All India Aakash Test Series for Medical - 2020

TEST - 4 (Code-E)

Test Date : 12/01/2020

ANSWERS

1.	(1)	37.	(3)	73.	(2)	109.	(1)	145.	(4)
2.	(3)	38.	(3)	74.	(3)	110.	(2)	146.	(4)
3.	(4)	39.	(4)	75.	(1)	111.	(1)	147.	(4)
4.	(3)	40.	(1)	76.	(4)	112.	(3)	148.	(3)
5.	(2)	41.	(4)	77.	(3)	113.	(2)	149.	(3)
6.	(3)	42.	(1)	78.	(2)	114.	(4)	150.	(2)
7.	(4)	43.	(3)	79.	(1)	115.	(4)	151.	(2)
8.	(2)	44.	(3)	80.	(4)	116.	(4)	152.	(4)
9.	(3)	45.	(4)	81.	(2)	117.	(4)	153.	(3)
10.	(2)	46.	(2)	82.	(2)	118.	(2)	154.	(3)
11.	(2)	47.	(3)	83.	(1)	119.	(1)	155.	(3)
12.	(1)	48.	(1)	84.	(3)	120.	(3)	156.	(1)
13.	(1)	49.	(4)	85.	(2)	121.	(3)	157.	(3)
14.	(4)	50.	(2)	86.	(4)	122.	(4)	158.	(3)
15.	(3)	51.	(2)	87.	(3)	123.	(4)	159.	(1)
16.	(2)	52.	(3)	88.	(2)	124.	(4)	160.	(3)
17.	(3)	53.	(1)	89.	(1)	125.	(3)	161.	(3)
18.	(4)	54.	(1)	90.	(3)	126.	(2)	162.	(4)
19.	(2)	55.	(4)	91.	(2)	127.	(3)	163.	(3)
20.	(2)	56.	(2)	92.	(3)	128.	(1)	164.	(4)
21.	(4)	57.	(3)	93.	(2)	129.	(4)	165.	(2)
22.	(2)	58.	(2)	94.	(4)	130.	(3)	166.	(3)
23.	(1)	59.	(3)	95.	(1)	131.	(2)	167.	(2)
24.	(4)	60.	(1)	96.	(1)	132.	(1)	168.	(3)
25.	(3)	61.	(4)	97.	(4)	133.	(3)	169.	(2)
26.	(3)	62.	(2)	98.	(2)	134.	(1)	170.	(4)
27.	(1)	63.	(4)	99.	(3)	135.	(4)	171.	(4)
28.	(2)	64.	(2)	100.	(3)	136.	(3)	172.	(4)
29.	(3)	65.	(3)	101.	(1)	137.	(1)	173.	(3)
30.	(1)	66.	(3)	102.	(2)	138.	(2)	174.	(1)
31.	(2)	67.	(2)	103.	(4)	139.	(4)	**175.**	**Delete**
32.	(3)	68.	(2)	104.	(3)	140.	(4)	176.	(3)
33.	(2)	69.	(1)	105.	(4)	141.	(4)	177.	(1)
34.	(4)	70.	(1)	106.	(4)	142.	(2)	178.	(2)
35.	(1)	71.	(4)	107.	(3)	143.	(1)	179.	(3)
36.	(4)	72.	(4)	108.	(1)	144.	(3)	180.	(3)

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (1)

Hint : Mean free path $\lambda = \frac{1}{\sqrt{2}\pi d^2 n}$

Sol. : $PV = Nk_BT$

$P = \left(\frac{N}{V}\right)k_BT$

$P = nk_BT$

$n = \frac{P}{k_BT}$

$\lambda = \frac{k_BT}{\sqrt{2}\pi d^2 P}$

$\lambda \propto T$

2. Answer (3)

Hint : $PV = nRT$

Sol. : Number of moles in 20 g N_2 gas = $\frac{20}{28} = \frac{5}{7}$

$\Rightarrow \quad PV = \frac{5}{7}RT$

3. Answer (4)

Hint & Sol. : Temperature of both the gases is same, i.e. equal to temperature of container, so internal energy per mole will be same.

4. Answer (3)

Hint & Sol. : Kinetic energy per molecule per degree of freedom is $\left(\frac{1}{2}k_BT\right)$ it becomes zero at absolute zero temperature but potential energy is non-zero.

5. Answer (2)

Hint & Sol. : $C_p - C_v = R$

$C_v = \frac{f}{2}R$

$C_p = C_v + R = \left(\frac{f}{2}R + R\right)$

$C_p = R\left(1 + \frac{f}{2}\right)$

6. Answer (3)

Hint : Apparent frequency $n' = n\left[\frac{v + v_0}{v - v_s}\right]$.

Sol. : v_s = 72 km/h = 72 × $\frac{5}{18}$ = 50 m/s

$n' = 1240\left[\frac{330 + 20}{330 - 20}\right]$

$= \frac{1240 \times 350}{310}$ = 1400 Hz

7. Answer (4)

Hint : r.m.s. speed $v = \sqrt{\frac{3RT}{M}}$.

Sol. : $T_1 = T$, $v_{rms} = v$

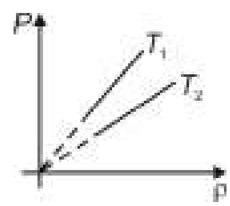
$v = \sqrt{\frac{3RT}{M}}$

$v' = \sqrt{\frac{3R(4T)}{\left(M/2\right)}} = 2\sqrt{2}\, v$

8. Answer (2)

Hint : $\frac{P}{\rho T}$ = constant

Sol. :



$PV = \frac{m}{M}RT$

$\frac{P}{\rho T} = \frac{R}{M}$ = Constant

For a given ρ, $P_1 > P_2$ so $T_1 > T_2$

9. Answer (3)

Hint & Sol. :

$P = \frac{1}{3}\frac{mnv_{rms}^2}{V} = \frac{2}{3}\left[\frac{\frac{1}{2}Mv_{rms}^2}{V}\right]$

$P = \frac{2}{3}\frac{E}{V}$

10. Answer (2)

Hint & Sol. : In SHM $\vec{F} \propto -\vec{x}$

$\vec{F} = -K\vec{x}$

So, graph will be straight line passing through origin with negative slope.

11. Answer (2)

Hint : The motion will be SHM, when $(\vec{a} \propto -\vec{x})$.

Sol. : $x = 3 \sin 2\pi t + 4 \sin 4\pi t$ is superposition of two SHM of time periods T_1 = 1s and $T_2 = \frac{1}{2}$ s.

$\frac{dx}{dt} = 6\pi \cos 2\pi t + 16\pi \cos 4\pi t$

$\frac{d^2x}{dt^2} = -12\pi \sin 2\pi t - 64\pi \cos 4\pi t$

$a = -4\pi\,[3 \sin 2\pi t + 16 \cos 4\pi t]$

Since $\vec{a}$ is not proportional to $\vec{x}$

$\vec{a} \not\propto -\vec{x}$

So, motion will be oscillatory and periodic with period 1 s but not SHM.

12. Answer (1)

Hint : $a = -\omega^2 x$

$a = -\omega^2 A \cos \omega t$

Sol. : Amplitude = 2 cm, T = 4 s

$|a| = \left(\frac{2\pi}{4}\right)^2 \times 2\cos\left(\frac{2\pi}{4} \times \frac{2}{3}\right)$

$|a| = \frac{4\pi^2}{16} \times 2 \times \frac{1}{2}$

$|a| = \frac{\pi^2}{4}$ cm/s^2

13. Answer (1)

Hint & Sol. : Potential energy of oscillating body from mean position

$U = \frac{1}{2} m\omega^2 y^2 = \frac{1}{2} m\omega^2 a^2 \sin^2 \omega t$

14. Answer (4)

Hint : As rope has mass, so tension of rope change at each points, hence speed of wave will change and frequency remains same.

Sol. : $\frac{\lambda_1}{\lambda_2} = \frac{\frac{v_1}{n}}{\frac{v_2}{n}} = \frac{v_1}{v_2} = \sqrt{\frac{T_1}{T_2}}$

$\frac{0.5}{\lambda_2} = \sqrt{\frac{2g}{8g}} = \frac{1}{2}$

λ = 1 m

15. Answer (3)

Hint : Time period of a simple pendulum $T = 2\pi\sqrt{\frac{l}{g_{\text{eff}}}}$.

Sol. : Elevator coming down with retardation $\left(\frac{g}{4}\right)$.

So, $g_{\text{eff}} = g + \frac{g}{4} = \frac{5g}{4}$

$T = 2\pi\sqrt{\frac{l \times 4}{5g}} = 4\pi\sqrt{\frac{l}{5g}}$

16. Answer (2)

Hint : Pendulum starts from extreme position, so displacement equation will be

$x = a \cos\omega t$, $v = \frac{dx}{dt}$

Sol. : $v = \frac{dx}{dt} = -a\omega \sin(\omega t)$

at $t = \frac{T}{6}$

$v = a\left(\frac{2\pi}{T}\right)\sin \frac{2\pi}{T} \times \frac{T}{6}$

$v = \frac{2\pi a}{T} \sin\frac{\pi}{3}$

$v = \frac{\pi a\sqrt{3}}{T}$

17. Answer (3)

Hint & Sol. : Time period of simple pendulum

$T = 2\pi\sqrt{\frac{l}{g}}$

$T^2 \propto l$

$T^2 = Kl$

So, graph will be straight line passing through origin.

18. Answer (4)

Hint & Sol. : $x = A \sin\omega t$

$\frac{dx}{dt} = A\omega \cos\omega t$

$\frac{d^2x}{dt^2} = -\omega^2 A \sin\omega t$

$a = \omega^2 A \sin(\omega t + \pi)$

So, phase difference is π.

19. Answer (2)

Hint & Sol. : Total energy of oscillating body remains constant, so time period is infinity and frequency is zero.

20. Answer (2)

Hint & Sol. : In case of forced oscillation, the frequency of oscillation will be equal to frequency of applied periodic force.

21. Answer (4)

Hint & Sol. : In stationary waves the particles of adjacent loops of a node vibrates in opposite phase. So phase difference between them is π.

22. Answer (2)

Hint & Sol. : Speed of longitudinal waves in a gas is independent of pressure at constant temperature. So $v \propto P^0$.

23. Answer (1)

Hint & Sol. : For sound wave water behaves as a rarer medium and air as denser medium, so sound waves bend towards normal.

24. Answer (4)

Hint & Sol. : Displacement antinode is pressure node, so there is minimum change in pressure and density of air.

25. Answer (3)

Hint : Speed of sound at room temperature $v = 2n(l_2 - l_1)$

Sol. : Length of first resonance, $l_1 = 17$ cm

Length of second resonance, $l_2 = 52$ cm

Frequency of source, $n = 1000$ Hz

$v = 2n(l_2 - l_1)$

$= 2 \times 1000\,(52 - 17) \times 10^{-2}$

$= 700$ m/s

26. Answer (3)

Hint & Sol. : Reflected wave has a phase change of π, when reflected from rigid support.

27. Answer (1)

Hint : The amplitude of resultant wave

$A = 2a\cos\left(\frac{\phi}{2}\right)$ for same amplitude.

Sol. : $y_1 = 10\sin(\omega t - kx)$

$y_2 = 10\sin\left(\omega t - kx + \frac{2\pi}{3}\right)$

So, phase difference $\phi = 120°$

$A = \sqrt{(10)^2 + (10)^2 + 2\times 10\times 10\cos 120°}$

$A = \sqrt{100 + 100 - 100}$

$A = 10$ units

28. Answer (2)

Hint : Frequency of sonometer wire

$$n = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

If T and μ are constant, then $n \propto \frac{1}{l}$

Sol. : In first case

$n_1 - n = 5$

$n_1 = n + 5$ …(i)

In second case

$n - n_2 = 5$

$n_2 = n - 5$ …(ii)

$$\frac{n_1}{n_2} = \frac{n+5}{n-5}$$

$$\frac{l_2}{l_1} = \frac{n+5}{n-5}$$

$$\frac{21}{20} = \frac{n+5}{n-5}$$

$n = 205$ Hz.

29. Answer (3)

Hint : Because second resonance is not exactly at three time, so there must be some end correction.

Sol. : $l_1 = 17$ cm, $l_2 = 53$ cm

$$\frac{l_2 + e}{l_1 + e} = 3$$

$$e = \frac{l_2 - 3l_1}{2}$$

$$= \frac{53 - 51}{2}$$

$e = 1$ cm

Effective length of first resonance = 18 cm

Effective length of third resonance = 18 × 5

= 90 cm

Length of third resonance = 90 – 1

= 89 cm

30. Answer (1)

Hint : After each lower octave frequency becomes half, and of 20 forks, 19 pairs will form.

Sol. : Assume frequency of first fork is $2n$ then of last fork will be n.

$2n - n = 19 \times 3$

$n = 57$ Hz

$2n = 114$ Hz

Frequency of tenth fork = 114 – 9 × 3

= 87 Hz

31. Answer (2)

Hint : Third overtone of open pipe is fourth harmonic.

Sol. : Assume length of open pipe is l_o and of closed pipe is l_c.

Frequency of third overtone of open pipe = $\frac{4v}{2l_o}$

Frequency of fifth harmonics of closed pipe = $\frac{5v}{4l_c}$

$$\frac{4v}{2l_o} = \frac{5v}{4l_c}$$

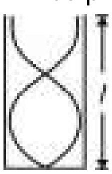
$$\frac{l_o}{l_c} = \frac{16}{10}$$

$$\frac{l_c}{l_o} = \frac{5}{8}$$

32. Answer (3)

Hint : Pressure variation is maximum at displacement nodes.

Sol. : In third harmonic, 2 nodes and 2 antinodes will be produced.



$$l = \frac{3\lambda}{4}$$

$$\frac{\lambda}{4} = \frac{l}{3} = \frac{60}{3} = 20\text{ cm}$$

First node will be formed at 20 cm from open end.

