Aggarwal CLASSES (A Division of Aggarwal Educare)

NEET TEST PAPER

TEST CODE : PNEETT012

PHYSICS, CHEMISTRY & BIOLOGY

[TIME : 3 HRS] **SOLUTIONS** **[MARKS : 720]**

Instructions

1. *The test paper consists of 180 questions . The maximum marks are 720.*
2. *Each question is allotted 4 (four) marks for each correct response.*
3. *¼ (one fourth) marks will be deducted for indicating incorrect response of each questions.No deduction from the total score will be made if no response is indicated for an item in the answer sheet.*
4. *There is only one correct response for each question. Filling up more than one response in any question will treated as wrong response and marks for wrong response will be deducted accordingly as per given instruction.*

PHYSICS

Q.1 Of the following quantities, which one has dimensions different from the remaining three?
(a) Energy per unit volume
(b) Force per unit area
(c) Product of voltage and charge per unit volume
(d) Angular momentum.

Ans: (d)

Sol: $=$ Moment of inertia $I \times$ Angular velocity ω.

$\therefore$ Dimensional formula $L = [ML^2][T^{-1}] = [ML^2T^{-1}]$

Q.2 A student measured the diameter of a small stell ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and zero of circular scale division coincides with 25 divisions above the reference level. if screw gauge has a zero error of -0.004 cm, the correct diameter of the ball is
(a) 0.521 cm **(b) 0.525 cm** **(c) 0.053 cm** **(d) 0.529 cm**

Ans: (d)

Sol: Dimeter of the ball

$= \text{MSR} + \text{CSR} \times (\text{Least count}) - \text{zero error}$

$= 5\,\text{mm} + 25 \times 0.001\,\text{cm} - (-0.004)\,\text{cm}$

$= 0.5\,\text{cm} + 25 \times 0.001\ \text{cm} - (-0.004)\,\text{cm} = 0.528\,\text{cm}.$

Q.3 The motion of a particle along a staight line is mass 'm' (in kg) moving in one dimension under the action of a force, is related to time 't' (in sec) by The displacement of the particle when its velocity is zero, will be
(a) 4 m **(b) 0 m (zero)** **(c) 6 m** **(d) 2 m**

Ans: (b)

Sol: Given : $t = \sqrt{x} + 3$ *or* $\sqrt{x} = t - 3$

$x = (t-3)^3$

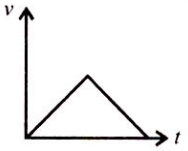
Velocity, $v = \frac{dx}{dt} = \frac{d}{dt}(t-3)^2 = 2(t-3)$

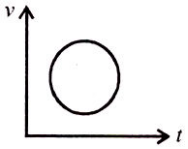
$2(t-3) = 0$ or $t = 3\ s$

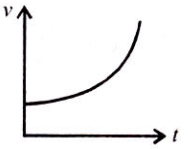
At $t = 3\ s$,

$x = (3-3)^2 = 0\,m$

Q.4 Which of the following curve does not represent motion in one dimension?

(a) 

(b) 

(c) 

(d) 

Ans: (b)

Sol: In one dimenstionl motion, the body can have at a time one value of velocity but not two values of velocities.

Q.5 A block A of mss m1 rests on a horizontal table. A light string connected to it passes over a frictionless pully at the edge of table and from its other end another block B of mass m_2 is suspended. The coefficient of kinetic friction between the block and the table is μ_k. When the block A is sliding on the table, the temsion in the string is

(a) $\frac{m_1 m_2 (1+\mu_k) g}{(m_1 + m_2)}$

(b) $\frac{m_1 m_2 (1-\mu_k) g}{(m_1 + m_2)}$

(c) $\frac{(m_2 + \mu_k m_1) g}{(m_1 + m_2)}$

(d) $\frac{(m_2 - \mu_k m_1) g}{(m_1 + m_2)}$

Ans: (a)

Sol: ———

Q.6 A monkey is decending from the branch of a tree with constant acceleration. If the breaking strength is 75% of the weight of the monkey, the minimum acceleration with which monkey can slide down without branch is

(a) g **(b)** $\frac{3g}{4}$ **(c)** $\frac{g}{4}$ **(d)** $\frac{g}{2}$

Ans: (c)

Sol: Let T be the tension in the branch of a tree when monkey is decending with

acceleration a

Thus, $mg - T = ma$

also, $T = \left(\frac{75}{100}\right)mg = \frac{3}{4}mg$

$\therefore \quad ma = mg - \left(\frac{3}{4}\right)mg = \frac{1}{4}mg$ or $a = \frac{g}{4}$

Q.7 A particle of mass m is released from rest and follows a parabolic path as shown. Assuming that the displacement of the mass from the origin is small, which graph correctly depicts the position of the particle as a function of time?

(a) **(b)** **(c)** **(d)**

Ans: (a)

Sol: ————

Q.8 The coefficient of restitution *e* for a perfectly elastic collision is

(a) 1 **(b) 0** **(c)** $\propto$ **(d) –1**

Ans: (a)

Sol: Coefficient of restitution or resilience of two bodies is defined as the constant ratio of relative velocity after impact to the relative velocity of the bodies before impact when the two bodies collide head on. Their velocities are in the opposite directions.

$$\text{Thus} \frac{v_1 - v_2}{u_1 - u_2} = \text{constant} = -e$$

The constant e is known as coeff. of restitution or resilience of two bodies. For a perfectly eleastic collision, $e = 1$ and for a perfectly inelastic collision, $e = 0$. Thus $0 \le e \le 1$.

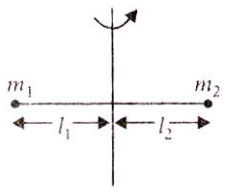
Q.9 A light rod of length *l* has two masses m_1 and m_2 attached to its two ends. The moment of inertia of the system about an axis perpendicular to the rod and passing through the centre of mass is

(a) $\frac{m_1 m_2}{m_1 + m_2} l^2$ **(b)** $\frac{m_1 + m_2}{m_1 m_2} l^2$ **(c)** $(m_1 + m_2) l^2$ **(d)** $\sqrt{m_1 m_2}\, l^2$

Ans: (a)

Sol: Here, $l_1 + l_2 = 1$

Centre of mass of the system.



$$l_1 = \frac{m_1 \times 0 + m_2 \times 1}{m_1 + m_2} = \frac{m_1 l}{m_1 + m_2}$$

$$l_2 = l - l_1 = \frac{m_1 l}{m_1 + m_2}$$

Required moment of inertia of the system.

$I = m_1 l^2_1 + m_2 l^2_2$

$$= (m_1 m^2{}_2 + m_2 m^2{}_1)\frac{l^2}{(m_1+m_2)^2}$$

$$= \frac{m_1 m_2 (m_1+m_2) l^2}{(m_1+m_2)^2} = \frac{m_1 m_2}{m_1+m_2} l^2$$

Q.10 A solid cylinder and a hollow cylinder, both of the same mass and same external diameter are relased from the same height at the same time on an inclined plane. Both roll down without slipping. Which one will reach the bottom first?

(a) Both together only when angle of inclination of plane is 45°
(b) Both together
(c) Hollow cylinder
(d) Solid cylinder

Ans: (d)

Sol: Time taken to reach the bottom of inclined plane.

$$t = \sqrt{\frac{2l\left(1+\frac{K^2}{R^2}\right)}{g\sin\theta}}$$

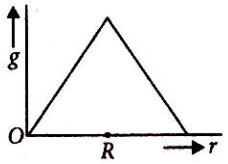
Here, l is length of incline plane

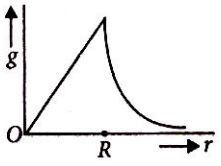
For solid cylinder $K^2 = \frac{R^2}{2}$

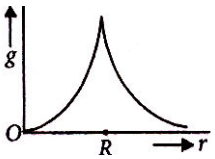
For hollow cylinder $K^2 = R^2$

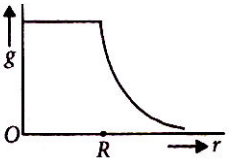
Hence, solid cylinder will reach the bottom first.

Q.11 Starting from the centre of the earth having radius R, the variation of g (acceleration due to gravity) is shown by

(a) 

(b) 

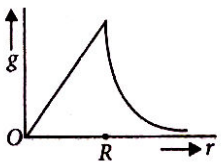
(c) 

(d) 

Ans: (b)

Sol: Acceleration due to gravity is given by

$$g = \begin{cases} \frac{4}{3}\pi\rho G r & ; r \le R \\ \frac{4}{3}\frac{\pi\rho R^3 G}{r^2} & ; r \le R \end{cases}$$



Q.12 Gravitational force is required for

(a) Stirring of liquid **(b) covection**

(c) conduction **(d) radiation**

Ans: (b)

Sol: ———

Q.13 The largest and the shortest distance of the eart from the sun are r1 and r2. Its distance from the sun when it is at perpendicular to the major-axis of the orbit drawn from the sun is

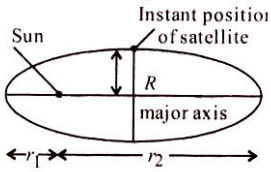
(a) $\frac{r_1 + r_2}{4}$ **(b)** $\frac{r_1 + r_2}{r_1 - r_2}$ **(c)** $\frac{2r_1 r_2}{r_1 + r_2}$ **(d)** $\frac{r_1 + r_2}{3}$

Ans: (c)

Sol: Applying the properties of ellipse, we have

$$\frac{2}{R} = \frac{1}{r_1} + \frac{1}{r_2} = \frac{r_1 + r_2}{r_1 r_2}$$

$$R = \frac{2r_1 r_2}{r_1 + r_2}$$



Q.14 Water rises to a height *h* in capillary tube. If the length of capillary tube above the surface of water is made less tha *h*, then

(a) water rises upto a point a little below the top and stays there.

(b) water does not rise at all.

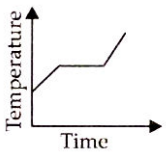
(c) Water rises upto the tip of capillary tube and then starts overflowering like a fountain.

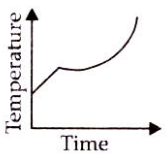
(d) water rises upto the top of capillary tube and stays there without overflowering.

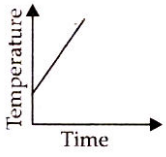
Ans: (d)

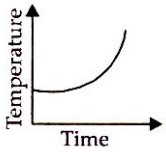
Sol: Water will not oveflow but will chnage its radius of curvature.

Q.15 Liquid oxygen at 50 K is heated to 300 K at constant pressure of 1 atm. The rate of heating is constant. Which one of the following graphs represnts the variation of temperature with time?

(a)


(b)


(c)


(d)


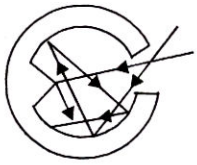
Ans: (a)

Sol: Temperature of liquid oxygen will first increase in the same phase. Then, the liquid oxygen will change to gaseous phase during which temperature will remain contsat/ After that temperature of oxygen in gasous state will increase. Hence option (a) represents corresponding temperature-time graph.

Q.16 Which of the following is best close to an ideal black body?
(a) black lamp
(b) cavity maintained at constant temperature
(c) platinum black
(d) a lump of charcoal heated to high temperature.

Ans: (b)

Sol: An ideal black body one which absorbs all the incident radiation without reflecting or transmitting any part of it. Black lamp absorbs approximately 96% of incident radiation.
An ideal black body can ve relasixed in practice by a small hole in the wall of a hollow body (as shown by figure) which is at uniform temperature. ANy radiation entering the hollow body through the holes suffere a number of reflections and ultimately gets completely absorbed. This can be faciliatated by coating the interior surface with black so that about 96% of the radiation is absorbed at each reflection. The portion of the interior surface opposite to the hole is made conical to avoid the escape of the reflected ray after one reflection.



Q.17 A gas is compressed isothermally to half its initial volume. The same gas is compressed separtaely through an adiabatic process until its volume is again reduced to half. Then
(a) Compressing the gas isothermally or adiabatically will require the same amount of work.
(b) Which of the case (whether compression through isothermal or through adiabatic process) requires more work will depend upon the atomicity of the gas.
(c) Compressing the isothermally will require more work to be done.
(d) Compressing the gas through adiabatic process will require more work to be done.

Ans: (d)

Sol: On P-V diagram,

> Area under isothermal curve.
So compressing the gas through adiabatic process will require more work to be done.

Q.18 A mass of diatomic gas at a pressure of 2 atmospheres is compressed adiabatically so that its temperature rises from 27°C to 927°C. The pressure of the gas in the final state is
(a) 8 atm (b) 28 atm (c) 68.7 atm (d) 256

Ans: (d)

Sol: For an adiabatic process

$$\frac{T^{\gamma}}{P^{\gamma-1}} = \text{constant}$$

$\therefore \quad \left(\frac{T_i}{T_f}\right)^{y} = \left(\frac{P_i}{P_f}\right)^{\gamma-1}$; $P_f = P_i\left(\frac{T_f}{T_i}\right)^{\frac{\gamma}{\gamma-1}}$ ...(i)

Substituting these values in eqn (i), we get

Here, $T_i = 27^oC = 300\ K,\ T_f = 927^oC = 1200\ K$

$P_i = 2$ atm, $\gamma = 1.4$

$$P_f = (2)\left(\frac{1200}{300}\right)^{\frac{1.4}{1.4-1}}$$

$= (2)(4)^{1.4/0.4} = 2(2^2)^{7/2} = (2)(2)^7 = 2^8 = 256$ atm

Q.19 The displacement of a particle along the x-axis is given by $x = a\sin^2\omega t$. The motion of the particle corres[onds to
(a) simple harmonic motion of frequency
(b) simple harmonic motion of frequency
(c) non simple harmonic motion
(d) simple harmonic motion of frequency

Ans: (c)

Sol: $x = a\sin^2\omega t = a\left(\frac{1-\cos 2\omega t}{2}\right)$ $(\because \cos 2\theta = 1 - 2\sin^2\theta)$

$$= \frac{a}{2} - \frac{a\cos 2\omega t}{2}$$

$\therefore$ Velocity, $v = \frac{dx}{dt} = \frac{2\omega a \sin 2\omega t}{2} = \omega a \sin 2\omega t$

Acceleration, $a = \frac{dv}{dt} = 2\omega^2 a\cos^2\omega t$

For the given displacement $x = a\sin^2\omega t$, $a \propto -x$ is not satisfied.

