Test Name

ANTS-MED-FT-22-30 AUG:Set 1

Answer Key

PHYSICS

1. b	2. c	3. a	4. c	5. c	6. a	7. b	8. c	9. c	10. a
11. a	12. a	13. d	14. b	15. a	16. b	17. b	18. a	19. a	20. c
21. b	22. b	23. b	24. b	25. a	26. d	27. b	28. a	29. b	30. b
31. a	32. d	33. a	34. c	35. a	36. b	37. a	38. b	39. b	40. a
41. b	42. c	43. b	44. a	45. c					

CHEMISTRY

1. a	2. d	3. c	4. b	5. b	6. c	7. c	8. c	9. a	10. c
11. b	12. c	13. a	14. a	15. d	16. b	17. c	18. c	19. a	20. a
21. d	22. b	23. c	24. d	25. b	26. d	27. d	28. a	29. c	30. a
31. d	32. a	33. c	34. b	35. b	36. a	37. a	38. a	39. d	40. d
41. d	42. c	43. c	44. a	45. b					

BIOLOGY

1. a	2. a	3. c	4. b	5. b	6. b	7. b	8. c	9. b	10. d
11. d	12. c	13. b	14. b	15. b	16. d	17. d	18. d	19. a	20. c
21. a	22. c	23. a	24. d	25. d	26. d	27. a	28. a	29. d	30. c
31. a	32. a	33. d	34. c	35. a	36. a	37. d	38. c	39. b	40. d
41. a	42. b	43. c	44. b	45. d	46. a	47. d	48. d	49. d	50. c
51. b	52. a	53. c	54. a	55. a	56. a	57. b	58. c	59. d	60. a
61. c	62. c	63. b	64. a	65. b	66. b	67. d	68. a	69. b	70. b
71. d	72. b	73. b	74. b	75. d	76. a	77. c	78. d	79. d	80. d
81. d	82. d	83. b	84. c	85. d	86. b	87. b	88. d	89. c	90. d

Question-wise Detailed Solution

PHYSICS

1 If the sum of the two unit vectors is also a unit vector, then magnitude of their difference is

Solution

Let A and B be two unit vector

Such thus $|\mathrm{A}+\mathrm{B}|=1 \Rightarrow \quad \mathrm{A}^2+\mathrm{B}^2+2 \mathrm{AB} \cos \theta=1 \quad \Rightarrow 2+2 \cos \theta=1$

$\left(\cos \theta=\frac{-1}{2}\right)$

then $|\mathrm{A}-\mathrm{B}|^2=\left|\mathrm{A}^2\right|+|\mathrm{B}|^2-2 \mathrm{AB} \cos \theta$

$|\mathrm{A}-\mathrm{B}|^2=1+1-2 \mathrm{AB} \cos \theta$

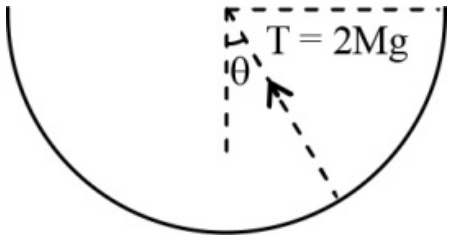
$=2-2.1 .1 .\left(\frac{-1}{2}\right)$

= 3

$|\mathrm{A}-\mathrm{B}|=\sqrt{3} \text { unit}$

2 In a simple pendulum, the breaking strength of the string is double the weight of the bob. The bob is released from rest when the string is horizontal. The string breaks when it makes an angle θ with the vertical

Solution



$T-\ M g\ \cos \theta=\frac{M v^2}{r}$

Where $T=2 M g$ and $\frac{1}{2} M v^2=\ M g\ (r\ \cos \theta)$

$2\ M g-M g \cos \theta=\frac{2\ M g\ r \cos \theta}{r}$

$\cos \theta=\frac{2}{3}$

$\theta=\cos ^{-1}\left(\frac{2}{3}\right)$

3 A body is projected horizontally with speed $20 \mathrm{~m} / \mathrm{s}$. The speed of the body after 5 s is nearly

Solution

$\mathrm{v_x}=\mathrm{u}=20 \mathrm{~m} / \mathrm{s}$

$\mathrm{v_y}=\mathrm{v_u}+\mathrm{gt}$

$=0+10 \times 5=50 \mathrm{~m} / \mathrm{s}$

$\mathrm{v}=\sqrt{\mathrm{u_x^2}+\mathrm{u_y^2}}$

$=\sqrt{(20)^2+(50)^2}$

4 A light whose frequency is equal to $6 \times 10^{14} \mathrm{~Hz}$ is incident on a metal whose work function is $2 \mathrm{~eV}$. $\left[h=6.63 \times 10^{-34} \mathrm{~J} \mathrm{~s}, \ 1 \mathrm{eV}=1.6 \times 10^{-19} \mathrm{~J}\right]$. The maximum energy of the electrons emitted will be

Solution

$KE_{max} = h\nu - \phi$

Where $h\nu$ = energy of incident photon,

ϕ = work function

$\mathrm{KE_{max}}$ = $6.6 \times 10^{-34} \times 6 \times 10^{14} - 2 \times 1.6 \times 10^{-19}$

= $3.96 \times 10^{-19} - 3.2 \times 10^{-19}$

= $\frac{0.76 \times 10^{-19}}{1.6 \times 10^{-19}}\ \mathrm{eV} = 0.475\ \mathrm{eV}$

5 Three vectors $\overrightarrow{\mathrm{A}}, \overrightarrow{\mathrm{B}}$ and $\overrightarrow{\mathrm{C}}$ satisfy the relation $\overrightarrow{\mathrm{A}} \cdot \overrightarrow{\mathrm{B}} = 0$ and $\overrightarrow{\mathrm{A}} \cdot \overrightarrow{\mathrm{C}} = 0$. If $\overrightarrow{\mathrm{B}}$ and $\overrightarrow{\mathrm{C}}$ are not lying in the same plane then $\overrightarrow{\mathrm{A}}$ is parallel to

Solution

As A.B = 0 and A.C = 0 so A is perpendicular to both B and C and as $\overrightarrow{\mathrm{B}} \times \overrightarrow{\mathrm{C}}$ is perpendicular to both B and C so A is parallel to $\overrightarrow{\mathrm{B}} \times \overrightarrow{\mathrm{C}}$

6 A passenger arriving in a new town wishes to go from the station to a hotel located 10 km away on a straight road from the station. A dishonest cabman takes him along a random path 23 km long and reaches the hotel in 28 min. What is the average speed of the taxi and the magnitude of average velocity ?

Solution

Given, shortest distance between the station and the hotel = 10 km

∴ Displacement of the taxi = 10 km

Distance travelled by the taxi = 23 km

Time taken by the taxi = 28 min$= \frac{28}{60} = \frac{7}{15}h$

(a) $\text{Average speed of the taxi} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$

$= \frac{23}{(7/15)} = \frac{345}{7}\mathrm{km/h}$

= 49.3 km/h

(b) Magnitude of average velocity

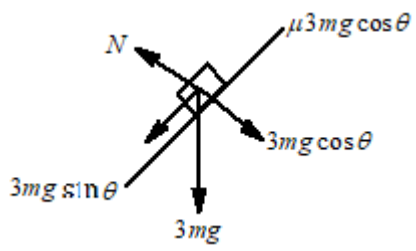
$= \frac{\text{Magnitude of that total displacement}}{\text{Total time taken}}$

$= \frac{10}{(7/15)} = \frac{150}{7}\mathrm{km/h}$

= 21.43 km/h

7 A rocket is fired vertically from the earth with an acceleration of 2g, where g is the gravitational acceleration. On an inclined plane inside the rocket, making an angle θ with the horizontal, a point object of mass m is kept. The minimum coefficient of friction $\mu_{\min}$ between the mass and the inclined surface such that the mass does not move is:

Solution



$3\text{mg}\sin\theta = \mu 3\text{mg}\cos\theta$

$\mu = \tan\theta$

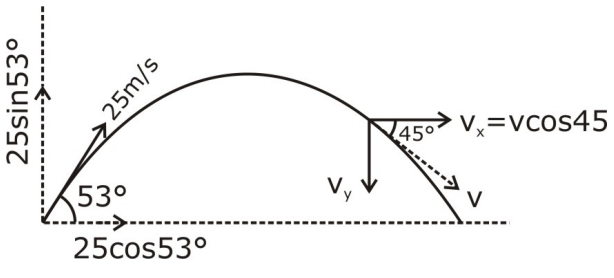
8 The engine of a car produces an acceleration of $6\ \text{ms}^{-2}$ in the car. If this car pulls another car of the same mass, then the acceleration would be

Solution

Let, mass of car$= m$
Force applied by engine $= 6m$
When two cars are pulled,
$(m+m)a = 6m$
or $2ma = 6m$ or $a = 3\ \text{ms}^{-2}$

9 A stone is thrown at $25\ \text{m/s}$ at 53^o above the horizontal. At what time its velocity is at 45^o below the horizontal?

Solution



Horizontal component of velocity, throughout the motion remain constant

using $u\cos\theta = v\cos\alpha$

$25\cos 53^\circ = v\cos 45^\circ$

$\implies v = 25 \times \frac{3}{5}.\sqrt{2}$

$= 15\sqrt{2}$

$\implies v_y = v\sin 45 = 15$

Now using $V_y = u_y + a_y t\ in\ \ y-$ direction,

$-15 = 25\sin 53^\circ - gt$

$-15 = 25 \times \frac{4}{5} - 10\,t$

$\implies t = 3.5\ \text{sec}$

10 The temperature of a gas contained in a closed vessel of constant volume increases by $1\ ^\circ\text{C}$ when the pressure of the gas is increased by 1%. The initial temperature of the gas is

Solution

According to Gay Lussac's law $p \propto T$

$\therefore \quad \frac{dp}{p} \times 100 = \frac{dT}{T} \times 100$

$1 = \frac{1}{T} \times 100$

$\Rightarrow T = 100\ \mathrm{K}$

11 **Statement 1 :** Two balls of different masses are thrown vertically upward with same speed. They will pass through their point of projection in the downward direction with the same speed.

Statement 2 : The height and the downward velocity attained at the point of projection are independent of the mass of ball.

Solution

$a = \frac{mg}{m} = g$
all mass have same acceleration.

$v^2 = u^2 + 2as \quad \ldots . (1)$

Here s is the displacement which is Zero for both the balls so from equation 1, velocity v will be same for both the balls which is equal to u from equation 1 in downword direction.

12 Statement-I: In Young's double slit experiment interference pattern disaapears when one of the slits is closed

Statement-II: Interference is observed due to superposition of light waves from two coherent sources

Solution

When one of the slits is closed, there appears general illumination from a single source. Interference does not take place.

13 A galvanometer of resistance 50 Ω is connected to a battery of 3 V along with a resistance of 2950 Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 divisions, the resistance in series should be

Solution

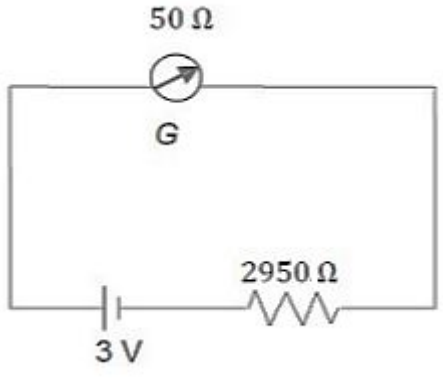
Current through the galvanometer

$I = \frac{3}{(50+2950)} = 10^{-3}\ \mathrm{A}$

Current for 30 divisions $= 10^{-3}\ \mathrm{A}$

Current for 20 divisions

$= \frac{10^{-3}}{30} \times 20 = \frac{2}{3} \times 10^{-3}\ \mathrm{A}$

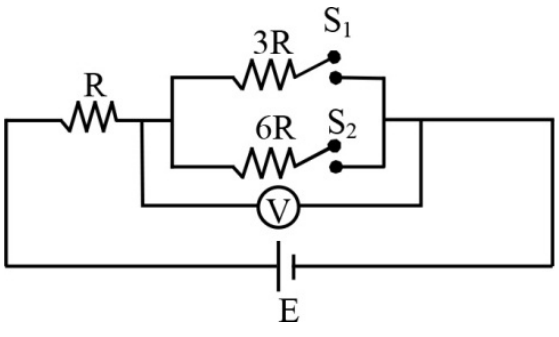


For the same deflection to obtain for 20 divisions, let resistance added be R

$\therefore\ \frac{2}{3} \times 10^{-3} = \frac{3}{(50+R)}$

or $\quad R = 4450\ \Omega$

14 In the circuit shown in the figure, the reading of the voltmeter is V_1 when only S_1 is closed, V_2 when only S_2 is closed and V_3 when both S_1 and S_2 are closed. From this we can conclude that