33. Answer (2)

Hint : Frequency of stretched string $n = \frac{p}{2l}\sqrt{\frac{T}{\mu}}$

$p = 1, 2, 3 \ldots\ldots$

Sol. : Frequency of p^{th} mode $n_p = \frac{p}{2l}\sqrt{\frac{T}{\mu}}$ …(i)

Frequency of $(p + 1)^{th}$ mode $n_{p+1} = \frac{p+1}{2l}\sqrt{\frac{T}{\mu}}$ …(ii)

Divide (i) by (ii)

$$\frac{420}{490} = \frac{p}{p+1}$$

$p = 6$

Put in equation (i)

$$420 = \frac{6}{2l}\sqrt{\frac{1.8\times10^3}{0.02}}$$

$$420 = \frac{6}{2l}\times300$$

$$l = \frac{1800}{840} = 2.14\text{ m}$$

34. Answer (4)

Hint : When tube is dipped in water it will behave as closed organ pipe.

Sol. : Frequency of 2^{nd} overtone of open pipe = frequency of fundamental tone of closed pipe

$$\frac{3v}{2l} = \frac{v}{4l'}$$

$$l' = \frac{l}{6}$$

Length of tube inside water = $l - \frac{l}{6} = \frac{5l}{6}$

35. Answer (1)

Hint : Speed of transverse wave in a string is given as $v = \sqrt{\frac{T}{\mu}}$

Sol. : Displacement equation of wave is.

$y = 0.021 \sin(0.1x + 30t)$

speed of wave $v = \frac{\omega}{k} = \frac{30}{0.1} = 300\text{ m/s}$

$$300 = \sqrt{\frac{T}{\mu}}$$

$T = 300 \times 300 \times 1.3 \times 10^{-4}$

$= 11.7$ N

36. Answer (4)

Hint & Sol. : All the points between two nodes vibrates in same phase, so they reach their mean position simultaneously

37. Answer (3)

Hint : $(v_p)_{max} = a\omega$

Wave velocity = $\frac{\omega}{k}$

Sol. : $(v_p)_{max} = 3v_w$

$$a\omega = 3\frac{\omega}{k}$$

$$\frac{2\pi}{\lambda}\cdot a = 3$$

$$\lambda = \frac{2\pi}{3}(2) = \frac{4\pi}{3}\text{m}$$

38. Answer (3)

Hint : Speed of sound in gas at temperature T

$$v = \sqrt{\frac{3RT}{M}}.$$

Sol. : According to question

$$\left(v_{O_2}\right)_{t^\circ C} = \frac{1}{2}\left(v_{H_2}\right)_{0^\circ C}$$

$$\sqrt{\frac{\gamma R(273+t)}{32}} = \frac{1}{2}\sqrt{\frac{\gamma R \times 273}{2}}$$

$$\frac{273+t}{4} = 273$$

$t = 273 \times 3 = 819°C$

39. Answer (4)

Hint : $L_2 - L_1 = 10\log_{10}\frac{I_2}{I_1}$ (in dB)

Sol. : $L_2 - L_1 = 10\log_{10}\frac{I_2}{I_1}$ (in dB)

$$90 - 40 = 10\log_{10}\frac{I_2}{I_1}$$

$$50 = 10\log_{10}\frac{I_2}{I_1}$$

$$5 = \log_{10}\frac{I_2}{I_1}$$

$$\frac{I_2}{I_1} = 10^5$$

40. Answer (1)

Hint : Equation of stationary wave from free end

$$y = 2a\sin\frac{2\pi x}{\lambda}\cdot\cos\frac{2\pi t}{T}$$

Sol. : Given equation of stationary wave

$$y = 5\sin\frac{\pi x}{3}\cdot\cos 40\,\pi t$$

On comparing

$$\frac{2\pi x}{\lambda} = \frac{\pi x}{3}$$

$\lambda = 6$ cm

Distance between adjacent node and antinode = $\frac{\lambda}{4}$

= 1.5 cm.

41. Answer (4)

Hint : Phase difference between two particles at distance Δx, $\Delta\phi = \frac{2\pi}{\lambda}\Delta x$

Sol. : $y = 8\sin 2\pi(0.1x - 2t)$

$$\frac{2\pi}{\lambda} = 2\pi \times 0.1$$

$\lambda = 10$ cm

$$\Delta\phi = \frac{2\pi}{\lambda}\Delta x = \frac{2\pi}{10}\times 2 = \frac{2\pi}{5}\text{ rad}$$

42. Answer (1)

Hint : $\gamma = 1 + \frac{2}{f}$ and $\gamma = \frac{C_p}{C_v}$

Sol. : $C_p = \frac{(\Delta Q)_p}{n\Delta T} = \frac{140}{2\times 10}$ = 7 cal/mol-K

$C_v = C_p - R = 5$ cal/mol-K

$$\gamma = \frac{C_p}{C_v} = \frac{7}{5}$$

$$\gamma = 1 + \frac{2}{f}$$

$$\frac{7}{5} - 1 = \frac{2}{f}$$

$$\frac{2}{5} = \frac{2}{f}$$

$f = 5$

43. Answer (3)

Hint : As the observer moves away from source apparent frequency goes on decreasing.

Sol. : Apparent frequency $n' = n\left[\frac{v - v_0}{v}\right]$

$$\left(\frac{n'}{n} - 1\right) = -\frac{v_0}{v}$$

$$\frac{\Delta n}{n} = -\frac{v_0}{v}$$

$$-\frac{8}{100} = -\frac{v_0}{v}$$

$$v_0 = 350 \times \frac{8}{100}$$

= 28 m/s.

$v^2 = u^2 + 2as$

$$s = \frac{28\times 28}{2\times 2} = 196\text{ m}$$

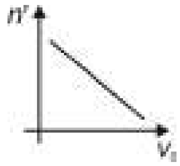
44. Answer (3)

Hint & Sol. : When observer moves away from source.

$$n' = n\left[1 - \frac{v_0}{v}\right]$$

$$n' = -\frac{n}{v}v_0 + n$$

It is an equation of straight line with negative slope.



45. Answer (4)

Hint : Frequency of stretched string

$$n = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

$n \propto \frac{1}{l}$, If T and μ are constants

Sol. : $n_1 : n_2 : n_3 = 1 : 2 : 3$

$$l_1 : l_2 : l_3 = \frac{1}{n_1} : \frac{1}{n_2} : \frac{1}{n_3}$$

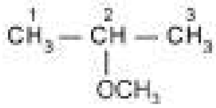
$$= 1 : \frac{1}{2} : \frac{1}{3}$$

$$= 6 : 3 : 2$$

[CHEMISTRY]

46. Answer (2)

Hint : IUPAC naming of an ether is Alkoxy alkane.

Sol. : 

2-Methoxypropane.

47. Answer (3)

Hint : $\overset{5}{C}H_3-\overset{4}{C}H=\overset{3}{C}H-\overset{2}{C}\equiv\overset{1}{C}H$

sp^2 hybridized sp hybridized

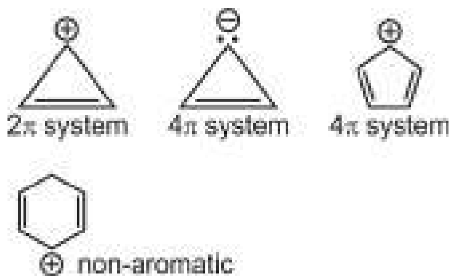
48. Answer (1)

Hint : –I effect decreases in the following order

$-NO_2 > -F > -OH > -C\equiv CH$

49. Answer (4)

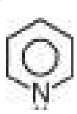
Hint : Cyclic planar structures having $(4n + 2)\pi$ delocalized electrons are aromatic.

Sol. : 

50. Answer (2)

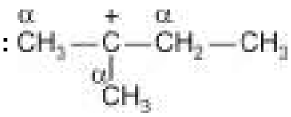
Hint : Electron deficient species is called electrophile.

Sol. : $H_2\ddot{O}$ – nucleophile, $AlCl_3$ – electrophile

$\ddot{N}H_3$ – Nucleophile,  – Nucleophile

51. Answer (2)

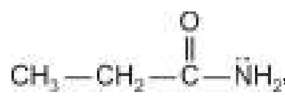
Hint : α-H atoms on carbon next to sp^2 hybridised carbon take part in hyperconjugation.

Sol. : 

It has total 8 α-H atoms which will participate in hyperconjugation.

52. Answer (3)

Hint : Basic strength of a base depends on availability of lone pair of electrons on N-atom.

Sol. : In compounds ,  and , lone pair is delocalized hence, weak bases.

So,  is most powerful base.

53. Answer (1)

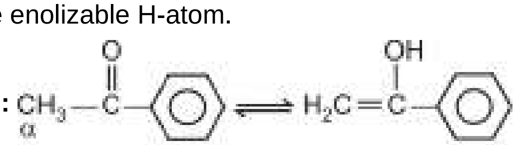
Hint : $\% \text{ of N} = \frac{1.4 \times \text{meq. of } NH_3}{\text{Mass of compound}}$

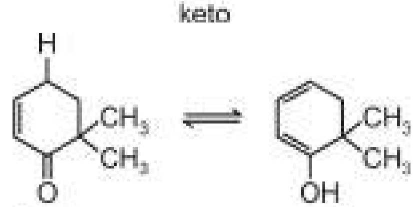
Sol. : Meq. of NH_3 = 25 × 1

$\therefore$ % N in the compound = $\frac{1.4 \times 25 \times 1}{1.25} = 28\%$

54. Answer (1)

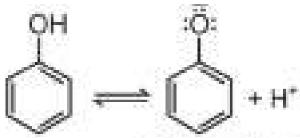
Hint : For keto-enol tautomerism molecule must have enolizable H-atom.

Sol. : 



55. Answer (4)

Hint : Acidic strength increases with increase in stability of conjugate base.

Sol. : 

(Phenoxide ion resonance stabilized)

p-nitrophenol is strongest acid as phenoxide ion is stabilized by strong –R effect of $–NO_2$ group.

56. Answer (2)

Hint : Resonance stabilized carbanion is highly stable.

Sol. : 

Negative charge is delocalized over oxygen atom, hence, highly stable anion.

57. Answer (3)

Hint : Aromatic compounds in which strong electron withdrawing groups are bonded to benzene ring don't undergo Friedel Crafts reaction easily.

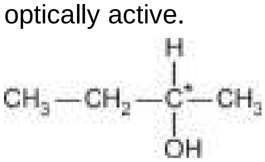
Sol. : 

doesn't undergo Friedel Crafts reaction easily.

58. Answer (2)

Hint : Chiral compound is optically active.

Sol. : Butan-2-ol has one chiral carbon hence, optically active.



59. Answer (3)

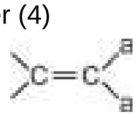
Hint : Alkanes can exhibit chain and position isomerism.

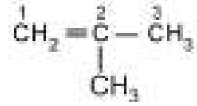
Sol. : Hexane (C_6H_{14}) has 5 structural isomers: n-hexane, 2-methylpentane, 2,2-dimethylbutane, 2,3-dimethylbutane, 3-methylpentane.

60. Answer (1)

Hint : Such liquids are made to boil at a temperature lower than their normal boiling points by reducing the pressure on their surface.

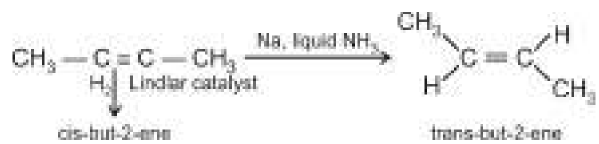
61. Answer (4)

Hint :  type molecules do not exhibit geometrical isomerism.

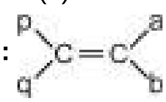
Sol. :  does not show geometrical isomerism.

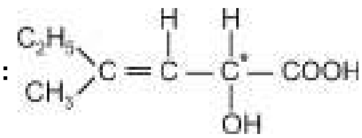
62. Answer (2)

Hint :



63. Answer (4)

Hint :  shows geometrical isomerism.

Sol. : 

This molecule has a chiral carbon, hence, shows optical and geometrical isomers.

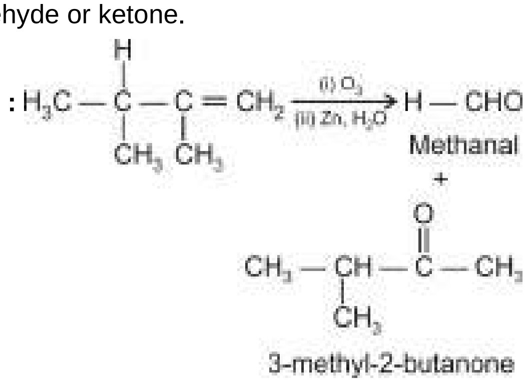
64. Answer (2)

Hint : $R—COONa + NaOH \xrightarrow[\Delta]{CaO} RH + Na_2CO_3$

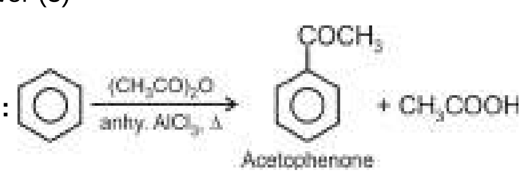
Sol. :

65. Answer (3)

Hint : Reductive ozonolysis of an alkene produces aldehyde or ketone.

Sol. : 

66. Answer (3)

Hint : 

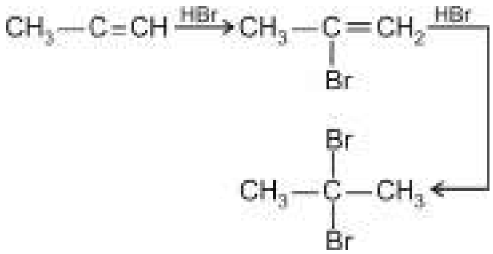
67. Answer (2)

Hint : Acetylene contains acidic hydrogens.

Sol. : $\overset{\delta-}{CH_3}—\overset{\delta+}{MgBr} + \overset{\delta+}{H}—C \equiv CH \longrightarrow CH_4(g)$

68. Answer (2)

Hint : Addition of HX to alkynes finally produces gemdihalides.

Sol. :


69. Answer (1)

Hint : Alkenes give electrophilic addition reactions.

70. Answer (1)

Hint : For isomeric alkanes, as the surface area decreases, boiling point of alkane decreases.

Sol. : B.P. order :

n-pentane > iso-pentane > neo-pentane.

71. Answer (4)

Hint : Ozonolysis followed by hydrolysis does cleavage of C = C.