$T = \frac{2\pi}{2\omega} = \frac{\pi}{\omega}$

Q.20 The timpe period of mass suspended from a spring is T. If the spring is cut into four equal parts and the same mass is suspended from one of the parts, then the new time period will be
(a) $T/4$ (b) T (c) $T/2$ (d) $2T$

Ans: (c)

Sol: Let k be the force constant of spring. If k' is the force constat of each part, then

$\frac{1}{k} = \frac{4}{k'} \Rightarrow k' = 4k.$

$\therefore$ Time period $= 2\pi\sqrt{\frac{m}{4k}} = \frac{1}{2} \times 2\pi\sqrt{\frac{m}{k}} = \frac{T}{2}.$

Q.21 The composition of two simple harmonic motions of equal periods at right angle to each other and with a phase difference of π results in the displacement of the particle along

(a) circle **(b) figure of eight**

(c) straight line **(d) ellipse**

Ans: (c)

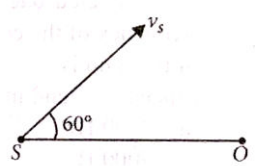
Sol: $x = a\sin\omega t$

and $y = b\sin(\omega t + \pi) = -b\sin\omega t.$

or $\frac{x}{a} = \frac{y}{b}$ or $y = -\frac{b}{a}x$

In is an equation of a straight line

Q.22 A source of sound D emitting waves of frequency 100 Hz and an observer O are located at some distance from each other. The source is moving with a speed of $19.4\,\mathrm{m\,s^{-1}}$ at an angle of 60° with the source observer line as shown in the firgure. The observer line is a rest. The apparent frequency observed is at rest. The apparent frequency observed by the observer (velocity of sound in air $330\,\mathrm{m\,s^{-1}}$), is



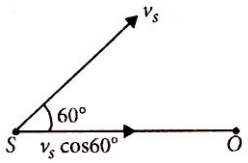
(a) 106 Hz **(b) 97 Hz** **(c) 100 Hz** **(d) 103 Hz**

Ans: (d)

Sol: Frequecny of source $v_o = 100\,\mathrm{Hz}$

Velocity of source, $\mathrm{v}_s = 19.5\,\mathrm{ms^{-1}}$

Velocity of sound in air, $\mathrm{v} = 330\,\mathrm{ms^{-1}}$



As the velocity of source along the source observer line is $\mathrm{v}_s = \cos 60°$ and the observer is at rest, so the apparent frquency obaserved by the obaserver is

$$v = v_0\left(\frac{v}{v - v_s\cos 60°}\right)$$

$$= (100\,\mathrm{Hz})\left[\frac{330\ \mathrm{ms^{-1}}}{330\,\mathrm{ms^{-1}}(19.4\,\mathrm{ms^{-1}})\left(\frac{1}{2}\right)}\right]$$

$$= (100\,\mathrm{Hz})\left(\frac{330\,\mathrm{ms^{-1}}}{330\,\mathrm{ms^{-1}} - 9.7\,\mathrm{ms^{-1}}}\right)$$

$$= (100\,\text{Hz})\left(\frac{330\,\text{ms}^{-1}}{320.3\,\text{ms}^{-1}}\right) = 103\ \text{Hz}$$

Q.23 The driver of a car travelling with speed 30 m/s towards a hill sounds a horn of frequency 600 Hz. If the velocity of sound in air is 330 m/s, the frequency of reflected sound as air is 330 m/s, the frequecny of reflected sound as heard by driver is

(a) 555.5 Hz (b) 720 Hz (c) 500 Hz (d) 550 Hz

Ans: (b)

Sol: Car is the source and the hill is oberver. Frequency heard at the hill, v_1

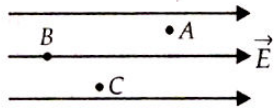
$$\therefore\ v_1 = \frac{v \times \text{v}}{(v - V)} = \frac{600 \times 330}{330 - 30}$$

Now for reflection, the hill is the source and the driver the observer.

$$\therefore\ v_2 = v_1 \times \frac{(330 + 30)}{330}$$

$$\Rightarrow v_2 = \frac{600 \times 330}{300} \times \frac{360}{330} \Rightarrow v_2 = 720\,\text{Hz}.$$

Q.24 A, B and C are threee points in a uniform electric field. The electric potential is



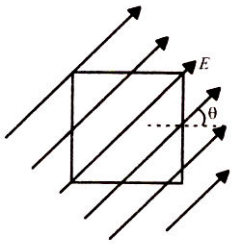
(a) maximum at C
(b) same at all the three points A, B and C
(c) maximum at A
(d) maximum at B

Ans: (d)

Sol: In the direction of electric field, electric potential decreases.

$\therefore\ V_B > V_C > V_A$

Q.25 A square surface of side L meter in the plane of the paper is placed in a uniform electric field E(volt/m) acting along the same plane at an angle θ with the horizontal side of the square as shown in figure.



The electric flux linked to the surface, in units of volt m is

(a) EL^2 (b) $EL^2\cos\theta$ (c) $EL^2\sin\theta$ (d) zero

Ans: (d)

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Sol: ———

Q.26 A set of ***n*** **equal resistors, of value *R* each, are connected in series to a battery of emf *E* and internal resistance R. The current drawn is *I*. Now, the n resistors are connected in parallel to the same battery. Then the current drawn from battery becomes 10*I*. The value of *n* is**
(a) 10 **(b) 11** **(c) 20** **(d) 9**

Ans: (a)

Sol: Current drawn from a battery when n resistors are connected in series is

$$I = \frac{E}{nR + R} \qquad \text{...(i)}$$

Current drawn from same battery when n resistors are connected in parallel is

$$10I = \frac{E}{R/n + R} \qquad \text{...(ii)}$$

On dividing eqn.(ii) by (i), $\frac{(n+1)\mathrm{R}}{(1/n+1)R}$

After solving the equation, $n = 10.$

Q.27 Consider the following two statements.
(A) Kirchhoff's junction law follows from the conservation of charge.
(B) Kirchhoff's loop law follows from the conservation of energy.
Which of the following is correct?
(a) Both (A) and (B) are wrong
(b) (A) is correct and (B) is wrong
(c) (A) is wrong and (B) is correct
(d) Both (A) and (B) are correct

Ans: (d)

Sol: Kirchhoff's junction law of Kirchhoff's first law is based on the conservation of charge.
Kirchhoff's loop law or Kirchhoff's second law is based on the consrvation of energy.
Hence both statemements (A) and (B) are correct.

Q.28 A milli voltmeter of 25 milli volt range is to be converted into an ammeter of 25 ampere range. The value (in ohm) of necessary shunt will be
(a) 0.001 **(b) 0.01** **(c) 1** **(d) 0.05**

Ans: (a)

Sol: $S = \frac{V_g}{(I - I_g)}$

Neglecting I_g

$$\therefore \quad S = \frac{V_g}{I} = \frac{25 \times 10^{-3} V}{25 A} = 0.001\Omega$$

Q.29 An electron moving in a circular orbit of radius *r* makes *n* rotations per second. The magnetic field produced at the centre has magnitude

(a) $\frac{\mu_0 n^2 e}{r}$ **(b)** $\frac{\mu_0 ne}{2r}$ **(c)** $\frac{\mu_0 ne}{2\pi r}$ **(d) zero**

Ans: (b)

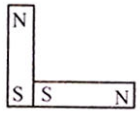
Sol: Current in the orbit, $I = \frac{e}{T}$

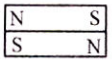
$$I = \frac{e}{(2\pi/\omega)} = \frac{\omega e}{2\pi} = \frac{(2\pi n)e}{2\pi} = ne$$

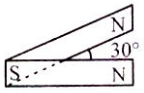
Magnetic field at centre of current carrying circular coil is given by

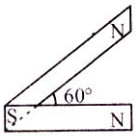
$$B = \frac{\mu_0 ne}{2r} = \frac{\mu_0 ne}{2r}$$

Q.30 Followinf figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment $\vec{m}$. Which configuration has highest net magnetic dipole moment?

(1) 

(2) 

(3) 

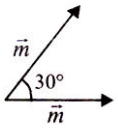
(4) 

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

Ans: (c)

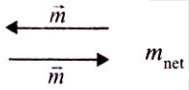
Sol: The direction of magnetic dipole moment is from south to north pole of the magnet.

In configuration (1),



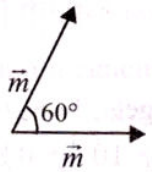
$$m_{net} = \sqrt{m^2 + m^2 + 2mm\cos 90^\circ}$$
$$= \sqrt{m^2 + m^2} = 2\sqrt{m}$$

In configuration (2),



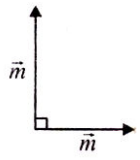
$$m_{net} = m - m = 0$$

In configuration (3),



$$m_{net} = \sqrt{m^2 + m^2 + 2mm\cos 30^\circ}$$
$$= \sqrt{2m^2 + 2m^2\left(\frac{\sqrt{3}}{2}\right)} = m\sqrt{2+\sqrt{3}}$$

In configuration (4),



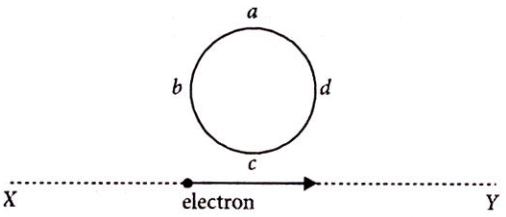
$$m_{net} = \sqrt{m^2 + m^2 + 2mm\cos 60^\circ}$$
$$= \sqrt{2m^2 + 2m^2\left(\frac{1}{2}\right)} = m\sqrt{3}$$

Q.31 A diamagnetic material in a magnetic field moves
(a) from stronger to the weaker parts of the field
(b) from weaker to the stronger parts of the field
(c) perpendicular to the field
(d) in none of yje above directions

Ans: (a)

Sol: ———

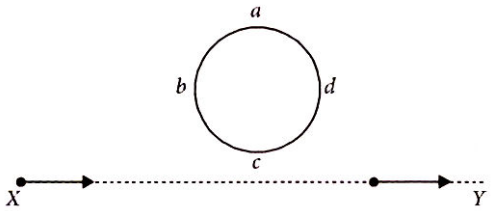
Q.32 An electron moves on a stright kine path XY as shown, The abcd is a coil adjacent to the path of electron. What will be the direction of current, if any, induced in the coil?



(a) The current will reverse its diretion as the eleactron goes past the coil
(b) No current induced
(c) *abcd*
(d) *adcb*

Ans: (a)

Sol:



When the electron moves from X to Y, the flux linked with the coil *abcd* (which is into the page) will first increase and then decrease as the electron passes by. So the induced current in the coil will be first anticlockwise and will reverse its direction (i.e. will become clockwise) as the electron goes past the coil.

Q.33 A coil of inductive reactance 31Ω has a resistance of 8Ω It is placed in the series with a condenser of capacitative reactance The combination is connected to an a.c. soruce of 110 V. The power factor of the circuit is
(a) 0.33 (b) 0.56 (c) 0.64 (d) 0.80

Ans: (d)

Sol: $X_L = 31\Omega,\ X_C = 25\Omega,\ R = 8\Omega$

$$Z = \sqrt{(R^2) + (X_L - X_C)^2}$$

$$= \sqrt{(8)^2 + (31-25)^2} = \sqrt{64+36} = 10\Omega.$$

$$\text{Power factor, } \cos\phi = \frac{R}{Z} = \frac{8}{10} = 0.8$$

Q.34 The decreasing order of wavelength of infared, microwave, ultraviolet and gamma rays is
(a) microwave, infrared, ultraviolet, gamma rays
(b) gamma rays, ultraviolet, infrared, microwaves
(c) microwaves, gamma rays, infrared, ultraviolet
(d) infrared, microwave, ultraviolet, gamma rays

Ans: (a)

Sol: The decreasing order of wavelength of the given electromagnetic waves is as follows :

$\lambda_{\text{Microwave}} > \lambda_{\text{Infrared}} > \lambda_{\text{Ultraviolet}} > \lambda_{\text{Gamma rays}}$

Q.35 In a diffraction pattern due to a single slit of width a, the first minimum is observed at an angle 30° when light of wavelength $5000\,\text{Å}$ is incident on the slit. The first secondary maximum is observed at an angle of

(a) $\sin^{-1}\left(\frac{1}{2}\right)$ **(b)** $\sin^{-1}\left(\frac{1}{4}\right)$ **(c)** $\sin^{-1}\left(\frac{3}{4}\right)$ **(d)** $\sin^{-1}\left(\frac{2}{3}\right)$

Ans: (b)

Sol: Here, $\frac{I_1}{I_2} = n$

$$\frac{I_{max}}{I_{min}} = \left(\frac{\sqrt{I_1}+\sqrt{I_2}}{\sqrt{I_1}-\sqrt{I_2}}\right)^2 = \left(\frac{\sqrt{I_1/I_2}+1}{\sqrt{I_1/I_2}-1}\right)^2 = \left(\frac{\sqrt{n}+1}{\sqrt{n}-1}\right)^2$$

$$\frac{I_{max}-I_{min}}{I_{max}-I_{min}} = \frac{\frac{I_{max}}{I_{min}}-1}{\frac{I_{max}}{I_{min}}+1}$$

$$= \frac{\left(\frac{\sqrt{n}+1}{\sqrt{n}-1}\right)^2-1}{\left(\frac{\sqrt{n}+1}{\sqrt{n}-1}\right)^2+1} = \frac{\left(\sqrt{n}+1\right)^2-\left(\sqrt{n}-1\right)^2}{\left(\sqrt{n}+1\right)^2+\left(\sqrt{n}-1\right)^2}$$

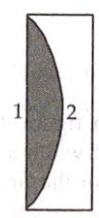
$$= \frac{4\sqrt{n}}{2(n+1)} = \frac{2\sqrt{n}}{1}$$

Q.36 A plano convex lens fits exactly into a plano concave lens. If lenses are made of different materials of refractive indices μ_1 and μ_2 R is the radius of curvature of the curved surface of the lenses, then the focal length of the combinatrion is

(a) $\frac{R}{(\mu_1-\mu_2)}$ **(b)** $\frac{2R}{(\mu_2-\mu_1)}$ **(c)** $\frac{R}{2(\mu_1+\mu_2)}$ **(d)** $\frac{R}{2(\mu_1-\mu_2)}$

Ans: (a)

Sol: The combination of two lenses 1 and 2 is as shown in figure.