Solution

In series $\mathrm{V} \propto \mathrm{R}$

When S_1 is closed and S_2 is open

$V_1 = \frac{3E}{4}$

When S_1 is open and S_2 is closed

$V_2 = \frac{6E}{7}$

When S_1 and S_2 both are closed

$V_3 = \frac{2E}{3}$

15 The speed of light (c), gravitational constant (G) and Planck's constant (h) are taken as fundamental units in a system. The dimensions of time in this new system should be:

Solution

Let time, $T \propto c^X G^Y h^Z$

$\Rightarrow T = kc^X G^Y h^Z$

Taking dimensions on both sides

$[M^0 L^0 T^1] = [LT^{-1}]^X [M^{-1} L^3 T^{-2}]^Y [ML^2 T^{-1}]^Z$

i.e.,

$[M^0 L^0 T^1] = [M^{-Y+Z} L^{X+3Y+2Z} T^{-X-2Y-Z}]$

Equating powers of M, L, and T, on both sides, we get –

$-Y + Z = 0 \quad ...(1)$

$X + 3Y + 2Z = 0 \quad ...(2)$

$-X - 2Y - Z = 1 \quad ...(3)$

From equation (i)

Adding (2) and (3)

$Y + Z = 1$

or $\quad 2Y = 1 \quad (\because \ Z = Y)$

$\therefore Z = Y = \frac{1}{2}$

Putting these values in (2), we get –

$X + \frac{3}{2} + 1 = 0 \ \text{ or } \ X = \frac{-5}{2}$

Hence, $[T] = [G^{\frac{1}{2}} h^{\frac{1}{2}} c^{\frac{-5}{2}}]$

16 The length of an elastic string is a m when the tension is 4 N, and 'b m when the tension is 5 N. The length in metre when the tension is 9 N, is

Solution

$T_1 = K\,(l_1 - l)$

$T_2 = K(l_2 - l)$

So, $\frac{T_1}{T_2} = \frac{l_1 - l}{l_2 - l}$

$\therefore \;\; T_1 l_2 - T_1 l = T_2 l_1 - T_2 l$

$(T_2 - T_1) l = T_2 l_1 - T_1 l_2$

$l = \frac{T_2 l_1 - T_1 l_2}{(T_2 - T_1)}$

$l = (5a - 4b)$ .....(i)

$5 - 4 = k(b - a)$

$k = \frac{1}{b-a}$ ...(ii)

$9 = kl'$ (l' = change in length)

$9 = \frac{1}{(b-a)} \times l' \Rightarrow l' = 9b - 9a$

Hence, final length

$l_{\text{final}} = l + l'$

$l_{\text{final}} = 5a - 4b + 9b - 9a$

$l_{\text{final}} = 5b - 4a$

17 An observer looks at a distant tree of height $10\ \text{m}$ with a telescope of magnifying power of 20. To the observer, the tree appears as

Solution

Angular magnification of the telescope is 20 so now the tree will subtend a larger angle at the observer's eye and hence appears 20 times nearer

18 The properties retentivity and coercivity of a permanent magnet are respectively,

Solution

The materials for a permanent magnet should have high retentivity (so that the magnet is strong) and high coercivity (so that the magnetism is not wiped out by stray magnetic fields). As the material in this case is never put to cyclic changes of magnetization, hence hysteresis is immaterial.

19 The tourmaline crystal

Solution

The tourmaline crystal absorbs ordinary light and transmits extra ordinary.

20 Using the following data

Mass hydrogen atom = $1.00783\ \text{u}$

Mass of neutron = $1.00867\ \text{u}$

Mass of nitrogen atom (${}_7\text{N}^{14}$)= $14.00307\ \text{u}$

The calculated value of the binding energy of the nucleus of the nitrogen atom (${}_7\text{N}^{14}$) is close to

Solution

The binding energy of nucleus may be defined as the energy equivalent to the mass defect of the nucleus.

If Δm is mass defect then according to Einstein's mass-energy relation.

Binding Energy

$= \Delta\, mc^2 \;=\; [\{Zm_p \;+\; (A-Z)m_n\} - M]c^2$

$= (7 \;\times\; 1.00783 \;+\; 7 \;\times\; 1.00867 - 14.00307)c^2$

or $\;\mathrm{BE} = 0\,.1124 \;\times\; 931\,.5 \;\;\mathrm{MeV}$

or $\mathrm{BE} \;=\; 104.6\;\mathrm{MeV}$

21 A coil of wire of radius r has 600 turns and self-inductance of $108\ \mathrm{mH}$. The self-inductance of a coil with the same radius and 500 turns is

Solution

Given $L_1 = 108\ \mathrm{mH},\ N_1 = 600$ turns, $N_2 = 500$ turns and $L_2 = ?$

By self - inductance of a plane coil

$L_1 = \frac{\mu_0 \pi N_1^2 a_1}{2}$ .....(i)

$L_2 = \frac{\mu_0 \pi N_2^2 a_2}{2}$ .....(ii)

From the equations (i) and (ii), we get

$\frac{L_1}{L_2} = \left(\frac{N_1}{N_2}\right)^2 \ (\because\ a_1 = a_2)$

$\frac{108}{L_2} = \left(\frac{600}{500}\right)^2$

$L_2 = \frac{108 \times 25}{36}$

$L_2 = 3 \times 25 = 75\ \mathrm{mH}$

22 A long metallic bar is carrying heat from one of its ends to the other end under steady-state. The variation of temperature θ along the length x of the bar from its hot end is best described by which of the following figure?

Solution

We know that $\frac{\mathrm{d}Q}{\mathrm{d}t} = kA\frac{\mathrm{d}\theta}{\mathrm{d}x}$

In steady-state flow of heat

$\mathrm{d}\theta = \frac{\mathrm{d}Q}{\mathrm{d}t} . \frac{1}{kA}\mathrm{d}x$

$\Rightarrow \theta_{\mathrm{H}} - \theta = kIx$

$\Rightarrow \theta = \theta_{\mathrm{H}} - kIx$

Equation $\theta = \theta_H - kIx$ represents a straight line.

23 During an adiabatic compression, 830 J of work is done on 2 moles of a diatomic ideal gas to reduce its volume by 50%. The change in its temperature is nearly :

(R = 8.3 JK^{-1} mol^{-1})

Solution

n = ? Moles, $V = \frac{v_0}{2}$, $\Delta T = ?$, W = -830 J

For adiabatic process

Q = 0

$\Delta U = -\Delta W$

$\therefore nC_V\Delta T = 830$

$2 \times \frac{5}{2}R\Delta T = 830$

$\therefore \Delta T = \frac{830}{5R}$

$= \frac{830}{5\times 8\cdot 3} = 20K$

Hence, 20 K

24 The dominant mechanisms for motion of charge carriers in forward and reverse biased silicon *p*-*n* junctions are

Solution

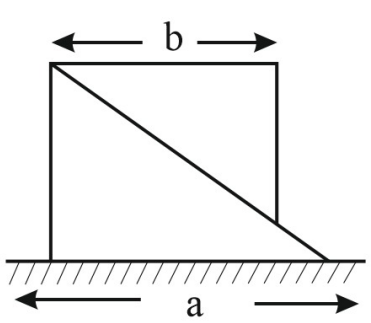
For forward biased, majority charge carrier constitute current by diffusing to other side of junction. For reversed biased, minority charge carrier constitute small amount of leakage current by drifting due to externally applied electric field.

25 The electric field at a distance $\frac{3R}{2}$ from the centre of a charged conducting spherical shell of radius R is E. The electric field at a distance $\frac{R}{2}$ from the centre of the sphere is

Solution

Electric field inside a charged conductor is always zero.

26 Two smooth and similar right-angled prisms are arranged on a smooth horizontal plane as shown in the figure. The lower prism has a mass 3 times that of the upper prism. The prisms are held in an initial position as shown and are released. As the upper prism touches the horizontal plane, the distance moved by the lower prism is



Solution

The displacement of the centre of mass of the system along the horizontal direction is zero. This means

$x_{cm} = \frac{m_1x_1+m_2x_2}{m_1+m_2} = 0$

Let x be the displacement of the lower prism, then

$x_{cm} = \frac{m(a-b-x)+3m(-x)}{m+3m} = 0$

$\Rightarrow a - b - x - 3x = 0$

$\Rightarrow x = \frac{a-b}{4}$

27 Two coplanar concentric circular coils of radii r and $2r$, have the same number of turns n. The smaller coil carries a clockwise current i, while the larger coil carries an anticlockwise current $2i$. The magnetic field induction at the centre is

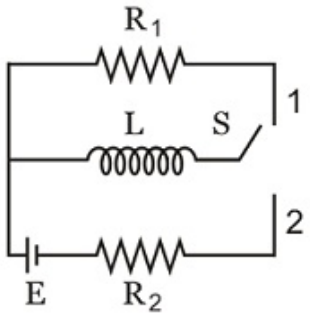
Solution

$B_1 = \frac{\mu_0 ni}{2r}$, $B_2 = \frac{\mu_0 n(2i)}{2(2r)}$

$B_R = B_1 - B_2$

$B_1 = B_2$, both are in opposite direction

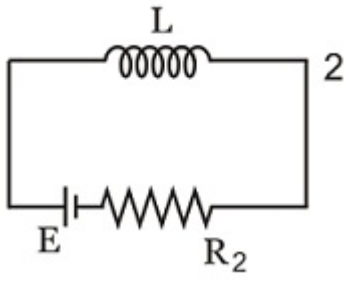
28 In the circuit shown switch S is connected to position 2 for a long time and then joined to position 1. The total heat produced in resistance R_1 is :



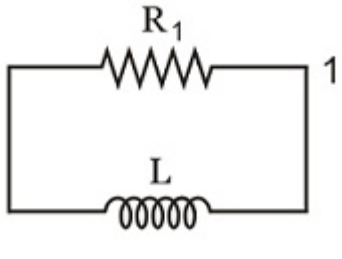
Solution

When the key is at position (B) for a long time; the energy stored in the inductor is :

$$U_B = \frac{1}{2}Li_0^2 = \frac{1}{2} \cdot L \cdot \left(\frac{E}{R_2}\right)^2 = \frac{LE^2}{2R_2^2}$$



This whole energy will be dissipated in the form of heat when the inductor is connected to R1 and no source is connected.



29 The photoelectric threshold frequency of metal is ν. When the light of frequency 4ν is incident on the metal, the maximum kinetic energy of the emitted photoelectrons is

Solution

From Einstein's photoelectric equation the maximum kinetic energy of photoelectrons emitted from the metal surface is given by

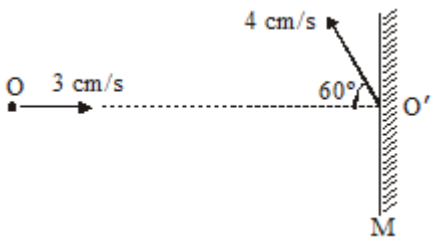
$$E_k = h\nu_1 - W$$

Where W is the work function of the metal.

Given, $W = h\nu$ and $\nu_1 = 4\nu$

$\therefore \quad E_k = 4h\nu - h\nu = 3h\nu$

30 A point object O and a mirror M move with velocities of 3 cm/s and 4 cm/s respectively as shown in the figure. OO' is the normal to the mirror. What is the velocity of the image ?



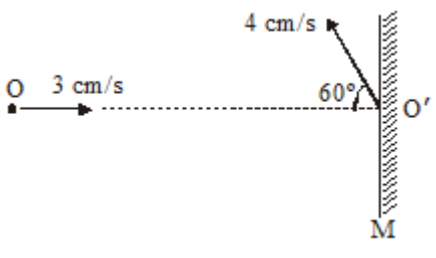
Solution

Only velocity of mirror along $\mathrm{OO'} = (= 2\ \mathrm{cm/s})$ is relevant

Relative to mirror : velocity = 5 cm/s

$\Rightarrow$ velocity of image relative to mirror = 5 cm/s towards left.

Relative to laboratory frame : velocity of image = 7 cm/s.