Sol. : Aldehydes have general formula $C_nH_{2n}O$,

So, 12n + 2n + 16 = 44

14n + 16 = 44

14n = 28

$\therefore$ n = 2

So, the aldehyde is CH_3-CHO

Hence, alkene is $CH_3-CH=CH-CH_3$.

72. Answer (4)

Hint : Alkenes decolourise $Br_2(l)$ and cold alkaline $KMnO_4$ solution but alkanes do not give this reaction.

Alkane, alkene do not react with $NaNH_2$.

73. Answer (2)

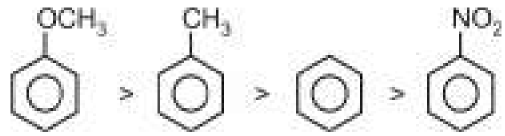
Hint : $\underset{\text{terminal alkyne}}{R-C\equiv C-H} + AgNO_3 \xrightarrow{\text{Ammoniacal solution}} \underset{\text{(white precipitate)}}{R-C\equiv C-Ag}$

$\underset{\text{Non terminal alkyne}}{R-C\equiv C-R} + AgNO_3 \xrightarrow[\text{solution}]{\text{Ammoniacal}}$ No reaction

74. Answer (3)

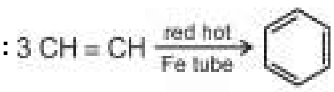
Hint : +M group present on benzene increases the rate of electrophilic aromatic substitution reactions.

Sol. : Rate of nitration follows the order



75. Answer (1)

Hint : $CaC_2 + 2H_2O \longrightarrow \underset{(P)}{HC\equiv CH} + Ca(OH)_2$

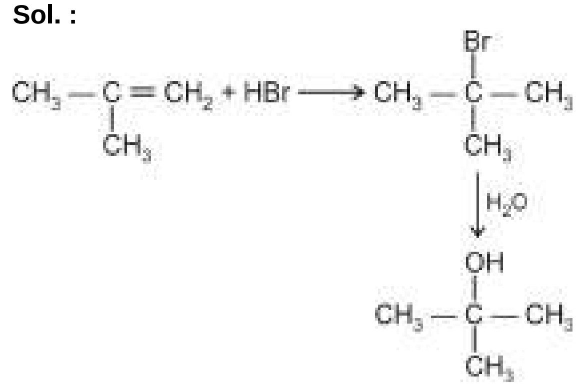
Sol. :


(X)

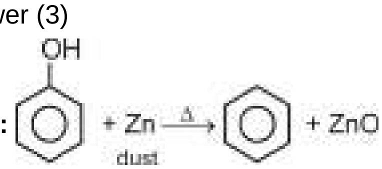
76. Answer (4)

Hint : HBr will show Markovnikov addition.

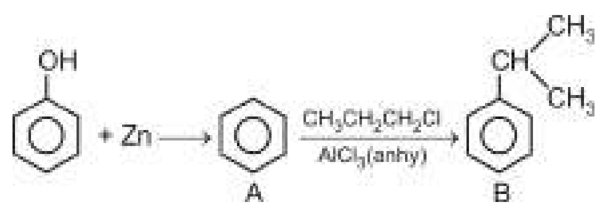
Sol. :



77. Answer (3)

Hint :


Sol. :



Mechanism:

$CH_3-CH_2-CH_2-Cl \xrightarrow[\text{(ahyd.)}]{AlCl_3} CH_3-CH_2-\overset{+}{C}H_2 + AlCl_4^-$

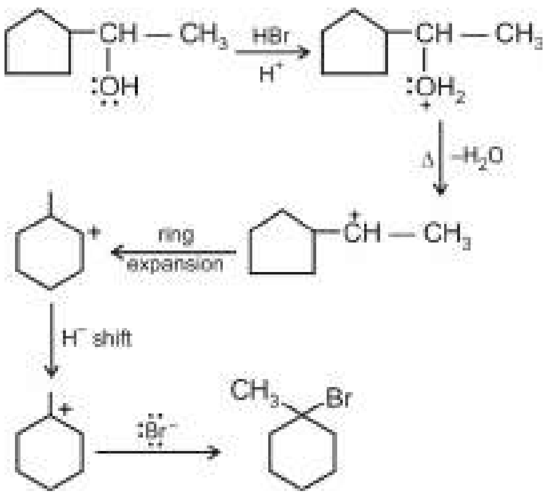
$\underset{1^\circ\text{ (less stable)}}{CH_3-CH_2-\overset{+}{C}H_2} \xrightarrow{H^-\text{ shift}} \underset{2^\circ\text{ (more stable)}}{CH_3-\overset{+}{C}H-CH_3}$

Now, this 2° carbocation is attacked by benzene ring.

78. Answer (2)

Hint : A five membered ring expands to six membered ring to attain greater stability if possible.

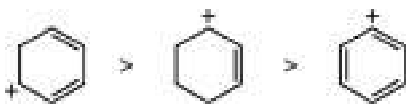
Sol. :



79. Answer (1)

Hint : S_N1 reactions proceed via carbocation intermediate formation.

Sol. : Stability of carbocation follows the order



also, C — Br bond is weaker than C — Cl bond, hence, in S_N1 reactions rate of R — Br > R — Cl.

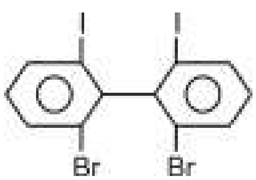
80. Answer (4)

Hint : R — Cl + AgF $\longrightarrow$ RF + AgCl

Sol. : In Swarts reaction alkyl fluorides are formed.

81. Answer (2)

Hint : o, o′ substituted biphenyls is non planar.

Sol. :  is optically active as the given biphenyl has no plane of symmetry/centre of symmetry.

82. Answer (2)

Hint : C — Cl bond length > C — F bond length.

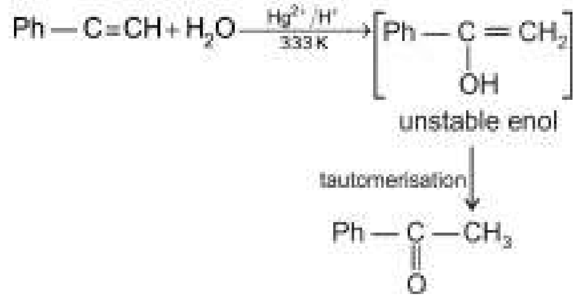
Sol. :

Molecule	CH_3F	CH_3Cl	CH_3Br	CH_3I
Dipole moment (D)	1.847	1.860	1.830	1.636

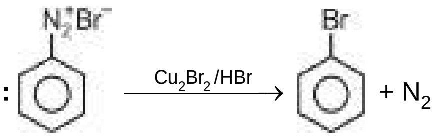
83. Answer (1)

Hint : Alkynes on hydration give aldehyde or ketone.

Sol. :

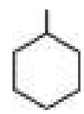


84. Answer (3)

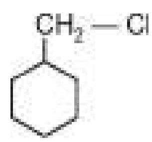
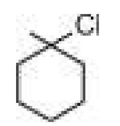
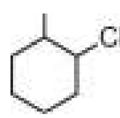
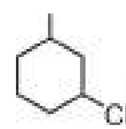
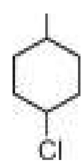
Hint : 

Reaction is called Sandmeyer reaction.

85. Answer (2)

Hint :  + $Cl_2 \xrightarrow{h\nu}$ five monochloro derivatives.

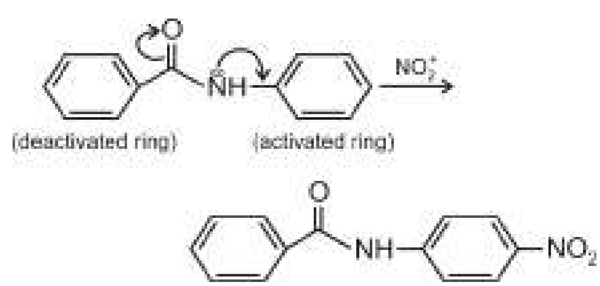
Sol. : Monochloro derivatives have following possible structures

(i) 
(ii) 
(iii) 
(iv) 
(v) 

86. Answer (4)

Hint : Activating groups like —NH_2, —OH etc. enhance rate of electrophilic aromatic substitution reactions at o, p positions.

Sol. :



87. Answer (3)

Hint : Methanol is a polar protic solvent. It contains H attached with electronegative oxygen.

88. Answer (2)

Hint : In aqueous medium, order of nucleophilicity

$I^- > Br^- > Cl^- > F^-$

89. Answer (1)

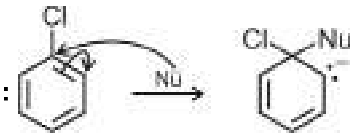
Hint :

$$CH_3COOAg + Br_2 \xrightarrow{CCl_4} CH_3 - Br + CO_2 + AgBr$$

This reaction is called Hunsdiecker reaction.

90. Answer (3)

Hint : S_NAr reactions are favoured by the presence of powerful electron withdrawing groups like —NO_2.

Sol. : 

This anion is stabilized by $-NO_2$ group(s)

so, $-NO_2$ groups at all o, p positions stabilizes carbanion most, hence rate of reaction will be fastest.

[BIOLOGY]

91. Answer (2)

Hint : Gaseous movement within the plant body does not require special membrane proteins.

Sol. : Diffusion is very important to plants since it is the only means for gaseous movement within the plant body.

92. Answer (3)

Hint : Porins are found in the outer membrane of the plastids, mitochondria and some bacteria.

Sol. : The porins are proteins which form huge pores in the outer membrane of plastids, mitochondria and some bacteria.

93. Answer (2)

Hint : Solute potential of a pure solvent at atmospheric pressure is taken to be zero.

Sol. : Solute potential of a solution is always negative. For a solution its value can never be zero or positive.

94. Answer (4)

Hint : Water moves from its high water potential to low water potential.

Sol. : ψ_w of cell A = –12 + 5 = –7 bar

ψ_w of cell B = –20 + 13 = –7 bar

ψ_w of cell C = –9 + 2 = –7 bar

95. Answer (1)

Hint : When water flows into the cell and out of the cell i.e. in equilibrium then, the osmotic concentration in the cell and out of the cell is said to be equal.

Sol. : A solution, whose osmotic concentration is equal to that of another solution or cell sap is called isotonic solution.

96. Answer (1)

Hint : When dry wood is kept in water, the water molecules are absorbed by the wood.

Sol. : The process of absorption of water by hydrophilic solid particles of a substance without forming a solution is called imbibition.

97. Answer (4)

Sol. : Bulk movement of different substances from one place to other in a plant is called translocation.

98. Answer (2)

Hint : Sinks are those structures or parts of plants where materials are utilised or stored.

Sol. : The chief sinks for the mineral elements in plants are growing regions and storage organs.

99. Answer (3)

Hint : Dry atmosphere has low water vapour pressure as compared to humid atmosphere.

Sol. : Rate of transpiration is inversally proportional to the relative humidity of the atmosphere.

100. Answer (3)

Hint : Apoplast pathway does not involve any membrane or cytoplasm.

Sol. : In roots, apoplastic movement of water is through intercellular spaces of cortical cells and walls of their cell. There is very little or no resistance to water movement.

101. Answer (1)

Hint : Hydroponics is the technique by which essentiality of mineral nutrients for plants is determined.

Sol. : In hydroponics, the plants are grown directly in a soil-free, defined mineral solution.

102. Answer (2)

Hint : An element is said to be essential for a plant if it is absolutely necessary for supporting normal growth and reproduction of the plant.

Sol. : Absence or reduced availability of the essential element causes disorder in the plants.

103. Answer (4)

Hint : Mineral elements are absorbed by the plants in the form of ions.

Sol. : Carbon is absorbed by the plants in the form of CO_2.

104. Answer (3)

Hint : *Rhizobium* is a symbiotic nitrogen-fixing bacterium.

Sol. : *Thiobacillus* – Nitrate $\longrightarrow$ Nitrogen

Nitrococcus – Ammonia $\longrightarrow$ Nitrite

Rhizobium – Nitrogen $\longrightarrow$ Ammonia

Nitrobacter – Nitrite $\longrightarrow$ Nitrate

105. Answer (4)

Hint : The activator of PEPCase is also a constituent of ring structure of chlorophyll.

Sol. : Mg^{2+} is an activator of both RuBisCO and PEPCase, both of which are critical enzymes involved in carbon fixation during photosynthesis.

106. Answer (4)

Hint : Nitrogenase functions under anaerobic conditions.

Sol. : Nitrogenase is made up of Mo-Fe protein and it is highly sensitive to molecular oxygen.

107. Answer (3)

Hint : Some elements which are responsible for the flowering in plants are also the constituents of proteins.

Sol. : Elements like N, S and Mo delay flowering if their concentration in plants is low.

108. Answer (1)

Hint : ATP is an example of energy related chemical compound.

Sol. : Mg is a component of chlorophyll that takes part in conversion of light energy to chemical energy. Phosphorus is a component of ATP.

109. Answer (1)

Hint : The scientist who revealed the essential role of air in the growth of green plants also discovered oxygen in 1774.

Sol. : Through his experiments, Joseph Priestley revealed the essentiality of air in the growth of green plants.

110. Answer (2)

Hint : Visible light consists of radiations having a wavelength between 390-760 nm.

Sol. : Photosynthetically active radiation has a wavelength between 400-700 nm.

111. Answer (1)

Hint : A factor is said to be limiting when it is near to its minimal value.

Sol. : In dense forests, very little sunlight is reached the ground and thus it becomes limiting factor for small plants.

112. Answer (3)

Hint : C_4 plants respond to higher temperature and show higher rate of photosynthesis.

Sol. : Maize and *Sorghum* are C_4 plants and they show higher rate of photosynthesis at higher temperature.

113. Answer (2)

Hint : RuBisCO is the most abundant enzyme on earth.

Sol. : During Calvin cycle, RuBisCO binds with CO_2 whereas during photorespiration the same enzyme binds with oxygen.

114. Answer (4)

Hint : C_4 plants have Kranz anatomy in their leaves.

Sol. : ATP consumed in C_4 plants:

C_4 cycle – 2 ATP per CO_2 fixed

C_3 cycle – 3 ATP per CO_2 fixed

Total – 5 ATP per CO_2 fixed

Therefore, for one glucose molecule ($C_6H_{12}O_6$), *i.e.*, to fix 6 CO_2 molecules, ATP required $= 6 \times 5 = 30$.