$\therefore \frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$

According to lens maker's formula

$$\frac{1}{f_1} = (\mu_1 - 1)\left(\frac{1}{\infty} - \frac{1}{-R}\right) = \frac{(\mu - 1)}{R}$$

$$\frac{1}{f_2} = (\mu_2 - 1)\left(\frac{1}{-R} - \frac{1}{\infty}\right)$$

$$\frac{1}{f_2} = (\mu_2 - 1)\left(-\frac{1}{R}\right) = -\frac{(\mu_2 - 1)}{R}$$

$$\therefore \frac{1}{f} = \frac{(\mu_1 - 1)}{R} - \frac{(\mu_2 - 1)}{R}$$

$$\frac{1}{f} = \frac{(\mu_1 - \mu_2)}{R}; f = \frac{R}{(\mu_1 - \mu_2)}$$

Q.37 Two thin lenses of focal lengths f_1 and f_2 are in contact and coaxial. The power of the combinations is

(a) $\frac{f_1 + f_2}{2}$ **(b)** $\frac{f_1 + f_2}{f_1 f_2}$ **(c)** $\sqrt{\frac{f_1}{f_2}}$ **(d)** $\sqrt{\frac{f_2}{f_1}}$

Ans: (b)

Sol: $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$; $\therefore$ Power $P = \frac{f_1 + f_2}{f_1 f_2}$

Q.38 The de-Broglie wavelength of a neutron in thermal equilibrium with heavy water at a temperature T (kelvin) and mass *m*, is

(a) $\frac{h}{\sqrt{3nkT}}$ **(b)** $\frac{2h}{\sqrt{3mkT}}$ **(c)** $\frac{2h}{\sqrt{mkT}}$ **(d)** $\frac{h}{\sqrt{mkT}}$

Ans: (a)

Sol: Kinetic energy of a neutron in thermal equilibrium with heavy water at a temperature T is given as

$$K = \frac{3}{2}kT \quad \ldots(i)$$

Also momentum (p) is, $p = \sqrt{2mK}$

From eqn. (i)

$$p = \sqrt{2m.\frac{3}{2}kT} = \sqrt{3mkT}$$

Required de-Broglie wavelength is given as

$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{3mkT}}$$

Q.39 Electrons used in an electron microscope are accelerated by a voltage of 25 kV. If the voltage is increased to 100 kV then the de-Broglie wavelength associated with the electrons would

(a) increase by 2 times **(b) decrese by 2 times**

(c) decrease by 4 times **(d) increase by 4 times**

Ans: (b)

Sol: The de Brogile wavelength associated with the electrons is

$$\lambda = \frac{1.227}{\sqrt{V}}$$

where V is the accelerating potential in volts.

or $\lambda \propto \frac{1}{\sqrt{V}}$

$$\therefore \frac{\lambda_1}{\lambda_2} = \sqrt{\frac{V_2}{V_1}} = \sqrt{\frac{100\times10^3}{25\times10^3}} = 2 \text{ or } \lambda_2 = \frac{\lambda_1}{2}$$

Q.40 Which of the following is not the property of cathode rays?

(a) photo electric effect **(b) interference**
(c) refraction **(d) polarization**

Ans: (a)

Sol: **———**

Q.41 In the spectrum of hydrogen, the ratio of the longest wavelength in the Lyman series to the longest wavelength in the Balmer series is

(a) $\frac{27}{5}$ **(b)** $\frac{5}{27}$ **(c)** $\frac{4}{9}$ **(d)** $\frac{9}{4}$

Ans: (b)

Sol: The wavelength of a spectral line in the Lyman series is

$\frac{1}{\lambda_L} = R\left(\frac{1}{1^2} - \frac{1}{n^2}\right), n = 2,3,4, \ldots\ldots$ and that in the Balmer series is

$\frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right), n = 3,4,5, \ldots\ldots$

For the longest wavelength in the Lyman series,

$n = 2$

$$\therefore \frac{1}{\lambda_L} = R\left(\frac{1}{1^2} - \frac{1}{n^2}\right) = R\left(\frac{1}{1} - \frac{1}{4}\right) = R\left(\frac{4-1}{4}\right) = \frac{3R}{4}$$

or $\lambda_L = \frac{4}{3R}$

For the longest wavelength in the Balmer series.

$n = 3$

$$\therefore \frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = R\left(\frac{1}{4} - \frac{1}{9}\right) = R\left(\frac{9-4}{36}\right) = \frac{5R}{36}$$

or $\lambda_B = \frac{36}{5R}$

Thus, $\frac{\lambda_L}{\lambda_B} = \frac{\frac{4}{3R}}{\frac{36}{5R}} = \frac{4}{3R} \times \frac{5R}{36} = \frac{5}{27}$

Q.42 The half life of a radioactive nucleus is 50 days. The time interval $(t_2 - t_1)$ between the time t_2 when of it has decayed and the time when $\frac{2}{3}$ of it had decayed is

(a) 30 days (b) 50 days (c) 60 days (d) 15 days

Ans: (b)

Sol: According to radioactive decay law

$N = N_0 e^{-\lambda t}$

where N_0 = Number of radiocative nuclei at time

$t = 0$

N = Number of radioactive nuclei left undecayed at any time t

λ = decay constant

At time $t_2, \frac{2}{3}$ of the sample and hecayed

$\therefore \; N = \frac{1}{3} N_0$

$\therefore \; \frac{1}{3} N_0 = N_0 e^{-\lambda t_2}$ ...(i)

At time $t_1 = \frac{1}{3}$ of the sample had decayed,

$\therefore \; N = \frac{2}{3} N_0$

$\therefore \; \frac{2}{3} N_0 = N_0 e^{-\lambda t_2}$

Divide (i) by (ii), we get

$\frac{1}{2} = \frac{e^{-\lambda t_2}}{e^{-\lambda t_1}} \Rightarrow \frac{1}{2} = e^{-\lambda(t_2 - t_1)}$

$\lambda(t_2 - t_1) = \ln 2$

$t_2 - t_1 = \frac{\ln 2}{\lambda} = \frac{\ln 2}{\left(\frac{\ln 2}{T_{1/2}}\right)} \qquad \left(\because \lambda = \frac{\ln 2}{T_{1/2}}\right)$

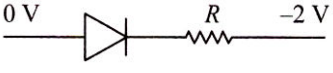
$= T_{1/2} = 50 \text{ days}$

Q.43 Which one of the following represents forward bias diode?

(a) 

(b) 

(c) 

(d) 

Ans: (d)

Sol: A diode is said to be forward biased if p-side is at higher potential than n-side of p-n junction.

Q.44 In semiconductors at a room temperature
(a) the valence band is partiallt empty and the conduction band is partially filled
(b) the valence band is completely filled and the conduction band is partially filled
(c) the valence band is completely filled
(d) the conduction band is completely empty

Ans: (a)

Sol: Insemiconductors at room temperature the electrons get through energy so that they are able to over come the forbidden gap. Thus at room temerature the valence band is partially empty and conduction band is partially filled. Conduction band in semiconductor is completely empty only at 0 K.

Q.45 The dimensions of RC is
(a) square of time **(b) square of inverse time**
(c) time **(d) inverse time**

Ans: (c)

Sol: $\text{Units of RC} = \text{ohm} \times \text{ohm}^{-1} \times \text{second} = \text{second}.$

$\text{Therefore dimensions of RC} = \text{time}.$

CHEMISTRY

Q.46 The number of moles of oxygen in one litre of air containing 21% oxygen by volume, under standard conditions, is
(a) 0.0093 mol **(b) 0.186 mol** **(c) 2.10 mol** **(d) 0.21 mol**

Ans: (a)

Sol: Volume of oxygen in one litre of air

$$= \frac{21}{100} \times 1000 = 210\,\text{mL}$$

$$\text{Therefore no. of mol} = \frac{210}{22400} = 0.0093\,\text{mol}$$

Q.47 Volume of CO_2 obtained by the complete decomposition of 9.85 g of $BaCO_3$ is
(a) 2.24 L **(b) 1.12 L** **(c) 0.84 L** **(d) 0.56 L**

Ans: (b)

Sol: $BaCO_3 \rightarrow BaO + CO_2$

$197.34\,\text{g} \rightarrow 22.4\,\text{L}$ at N.T.P.

$$9.85\,\text{g} \rightarrow \frac{22.4}{197.34} \times 9.85 = 1.118\,\text{L}$$

$\Rightarrow 9.85\,\text{g}\ BaCO_3$ will produce $1.118\,\text{L}\ CO_2$ at N.T.P. on the complete decomposition.

Q.48 The angular momentum of electron in '*d*' orbital is equal to

(a) $2\sqrt{3}\,h$ **(b)** oh **(c)** $\sqrt{6}\,h$ **(d)** $\sqrt{2}\,h$

Ans: (c)

Sol: Angular momentum $= \sqrt{l(l+1)h}$

Angular momentum $= \sqrt{2(2+1)h} = \sqrt{6}h$

For d orbital, $l = 2$

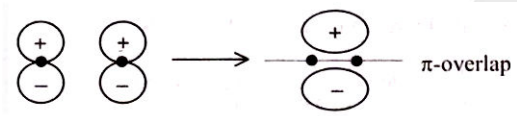
Q.49 Main axis of a diatomic molecule is *z*, molecular orbital p_x and p_y overlap to form which of the following orbitals.

(a) π **molecular orbital** **(b)** σ **molecular orbital**

(c) δ **molecular orbital** **(d) No bond will form.**

Ans: (a)

Sol: For π overlap, the lobes of the atomic orbitals are perpendicular to the line joining the nuclei.



Hence, only sidewise overlapping takes place.

Q.50 Which of the following oxides is most acidic in nature?

(a) MgO **(b) BeO** **(c) BaO** **(d) CaO**

Ans: (b)

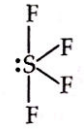
Sol: In metals, on moving down the group, metallic character increases, so basic nature increases hence most acidic will be BeO.

Q.51 In the periodic table, with the increase in atomic number, the metallic charcter of an element

(a) decreases in a period and increases in a group
(b) increases in a period and decreases in a group
(c) increases both in a period and the group
(d) decreases in a period and the group

Ans: (a)

Sol: Metallic character decreases in a period and increases in a group.



Q.52 Which if the following is a polar molecule?

(a) SiF_4 **(b)** XeF_4 **(c)** BF_3 **(d)** SF_4

Ans: (d)

Sol: SF_4 has sp^3d-hybridisation and see-saw shape with (4 bp + 1lp)

Q.53 The correct order of C – O bond length among CO, CO_3^{2-}, CO_2 is

(a) $CO < CO_3^{2-} < CO_2$ **(b)** $CO_3^{2-} < CO_2 < CO$

(c) $CO < CO_2 < CO_3^{2-}$ **(d)** $CO_2 < CO_3^{2-} < CO$

Ans: (c)

Sol: More single bond character in resonance hybrid, more is the bond length. Hence the increasing bond length is

$CO < CO_2 < CO_3^{2-}$

Q.54 A gas such as carbon monoxide would be most likely to obey the ideal gas law at

(a) low temperatures and high pressures
(b) high temperatures and high pressures
(c) low temperatures and low pressures
(d) high temperatures and low pressures.

Ans: (d)

Sol: Real gases show ideal gas behaviour at high temperatures and low pressures.

Q.55 50 mL of hydrogen diffuses out through a small hole of a vessel, in 20 minutes. The time taken by 40 mL of oxygen to diffuse out is

(a) 32 minutes (b) 64 minutes (c) 8 minutes (d) 12 minutes

Ans: (b)

Sol: Volume of hydrogen $= 50$ mL; Time for diffusion (t) = 20 min and volume of oxygen $= 40$ mL.

Rate of diffusion of hydrogen $(r_1) = \frac{50}{20} = 2.5$ mL/min

Rate of diffusion of oxygen $(r_2) = \frac{40}{t}$ mL/min

Since the molecular mass of hydrogen $(M_1) = 2$ and that of oxygen $(M_2) = 32$, therefore

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}} \Rightarrow \frac{2.5}{40/t} = \sqrt{\frac{32}{2}}$$

$$\Rightarrow \frac{t}{16} = 4 \Rightarrow t = \text{minutes}$$ **s**

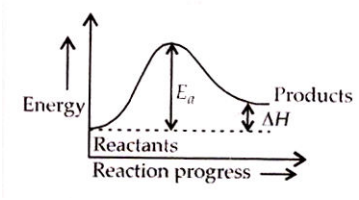
Q.56 For an endothermic reaction, energy of activation is E_a **and enthalpy of reaction is (both of these in kJ/mol). Minimum value of E_a will be**

(a) less than ΔH **(b) equal to ΔH**

(c) more than ΔH **(d) equal to zero**

Ans: (c)

Sol:



We find that the least E_a will be more than for an endothermic reaction since

$E_{products} > E_{reactants}$

Q.57 Which of the following pairs of a chemical reaction is certain to result in a spontaneous reaction?
(a) Exothermic and increasing disorder
(b) Exothermic and decreasing disorder
(c) Endothermic and increasing disorder
(d) Endothermic and decreasing disorder.