31 A body of mass m is accelerated uniformly from rest to a speed v in a time T. The instantaneous power delivered to the body as a function of time t, is given by

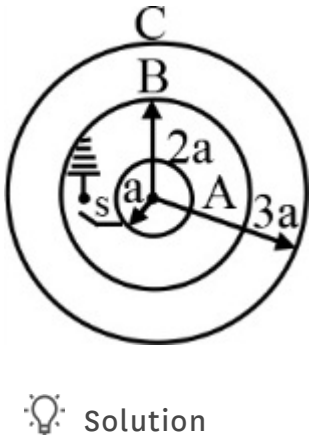
Solution

$F = \mathrm{ma} = \frac{\mathrm{mv}}{T} \qquad \left(\because a = \frac{\mathrm{v}-0}{T}\right)$

Instantaneous power $= Fv$

$= \mathrm{mav} = \frac{\mathrm{mv}}{T}at = \frac{\mathrm{mv}}{T}\frac{\mathrm{v}}{T}t = \frac{\mathrm{mv}^2}{T^2}t$

32 Three conducting concentric spherical shells $\mathrm{A},\ \mathrm{B}$ and C having radii $\mathrm{a},\ 2\mathrm{a}$ and $3\mathrm{a}$ respectively are placed as shown. Initially A and C carry some positive charge whereas shell B is uncharged. Now switch S is closed. The potential difference $(\mathrm{V_A} - \mathrm{V_B})$ between shell A and B will -



Solution

After connecting with earth charge on inner shell becomes negative direction of electric field charges magnitude of potential difference may increase depending on value of charge

33 The ground state energy of H-atom is $13.6\ \mathrm{eV}$. The energy needed to ionize H-atom from its second excited state is

Solution

Ionization energy is the energy required to remove an electron from a gaseous atom or ion.

for this case, initially, the electron is in 3^{rd} orbit and we know for H-atom $\mathrm{E_{n=3}} = -1.51\ \mathrm{eV}$

Hence ionization energy of the electron is $1\ .51\ \ \mathrm{eV}$

34 If a satellite is moving around the earth in an orbit of $5R$ radius, here R = radius of the earth. The minimum kinetic energy required to be provided to the satellite such that it escapes the gravitational field of the earth is (M and m are masses of earth and satellite respectively)

Solution

if a satellite is moving in a orbit of 5R radius,

The total energy of satellite (binding energy)
$= E_{\mathrm{T}} = \frac{-1}{2}\frac{\mathrm{GMm}}{(5\mathrm{R})}$

The energy that needs to be provided = (- Binding energy)
$\Rightarrow \mathrm{E}_{\text{to be given}} = \frac{\mathrm{GMm}}{10\,\mathrm{R}}$

35 The maximum energy in thermal radiation from a source occurs at the wavelength $4000\,\text{Å}$. The effective temperature of the source is (Wien's constant, $b = 2.93 \times 10^{-3}\ \mathrm{m\,K}$)

Solution

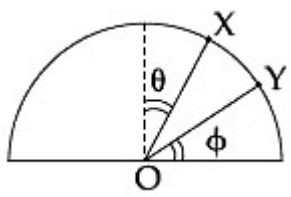
According to Wien's displacement law

$\lambda_m = \frac{b}{T} \Rightarrow T = \frac{b}{\lambda_m} = \frac{2.93\times10^{-3}}{4000\times10^{-10}} = 7325\,\mathrm{K}$

36 A big explosion on the moon cannot be heard on the earth because

Solution

As the sound waves are mechanical waves they requires medium for propagation.

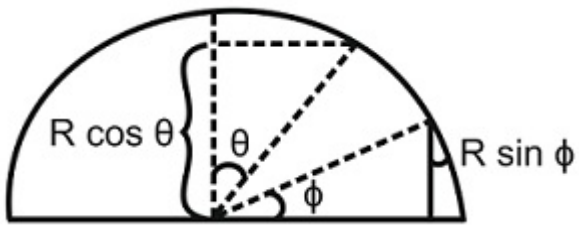
37 

A particle is released on a vertical smooth semicircular track from point X so that OX makes angle θ from the vertical (see figure). The normal reaction of the track on the particle vanishes at point Y where OY makes angle ϕ with the horizontal. Then :

Solution

$\mathrm{mg}\cdot(\mathrm{R}\cos\theta - \mathrm{R}\sin\phi) = \frac{1}{2}\,\mathrm{mV}^2$ _____ (1)

on loosing contact N=0 $\Rightarrow \mathrm{mg}\sin\phi = \frac{\mathrm{mV}^2}{\mathrm{R}}$ _____ (2)



$\Rightarrow\ \mathrm{mgR}\,(\cos\theta - \sin\phi) = \frac{1}{2}\ \mathrm{mg\,R}\ \ \sin\phi$

$\Rightarrow 2\cos\theta = 3\sin\phi$

38 The internal and external diameters of a hollow cylinder are measured with the help of vernier callipers. Their values are 4.23 ± 0.01 cm and 3.87 ± 0.01 cm respectively. The thickness of the wall of the cylinder is

Solution

$t = \frac{D_1 - D_2}{2} = \frac{4.23 - 3.87}{2} = 0.18\,\text{cm}$

$\Delta t = \Delta D_1 + \Delta D_2$

$= 0\ .01 + 0\ .01 = 0.02\,\text{cm}$

$\Rightarrow \text{t} = (0\ .18 \pm 0\ .02)\ \text{cm}$

39 Three samples of the same gas A, B and C ($\gamma = \frac{3}{2}$) have equal volume initially. Now, the volume of each sample is doubled. For A, the process is adiabatic; for B, it is isobaric and for C, the process is isothermal. If the final pressures are equal for all the three samples, the ratio of their initial pressures is

Solution

Let P_A, P_B, P_C be the initial pressures of the three samples and P be the final pressure of each.

For A process is adiabatic, $PV^{\gamma} = \text{constant}$

$\therefore\ P_A\left(V\right)^{3/2} = P\left(2V\right)^{3/2} \Rightarrow P_A = 2^{3/2}\,P$

For B, the process is isobaric $\therefore\ P_B = P$

For C, the process is isothermal, $PV = \text{constant}$

$\therefore\ P_C(V) = P(2V) \Rightarrow P_C = 2P$

Hence, $\text{P}_\text{A} : \text{P}_\text{B} : \text{P}_\text{C} = 2^{3/2} : 1 : 2 = 2\sqrt{2} : 1 : 2$

40 An electron having kinetic energy $10\ \text{eV}$ is circulating in a path of radius $0.1\ \text{m}$ in an external magnetic field of intensity $10^{-4}\ \text{T}$. The speed of the electron will be

Solution

When charge enters into a perpendicular magnetic field, it starts to move in a circular path.
Radius of a circular path followed by a charge particle:
$r = \frac{mV}{qB}$
$V = 1.76 \times \left(10^6\right)\ \text{ms}^{-1}$

41 The moment of inertia of a rigid body in terms of its angular momentum L and kinetic energy K is

Solution

Angular momentum of a rigid body about a fixed axis is given by

$L = I\omega$

Where I is moment of inertia and ω is angular velocity about that axis.

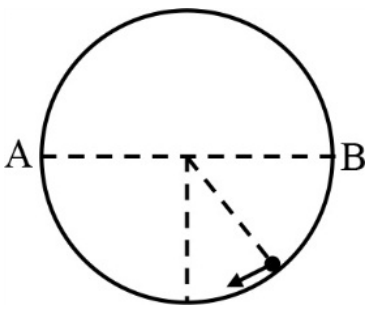
Kinetic energy of body is given by

$K = \frac{1}{2}\,I\omega^2$

$\therefore K = \frac{1}{2I}(I\omega)^2 = \frac{L^2}{2I}$

$\Rightarrow I = \frac{L^2}{2K}$

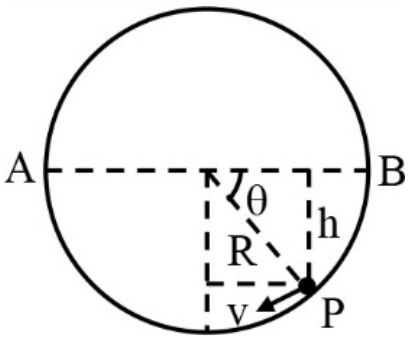
42 A particle of mass m oscillates along the horizontal diameter AB inside a smooth spherical shell of the radius R. At any instant the kinetic energy of the particle is K. Then the force applied by particle on the shell at this instant is



Solution

Let the velocity of the particle at the point P is v.

From the conservation of mechanical energy



$\frac{1}{2}mv^2 = K = mgh$

Let N be the normal reaction between the particle and the shell at this instant. Then

$N - \ mg\ \sin\theta = \frac{mv^2}{R}\ \left(\frac{mv^2}{R} = \frac{2K}{R}\right)$

or $N = mg\left(\frac{h}{R}\right) + \frac{2K}{R} = \frac{K}{R} + \frac{2K}{R} \quad (mgh = \ K)$

$\therefore\ N = \frac{3K}{R} = \text{ force on shell}$

43 A vibration magnetometer consists of two identical bar magnets placed one over the other such that they are mutually perpendicular and bisect each other. The time period of the combination is $4\ \mathrm{s}$. If one of the magnets is removed, then the time period of other one will be

Solution

As magnets are perpendicular to each other, the resultant magnetic moment

$$\mathrm{M'} = \sqrt{\mathrm{M}^2 + \mathrm{M}^2} = \sqrt{2}\,\mathrm{M}$$

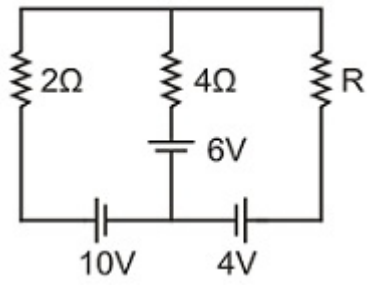
$\therefore\ \ \mathrm{T}_1 = 2\pi\sqrt{\frac{2\mathrm{I}}{\left(\sqrt{2}\mathrm{M}\right)\mathrm{H}}}$

In the second case, $\mathrm{T}_2 = 2\pi\sqrt{\frac{\mathrm{I}}{\mathrm{MH}}}$

$$\frac{\mathrm{T}_2}{\mathrm{T}_1} = \frac{1}{(2)^{1/4}}$$

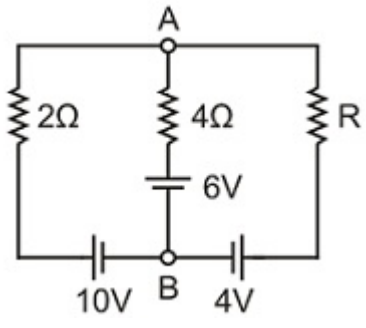
$\therefore \qquad \mathrm{T}_2 = \frac{4}{(2)^{1/4}} = 3.36\ \mathrm{s}$

44 For what value of R in the circuit as shown current passing through 4 Ω resistance will be zero



Solution

When current through 4 Ω resistance is zero, then V_A - V_B = 6 V



i.e., potential difference across 2 Ω resistance would be 10 - 6 = 4V

$\therefore$ Current through 2 Ω resistance is 2 A.

Potential difference across R is $(6-4)$V and 2A flows through it

$\Rightarrow R = \frac{6-4}{2}$

$\therefore \mathrm{R} = 1\Omega$

45 A gas expands with temperature according to the relation $V = KT^{2/3}$, where K is a constant. Calculate work done when the temperature changes by $60\ \mathrm{K}$?

Solution

$dW = PdV = \frac{RT}{V}\,dV \qquad \ldots(\mathrm{i})$

As $V = KT^{2/3} \therefore\ dV = K\,\frac{2}{3}\,T^{-1/3}\,\mathrm{d}\,T$

$\therefore \quad \frac{\mathrm{d}V}{V} = \frac{K\,\frac{2}{3}\,T^{-1/3}\,\mathrm{d}\,T}{KT^{2/3}} = \frac{2}{3}\,\frac{\mathrm{d}T}{T} \qquad \ldots(\mathrm{ii})$

From (i), $W \int_{V_1}^{V_2} RT\,\frac{\mathrm{d}V}{V} = \int_{T_1}^{T_2} RT\,\frac{2}{3}\,\frac{dT}{T}$ (Using (ii))

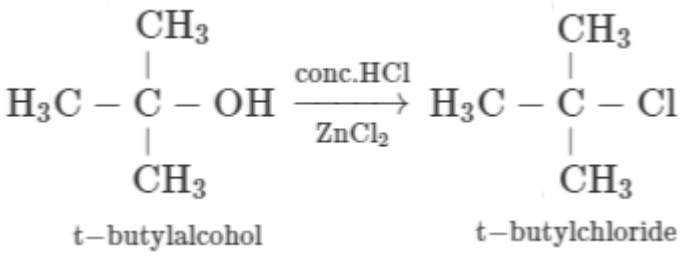
$W = \frac{2}{3}R\,[T]_{T_1}^{T_2}$

$W = \frac{2}{3}R\,[T_2 - T_1] = \frac{2}{3}R \times 60 = 40\,R$

CHEMISTRY

1 Tertiary butyl alcohol gives tertiary butyl chloride on treatment with

Solution



2 The energy of an electron in the first orbit of $\mathrm{H}-$ atom is $-13.6\ \mathrm{eV}$. The possible energy values of the excited state for electrons in Bohr orbits of Li^{2+} ions is/are-

Solution

$\mathrm{E_n} = -\frac{13.6\ \mathrm{Z}^2}{\mathrm{n}^2}$ for Li^{2+}, $\mathrm{E_n} = -\frac{13.6 \times 9}{\mathrm{n}^2}$

$= \frac{-122.4}{\mathrm{n}^2}\ \mathrm{eV}$

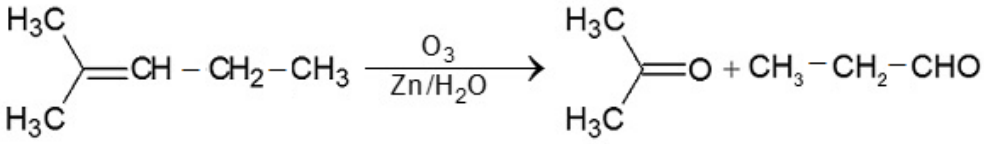
If $\mathrm{n} = 1,\ \mathrm{E_n} = -122.4\ \mathrm{eV}$

If $\mathrm{n} = 2,\ \mathrm{E_n} = -30.6\ \mathrm{eV}$

If $\mathrm{n} = 3,\ \mathrm{E_n} = -13.6\ \mathrm{eV}$

3 2-Methylpent-2-ene on reductive ozonlysis will give

Solution



4 A binary solid $(\mathrm{A}^{+}\mathrm{B}^{-})$ has a rock salt structure. If the edge length is 400 pm and radius of cation is 75 pm the radius of anion is:

Solution

$\mathrm{Edge} = 2\mathrm{r}^{+} + 2\mathrm{r}^{-}$

$\therefore 400 = 2 \times 75 + 2\mathrm{r}^{-}$

$\therefore \mathrm{r}^{-} = 125\ \mathrm{pm}$

Therefore the radius of anion is 125 pm.

