

# NEET MOCK TEST 4

## ANSWER KEY & SOLUTIONS

### ANSWER KEY

#### Physics

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

#### Botany

101.	(c)
102.	(c)
103.	(c)
104.	(a)
105.	(a)
106.	(b)
107.	(a)
108.	(a)
109.	(b)
110.	(c)
111.	(d)
112.	(b)
113.	(b)
114.	(c)
115.	(a)
116.	(b)
117.	(a)
118.	(b)
119.	(d)
120.	(d)
121.	(c)
122.	(b)
123.	(c)
124.	(b)
125.	(d)
126.	(b)
127.	(d)
128.	(a)
129.	(c)
130.	(c)
131.	(d)
132.	(b)
133.	(c)
134.	(a)
135.	(d)
136.	(b)
137.	(a)
138.	(d)
139.	(d)
140.	(a)
141.	(b)
142.	(d)
143.	(c)
144.	(b)
145.	(d)
146.	(d)
147.	(c)
148.	(b)
149.	(a)
150.	(a)

#### Chemistry

51.	(c)
52.	(d)
53.	(b)
54.	(c)
55.	(d)
56.	(c)
57.	(b)
58.	(c)
59.	(a)
60.	(b)
61.	(c)
62.	(b)
63.	(a)
64.	(d)
65.	(c)
66.	(d)
67.	(b)
68.	(b)
69.	(d)
70.	(a)
71.	(b)
72.	(c)
73.	(a)
74.	(a)
75.	(c)
76.	(d)
77.	(c)
78.	(c)
79.	(c)
80.	(d)
81.	(d)
82.	(d)
83.	(c)
84.	(a)
85.	(c)
86.	(c)
87.	(b)
88.	(b)
89.	(d)
90.	(d)
91.	(b)
92.	(b)
93.	(d)
94.	(d)
95.	(b)
96.	(b)
97.	(c)
98.	(a)
99.	(d)
100.	(c)

#### Zoology

151.	(a)
152.	(b)
153.	(b)
154.	(a)
155.	(b)
156.	(c)
157.	(a)
158.	(d)
159.	(a)
160.	(b)
161.	(d)
162.	(b)
163.	(c)
164.	(c)
165.	(d)
166.	(d)
167.	(c)
168.	(b)
169.	(c)
170.	(a)
171.	(b)
172.	(c)
173.	(d)
174.	(d)
175.	(c)
176.	(c)
177.	(a)
178.	(d)
179.	(b)
180.	(c)
181.	(d)
182.	(a)
183.	(d)
184.	(b)
185.	(a)
186.	(c)
187.	(d)
188.	(b)
189.	(c)
190.	(d)
191.	(a)
192.	(b)
193.	(a)
194.	(d)
195.	(d)
196.	(c)
197.	(b)
198.	(d)
199.	(d)
200.	(a)

# ANSWERS WITH EXPLANATION

## PHYSICS

### Section A

**1. Option (c) is correct.**

Linear velocity, acceleration, and force vary in the direction of motion. Only angular velocity will be constant.

**2. Option (b) is correct.**

The voltage across the terminals is the same for both the cases

$$\text{Illuminance, } H \propto \frac{1}{R}$$

Hence the combination of 39 bulbs have lower resistance as compared to 40 bulbs, so 39 bulbs combination will glow more.

**3. Option (a) is correct.**

When the balloon is descending, then

$$mg - F = ma$$

where F is thrust force

If mass  $m'$  is removed, then the balloon will start moving up, then

$$F - (m - m')g = (m - m')a$$

From above equations

$$mg - (m - m')g = ma + (m - m')a$$

Now,

$$m'g = ma + ma - m'a$$

$$m'(g + a) = 2ma$$

$\therefore$

$$m' = 2ma/(g + a)$$

**4. Option (d) is correct.**

Now,

$$\text{Initial potential energy} = mgh$$

$$\text{Final potential energy after rebound} = mgh'$$

Since 40% energy lost during impact, so

$$mgh' = 60\% \text{ of } mgh$$

$$h' = \frac{60}{100} \times h = \frac{60}{100} \times 10$$

$$= \frac{60}{100} \times 10 = 6 \text{ m}$$

**5. Option (b) is correct.**

$$\text{Wavelength } \lambda = \frac{\text{speed}}{\text{frequency}}$$

$$\lambda = \frac{360 \text{ m}}{500}$$

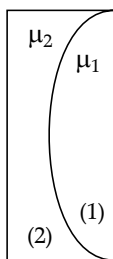
The phase difference is  $(2\pi/\lambda) \times \text{path difference}$

As the phase difference is  $60^\circ$ ,

so  $60^\circ = (360^\circ/36) \times 50 \times \text{path difference}$

Hence the distance between the two nearest points is  $= 6/50$  metre or 12 cm

**6. Option (d) is correct.**



Equivalent focal length is

$$\frac{1}{f_{eq}} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$\frac{1}{f_{eq}} = (\mu_1 - 1) \left[ \left( \frac{1}{\infty} \right) - \left( \frac{1}{-R} \right) \right] + (\mu_2 - 1) \left[ \frac{1}{-(R)} - \frac{1}{\infty} \right]$$

$$\text{Now, } f_{eq} = \frac{R}{(\mu_1 - \mu_2)}$$

**7. Option (b) is correct.**

Intersection of medians is the centre of mass of the triangle. Since distance of centre of mass from the sides are related as

$$x_{BC} > x_{AB} > x_{AC}$$

Therefore,  $I_{BC} > I_{AB} > I_{AC}$

**8. Option (b) is correct.**

$$F = qE$$

$$ma = qE$$

$$a = qE/m$$

$$[E = V/l]$$

$$a = qV/ml$$

$$= qV/ml = (v^2 - u^2)/2l$$

$$[\therefore v^2 = u^2 + 2as]$$

$$V = mv^2/2q$$

$$V = 2 \times 10^{-3} \times 100 / (2 \times 2 \times 10^{-6})$$

$$V = 50 \text{ kV}$$

**9. Option (a) is correct.**

The energy of the incident electrons:

$$\begin{aligned} E &= \frac{p^2}{2m} \\ &= \frac{(h/\lambda)^2}{2m} \\ &= \frac{h^2}{2m\lambda^2} \end{aligned}$$

The energy of the emitted X-ray photon:

$$E_0 = \frac{hc}{\lambda_0}$$

At cut off frequency:

$$E = E_0$$

$$\frac{h^2}{2m\lambda^2} = \frac{hc}{\lambda_0}$$

or,

$$\lambda_0 = \frac{2mc\lambda^2}{h}$$

**10. Option (a) is correct.**

By adjoining graph,  $W_{AB} = 0$

$$W_{BC} = 8 \times 10^4 [5 - 2] \times 10^{-3}$$

$$= 240 \text{ J}$$

$$W_{AC} = W_{AB} + W_{BC} = 0 + 240$$

$$= 240 \text{ J}$$

$$\begin{aligned} \Delta Q_{AC} &= \Delta Q_{AB} + \Delta Q_{BC} \\ &= 600 + 200 \\ &= 800 \text{ J} \end{aligned}$$

From First law of Thermodynamics,

$$\begin{aligned} \Delta Q_{AC} &= \Delta U_{AC} + \Delta W_{AC} \\ 800 &= \Delta U_{AC} + 240 \\ \Delta U_{AC} &= 560 \text{ J} \end{aligned}$$

**11. Option (a) is correct.**

Net torque is zero.

Therefore Angular momentum is conserved. When the arms are stretched the rotational inertia is higher.

The angular velocity of the man would increase because the radius of gyration is decreased.

**12. Option (c) is correct.**

There is no displacement thus work done is zero because

$$W = \vec{F} \cdot \vec{d}$$

**13. Option (b) is correct.**

The electron has negative charge. When an electron is approaching towards another electron, then due to same negative charge repulsive force is produced between them. So, to bring them closer a work is done against this repulsive force. This work is stored in the form of electrostatic potential energy. Thus, electrostatic potential energy of system increases.