Ans: (a)

Sol: For spontaneous reaction $\Delta H = -ve,\ \Delta S = +ve$
Spontaneity depends upon both critical minumum energy and maximum randomness / disorder.

Q.58 For the reversible reaction,

$$N_{2(g)} + 3H_{2(g)} \quad 2NH_{3(g)} + \text{heat}$$

The equilibrium shift in forward direction
(a) by increasing the concentration of $NH_{3(g)}$
(b) by decreasing the pressure
(c) by decreasing the concentrations of $N_{2(g)}$ and H2(g)
(d) by increasing pressure and decreasing temperature.

Ans: (d)

Sol: As the forward reaction is exothermic and leads to lowering of pressure (produces lesser number of gaseous moles) hence, according to Le Chatelier's principles. at high pressure and low temperature, the given reversible reaction will shift in forward direction to from more product.

Q.59 In a buffer solution containing equal concentration of B^- and HB, the K_b for B^- is 10^{-10} The pH of buffer solution is
(a) 10 (b) 7 (c) 6 (d) 4

Ans: (d)

Sol: We know, $pOH = pK_b + \log\dfrac{[B^-]}{[HB]}$

Since, $[B^-] = [HB]$ (given)

$\therefore\ pOH = pK_b \Rightarrow pOH = 10$

$\therefore\ pH = 14 - 10 = 4$

Q.60 Number of moles of MnO_4^- required to oxidize one mole of ferrous oxalate completely in acidic medium will be
(a) 7.5 moles (b) 0.2 moles (c) 0.6 moles (d) 0.4 moles.

Ans: (d)

Sol: $\left[5e^- + MnO_4 + 8H^+ \rightarrow Mn^{2+} + 4H_2O \ ..(i) \times 2\right]$

$$\left[C_2O_4^{2-} \rightarrow 2e^- + 2CO_2 \ ...(ii)\right] \times 5$$

$2MnO_4^- + 16H^- + 5C_2O_4^{2-} \rightarrow 2Mn^{2+} + 10CO_2$

2 moles of MnO_4^- required to oxidise 5 moles of oxalate.

$\therefore$ Number of moles of MnO_4^- required to oxidise 1 mole of oxalate = 2/5 = 0.4.

Q.61 Oxidation state of Fe in Fe3O4 is

(a) $\frac{5}{4}$ **(b)** $\frac{4}{5}$ **(c)** $\frac{3}{2}$ **(d)** $\frac{8}{5}$

Ans: (d)

Sol: $Fe_3O_4 \rightarrow 3x + 4(-2) = 0 \Rightarrow x = +\frac{8}{5}$

Q.62 Which of the following groups of ions makes the water hard?

(a) Sodium and bicarbonate **(b) Magnesium and chloride**

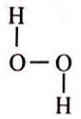
(c) Potassium and sulphate **(d) Ammonium and chloride**

Ans: (b)

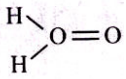
Sol: Hardness of water, due to the presence of chlorides and sulphates of Ca and Mg is called perma nent hardness. Hence, hard water will consist of Mg^{2+} and Cl^- ions.

Q.63 Which of the following is the true structure of H_2O_2?

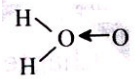
(a) **H – O – O – H** **(b)**



(c)

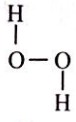


(d)



Ans: (b)

Sol:



is the true structure.

Q.64 Property of the alkaline earth metals that increases with their atomic number

(a) solubility of their hydroxides in water

(b) solubility of their sulphates in water

(c) ionization energy

(d) electronegativity

Ans: (a)

Sol: The solubility of an ionic compound depends on two factors:

(a) lattice energy, and (b) hydration energy

In case of alkaline metal hydroxides, the lattice energy decreases as we move down the group. This decrease is more than the decrease in the hydration energy down the group.

Q.65 Which of the following atoms will have the smallest size?
(a) Mg (b) Na (c) Be (d) Li

Ans: (c)

Sol: The atomic size decreases within a period from left to right, therefore Li > Be and Na > Mg The size increases in a group from top to bottom, Hence, the size of Na is greater than Li. Overall order Na > Mg > Li > Be
Thus, Be has smallest size.

Q.66 Which of the following oxide is amphoteric?
(a) SnO_2 (b) CaO (c) SiO_2 (d) CO_2

Ans: (a)

Sol: SnO_2 reacts with acid as well as base. So SnO_2 is an amphoteric.

$$SnO_2 + 4HCl \rightarrow SnCl_2 + 2H_2O$$

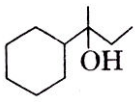
$$SnO_2 + 2NaOH \rightarrow Na_2SnO_3 + H_2O$$

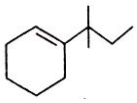
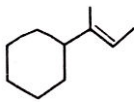
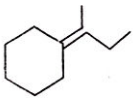
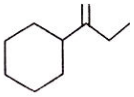
CaO is basic in nature while SiO_2 and CO_2 are acidic in nature.

Q.67 Carbon ans silicon belong to (IV) group. The maximum coordination number of carbon in commonly occuring compounds is 4, whereas that of silicon is 6. This is due to
(a) availability of low lying *d*-orbitals in silicon
(b) large size of silicon
(c) more electropositive nature of silicon
(d) both (b) and (c)

Ans: (a)

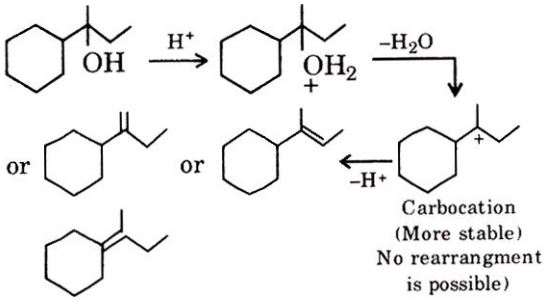
Sol: Carbon has no d-orbitals, while silicon contains *d*-orbitals in its valence shell which can be used for bonding purposes.

Q.68 Which of the following is not the product of dehydration of  **?**

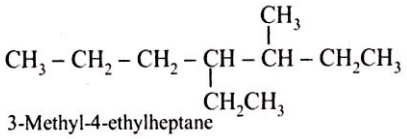
(a)  **(b)**  **(c)**  **(d)** 

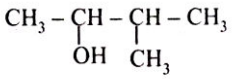
Ans: (a)

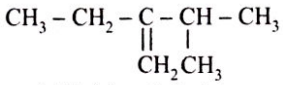
Sol:

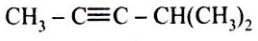


Q.69 Names of some compounds are given. Which one is not in IUPAC system?

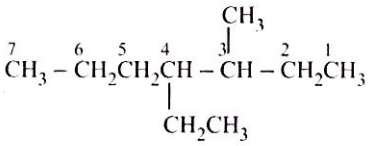
(a) 
3-Methyl-4-ethylheptane

(b) 
3-Methyl-2-butanol

(c) 
2-Ethyl-3-methylbut-1-ene

(d) 
4-Methyl-2-pentyne

Ans: (a)

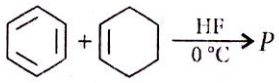
Sol: 

Q.70 Isomers of a substance must have most stable carbocation (carbonium ion)?
(a) structural formula **(b) physical properties**
(c) chemical properties **(d) molecular formula**

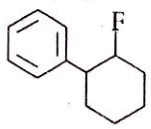
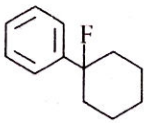
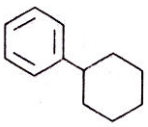
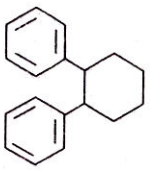
Ans: (d)

Sol: Isomers must have same molecular formula but different structural formula.

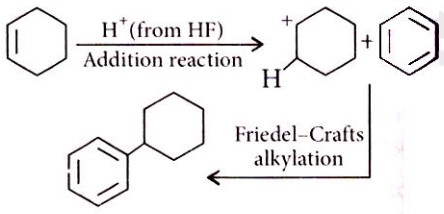
Q.71 In the given reaction,



the product P is

(a)  **(b)**  **(c)**  **(d)** 

Ans: (c)

Sol: 

Q.72 Which of the following is a sink for CO?
(a) Microorganisms present in the soil
(b) Oceans
(c) Plants
(d) Haemoglobin

Ans: (a, d)

Sol: Microorganisms presnt in the soil consume atmospgeric CO. Haemoglobin has higher affinity for CO and it combines with CO to form carboxyhaemoglobin.

Q.73 Copper crystallises in a face-centred cubic lattice with a unit cell length of 361 pm, What is the radius of copper atom in pm?
(a) 157 (b) 181 (c) 108 (d) 128

Ans: (d)

Sol: Since Cu crystallises in a face-centred cubic lattice,

Atomic radius, $r = \frac{a}{2\sqrt{2}} (a = \text{edge length} = 361 \text{ pm})$

$\therefore \; r = \frac{361}{2\sqrt{2}} = 127.6 \approx 128 \text{ pm}$

Q.74 The mole fraction of the solute in one molal aqueous solution is
(a) 0.009 (b) 0.018 (c) 0.027 (d) 0.036

Ans: (b)

Sol: 1 mole of solute present in 1 kg of H_2O

1 mole of solute present in $\frac{1000}{18}$ g mole of H_2O

$X_{solute} = \frac{1}{1000+1} = \frac{18}{1018} = 0.01765 \approx 0.018$

Q.75 A hydrogen gas electrode is made by dipping platinum wire in a solution of HCl of pH = 10 and by passing hydrogen gas around the platinum wire at one atm pressure. The oxidation potential of electrode would be
(a) 0.118 V (b) 1.18 V (c) 0.059 V (d) 0.59 V

Ans: (d)

Sol: $\underset{1 \text{ atm}}{H_2} \rightarrow \underset{10^{-10}}{2H^+} + 2e^-$

$E_{H_2/H^+} = 0 - \frac{0.059}{2} \log \frac{(10^{-10})^2}{1}$

$E_{H_2/H^+} = +0.59 \text{ V}$

Q.76 If the rate of the reaction is equal to the rate constant, the order of the reaction is
(a) 0 (b) 1 (c) 2 (d) 3

Ans: (a)

Sol: $A \rightarrow$ products

If $-\frac{dx}{dt} = k$, it means $-\frac{dx}{dt} = k[A]^0 = k$

Hence order of reaction must be zero.

Q.77 Which is not correct regarding the adsorption of a gas on surface of a solid?
(a) On increasing temperature adsorption increases continuously.
(b) Enthalpy and entropy change is negative.
(c) Adsorption is more for some specific substance.
(d) It is a reversible reaction.

Ans: (a)

Sol: Adsorption is the ability of a substance to concentrate or hold gases, liquids or dissolved substance upon its surface. Solids adsorb greater amounts of substances at lower temperature. In general, adsorption decreases with increase in temperature.

Q.78 The following reactions take place in the blast furnace in the preparation of impure iron. Identify the reaction pertaining to the formation of the slag.

(a) $Fe_2O_{3(s)} + 3CO_{(g)} \rightarrow 2Fe_{(l)} + 3CO_{2(g)}$

(b) $CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$

(c) $CaO_{(s)} + SiO_{2(s)} \rightarrow CaSiO_{3(s)}$

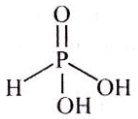
(d) $2C_{(s)} + O_{2(g)} \rightarrow 2CO_{(g)}$

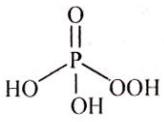
Ans: (c)

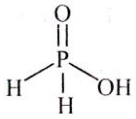
Sol: Slag is formed by the reaction

$CaO + SiO_2 \rightarrow CaSiO_3$

Q.79 The structural formula of hypophosphorous acid is

(a) 

(b) 

(c) 

(d) None of these

Ans: (c)

Sol: The formula of hypophosphorous acid is H_3PO_2 as shown in (c). It is monobasic acid.

Q.80 Hypo is used in photography to
(a) reduce AgBr grains to metallic silver
(b) convert metallic silver to silver salt
(c) remove undecomposed silver bromide as a soluble complex
(d) remove reduced silver.

Ans: (c)

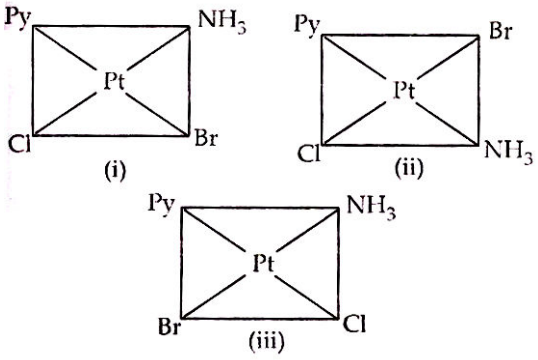
Sol: Undecomposed AgBr forms a soluble complex with hypo and the reaction is given as :

$AgBr + 2Na_2S_2O_3 \rightarrow Na_3[Ag(S_2O_3)_2]$

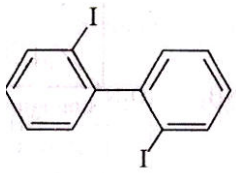
Q.81 The complex, $[Pt(Py)(NH_3)BrCl]$ will have how many geometrical isomers?
(a) 3 **(b) 4** **(c) 0** **(d) 2**

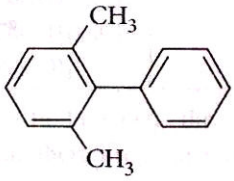
Ans: (a)

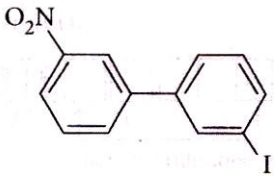
Sol: $[Pt(Py)(NH_3)BrCl]$ can have three isomers.

