NEET MOCK TEST PAPER 1

ANSWER KEY

ANSWER KEY

Physics

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

Chemistry

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

Botany

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

Zoology

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

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ANSWERS WITH EXPLANATION

PHYSICS

Section A

1. Option (b) is correct.

Least count of screw gauge = 0.001 cm
Main scale reading (MSR) = 5 mm = 0.5 cm
Zero error of screw gauge = – 0.004 cm
Circular scale reading (CSR) = 25 divisions
As the zero error is negative, its absolute value will be added to the total reading of the screw gauge.
Reading of the screw gauge
= MSR + (CSR × LC) – zero error
= 0.5 cm + 0.025 cm – (– 0.004 cm)
= 0.5 cm + 0.025 cm + 0.004 cm
= 0.529 cm

2. Option (b) is correct.

When the negatively charged pendulum oscillates over a positively charged plate then effective value of acceleration g increases, so the time period decreases:

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

3. Option (c) is correct.

Number density of atoms in Si
$= 5 \times 10^{28}$ atom/m^3
$= 5 \times 10^{22}$ atom/cm^3
Since 1 atom of indium is doped in 5×10^7 silicon atoms,
$\therefore$ Total number of doped indium atoms

$$= \frac{5\times10^{22}}{5\times10^{7}}$$

$= 1 \times 10^{15}$ atom/cm^3
$\because$ No. of accept for atoms in silicon $= 1 \times 10^5$ atoms/cm^3

4. Option (c) is correct.

Resultant acceleration acting on system (Man + lift) is
$a = 1$ m/s^2
Total weight m = 60 + 940 = 1000 kg
Resultant force = $ma = 1000 \times 1 = 1000$ N
Let T be tension in supporting cable acting upwards, so gravitational force = mg is acting downwards.
$ma = T - mg$ or $T = ma + mg$
$T = 1000 \times 1 + 1000 \times 10$
T = 11000 N

5. Option (b) is correct.

Since the average velocity of molecules increases with the increase of temperature that results in a faster collision. Hence, collision frequency will increase.

6. Option (c) is correct.

Condition for First minima
$d \sin\theta = \lambda$

Also, $$\sin\theta = \frac{\lambda}{d}$$

Now, $$\theta = \sin^{-1}\times\frac{5000\times10^{-10}\,\text{m}}{0.001\times10^{-3}\,\text{m}}$$

$= 30°$

7. Option (a) is correct.

Maximum Height

$$H_{max} = \frac{u^2}{2g}$$

Now, $$H_{max} \propto \frac{1}{g}$$

So, on planet B value of g is $\frac{1}{9}$ times to that of planet A.
Hence the value of H_{max} will become,
$2 \times 9 = 18$ m

8. Option (c) is correct.

Now $v = \omega\sqrt{A^2 - x^2}$
Then: $v_1^2 = \omega^2A^2 - \omega^2x_1^2$
$v_2^2 = \omega^2A^2 - \omega^2x_2^2$
On subtracting above equations, we get
$v_1^2 - v_2^2 = \omega^2x_2^2 - \omega^2x_1^2$
or, $v_1^2 - v_2^2 = \omega^2(x_2^2 - x_1^2)$

or, $$\omega^2 = \frac{v_1^2 - v_2^2}{(x_2^2 - x_1^2)}$$

or, $$\omega = \sqrt{\frac{v_1^2 - v_2^2}{x_2^2 - x_1^2}}$$

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

$$T = 2\pi\sqrt{\frac{x_2^2 - x_1^2}{v_1^2 - v_2^2}}$$

9. Option (b) is correct.

A polarizer is used to produce polarized light.

10. Option (b) is correct.

Wetting is the ability of a liquid to maintain contact with a solid surface, resulting from intermolecular interactions when the two are brought together.

11. Option (c) is correct.

Initially, the object has rotational and translational kinetic energy but zero gravitational potential energy. At a height of $3v^2/4g$, it has zero kinetic energy as kinetic energy gets converted to gravitational potential energy.
So, from the law of conservation of energy

$$\frac{1}{2}I\omega^2 + \frac{1}{2}mv^2 + 0 = mg(3v^2/4g)$$

Where all alphabets are in their usual meaning.
On simplifying

$$\frac{1}{2}I\omega^2 = \frac{1}{4}mv^2$$

As $\omega = v/R$, the equation will become

$$I\frac{v^2}{R^2} = \frac{1}{2}mv^2$$

Hence $I = \frac{mR^2}{2}$ which shows that the object is a disc.