**14. Option (a) is correct.**

$$\frac{R_1}{R_2} = \left(\frac{A_1}{A_2}\right)^{1/3}$$

$$\left(\frac{216}{64}\right)^{1/3} = \frac{6}{4} = 3:2$$

**15. Option (c) is correct.**

From the given diagram,  $C_1, C_2, C_3$  are connected in parallel. Further, this group is connected in series with  $C_4$ . Let  $C_{AB}$  be the equivalent capacitance of the system.

Here,  $C_1 = \frac{2\epsilon_0 K_1 A}{3d}, C_2 = \frac{2K_2 \epsilon_0 A}{3d}$

$$C_3 = \frac{2\epsilon_0 K_3 A}{3d}, C_4 = \frac{2\epsilon_0 K_4 A}{d}$$

So,  $\frac{1}{C_{AB}} = \frac{1}{C_1 + C_2 + C_3} + \frac{1}{C_4}$

$$\Rightarrow \frac{1}{K\left(\frac{\epsilon_0 A}{d}\right)} = \frac{1}{\frac{2\epsilon_0 A}{3d}(K_1 + K_2 + K_3)} + \frac{1}{\frac{2\epsilon_0 A K_4}{d}}$$

$$\frac{1}{K} = \frac{3}{2(K_1 + K_2 + K_3)} + \frac{1}{2K_4}$$

or,  $\frac{2}{K} = \frac{3}{(K_1 + K_2 + K_3)} + \frac{1}{K_4}$

**16. Option (b) is correct.**

$$W = \int_{(0,0)}^{(1,1)} \vec{F} \cdot d\vec{x}$$

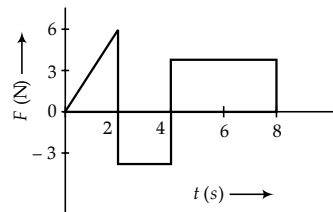
Here  $d\vec{s} = dx\hat{i} + dy\hat{j} + dz\hat{k}$

$$\therefore W = \int_{(0,0)}^{(1,1)} (x^2 dy + y dx)$$

$$= \int_{(0,0)}^{(1,1)} (y^2 dy + x dx) \quad (\text{as } x = y)$$

$$\therefore W = \left[ \frac{y^3}{3} + \frac{x^2}{2} \right]_{(0,0)}^{(1,1)} = \frac{5}{6} \text{ J}$$

**17. Option (a) is correct.**



From the figure,

change in momentum = area under the curve

$$= \frac{1}{2} \times 2 \times 6 - 2 \times 3 + 4 \times 3$$

$$= 12 \text{ Ns}$$

**18. Option (b) is correct.**

In a uniform electric field, the direction of electric field potential decreases, so

$$V_A = V_B > V_C$$

**19. Option (b) is correct.**

Work function,  $\phi_0 = \frac{hc}{\lambda}$

$$\lambda = \frac{hc}{\phi_0} = \frac{12400}{2}$$

or  $\lambda = 620 \text{ nm}$

**20. Option (c) is correct.**

Let  $x = a \sin \omega t$

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

further,  $\frac{x}{a} = -\frac{y}{b}$

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

which is an equation of the straight line

**21. Option (b) is correct.**

In case of zero deflection in galvanometer, the potential difference across resistance X will be:

$$E = 2V$$

Considering mesh AOPD,

$$\frac{12X}{500 + X} = 2$$

On solving, we see that the value of resistance  $X = 100 \Omega$

**22. Option (c) is correct.**

The momentum transferred to the surface

$$= \text{change in momentum}$$

$$= P_f - P_i$$

$$= +\frac{E}{c} - \left(-\frac{E}{c}\right) = \frac{2E}{c}$$

**23. Option (c) is correct.**

$$E = \Delta mc^2$$

$$= 1.66 \times 10^{27} \times (3 \times 10^8)^2$$

$$= 1.49 \times 10^{-10}$$

$$1 \text{ MeV} = 1.6 \times 10^{-13} \text{ J}$$

So,  $E = \frac{1.49 \times 10^{-10}}{1.6 \times 10^{-13}}$

$$E = 931 \text{ MeV}$$

24. Option (d) is correct.

$$a = \frac{F_3}{m} = \frac{|\vec{F}_1 \cdot \vec{F}_2|}{m} = \frac{\sqrt{F_1^2 + F_2^2}}{m}$$

All forces must be coplanar and each pair of force is equivalent to the third force.

25. Option (b) is correct.

Using equation of motion in vector form,

$$v = u + at$$

$$v = 3\hat{i} + 4\hat{j} + (0.4\hat{i} + 0.3\hat{j}) \times 10$$

$$v = 7\hat{i} + 7\hat{j}$$

$$|v| = 7\sqrt{2} \text{ unit}$$

26. Option (b) is correct.

In case of Balmer series:

$$n_1 = \infty, \quad n_2 = 2 \Rightarrow \lambda_1 = \frac{4}{R}$$

In case of Lyman series:

$$n_1 = \infty, \quad n_2 = 1 \Rightarrow \lambda_2 = \frac{1}{R}$$

Now,  $\lambda_1/\lambda_2 = 4$

27. Option (a) is correct.

Here  $r = 0.3 \text{ mm} = 0.03 \text{ cm}$ ,

$v = 1 \text{ ms}^{-1} = 100 \text{ cm}^{-1}$ ,  $\eta = 18 \times 10^{-5} \text{ poise}$ .

According to Stokes' law, force of viscosity on rain drop is

$$\begin{aligned} F &= 6\pi\eta rv \\ &= 6 \times 3.142 \times 18 \times 10^{-5} \times 0.03 \times 100 \text{ dyne} \\ &= 1.018 \times 10^{-2} \text{ dyne.} \end{aligned}$$

28. Option (c) is correct.

The term mass is used to refer to the amount of matter in any given object. Mass is constant because mass is quantity of matter present in an object and does not change with gravity.

$\Rightarrow$  Mass = constant

29. Option (c) is correct.

Effective length of the pendulum is  $(92.0 + 2.17) \text{ cm} = 94.2 \text{ cm}$  after rounding off to 3 significant digits.

30. Option (d) is correct.

$$y(x, t) = 8.0 \sin(0.5\pi x - 4\pi t - \pi/4)$$

$$y(x, t) = a \sin(kx - \omega t + \phi)$$

$$k = 0.5\pi, \quad \omega = 4\pi$$

$$v = \frac{\omega}{k} = \frac{4\pi}{0.5\pi} = 8 \text{ m/s}$$

31. Option (c) is correct.

We have  $d = 2700 \text{ m}$ ,  $\rho = 10^3 \text{ kg/m}^3$ , compressibility =  $45.4 \times 10^{-11} / \text{pascal}$

Now the pressure at the bottom of ocean is

$$\begin{aligned} P &= \rho g d \\ &= 10^3 \times 10 \times 2700 \\ &= 27 \times 10^6 \text{ Pa} \end{aligned}$$

Hence, fractional compression

$$\begin{aligned} &= 45.4 \times 10^{-11} \times 27 \times 10^6 \\ &= 1.2 \times 10^{-2} \end{aligned}$$

32. Option (b) is correct.

As  $r_1$  is continuously increasing or torque on the particle is continuously increasing. The angular momentum is also continuously increasing.

33. Option (c) is correct.

Actual height of the air bubble from one end,

$$h_1 = \mu \times (h) = 3/2 \times 5 = 15/2 \text{ cm}$$

From other end of the slab,

$$h_2 = \mu \times h = 3/2 \times 3 = 9/2 \text{ cm}$$

Now total height of the slab,

$$(15/2 + 9/2) = 24/2 = 12 \text{ cm}$$

34. Option (b) is correct.

Diffusion of charge carriers.

35. Option (c) is correct.

We know,

$$T \propto \sqrt{\frac{I}{M}}$$

If M becomes 4 times T becomes half.

Therefore new T = 2 s.

