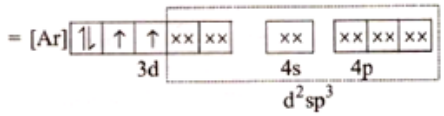


As the CN^- is a strong ligand, it causes the pairing of electrons in the complex.



The coordination number of Mn is 6, therefore an octahedral complex is formed.

$\therefore [Mn(CN)_6]^{3-}$



89. Ans. B
5f, 6d and 7s subshell have a minimum or comparable energy gap which makes the electron excitation easier in nature; therefore a greater range of oxidation states is seen in the actinoids.

90. Ans. C

During the denaturation of proteins, the helix of the proteins get uncoiled. Due to this, the protein loses its biological activity.

91. Ans. A
Holoenzyme is the complete functional enzyme. Some enzymes have a protein part called apoenzyme, and a non-protein part which associates transiently called coenzyme co-factor. Co-factors are usually inorganic, while coenzymes are organic.

92. Ans. A
The atrial natriuretic factor is released from the atria and helps in vasodilation when the blood pressure/volume increases. Other factors in the options are all released when blood pressure/volume decreases.

93. Ans. A
Paneth cells secrete anti-microbial agents. Zymogen cells are present in pancreas. Kupffer cells are present in liver. Argentaffin cells produce hormones.

94. Ans. C
If the forming units of the given biological macromolecules are considered, proteins are formed of amino acids joined one after the other, polysaccharides are formed from monosaccharides, nucleic acids are formed of nucleotides. Only lipids are not made of uniform components, that is, they are not polymeric. They are tri-esters of fatty acids and glycerol.

95. Ans. B
Megaspore is formed from megaspore mother cell. The functional megaspore divide mitotically into 8 cells, to give the 7 celled 8 nucleate embryo sac. Embryo and endosperms are products after double fertilization in angiosperms. Ovule bears the megaspore mother cells and becomes seed after fertilization.

96. Ans. D
Myelin sheath wrapped around the nerve axon. Oligodendrocytes are neuroglial cells which produce myelin sheath in central nervous system while Schwann cell produces myelin sheath in peripheral nervous system.

97. Ans. A
In entomophily, that is, insect pollination, the insect is attracted by factors like colour of flower, odour etc. They are also rewarded with nectar and pollen grains. Insects play a crucial role in pollination.

98. Ans. C
Neurotransmitters help in chemical conduction of nerve impulses across the synapses. They are stored in synaptic vesicles of the axon terminals. The membrane of neuron next to the synapse is the post-synaptic membrane and bears the receptors for neurotransmitters.

99. Ans. D
Coconut is a drupe fruit as it has a thin shell covering the fleshy part. Inside they have a hardened endocarp.

100. Ans. D
In human RBC, the nucleus is lost during maturation. This provides lot of space for oxygen transport due to presence of haemoglobin. RBC lacks other organelles like mitochondria as well.

101. Ans. C
Capacitation is an event that occurs following insemination and it leads to better fertilization of the ovum by the sperm. It occurs in the female reproductive tract.

102. Ans. D
Archaebacteria are known to live in extreme conditions and they are much more primitive and durable. It can be of various types depending on the condition where it is staying. Extreme saline conditions are habitats of Halophiles. Eubacteria are the true bacteria, evolutionarily advanced and more fragile.

103. Ans. A
In logistic growth curve, the curve has an upper asymptote known as carrying capacity (K) is obtained when the maximum population size is at $\frac{dN}{dt} = 0$. A population growing in a habitat with limited resources shows logistic growth curve.

For logistic growth $\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$

If K=N then $\left(\frac{K-N}{K}\right) = 0$

$\therefore$ the $\frac{dN}{dt} = 0$.

The population reaches asymptote.

104. Ans. A
Artificial selection to obtain cows yielding higher milk output is an example of directional evolution. It is not disruptive, because two extremes are not selected. It is not stabilizing as it does not keep the mean character stable in the population.