12. Option (d) is correct.

Considering the quantities c, G and $\frac{e^2}{4\pi\varepsilon_0}$, we will write as:

$$[L] = [c]^a[G]^b\left[\frac{e^2}{4\pi\varepsilon_0}\right]^c \quad \text{...(i)}$$

Now writing the dimensional formula for c, G and $\frac{e^2}{4\pi\varepsilon_0}$,

$$[L] = [LT^{-1}]^a[M^{-1}L^3T^{-2}]^b[ML^3T^{-2}]^c$$

Now expanding and clubbing:

$$[L] = [M^{-b+c}\,L^{a+3b+3c}\,T^{-a-2b-2c}]$$

Now equating powers of M, L, T, we get

$$a + 2b + 2c = 0$$
$$-b + c = 0$$
$$a + 3b + 3c = 1$$

Solving to get values of a, b and c

$$b = \frac{1}{2} \text{ and } c = \frac{1}{2} \text{ and a} = -2$$

Putting values of a, b and c in eqn. **(i)**, we get:

$$[L] = [c]^{-2}[G]^{1/2}\left[\frac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$$

Hence, dimensions of length is $\frac{1}{c^2}\left[G\frac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$

13. Option (c) is correct.

$X = A\cos\omega t$

$$v = \frac{dX}{dt} = -A\omega\sin\omega t$$

$$a = \frac{dv}{dt} = -A\omega^2\cos\omega t$$

The displacement vector X is a cos wave.

The acceleration vector is 180° out of phase with displacement vector.

So, option **(c)** is the correct answer.

14. Option (b) is correct.

Let I be the intensity of the light coming out of the analyzer.

As per Malus' Law $I = I_0\cos^2\phi$. Where I_0 is the intensity of incident light to the analyzer and ϕ is the angle between the polarizer and analyzer. Here, it is given $\phi = 45°$.

Therefore, we get $I = I_0\cos^2 45° = \frac{I_0}{2}$.

15. Option (d) is correct.

$(n-1)$ and $(n+1)$ superimpose to form frequency n.

n and n will be at resonance.

$n-1$ and n produce 1 beat.

$n+1$ and n produce 1 beat.

Therefore, the number of beats formed is '2'.

16. Option (c) is correct.

Isothermal elasticity of gas is given as $K_i = P$, it is equal to the pressure.

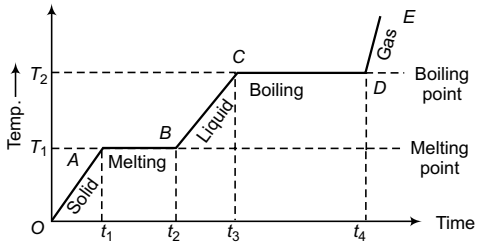
17. Option (b) is correct.

Since pressure,

$$= \frac{F}{A} = \frac{[MLT^{-2}]}{L^2}$$
$$= [ML^{-1}T^{-2}]$$

18. Option (a) is correct.

The graph below shows various changes of state with temperature and time. Point B is our starting point (T = 50 K for oxygen).



The initial increase in temperature changes the state from liquid to boiling and gas as shown in option a.

19. Option (c) is correct.

Velocity of light in glass = 2×10^8 m/s

refractive index **(μ)** = 1.5

Now, $\mu \propto \frac{1}{v}$

$$\frac{\mu_l}{\mu_g} = \frac{v_g}{v_l}$$

So, $\frac{\mu_l}{1.5} = \frac{2\times10^8}{2.5\times10^8}$

$$\mu_l = 1.20$$

20. Option (a) is correct.

In reverse bias, the current through a p-n junction is almost zero.