## Section B

36. Option (b) is correct.

(b) The orbital velocity is independent of mass, in such a case both satellites  $S_1$  and  $S_2$  will move with the same speed.

$$\text{As } v = R \sqrt{\frac{g}{R+h}}$$

37. Option (d) is correct.

Threshold wavelength,  $\lambda_0 = 3250 \text{ \AA}$

$$\begin{aligned} \text{Energy corresponding to the threshold wavelength, } E_0 &= \frac{12375}{\lambda_0} = \frac{12375}{3250} \text{ eV} \\ E_0 &= 3.81 \text{ eV} \end{aligned}$$

Ultraviolet wavelength,  $\lambda = 2536 \text{ \AA}$

$$\text{So, imparted energy, } E = \frac{12375}{2576} \text{ eV} = 4.88 \text{ eV}$$

Now, max. kinetic energy,  $\frac{1}{2}mv^2 = E - E_0$

$$v = \sqrt{\frac{2 \times 1.07 \times 1.6 \times 10^{-19}}{9.1 \times 10^{-31}}}$$

$$v = 0.61 \times 10^6 \text{ m/s} = 6.0 \times 10^5 \text{ m/s}$$

38. Option (c) is correct.

$$\frac{T_2}{T_1} = \left(\frac{R_2}{R_1}\right)^{3/2} = \frac{27T}{T}$$

$$R_2 = (27)^{2/3}R$$

$$R_2 = 9R$$

39. Option (d) is correct.

Volume =  $\pi r^2 l$

So, for constant Volume  $l \propto \frac{1}{r^2}$

$$\text{So, } \frac{l_1}{l_2} = \left(\frac{r_2}{r_1}\right)^2$$

$$\text{or } l_2 = l_1 \left(\frac{r_1}{r_2}\right)^2$$

$$= 2.4/4$$

$$l_2 = 0.6 \text{ cm}$$

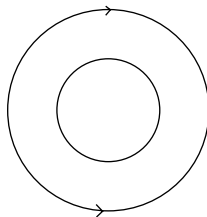
40. Option (b) is correct.

Magnetic field due to current carrying element is given by  $B = \mu_0 i / 2\pi r$ .  $r$  is the distance between the wire and the measuring point. Thus, the magnetic field  $B$  is independent of the diameter of the wire. Hence, the magnetic field will be the same.

41. Option (b) is correct.

Due to the clockwise current in the outer loop, the magnetic field direction is inwards to the plane of paper and increases with time.

So according to Lenz law the induced current in the inner loop will be anticlockwise so that it can produce outward magnetic field and the total flux remains constant.



42. Option (b) is correct.

$$|q| = \frac{\Delta\phi}{R}$$

$\Delta\phi$  = Change in flux

$$\Delta\phi = B_2A - B_1A$$

$$\Delta\phi = 2 \times \pi r^2 - 2 \times 0$$

$$\Delta\phi = 2 \times \pi \times (0.1)^2$$

$$\Delta\phi = 2 \times 3.14 \times 0.01$$

$$q = \frac{\Delta\phi}{R} = \frac{2 \times 3.14 \times 0.01}{0.01}$$

$$q = 6.28 \text{ C}$$

43. Option (d) is correct.

$$\text{Frequency} = \frac{1}{\text{time}}$$

RC = Time constant of the RC circuit

$$\text{So, } \frac{1}{RC} = \text{frequency}$$

$$\frac{L}{R} = \text{Time constant of LR circuit}$$

$$\text{So, } \frac{R}{L} = \text{frequency}$$

$$\frac{1}{\sqrt{LC}} = \text{frequency of LC circuit}$$

So,  $\frac{C}{L}$  does not have the dimension of frequency

44. Option (b) is correct.

$$E = 200\sqrt{2} \sin(100t)$$

Comparing with

$$E = E_0 \sin(\omega t)$$

$$E_0 = 200\sqrt{2}, \omega = 100$$

$$E_{rms} = \frac{E_0}{\sqrt{2}} = \frac{200\sqrt{2}}{\sqrt{2}} = 200$$

$$I_{rms} = \frac{E_{rms}}{X_c}$$

$$I_{rms} = \frac{E_{rms}}{\omega C}$$

$$I_{rms} = E_{rms} \omega C$$

$$I_{rms} = 200 \times 100 \times 1 \times 10^{-6}$$

$$I_{rms} = 2 \times 10^{-2} \text{ A}$$

$$I_{rms} = 20 \times 10^{-3} \text{ A}$$

$$I_{rms} = 20 \text{ mA}$$

45. Option (a) is correct.

$$\text{Fringe width } \beta = \frac{\lambda D}{d}$$

$$\beta \propto \lambda$$

$\lambda$  is greatest for red color and minimum for violet color. So fringe width is greatest for red color and smallest for violet color.

46. Option (a) is correct.

Condition for  $n^{\text{th}}$  dark band, path difference =  $(2n - 1) \frac{\lambda}{2}$

For third dark band,  $n = 3$

$$\text{Path difference} = (2 \times 3 - 1) \frac{\lambda}{2}$$

$$\Rightarrow \frac{5\lambda}{2}$$

$$\text{Path difference} = \frac{5}{2} \times 6000 \times 10^{-10} \text{ m}$$

$$= 15 \times 10^{-7} \text{ m}$$

$$= 1.5 \times 10^{-6} \text{ m} = 1.5 \mu\text{m}$$

47. Option (d) is correct.

Polarising angle  $i_p = \tan^{-1}(n)$

$$\tan i_p = n$$

$$\tan 60^\circ = n$$

$$\sqrt{3} = n$$

$$\text{Critical angle } C = \sin^{-1}\left(\frac{1}{n}\right)$$

$$C = \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$$

48. Option (d) is correct.

When the two plates are connected with wire the energy stored in the capacitor gets dissipated in the form of heat.

$$H = \frac{1}{2} CV^2$$

$$= \frac{1}{2} \times 2 \times 10^{-6} \times (100)^2$$

$$H = 10^{-2} \text{ J} = 0.01 \text{ J}$$

49. Option (b) is correct.

Change in velocity will be equal to the area under  $a - t$  graph.

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 11 \text{ s} \times 10 \text{ m/s}^2$$

$$\text{Area} = 55 \text{ m/s}$$

50. Option (d) is correct.

$$h = \frac{2t \cos \theta}{rsg}$$

$$hr = \frac{2t \cos \theta}{sg}$$

All things remains same

$$hr = \text{constant}$$

$$h_1 r_1 = h_2 r_2$$

$$20 \times r = h_2 \times \frac{r}{4}$$

$$h_2 = 80 \text{ mm}$$

## CHEMISTRY

## Section A

## 51. Option (a) is correct.

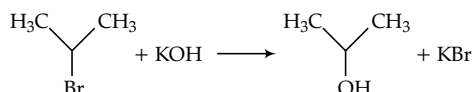
for s-electron,  $l = 0$

$$\text{Orbital angular momentum} = \sqrt{l(l+1)} \frac{h}{2\pi} = 0$$

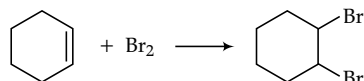
## 52. Option (d) is correct.



Saturated compound is converted into unsaturated compound by removal of group of atoms hence, it is an elimination reaction.



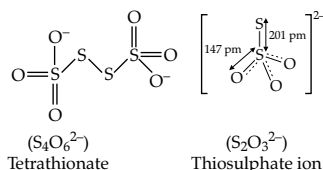
—Br group is replaced by —OH group hence, it is a substitution reaction.



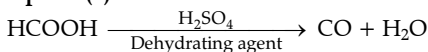
The addition of  $\text{Br}_2$  converts an unsaturated compound into a saturated compound hence, it is an addition reaction.

## 53. Option (b) is correct.

$\text{S}_4\text{O}_6^{2-}$  and  $\text{S}_2\text{O}_3^{2-}$  have S—S bond.



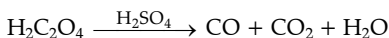
## 54. Option (c) is correct.



( $\text{H}_2\text{O}$  absorbed by  $\text{H}_2\text{SO}_4$ )

$$\text{Initial moles} = \frac{2.3}{46} = \frac{1}{20} \rightarrow 0 + 0$$

$$\text{Final moles} = 0 \rightarrow \frac{1}{20} + \frac{1}{20}$$



[ $\text{H}_2\text{O}$  absorbed by  $\text{H}_2\text{SO}_4$ ]

$$\text{Initial moles} = \frac{4.5}{90} = \frac{1}{20} \rightarrow 0 + 0 + 0$$

$$\text{Final moles} = 0 \rightarrow \frac{1}{20} + \frac{1}{20} + \frac{1}{20}$$

$\text{CO}_2$  is absorbed by  $\text{KOH}$ , so the remaining product is only  $\text{CO}$ .