5 $3\ \mathrm{gm}$ of Mg is burnt in a closed vessel containing $3\ \mathrm{gm}$ of oxygen,. The weight of excess reactant left is-

Solution

$\mathrm{Mg} + \frac{1}{2}\mathrm{O_2} \longrightarrow \mathrm{MgO}$

For $3\ \mathrm{gm}$ of Mg, mass of oxygen required$= \frac{16 \times 3}{24} = 2\ \mathrm{gm}$

$\therefore$ mass of excess oxygen $= 3 - 2 = 1\ \mathrm{gm}$

6 The Lanthanide contraction relates to

Solution

Atomic radius

7 Which one of the following constitutes a group of the isoelectronic species?

Solution

Species having the same number of electrons called as isoelectronic species. By calculating the number of electrons in each species given here, we get

$\mathrm{CN}^{-}\,(6+7+1=14); \mathrm{N}_2\,(7+7=14);$

$\mathrm{O}_2^{2-}\,(8+8+2=18); \mathrm{C}_2^{2-}\,(6+6+2=14);$

$\mathrm{O}_2^{-}\,(8+8+1=17)\,; \mathrm{NO}^{+}\,(7+8-1=14)$

$\mathrm{CO}\,(6+8=14); \mathrm{NO}\,(7+8=15)$

From the above calculation we find that all the species listed in choice c have 14 electrons each so it is the correct answer.

8 Which quantities are conserved in all oxidation reduction reaction

Solution

Both charge and mass conserves in an oxidation - reduction reaction.

9 0.2033g of an organic compound in Dumas method gave 31.7 mL of moist N_2 at $14^{\circ}\mathrm{C}$ and 758 mm pressure. Percentage of N_2 in the compound is $(\text{Aqueous Tension at } 14^{\circ}\mathrm{C} = 14\mathrm{mm})$

Solution

Find the value of N_2 at STP by using

$\frac{\mathrm{P}_1\mathrm{V}_1}{\mathrm{T}_1} = \frac{\mathrm{P}_2\mathrm{V}_2}{\mathrm{T}_2}$ then find

$\%\mathrm{N} = \frac{28}{22400} \times \frac{\text{Volume of } \mathrm{N}_2 \text{ at STP(ml)}}{\text{Weight of organic compound}} \times 100$

10 In the manufacture of NH_3 in Haber's continuous flow process involving the reaction

$\mathrm{N}_{2(g)} + 3\mathrm{H}_{2(g)} \overset{[\mathrm{Fe}_2\mathrm{O}_3]}{\rightleftharpoons} 2\mathrm{NH}_{3(g)}, \Delta\mathrm{H} = -22.08\mathrm{kcal}.$

The favourable conditions are:

Solution

The reaction is exothermic and takes place with a decrease in number of molecules of gaseous species. Obviously high pressure and low temperature are the favourable conditions for the shift of equilibrium to products side. However, in continuous flow process optimum elevated temperature is required to have more NH_3 due to high activation energy of the reaction.

11 Which one of the following is an example of thermosetting polymers ?

Solution

Thermosetting polymer :A thermosetting polymer can be molded into desired shape when hot, but once these get cooled and hardened, they cannot be remoulded again. An example of this is Bakelite

12 Which one of the following is not applicable to chemisorption?

Solution

It is based on concept of chemisorption.

13 When NaCl is heated with sulphuric acid in the presence of MnO_2 a greenish-yellow gas is liberated. The gas is

Solution

Yellowish-green gas of chlorine is evolved when the sodium chloride is heated with concentrated H_2SO_4 in presence of MnO_2.

$NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$

14 The rate constant for the first-order reaction is $60\ s^{-1}$. How much time will it take to reduce the concentration of the reactant to 1/16 of initial value?

Solution

$t = \frac{2.303}{k}\log\frac{[A]_0}{[A]}$

$= \frac{2.303}{60}\log\frac{a}{\frac{a}{16}} = \frac{2.303}{60}\log 16$

$= \frac{2.303}{60} \times 1.204$

$= 0.0462s$

$= 4.6 \times 10^{-2}\ s$

15 An open vessel at 27^oC is heated until $3/8th$ of the air in it has been expelled. Assuming that the volume remains constant, calculate the temperature at which the vessel was heated

Solution

If $\frac{3^{th}}{8}$ of the air is expelled out then remaining air $= \frac{5}{8}$

In the open vessel volume and pressure are both constant but moles are decreasing

$\therefore \quad n_1T_1 = n_2T_2$

$\therefore\ n_1 \times 300 = \left(\frac{5}{8}n_1\right)T_2$

$\therefore\ T_2 = \frac{8}{5} \times T_1 = \frac{8}{5} \times 300 = 480\ K$

$= 480 - 273 = 207^oC$

16 For an exothermic chemical process occurring in two steps as :

(i) $A + B \rightarrow X\ (Slow)$

(ii) $X \rightarrow AB\ (Fast)$

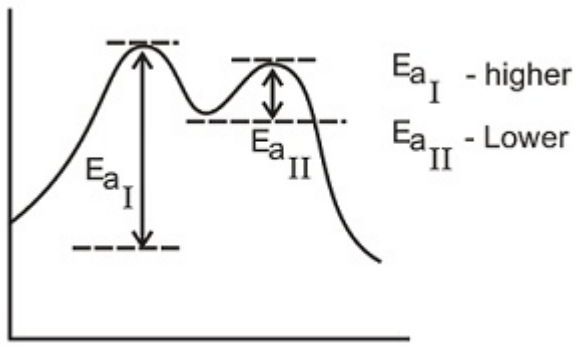
The progress of the reaction can be best described by

Solution

Two step reactions i.e. two peaks in P.E. v/s time diagram for reaction and X is intermediate lying at the valey of two peaks.

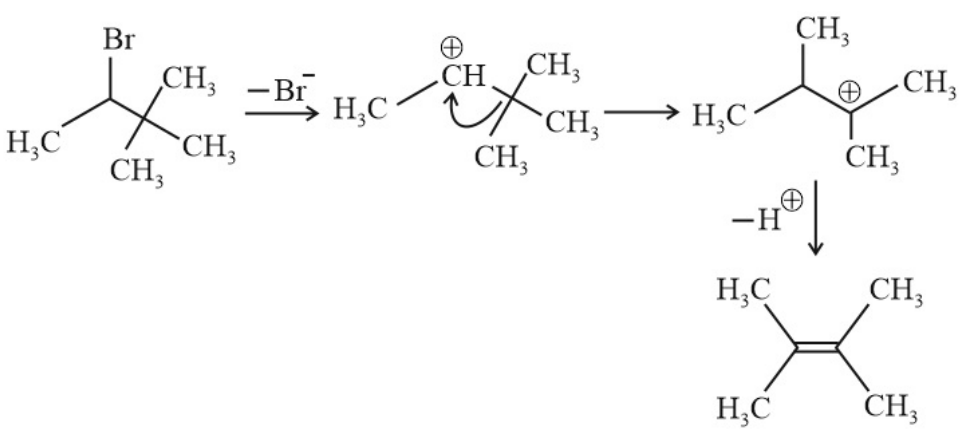
(E_{a_I}) First step high activation energy (Slow)

$(E_{a_{II}})$ Second step lower activation energy (Fast)



17 The major product in the dehydrohalogenation of 3-Bromo-2, 2-dimethylbutane is

Solution



18 If for $N_2 + 3H_2 \rightleftharpoons 2NH_3,\ K_{eq} = 1.6 \times 10^{-5}$, then the value of K_{eq} for the reaction $NH_3 \rightleftharpoons \frac{1}{2}N_2 + \frac{3}{2}H_2$ will be

Solution

Given,

$N_2 + 3H_2 \rightleftharpoons 2NH_3,\ K_{eq} = 1.6 \times 10^{-5}$

$K_{eq} = \frac{[NH_3]^2}{[N_2][H_2]^3} = 1.6 \times 10^{-5}$ ...(i)

For reaction,

$NH_3 \rightleftharpoons \frac{1}{2}N_2 + \frac{3}{2}H_2$

$K\prime_{eq} = \frac{[N_2]^{1/2}[H_2]^{3/2}}{[NH_3]}$ ...(ii)

On squaring both sides, Eq.(ii) becomes

$(K'_{eq})^2 = \frac{[N_2][H_2]^3}{[NH_3]^2}$ ...(iii)

Eq.$(i) \times$ Eq. (iii), we get

$K_{eq} \times \left(K^{'}_{eq}\right)^2 = 1$

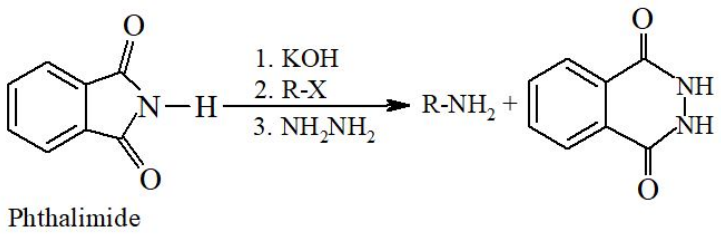
$1.6 \times 10^{-5} \times (K'_{eq})^2 = 1$

$K'_{eq} = \frac{1}{\sqrt{1.6 \times 10^{-5}}} = \frac{1000}{4} = 250$

19 Gabriel's synthesis is used frequently for the preparation of which of the following ?

Solution

Gabriel's synthesis : Phthalimide is reacted with KOH to form potassium phthalimide. The potassium salt is treated with an alkyl halide. The product N-alkyl phthalimide is put to hydrolyse with hydrochloric acid, then primary amine is formed.

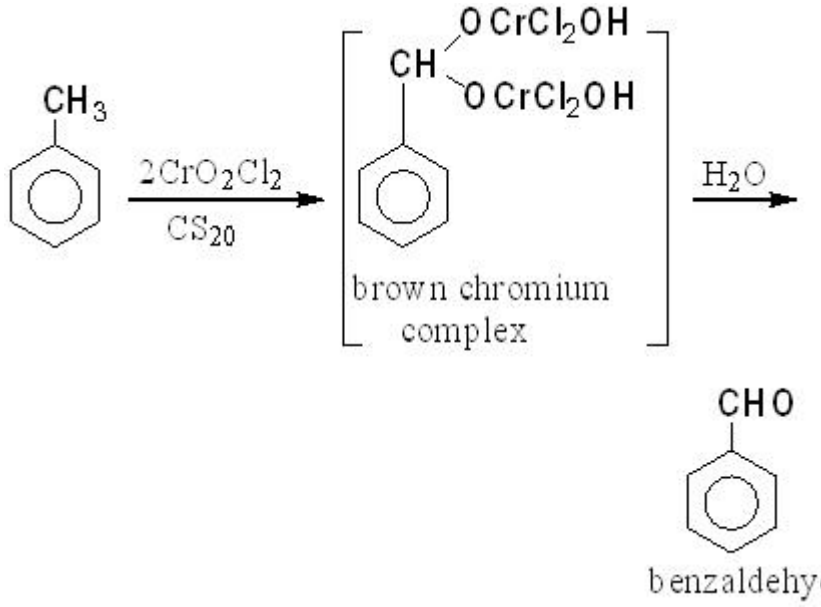


Phthalimide

20 Etard's reaction involves the preparation of benzaldehyde from

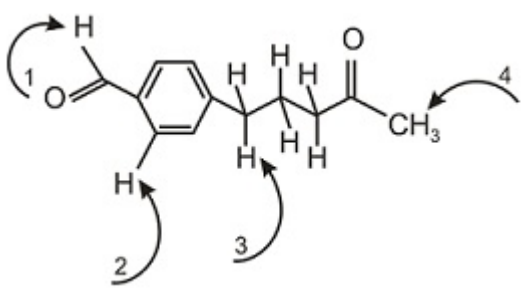
Solution

Toluene can be oxidized to benzaldehyde with a solution of chromyl chloride (CrO_2Cl_2) in CS_2 or CCl_4. This is known as Etard reaction

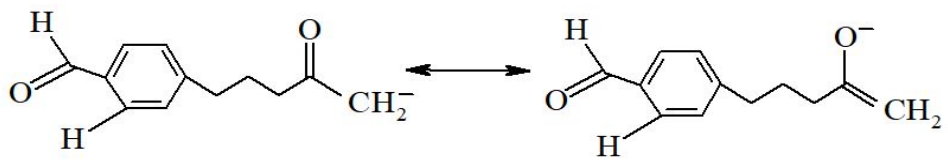


Further oxidation of benzaldehyde to benzoic acid is avoided by protection of carbonyl group

21 Choose from the indicated protons, the one that is most acidic



Solution

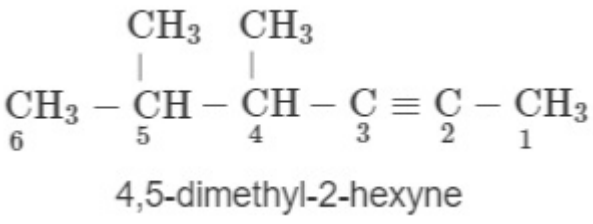


Deprotonation of hydrogen labelled 4 produces a conjugate base which has more stable resonating structure and a resonance structure in which negative charge is present on the electronegative oxygen atom. Therefore, hydrogen labelled 4 is most acidic.