115. Answer (4)

Hint : RuBP (Ribulose bisphosphate) is a 5-carbon compound.

Sol. : Phosphoglycolate – 2-carbon

Aspartic acid – 4-carbon

Phosphoenol pyruvate – 3-carbon

116. Answer (4)

Hint : In C_4 plants, Calvin cycle occurs in bundle sheath cells.

Sol. : A – C_4 acid

B – C_3 acid

C – Mesophyll cell

D – Bundle sheath cell

117. Answer (4)

Hint : Absorption peak in PS-I is at 700 nm.

Sol. : In PS-II, reaction centre has an absorption maxima at 680 nm.

All photosynthetic pigments other than chlorophyll 'a' are accessory pigments.

118. Answer (2)

Hint : Cyclic photophosphorylation is performed by PS-I independently.

Sol. : PS-II is not found in stroma lamellae therefore the cyclic photophosphorylation involves PS-I only, that occurs in stroma lamellae.

119. Answer (1)

Hint : Calvin cycle starts with the carboxylation of RuBP.

Sol. : The sequence of the three stages of Calvin cycle is

Carboxylation $\longrightarrow$ Reduction $\longrightarrow$ Regeneration

120. Answer (3)

Hint : Product of amino acid that enters into aerobic respiration is pyruvic acid.

Sol. : Pyruvic acid is first common respiratory product of amino acid and glycerol.

121. Answer (3)

Hint : Energy of ATP is also utilised during glycolysis.

Sol. : During glycolysis NAD^+ is converted into $NADH + H^+$.

122. Answer (4)

Hint : The balanced equation is as follows :

$2(C_{51}H_{98}O_6) + 145O_2 \rightarrow 102CO_2 + 98H_2O$ + energy

Sol. : RQ = $\frac{102\ CO_2}{145\ O_2} = 0.7$

123. Answer (4)

Hint : Oxidative decarboxylation of pyruvate occurs in mitochondria.

Sol. : Pyruvate enters into mitochondrial matrix where its oxidative decarboxylation occurs with the help of pyruvate dehydrogenase.

124. Answer (4)

Hint : Conversion of phosphoenol pyruvate to pyruvic acid is a step in glycolysis. CO_2 is not released in glycolysis.

Sol. : Both phosphoenol pyruvate and pyruvic acid are 3-carbon molecules

125. Answer (3)

Hint : During oxidation of succinate, $FADH_2$ is generated

Sol. : Cytochrome c oxidase complex contains two copper centres.

Cytochrome c is a protein attached to the outer surface of inner mitochondrial membrane.

Ubiquinone receives reducing equivalents via complex II.

126. Answer (2)

Hint : Plants have the capacity for indeterminate growth.

Sol. : Growth in plants is continuous throughout their life due to the presence of different types of meristems at specific locations in their body.

127. Answer (3)

Sol. : Life span is not related with the growth in size or weight of the organisms.

128. Answer (1)

Hint : The curve in the graph shows exponential growth of that plant organ.

Sol. : A sigmoid curve is a characteristic of living organism growing in a natural environment. The geometric growth is expressed as

$W_1 = W_0\ e^{rt}$

129. Answer (4)

Hint : Dedifferentiation is a phenomenon where certain living differentiated cells regain their ability to divide and form new cells.

Sol. : Interfascicular cambium, cork cambium and wound cambium are dedifferentiated tissues. Intrafascicular cambium is primary meristem.

130. Answer (3)

Hint : Heterophylly is the phenomenon of appearance of different forms of leaves on the same plant.

Sol. : Difference in shapes of leaves is observed in buttercup present in air and water *i.e.*, different shapes of leaves according to its habitat.

131. Answer (2)

Hint : The growth promoting substance extracted from *Gibberella fujikuroi* was termed as gibberellin.

Sol. : *Gibberella fujikuroi* causes bakane disease of rice seedlings.

132. Answer (1)

Hint : Dormancy is the condition of seed when it is unable to germinate inspite of the availability of all environmental conditions suitable for germination.

Sol. : Endosperm nourishes the growing embryo. Some mature seeds do not have endosperm but they can germinate.

133. Answer (3)

Sol. : Auxin promotes the abscission of older leaves, fruits and flowers.

134. Answer (1)

Hint : The hormone florigen migrates from leaves to shoot apices for inducing flowering.

Sol. : Shoot apices modify themselves into flowering apices, therefore they themselves cannot perceive photoperiods. The site of perception of light/dark is the leaves of plants.

135. Answer (4)

Hint : Vernalisation refers to promotion of flowering by an exposure of low temperature.

Sol. : Vernalisation prevents precocious reproductive development late in the growing season and enables the plant to have sufficient time to reach maturity.

136. Answer (3)

Hint : Union of gametes occurs in water.

Sol. : Sponges reproduce asexually by fragmentation and sexually by formation of gametes. Fertilisation is internal.

137. Answer (1)

Hint : Animals of this phylum are known to be soft bodied.

Sol. : Over two-thirds of all named species of animals are members of phylum Arthropoda. Phylum Mollusca is the second-largest phylum.

138. Answer (2)

Hint : Characteristic of aschelminthes.

Sol. : Annelids have a fluid-filled cavity between the outer body wall and the gut and this is referred to as schizocoelom. Aschelminthes are pseudocoelomate animals.

139. Answer (4)

Hint : Body of molluscs has a distinct head, muscular foot and visceral hump.

Sol. : Body of molluscs does not show segmentation therefore they are called unsegmented animals.

140. Answer (4)

Hint : All the above organisms are arthropods.

Sol. : All arthropods (arthro = joint, poda = foot) have jointed appendages.

141. Answer (4)

Hint : These are the smallest blood vessels.

Sol. : A capillary network is not found in open circulatory system. They are property of a closed circulatory system.

142. Answer (2)

Hint : Select an insect reared in sericulture.

Sol. : *Bombyx mori,* also known as silk worm is an economically important insect. *Dentalium* belongs to phylum Mollusca. *Ancylostoma* is an aschelminth. *Hirudinaria* is an annelid.

143. Answer (1)

Hint : These animals are exclusively marine.

Sol. : Molluscs, Annelida and Arthropods are bilaterally symmetrical. Adult echinoderms exhibit secondary radial symmetry.

144. Answer (3)

Hint : Identify a bird

Sol. : *Crocodilus* belongs to class Reptilia while *Pavo* belongs to class Aves.

145. Answer (4)

Hint : Identify an animal which can maintain its body temperature.

Sol. : Birds (including penguins) are warm blooded. Penguins have thick skin and blubber to keep them warm in cold weather. They are homeotherms

146. Answer (4)

Hint : Development in mammals is direct with few exceptions.

Sol. : Viviparity is seen in many taxa of animals. Monotremes are a group of mammals that lay eggs. e.g. : Platypus and Echidna.

147. Answer (4)

Hint : Identify a reptile.

Sol. : *Naja* is a genus of venomous elapid snakes known as cobras. Terrestrial reptiles show internal fertilisation.

148. Answer (3)

Hint : Its mouth contains a file-like rasping organ for feeding called radula.

Sol. : *Pennatula* (Sea-pen), *Adamsia* (Sea-anemone) and *Gorgonia* (Sea-fan) belong to Phylum Coelenterata. *Aplysia* (sea-hare) is a mollusc.

149. Answer (3)

Hint : It has dorso-ventrally flattened body.

Sol. : Planarians exhibit an extraordinary ability to regenerate lost body parts. A planarian when split lengthwise or crosswise can regenerate into separate individuals.

150. Answer (2)

Hint : *Xenopsylla* is also known as rat flea.

Sol. : Chikungunya virus is spread to people by female *Aedes aegypti* mosquito. These are the same mosquitoes that transmit dengue virus. Female *Anopheles* spreads *Plasmodium* that causes malaria.

151. Answer (2)

Hint : Syrinx is well developed in songbirds.

Sol. : Nearly all birds produce sound through an organ unique to birds, the syrinx.

152. Answer (4)

Hint : National bird of India.

Sol. : Peacocks are good with flying and are as avid and swift as any other average bird. Ostrich, Emu, Kiwi *etc*. are flightless birds, as they lost their ability to fly over a period of time.

153. Answer (3)

Hint : Mammals have a bony skeleton.

Sol. : Sting rays (*Trygon*), electric ray (*Torpedo*) and sharks belong to class chondrichthyes.

154. Answer (3)

Hint : The Greek term 'herpein' means 'to creep'.

Sol. : Ornithology is a branch of zoology which deals with study of birds. Study of insects is called Entomology. Batrachology is study of amphibians.

155. Answer (3)

Hint : It is also known a flying fish.

Sol. : *Exocoetus* belongs to class Osteichthyes and has a bony endoskeleton. A bony fish's heart has two chambers : an atrium and a ventricle.

156. Answer (1)

Hint : It has body with both ends pointed like in a lance.

Sol. : Excretion in *Ascidia*, *Doliolum* and *Herdmania* occurs by neural gland.

157. Answer (3)

Hint : The term cyclostome refers to "round mouth".

Sol. : Cyclostomes have mouth without jaws, so they are grouped under agnatha. Mouth is ventral, suctorial and is circular.

158. Answer (3)

Hint : A pupal stage is formed during this kind of metamorphosis in butterfly.

Sol. : Complete metamorphosis – Holometaboly

Incomplete metamorphosis – Hemimetaboly

No metamorphosis – Ametaboly

Two or three distinct type of larval instars with different habits and structures are found – Hypermetaboly

159. Answer (1)

Hint : This has pneumatic bones.

Sol. : Bird's hollow bones make the skeleton lighter for flying. Air sacs help more oxygen to be absorbed from air into the blood for the extra energy a bird needs. Air sacs are not site of exchange of gases. *Testudo* and *Chelone* are reptiles while *Macaca* is a mammal.

160. Answer (3)

Hint : Select an animal with webbed feet and a rubbery snout.

Sol. : Mammals that lay eggs are called monotremes and include platypuses and echidnas (spiny anteaters) both of which are natives of Australia. Birds lack diaphragm. *Delphinus* is viviparous.

161. Answer (3)

Hint : Select a vascular structure.

Sol. : Mammals possess a 4-chambered heart with left systemic arch.

162. Answer (4)

Hint : Mammals are ureotelic.

Sol. : Ureotelic organisms include cartilaginous fish, few bony fishes, adult amphibians and mammals including humans and whale.

163. Answer (3)

Hint : Identify an animal that lives on both land and water.

Sol. : Whales and dolphins use their lungs to breathe. Frogs can breathe through their lungs and skin once they reach adulthood. Spider respires through book lungs.

164. Answer (4)

Hint : It is a parasitic worm that lives in alimentary canal of man.

Sol. : Adults are hermaphroditic, capable of self-fertilisation. Earthworms exhibit reciprocal exchange of sperms.

165. Answer (2)

Hint : Reptiles are ectothermic.

Sol. : Reptiles are cold-blooded and cannot produce heat in their own bodies and have to rely on their surroundings to keep warm.

166. Answer (3)

Hint : Gizzard is also called gastric mill.

Sol. : Gizzard, in many birds is the hind part of the stomach, which is especially modified for grinding food. It is located between the saclike crop and the intestine. It has a thick muscular wall and may contain small stones, or gastroliths, that help in the mechanical breakdown of seeds and other foods.

167. Answer (2)

Hint : Members of this phylum are exclusively marine.

Sol. : Tube feet are small tube-like projections on the underside (oral side) of echinoderms. They are part of the water vascular system of echinoderms and are used to move, assist feeding and respire.

168. Answer (3)

Hint : *Hyla* is tree frog.

Sol. : *Bufo* – Toad

Salamandra – Salamander

Ichthyophis – Limbless amphibian

169. Answer (2)

Hint : Spider belongs to this class.

Sol. : Chilopoda – Centipede

Diplopoda – Millipede

Insecta – Silver fish

170. Answer (4)

Hint : Select a viviparous fish.

Sol. : *Gambusia* feeds on insects and their aquatic larvae, small amphibians, eggs, small fish, and mosquito larvae.

171. Answer (4)

Hint : This is called jelly fish.

Sol. : Metagenesis is alternation of generations seen in cnidarians *e.g.*: *Obelia*.

172. Answer (4)

Hint : Earthworm has closed circulatory system.

Sol. : Blood of *Pheretima* is red coloured due to the presence of a respiratory pigment erythrocruorin in it. Haemoglobin is not contained in the corpuscles like vertebrates but it is found dissolved in plasma.

173. Answer (3)

Hint : *Nereis* possesses lateral appendages parapodia.

Sol. : Osteichthyes have four pairs of gills which are covered by an operculum. Choanocytes or collar cells line the spongocoel and the canals in sponges. 4 pairs of comb plates are present in ctenophores.

174. Answer (1)

Hint : Identify the outermost layer of skin in reptiles.

Sol. : Stratum corneum ("the horny layer") is the outermost layer of epidermis. It is mainly composed of dead cells that lack nuclei. In reptiles, the stratum corneum is replaced during times of rapid growth, and repair in a process called ecdysis or moulting. The new layer is regularly formed by underlying stratum germinativum.

175. Delete

176. Answer (3)

Hint : They perform function analogous to functions of kidney in humans.

Sol. : Malphigian tubules are present at the junction of midgut and hindgut of cockroach. Their function is removal of excretory products from haemolymph.

177. Answer (1)

Hint : Testes are present anterior to mushroom gland.

Sol. : Male gonads are a pair of testes, one lying on either dorso-lateral side of 4^{th} to 6^{th} abdominal segments.

178. Answer (2)

Hint : Spiracles are present in cockroach.

Sol. : The respiratory system consists of a network of trachea. Thin branching tubes (tracheal tubes subdivided into tracheoles) carry oxygen from the atmospheric air to all the tissues of cockroach.

179. Answer (3)

Hint : Thin and flexible articular membrane.

Sol. : Exoskeleton for each segment consists of a dorsal tergum, a ventral sternum and lateral pleura; these plates are joined to each other by a thin and flexible articular membrane known as arthrodial membrane.

180. Answer (3)

Hint : The excretory product of birds is same as cockroach.

Sol. : Excretion is performed by malpighian tubules in cockroach. Each tubule absorbs nitrogenous waste products and ultimately it is converted into uric acid.