Moles of  $\text{CO}$  formed from both reactions,

$$= \frac{1}{20} + \frac{1}{20} = \frac{1}{10}$$

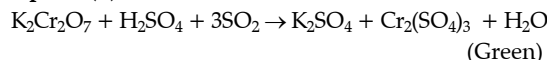
Remaining mass of  $\text{CO} = \text{Moles} \times \text{Molar mass}$

$$\text{So, } = \frac{1}{10} \times 28 = 2.8$$

## 55. Option (d) is correct.

Conformers are the isomers that are formed by rotation about single bonds without any cleavage of any bond. These conformers have same bond angle between them and have same bond length while their dihedral angle changes.

## 56. Option (b) is correct.



## 57. Option (b) is correct.

For a given orbital, the two electrons occupying this orbital has the same principle, azimuthal and magnetic quantum numbers. The only difference is in their  $m_s$  values *i.e.*, one electron has spin quantum number  $+\frac{1}{2}$  and other has the value of  $-\frac{1}{2}$  as their spin orientations are clockwise and anti-clockwise respectively.

## 58. Option (c) is correct.

$\text{Zn-Hg}$  with  $\text{HCl}$ . (Clemmensen reduction)

## 59. Option (a) is correct.

$\text{NO}_2^+$   $\rightarrow$   $sp$  hybridization *i.e.*,  $180^\circ$  bond angle.

$\text{NO}_3^-$   $\rightarrow$   $sp^2$  hybridization *i.e.*,  $120^\circ$  bond angle

$\text{NO}_2^-$   $\rightarrow$   $sp^2$  hybridization with two bond pairs and one lone pair thus, the bond angle is  $115^\circ$ .

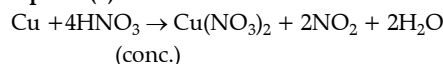
$\text{NO}_2$   $\rightarrow$   $sp^2$  hybridization with two bond pairs and one orbital contains one electron thus the bond angle increases to  $134^\circ$ .

Thus, the maximum bond angle at nitrogen is of  $\text{NO}_2^+$ .

## 60. Option (b) is correct.

Due to the poor shielding of  $d$ -orbital in  $\text{Ga}$ , the atomic radius of  $\text{Ga}$  is smaller than that of  $\text{Al}$ . Thus,  $\text{Ga} < \text{Al} < \text{Tl}$ .

## 61. Option (c) is correct.



## 62. Option (b) is correct.

For the reversible expansion of an ideal gas, change in entropy can be related to initial and final pressure and temperature as follows:

$$\Delta S = nC_v \ln \frac{T_f}{T_i} + nR \ln \frac{P_i}{P_f}$$

As, the reaction is isothermal, thus,  $T_i$  and  $T_f$  are same

$$\Delta S = nC_p \ln 1 + nR \ln \frac{P_i}{P_f} = 0 + nR \ln \frac{P_i}{P_f}$$

$$\Delta S = nR \ln \left( \frac{P_i}{P_f} \right)$$

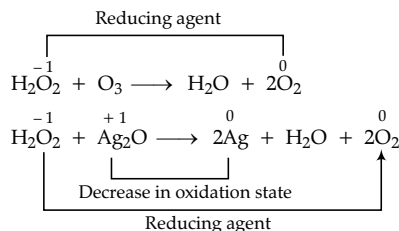
## 63. Option (a) is correct.

In IUPAC nomenclature, preference is given to multiple bond than halogen substituent so the correct name of  $\text{Br-CH}_2\text{-CH=CH}_2$  is 3-bromo-prop-1-ene.

## 64. Option (d) is correct.

Interhalogen compounds are generally more reactive than halogens (except fluorine).

65. Option (c) is correct.



∴ H<sub>2</sub>O<sub>2</sub> acts as a reducing agent in all those reactions in which O<sub>2</sub> is evolved.

66. Option (d) is correct.

According to Raoult's law, if volatile liquid is added to pure solvent then the total pressure is equal to the sum of the partial pressure of volatile liquid and the solvent.

By Raoult's law

Total vapour pressure of solution is given by:

$$p_T = p'_A + p'_B$$

here  $p'_A = p'_B$  are partial vapour pressures of A and B respectively.

$$p_T = p_A \chi_A + p_B \chi_B, \chi_B = 1 - \chi_A$$

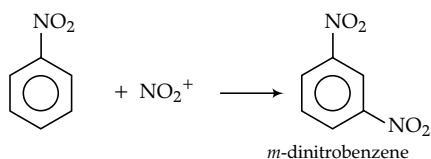
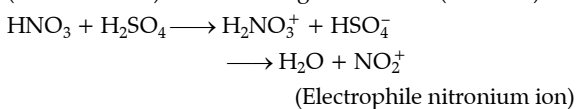
$$p_T = p_A \chi_A + p_B (1 - \chi_A)$$

$$p_T = p_A \chi_A + p_B - p_B \chi_A$$

$$p_T = p_B + \chi_A (p_A - p_B)$$

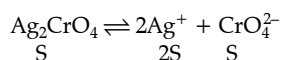
67. Option (b) is correct.

As NO<sub>2</sub> is an electron-withdrawing group, it reduces electron density at ortho and para position, thus meta-position becomes electron rich on which the electrophile (nitronium ion) attacks during the reaction (nitration).



68. Option (b) is correct.

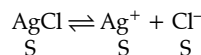
From the K<sub>sp</sub> values of the given salts calculate the solubility values. A salt having the highest solubility will precipitate at last.



$$K_{sp} = (2S)^2(S)$$

$$1.1 \times 10^{-12} = 4S^3$$

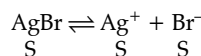
$$\Rightarrow S = 0.65 \times 10^{-4}$$



$$K_{sp} = S \times S$$

$$\Rightarrow 1.8 \times 10^{-10} = S^2$$

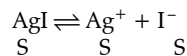
$$\Rightarrow S = 1.34 \times 10^{-5}$$



$$K_{sp} = S \times S$$

$$\Rightarrow 5 \times 10^{-13} = S^2$$

$$\Rightarrow S = 0.71 \times 10^{-6}$$



$$K_{sp} = S \times S$$

$$\Rightarrow 8.3 \times 10^{-17} = S^2$$

$$\Rightarrow S = 0.9 \times 10^{-8}$$

Hence, the solubility of Ag<sub>2</sub>CrO<sub>4</sub> is maximum thus, it will precipitate at last.

69. Option (d) is correct.

At very high temperature and at high pH reaction becomes explosive.

70. Option (a) is correct.

The energy of activation of reverse reaction is less than or more than energy of activation E<sub>a</sub> of forward reaction

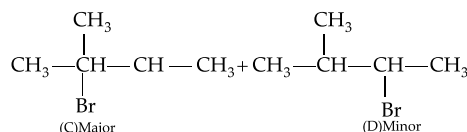
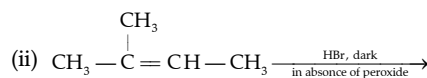
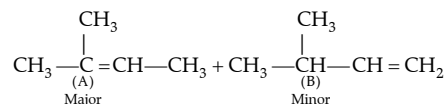
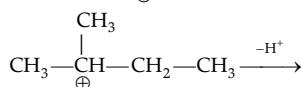
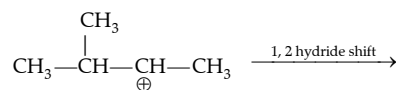
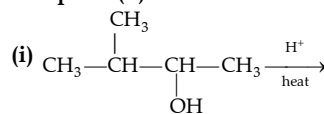
$$\Delta H = (E_a)_F - (E_a)_R$$

Because it depends upon the nature of reaction.