21. Option (b) is correct.

It is observed that electric potential due to dipole at a point on the dipole axis is given as:

$$V = \frac{k\times p\cos\theta}{r^2}$$

So, $V \propto \frac{1}{r^2}$

22. Option (b) is correct.

For loop of radius r, the magnetic field at the center of the loop is given by:

$$B = \mu_0 nI/2r$$

For $n = 1$, $B = \mu_0 I/2r$;

When the same loop ($n = 1$, radius $= r$) is bent into a loop of n turns, the new radius r' will be:

$$n \times 2\pi r' = 2\pi r$$

or, $r' = \frac{r}{n}$

Now, $B' = \frac{\mu_0 nI}{2r'} = n^2 \times \frac{\mu_0 I}{2r} = n^2 B$

23. Option (b) is correct.

Since, resistance, $R = \frac{\Delta V}{\Delta i}$,

the portion CD with a negative slope corresponds to the negative resistance.

24. Option (c) is correct.

Work done = Change in Surface Energy

$$\Rightarrow W = 2T\times4\pi\left(R_2^2 - R_1^2\right)$$

$$\Rightarrow W = 2\times0.03\times4\pi[(5)^2 - (3)^2]\times10^{-4}\,J$$
$$= 0.4\pi\text{ mJ}$$

25. Option (d) is correct.
Apply Newton's second law.
Change in momentum is equal to Impulse.

$$I = m(v_2 - v_1)$$

26. Option (d) is correct.
Stopping potential, $V = E - K_{max}$, where E is the energy of the incident photon and K_{max} is the maximum kinetic energy of the emitted photoelectron.

$$K_{max} = \phi = \frac{hc}{\lambda_0}$$

$$V = E - \phi$$

$$V + \phi = E$$

Case 1: $3eV_0 + \phi = hc/\lambda$ ...**(i)**

Case 2: $eV_0 + \phi = hc/2\lambda$ ...(ii)

Solving equations **(i)** and (ii), we get

$$\phi = \frac{hc}{4\lambda}$$

$$\phi = \frac{hc}{\lambda_0} = \frac{hc}{4\lambda}$$

Hence, $\lambda_0 = 4\lambda$

27. Option (c) is correct.
In the first medium and the second medium the frequency will remain the same.

$$\frac{v'}{\lambda'} = \frac{v}{\lambda}$$

$$\frac{2v}{\lambda'} = \frac{v}{\lambda} \Rightarrow \lambda' = 2\lambda$$

28. Option (b) is correct.
On stretching arms, the distance from the axis of rotation K increases.
So $I = MK^2$ increases.
As $I\omega$ = constant, therefore, angular velocity ω decreases.

29. Option (c) is correct.
If there are n equal resistors of value R connected in series, then $R_t = R + R + R + ... n = nR$
If n resistors are connected in series with emf of battery E and internal resistance R, then current

$$I = \frac{E}{R + nR}$$

If there are n equal resistors of value R connected in parallel, then $1/R_t = 1/R + 1/R + 1/R .... n = n/R$
If n resistors are connected in parallel with emf of battery E and internal resistance R, then current I increase 10 times

$$10\,I = \frac{E}{R + \frac{R}{n}}$$

$$10I = \frac{nE}{nR + R} = n\left(\frac{E}{nR + R}\right) = nI$$

or $n = 10$

30. Option (c) is correct.
An isovolumetric process takes place at constant volume. In such a process the work done is equal to zero because there is no change in volume. Thus, the first law of thermodynamics gives $\Delta U = Q$. This indicating that the net energy Q added to the water goes into increasing the internal energy of the water. The net energy added to the water is

$$Q = 10.0 - 2.0 = 8.0 \text{ kJ}$$

Since $Q = mc\,\Delta T$, the temperature increase of the water is

$$\Delta T = \frac{Q}{mc} = \frac{8.0 \times 10^3}{(2.0)(4.186 \times 10^3)} = 0.96°C$$

31. Option (b) is correct.

$$\left(\frac{dp}{dt}\right)_{\text{adiabatic}} = -\gamma\frac{p}{V}$$

and $$\left(\frac{dp}{dt}\right)_{\text{isothermal}} = -\frac{p}{V}$$

$\Rightarrow$ Slope of adiabatic is more than isothermal.
As y is always greater than 1.

32. Option (b) is correct.
In the present case, the tangential component of frictional force is responsible for changing the speed of the car while the component along the radial direction is providing the necessary centripetal force, hence net friction force is neither towards radial nor along tangential direction.