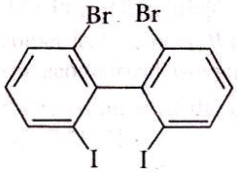


Q.82 Which of the following biphenyls is optically active?

(a) 

(b) 

(c) 

(d) 

Ans: (d)

Sol: o - Substituted biphenyls are optically active as both the rings are not in one plane and their mirror images are non-superimposable.

Q.83 After he emission of one α- particle followed by one β- particule from the atom of the number of neutrons in the atom will be
(a) 144 (b) 143 (c) 148 (d) 146

Ans: (b)

Sol: $^{238}_{92}X \xrightarrow{-\alpha} {}^{234}_{92}Y \xrightarrow{-\beta} {}^{234}_{91}Z$

Therefore, number neutrons in $^{234}_{91}Z$

$$= 234 - 91 = 143$$

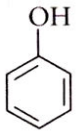
Q.84 Ethyl chloride is converted into diethyl ether by
(a) Perkins reaction
(b) Grignard reaction
(c) Wurtz synthesis
(d) Williamson's synthesis

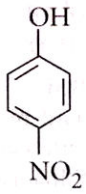
Ans: (d)

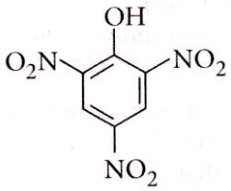
Sol: $C_2H_5 - Cl + Na - O - C_2H_5 \rightarrow C_2H_5 - O - C_2H_5 + NaCl$

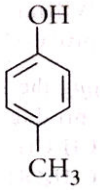
The above reaction is called as Williamson's synthesis.

Q.85 Which one is the most acidic compound?

(a) 

(b) 

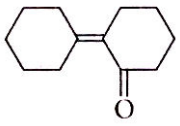
(c) 

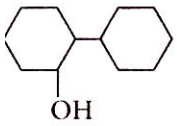
(d) 

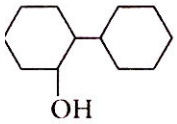
Ans: (c)

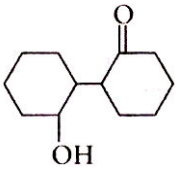
Sol: Electron withdrawing groups increase the acidity while electron donating groups decrease the acidity of phenol.

Q.86 Of the following, which is the product formed when cyclohexanone undergoes aldol condensation followed by heating?

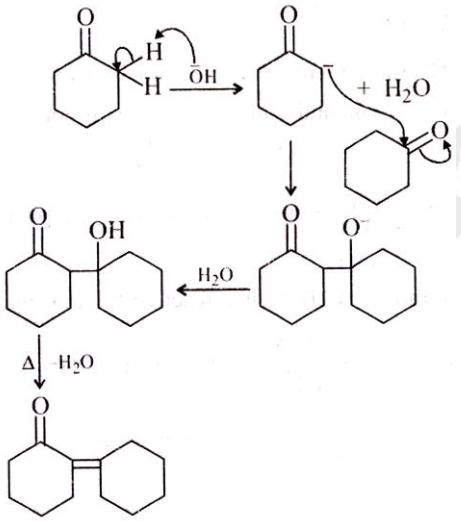
(a) 

(b) 

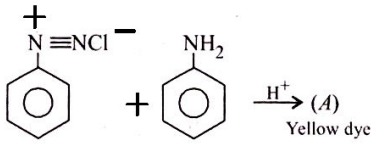
(c) 

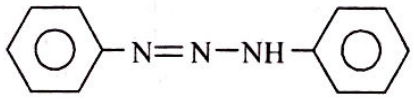
(d) 

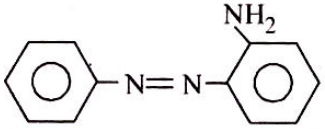
Ans: (a)

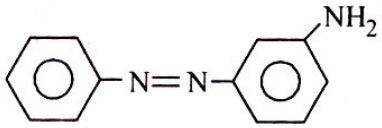
Sol: 

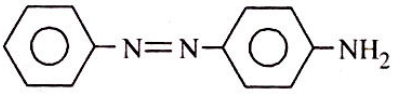
Q.87 In the following reaction, the product (A) is



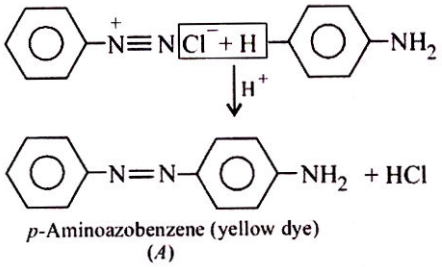
(a) 

(b) 

(c) 

(d) 

Sol:



Ans: (d)

Q.88 In DNA, the linkages between different nitrogenous bases are
(a) phosphate linkage **(b) H-bonding**
(c) glycosidic linkage **(d) peptide linkage**

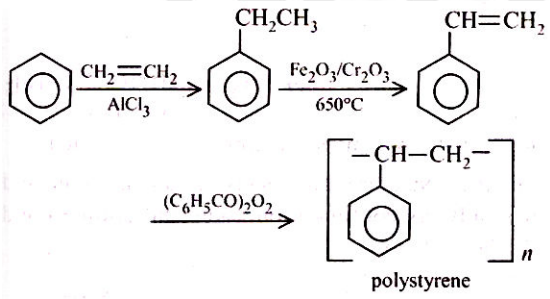
Ans: (b)

Sol: Nitrogeneous bases are linked together by hydrogen bonds.

Q.89 Which one of the following is a chain growth polymer?
(a) Starch **(b) Nucleic acid**
(c) Polystyrene **(d) Protein**

Ans: (c)

Sol: Chain-growth polymers involve a series of reactions each of which consume a reactive particle and produces another similar one. The reactive particles may be free radicals or ions (cation or anion) to which monomers get added by a chain reaction. It is an important reaction of alkenes and conjugated dienes or indeed of all kinds of compounds that contains $C-C$ double bonds.



Q.90 Mixture of chloroxylenol and terpineol acts as
(a) antiseptic **(b) antipyretic**
(c) antibiotic **(d) analgesic**

Ans: (a)

Sol: Dettol which is a well known antiseptic is a mixture of chloroxylenol and α-terpineol in a suitable solvent.

BIOLOGY

Q.91 One of the most important functions of botanical gardens is that
(a) they provide a beautiful area of recreation
(b) one can observe tropical plants there
(c) they allow *ex situ* conservation of germplasm
(d) they provide the natural habitat for wild life.

Ans: (c)

Sol: *Ex situ* conservation means "offsite conservation". It is the process of protecting endangered species of plants and animals by removing endangered species of plants and animals by removing it from an unsafe or threatened habitat and placing it or part of it under the care of humans. Botanical garden serve *ex situ* conservation of germplasm of different plants, to maintain rare and endemic plant species and also to provide recreation and knowledge about plants to a common man.

Q.92 A taxon is
(a) a group of related families
(b) a group of related species
(c) a type of living organisms
(d) a taxonomic group of any ranking.

Ans: (d)

Sol: The world taxon signifies a taxonimic group of any rank which represents the real biological organisms included in a category. The term taxon eas coined by Adolf Meyer (1926) for animals and H.J LAm (1948) used this term in plant science.

Q.93 Which of the following components provides sticky character to the bacterial cell?
(a) Nuclear membrane **(b) Plasma membrane**
(c) Glycocalyx **(d) Cell Wall**

Ans: (c)

Sol: Glycocalyx is the outermost mucilage layer of the cell envelope which consists of non-cellulosic polysaccharides with or without proteins. It gives stickly character to the cell.

Q.94 Single-celled eukaryotes are included in
(a) protista **(b) fungi** **(c) archaea** **(d) monera**

Ans: (a)

Sol: Protista include all unicellular and colonial eukaryotes except those of green and red algae. The protistan cells are typically eukaryotic having membrane bound organelles like mitochondria, chloroplasts, Golgi bodies, endoplasmic reticulum nucleus, etc. Protista is commonly known as kingdom of unicellular eukaryotes. Kingdom Fungi contains achlorophyllous, spore producing heterotrophic, multicellular or multinucleate eukaryotic organisms (unicellular yeasts are also included amongst fungi because their sexual reproduction is similar to that of some fungi). Monerans are basically unicellular prokayotes. Archaea (ancient bacteria) are also a type of monerans which live in primitive environment like high temperature, high salt content, acidic pH, etc.

Q.95 Syngamy can occur outside the body of the organism in
(a) mosses (b) algae (c) ferns (d) fungi

Ans: (b)

Sol: In *Funaria* (Bryophyta), *Dryopteris* (Pteridophyta) and *Ginkgo* (Gymnosperm) female sex organ archaegonium is formed. Funaria lacks independent sporophyte and vascular tissues while independent gametophyte is absent in Ginkgo.

Q.96 In ferns, meiosis takes place at the time of
(a) spore formation (b) spore germination
(c) gamete formation (d) antheridia and archegonia formation

Ans: (a)

Sol: A fern plant body is sporophytic (2n) and is differentiated into roots, stems and leaves. On the ventral surface of leaves sporangia are borne in a group called sori. Inside the sporangium are present the spores which are formed by reduction division, Thus the spores produced are haploid in nature and germinate to produce a prothallus that represents the gametophytic generation. Antheridium and archegonium are borne on this prothallus. Thus meiosis takes place at the stage of spore formation.

Q.97 A plant having seeds but lacking flowers and fruits belongs to
(a) pteridophytes (b) mosses
(c) ferns (d) gymnosperms

Ans: (d)

Sol: A plant having seed but lacking flowers and fruit belongs to gymnosperms. Gymnosperms are vascular land plants and bears seeds which are naked i.e., ovules not enclosed in the ovary. Hence, flowers are absent.

Q.98 Crocodile and pengium are similar to whale and dogfish in which of the following features?
(a) Possess a solid single stranded dentral nervous system
(b) Lay eggs and guard them till they hatch
(c) Possess bony skeleton
(d) Have gill slits at some stage.

Ans: (d)

Sol: Animals belonging to Phylum Chordata are fundamentally characterised by the presence of a notochord, a dorsal hollow nerve cord and paired pharyngeal gill slits. Crocodile, penguin, whale and dogfish are all chordates. All of them have gill slits or have had it during embryonic development. Thus, paired gill slits are present in these animal at some stage of life.

Q.99 Pneumatic bone is found in
(a) shark (b) Rana (c) pigeon (d) whale

Ans: (c)

Sol: Pneumatic bones is present in pigeon to keep the bones light weight because the pigeon has to fly. Pneumatic bone has a hollow cavity, which makes it light.

Q.100 Sweet Potato is a modified
(a) stem (b) adventitious root
(c) taproot (d) rhizome

Ans: (b)

Sol: Sweet potato (Ipomoes batata) is swollen single root tuber that does not assume a definite shape. It is modified adventitious root for storage of food.

Q.101 A drupe develops in
(a) mango (b) wheat (c) pea (d) tomato

Ans: (a)

Sol: Drupe is a fleshy fruit that develops from either one or several fused carpels and contains one or many seeds. The seeds are enclosed by the hard protective endocarp (pericarp) of the fruit, e.g., mango. In mango the pericarp is well differentiated into an outer thin epicarp, a middle fleshy edible mesocarp and an inner stony hard endocarp.

Q.102 Vegetative reproduction of *Agave* occurs through
(a) rhizome (b) stolon (c) bulbils (d) sucker.

Ans: (c)

Sol: Vegetative reproduction in *Agave* occurs through bulbils. Bulbils are the specialised buds vegetative or floral that modify into a swollen structure. It separates from the parent plant and on approch of favourable codition gives rise to new plant.

Q.103 Which of the following is made up of dead cells?
(a) Collenchyma (b) Phellem
(c) Phloem (d) Xylem parenchyma

Ans: (b)

Sol: The phellem or cork consists of dead and compactly arranged rectangular cells that possess suberised cell wall.

Q.104 At maturity, which of the following is non-nucleated?
(a) Palisade cell (b) Cortical cell
(c) Sieve cell (d) Companion cell

Ans: (c)

Sol: In pteridophytes and gymnosperms, sieve tubes are not arranged in linear rows and hence called sieve cells. Sieve tube elements are the conducting element of phloem. These are arranged end to end in linear rows with septa (sieve plate) between two sieve pores. Sieve tube elements are living and have thin cellulosic walls in young cells but they become thick walled and are without nuclei at maturity.

Q.105 Identify the tissue shown in the diagram and match with its characteristics and its location.

(a) Smooth muscles, show branching, found in the wall of the heart.
(b) Cardiac muscles, unbranched muscles, found in the walls of the heart.
(c) Striated muscles, tapering at both-ends, attached with the bones of the ribs.
(d) Skeletal muscles show striations and are closely attached with the bones of the limbs

Ans: (d)

Sol: Locomotion (performed by limbs) in humans depends on the movements of muscl fibres, Skeletal muscles are attached to the bones by tendons and help in the movement of the parts of skeleton. These muscles are under the control of conscious mind and are called voluntary muscles. Under the microscope these muscles show transverse stripes and hence are designated as striated muscles.