105. Ans. A
Rhodospirillum is a facultative anaerobe and a free living nitrogen fixer. Mycorrhiza are symbiotic association of fungi and higher plant roots. So this is the incorrect pair.

106. Ans. A
Carotene is the chief source of Vitamin A derivative, Retinal. Retinal is he light absorbing part of all photopigments.

107. Ans. C
Ethidium bromide stains the DNA orange and helps in visualization upon exposure to UV radiation. EtBr gets intercalated between the base pairs helping in visualization.

108. Ans. C
Hepatic portal circulation is the draining of blood from intestine to liver through the hepatic portal vein.

109. Ans. B
In secondary growth, vascular cambium gives rise to secondary xylem and phloem. Phelloderm is formed from cork cambium.

110. Ans. B
Sickle cell anemia occurs due to point mutation and leads to sickle shaped RBCs. It is a qualitative defect. Thalassemia occurs due to lesser synthesis of globin chains of hemoglobin. It is a quantitative defect. Thus (B) is the correct option.

111. Ans. B
Both parents are heteroallelic and there are four possible genotypes of their children – I^AI^A, I^Ai, I^AI^B, I^Bi – if we solve by Punnett Square. The 3 phenotypes are - Blood group A, B and AB.

112. Ans. B
The radial orientation of cellulose microfibrils help in opening stomatal aperture. The stomatal aperture opens when guard cells become turgid and the curvature of the cells increase opening the stomatal aperture.

113. Ans. B
Thorns in Bougainvillea are modifications of stem. They act as protection against grazing animals.

114. Ans. D
Ex-situ conservation is the method of bringing out endangered species and protecting them in artificial habitats. Wildlife safari parks is an example to protect threatened animals and plans in artificial environments. Rest of the options are in-situ conservation, that is, protection in their natural habitats.

115. Ans. D
Root hairs develop from the region of maturation or the region of differentiation.

116. Ans. D
Down's syndrome is caused by three copies of chromosome 21, trisomy of 21. It is caused by non-disjunction of autosomal chromosomes. Klinefelter's syndrome and Turner's syndrome are caused by anomalies in the sec chromosomes. Sickle cell anemia is caused by point mutation and not non-disjunction.

117. Ans. D
By convention, water potential of pure water at standard temperature, which is not under any pressure, is taken to be zero.

118. Ans. A
First condensation of the chromatin occurs, to form compact chromosomes, nuclear membrane disassembly occurs (prophase). Then the chromosomes are arranged along the equator forming metaphase plate (metaphase). Then centromere division occurs and sister chromatids segregate (anaphase). Finally telophase occurs.

119. Ans. A
After the protein of interest is obtained in substantial amount from the biotechnological methods, the protein is purified before marketing. This is called Downstream processing.

120. Ans. A
Corpus luteum is a temporary endocrine gland formed in female human body. It secretes hormones like progesterone, estrogen, etc.

121. Ans. B
Cork cambium undergoes periclinal division and cuts off thick walled suberized dead cells toward outside i.e., phellem (cork) and it cuts off thin walled living cells i.e., phelloderm on inner side.

122. Ans. A
Volvox is a colonial algae. It forms spherical colonies.

123. Ans. D
.

124. Ans. D
Cu^{2+} ions interfere with sperm movement. Thus copper releasing IUD's function as effective contraceptive measure.

125. Ans. B
Primary treatment involves the removal of suspended solids by sedimentation and filtration.

126. Ans. B
Gill slits are present in pharynx in both hemichordates and chordates. Ventral tubular nerve cord is present in hemichordates only. Notochord is present in chordates only.

127. Ans. A

128. Ans. A
The trichome characteristic was not considered by Mendel in his experiments of genetics.

129. Ans. A
Halophytes have pneumatophores as well vivipary. In extreme saline conditions, the have pneumatophores as breathing roots. Vivipary is a special process of seed germination.