❑ ❑ ❑

All India Aakash Test Series for Medical - 2020

TEST - 4 (Code-F)

Test Date : 12/01/2020

ANSWERS

1.	(4)	37.	(3)	73.	(4)	109.	(4)	145.	(4)
2.	(3)	38.	(2)	74.	(2)	110.	(4)	146.	(4)
3.	(3)	39.	(4)	75.	(4)	111.	(4)	147.	(2)
4.	(1)	40.	(3)	76.	(1)	112.	(4)	148.	(3)
5.	(4)	41.	(2)	77.	(3)	113.	(2)	149.	(2)
6.	(1)	42.	(3)	78.	(2)	114.	(3)	150.	(3)
7.	(4)	43.	(4)	79.	(3)	115.	(1)	151.	(2)
8.	(3)	44.	(3)	80.	(2)	116.	(2)	152.	(4)
9.	(3)	45.	(1)	81.	(4)	117.	(1)	153.	(3)
10.	(4)	46.	(3)	82.	(1)	118.	(1)	154.	(4)
11.	(1)	47.	(1)	83.	(1)	119.	(3)	155.	(3)
12.	(4)	48.	(2)	84.	(3)	120.	(4)	156.	(3)
13.	(2)	49.	(3)	85.	(2)	121.	(4)	157.	(1)
14.	(3)	50.	(4)	86.	(2)	122.	(3)	158.	(3)
15.	(2)	51.	(2)	87.	(4)	123.	(4)	159.	(3)
16.	(1)	52.	(3)	88.	(1)	124.	(2)	160.	(1)
17.	(3)	53.	(1)	89.	(3)	125.	(1)	161.	(3)
18.	(2)	54.	(2)	90.	(2)	126.	(3)	162.	(3)
19.	(1)	55.	(2)	91.	(4)	127.	(3)	163.	(3)
20.	(3)	56.	(4)	92.	(1)	128.	(2)	164.	(4)
21.	(3)	57.	(1)	93.	(3)	129.	(4)	165.	(2)
22.	(4)	58.	(2)	94.	(1)	130.	(1)	166.	(2)
23.	(1)	59.	(3)	95.	(2)	131.	(1)	167.	(3)
24.	(2)	60.	(4)	96.	(3)	132.	(4)	168.	(3)
25.	(4)	61.	(1)	97.	(4)	133.	(2)	169.	(4)
26.	(2)	62.	(3)	98.	(1)	134.	(3)	170.	(4)
27.	(2)	63.	(2)	99.	(3)	135.	(2)	171.	(4)
28.	(4)	64.	(4)	100.	(2)	136.	(3)	172.	(3)
29.	(3)	65.	(4)	101.	(3)	137.	(3)	173.	(1)
30.	(2)	66.	(1)	102.	(4)	138.	(2)	174.	(2)
31.	(3)	67.	(1)	103.	(4)	139.	(1)	175.	(4)
32.	(4)	68.	(2)	104.	(4)	140.	(3)	176.	(4)
33.	(1)	69.	(2)	105.	(3)	**141.**	**Delete**	177.	(4)
34.	(1)	70.	(3)	106.	(3)	142.	(1)	178.	(2)
35.	(2)	71.	(3)	107.	(1)	143.	(3)	179.	(1)
36.	(2)	72.	(2)	108.	(2)	144.	(4)	180.	(3)

HINTS & SOLUTIONS

[PHYSICS]

1. Answer (4)

Hint : Frequency of stretched string

$$n = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

$n \propto \frac{1}{l}$, If T and μ are constants

Sol. : $n_1 : n_2 : n_3 = 1 : 2 : 3$

$$l_1 : l_2 : l_3 = \frac{1}{n_1} : \frac{1}{n_2} : \frac{1}{n_3}$$

$$= 1 : \frac{1}{2} : \frac{1}{3}$$

$$= 6 : 3 : 2$$

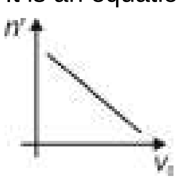
2. Answer (3)

Hint & Sol. : When observer moves away from source.

$$n' = n\left[1 - \frac{v_0}{v}\right]$$

$$n' = -\frac{n}{v}v_0 + n$$

It is an equation of straight line with negative slope.



3. Answer (3)

Hint : As the observer moves away from source apparent frequency goes on decreasing.

Sol. : Apparent frequency $n' = n\left[\frac{v - v_0}{v}\right]$

$$\left(\frac{n'}{n} - 1\right) = -\frac{v_0}{v}$$

$$\frac{\Delta n}{n} = -\frac{v_0}{v}$$

$$-\frac{8}{100} = -\frac{v_0}{v}$$

$$v_0 = 350 \times \frac{8}{100}$$

$= 28$ m/s.

$v^2 = u^2 + 2as$

$$s = \frac{28 \times 28}{2 \times 2} = 196 \text{ m}$$

4. Answer (1)

Hint : $\gamma = 1 + \frac{2}{f}$ and $\gamma = \frac{C_p}{C_v}$

Sol. : $C_p = \frac{(\Delta Q)_p}{n\Delta T} = \frac{140}{2 \times 10}$ = 7 cal/mol-K

$C_v = C_p - R = 5$ cal/mol-K

$$\gamma = \frac{C_p}{C_v} = \frac{7}{5}$$

$$\gamma = 1 + \frac{2}{f}$$

$$\frac{7}{5} - 1 = \frac{2}{f}$$

$$\frac{2}{5} = \frac{2}{f}$$

$f = 5$

5. Answer (4)

Hint : Phase difference between two particles at distance Δx, $\Delta\phi = \frac{2\pi}{\lambda}\Delta x$

Sol. : $y = 8 \sin 2\pi\,(0.1x - 2t)$

$$\frac{2\pi}{\lambda} = 2\pi \times 0.1$$

$\lambda = 10$ cm

$$\Delta\phi = \frac{2\pi}{\lambda}\,\Delta x = \frac{2\pi}{10} \times 2 = \frac{2\pi}{5} \text{ rad}$$

6. Answer (1)

Hint : Equation of stationary wave from free end

$$y = 2a\sin\frac{2\pi x}{\lambda} \cdot \cos\frac{2\pi t}{T}$$

Sol. : Given equation of stationary wave

$$y = 5\sin\frac{\pi x}{3} \cdot \cos 40\,\pi t$$

On comparing

$$\frac{2\pi x}{\lambda} = \frac{\pi x}{3}$$

λ = 6 cm

Distance between adjacent node and antinode = $\frac{\lambda}{4}$

= 1.5 cm.

7. Answer (4)

Hint : $L_2 - L_1 = 10\log_{10}\frac{I_2}{I_1}$
(in dB)

Sol. : $L_2 - L_1 = 10\log_{10}\frac{I_2}{I_1}$
(in dB)

$90 - 40 = 10\log_{10}\frac{I_2}{I_1}$

$50 = 10\log_{10}\frac{I_2}{I_1}$

$5 = \log_{10}\frac{I_2}{I_1}$

$\frac{I_2}{I_1} = 10^5$

8. Answer (3)

Hint : Speed of sound in gas at temperature T

$v = \sqrt{\frac{3RT}{M}}$.

Sol. : According to question

$$\left(v_{O_2}\right)_{t^\circ\mathrm{C}} = \frac{1}{2}\left(v_{H_2}\right)_{0^\circ\mathrm{C}}$$

$$\sqrt{\frac{\gamma R(273+t)}{32}} = \frac{1}{2}\sqrt{\frac{\gamma R\times 273}{2}}$$

$$\frac{273+t}{4} = 273$$

$t = 273 \times 3 = 819°\mathrm{C}$

9. Answer (3)

Hint : $(v_p)_{\max} = a\omega$

Wave velocity = $\frac{\omega}{k}$

Sol. : $(v_p)_{\max} = 3v_w$

$$a\omega = 3\frac{\omega}{k}$$

$$\frac{2\pi}{\lambda}\cdot a = 3$$

$$\lambda = \frac{2\pi}{3}(2) = \frac{4\pi}{3}\mathrm{m}$$

10. Answer (4)

Hint & Sol. : All the points between two nodes vibrates in same phase, so they reach their mean position simultaneously

11. Answer (1)

Hint : Speed of transverse wave in a string is given as $v = \sqrt{\frac{T}{\mu}}$

Sol. : Displacement equation of wave is.

$y = 0.021\sin(0.1x + 30t)$

speed of wave $v = \frac{\omega}{k} = \frac{30}{0.1} = 300$ m/s

$$300 = \sqrt{\frac{T}{\mu}}$$

$T = 300 \times 300 \times 1.3 \times 10^{-4}$

= 11.7 N

12. Answer (4)

Hint : When tube is dipped in water it will behave as closed organ pipe.

Sol. : Frequency of 2nd overtone of open pipe = frequency of fundamental tone of closed pipe

$$\frac{3v}{2l} = \frac{v}{4l'}$$

$$l' = \frac{l}{6}$$

Length of tube inside water = $l - \frac{l}{6} = \frac{5l}{6}$

13. Answer (2)

Hint : Frequency of stretched string $n = \frac{p}{2l}\sqrt{\frac{T}{\mu}}$

p = 1, 2, 3 ……

Sol. : Frequency of p^{th} mode $n_p = \frac{p}{2l}\sqrt{\frac{T}{\mu}}$ …(i)

Frequency of $(p+1)^{th}$ mode $n_{p+1} = \frac{p+1}{2l}\sqrt{\frac{T}{\mu}}$ …(ii)

Divide (i) by (ii)

$$\frac{420}{490} = \frac{p}{p+1}$$

$p = 6$

Put in equation (i)

$$420 = \frac{6}{2l}\sqrt{\frac{1.8\times 10^3}{0.02}}$$

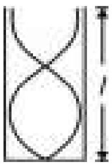
$$420 = \frac{6}{2l} \times 300$$

$$l = \frac{1800}{840} = 2.14 \text{ m}$$

14. Answer (3)

Hint : Pressure variation is maximum at displacement nodes.

Sol. : In third harmonic, 2 nodes and 2 antinodes will be produced.



$$l = \frac{3\lambda}{4}$$

$$\frac{\lambda}{4} = \frac{l}{3} = \frac{60}{3} = 20 \text{ cm}$$

First node will be formed at 20 cm from open end.

15. Answer (2)

Hint : Third overtone of open pipe is fourth harmonic.

Sol. : Assume length of open pipe is l_o and of closed pipe is l_c.

Frequency of third overtone of open pipe = $\frac{4v}{2l_o}$

Frequency of fifth harmonics of closed pipe = $\frac{5v}{4l_c}$

$$\frac{4v}{2l_o} = \frac{5v}{4l_c}$$

$$\frac{l_o}{l_c} = \frac{16}{10}$$

$$\frac{l_c}{l_o} = \frac{5}{8}$$

16. Answer (1)

Hint : After each lower octave frequency becomes half, and of 20 forks, 19 pairs will form.

Sol. : Assume frequency of first fork is $2n$ then of last fork will be n.

$2n - n = 19 \times 3$

$n = 57$ Hz

$2n = 114$ Hz

Frequency of tenth fork $= 114 - 9 \times 3$

$= 87$ Hz

17. Answer (3)

Hint : Because second resonance is not exactly at three time, so there must be some end correction.

Sol. : $l_1 = 17$ cm, $l_2 = 53$ cm

$$\frac{l_2 + e}{l_1 + e} = 3$$

$$e = \frac{l_2 - 3l_1}{2}$$

$$= \frac{53 - 51}{2}$$

$e = 1$ cm

Effective length of first resonance = 18 cm

Effective length of third resonance = 18 × 5

= 90 cm

Length of third resonance = 90 – 1

= 89 cm

18. Answer (2)

Hint : Frequency of sonometer wire

$$n = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

If T and μ are constant, then $n \propto \frac{1}{l}$

Sol. : In first case

$n_1 - n = 5$

$n_1 = n + 5$ …(i)

In second case

$n - n_2 = 5$

$n_2 = n - 5$ …(ii)

$$\frac{n_1}{n_2} = \frac{n+5}{n-5}$$

$$\frac{l_2}{l_1} = \frac{n+5}{n-5}$$

$$\frac{21}{20} = \frac{n+5}{n-5}$$

$n = 205$ Hz.

19. Answer (1)

Hint : The amplitude of resultant wave

$A = 2a\cos\left(\frac{\phi}{2}\right)$ for same amplitude.

Sol. : $y_1 = 10\sin(\omega t - kx)$

$y_2 = 10\sin\left(\omega t - kx + \frac{2\pi}{3}\right)$

So, phase difference $\phi = 120°$

$A = \sqrt{(10)^2 + (10)^2 + 2\times10\times10\cos120°}$

$A = \sqrt{100+100-100}$

$A = 10$ units

20. Answer (3)

Hint & Sol. : Reflected wave has a phase change of π, when reflected from rigid support.

21. Answer (3)

Hint : Speed of sound at room temperature $v = 2n\,(l_2 - l_1)$

Sol. : Length of first resonance, $l_1 = 17$ cm

Length of second resonance, $l_2 = 52$ cm

Frequency of source, $n = 1000$ Hz

$v = 2n\,(l_2 - l_1)$

$= 2 \times 1000\,(52 - 17) \times 10^{-2}$

$= 700$ m/s

22. Answer (4)

Hint & Sol. : Displacement antinode is pressure node, so there is minimum change in pressure and density of air.

23. Answer (1)

Hint & Sol. : For sound wave water behaves as a rarer medium and air as denser medium, so sound waves bend towards normal.

24. Answer (2)

Hint & Sol. : Speed of longitudinal waves in a gas is independent of pressure at constant temperature. So $v \propto P^0$.

25. Answer (4)

Hint & Sol. : In stationary waves the particles of adjacent loops of a node vibrates in opposite phase. So phase difference between them is π.

26. Answer (2)

Hint & Sol. : In case of forced oscillation, the frequency of oscillation will be equal to frequency of applied periodic force.

27. Answer (2)

Hint & Sol. : Total energy of oscillating body remains constant, so time period is infinity and frequency is zero.

28. Answer (4)

Hint & Sol. : $x = A\sin\omega t$

$\frac{dx}{dt} = A\omega\cos\omega t$

$\frac{d^2x}{dt^2} = -\omega^2 A\sin\omega t$

$a = \omega^2 A\sin(\omega t + \pi)$

So, phase difference is π.