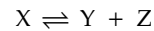
If (E<sub>a</sub>)<sub>F</sub> > (E<sub>a</sub>)<sub>R</sub>, reaction is endothermic

or (E<sub>a</sub>)<sub>F</sub> < (E<sub>a</sub>)<sub>R</sub>, reaction is exothermic

71. Option (b) is correct.



72. Option (c) is correct.



Initial: 1 0 0

Equilibrium: 1 - α α α

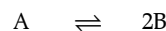
Total number of moles = 1 - α + α + α = 1 + α

$$[X] = \frac{1-\alpha}{1+\alpha}, [Y] = \frac{\alpha}{1+\alpha}, [Z] = \frac{\alpha}{1+\alpha}$$

[P<sub>1</sub> = Total pressure at equilibrium (i)]

$$K_{p1} = \frac{[Y]P_1 \times [Z]P_1}{[X]P_1}$$

$$K_{p1} = \frac{\left(\frac{\alpha}{1+\alpha}\right)^2 P_1^2}{\left(\frac{1-\alpha}{1+\alpha}\right) P_1} = \frac{\alpha^2 P_1}{1-\alpha^2}$$



Initial: 1 0

Equilibrium: 1 - α 2α

Total number of moles = 1 - α + 2α = 1 + α

$$[A] = \frac{1\alpha}{1+\alpha} \quad [B] = \frac{2\alpha}{1+\alpha}$$

$$Kp_2 = \frac{[B]^2 P_2^2}{[A] P_2} \quad [P_2 = \text{Total pressure at equilibrium (ii)}]$$

$$Kp_2 = \frac{\left(\frac{2\alpha}{1+\alpha}\right)^2 P_2^2}{\left(\frac{1-\alpha}{1+\alpha}\right) P_2} = \frac{4\alpha^2}{1-\alpha^2} P_2$$

$$\frac{Kp_1}{Kp_2} = \frac{\alpha^2 P_1}{1-\alpha^2} \times \frac{1-\alpha^2}{4\alpha^2 P_2} = \frac{P_1}{4P_2}$$

$$\frac{9}{1} = \frac{P_1}{4P_2}$$

$$\Rightarrow \frac{36}{1} = \frac{P_1}{P_2}$$

$$\Rightarrow P_1 : P_2 = 36 : 1$$

**73. Option (a) is correct.**

According to Gibbs free energy,

$$\Delta G = \Delta H - T\Delta S$$

For the spontaneous reaction,  $\Delta G$  must be negative. So,  $\Delta H < 0$  and  $\Delta S > 0$  for  $\Delta G$  to be magnitude.

**74. Option (a) is correct.**

Depression at freezing point

$$\Delta T_f = K_f \times m$$

$$m \text{ (molality)} = \frac{W_B \times 1000}{M_B \times W_A} = \frac{68.5 \times 1000}{342 \times 1000} = \frac{68.5}{342}$$

$$\Delta T_f = 1.86 \times \frac{68.5}{342} = 0.372^\circ\text{C}$$

$$T_f = T_f^\circ - \Delta T_f = 0 - 0.372 = -0.372^\circ\text{C}$$

**75. Option (c) is correct.**

From Arrhenius equation,

$$k = A e^{-E_a/RT}$$

The activation energy of the reaction in the presence of enzyme is different from  $E_a$  obtained in laboratory.

**76. Option (d) is correct.**

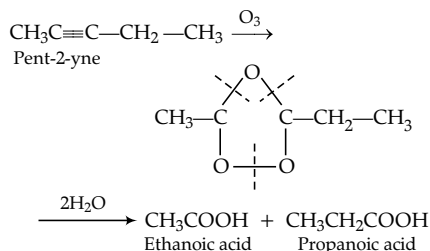
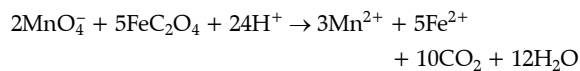
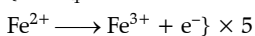
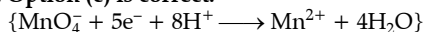
Because zinc has lower reduction potential.

**77. Option (c) is correct.**

DNA contains two types of nitrogenous bases Purine  $\rightarrow$  Adenine (A) and Guanine (G)

Pyrimidine  $\rightarrow$  Cytosine (C) and Thymine (T)

Adenine pairs with thymine and guanine pairs with cytosine.

**78. Option (c) is correct.****79. Option (c) is correct.**

3 moles of  $\text{MnO}_4^-$  required to oxidise 5 moles of ferrous oxalate.

$\therefore$  Number of moles of  $\text{MnO}_4^-$  required to oxidize 1 mole of oxalate =  $\frac{3}{5} = 0.6$  mol.

**80. Option (d) is correct.**

Kohlrausch's law states that the equivalent conductance of an electrolyte at infinite dilution is equal to the sum of the equivalent conductance of the component ions.

$$\lambda_\infty = \lambda_a + \lambda_c$$

where  $\lambda_a$  = equivalent conductance of the anion

$\lambda_c$  = equivalent conductance of the cation.

**81. Option (d) is correct.**

During osmosis, flow of water through semipermeable membrane is from solution having lower concentration only.

**82. Option (d) is correct.**

In isoelectronic species,

Ionic Radii  $\propto$  negative charge on the anion

$$\propto \frac{1}{\text{Positive charge on the cation}}$$

Thus, from  $\text{O}^{2-}$  to  $\text{Al}^{3+}$ , the negative charge decreases and the positive charge increases therefore, there is a significant decrease in ionic radii from  $\text{O}^{2-}$  to  $\text{Al}^{3+}$ .

**83. Option (c) is correct.**

Cannizzaro reaction do not involve C—C bond formation.

**84. Option (a) is correct.**

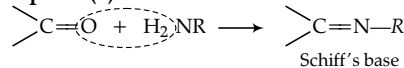
$$\text{pOH} = \text{p}K_b + \log \frac{[\text{salt}]}{[\text{base}]}$$

$$= -\log K_b + \log \frac{[\text{salt}]}{[\text{base}]}$$

$$= -\log 1.8 \times 10^{-5} + \log \frac{0.20}{0.30}$$

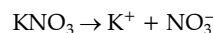
$$= 5 - 0.25 + (-0.176) = 4.57$$

$$\text{Now, pH} = 14 - \text{pOH} = 14 - 4.57 = 9.43$$

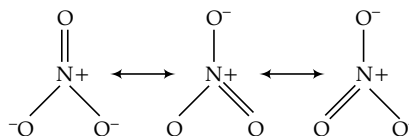
**85. Option (c) is correct.****Section B****86. Option (c) is correct.**

Metals are not found as nitrates in their ores because metal nitrates are highly soluble in water.

e.g.,  $\text{KNO}_3$  dissociates as



The nitrate anion has three equivalent oxygen surrounding a central nitrogen atom. This tends to spread the single negative charge and make it easier for water to separate the ions in solution.



87. **Option (b) is correct.**

Biodegradable polymer can be formed by  $\text{H}_2\text{N}-\text{CH}_2-\text{COOH}$  and  $\text{H}_2\text{N}-(\text{CH}_2)_5-\text{COOH}$ .

88. **Option (b) is correct.**

This will take place due to hydrogen bonding.

89. **Option (d) is correct.**

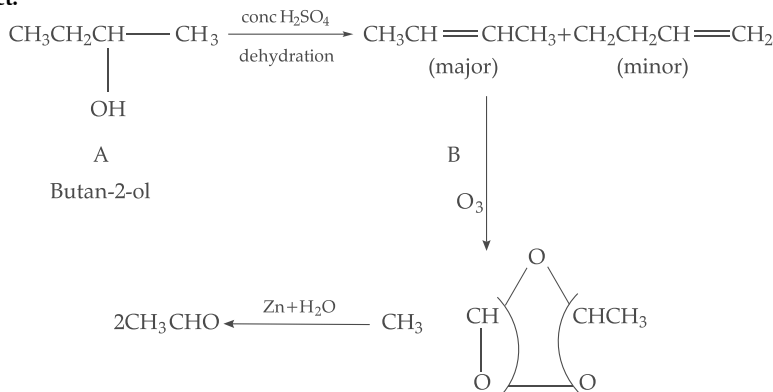
Conductance of an electrolytic solution increases with dilution. The molar conductance of both weak and strong electrolytic increases with decrease in concentration or increase in dilution.

90. **Option (d) is correct.**

$\text{HCOOH} + \text{Sulphuric Acid} = \text{CO}$

91. **Option (b) is correct.**

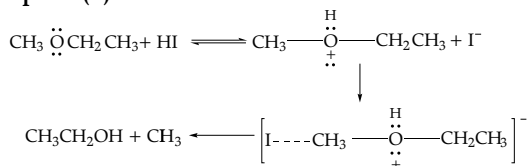
93. **Option (d) is correct.**



94. **Option (d) is correct.**

Coordination compounds having coordination number 6 of type  $\text{MA}_4\text{B}_2$ ,  $\text{MA}_3\text{B}_3$ ,  $\text{M}(\text{AB})_3$ ,  $\text{M}(\text{AA})_2\text{B}_2$  exhibit geometrical isomerism.