33. Option (c) is correct.
Interference, Refraction, and Reflection are shown by both light and sound waves while polarization is shown by light waves only.

34. Option (d) is correct.
As a result of heating, temperature increases which generates a large number of electron-hole pairs which lead to an increase in conductivity. As current increases $I = I_0 (e^{-qv/KT})$, overall resistance of diode changes which affects forward and reversed biasing.

35. Option (a) is correct.
Effective acceleration increases in the presence of electric field.
The time of oscillation T is

$$T = 2\pi\sqrt{\frac{l}{g'}}$$

$$g' = \frac{mg + qE}{m}$$

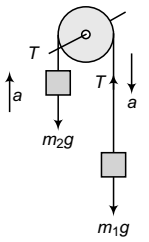
$$= g + \frac{qE}{m}$$

$$T \propto \sqrt{\frac{1}{g'}}$$

$\Rightarrow$ T is less when an electric field is present
$\Rightarrow$ When E is switched off, the period will increase.

Section B

36. Option (b) is correct.
Here, $m_1 > m_2$



Let 'a' be resultant acceleration of masses
For mass m_1; $m_1a = m_1g - T$
For mass m_2; $m_2a = T - m_2g$
Now by adding above two equations we get

$$a = \frac{(m_1 - m_2)g}{m_1 + m_2}$$

Now, $a = \frac{g}{8}$ given before

$$\frac{g}{8} = \frac{(m_1 - m_2)g}{m_1 + m_2}$$

$$\frac{1}{8} = \frac{(m_1 - m_2)}{m_1 + m_2}$$

$$m_1 + m_2 = 8m_1 - 8m_2$$
$$9m_2 = 7m_1$$
$$\frac{m_1}{m_2} = \frac{9}{7}$$

37. Option (a) is correct.

From Kirchoff's current law,

$$i_3 = i_1 + i_2$$
$$= 3 \sin \omega t + 4 \cos \omega t$$

Now divide by

$$= \sqrt{3^2 + 4^2} = 5$$

$$i_3 = \frac{3}{5} \sin \omega t + \frac{3}{5} \cos \omega t$$

Here, $\frac{3}{5} = \cos 53°$ and $\frac{4}{5} = \sin 53°$

$i_3 = 5 (\sin \omega t \cos 53° + \cos \omega t \sin 53°)$

$\therefore \quad i_3 = 5 \sin (\omega t + 53°)$

38. Option (b) is correct.

Angle of banking = $\tan \theta$

$$\tan \theta = \frac{v^2}{rg} = \frac{v^2}{160 \times 10}$$
$$v^2 = 1600 \tan 45°$$
$$v = \sqrt{1600 \times \tan 45°}$$
$$v = 40 \times 1 = 40 \text{ m/s}$$

39. Option (a) is correct.

Total energy = Kinetic energy linear + Kinetic energy rolling

$$E = \tfrac{1}{2}(mv^2) + \tfrac{1}{2} I \omega^2 \quad \text{....(i)}$$

Here, $\omega = v/r$

For solid sphere, moment of inertia $I = (2/5) mr^2$

On substituting values of ω and I, in equation **(i)**,

$$E = \tfrac{1}{2} mv^2 + (1/5) mv^2$$
$$E = (7/10)mv^2$$

Now Potential energy = Total kinetic energy

$$mgh = (7/10)mv^2$$

Velocity equation

$$v = \sqrt{\frac{10gh}{7}}$$

40. Option (b) is correct.

Energy stored

$U = Q^2/2C$

$= (40 \times 10^{-6})^2/(2 \times 10^{-6} \times 10)$

$= 16 \times 10^{-10}/(2 \times 10^{-5}) = 8 \times 10^{-5}$ J

Now converting to erg,

$= 8 \times 10^{-5} \times 10^7 = 800$ erg

41. Option (b) is correct.

Using $v^2 = u^2 + 2aS$

Case 1: $v = 0, u = 72 \times \frac{5}{18} = 20$ m/s

$$S = 40 \text{ m}$$
$$0^2 = (20)^2 + 2a(40)$$
$$-400 = 80a \quad \text{...(i)}$$

Case 2: $v = 0, u = 144 \times \frac{5}{18} = 40$ m/s

$$S = ?$$
$$0^2 = (40)^2 + 2aS$$
$$-1600 = 2aS \quad \text{...(ii)}$$

Eq. (i) ÷ Eq. (ii)

$$\frac{-400}{-1600} = \frac{80a}{2aS} \Rightarrow \frac{1}{4} = \frac{40}{S}$$

$$S = 160 \text{ m.}$$

As car is same, so value of 'a' is same.