29. Answer (3)

Hint & Sol. : Time period of simple pendulum

$T = 2\pi\sqrt{\frac{l}{g}}$

$T^2 \propto l$

$T^2 = Kl$

So, graph will be straight line passing through origin.

30. Answer (2)

Hint : Pendulum starts from extreme position, so displacement equation will be

$x = a\cos\omega t\,,\ v = \frac{dx}{dt}$

Sol. : $v = \frac{dx}{dt} = -a\omega\sin(\omega t)$

at $t = \frac{T}{6}$

$v = a\left(\frac{2\pi}{T}\right)\sin\frac{2\pi}{T}\times\frac{T}{6}$

$v = \frac{2\pi a}{T}\sin\frac{\pi}{3}$

$v = \frac{\pi a\sqrt{3}}{T}$

31. Answer (3)

Hint : Time period of a simple pendulum $T = 2\pi\sqrt{\frac{l}{g_{\text{eff}}}}$.

Sol. : Elevator coming down with retardation $\left(\frac{g}{4}\right)$.

So, $g_{\text{eff}} = g + \frac{g}{4} = \frac{5g}{4}$

$T = 2\pi\sqrt{\frac{l\times4}{5g}} = 4\pi\sqrt{\frac{l}{5g}}$

32. Answer (4)

Hint : As rope has mass, so tension of rope change at each points, hence speed of wave will change and frequency remains same.

Sol. : $\frac{\lambda_1}{\lambda_2} = \frac{\frac{v_1}{n}}{\frac{v_2}{n}} = \frac{v_1}{v_2} = \sqrt{\frac{T_1}{T_2}}$

$\frac{0.5}{\lambda_2} = \sqrt{\frac{2g}{8g}} = \frac{1}{2}$

$\lambda = 1$ m

33. Answer (1)

Hint & Sol. : Potential energy of oscillating body from mean position

$U = \frac{1}{2}m\omega^2 y^2 = \frac{1}{2}m\omega^2 a^2 \sin^2 \omega t$

34. Answer (1)

Hint : $a = -\omega^2 x$

$a = -\omega^2 A \cos \omega t$

Sol. : Amplitude = 2 cm, $T = 4$ s

$|a| = \left(\frac{2\pi}{4}\right)^2 \times 2\cos\left(\frac{2\pi}{4} \times \frac{2}{3}\right)$

$|a| = \frac{4\pi^2}{16} \times 2 \times \frac{1}{2}$

$|a| = \frac{\pi^2}{4}$ cm/s^2

35. Answer (2)

Hint : The motion will be SHM, when $(\vec{a} \propto -\vec{x})$.

Sol. : $x = 3 \sin 2\pi t + 4 \sin 4\pi t$ is superposition of two SHM of time periods T_1 = 1s and $T_2 = \frac{1}{2}$ s.

$\frac{dx}{dt} = 6\pi \cos 2\pi t + 16\pi \cos 4\pi t$

$\frac{d^2x}{dt^2} = -12\pi \sin 2\pi t - 64\pi \cos 4\pi t$

$a = -4\pi [3 \sin 2\pi t + 16 \cos 4\pi t]$

Since $\vec{a}$ is not proportional to $\vec{x}$

$\vec{a} \not\propto -\vec{x}$

So, motion will be oscillatory and periodic with period 1 s but not SHM.

36. Answer (2)

Hint & Sol. : In SHM $\vec{F} \propto -\vec{x}$

$\vec{F} = -K\vec{x}$

So, graph will be straight line passing through origin with negative slope.

37. Answer (3)

Hint & Sol. :

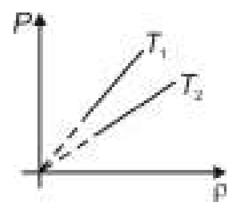
$P = \frac{1}{3}\frac{mnv_{\text{rms}}^2}{V} = \frac{2}{3}\left[\frac{\frac{1}{2}Mv_{\text{rms}}^2}{V}\right]$

$P = \frac{2}{3}\frac{E}{V}$

38. Answer (2)

Hint : $\frac{P}{\rho T}$ = constant

Sol. :



$PV = \frac{m}{M}RT$

$\frac{P}{\rho T} = \frac{R}{M}$ = Constant

For a given ρ, $P_1 > P_2$ so $T_1 > T_2$

39. Answer (4)

Hint : r.m.s. speed $v = \sqrt{\frac{3RT}{M}}$.

Sol. : $T_1 = T$, $v_{\text{rms}} = v$

$v = \sqrt{\frac{3RT}{M}}$

$v' = \sqrt{\frac{3R(4T)}{(M/2)}} = 2\sqrt{2}\, v$

40. Answer (3)

Hint : Apparent frequency $n' = n\left[\frac{v + v_0}{v - v_s}\right]$.

Sol. : v_s = 72 km/h = 72 × $\frac{5}{18}$ = 50 m/s

$n' = 1240\left[\frac{330 + 20}{330 - 20}\right]$

$= \frac{1240 \times 350}{310}$ = 1400 Hz

41. Answer (2)

Hint & Sol. : $C_p - C_v = R$

$$C_v = \frac{f}{2}R$$

$$C_p = C_v + R = \left(\frac{f}{2}R + R\right)$$

$$C_p = R\left(1 + \frac{f}{2}\right)$$

42. Answer (3)

Hint & Sol. : Kinetic energy per molecule per degree of freedom is $\left(\frac{1}{2}k_BT\right)$ it becomes zero at absolute zero temperature but potential energy is non-zero.

43. Answer (4)

Hint & Sol. : Temperature of both the gases is same, i.e. equal to temperature of container, so internal energy per mole will be same.

44. Answer (3)

Hint : $PV = nRT$

Sol. : Number of moles in 20 g N_2 gas = $\frac{20}{28} = \frac{5}{7}$

$$\Rightarrow \quad PV = \frac{5}{7}RT$$

45. Answer (1)

Hint : Mean free path $\lambda = \frac{1}{\sqrt{2}\pi d^2 n}$

Sol. : $PV = Nk_BT$

$$P = \left(\frac{N}{V}\right)k_BT$$

$$P = nk_BT$$

$$n = \frac{P}{k_BT}$$

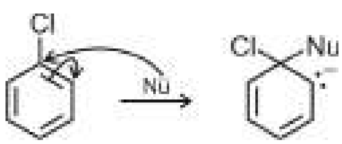
$$\lambda = \frac{k_BT}{\sqrt{2}\pi d^2 P}$$

$$\lambda \propto T$$

[CHEMISTRY]

46. Answer (3)

Hint : S_NAr reactions are favoured by the presence of powerful electron withdrawing groups like —NO_2.

Sol. : 

This anion is stabilized by –NO_2 group(s)

so, –NO_2 groups at all o, p positions stabilizes carbanion most, hence rate of reaction will be fastest.

47. Answer (1)

Hint :

$$CH_3COOAg + Br_2 \xrightarrow{CCl_4} CH_3 - Br + CO_2 + AgBr$$

This reaction is called Hunsdiecker reaction.

48. Answer (2)

Hint : In aqueous medium, order of nucleophilicity

$I^- > Br^- > Cl^- > F^-$

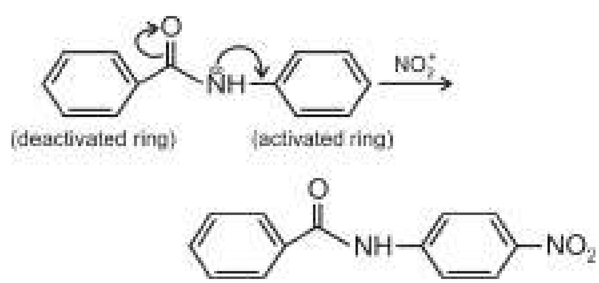
49. Answer (3)

Hint : Methanol is a polar protic solvent. It contains H attached with electronegative oxygen.

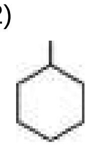
50. Answer (4)

Hint : Activating groups like —NH_2, —OH etc. enhance rate of electrophilic aromatic substitution reactions at o, p positions.

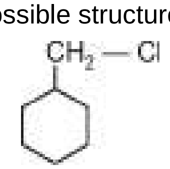
Sol. :

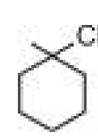


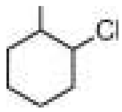
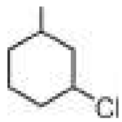
51. Answer (2)

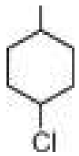
Hint :  $+ Cl_2 \xrightarrow{h\nu}$ five monochloro derivatives.

Sol. : Monochloro derivatives have following possible structures

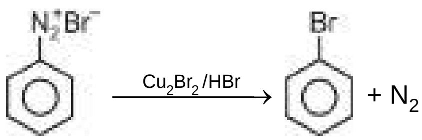
(i) 

(ii) 

(iii)  (iv) 

(v) 

52. Answer (3)

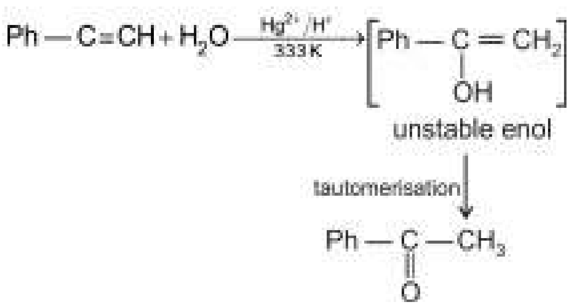
Hint : 

Reaction is called Sandmeyer reaction.

53. Answer (1)

Hint : Alkynes on hydration give aldehyde or ketone.

Sol. :



54. Answer (2)

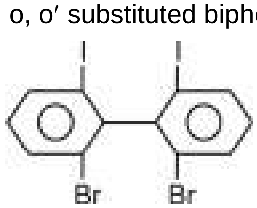
Hint : C — Cl bond length > C — F bond length.

Sol. :

Molecule	CH_3F	CH_3Cl	CH_3Br	CH_3I
Dipole moment (D)	1.847	1.860	1.830	1.636

55. Answer (2)

Hint : o, o′ substituted biphenyls is non planar.

Sol. :  is optically active as the given biphenyl has no plane of symmetry/centre of symmetry.

56. Answer (4)

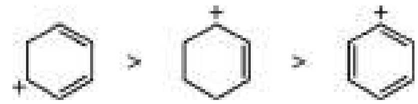
Hint : R — Cl + AgF ⟶ RF + AgCl

Sol. : In Swarts reaction alkyl fluorides are formed.

57. Answer (1)

Hint : S_N1 reactions proceed via carbocation intermediate formation.

Sol. : Stability of carbocation follows the order

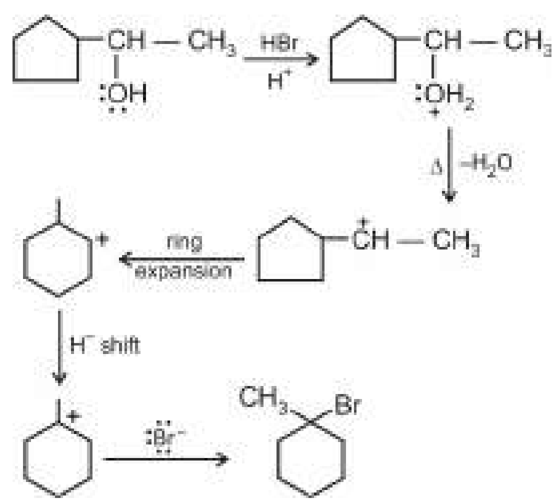


also, C — Br bond is weaker than C — Cl bond, hence, in S_N1 reactions rate of R — Br > R — Cl.

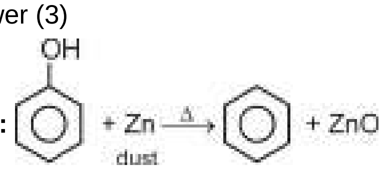
58. Answer (2)

Hint : A five membered ring expands to six membered ring to attain greater stability if possible.

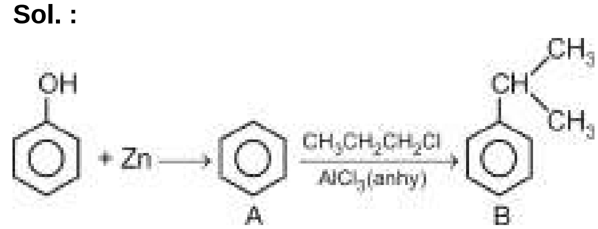
Sol. :



59. Answer (3)

Hint : 

Sol. :



Mechanism:

$$CH_3-CH_2-CH_2-Cl \xrightarrow[\text{(ahyd.)}]{AlCl_3} CH_3-CH_2-\overset{+}{C}H_2 + AlCl_4^-$$

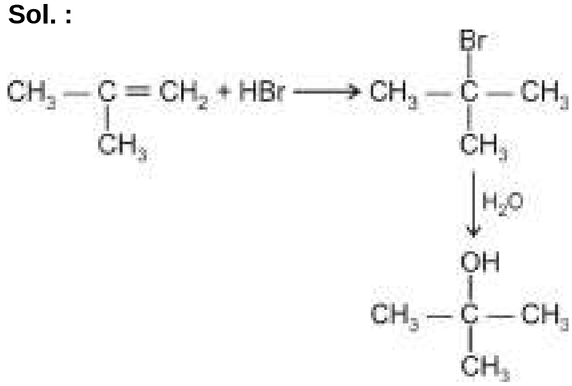
$$\underset{1^\circ\text{ (less stable)}}{CH_3-CH_2-\overset{+}{C}H_2} \xrightarrow{H^-\text{ shift}} \underset{2^\circ\text{ (more stable)}}{CH_3-\overset{+}{C}H-CH_3}$$

Now, this 2° carbocation is attacked by benzene ring.

60. Answer (4)

Hint : HBr will show Markovnikov addition.

Sol. :



61. Answer (1)

Hint : $CaC_2 + 2H_2O \longrightarrow \underset{(P)}{HC\equiv CH} + Ca(OH)_2$

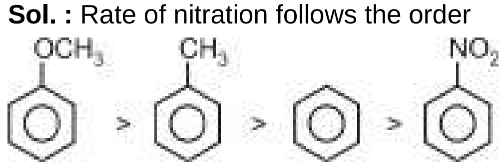
Sol. : 

(X)

62. Answer (3)

Hint : +M group present on benzene increases the rate of electrophilic aromatic substitution reactions.