95. **Option (b) is correct.**



$\text{I}^-$  being a good nucleophile attacks the least substituted carbon of oxonium ion and displaces molecule by  $\text{S}_{\text{N}}2$  mechanism.

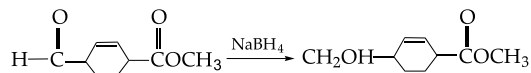
96. **Option (b) is correct.**

For the isobaric process;

$$\Delta S = \frac{\Delta H}{T}$$

97. **Option (c) is correct.**

Due to formation of intermolecular H-bonding in carboxylic acid, association occurs. Hence boiling points are more than the boiling point of aldehydes, ketones and alcohols of comparable molecular masses.



$\text{NaBH}_4$  is a selective reducing agent for aldehydes and ketones.  $\text{LiAlH}_4$  can reduce aldehyde as well as the ester group. DIBAL can reduce only the ester group whereas  $\text{H}_2/\text{Pt}$  can reduce aldehyde, ester, and a double bond.

92. **Option (b) is correct.**

Transition elements exhibit higher enthalpies of atomisation because of larger number of unpaired electrons in their atoms they have stronger interatomic interaction and hence stronger bonding between atoms.

98. **Option (a) is correct.**

The crystal field splitting  $\Delta_0$  depends upon the field produced by the ligand and the charge on the metal ion. Stronger is the ligand, larger will be the splitting.

99. **Option (d) is correct.**

$[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$  will not exhibit optical isomerism. It will exhibit meridional and facial isomerism.

100. **Option (c) is correct.**

(a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)

Work is a path function whereas enthalpy is a state function

- $\Rightarrow \Delta U = Q + w$  (1st law of thermodynamics)
- $\Delta U = Q$  (at constant volume,  $w = P\Delta v = 0$ )
- $\Rightarrow \Delta H = \Delta U + P\Delta v + v\Delta P$  (Also  $\Delta U = Q - P\Delta v$ )
- $\Delta H = Q + v\Delta P$
- $\Rightarrow$  At constant pressure,  $\Delta H = q$ .

## BOTANY

### Section A

101. **Option (c) is correct.**

*Saccharomyces i.e.*, yeast is an eukaryote. *Mycobacterium* is a bacterium. *Oscillatoria* and *Nostoc* are cyanobacteria.

102. **Option (c) is correct.**

**Zygotene Stage:** Pairing of homologous chromosomes synapsis occurs

**Pachytene stage:** Crossing over takes place

**Diakinesis** : Terminalisation of chiasmata and disappearance of nucleolus

Synapsis  $\rightarrow$  Crossing over  $\rightarrow$  Terminalisation of chiasmata  $\rightarrow$  Disappearance of the nucleolus

103. **Option (c) is correct.**

Inheritance of flower colour in *Snapdragon* is a classic example for incomplete dominance. In a cross between

true breeding red flower (RR) and true breeding white flower (rr) produced a pink flower (Rr). When the pink coloured flower of F<sub>1</sub> generation was selfed, F<sub>2</sub> generation produced plants with red flowers, pink flowers and white flowers in the ratio of 1 : 2 : 1. Here, both red and white flowers were not dominant over each other. Both tried to express their traits and hence an intermediate colour of both red and white resulting in pink colour flowers. Thus, genes for flower colour in snapdragon is an exception of Mendel's first principle i.e. Law of dominance. Law of segregation is universally applicable.

**104. Option (a) is correct.**

A virus particle consists of DNA or RNA within a protective protein coat called a capsid.

**105. Option (a) is correct.**

Pteridophytes are called vascular cryptogams; hence *Equisetum* is a vascular cryptogam.

**106. Option (b) is correct.**

The unequivocal proof that DNA is the genetic material came from the experiments of Alfred Hershey and Martha Chase (1952). They worked with viruses that infect bacteria called bacteriophages.

**107. Option (a) is correct.**

Medicinal plant	Family
<i>Aloe</i>	Liliaceae
<i>Belladonna</i>	Solanaceae
<i>Ashwagandha</i>	Solanaceae
<i>Mulathi</i>	Fabaceae

**108. Option (a) is correct.**

Cell division is promoted by both auxins and cytokinins acting synergetically. Cell growth is controlled by auxins, gibberellins and cytokinins.

**109. Option (b) is correct.**

Fimbriae help bacteria to adhere to the surface of the host cell. Cilia are shorter than flagella but it is the long flagella that help in motility. Pili helps in the transfer of genetic material.

**110. Option (c) is correct.**

Because the respiratory pathway is involved in both anabolism and catabolism, it would hence be better to consider the respiratory pathway as an amphibolic pathway rather than as a catabolic one.

**111. Option (d) is correct.**

Fact.

**112. Option (b) is correct.**

Fact.

**113. Option (b) is correct.**

Smaller the fragment size, the farther it moves from the cathode.

**114. Option (c) is correct.**

Persistent Nucellus is called Perisperm. Perisperm is a layer of nutritive tissue in the seed of certain flowering plants that is derived from the nucellus and surrounds the embryo.

**115. Option (a) is correct.**

The polyphasic approach is a grouping of organisms based on physiological, morphological, and biochemical features. It is the most, popular approach currently for classifying bacteria.

**116. Option (b) is correct.**

Chlorophyll pigments are present in the thylakoids.

**117. Option (a) is correct.**

Rhizoid, oosphere, and megaspore are haploid whereas leaf cell is diploid.

**118. Option (b) is correct.**

Conidia are exogenously producing asexual spores in sac fungi (Ascomycetes).

**119. Option (d) is correct.**

Vitamins are the essential components of many coenzymes.

**120. Option (d) is correct.**

Biological names are in Latin.

**121. Option (c) is correct.**

During the G<sub>2</sub> phase, proteins are synthesized in preparation for mitosis while cell growth continues

**122. Option (b) is correct.**

When only PS I is functional, the electron is circulated within the photosystem and the phosphorylation occurs due to cyclic flow of electrons. A possible location where this could be happening is in the stroma lamellae. While the membrane or lamellae of the grana have both PS I and PS II, the stroma lamellae membranes lack PS II as well as NADP reductase enzyme. The excited electron does not pass on to NADP<sup>+</sup> but is cycled back to the PS I complex through the electron transport chain. The cyclic flow hence results only in the synthesis of ATP, but not of NADPH + H<sup>+</sup>.

**123. Option (c) is correct.**

Ecological Niche is physical position and functional role of a species within the community.

**124. Option (b) is correct.**

Type I, II, and III recognize specific palindromic sequence but only type II cut the sequence at specific site.

**125. Option (d) is correct.**

Ribosomes are naked ribonucleoprotein protoplasmic particles (RNP, particles) which function as the sites of protein synthesis.

**126. Option (b) is correct.**

The tightly linked genes show 100% parental types and 0% recombinants, that is, they show complete linkage.

**127. Option (d) is correct.**

During meiosis only one cycle of DNA replication takes place during the S-phase of interphase.

**128. Option (a) is correct.**

Decrease.

**129. Option (c) is correct.**

Some strains of *Bacillus thuringiensis* produce proteins that kill certain insects such as *lepidopterans* (tobacco budworm, armyworm), *coleopterans* (beetles) and *dipterans* (flies, mosquitoes).

**130. Option (c) is correct.**

Microtubules are constituents of cilia, flagella, centrioles, and spindle fibers. They are also the part of fibers found in the cytoskeleton.

**131. Option (d) is correct.**

Hemoglobin is the best example of globular protein.

**132. Option (b) is correct.**

Fact.

**133. Option (c) is correct.**

In many Basidiomycetes, the central septal pore contains a barrel-shaped inflammation. This kind of septum is called the dolipore septum. These pores may get partially

plugged by membrane-bound bodies and crystalline structures called woronin bodies. Other statements can be corrected as-

Basidiomycetes are also known as club fungi. Their mycelium is branched and septate. Examples include *Agaricus*, *Puccinia*, etc. On the other hand, Phycomycetes are sac fungi and its examples are *Albugo* and *Rhizopus*.