Q.106 Blood of *Pheretima* is

(a) blue with haemocyanin in corpuscles
(b) blue with haemocyanin in plasma
(c) red with haemoglobin in corpuscles
(d) red with haemoglobin in plasma.

Ans: (d)

Sol: Circulatory or blood vascular system of earthworm is a closed consisting of blood vessels and capillaries which ramify to all parts of the body. Blood is composed of a fluid plasma and colourless corpuscles, phsiologically comparable to the leucocytes of the vertebrates. The red respiratory pigment, haemoglobin (or erythrocruorin) occurs dissoved in plasma. It gives a red colour to blood and aids in the transporation of oxygen for respiration.

Q.107 Peptide synthesis inside a cell takes place in

(a) Chloroplast **(b) mitochondria**
(c) chromoplast **(d) ribosomes**

Ans: (d)

Sol: Peptide synthesis inside a cell take splace in ribosome. Ribosomes are found in all cells and ae involved in protein synthesis. The major constituents of ribosomes are RNA and proteins present in approximately equal amounts.

Q.108 Biological organation starts with

(a) cellular level
(b) organismic level
(c) atomic level
(d) submicroscopic molecular level.

Ans: (d)

Sol: Molecular assemblies are large organised seta of moleculae units that make up parts of organelles. For example, one common macromolecular assembly is the microtubule which is important in forming structure in the cell related to cell movement. The cell (plasma) membrane that surrounds many organelles and the cell is a highly organised molecular assembly.

Q.109 Angstrom is equal to ($\mathring{A}$) is equal to

(a) 0.01 mm **(b) 0.001 mm** **(c) 0.0001 mm** **(d) 0.00001 mm**

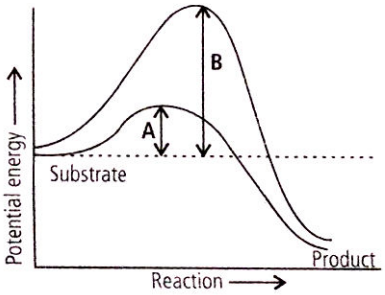
Ans: (c)

Sol: An angestrom (symbol $\mathring{A}$) is a non-SI unit of length that is internationally recognised, equal to 0.1 nanometer (nm). It can be written in scientific notations

1×10^{-10} as It is used in expressing the size of atoms, length of chemical bonds etc. It is named after Anders Jonas Angstrom.

Angstrom = 0.0001 mm

Q.110 Which of the following describes the given graph correctly?



(a) Endothermic reaction with energy A in presence of enzyme and B in absence of enzyme.
(b) Eothermic reaction with energy A in presence of enzyme and B in absence of enzyme.
(c) Endothermic rection with energy A in presence of enzyme and B in presence of enzyme.
(d) Eothermic reaction with energy A in absence of enzyme and B in presence of enzyme.

Ans: (b)

Sol: _____

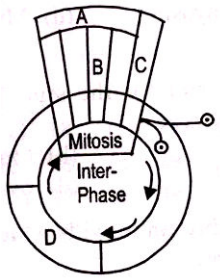
Q.111 Living cell contains $60-95\%$ water. Water present in human body is

(a) $60-65\%$ **(b) $50-55\%$** **(c) $75-80\%$** **(d) $65-70\%$**

Ans: (d)

Sol: Water is the most abundant substance of living beings. The water content of actively living cells varies between $60-95\%$ In human beings maximum water content is found in the embryo $90-95\%$ Water content decreases thereafter in adult and the aged where it is $65-70\%$.

Q.112 Given below is a schematic break-up of the phases/stages of cell cycle. Which one of the following is the correct indication of the stage/phase in the cell cycle?



(a) C - karyokinesis
(b) D - synthetic phase
(c) A - cytokinesis
(d) B - metaphase

Ans: (b)

Sol: In cell cycle, there are two main phases interphase and mitotic phase. Interphase is divided into 3 stage G_1, S and G_2, G_1 is first growth phase. S is synthetic phase and G_2 is second growth phase.

Q.113 Number of chromatids at metaphase is
(a) two each in mitosis and meiosis
(b) two in mitosis and one in meiosis
(c) two in mitosis and four in meiosis
(d) one in mitosis and two in meiosis.

Ans: (a)

Sol: Number of chromatids at metaphase is two each in mitosis Chromatid is a half chromosome during duplication in early prophase and metaphase of mitosis and between diplotene and the second metaphase of meiosis. After these stages chromatids are called a daughter chromosomes.

Q.114 The water potential and osmotic potential of pure water are
(a) 100 and 200 **(b) zero and 100**
(c) 100 and zero **(d) zero and zero**

Ans: (d)

Sol: Water potential or chemical potential in pure water is zero. Osmotic potential or solute potential represents the effect of dissolved solutes on water potential solutes reduce the free energy of water by diluting the water. The osmotic potential of pure water is zero. If solutes are added to water its potential becomes less than of pure water and is expressed as a negative value.

Q.115 Minerals absorbed by root move to the leaf through
(a) xylem **(b) phloem** **(c) sieve tubes** **(d) none of the above.**

Ans: (a)

Sol: Minerals absorbed by roots move to the leaf through xylem. Xylem plays an important role in conduction of water. Hence, when water moves upwards through xylem, minerals are also absorbed by the roots and move towards leaves through xylem only. This is known as ascent of sap.

Q.116 Which one of the following is not a micronutrient?
(a) Molybdenum **(b) Magnesium**
(c) Zinc **(d) Boron**

Ans: (b)

Sol: Macronutrients are essential elements which are present in easily detectable qunatities, 1-10 mg per gram of dry weight. The macronutrients include carbon, hydrogen, oxygen, nitrogen, phosphorous, sulphur, potassium, calcium and magnesium. Micronutrients or trace elements, are needed in very small amounts (equal or less than 0.1 mg/gm of dry matter). These include iron, manganese, copper, molybdenum, zinc, boron, chlorine and nickel.

Q.117 Which aquatic fern performs nitrogen fixation?
(a) ***Azolla*** **(b)** ***Nostoc*** **(c)** ***Salvia*** **(d)** ***Salvinia***

Ans: (a)

Sol: *Azolla* is an aquatic fern which is inoculated in the rice filed to increase the yeild.

Azolla contains Nostoc and Anabaena (BGA) in its leaf cavities which perform nitrogen fixation.

Q.118 Water soluble pigments found in plant cell vacuoles are

(a) carotenoids **(b) anthocyanins**

(c) xanthophylls **(d) chlorophylls**

Ans: (b)

Sol: Anthocyanins are water soluble pigments, which commonly occur in membrane enclosed vacuoles. They are responsible for colour of fruits and flower petals.

Q.119 CAM helps the plants in

(a) conserving water **(b) secondary growth**

(c) disease resistance **(d) reproduction**

Ans: (a)

Sol: Crassulacean acid metabolism (CAM) is photosynthesis by the C_4 pathway in which carbondioxide is taken up during the night, when the plant's stomata are open and fixed into malic acid. During the day, when the stomata are closed, carbon dioxide is relased from malic acid for use in the Calvin cycle., This is important for plants that in arid conditions as it enables them to keep their stomata closed during the day to reduce water loss from evaporation. Crassulaceam acid metabolism is common in succulent plants of desert regions, including cacti and spurges and in certain ferns.

Q.120 Which one of the following concerns photophosphorylation?

(a) $\mathbf{ADP + AMP \xrightarrow{\text{Light energy}} ATP}$

(b) $\mathbf{ADP + Inorganic\ PO_4 \xrightarrow{\text{Light energy}} ATP}$

(c) $\mathbf{ADP + Inorganic\ PO_4 \rightarrow ATP}$

(d) $\mathbf{AMP + norganic\ PO_4 \xrightarrow{\text{Light energy}} ATP}$

Ans: (b)

Sol: The light dependent production of ATP from ADP +P*i* in the chloroplasts is called photophosphorylation. Photophorylation is of 2 types Cyclic photophosphorylation is of 2 types - It involves only PS-I, water is not utilised and so no oxygen is evolved. Here two ATP molecules are produced.
Non-cyclic photophosphorylation-It involves both PS-U and PS-II, water is utilised and so oxygen is evolved. Here one ATP molecule and one $NADPH_2$ molecule are produced.

Q.121 How many ATP molecules are produced by acerobic oxidation of one molecule of glucose?

(a) 2 **(b) 4** **(c) 38** **(d) 34**

Ans: (c)

Sol: Energy gain in one complete cycle of aerobic respiration is :

$$\underset{\text{(or EMP)}}{\text{Glycolysis}} \rightarrow 2ATP + 2NADH_2 = 8\ ATP$$
$$\downarrow\ ETS$$
$$6\ ATP$$

$$\text{Intermediate step} = 2NADH_2 \xrightarrow[ETS]{} = 6\ ATP$$
$$\text{Kreb's cycle} = 6NADH_2 + 2FADH_2 + 2ATP = 24\ ATP$$
$$ETS\downarrow \qquad \downarrow ETS$$
$$18\ ATP \qquad 4ATP$$
$$\text{Total} = 38\ ATP$$

In aerobic respiration complete oxidation of one glucose molecules produces 38 ATP molecules. But the number of ATP molecules so produced may vary depending upon the mode of entry of $NADH_2$ in the mitochondria. If the electrons of $NADH_2$ are accepted by malate then each molecule of $NADH_2$ yields 3 ATP molecules and the total would be 38 ATP molecules. But if the electrons of $NADH_2$ are accepted by FAD it yields only 2 ATP molecules making the total of 36 ATP molecules. This types of shuttle occurs in modt of the eukaryotic cells.

Q.122 Out of 38 ATP molecules produced per glucose, 32 ATP molecules are formed from $NADH/FADH_2$ in
(a) respiratory chain **(b) Krebs' cycle**
(c) oxidative decarboxylation **(d) EMP.**

Ans: (a)

Sol: During respiratory chain, complete degradation of one glucose molecule produced 38 ATP molecules. NAD and FAD is reduced to $NADH/FADH_2$.

Q.123 During seed germination its stored food is mobilized by
(a) ABA **(b) gibberellin** **(c) ethylene** **(d) cytokinin**

Ans: (b)

Sol: Gibberellins are plant growth substances chemically related to terpenes and occuring naturally in plants and fungi. They promote elongation of stems, e.g., bolting in cabbage plants and the mobilization of food reserves in germinating seeds and are influential in inducing flowering and fruit development.

Q.124 Which one among the following chemicals is used for causing defoliation of forest trees?
(a) Malic hydrazide **(b) 2, 4-D**
(c) Amo-1618 **(d) Phosphon D**

Ans: (b)

Sol: 2, 4-D is a famous herbicide or weedicide which especially kills broad leaved weeds. It kills weeds perhaps by over stimulated roo growth. Other auxins like 2, 4, 5-T have also been used as defoliants during early sixties.

Q.125 The initial step in the digestion of milk in humans is carried out by
(a) lipase **(b) trypsin** **(c) rennin** **(d) pepsin**

Ans: (c)

Sol: Rennin is secreted by peptic cells present in epithelium of gastric glands. It is found in the gastric juice of human beings during infancy and in calf. In adults

gastric juice is devoid of rennin. It converts milk protein casein into paracasein, leading to milk coagulation.

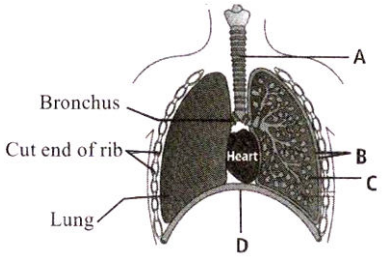
Q.126 Lamina propria is connected with

(a) acini **(b) liver**
(c) Graafian follicle **(d) intestine**

Ans: (d)

Sol: It is the middle layer of 3 layered mucosa (outer muscularis mucosa, middle lamina propria and inner simple colunar epithelium) of intestine. It is make up of a highly vascular connective tissue containing lymphatic nodules.

Q.127 The figure shows a diagrammatic view of human respiratory system whith labels A, B, C and D. Select the option which gives correct identification and main function and/or characteristic.



(a) C - Alveoli - Thin walled vascular bag like structures for exhange of gases.
(b) D - Lower end of lungs - Diaphragm pulls it down during inspiration
(c) A - Trachea - Long tube supported by complete cartilaginous rings for conducting inspired air.
(d) B - Pleural membrane - Surround ribs on both sides to provide cushion against rubbing.

Ans: (a)

Sol: In the given figure A is trachea. It is supported by incomplete cartilaginous rings which prevent its collapse during inspiration. B is pleural membrane. It encloses lungs. C is alveoli. They are thin walled sacs having extensive network of capillaries for gaseous exchange. D is diaphragm.

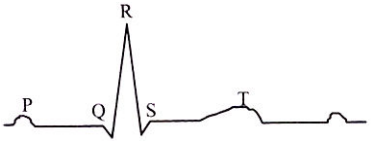
Q.128 Skin is an accessory organ of respiration in

(a) humans **(b) frog** **(c) rabbit** **(d) lizard**

Ans: (b)

Sol: In addition to lungs. skin is also an organ of respiration in frog. It is practically the only mode of respiration when the frog is under water or hibernating. Skin is richly supplied with blood and is permeable to gases. That is why frogs always stay near water to keep their skin moist. It is further kept moist by secretion of mucus from its glands, and does not become dry out of water.

Q.129 The diagram given here is the standard ECG of a normal perso. The P-wave represents the



(a) beginning of the systole
(b) end of systole
(c) contraction of both the atria
(d) initation of the ventricular contraction.

Ans: (c)

Sol: In the given diagram the P-wave represents the electrical excitation (or depolarisation) of the atria, which leads to the contraction of both the atria. The QRS complex represents the depolarisation of the ventricles, which initiates the ventricular contraction. The contraction starts shotly after Q and marks the beginning of the systole. The T-wave represents the return of the ventricles from excited to normal state (repolarisation). The end of the T-wave marks the end of systole.