Sol. : Rate of nitration follows the order



63. Answer (2)

Hint : $\underset{\text{terminal alkyne}}{R-C\equiv C-H} + AgNO_3 \xrightarrow{\text{Ammoniacal solution}}$

$\underset{\text{(white precipitate)}}{R-C\equiv C-Ag}$

$\underset{\text{Non terminal alkyne}}{R-C\equiv C-R} + AgNO_3 \xrightarrow[\text{solution}]{\text{Ammoniacal}}$ No reaction

64. Answer (4)

Hint : Alkenes decolourise $Br_2(l)$ and cold alkaline $KMnO_4$ solution but alkanes do not give this reaction.

Alkane, alkene do not react with $NaNH_2$.

65. Answer (4)

Hint : Ozonolysis followed by hydrolysis does cleavage of C = C.

Sol. : Aldehydes have general formula $C_nH_{2n}O$,

So, 12n + 2n + 16 = 44

14n + 16 = 44

14n = 28

$\therefore$ n = 2

So, the aldehyde is CH_3-CHO

Hence, alkene is $CH_3-CH=CH-CH_3$.

66. Answer (1)

Hint : For isomeric alkanes, as the surface area decreases, boiling point of alkane decreases.

Sol. : B.P. order :

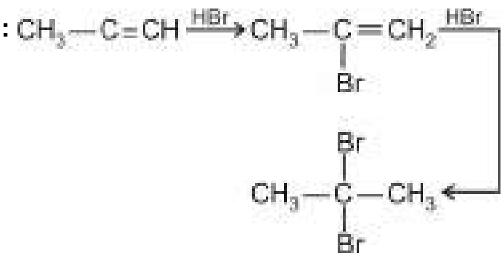
n-pentane > iso-pentane > neo-pentane.

67. Answer (1)

Hint : Alkenes give electrophilic addition reactions.

68. Answer (2)

Hint : Addition of HX to alkynes finally produces gemdihalides.

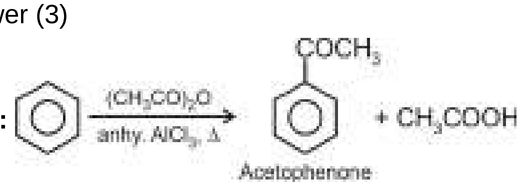
Sol. : 

69. Answer (2)

Hint : Acetylene contains acidic hydrogens.

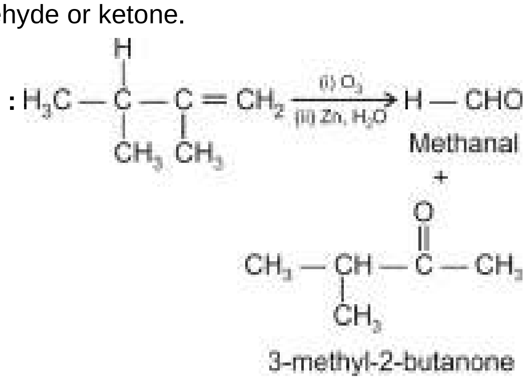
Sol. : $\overset{\delta-}{CH_3}-\overset{\delta+}{MgBr} + \overset{\delta+}{H}-C\equiv CH \longrightarrow CH_4(g)$

70. Answer (3)

Hint : 

71. Answer (3)

Hint : Reductive ozonolysis of an alkene produces aldehyde or ketone.

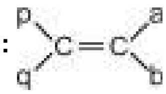
Sol. : 

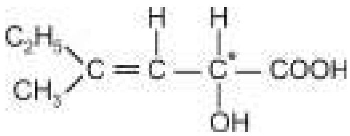
72. Answer (2)

Hint : $R-COONa + NaOH \xrightarrow[\Delta]{CaO} RH + Na_2CO_3$

Sol. :

73. Answer (4)

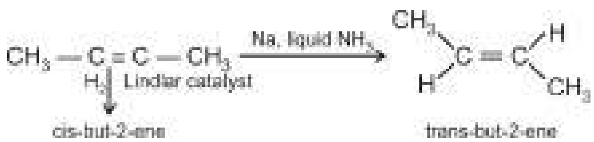
Hint :  shows geometrical isomerism.

Sol. : 

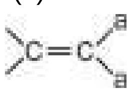
This molecule has a chiral carbon, hence, shows optical and geometrical isomers.

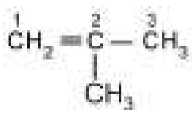
74. Answer (2)

Hint :



75. Answer (4)

Hint :  type molecules do not exhibit geometrical isomerism.

Sol. :  does not show geometrical isomerism.

76. Answer (1)

Hint : Such liquids are made to boil at a temperature lower than their normal boiling points by reducing the pressure on their surface.

77. Answer (3)

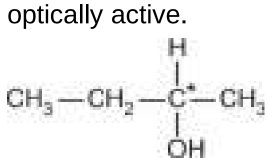
Hint : Alkanes can exhibit chain and position isomerism.

Sol. : Hexane (C_6H_{14}) has 5 structural isomers: n-hexane, 2-methylpentane, 2,2-dimethylbutane, 2,3-dimethylbutane, 3-methylpentane.

78. Answer (2)

Hint : Chiral compound is optically active.

Sol. : Butan-2-ol has one chiral carbon hence, optically active.



79. Answer (3)

Hint : Aromatic compounds in which strong electron withdrawing groups are bonded to benzene ring don't undergo Friedel Crafts reaction easily.

Sol. :  doesn't undergo Friedel Crafts reaction easily.

80. Answer (2)

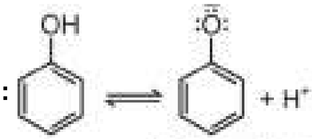
Hint : Resonance stabilized carbanion is highly stable.

Sol. : 

Negative charge is delocalized over oxygen atom, hence, highly stable anion.

81. Answer (4)

Hint : Acidic strength increases with increase in stability of conjugate base.

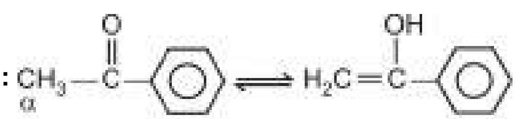
Sol. : 

(Phenoxide ion resonance stabilized)

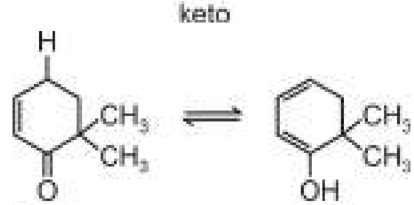
p-nitrophenol is strongest acid as phenoxide ion is stabilized by strong –R effect of $–NO_2$ group.

82. Answer (1)

Hint : For keto-enol tautomerism molecule must have enolizable H-atom.

Sol. : 

keto enol



keto enol

83. Answer (1)

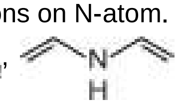
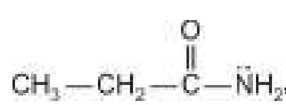
Hint : % of N $= \dfrac{1.4 \times \text{meq. of } NH_3}{\text{Mass of compound}}$

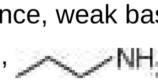
Sol. : Meq. of NH_3 = 25 × 1

$\therefore$ % N in the compound = $\dfrac{1.4 \times 25 \times 1}{1.25} = 28\%$

84. Answer (3)

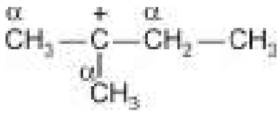
Hint : Basic strength of a base depends on availability of lone pair of electrons on N-atom.

Sol. : In compounds ,  and , lone pair is delocalized hence, weak bases.

So,  is most powerful base.

85. Answer (2)

Hint : α-H atoms on carbon next to sp^2 hybridised carbon take part in hyperconjugation.

Sol. : 

It has total 8 α-H atoms which will participate in hyperconjugation.

86. Answer (2)

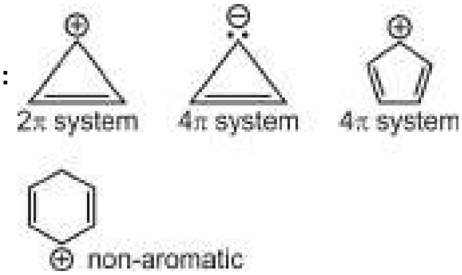
Hint : Electron deficient species is called electrophile.

Sol. : $H_2\ddot{O}$ – nucleophile, $AlCl_3$ – electrophile

$\ddot{N}H_3$ – Nucleophile,  – Nucleophile

87. Answer (4)

Hint : Cyclic planar structures having $(4n + 2)\pi$ delocalized electrons are aromatic.

Sol. : 

88. Answer (1)

Hint : –I effect decreases in the following order

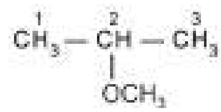
$-NO_2 > -F > -OH > -C \equiv CH$

89. Answer (3)

Hint : 

90. Answer (2)

Hint : IUPAC naming of an ether is Alkoxy alkane.

Sol. : 

2-Methoxypropane.

[BIOLOGY]

91. Answer (4)

Hint : Vernalisation refers to promotion of flowering by an exposure of low temperature.

Sol. : Vernalisation prevents precocious reproductive development late in the growing season and enables the plant to have sufficient time to reach maturity.

92. Answer (1)

Hint : The hormone florigen migrates from leaves to shoot apices for inducing flowering.

Sol. : Shoot apices modify themselves into flowering apices, therefore they themselves cannot perceive photoperiods. The site of perception of light/dark is the leaves of plants.

93. Answer (3)

Sol. : Auxin promotes the abscission of older leaves, fruits and flowers.

94. Answer (1)

Hint : Dormancy is the condition of seed when it is unable to germinate inspite of the availability of all environmental conditions suitable for germination.

Sol. : Endosperm nourishes the growing embryo. Some mature seeds do not have endosperm but they can germinate.

95. Answer (2)

Hint : The growth promoting substance extracted from *Gibberella fujikuroi* was termed as gibberellin.

Sol. : *Gibberella fujikuroi* causes bakane disease of rice seedlings.

96. Answer (3)

Hint : Heterophylly is the phenomenon of appearance of different forms of leaves on the same plant.

Sol. : Difference in shapes of leaves is observed in buttercup present in air and water *i.e.*, different shapes of leaves according to its habitat.

97. Answer (4)

Hint : Dedifferentiation is a phenomenon where certain living differentiated cells regain their ability to divide and form new cells.

Sol. : Interfascicular cambium, cork cambium and wound cambium are dedifferentiated tissues. Intrafascicular cambium is primary meristem.

98. Answer (1)

Hint : The curve in the graph shows exponential growth of that plant organ.

Sol. : A sigmoid curve is a characteristic of living organism growing in a natural environment. The geometric growth is expressed as

$W_1 = W_0\, e^{rt}$

99. Answer (3)

Sol. : Life span is not related with the growth in size or weight of the organisms.

100. Answer (2)

Hint : Plants have the capacity for indeterminate growth.

Sol. : Growth in plants is continuous throughout their life due to the presence of different types of meristems at specific locations in their body.

101. Answer (3)

Hint : During oxidation of succinate, $FADH_2$ is generated

Sol. : Cytochrome c oxidase complex contains two copper centres.

Cytochrome c is a protein attached to the outer surface of inner mitochondrial membrane.

Ubiquinone receives reducing equivalents via complex II.

102. Answer (4)

Hint : Conversion of phosphoenol pyruvate to pyruvic acid is a step in glycolysis. CO_2 is not released in glycolysis.

Sol. : Both phosphoenol pyruvate and pyruvic acid are 3-carbon molecules

103. Answer (4)

Hint : Oxidative decarboxylation of pyruvate occurs in mitochondria.

Sol. : Pyruvate enters into mitochondrial matrix where its oxidative decarboxylation occurs with the help of pyruvate dehydrogenase.

104. Answer (4)

Hint : The balanced equation is as follows :

$2(C_{51}H_{98}O_6) + 145O_2 \rightarrow 102CO_2 + 98H_2O$ + energy

Sol. : RQ = $\frac{102\ CO_2}{145\ O_2} = 0.7$

105. Answer (3)

Hint : Energy of ATP is also utilised during glycolysis.

Sol. : During glycolysis NAD^+ is converted into $NADH + H^+$.

106. Answer (3)

Hint : Product of amino acid that enters into aerobic respiration is pyruvic acid.

Sol. : Pyruvic acid is first common respiratory product of amino acid and glycerol.

107. Answer (1)

Hint : Calvin cycle starts with the carboxylation of RuBP.

Sol. : The sequence of the three stages of Calvin cycle is

Carboxylation $\longrightarrow$ Reduction $\longrightarrow$ Regeneration

108. Answer (2)

Hint : Cyclic photophosphorylation is performed by PS-I independently.

Sol. : PS-II is not found in stroma lamellae therefore the cyclic photophosphorylation involves PS-I only, that occurs in stroma lamellae.

109. Answer (4)

Hint : Absorption peak in PS-I is at 700 nm.

Sol. : In PS-II, reaction centre has an absorption maxima at 680 nm.

All photosynthetic pigments other than chlorophyll 'a' are accessory pigments.

110. Answer (4)

Hint : In C_4 plants, Calvin cycle occurs in bundle sheath cells.

Sol. :

A	–	C_4 acid
B	–	C_3 acid
C	–	Mesophyll cell
D	–	Bundle sheath cell

111. Answer (4)

Hint : RuBP (Ribulose bisphosphate) is a 5-carbon compound.

Sol. :

Phosphoglycolate	–	2-carbon
Aspartic acid	–	4-carbon
Phosphoenol pyruvate	–	3-carbon

112. Answer (4)

Hint : C_4 plants have Kranz anatomy in their leaves.

Sol. : ATP consumed in C_4 plants:

C_4 cycle	–	2 ATP per CO_2 fixed
C_3 cycle	–	3 ATP per CO_2 fixed
Total	–	5 ATP per CO_2 fixed

Therefore, for one glucose molecule ($C_6H_{12}O_6$), *i.e.*, to fix 6 CO_2 molecules, ATP required = 6 × 5 = 30.

113. Answer (2)

Hint : RuBisCO is the most abundant enzyme on earth.

Sol. : During Calvin cycle, RuBisCO binds with CO_2 whereas during photorespiration the same enzyme binds with oxygen.