**134. Option (a) is correct.**

Gregor Johann Mendel for the first time conducted experiments to understand the pattern of inheritance and variations in living things. He is also known as the 'Father of Genetics.' He conducted hybridization experiments on garden pea (*Pisum sativum*) for seven years, i.e., 1856 to 1863 and proposed the laws of inheritance in living organisms.

**135. Option (d) is correct.**

The synergids have a filiform apparatus which have an important role in guiding the pollen tube into the synergid.

## Section B

**136. Option (b) is correct.**

Intercellular movement is through the plasmodesmata.

**137. Option (a) is correct.**

There is more solar energy available in the tropics, which contributes to higher productivity; which in turn contribute indirectly to greater diversity.

**138. Option (d) is correct.**

Photosynthetically active radiation (PAR) is the proportion of the sun's radiation that reaches. Plants capture 2–10% of PAR.

**139. Option (d) is correct.**

Fact.

**140. Option (a) is correct.**

In CAM plant, the stomata in the leaves remain closed during the day to reduce transpiration, but open at night to collect CO<sub>2</sub>. This CO<sub>2</sub> is fixed into oxaloacetate by PEP carboxylase, which is then converted to malate and stored as in vacuoles at night. In the daytime, it is transported to chloroplasts where it is converted back to CO<sub>2</sub>, which is then used during photosynthesis.

**141. Option (b) is correct.**

Chargaff's law = A + G = T + C

Also, the number of adenine is equal to thymine while the number of guanine is equal to cytosine.

From Chargaff's law mentioned above: A and T has 40 nucleotides and G and C has 75 nucleotides. Thus, the total nucleotides = 75 + 40 = 115

Now these many nucleotides are on one strand. Therefore, on both the strands it will be 115 × 2 = 230 nucleotides.

**142. Option (d) is correct.**

In the second stage of hydrosere, rooted submerged plants are occupied. *Vallisneria* is a rooted submerged plant.

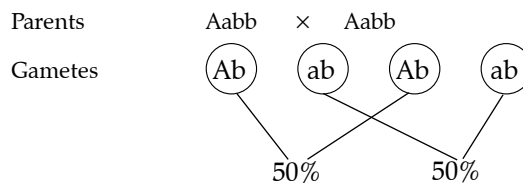
**143. Option (c) is correct.**

The bulbs are underground condensed shoots that have

one or more buds that give rise to new plants. Onion is vegetatively propagated by bulbs.

**144. Option (b) is correct.**

When two pea plants have the genotype Aabb is crossed. The probability of getting gametes, Ab and ab both is 50%.



**145. Option (d) is correct.**

Ribonucleoside is formed when a nitrogenous base (Uracil) is linked to a pentose sugar (Ribose) through N-glycosidic linkage. In RNA,

Ribose + Uracil → Uridine (Ribonucleoside)

On the other hand, Ribonucleotide is formed when a phosphate group is linked to 5'OH of a ribonucleoside through a phosphodiester linkage. In RNA,

Uridine (Ribonucleoside) + Phosphate  
→ Uridine 5' monophosphate or 5'-uridylic acid (Ribonucleotide)

**146. Option (d) is correct.**

Potatoes are stem tubers that are underground swollen tips of the underground branches. Since the growth of the branch is retarded food accumulates.

**147. Option (c) is correct.**

In the evolutionary history of plant forms, Psilophyton is the common ancestor for horsetails, ferns and gymnosperms (Conifers).

**148. Option (b) is correct.**

The correct amino acid sequence coded by the given sequence of amino acids is:

UAU CAC AUA AGA GCG UCU

Tyr - His - Ile - Arg - Ala - Ser

Here, Tyr is Tyrosine, His - Histidine, Ile - Isoleucine, Arg - Arginine, Ala - Alanine and Ser - Serine amino acids.

**149. Option (a) is correct.**

Out of all the given characteristics, only three are true for monocotyledonous plants. Monocots have a fibrous root system, in them stomata are dumb-bell shaped, cambium is absent. On the other hand, secondary growth is absent in their roots and stems with few exceptions and root of the monocots have pith in the center.

**150. Option (a) is correct.**

In the given diagrammatic representation of the nucleosome, A represents the core of histone octamer molecule (four histone proteins, i.e., H<sub>2</sub>A, H<sub>2</sub>B, H<sub>3</sub>, and H<sub>4</sub> occur in pairs and produce the core of histone octamer or nucleosome), B represents H<sub>1</sub> histone protein and C represents negatively charged DNA.

In nucleosomes, the negatively charged DNA wraps around the positively charged histone octamer, held at the position by H<sub>1</sub> histone and further condenses to form chromosomes.

## Section A

**151. Option (a) is correct.**

Areolar connective tissues are widely distributed and serve as a universal packing material between other tissues. The functions of areolar connective tissue include the support and binding of other tissues.

**152. Option (b) is correct.**

Pineal secretes a hormone called melatonin. Melatonin plays a very important role in the regulation of a 24-hour (diurnal) rhythm of our body. For example, it helps in maintaining the normal rhythms of sleep-wake cycle, body temperature. In addition, melatonin also influences metabolism, pigmentation, the menstrual cycle as well as our defense capability.

**153. Option (b) is correct.**

Cancerous cells do not show contact inhibition whereas normal cells show.

**154. Option (a) is correct.**

Various types of bonds or interactions such as covalent bonds, ionic bonds, hydrogen bonds, van der Waals and hydrophobic bonds are found during the coiling of polypeptides.

**155. Option (b) is correct.**

Basophils are involved in inflammatory reactions.

**156. Option (c) is correct.**

Malaria is a mosquito-borne infectious disease affecting humans and other animals caused by Plasmodium species. In the female *Anopheles* mosquito, gametocytes are taken up with the blood and mature in the mosquito gut. The male and female gametocytes fuse and form an ookinete—a fertilized, motile zygote. Ookinetes develop into new sporozoites that migrate to the insect's salivary glands, ready to infect a new vertebrate host.

**157. Option (a) is correct.**

The matrix of blood is fibreless.

**158. Option (d) is correct.**

*Toxoplasma* is a single-celled protozoan parasite.

**159. Option (a) is correct.**

*Fasciola* belonging to Phylum Platyhelminthes, have incomplete alimentary canal. There is a single opening both for ingestion and egestion.

**160. Option (b) is correct.**

The breathing center is situated in the medulla oblongata and brainstem consists of the midbrain, pons and medulla oblongata. Cerebral aqueduct/iter occurs as a narrow passage in the midbrain, to connect 3<sup>rd</sup> ventricle with 4<sup>th</sup> ventricle.

**161. Option (d) is correct.**

The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli. The alveoli open into mammary tubules. The tubules of each lobe join to form a mammary duct.

Several mammary ducts join to form a wider mammary ampulla which is connected to lactiferous duct through which milk is sucked out. Thus, from proximal to distal option (d) is the correct sequence.

**162. Option (b) is correct.**

Active reabsorption of sodium takes place in the proximal convoluted tubule. It is lined by simple cuboidal brush border epithelium which increases the surface area for reabsorption.

**163. Option (c) is correct.**

Dolly was the first cloned sheep while Polly was a transgenic sheep.

**164. Option (c) is correct.**

Such marriages are associated with an increased risk for congenital malformations an autosomal recessive disease with some resultant increased postnatal mortality in the offspring of first cousin couples, but demographic and socioeconomic confounders need to be well controlled.

**165. Option (d) is correct.**

The antennal gland or green gland perform excretory function in crustaceans e.g., Prawn.

**166. Option (d) is correct.**

In human beings, ammonia produced in the body gets converted into principal nitrogenous excretory compound urea (in the liver) through the urea cycle. This urea releases into the blood, which is filtered and excreted out as urine by the kidneys.

**167. Option (c) is correct.**

Sperms can remain alive for up to 72 hours and retain their ability to fertilize an ovum up to 48 hours after getting released into the female genital tract.

**168. Option (b) is correct.**

Certain bacteria, which grow anaerobically on cellulose material, produce large amount of methane along with CO<sub>2</sub> and H<sub>2</sub>S.