22 Choose the correct IUPAC name of the compound

$$CH_3-\underset{|}{\overset{CH_3}{CH}}-\underset{|}{\overset{CH_3}{CH}}-C\equiv C-CH_3$$

Solution



4,5-dimethyl-2-hexyne

23 A mixture of methane and ethene in a molar ratio of $x : y$ has an average molecular mass of $20\ u$. The mean molar mass when they are mixed in the molar ratio of $y : x$ will be -

Solution

Mol. wt. of $CH_4 = 16$

Mol. wt. of $C_2H_4 = 28$

$\therefore 20 = \frac{16x+28y}{x+y}$

or $16x + 28\ y = 20\ x + 20\ y$

or $4x = 8y$

or $x = 2y$

In the gaseous mixture when the mole ratio of CH_4 and C_2H_4 is $y\ :\ x$

then avg. mol. $wt = \frac{16y+28x}{x+y} = \frac{16y+56y}{3y}$

$= \frac{72y}{3y} = 24\ u$

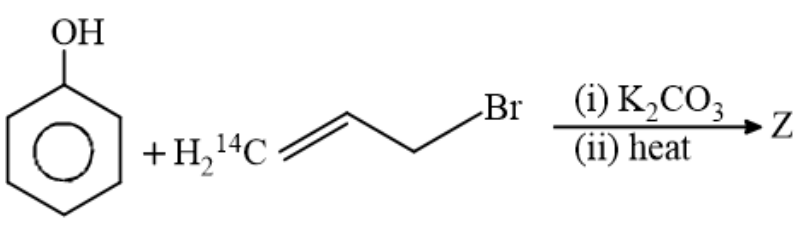
24 $5N\ H_2SO_4$ was diluted from 1 litre to 10 litres . Normality of the solution obtained is

Solution

$N_1V_1 = N_2V_2\ \ 5N\ \times 1\ lit\ =\ x\ \times\ 10\ lit.$

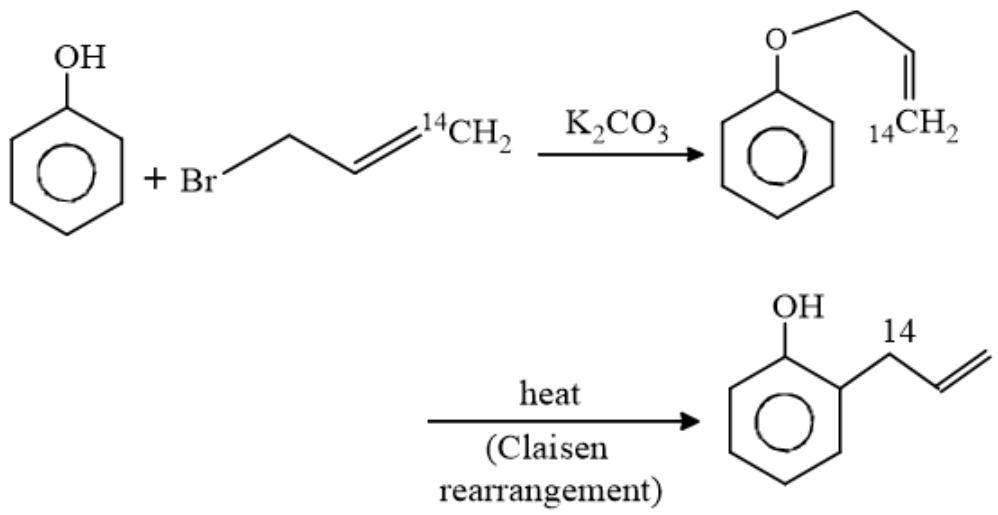
$\therefore x = 0.5\ N$

25



Here Z is

Solution



26 Minimum moles of NH_3 required to be added to 1L solution so as to dissolve 0.1 mol of $AgCl$ $\left(K_{sp} = 1.0 \times 10^{-10}\right)$ by the reaction is:

$$AgCl(s) + 2NH_3 \rightleftharpoons \left[Ag(NH_3)_2\right]^+ + Cl^-$$

Given K_f of $\left[Ag(NH_3)_2\right]^+ = 10^8$

Solution

$$AgCl_{(s)} + aq \rightleftharpoons Ag^+_{(aq)} + Cl^-_{aq} \; ; \; K_{sp}$$
$$Ag^+_{aq} + 2NH_{3_{aq}} \rightleftharpoons \left[Ag(NH_3)^+_{2_{aq}}\right] \; ; \; K_f$$

$$AgCl_{(s)} + 2NH_3 \rightleftharpoons \left[Ag(NH_3)^+_{2_{aq}}\right] + Cl^-_{aq} \qquad K = K_{sp} \times K_f$$

$(C - 0.2)M \qquad 0.1\ M \qquad 0.1\ M$ Equilibrium concentration

$$K = 10^{-10} \times 10^8 = 10^{-2} = \frac{\left[Ag[NH_3)^+_2\right][Cl^-]}{[NH_3]^2}$$

$$10^{-2} = \frac{10^{-1} \times 10^{-1}}{(M - 0.2)^2}$$

$$\therefore \; M - 0.2 = 1$$

$$\therefore \; M = 1.2\ M$$

27 Using the data provided, calculate the multiple bond energy $\left(kJ\ mol^{-1}\right)$ of a $C \equiv C$ bond in C_2H_2 . That energy is (take the bond energy of a $C - H$ bond as $350\ kJ\ mol^{-1}$)

$$2C\,(s) \rightarrow 2C\,(g\ ;\ )\Delta H = 1410\ kJ\ mol^{-1}$$

$$H_2\,(g) \rightarrow 2H(g\ ) : \Delta H = 330\ kJ\ mol^{-1}$$

$$2C\,(s) + H_2\,(q) \rightarrow C_2H_2\ \ ;\ \Delta H = 225\ kJmol^{-1}$$

Solution

(i) $2C\,(s) + H_2\,(g) \rightarrow H - C \equiv C - H(g)$

$\Delta H = 225\ kJ\ mol^{-1}$

(ii) $2C\,(s) \rightarrow 2C(g)$

$\Delta H_1 = 1410\ KJ\ mol^{-1}$

(iii) $H_2(g) \rightarrow 2H(g)$

$\Delta H_2 = 330 \text{ KJ mol}^{-1}$

From equation (i) :

$225 = (\Delta H_1 + \Delta H_2) - [\ 2\ \Delta\ H_{C-H} + \Delta H_{C \equiv C}]$

$225 = [\ 1410 + 330] + (2 \times 350) + \Delta H_{C \equiv C}\ ]$

$225 = 1040 - \Delta H_{C \equiv C}$

$\Delta H_{C \equiv C} = 1040 - 225 = 815 \text{ KJ mol}^{-1}$

28 Which element has the lowest electronegativity?

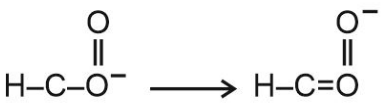
Solution

$_3Li - 1s^2 2s^1$ donates one electron easily from the outer shell. Hence, is less electronegative.

29 In the anion $HCOO^-$ the two carbon - oxygen bonds are found to be of equal length. What is the reason for it ?

Solution

$HCOO^-$ exists as



So, the two carbon-oxgen bonds are found to be of equal length

30 If 0.15 g of a solute, dissolved in 15 g of solvent, is boiled at a temperature higher by $0.216^{\circ}C$ than that of the pure solvent. The molecular weight of the substance (molal elevation constant for the solvent is $2.16^{\circ}C$) is

Solution

weight of solute (w) =0.15 g, weight of solvent (W)=15 g,

ΔT_b =0.216°C

k_b = 2.16°C

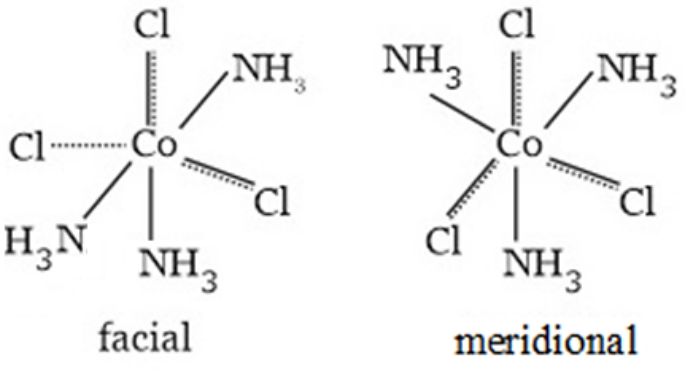
$\therefore M = \frac{k_b \times w \times 1000}{\Delta T_b \times W}$

$= \frac{2.16 \times 0.15 \times 1000}{0.216 \times 15} = 100$

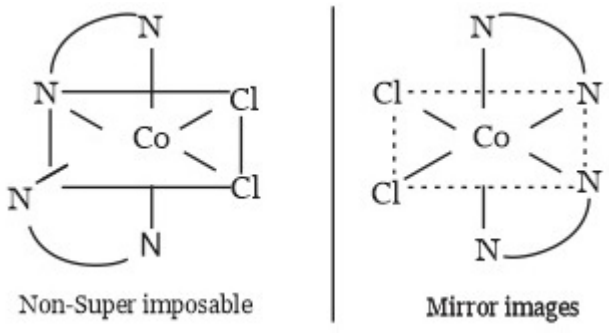
31 Which one of the following complexes shows optical isomerism? (en=ethylendiamine)

Solution

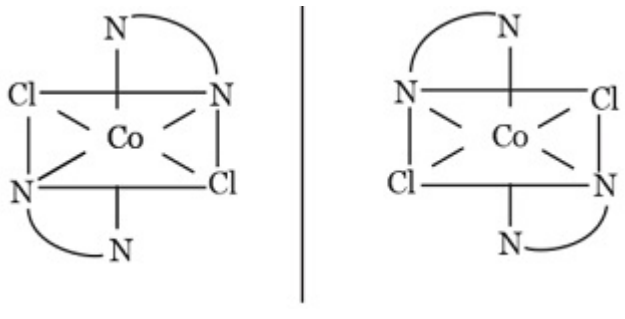
Geometrical isomer

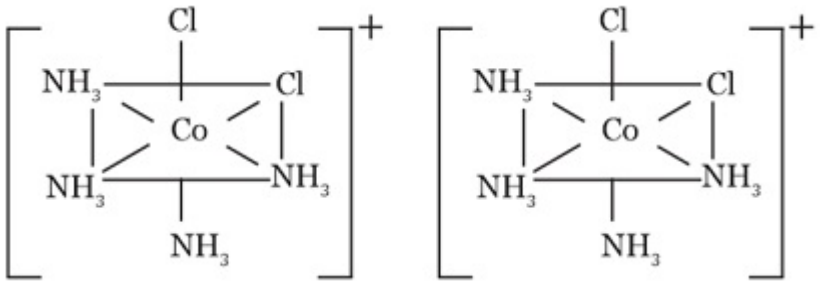


cis $\left[\mathrm{Co(en)_2Cl_2}\right]\mathrm{Cl}$



trans $\left[\mathrm{co(en)_2Cl_2}\right]\mathrm{Cl}$





Cis trans

32 Which of the following pairs of a chemical reaction is certain to result in a spontaneous reaction?

Solution

$\Delta \mathrm{G} < 0$. As per Gibbs Helmholtz equation,

$\Delta \mathrm{G} = \Delta \mathrm{H} - \mathrm{T}\Delta \mathrm{S}$

Thus $\Delta \mathrm{G}$ is –ve only

When $\Delta \mathrm{H} = \ -\mathrm{ve}$ (exothermic)

and $\Delta \mathrm{S} = +\mathrm{ve}$ (increasing disorder)

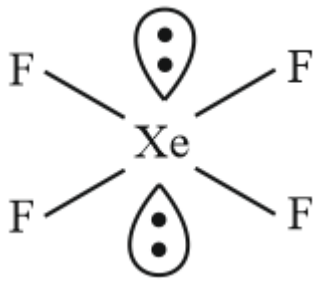
This reaction will be spontaneous at all Temperatures.