Q.130 Carbonic anhdrase is formed of

(a) lymphocytes **(b) blood plasma**
(c) RBC **(d) leucocytes**

Ans: (c)

Sol: During transport of CO_2 in the blood, about 70% of CO_2 released by respiring tissue cells is transported as bicarbonate ions. It diffuses into the plasma and then into the RBCs. Here, CO_2 combines with water to form carbonic acid. This reaction is catalyzed by a azinc containing enzyme carbonic anhydrase. Carbonic acid dissociates into bicarbonate and hydrogen ions. A small amount of bicarbonate ions is transported in the RBCs, whereas most of them diffuse into the plasma to be carried by it.

Q.131 Which one of the following is not a part of a renal pyramid?

(a) Peritubular capillaries **(b) Convoluted tubules**
(c) Collecting ducts **(d) Loop of Henle**

Ans: (b)

Sol: The medulla of kidney is divided into a number of conical areas, the medulla pyramids or renal pyramids. Peritubular capillaries, loop of Henle and collecting ducts lie in the medulla (renal pyramids) while convoluted tubules lie in the cortex of kidney.

Q.132 Under normal conditions which one is completely reabsorbed in the renal tubule?

(a) Urea **(b) Uric acid** **(c) Salts** **(d) Glucose**

Ans: (d)

Sol: The cells lining the proximal convoluated tubule are well adapted for reabsorption of materials from the filtrate. They hav abundant mitochondria and bear numerous microvilli on the free side thus giving brush border appearance. The cells reabsorb entire glucose, amino acids, most of the inorganic ions, much of the water as well as some urea from the filtrate.

Q.133 Which of the following statements is correct?

(a) The descending limb of loop of Henle is impermeable to water.
(b) The ascending limb of loop of Henle is permeable to water.
(c) The descending limb of loop of Henle is permeable to electrolytes.
(d) The ascending limb of loop of Henle is impermeable to water.

Ans: (d)

Sol: Descending limb of loop of Henle is permeable to water but impermeable to electrolytes. Ascending limb of loop of Henle is impermeable to water but permeable to electrolytes.

Q.134 In human body, which one of the following is anatomically correct?

(a) Collar bones - 3 pairs
(b) Salivary glands - 1 pair
(c) Cranial nerves - 10 pairs
(d) Floating ribs - 2 pairs

Ans: (d)

Sol: Collar bones (Calvicle) - 2 pairs
Salivary glands - 1 pair - 3 pairs
Cranial nerves - 10 pairs - 12 pairs

Q.135 Receptor sites for neurotransmitters are present on

(a) pre-synaptic membrane **(b) tips of axons**
(c) post-synaptic membrane **(d) membranes of synaptic vesicles**

Ans: (c)

Sol: Neurotransmitter is a chemical substance responsible for transmission of nerve impulse across synapse. It is released by synaptic vesicle into the synaptic cleft. Neurotransmitter binds with protein receptor molecule present on post synaptic membrane causing its depolarisation and generation of action potential.

Q.136 The nerve centres which control the body tenperature and the urge for eating are contained in

(a) hypothalamus **(b) pons**
(c) cerebellum **(d) thalamus**

Ans: (a)

Sol: Hypothalamus is the region of the forbrain in the floor of the third ventricle, linked with the thalamus above and the pituitary gland below. It contains several imporatant centres controlling body temperature, thirst, hunger and eating, water balance and sexula function. It is also closely connected with emotional activity and sleep and functions as a centre for the integration of hotmonal and autonomic nervous activity through its control of the pituitary secretions.

Q.137 A preganat female delivers a baby who suffers from stunted growth, mental retardation. low intelligence quotient and abnormal skin.

(a) cancer of the thyroid gland
(b) Oversecretion of pars distails
(c) deficiency of iodine in diet
(d) low secretion of growth hormone.

Ans: (c)

Sol: Iodine is needed for the synthesis of T_3 and T_4. Iodine binds to the tyrosine residues in thyroglobulin, which is then hydrolysed into iodotyrosines that combine to form triiodothyroninw (T_3) or thyroxine (tetra-iodothyronine or T_4). Therefore, deficiency of iodine in the diet of a pregnat female will lead to improper synthesis of thyroid hormone in newly borne infant. The deficieny of thyroid hormones in infants causes 'cretinism' whose symptoms are slow heart beat, lower blood pressure, decrease in temperature, stunted growth, low intelligence quotient and abnormal skin.

Q.138 Mainly which type of hormones control the menstrual cycle in human beings?

(a) FSH **(b) LH**
(c) FSH, LH, estrogen **(d) progesterone**

Ans: (c)

Sol: Menstrual cycle is controlled by several endocrinal parameters.
In beginning of the cycle FSH (follicle stimulating hormone) of pituitary initiates developemnet of an ovarian follicle. A growing ovarian follicle graduallyy secretes increasing amount of estrogen. This in turn leads to sudden surger of LH secretion by the pituitary. As the LH (leutinising hormone) level in blood suddenly increases there is ovulation.
Thus only FSH or LH cannot control all the events of menstrual cycle.
Progesterone is relased by a corpus luteum after ovulation which actually prepares the uterus for a possible pregnancy.
If there is no fertilisation progesterone level falls and there is beginning of a new cycle.

Q.139 Which of the following flowers only once in its lifetime?
(a) Bamboo species **(b) Jackfruit**
(c) Mango **(d) Papaya**

Ans: (a)

Sol: Certain bamboo species are monocarpic i.e. flower generally only once in their lifetime (after 50-100 years). Other plants (jackfruit, mango and papaya) are polycarpic, i.e., produce flowers and fruits many times during their lifetime.

Q.140 In ginger, vegative propagation occurs through
(a) bulbils **(b) runners** **(c) rhizome** **(d) offsets**

Ans: (c)

Sol: The rhizome is a thickened, underground, dorsiventral stem that grows gorizontally at a particular depth within the soil. It is brown in colour and shows cymose branching. It can be distinguised from the modified root by the presence of node, internodes, terminal buds, axillary buds and scale leaves. The rhizome are prennial and propagate vegetatively. The store food materials and appear tuberous.
indica.

Q.141 Which one of the following may require pollinators, but is genetically similar to autogamy?
(a) Apogamy **(b) Cleistogamy**
(c) Geitonogamy **(d) Xenogamy**

Ans: (c)

Sol: Geitonogamy involves transfer of the pollen from one flower of a plant to the stigma of another flower of the same plant, e.g., in maize. As the pollen has to move from one flower to another flower., it requires a pollinating agent. Yet it is genetically similar to autogamy, as both the flowers of the plant, share the same genotype of the plant.

Q.142 The "eyes" of the potato tuber are
(a) root buds **(b) flower buds** **(c) shoot buds** **(d) axillary buds.**

Ans: (d)

Sol: Potato is the common example of stemtuber. It stores starch as reserve food material. The potato-tubers are used for vegetative propagation. These posses axillary buds over their nodes oe eyes. The buds produce new plantlets when a stem-tuber or a part of it having an eye is placed in the soil.

Q.143 The shared terminal duct of the reproductive and urinary system in the human male is

(a) urethra (b) ureter (c) vas deferens (d) vasa efferentia

Ans: (a)

Sol: Urethra is the urinary duct which originates from the neck of urinary bladder and opens to the exterior at the tip of penis in males. It is a common pathway for passage of urine and semen.

Q.144 The part of Fallopian tube closest to the ovary is

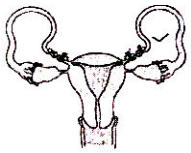
(a) isthmus (b) infundibulum

(c) (d) ampulla

Ans: (b)

Sol: Each Fallopian tube is about 10-12 cm long and extends from the periphery of each ovary of the uterus, the part closer to the ovary is the funnel-shaped infundibulum. The edges of the infundibulum possess finger-like projections called fimbriae, which help in collection of the ovum after ovulation. The infundibulum leads to a wider part of the oviduct called ampulla. The last part of type oviduct, isthmus has a narrow lumen and it joins the uterus.

Q.145 What is figure given below showing in particular?



(a) Ovarian cancer (b) Uterine cancer

(c) Tubectomy (d) Vasectomy

Ans: (c)

Sol: Tubectomy involves blocking of the fallopian tubes. The Fallopian tubes are tied twice and cut between the knot. It prevents the sperms from reaching the ovum and thus prevents fertilization. It is a permanent method of sterilization.

Q.146 The present population of the world is about

(a) 15 trilloin (b) 6 billion (c) 500 million (d) 100 million

Ans: (b)

Sol: As this question appeared in 1997, so the population of world in mid 1997 was 5, 840, 324, 240 i.e., approximately 6 billion.

Q.147 Which of the following most appropriately describes haemophilia?

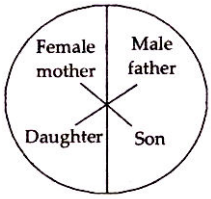
(a) chromosomal disorder (b) Dominanat gene disorder

(c) Recessive gene disorder (d) X-linked recessive gene disorder

Ans: (d)

Sol: HAemophilia is sex-linked disease. It occurs due to the presence of a recessive six linked gene, *h*, which is carried by X-chromosome.

Q.148 Represented below is the inheritance pattern of a certain type of trait in humans. WHich one of the following conditions could be an example of this pattern?



(a) Phenylketonuria **(b) Sickle cell anaemia**
(c) Haemophilia **(d) Thalassemia**

Ans: (c)

Sol: ——–

Q.149 AGGTATCGCAT is a sequence from the coding sequence of the transcribed *m*RNS?
(a) AGGUAUCGCAU **(b) UGGTUTCGCAT**
(c) ACCUAUGCGAU **(d) UCCAUAGCGUA**

Ans: (a)

Sol: Coding strand and *m*RNA have same nucleotide sequnce except, 'T' - Thymine is replaced by 'U' - Uracil in RNA.

Q.150 In eukaryotic cell transcription, RNA splicing and RNA capping take place inside the
(a) ribosomes **(b) nucleus** **(c) dictyosomes** **(d) ER**

Ans: (b)

Sol: Unlike in prokaryotes where transcription and translation take place in the smae compartment, in eukaryotes primary transcript is first processed in the nucleus and then transported outside of the nucleus. Since the primary transcripts of the eukaryotes contains both the expressing genes (exons) and non expressing genes (introns), it undergoes splicing of introns and later capping and tailing at 5'-end and 3'-end respectively.

Q.151 Which is the most common mechansm of genetic variation in the population of a sexually reproducing organism?
(a) Genetic drift **(b) Recombination**
(c) Transduction **(d) Chromosomal aberrations**

Ans: (c)

Sol: Hardy-Weinberg law states that allele frequencies in a population are stable and remain constant from generation to generation when there is random and non-selective mating. In case of lack of random mating, genetic equilibrium may be distrubed.

Q.152 Thorn of Bougainvillea and tendril of Cucurbita are examples of
(a) Vestigial organs **(b) retrogressive evoluation**
(c) analogous organs **(d) homologous organs**

Ans: (d)

Sol: The organs which have the same fundamental structure but are different in function are called homologous organs. Thorn of Bougainvillea and tendril of Cucurbita both arises in the axillary position, but have diffrent functions.

Q.153 Which is the particular type of drugh that is obtained from the plant whose one flowering branch is shown here?

(a) Hallucinogen **(b) Depressant**
(c) Stimulant **(d) Pain killer**

Ans: (a)

Sol: The plant illustrated in the diagram is *Datura*. Seeds of *Datura stramonium* are misused for their hallucinogenic proprties because of the presence of anticholinergic alkaloids atropine, hyoscyamine and scopolamine (= hyoscine). However, even in slight excess, they can cause death.

Q.154 Human immuno deficiency virus (HIV) has a protein coat and a genetic material which is
(a) double stranded RNA **(b) double stranded**
(c) single stranded DNA **(d) single standed RNA**

Ans: (d)

Sol: HIV is a retrovirus, which contains single stranded RNA, surrounded by protein coat (core shell) as genetic material. It causes AIDS. HIV is different in structure from other retroviruses. It is around 120 nm in diameter (around 60 times smaller than a red blood cell) and roughly spherical.

Q.155 A technique of micropropagation is
(a) protoplast fusion **(b) embryo rescue**
(c) somatic hybridisation **(d) somatic embryogenesis**

Ans: (d)

Sol: Micropropagation is the latest method of obtaining a large number of plantlets from plant tissue culture. It is called micropropagation because of the minute size of the propagules. It involves repeated subculture of the explant by changing the medium so as to form a large number of plantlets from that single explant. Somatic embryogenesis i.e., developing embryos from somatic cells is one of the techniques of micropropagation.

Q.156 The world's highly prized wool yielding 'Pashmina' breed is
(a) goat **(b) sheep**
(c) goat-sheep cross **(d) Kashmir sheep-A fghan sheep cross**

Ans: (a)

Sol: Pashmina refers to a type of cashmere wool and textiles made from it. This wool comes from a special breed of goat indigenous to high altitudes of the Himalayan mountains. The himalayan mountain goat, Capra hircus, sheds its winner coat every spring and the fleece is caught on thorn bushes. One goat sheds approximately 3-8 ounces of the fibre.

Q.157 Probiotics are
(a) cancer inducing microbes
(b) new kind of food allergens
(c) live microbial food supplement
(d) safe antibiotics

Ans: (c)

Sol: Probiotics are dietary supplements containing potentially beneficial bacteria or yeast, with lactic acid bacteria (LAB) as the most common microbes used. LAB have been used in the food industry for many years, because they are able to convert sugars (including lactose) and other carbohydrates into lactic acid. They not only provides the characteristic sour taste of femented dairy food such as yougurt, but acts asa preservative, by lowering the pH and creating fewer opportunities for spoilage organisms to grow.