**169. Option (c) is correct.**

Fact.

**170. Option (a) is correct.**

During gastrulation, the blind sac get replaced by tube within tube.

**171. Option (b) is correct.**

The hormone releasing IUDs are Progestasert, LNG-20.

**172. Option (c) is correct.**

In ecology, the competitive exclusion principle, sometimes referred to as Gause's law of competitive exclusion or just Gause's law, is a proposition that states that two species competing for the same resource cannot coexist at constant population values, if other ecological factors remain constant. When two competing life forms attempt to occupy the same niche, only one outcome is possible: One life form will drive out the other.

**173. Option (d) is correct.**

Platypus is oviparous. It is the only mammal that is egg-laying.

**174. Option (d) is correct.**

The increased levels of GnRH act in the anterior the pituitary gland and stimulates secretion of two gonadotropins – luteinizing hormone (LH) and follicle-stimulating hormone (FSH).

**175. Option (c) is correct.**

A person who is likely to develop tetanus is immunized by administering pre-formed antibodies and these antibodies produce passive immunity which is very fast and provides a quick immune response.

**176. Option (c) is correct.**

Parathormone secretes parathyroid hormone and increases the blood calcium levels by increasing the reabsorption of calcium in bones. Excess parathyroid hormone can lead to negative effects on the body such as osteoporosis as bone reabsorption outpaces bone formation hence bones lose mass and become brittle.

**177. Option (a) is correct.**

Limbic system is involved in the regulation of sexual behaviour, expression of emotional reactions (*e.g.*, excitement, pleasure, rage and fear) and motivation, etc. The dorsal portion of the midbrain consists mainly of four round swellings or lobes collectively called the corpora quadrigemina.

**178. Option (d) is correct.**

12 pairs of ribs that form the lateral walls of the thoracic cage.

**179. Option (b) is correct.**

Heparins depend on the activity of antithrombin; *i.e.*, these limits the ability of the blood to clot. In all mammals, heparin is produced by basophils and mast cells.

**180. Option (c) is correct.**

CO combines irreversibly with hemoglobin to form carboxyhemoglobin and thus reduces O<sub>2</sub> transport.

**181. Option (d) is correct.**

Creatine is excreted by the fetus, pregnant and lactating women. It is produced in muscle cells from creatine phosphate. On the other hand, guanine and Xanthine are excreted by spiders and penguins in semi-solid form.

**182. Option (a) is correct.**

In the Sex determination mechanism, XX-XY Type and XX-XO Type represents male heterogamety. It means a male produces two different types of gametes. Whereas, ZZ-ZW Type and ZZ-ZO Type represents female heterogamety, in which a female produces two different types of gametes in terms of sex chromosomes.

**183. Option (d) is correct.**

All the mentioned issues can be used in DNA profiling technique. In an individual, DNA from every tissue, *i.e.*, hair follicle, skin, bone, saliva, sperms, blood etc., shows the same degree of polymorphism. Thus, they play a very crucial role as an identification tool in forensic applications. As polymorphism is inherited from parents to children. So, it is useful in paternity testing.

**184. Option (b) is correct.**

Adams stokes syndrome is characterized by loss of consciousness or fainting due to cardiac arrhythmia.

**185. Option (a) is correct.**

In human, 12 pairs of ribs are present in which 7 pairs of ribs from 1<sup>st</sup> to 7<sup>th</sup> pairs are true ribs. These are attached dorsally to vertebral column and ventrally to the sternum.

## Section B

**186. Option (c) is correct.**

The most commonly used matrix is agarose which is a natural polymer extracted from sea weeds. Thus, statement (1) is correct.

The DNA fragments separate (resolve) according to their size through sieving effect provided by the agarose gel. Thus, statement (2) is correct.

Since DNA fragments are negatively charged molecules, they are separated by forcing them to move towards the anode (positively-charged electrode) under an electric field through a medium/matrix. Thus, statement (3) is correct.

Statement (4) is incorrect.

**187. Option (d) is correct.**

The spotted cuscus is a marsupial mammal which shows analogy with a lemur.

**188. Option (b) is correct.**

As per the latitudinal gradient pattern of diversity species diversity decreases as we move away from the equator towards the poles. With very few exceptions, tropics (latitudinal range of 23.5° N to 23.5° S) harbour more species than temperate or polar areas. Thus, option (b) is the answer.

**189. Option (c) is correct.**

Disturbance in genetic equilibrium or Hardy Weinberg equilibrium *i.e.*, change of frequency of alleles in a population would be interpreted as resulting in the evolution.

**190. Option (d) is correct.**

Pulse is a series of pressure waves that travel through the arteries due to ventricular systole. It is the strongest in arteries closer to the heart and gradually becomes weak in arteries away from heart. It can be felt easily in the superficial arteries like radial artery in the wrist.

**191. Option (a) is correct.**

Adaptive immunity is an antigen-specific immune response unlike innate immunity which is antigen non-specific and can protect against any antigen.

**192. Option (b) is correct.**

Ciliary movement is the movement in the cells or organs with the help of cilia. Examples: In the respiratory tract, cilia help to push the mucus towards the pharynx. In oviducts, cilia help in the movement of the egg towards the uterus.

Flagellar movement is the type of movement which takes place with the help of flagella. Example: In human beings, sperms swim in female genital tract with the help of flagellar movement.

Pseudopodial (amoeboid) movement occurs with the help of finger-shaped protoplasmic extensions, *i.e.*, pseudopodia. Example: Macrophages and leucocytes in blood show pseudopodial movement when they leave blood to move into tissues.

**193. Option (a) is correct.**

Astrocytes – In CNS, these are the most numerous cells and perform several functions, including biochemical support of endothelial cells that form the blood-brain barrier, regulation of cerebral blood flow.

Oligodendrocytes – In CNS, these glial cells wrap themselves around neurons and responsible for forming the myelin sheath that surrounds axons.

Microglia – In CNS, these are the primary immune cells. These cells engulf microbes and remove cellular debris.

**194. Option (d) is correct.**

Pituitary gland is also known as the master gland. This gland has three major lobes, *i.e.*, anterior, intermediate and posterior. It is anatomically divided into two major portions, *i.e.* Adenohypophysis (anterior portion) which

further has two parts, pars distalis, pars intermedia and Neurohypophysis (posterior portion) which is also called pars nervosa.

**195. Option (d) is correct.**

The term single step large mutation was given by Hugo de Vries. He stated that mutation caused speciation and called it saltation (single-step large mutation). Other options can be corrected as – Ontogeny recapitulates phylogeny phrase was given by Ernst Haeckel.

Taxonomy without phylogeny is similar to bones without flesh as said by Takhtajan.

Survival of the fittest is a phrase given by Charles Darwin.

**196. Option (c) is correct.**

This genetic abnormality is Klinefelter's syndrome. It occurs due to the presence of an additional copy of the X-chromosome resulting in the karyotype of 47, XXY. Such individuals will have an overall masculine development along with feminine characters.

**197. Option (b) is correct.**

Hemoglobin binds with oxygen to form oxyhemoglobin in the lungs whereas, dissociation of oxyhemoglobin into Hb and O<sub>2</sub> takes place in tissues.

**198. Option (d) is correct.**

Vital Capacity (VC) is the maximum volume of air a person can breathe in after a forced expiration. This includes ERV, TV and IRV or the maximum volume of air a person can breathe out after a forced inspiration. Thus, statements (1), (3) and (5) are correct.

**199. Option (d) is correct.**

In *Drosophila*, sex is determined according to the genic balance theory in which X/A ratio, i.e., ratio of X-chromosomes and autosomes determine the sex. There is no role of Y-chromosome in it. According to this

theory, XX + 3A has  $\frac{2}{3}$  or  $0.67 \frac{X}{A}$  ratio and the sexual

morphology of the offspring will be intersex, sterile:

**200. Option (a) is correct.**

*Australopithecus* is known as the first ape-man. The incorrect match can be corrected as *Homo neanderthalensis* are also known as Neanderthal man. They have a cranial capacity of approximately 1300–1600 CC.

*Homo habilis* is the handyman or first toolmaker. Whereas, *Homo erectus* is known as the Java man because their fossils were found in Java in 1891.

□□□