33 The fluoride for which the dipole moment is not equal to zero, is :

Solution

As per VSEPR Theory

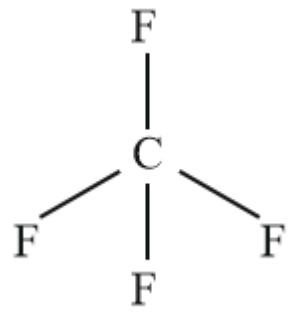
$\mathrm{XeF_4} \Rightarrow \mathrm{H} \Rightarrow \frac{1}{2}(8+4) = \mathrm{sp^3\,d^2}\,(6)$



Geometry square planar with 2 L.P.

$\overrightarrow{\mu} = 0$ (symmetry)

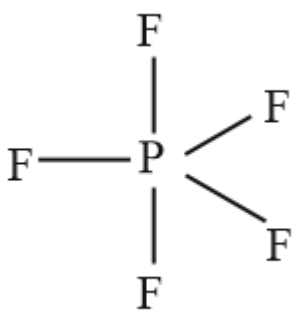
$\mathrm{CF_4} \Rightarrow \mathrm{H} \Rightarrow \frac{1}{2}(4+4) = \mathrm{sp^3}\,(4)$



Tetrahedral geometry

$\overrightarrow{\mu} = 0$ (symmetry)

$\mathrm{PF_5} \Rightarrow \mathrm{H} = \frac{1}{2}(5+5) = \mathrm{sp^3d}\,(5)$



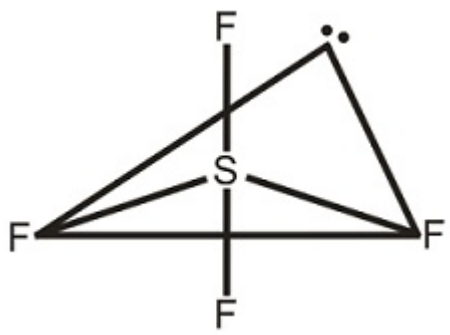
Trigonal bipyramidal

$\overrightarrow{\mu} = 0$ (Symmetry)

$\mathrm{SF_4} \Rightarrow \mathrm{H} = \frac{1}{2}(6+4) = \mathrm{sp^3d}\,(5)$

With one L.P see saw geometry

$\overrightarrow{\mu} \neq 0$ has a value



$\mu > 0$ due to two S - F bonds in equatorial plane.

34 The element which on burning in air gives peroxide is

Solution

Alkali metals on burning in air give monoxide, peroxide or superoxide.

Li forms monoxide.

$$2\mathrm{Li} + \frac{1}{2}\mathrm{O_2} \rightarrow \mathrm{Li_2O}$$

Na form peroxide as well as monoxide.

$$2\mathrm{Na} + \mathrm{O_2} \rightarrow \mathrm{Na_2O_2}$$

$$2\mathrm{Na} + \frac{1}{2}\mathrm{O_2} \rightarrow \mathrm{Na_2O}$$

K, Rb, and Cs form superoxide.

$$M\,(=K,\ \mathrm{Rb},\ \mathrm{Cs}) + \mathrm{O_2} \rightarrow MO_2$$

35 The number of unit cells present in $39\ \mathrm{g}$ of potassium if it crystallizes as body centred cube is ($\mathrm{N} =$ Avogadro number, At. Wt. of potassium = $39\ \mathrm{g/mol}$)

Solution

Potassium has bcc system
Number of mole $= 39/39 = 1$ mole
1 mole of atoms = 6.022×10^{23} atoms $= \mathrm{N}$
$\because$ In bcc system 2 atoms are present in 1 unit cell.

$\therefore$ N number of atoms are present in $\frac{\mathrm{N}}{2}$ unit cells.

36 Antiseptic chloroxylenol is

Solution

Antiseptic chloroxylenol is 4-chloro-3, 5-dimethylphenol

37 **Statement I :** For adsorption $\Delta \mathrm{G}, \Delta \mathrm{H}, \Delta \mathrm{S}$ all have negative values.

Statement II : Adsorption is an exothermic process in which randomness decreases due to force of attraction between adsorbent and adsorbate.

Solution

II is correct explanation of I as adsorption leads to arrangement i.e., decreases randomness $(\because \Delta \mathrm{S} = -\mathrm{ve})$ at the same time energy is released due to attraction between adsorbate and adsorbent $(\because \Delta \mathrm{H} = -\mathrm{ve})$.

Adsorption is a spontaneous process as it occurs on its own. For all spontaneous processes, the change in free energy is negative. Or,

$\therefore$ $\Delta \mathrm{G} = -\mathrm{ve}$

38 Heating mixture of $\mathrm{Cu_2O}$ and $\mathrm{Cu_2S}$ will give

Solution

$\mathrm{Cu_2S + 2Cu_2O \rightarrow 6Cu + SO_2}$ (Auto-reduction).
This reaction occurs in reverberatory furnace to get metallic copper.

39 Least thermally stable is -

Solution

The thermal stability of tetrahalides decreases in order

$\mathrm{CX_4 > SiX_4 > GeX_4 > SnX_4}$ and in terms of same metal with different halides is in order of $\mathrm{MF_4 > MCl_4 > MBr_4 > MI_4}$.

40 At STP, $0.50\,\mathrm{mole}$ $\mathrm{H_2}$ gas and $1.0\,\mathrm{mole}\,\mathrm{He}$ gas

Solution

Average translational kinetic energy (E) per molecule

$\mathrm{E} = \frac{3}{2}\mathrm{kT}$

k is Boltzmann's constant, equal to 1.38×10^{-23}

Average kinetic energy depends only on temperature $\left(\mathrm{K.E} = \frac{3}{2}\mathrm{kT}\right)$

41 Assertion : Moving phase is liquid and stationary phase is solid in paper chromatography.

Reason: Paper chromatography is used for analysis of polar organic compounds.

Solution

Paper chromatography is a liquid-liquid partition chromatography in which the water is adsorbed or chemically bond to cellulose of paper which acts as the stationary phase while the mobile phase is another liquid which is usually a mixture of two or three solvents in which water is one of the components.

42 Dissociation constants of CH_3COOH and NH_4OH are 1.8×10^{-5} each at $25^\circ C$. The equilibrium constant for the reaction of CH_3COOH and NH_4OH will be -

Solution

$$CH_3COOH + NH_4OH \rightleftharpoons CH_3COO^- + NH_4^+ + H_2O$$

$$K_h = \frac{[CH_3COO^-][NH_4^+]}{[CH_3COOH][NH_4OH]} = \frac{K_a K_b}{K_w} = (1.8)^2 \times 10^4$$

43 The desired amount of charge for obtaining one mole of Al from Al^{3+} is

Solution

The reaction can be given as $Al \rightarrow Al^{3+} + 3e^-$

Therefore the charge required is$= 3 \times 96500\ C$

44 The coordination number of a central metal atom in a complex is given by

Solution

The coordination number is the maximum covalency shown by a metal or metal ion.

$$\text{Coordination number} = \sum (\text{number of ligands}) \times \text{denticity}$$

45 The osmotic pressure of 0.4% urea solution is 1.66 atm and that of a solution of sugar of 3.42% is 2.46 atm. When equal volumes of both the solutions are mixed then the osmotic pressure of the resultant solution will be?

Solution

$$\pi_f = \left[\frac{c_1}{2} + \frac{c_2}{2}\right] RT$$

As volume is doubled, concentration is halved

$$\therefore \pi_f = \frac{c_1 RT + c_2 RT}{2}$$

$$\frac{\pi_1 + \pi_2}{2} = \frac{1.66 + 2.46}{2}$$

$= 2.06$ atm.

BIOLOGY

1 What is the main function of anti-transpirants?

Solution

Anti-transpirants reduce the rate of transpiration without affecting the metabolic process *i.e.*, transpirants are permeable to CO_2 and O_2 to allow photosynthesis and respiration.

In lung, maximum gaseous exchange is due to

2 Solution

Maximum gaseous exchange between blood (dissolved phase) and alveolar (lungs) air (gaseous phase) across respiratory membrane occurs by simple diffusion. The exchange depends upon the concentration gradients (partial pressure) of the concerned gases in blood and alveolar air. Both O_2 and CO_2 are highly and equally soluble in lipid and hence, easily diffusible through cell membrane.

In passive transport an ion on molecule crossing a membrane moves down its concentration gradient and no metabolic energy is consumed. Facilitated diffusion is special type of passive transport where specific permeases in membrane facilitate the crossing of solutes.

Active transport uses specific transport protein called pumps, which use metabolic energy (ATP) to move ions or molecule against their concentration gradient.

3 Which of the statements supports that a flower is a highly condensed and modified part of the plant body?

Solution

A bract is a modified or specialized leaf, especially one associated with a reproductive structure such as a flower, inflorescence axis, or cone scale. They may be smaller, larger, or of a different color, shape, or texture. The flower may develop in the axis of a bract

4 Select the plant species which flower only once in their life time, generally after 50-100 years, produce large number of fruits and die.

Solution

Bamboo plants are monocarpic. They flower only once in their life time, generally after 50-100 years, produce large number of fruits and die.

5 Wilting of leaves at noon and their recovery toward evening is known as

Solution

Temporary of transient wilting occurs during midday and is visible externally due to dropping of leaves and young shoot. It is corrected in the afternoon when transpiration decreases.

6 Nucellar embryo is

Solution

Substitution of usual sexual reproduction by a form of reproduction which does not include meiosis and syngamy is called apomixis. In this phenomenon, embryo is developed by some other tissue without fertilization, e.g., nucellus or integuments or unfertilized egg. Nucellus is a diploid tissue, so nucellar embryo is apomictic diploid.

7 Which one of the following is the incorrect matching of the events occurring during the menstrual cycle?

Solution

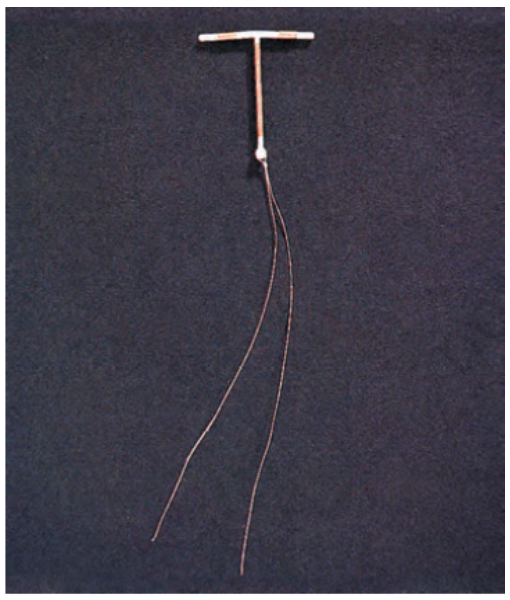
The corpus luteum is essential for establishing and maintaining pregnancy in females. In the ovary, the corpus luteum secretes estrogen and progesterone, which are steroid hormones responsible for the thickening of the endometrium and its development and maintenance, respectively.

8 The chemiosmotic coupling hypothesis of oxidative phosphorylation proposes that Adenosine Triphosphate (ATP) is formed because

Solution

The production of ATP with the help of energy liberated during oxidation of reduced coenzymes and terminal oxidation is called oxidative phosphorylation. Peter Mitchell (1961) put forward a hypothesis known as chemiosmotic hypothesis for ATP synthesis. According to this when electrons flow from duel proton, electron carrier to a non-hydrogen carrier the H^+ are released and expelled into the intermembrane space and thus creates a proton gradient with higher concentration of H^+ in the inter membranous space than the matrix. Due to proton motive force the protons flow back and energy liberated during this back flow of protons activate ATPase [present in F_1 head to synthesize ATP].

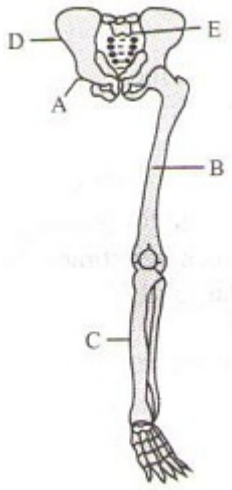
9 What is correct about the contraceptive method shown in the diagram below?