114. Answer (3)

Hint : C_4 plants respond to higher temperature and show higher rate of photosynthesis.

Sol. : Maize and *Sorghum* are C_4 plants and they show higher rate of photosynthesis at higher temperature.

115. Answer (1)

Hint : A factor is said to be limiting when it is near to its minimal value.

Sol. : In dense forests, very little sunlight is reached the ground and thus it becomes limiting factor for small plants.

116. Answer (2)

Hint : Visible light consists of radiations having a wavelength between 390-760 nm.

Sol. : Photosynthetically active radiation has a wavelength between 400-700 nm.

117. Answer (1)

Hint : The scientist who revealed the essential role of air in the growth of green plants also discovered oxygen in 1774.

Sol. : Through his experiments, Joseph Priestley revealed the essentiality of air in the growth of green plants.

118. Answer (1)

Hint : ATP is an example of energy related chemical compound.

Sol. : Mg is a component of chlorophyll that takes part in conversion of light energy to chemical energy. Phosphorus is a component of ATP.

119. Answer (3)

Hint : Some elements which are responsible for the flowering in plants are also the constituents of proteins.

Sol. : Elements like N, S and Mo delay flowering if their concentration in plants is low.

120. Answer (4)

Hint : Nitrogenase functions under anaerobic conditions.

Sol. : Nitrogenase is made up of Mo-Fe protein and it is highly sensitive to molecular oxygen.

121. Answer (4)

Hint : The activator of PEPCase is also a constituent of ring structure of chlorophyll.

Sol. : Mg^{2+} is an activator of both RuBisCO and PEPCase, both of which are critical enzymes involved in carbon fixation during photosynthesis.

122. Answer (3)

Hint : *Rhizobium* is a symbiotic nitrogen-fixing bacterium.

Sol. : *Thiobacillus* – Nitrate $\longrightarrow$ Nitrogen

Nitrococcus – Ammonia $\longrightarrow$ Nitrite

Rhizobium – Nitrogen $\longrightarrow$ Ammonia

Nitrobacter – Nitrite $\longrightarrow$ Nitrate

123. Answer (4)

Hint : Mineral elements are absorbed by the plants in the form of ions.

Sol. : Carbon is absorbed by the plants in the form of CO_2.

124. Answer (2)

Hint : An element is said to be essential for a plant if it is absolutely necessary for supporting normal growth and reproduction of the plant.

Sol. : Absence or reduced availability of the essential element causes disorder in the plants.

125. Answer (1)

Hint : Hydroponics is the technique by which essentiality of mineral nutrients for plants is determined.

Sol. : In hydroponics, the plants are grown directly in a soil-free, defined mineral solution.

126. Answer (3)

Hint : Apoplast pathway does not involve any membrane or cytoplasm.

Sol. : In roots, apoplastic movement of water is through intercellular spaces of cortical cells and walls of their cell. There is very little or no resistance to water movement.

127. Answer (3)

Hint : Dry atmosphere has low water vapour pressure as compared to humid atmosphere.

Sol. : Rate of transpiration is inversally proportional to the relative humidity of the atmosphere.

128. Answer (2)

Hint : Sinks are those structures or parts of plants where materials are utilised or stored.

Sol. : The chief sinks for the mineral elements in plants are growing regions and storage organs.

129. Answer (4)

Sol. : Bulk movement of different substances from one place to other in a plant is called translocation.

130. Answer (1)

Hint : When dry wood is kept in water, the water molecules are absorbed by the wood.

Sol. : The process of absorption of water by hydrophilic solid particles of a substance without forming a solution is called imbibition.

131. Answer (1)

Hint : When water flows into the cell and out of the cell i.e. in equilibrium then, the osmotic concentration in the cell and out of the cell is said to be equal.

Sol. : A solution, whose osmotic concentration is equal to that of another solution or cell sap is called isotonic solution.

132. Answer (4)

Hint : Water moves from its high water potential to low water potential.

Sol. : ψ_w of cell A = –12 + 5 = –7 bar

ψ_w of cell B = –20 + 13 = –7 bar

ψ_w of cell C = –9 + 2 = –7 bar

133. Answer (2)

Hint : Solute potential of a pure solvent at atmospheric pressure is taken to be zero.

Sol. : Solute potential of a solution is always negative. For a solution its value can never be zero or positive.

134. Answer (3)

Hint : Porins are found in the outer membrane of the plastids, mitochondria and some bacteria.

Sol. : The porins are proteins which form huge pores in the outer membrane of plastids, mitochondria and some bacteria.

135. Answer (2)

Hint : Gaseous movement within the plant body does not require special membrane proteins.

Sol. : Diffusion is very important to plants since it is the only means for gaseous movement within the plant body.

136. Answer (3)

Hint : The excretory product of birds is same as cockroach.

Sol. : Excretion is performed by malpighian tubules in cockroach. Each tubule absorbs nitrogenous waste products and ultimately it is converted into uric acid.

137. Answer (3)

Hint : Thin and flexible articular membrane.

Sol. : Exoskeleton for each segment consists of a dorsal tergum, a ventral sternum and lateral pleura; these plates are joined to each other by a thin and flexible articular membrane known as arthrodial membrane.

138. Answer (2)

Hint : Spiracles are present in cockroach.

Sol. : The respiratory system consists of a network of trachea. Thin branching tubes (tracheal tubes subdivided into tracheoles) carry oxygen from the atmospheric air to all the tissues of cockroach.

139. Answer (1)

Hint : Testes are present anterior to mushroom gland.

Sol. : Male gonads are a pair of testes, one lying on either dorso-lateral side of 4^{th} to 6^{th} abdominal segments.

140. Answer (3)

Hint : They perform function analogous to functions of kidney in humans.

Sol. : Malphigian tubules are present at the junction of midgut and hindgut of cockroach. Their function is removal of excretory products from haemolymph.

141. **Delete**

142. Answer (1)

Hint : Identify the outermost layer of skin in reptiles.

Sol. : Stratum corneum ("the horny layer") is the outermost layer of epidermis. It is mainly composed of dead cells that lack nuclei. In reptiles, the stratum corneum is replaced during times of rapid growth, and repair in a process called ecdysis or moulting. The new layer is regularly formed by underlying stratum germinativum.

143. Answer (3)

Hint : *Nereis* possesses lateral appendages parapodia.

Sol. : Osteichthyes have four pairs of gills which are covered by an operculum. Choanocytes or collar cells line the spongocoel and the canals in sponges. 4 pairs of comb plates are present in ctenophores.

144. Answer (4)

Hint : Earthworm has closed circulatory system.

Sol. : Blood of *Pheretima* is red coloured due to the presence of a respiratory pigment erythrocruorin in it. Haemoglobin is not contained in the corpuscles like vertebrates but it is found dissolved in plasma.

145. Answer (4)

Hint : This is called jelly fish.

Sol. : Metagenesis is alternation of generations seen in cnidarians *e.g.*: *Obelia*.

146. Answer (4)

Hint : Select a viviparous fish.

Sol. : *Gambusia* feeds on insects and their aquatic larvae, small amphibians, eggs, small fish, and mosquito larvae.

147. Answer (2)

Hint : Spider belongs to this class.

Sol. : Chilopoda – Centipede

Diplopoda – Millipede

Insecta – Silver fish

148. Answer (3)

Hint : *Hyla* is tree frog.

Sol. : *Bufo* – Toad

Salamandra – Salamander

Ichthyophis – Limbless amphibian

149. Answer (2)

Hint : Members of this phylum are exclusively marine.

Sol. : Tube feet are small tube-like projections on the underside (oral side) of echinoderms. They are part of the water vascular system of echinoderms and are used to move, assist feeding and respire.

150. Answer (3)

Hint : Gizzard is also called gastric mill.

Sol. : Gizzard, in many birds is the hind part of the stomach, which is especially modified for grinding food. It is located between the saclike crop and the intestine. It has a thick muscular wall and may contain small stones, or gastroliths, that help in the mechanical breakdown of seeds and other foods.

151. Answer (2)

Hint : Reptiles are ectothermic.

Sol. : Reptiles are cold-blooded and cannot produce heat in their own bodies and have to rely on their surroundings to keep warm.

152. Answer (4)

Hint : It is a parasitic worm that lives in alimentary canal of man.

Sol. : Adults are hermaphroditic, capable of self-fertilisation. Earthworms exhibit reciprocal exchange of sperms.

153. Answer (3)

Hint : Identify an animal that lives on both land and water.

Sol. : Whales and dolphins use their lungs to breathe. Frogs can breathe through their lungs and skin once they reach adulthood. Spider respires through book lungs.

154. Answer (4)

Hint : Mammals are ureotelic.

Sol. : Ureotelic organisms include cartilaginous fish, few bony fishes, adult amphibians and mammals including humans and whale.

155. Answer (3)

Hint : Select a vascular structure.

Sol. : Mammals possess a 4-chambered heart with left systemic arch.

156. Answer (3)

Hint : Select an animal with webbed feet and a rubbery snout.

Sol. : Mammals that lay eggs are called monotremes and include platypuses and echidnas (spiny anteaters) both of which are natives of Australia. Birds lack diaphragm. *Delphinus* is viviparous.

157. Answer (1)

Hint : This has pneumatic bones.

Sol. : Bird's hollow bones make the skeleton lighter for flying. Air sacs help more oxygen to be absorbed from air into the blood for the extra energy a bird needs. Air sacs are not site of exchange of gases. *Testudo* and *Chelone* are reptiles while *Macaca* is a mammal.

158. Answer (3)

Hint : A pupal stage is formed during this kind of metamorphosis in butterfly.

Sol. : Complete metamorphosis – Holometaboly

Incomplete metamorphosis – Hemimetaboly

No metamorphosis – Ametaboly

Two or three distinct type of larval instars with different habits and structures are found – Hypermetaboly

159. Answer (3)

Hint : The term cyclostome refers to "round mouth".

Sol. : Cyclostomes have mouth without jaws, so they are grouped under agnatha. Mouth is ventral, suctorial and is circular.

160. Answer (1)

Hint : It has body with both ends pointed like in a lance.

Sol. : Excretion in *Ascidia*, *Doliolum* and *Herdmania* occurs by neural gland.

161. Answer (3)

Hint : It is also known a flying fish.

Sol. : *Exocoetus* belongs to class Osteichthyes and has a bony endoskeleton. A bony fish's heart has two chambers : an atrium and a ventricle.

162. Answer (3)

Hint : The Greek term 'herpein' means 'to creep'.

Sol. : Ornithology is a branch of zoology which deals with study of birds. Study of insects is called Entomology. Batrachology is study of amphibians.

163. Answer (3)

Hint : Mammals have a bony skeleton.

Sol. : Sting rays (*Trygon*), electric ray (*Torpedo*) and sharks belong to class chondrichthyes.

164. Answer (4)

Hint : National bird of India.

Sol. : Peacocks are good with flying and are as avid and swift as any other average bird. Ostrich, Emu, Kiwi *etc*. are flightless birds, as they lost their ability to fly over a period of time.

165. Answer (2)

Hint : Syrinx is well developed in songbirds.

Sol. : Nearly all birds produce sound through an organ unique to birds, the syrinx.

166. Answer (2)

Hint : *Xenopsylla* is also known as rat flea.

Sol. : Chikungunya virus is spread to people by female *Aedes aegypti* mosquito. These are the same mosquitoes that transmit dengue virus. Female *Anopheles* spreads *Plasmodium* that causes malaria.

167. Answer (3)

Hint : It has dorso-ventrally flattened body.

Sol. : Planarians exhibit an extraordinary ability to regenerate lost body parts. A planarian when split lengthwise or crosswise can regenerate into separate individuals.

168. Answer (3)

Hint : Its mouth contains a file-like rasping organ for feeding called radula.

Sol. : *Pennatula* (Sea-pen), *Adamsia* (Sea-anemone) and *Gorgonia* (Sea-fan) belong to Phylum Coelenterata. *Aplysia* (sea-hare) is a mollusc.

169. Answer (4)

Hint : Identify a reptile.

Sol. : *Naja* is a genus of venomous elapid snakes known as cobras. Terrestrial reptiles show internal fertilisation.

170. Answer (4)

Hint : Development in mammals is direct with few exceptions.

Sol. : Viviparity is seen in many taxa of animals. Monotremes are a group of mammals that lay eggs. e.g. : Platypus and Echidna.

171. Answer (4)

Hint : Identify an animal which can maintain its body temperature.

Sol. : Birds (including penguins) are warm blooded. Penguins have thick skin and blubber to keep them warm in cold weather. They are homeotherms

172. Answer (3)

Hint : Identify a bird

Sol. : *Crocodilus* belongs to class Reptilia while *Pavo* belongs to class Aves.

173. Answer (1)

Hint : These animals are exclusively marine.

Sol. : Molluscs, Annelida and Arthropods are bilaterally symmetrical. Adult echinoderms exhibit secondary radial symmetry.

174. Answer (2)

Hint : Select an insect reared in sericulture.

Sol. : *Bombyx mori,* also known as silk worm is an economically important insect. *Dentalium* belongs to phylum Mollusca. *Ancylostoma* is an aschelminth. *Hirudinaria* is an annelid.

175. Answer (4)

Hint : These are the smallest blood vessels.

Sol. : A capillary network is not found in open circulatory system. They are property of a closed circulatory system.

176. Answer (4)

Hint : All the above organisms are arthropods.

Sol. : All arthropods (arthro = joint, poda = foot) have jointed appendages.

177. Answer (4)

Hint : Body of molluscs has a distinct head, muscular foot and visceral hump.

Sol. : Body of molluscs does not show segmentation therefore they are called unsegmented animals.

178. Answer (2)

Hint : Characteristic of aschelminthes.

Sol. : Annelids have a fluid-filled cavity between the outer body wall and the gut and this is referred to as schizocoelom. Aschelminthes are pseudocoelomate animals.

179. Answer (1)

Hint : Animals of this phylum are known to be soft bodied.

Sol. : Over two-thirds of all named species of animals are members of phylum Arthropoda. Phylum Mollusca is the second-largest phylum.

180. Answer (3)

Hint : Union of gametes occurs in water.

Sol. : Sponges reproduce asexually by fragmentation and sexually by formation of gametes. Fertilisation is internal.

❑ ❑ ❑