130. Ans. B
Pivot joint is a type of synovial joint. Synovial joints are joints that allow movement in various directions.

131. Ans. B
In C_3 plants photosynthesis decreases at higher temperature due to increased photorespiration.
C_4 plants have higher temperature optimum because of the presence of enzyme called pyruvate phosphate dikinase, which is sensitive to low temperature. The rest of the statements are correct.

132. Ans. A
DNA molecules are negatively charged. It has phosphate in its backbone making it negatively charged.

133. Ans. C

Glycocalyx is a slimy layer present outside the cell wall of bacteria that provides it a sticky character.

134. Ans. C
Pancreatic juice comprises of lipase, amylase, trypsinogen, procarboxypeptidase. Pepsin and rennin are present in gastric juices.

135. Ans. B
Whales, dolphins, seals all belong to Class Mammalia. But Trygon and sharks are cartilaginous fishes.

136. Ans. B
Auxins prevent premature leaf and fruit fall. Ethylene is a gaseous plant hormone that helps in fruit ripening.

137. Ans. C

138. Ans. B
Couples where the male partner has low sperm count or motility, unsuitable for fertilization, artificial insemination is an effective technique. Here sperm from a suitable donor is injected into the vagina or uterus directly.

139. Ans. D
Forest ecosystem has the maximum biomass.

140. Ans. D
It is the volume of air that remains in alveoli even after forceful expiration. This volume of air prevents the alveoli to collapse.

141. Ans. A
The tropical rain forest have five vertical strata on the basis of plants height i.e., ground vegetation, shrubs, short canopy trees, tall canopy trees and tall emergent trees.

142. Ans. D
The descending limb of loop of Henle is permeable to water, impermeable to electrolytes. The ascending limb of loop of Henle is impermeable to water, permeable to electrolytes.

143. Ans. B
Alexander Von Humboldt proved that the species richness increases with the increase of area.

144. Ans. C
Chlamydomonas shows haplontic life cycle. Thus the zygotic meiosis forms a feature of this organism.

145. Ans. B
999 bases of mRNA means 999/3 = 333 amino acids. If 901th base is deleted, previous 900/3=300 amino acids remain intact. Next 33 amino acids are altered. That means, 33 codons are altered.

146. Ans. B
Wind pollination or anemophily occurs in those flowers which have single ovule in the ovary, and are packed into inflorescences. It is a non-directional pollination.

147. Ans. A
Graft rejection occurs due to cell-mediated response.

148. Ans. B
Ectocarpus shows haplodiplontic life cycle. Fucus shows Diplontic life cycle.

149. Ans. D
Selectable markers are used to identify transformed cells. The common examples of such genes are antibiotic resistance genes.

150. Ans. A
Dioecious plants bear male and female flowers on two plants. Thus they prevent autogamy (pollination in same flower, bisexual flower) as well as geitonogamy (cross pollination between male and female flowers on same plant).

151. Ans. C
The Krebs' Cycle begins with conversion of acetyl CoA with oxalo-acetic acid to yield citric acid. Citric acid is a 6 carbon molecule.

152. Ans. A
PEP is present in the mesophyll cell cytoplasm of C_4 plants like sorghum, maize, etc.

153. Ans. C
Okazaki fragments are used to synthesize the complementary strand of the lagging strand. However, due to the directionality of the replication, the synthesis occurs from 5' -> 3' direction and the Okazaki fragments are formed on the lagging strand away from the replication fork.

154. Ans. D
The r-RNA or ribosomal RNA is present in abundance in the animal cell. It constitutes 80% of the cell RNA content. It is obvious from the fact that the r-RNA constitutes the translational machinery of the cell.

155. Ans. A
GnRH acts on the anterior pituitary. It stimulates release of LH or Luteinizing Hormone and FSH or Follicle Stimulating Hormone. Both play roles in the reproductive system and gametogenesis.