Solution

IUDs increase phagocytosis of sperms within the uterus and the Cu ions released suppress sperm motility and the fertilizing capacity of sperms. The hormone-releasing IUDs, in addition, make the uterus unsuitable for implantation and the cervix hostile to the sperms ex: Cu T (copper T), Multiload 375 etc.

10 Parts labelled as ‘A’, ‘B’, ‘C’, ‘D’ and ‘E’ respectively indicate in the given figure are



Solution

The picture shows pelvic girdle with hindlimbs. The correct labeling is given below. A-pubis; B-femur; C-Tibia, D-ilium; E-Sacrum

11 The capacity of an environment to pull on a limited number of individuals is known as

Solution

Carrying capacity refers to the size of a population that can be maintained indefinitely. Carrying capacity is the maximum number of individuals of a given species that an area's resources can sustain indefinitely without significantly depleting or degrading those resources.

12 Which of the following is not required in the synthesis of carbohydrates

Solution

Water, carbon dioxide, light and chlorophyll are required in the synthesis of carbohydrates. Nitrogen is not involved in the process of photosynthesis.

13 The commercial lac is produced in large quantities by

Solution

Due to short life period males do not takes major part in the secretion of lac but female secretes lac throughout her life and its life span is longer than males. Major quantity of lac is secreted from females.

14 What is true about ribosomes?

Solution

Ribosomes are amembraneous (i.e., without membrane) cell organelle composed of rRNA and protein. These are found in both prokaryotic and eukaryotic cells. In prokaryotes, ribosomes are 70S type while in eukaryotes, it is 80S type. Here 'S' (Svedberg's Unit) stands for the sedimentation coefficient.

15 **Statement I** In animal cells, the cytokinesis is achived by the appearance of a furrow in plasma membrane.

Statement II In plant cells, the formation of the new cell wall begins with the formation of simple precursor called cell plate.

Choose the correct option

Solution

In an animal cell, cytokinesis is achieved by the appearance of a furrow in the plasma membrane. The furrow gradually deepens and ultimately joins in the centre dividing the cell cytoplasm into two. Plants cells however, are enclosed by a relatively inectensible cell wall, therefore they undergo cytokinesis by a different mechanism. In plant cells, wall formation starts in the existing in the centre of the cell and grows outward to meet the existing lateral walls. The formation of the new cell wall begins with the formation of a simple precursor, called the cell-plate that represents the middle lamella between the walls of two adjacent cells.

16 Gestation period in human beings is about

Solution

The average length of human gestation is 280 days, or 36 weeks, from the first day of the woman's last menstrual period.

17 Which of the following does not constitute appendicular skeleton?

Solution

In humans the appendicular skeleton is composed of 126 bones. Functionally it is involved in locomotion (lower limbs) of the axial skeleton and manipulation of objects in the environment (upper limbs) The frontal lobe, located at the front of the brain, is one of the four major lobes of the cerebral cortex in the brain of mammals. The sternum is a flat bone on the ventral midline of thorax and is a part of the axial skeleton.

18 In amniocentesis, the fluid is taken from

Solution

In amniocentesis the fluid is taken from amniotic fluid, which is immediate surrounding of foetus.

19 Which pteriodophyte is called as horse-tail?

Solution

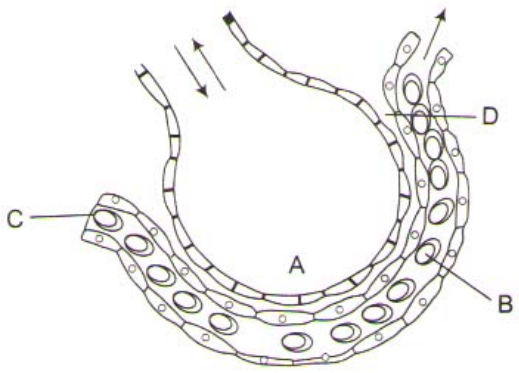
Equisetum is commonly called scouring rushes or horse tail.The name "horsetail", often used for the entire group, arose because the branched species somewhat resemble a horse's tail.

20 In cork cambium, cork and secondary cortex are collectively called :

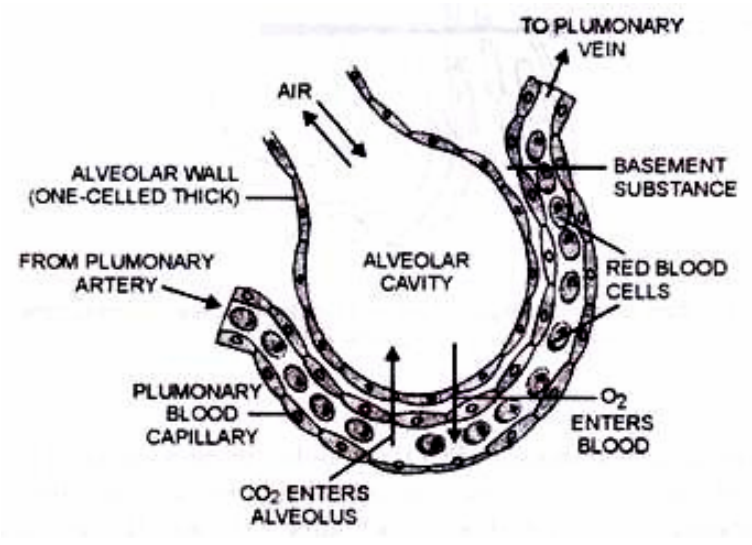
Solution

Phellem, phellogen and phelloderm are collectively called periderm.

21 The figure given below shows a small part of human lung where exchange of gas takes place. In which one of the options given below, the one part A, B, C or D is correctly identified along with its function.



Solution



22 The narrow middle part of the epididymis is called

Solution

Each epididymis is differentiated into upper caput epididymis, middle corpus epididymis and lower cauda epididymis.

23 Which of the following cranial nerves can regulate heart beat? :-

Solution

X^{th} pair of cranial nerves (vagus nerves) has a motor branch called cardiac nerve which innervate cardiac muscles.

24 Which enzyme is useful as colour brightening agent in detergent industry?

Solution

Cellulase enzyme is used in detergent industry for colour brightening and softening. It hydrolzes the major component of plant cell.

25 'Himgiri' is a variety of _____, developed by hybridisation and selection for disease resistance against rust pathogens.

Solution

Himgiri is a variety of wheat which is developed by hybridization and selection for disease resistance against rust pathogens.

26 Cladistics can be defined as

Solution

Phylogeny is the evolutionary history of a species or individual. It plays a great role in classification. It is the appropriate theoretical background for taxonomy and is quite essential in explaining all the associations involved in classification. Cladistics is exclusively based on phylogenetic characters.

27 Oral contraceptives help in preventing pregnancy by inhibiting

Solution

Progesterone only pills (POP) is a contraceptive pill that helps in preventing pregnancy by not allowing the formation of ova, as progesterone inhibits the development of FSH and LH.

28 Adenosine diphospate contains

Solution

$ADP \xrightarrow{\text{hydrolysis}} AMP + Pi + 7.3kcal.$

Adenosine diphosphate (ADP), also known as adenosine pyrophosphate (APP), is an important organic compound in metabolism and is essential to the flow of energy in living cells. ADP consists of three important structural components: a sugar backbone attached to adenine and two phosphate groups bonded to the 5 carbon atom of ribose. The diphosphate group of ADP is attached to the 5' carbon of the sugar backbone, whereas the adenosine attaches to the 1' carbon

29 Select the incorrect statement with respect to the packaging of DNA helix

Solution

Heterochromatin it is dark-staining, genetically inactive, and tightly coiled.

30 Cellulose is a polymer of

Solution

Cellulose is homopolysaccharide, a polymer of $\beta-$ glucose. The glucose monomers are linked together by $\beta-1, 4$ linkages. Cellulose is the main constituent of the plant cell wall.

31 *Nicotiana sylvestris* flowers only during long days and *N. tabacum* flowers only during short days. If raised in the laboratory under different photoperiods, they can be induced to flower at the same time and can be cross-fertilized to produce self-fertile offspring. What is the best reason for considering *N. sylvestris* and *N. tabacum* to be separate species?

Solution

The term species evolves from word specific means only those groups of plants or animals come under one species which can interbreed and produce fertile offsprings naturally. *N. tabacum* and *N. sylvestris* cannot produce flowers naturally have different photoperiods, hence they cannot belong to the same species. Thus, they cannot interbreed in nature.

32 Which protein production was successfully introduced in *E. coli*

Solution

Interferons (antiviral proteins) were produced by Charles Weismann through recombinant DNA technology in *E. coli* in 1980.

33 Which one is true for ATP?

Solution

ATP is a coenzyme. Coenzyme is an organic cofactor molecule smaller than protein that bonds with a specific enzyme, while the reaction is being catalysed.

34 The western blot test is used to detect :-

Solution

The western blot is an analytical technique used to detect specific proteins in a given sample of tissue homogenate or extract. The confirmatory HIV test employs a Western blot to detect anti - HIV antibody in a human serum sample.

35 Drop in the photosynthetic rate after 680 nm is called

Solution

The decrease in the photosynthetic activity after 680 nm is considered a red drop. It is called 'red drop' because it occurs in the red part of the spectrum.

36 Which one of the following combinations of microbes is responsible for the formation and flavor of yoghurt?

Solution

Yoghurt consists of pasteurized homogenized whole milk that is incubated with Streptococcus thermophillus, Lactobacillus bulgaricus or Lactobacillus casei.

37 Who gave the criteria of essentiality?

Solution

Criteria for essentiality of elements were first of all given by Arnon.

38 Which of the following is expected to have the highest value ($gm/m^2/yr$) in a grassland ecosystem?

Solution

Grasslands will have highest value of gross production. Net production is obtained after subtracting the respiratory utilization from grass production. Secondary and tertiary production is related with secondary and tertiary consumers respectively.

39 The growth of a population without limit at its maximal rate and also that, rates of immigration and emigration are equal, then it is called

Solution

Biotic potential is the inherent capacity of an organism to increase in numbers under ideal conditions, i.e., maximum reproductive capacity when environment resources are non limiting, conditions favour minimum mortality (absence of competition, predation, parasitism, etc.) and rates of immigration and emigration are equal.

40 Wastes may be sealed in concrete filled drums and discharged to a depth of about 500 m. This specific statement is true for

Solution

It has been recommended that storage of nuclear waste, after sufficient pre-treatment, should be done in suitably shielded containers (concrete-filled drums) buried within the rocks, about 500 m deep below the earth's surface.

41 Chlorophyll-a and b differ in having

Solution

Chlorophylls are magnesium porphyrin compounds. Chlorophyll-a ($C_{55}H_{72}O_6N_4Mg$) and chlorophyll-b ($C_{55}H_{70}O_6N_4Mg$), both consist of magnesium porphyrin head, which is hydrophilic and a phytol tail, which is lipophilic but chlorophyll-b differs from chlorophyll-a only in one of the functional groups bonded to porphyrin. Actually in chlorophyll-b, there is $-CHO$(aldehyde) group instead of $-CH_3$ (methyl) group at the third C-atom in second pyrrole ring.

42 Which organism behaves like plants in the presence of light and absence of organic food, but in reverse conditions behaves like animals?

Solution

Euglena having chlorophyll, photosynthesize and produce food while in reverse condition *Euglena* consumes food and behave like animals.

43 Smoking addiction is harmful because it produces polycyclic aromatic hydrocarbons, which cause

Solution

Polycyclic aromatic hydrocarbons are carcinogenic and thus, cause cancer.

44 Cultivation of fishes, oysters, shrimps and crabs come under

Solution

Cultivation of fishes, oysters, shrimps and crabs come under aquaculture.

45 Ecological backlash (or Ecological Boomerang) is

Solution

Broad spectrum pesticides kill most of the pathogenic microbes. So these are also called as biocides. Many biocides are persistent in nature. Some persistent biocides adversely affect useful microbes, this phenomena is called Ecological backlash (or Ecological Boomerang) .

46 Formation of corpus luteum is influenced by

Solution

During ovulation, the mature follicle bursts and the ovum is released. After ovulation, the granulosa cells and the interstitial cells form a mass of large and yellowish conical cells. This is named as corpus luteum and serves as a temporary endocrine gland by releasing progesterone and oestrogen. If fertilization takes place, corpus luteum persists and enlarges by influence of LH (Luteinizing hormone).

47 Chloragogen cells of earthworm are similar to which organ of vertebrates?

Solution

Chloragogen cells of earthworm are similar to the liver of vertebrates because of the connection with storage and synthesis of glycogen and fat, deamination and urea formation.

48 Which of the following is not the application of PCR?

a. Detection of very low concentration of bacteria or virus.

b. Detection of mutations in genes in suspected cancer patients.
c. Amplification of the desired DNA segment.
d. Detection of antibodies synthesized against pathogens.