Q.158 Which one of the following statements is correct?

(a) Legumes fix nitrogen only through the specialized bacteria that live in their roots.

(b) Legumes fix nitrogen independently of the specialized bacteria that live in their roots.

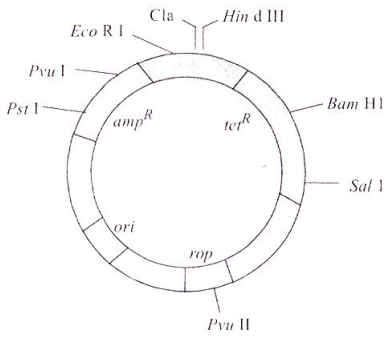
(c) Legumes fix nitrogen only through specialized bacteria that live in their roots.

(d) Legumes are incapable of fixing nitrogen.

Ans: (a)

Sol: The nitrogen-fixing ability of leguminous plants is not a property of the plants as such but results from infection of their roots by bacteria in the soil, infection leading to the formation of nodules. These organisms are Gram-negative motile rods that are classified.

Q.159 The given figure is the diagrammatic representation of the *E.* coli vector pBR322. EHich one of the given options correctly identifies its certain component (s)?



(a) *ori*-original restriction enzyme

(b) *rop*-reduced osmotic pressure

(c) HindIII, EcoRI - selectable markers

(d) amp^R, tet^R - antibiotic resistance genes

Ans: (d)

Sol: In pBR322, ori-represents site or origin of replication, rop-codes for proteins that take part in the replication sites of plasmid. *Hin* d III, *Eco* RI-recognition sites of restriction endonucleases. amp^R and tet^R - antibiotic resistence genes.

Q.160 Gel electrophoresis is used for

(a) construction of recombinant DNA by joining with cloning vectors.

(b) isolation of DNA molecules

(c) cutting of DNA into fragments

(d) separation of DNA fragments according to their size.

Ans: (a)

Sol: Electrophoresis is a technique used for the separation of substances of different ionic properties. Since the DNA fragments are negatively charged molecules, they can be separated by allowing them to move towards the anode. DNA fragments move towards the anode according to their molecule size through the pores of agarose gel. Thus, the smaller fragmentsmove farther away as compared to larger fragements.

Q.161 The bacteria generally used for genetic engineering is
(a) *Agrobacterium* **(b) *Bacillus***
(c) *Pseudomonas* **(d) *Clastridium***

Ans: (a)

Sol: _____

Q.162 The crops engineered for glyphosate are resistant/tolerant to
(a) insects **(b) herbicides** **(c) fungi** **(d) bacteria**

Ans: (b)

Sol: Glyphosate is a broad spectrum herbicide which especially kills broad herbs. Crop plants may also get affected by the herbicide, thus now crop plants are genetically engineered for glyphosate resistance. So, when glyphosate hherbicide is applied, only weeds and no crop plants get harmed.

Q.163 Tobacoo plants resistant to a nematode have been developed by the introduction of DNA been developed by the intriduction of DNA that produces (in the host cells)
(a) both sense and anti-sense RNA **(b) a particular hormone**
(c) an antifeedant **(d) a toxic protein**

Ans: (a)

Sol: Many nematodes live in plants and animals including human beings. A nematode Meloidogyne incognita infest the roots of tobacco plants and causes a great reduction in yeild. A novel dtrategy was adopted to prevent this infection that was based on the process of RNA interference (RNAi). RNA interference (RNAi) is the phenomenon of inhibiting activity of a gene by synthesis of RNA molecules complementary to themRNA. The normal (in vivo synthesized) *m*RNA of a gene is said to "sense" because it carries the codones that are "read" during translation. Normally the complement to the *m*RNA "sense" strand will not contain a sequence of codons that can be translated to prosuce a functional protein; thus, this complementary strand is called "anti-sense RNA". The anti-sense RNA and mRNA molecules will annela to form duplex RNA molecules (or double standed RNA) and the duplex RNA molecules can not be translated. THus, the presence of the affected gene. In fact, recent evidence indicates that these RNA duplexes are often rapidly degraded in *vivo*.

Q.164 The first transegenic crop was
(a) tabacco **(b) cotton** **(c) pea** **(d) flax**

Ans: (a)

Sol: Trangenic plants are those plants in which a forign gene has been introduces and tably integrated into host DNA. The first transgenic plants were produced in

tobaaco (Nicotiana tabacum). A gene resistent to PPT (L-phosphinothricin), an activeingredient of herbicide 'BAsta', was isolated from Medicago sativa. It inhibits the enzyme GS (Glutamine synthase) which is involved in ammonia assimilation. This gene resistant to PPT was incorporated into tobacco, as a result of which teansegnic tobacco was produced which was resistant to PPT.

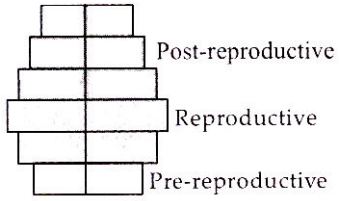
Q.165 Pneumatophores occur in

(a) halophytes **(b) free-floating hydrophytes**
(c) carnivorous plants **(d) submerged hydrophytes**

Ans: (a)

Sol: Pneumatophores are breathing or respitory roots which are found in plants growing in mangroves or water logged soil or saline swamps. Such plants are called halophytes.

Q.166 The following graph depicts changes in two populaions (A and B) of herbivores in a grassy field. A possible reason for these changes is that

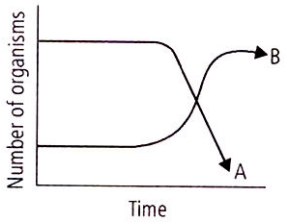


(a) population A produced more offspring than population B
(b) population A consumed the members of population B
(c) both plant populations in this habitat decreased
(d) population B competed more successfully for food than population A

Ans: (d)

Sol: Both the populations are herbivorous, thus they cannot affect each other. If the food sources for these populations A and B have descreased, then both the populations A and B would have declined. If population A have produced more offspring then the graph A should have increased. Based on the graph, population A, that is why number of oragnisms in population B increased while that in population A decreased, as they get access to limited resources.

Q.167 What type of human population is represented by the following age pyramid?



(a) Vanishing population **(b) Stable population**
(c) Declining population **(d) Expanding population**

Ans: (d)

Sol: Age pyramid is a graphic representation of abundance of individuals of different age groups with pre-reproductibve individuals at the base, reproductive individuals in the middle and post-reproductive individuals at the top. Triangular age pyramis has high proporation of reproductive individuals and fewer post-reprodutive individulas. It represents young or rapidly growing population. In

bell-shaped age pyramid, the number of pre-reproductive and reproductive individuals is almost equal. Post-reproductive individuals are comparatively fewer. It represents stable or stantinary population where growth rate is nearly zero. In urn-shaped age pyramid, the number of reproductive individuals is higher than the number of pre-reproductive individulas. If represents declining or diminishing population.

Q.168 Which one of the following pairs is mismatched?

(a) Tundra - permafrost
(b) Savanna - Acacia trees
(c) Prairie - Epiphytes
(d) Coniferous - Evergreen trees

Ans: (a)

Sol: A biome is a major terrestrial community characterized by a distinct climate and inhabited by a particular species of plants and animals. Tundra is characterized by precipitation of less than 25 cm annually. Permafrost or permanent ice is found about a meter down from the surface, it never melts and is imoenetrable t both water and roots. Savannahs arew open grasslands with scattered shrubs and trees. Coniferous forest contain evergreen trees. In these forests all plants do not shed their leaves at the same time hence forest remains always evergree. But Prairies is a grassland and epiphytes and ephemerals are found in deserts.

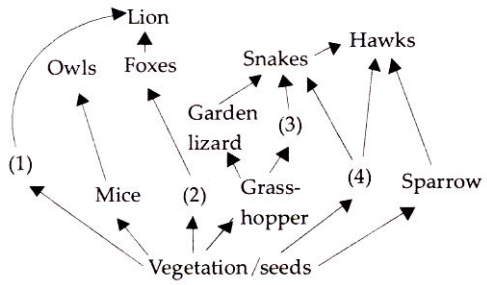
Q.169 Most animals are tree dwellers in a

(a) temperate deciduous forest
(b) tropical rainforest
(c) coniferous forest
(d) thorn woodland

Ans: (b)

Sol: Tropical rainforests have a very dense plant cover. They also experience a large amount of precipitation, thus the forest floor is always damp. Thus, conditions there have led animals to get adapted to arborcal habitals. Most animals found there are tree dwellers as almost every space on the forest floor is occupied by the vegetation.

Q.170 Identify the likely organisms (1), (2), (3) and (4) in the food web shown below,



	(1)	(2)	(3)	(4)
(a)	Deer	Rabbit	Frog	Rat
(b)	Dog	Squirrel	Bat	Deer
(c)	Rat	Dog	Tortoise	Crow
(d)	Squirrel	Cat	Rat	Pigeon

Ans: (a)

Sol: _____

Q.171 Which ecosysten has the maximum biomass?

(a) Grassland ecosystem **(b) Pond ecosystem**

(c) Lake ecosystem **(d) Forest ecosystem**

Ans: (d)

Sol: ———

Q.172 Pyramid of numbers deals with number of

(a) species in an are

(b) individuals in a community

(c) individuals in a trophic-level

(d) subsoecies in a community

Ans: (c)

Sol: Pyramid of numbers is an ecological pyramid which employs the numbe of individuals per unit are at various trophic levels sequence wise with producers at the base and variuos consumers at successively higher levels. Pyamifd of number assumes different shapes in different ecosystems. The pyramid of number in pond ecosystem is also upright. In forest ecosystem the pyamid of number is intermediate. Here, the number of primary consumers is more than producers as well as top consumers. In parasitic food chain the pyramid of number is inverted.

Q.173 How many hotspots of biodiversity in the world have been identified till date by Norman Myers?

(a) 17 **(b) 25** **(c) 34** **(d) 43**

Ans: (c)

Sol: Biodiversity hotspots are a method to identify those regions of the world where attention is needed to address biodiversity loss and to guide investments in conservation. The idea was first developed by Norman Myers in 1988 to identify tropical forests hotspots chacterised both by exceptional levels of plant expanded to a more global scope. Currently 34 biodiversity hotspots have been identified most of which occur in tropical forests.

Q.174 World Summit on Sustainable Developement (2002) was held in

(a) Argentina **(b) South Africa** **(c) Brazil** **(d) Sweden**

Ans: (b)

Sol: Conservation of biodiversity is a collective responsibility of all nations. The historic Convention on Biological Diversity ('The Earth Summit') held in Rio de Janeiro in 1992, called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits. In a follow-up, the World Summit on Sustainable development held in 2002 in Johannesburg, South Africa, 190 countries pledged their commitement to achieve by 2010, a significant reduction in the current rate of biodiveristy loss at global, regional and local levels.

Q.175 Upper part of sea/aquatic ecosystem contains

(a) plankton **(b) nekton**

(c) plankton and nekton **(d) benthos**

Ans: (a)

Sol: Planktons are passively floating in upper water, nektons are actively swimming while benthos lead sedentary life upon the sea bottom. Planktons are producers and are present in large number.

Q.176 Which of the following is a secondary pollutant?
(a) CO (b) CO_2 (c) SO_2 (d) O_3

Ans: (d)

Sol: Secondary pollutants are produced phto chemically from primary pollutants and are called photochemical oxidants. These include peroxyacyl nitrates (PAN), ozone, aldehydes, smog, etc. CO, CO_2 and SO2 are primary pollutants.

Q.177 Eutrophication os often seen in
(a) deserts (b) fresh water lakes
(c) ocean (d) mountains

Ans: (b)

Sol: Eutrophication is the excessive growth iof alage, plants and animals in water bodies due to the nutrient enrichment particularly with nitrogen and phosphate. Nutrients presnet in sewage, agricultural wastes and fertillisers cayse dense growth of plants and planktonic algae. The excessive growth of planktonic algae that cause colouration of water is called algal bloom, which is toxic to animals and humans. Eutrophic water bodies also support excessive growth of floating plants. ALgal blooms and floating plants cut off light form submerged plants, resulting in their death. There is drastic decrease in oxygen replenishment inside water. Non-availability of oxygen results in the death of aquatic animals such as fish, which further adds to organic loading of water. Decomposition is replacement by puterfraction which is anaerobic, leading to absence of oxygen in water and death of aquatic animals.

Q.178 Which one of the following is not used for disinfection of drinking water?
(a) Chlorine (b) Ozone (c) Chloramine (d) Phenyl

Ans: (d)

Sol: In a sewage efficient tratment plan (CETP) during the tertiary tratement the decreased water is chlorinated with chlorine or perchlorate salts, ozonised or irradiate with UV to kill pathogens. Phenyl is not used for disinfection of drinking water.

Q.179 The second commitment period for Kyoto Protocol was decided at
(a) Durban (b) Bali (c) Doha (d) Cancun

Ans: (c)

Sol: International conference held in Kyoto, Japan obtained commitments from different countries for reducing overall green house gas emissions at a level 5% below than that in 1990 by 2008-2012. In Doha, Quatar on 8th December 2012, the "DOha amendment to the Kyoto Protocol" was adopted. The second commitment period is from 1st January 2013 to 31st December 2020.

Q.180 Major aerosol pollutant in jet plane emission is
(a) sulphur dioxide (b) carbon monoxide
(c) methane (d) fluorocarbon

Ans: (d)

Sol: Aerosols are chlorofluoro-hydrocarbon compounds released into air with force in the form of vapor. Main source of aerosols is the emission of jet planes, where fluorocarbon are used. These chloroflurocarbons depletes the ozone layer in the higher atmosphere. These CFC's have produced a hole in the ozone layer.

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