156. Ans. A
The smaller DNA fragments move farther in the gel. The pores in the gel help the smaller fragments to pass faster than the larger fragments due to the sieving effect of the gel.

157. Ans. A
Epiphyseal plates are hyaline cartilage plates at end of long bones that help bone growth. They close after adolescence. So hypersecretion of growth hormone does not lead to increase in height in adults.

158. Ans. B
Just before fission, the bacterial cell undergoes DNA replication. After replication the cell divides. The nucleolus is not present in prokaryotic bacteria. Well defined S-phase is also absent due to primitive nature.

159. Ans. D

160. Ans. C
Viroids are basically RNA molecules without the protein coat.

161. Ans. D
MALT or Mucosa Associated Lymphoid Tissue is present along the inner lining of mucosa. It is present about 50% of the total lymphoid tissues in human body.

162. Ans. C
Brewer's yeast or Saccharomyces cerevisiae is used in industries for fermentation of carbohydrates to produce ethanol.

163. Ans. B
Mycoplasma are the smallest living cells known till date. They lack proper cell wall and can survive without oxygen.

164. Ans. A
The taxonomic arrangement of horses is as follows:-
Order - Perissodactyla
Family - Equidae
Genus - Equus
Species- ferus
Subspecies – caballus

165. Ans. C
A frog's heart is autoexcitable and myogenic. It is similar to the other vertebrates.

166. Ans. D
Homozygous purelines in cattle can be obtained by mating related individuals of same breed that is, inbreeding. Inbreeding leads to homozygosity, but also leads to inbreeding depression.

167. Ans. B
Heartwood is inactive physiologically. It has lignin deposits and other organic compounds. So it cannot help in conduction of water and minerals.

168. Ans. B
As the name suggests, Anaphase Promoting Complex will lead to segregation of chromosomes and promote anaphase. But if APC is defective in a human cell, the chromosomes will not separate.

169. Ans. C
Mitochondrion is the seat of aerobic respiration. It helps to extract energy from carbohydrates to form ATP or the energy currency of the cell.

170. Ans. C
Mycorrhizae are the symbiotic association of higher plant roots like *Pinus* and fungi, Here both are benefitted and none are harmed. Benefits are in the form of nutrients, shelter, etc.

171. Ans. D
There are 7 pairs of true ribs each attached dorsally to the vertebral column and ventrally to the sternum. Out of the other 5 pairs, 3 pairs are articulated to the ribs above while the other 2 are called floating ribs. There are 12pairs of ribs in total.

172. Ans. B
The flagellated cells lining the spongocoel is called choanocytes cells. Ostia are the pores present on the body of Sponges.

173. Ans. B
Aerosols cause air pollution. Air pollution can never cause increase in agricultural productivity. In fact, by various harmful effect on plants it causes decrease in agricultural output.

174. Ans. B
In human child, the number of baby tooth is 20. In adults it is 32. Premolars are absent in children.

175. Ans. D
Pinus is a plant bearing both male and female cones in the same plant. Thus it is monoecious.

176. Ans. B
The edible part of coconut is endosperm. Endosperm in coconuts are of two kinds – cellular and liquid.

177. Ans. C
Angiosperms like Mango exhibit double fertilization. It is a special feature of angiosperms.

178. Ans. C
Spliceosomes are the machinery used for splicing in Eukaryotic cells. Splicing refers to the removal of noncoding regions or Introns from the Heterogeneous RNA and joining of exons or the coding sequences to form the mature mRNA. It is absent in prokaryotes, i.e., Bacteria.

179. Ans. B
If H1 histone is associated with nucleosome in the DNA, then it indicates DNA to be packed in the cells normally. That is, condensation has occurred and DNA is existing in the form of chromatin fibre.

180. Ans. D
The core zone has no human activities. The Biosphere Reserve has 3 major zones:-
(a) Core zone – does not have any human interference
(b) Buffer zone – has limited human activity
(c) transition zone – allows human settlement, grazing cultivation etc.

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