Solution

Polymerase chain reaction, PCR technology, is an efficient and cost-effective way to copy or amplify small segments of DNA . PCR tests to detect cancer cells PCR is not used for detection of antibodies synthesised against pathogens

49 Micro-organisms are used in

Solution

Microbes are used in Sewage disposal, Biological control of diseases, Biological welfare, etc.

50 In the ABO system of blood groups, if both antigens are present but no antibody, the blood group of the individual would be

Solution

Blood group AB is also known as the universal recipient. AB blood group contains both the antigen 'A' and 'B' but not contain any of the antibody.

51 *Claviceps purpurea* is causative organism for

Solution

The fungus that causes the disease 'ergot of rye' is *Claviceps purpurea*. It contains many poisonous alkaloids. The hallucinogenic drug LSD is extracted from these fungi.

- Rust of wheat is used by *Puccinia graminis.*
- Powdery mildew of pea is caused by *Erysiphae.*
- Smut of barley is caused by *Ustilago.*

52 Statement I: In *Spirogyra*, sometimes the gametes behave directly as zygospores without fusion.
Statement II: In *Spirogyra*, asexual reproduction is by flagellated zoospores produced in zoosporangia.

Select the correct option regarding both the statements.

Solution

In *Spirogyra*, vegetative reproduction usually takes place by fragmentation or by the formation of different types of spores. Asexual reproduction is by flagellated zoospores produced in zoosporangia.

In *Spirogyra*, sexual reproduction takes place through the fusion of two gametes to form zygospores. These gametes are non-flagellated (non-motile) but similar in size, and sometimes the gametes behave directly as zygospores without fusion.

53 Spot out the zone of our country considered as the hot spot of biodiversity and regarded as the 'Cradle of Speciation'.

Solution

The Eastern Himalayas hot spot of our country extends to the North Eastern India and Bhutan. The temperate forests are found at altitudes of 1780-3500 metre. Many deep and semi-isolated valleys found in this region are exceptionally rich in endemic plant species. It is an active centre of evolution and rich diversity of flowering plants.

54 Find the correct match

	Column I		**Column II**

a.	Non-degenerate codon	(i)	GUG
b.	Ambiguous codon	(ii)	UAG
c.	Amber	(iii)	UGG
d.	Ochre	(iv)	UGA
		(v)	UAA

Solution

Non-degenerate codon	UGG
Ambiguous codon	GUG
Amber	UAG
Ochre	UAA

55 Apical dominance in higher plants is due to

Solution

Presence of auxin causes apical dominance in plants and cytokinins are responsible for breaking of apical dominance.

56 The poisons produced in the body by bacteria are called :-

Solution

Toxins is a poisonous substance produced within living cells or organisms

57 Microsporogenesis is a synonym for

Solution

The formation of microspores inside the microsporangia of seed plants. A diploid cell in the microsporangium, called a microsporocyte or a pollen mother cell, undergoes meiosis and gives rise to four haploid microspores.

58 Parchment paper is

Solution

Memebrane which allows all solvents but no solute to pass through are called semipermeable membranes, e.g. parchment paper.

59 Mendel did not recognise the linkage phenomenon in his experiments because

Solution

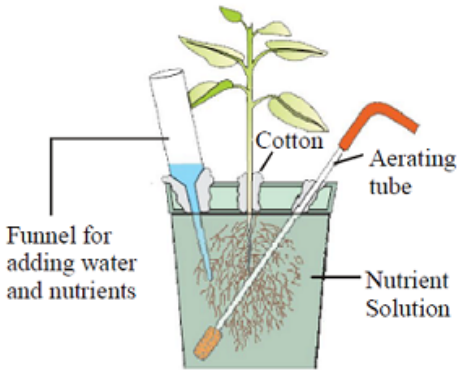
Mendel did not recognise the linkage phenomenon in his experiments because characters he studied were located on different chromosomes. He studied seven pairs of characters which were present on four different pairs of chromosomes.

60 Plasmid is used as carrier because

Solution

The plasmid is an extrachromosomal material in bacteria and is used in biotechnology or genetic engineering for making the multiple copies of desired genes (DNA segment). Plasmids are the carrier DNA molecules with antibiotic resistance gene. This feature makes it easy to isolate from the transformed cell with the desired insert in it.

61 Below diagram showing a technique for the culture of plants. This technique has been successfully employed for the production of which of the following?



Solution

The above diagram shows the hydroponic technique. Hydroponics is a subset of hydroculture and is a method of growing plants using mineral nutrient solutions, in water, without soil. This technique has been successfully employed for the production of seedless cucumber, lettuce and tomato plants.

62 ''Gametes are never hybrid''. This is a statement of

Solution

''Gametes are never hybrid''. This is a statement of law of segregation.

63 Ten percent law of energy transfer in a food chain was enunciated by

Solution

The Ten percent law for the transfer of energy from one trophic level to the next was introduced by Raymond Lindeman (1942). According to this law, during the transfer of energy from organic food from one trophic level to the next, only about ten percent of the energy from organic matter is stored as flesh. The remaining is lost during transfer, broken down in respiration, or lost to incomplete digestion by higher trophic levels.

64 Frequency of an allele in a isolated population may change due to

Solution

Mutations are sudden inheritable variations which develop in the genetic system. Natural selecation operates through differential reproduction..

65 Simple epithelium is a tissue in which the cells are

Solution

An epithelium is a sheet or tube of firmly adherent cells with minimum (practically negligible) material and space between them.

66 The term 'biodiversity' was given by

Solution

Biodiversity is the term popularized by the sociobiologist Edward Wilson to describe the combined diversity at all levels of biological organization. Immense diversity (heterogeneity) exists in our biosphere, not only at the species level but at all the levels of biological organization ranging from the macromolecules within cells to biomes. The most important types of biodiversity are genetic diversity, species diversity and ecological diversity.

67 Through which route the pollen tube enters the ovule

Solution

All three types can be route of the pollen tube enters in the ovule as chalazogamy mesogamy and porogamy.

68 Glucose is taken back from glomerular filtrate through

Solution

The useful materials such as glucose, amino acids, vitamin C and inorganic ions are actively reabsorbed in selective reabsorption.

69 The enteronephric nephridia of earthworm are concerned with

Solution

The nephridia are the excretory organs. The nephridia in earthworm are – septal nephridia, Pharyngeal nephridia and Integumentary nephridia. The septal nephridia do not discharge excretory fluid to the exterior rather it pour them into the intestine. Hence these are also called Enteronephric nephridia.

70 Plasmogamy is fusion of

Solution

It is the first stage of sexual reproduction in which the cytoplasm of two sex cells fuse with each other. The nuclei of sex cells come close to each other but do not fuse. Thus the resulting cell becomes binucleate or dikaryon.

71 Blood capillaries are made of

Solution

The walls of blood capillaries do not possess tunica externa (connective tissue layer containing lymph vessels), tunica media (a thick network of smooth muscle fibers) but only tunica interna (a single layer endothelium of squamous cells).

72 The colour of the faeces is due to the

Solution

It is an oxidation product of bile pigment.
Stercobilin is a tetrapyrrolic bile pigment and is one end-product of heme catabolism. It is the chemical responsible for the brown colour of human faeces and was originally isolated from faeces in 1932.

73 Biological Oxygen Demand (BOD) is a measure of

Solution

To measure water pollution, the BOD test is made. In this test, the amount of oxygen sufficient to degrade waste organic matter by bacteria in a sample is measured. The more oxygen used up by the bacteria to degrade the organic matter in ample, the greater the BOD would be.

74 Which of the following is a coconut milk factor?

Solution

Cytokinins are plant growth hormones that are basic in nature and derivatives of aminopurine or phenyl urea. These hormones promote cell division (cytokinesis) either alone or in conjugation with auxin. In liquid endosperm of coconut kinetin (cytokinin) are present.

75 The theory of Natural selection that explains the appearance of new forms of life on earth was given by

Solution

Charles Darwin in the year 1859 put forth his theory of evolution by natural selection as an explanation for adaptation and formation of new species. He defined natural selection as the principle by which each useful variation is preserved.

76 Malphigian tubules are

Solution

Malpighian tubules are fine, unbranched, yellow tubules that lie more or less free in the haemocoel. They absorb nitrogenous waste product, thus acts as excretory organs in insects.

77 Mitochondria in the living cell can readily be identified from other organelles of the cell through light microscope by using

Solution

Janus green (vital dye) is used to stain mitochondria.

78 Select the incorrect statement w.r.t. meiosis

Solution

Meiosis is also called as reduction division as chromosome number is reduced. In meiosis l, the homologous chromosomes are separated, reducing the chromosome number by half. Hence, it is called heterotypic division. During meiosis ll, sister chromatids of chromosomes are separated and chromosome number remains same. Hence, it is called homotypic division.

79 New systematics is another name of

Solution

In modern taxonomy species has been considered as product of evolution. Also known as population systematics or biosystematics.

80 Eli Lilly, an American company, is famous for

Solution

Eli Lilly marketed the first such insulin, Humulin, in 1982. Humulin was the first medication produced using modern genetic engineering techniques in which actual human DNA is inserted into a host cell (*E. coli* in this case). The host cells are then allowed to grow and reproduce normally, and due to the inserted human DNA, they produce a synthetic version of human insulin. However, the clinical preparations prepared from such insulins differ from endogenous human insulin in several important respects; an example is the absence of C-peptide which has in recent years been shown to have systemic effects itself. Genentech developed the technique Lilly used to produce Humulin, although the company never commercially marketed the product themselves.

81 Adrenal glands located in abdominal cavity are in close association with

Solution

Adrenal glands are paired endocrine glands located superior to kidney, hence called ‘suprarenals’.

82 The polyestrous mammal is

Solution

The animals that have a recurrence of estrous during breeding season are called polyestrous e.g., mouse, cow sheep pig, horse etc.

83 The trigger for activation of toxin produced by *Bacillus thuringiensis* requires

Solution

When the bacteria is consumed by certain insects, the toxic crystal is released in the insect's highly alkaline gut, blocking the system which protects the pest’s stomach from its own digestive juices. The stomach is penetrated, and the insect dies by poisoning from the stomach contents and the spores themselves.

84 The taste receptors of cockroach are

Solution

The taste receptor (gustatoreceptors) are organs of taste. In cockroach, they are mainly confined to the tips of maxillary palps, labial palps, labium and hypopharynx.

85 Study the following statements and choose the correct answer:

I. Cross-pollinating flowers have extrorse anthers.
II. Samara is a type of fleshy fruit.
III. Marginal placentation has a monocarpellary, unilocular ovary.
IV. Opposite phyllotaxy is seen in guava.

Solution

Extrorse anther dehiscence is an adaptation to facilitate the cross-pollination. Marginal Placentation is Monocarpellary unilocular ovary bears single longitudinal ovule containing placenta, that arises along the junction of two fused margins. Opposite phyllotaxy is two leaves are borne on each node lying always opposite to each other, example: Guava.

Samara is a type of Dry indehiscent fruit. Its pericarp becomes membraneous and flat like wings that help in dispersal.

86 The amount of CSF in the cranial cavity is :-

Solution

All the ventricles of brain and central canal of spinal cord contain lymph-like extracellular fluid called cerebrospinal fluid (CSF). The total amount of CSF present in and around central nervous system is 80-150 mL. CSF contains glucose, proteins, lactic acid, urea, Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, HCO_3^- and some WBCs.

87 The site of ADA production in the body is

Solution

Lymphocytes are types of white blood cells present in the bone marrow. ADA (adenosine deaminase) is an enzyme that is present in lymphocytes and is very important for the immune system to function. The deficiency of this enzyme causes SCID.

88 Choose the correct statement.

Solution

The ascending limb of Henle's loop (the next part of renal tubule) continues as another highly coiled tubular region called Distal Convoluted Tubule (DCT).

The juxtamedullary nephrons have long Henle's loop.

Vasa recta are absent or highly reduced in cortical nephrons.

Bowman's capsule encloses the glomerulus.

The Malpighian corpuscles, proximal convoluted tubule (PCT), and distal convoluted tubule (DCT) are situated in the cortical region of the kidney, whereas the Henle's loop in the medulla.

89 Vascular bundle having phloem at the centre encircled by xylem is known as

Solution

When phloem is surronunded by xylem on all sides, such concentric vascular bundle is called **amphivasal** or **leptocentric**. Such vascular bundle is found in *Dracaena, Yucca, Aloe*, etc.

90 During ionic flux, uptake of ions into inner space is

Solution

The movement of ions is called flux. The movement of ions into the cell is called influx and outward migration of ions is known as efflux. The energy is considered to be involved in the transport of such free ions across the membrane. The absorption of ions, involving the use of metabolic energy, is called active absorption. Energy used in these mechanisms comes from metabolic activities. Mineral absorption is mainly an active process.