42. Option (d) is correct.

$$H = \frac{u^2 \sin^2 \theta}{2g}$$

Case 1: Let $H = H_1, u = u_1, \theta = \theta_1$

$$H_1 = \frac{u_1^2 \sin^2 \theta_1}{2g}$$

Similarly, **case 2:** $H_2 = \frac{u_2^2 \sin^2 \theta_2}{2g}$

$H_1 = H_2$

$$\frac{u_1^2 \sin^2 \theta_1}{2g} = \frac{u_2^2 \sin^2 \theta_2}{2g}$$

$$\frac{u_1^2}{u_2^2} = \frac{\sin^2 \theta_2}{\sin^2 \theta_1}$$

$$\frac{u_1^2}{u_2^2} = \frac{\sin^2 60}{\sin^2 45}$$

$$\frac{u_1^2}{u_2^2} = \frac{3/4}{1/2}$$

$$\frac{u_1}{u_2} = \sqrt{\frac{3}{2}}$$

43. Option (b) is correct.

Potential enegy is defined only in case of conservative forces.

44. Option (a) is correct.

$$\oint \vec{B}.\vec{dl} = \mu_0 I$$

$$\oint \vec{B}.\vec{dl} = 4\pi \times 10^{-7} \times 4 \times 10^{-3}$$
$$= 1.6\pi \times 10^{-9} \text{ Wbm}^{-2}$$

45. Option (a) is correct.

$$\phi = 10t^2 - 8t + 6$$

$$|e| = \frac{d\phi}{dt} = \frac{d}{dt}(10t^2 - 8t + 6)$$

$$|e| = 20t - 8$$

At $t = 2$

$$e = 20 \times 2 - 8$$
$$e = 32$$

$$I = \frac{e}{R} \Rightarrow I = \frac{32}{10}$$

$$I = 3.2 \text{ A}$$

46. Option (c) is correct.

$$V_{supply} = \sqrt{V_R^2 + (V_L - V_c)^2}$$

$V_R = 120, V_L = 50, V_c = 0$ (as capacitor is not there in circuit)

$$V_{supply} = \sqrt{(120)^2 + (50)^2} = 130 \text{ V}$$

47. Option (d) is correct.
Current is ahead of $50\pi t$ by $\pi/6$ and voltage lags behind $50\pi t$ by $\pi/6$. Phase difference between them is $\left[\left(50\pi t+\frac{\pi}{6}\right)-\left(50\pi t-\frac{\pi}{6}\right)\right]$

Phase difference $= \left[\cancel{50\pi t}+\frac{\pi}{6}-\cancel{50\pi t}+\frac{\pi}{6}\right]$

$$= \frac{\pi}{6}+\frac{\pi}{6}=\frac{\pi}{3}=60^\circ$$

48. Option (c) is correct.
From Bohr's postulate

$$mvr = \frac{nh}{2\pi}$$

$$v = \frac{nh}{2\pi mr}$$

For 1st orbit $n = 1$

$$v = \frac{h}{2\pi mr}$$

Centripetal acceleration, $a = \frac{v^2}{r}$

$$a = \frac{\left(\frac{h}{2\pi mr}\right)^2}{r}$$

$$a = \frac{h^2}{4\pi^2 m^2 r^3}$$

49. Option (d) is correct.
By using

$$f_n = \frac{4\pi k^2 z^2 e^4 m}{n^3 h^3}$$

$$\therefore f_1 = \frac{4\times 3.14\times 81\times 10^{18}(1.6\times 10^{-19})^4\times 9.1\times 10^{-31}}{(6.62\times 10^{-34})^3}$$

(As $z = 1$ and $n = 1$)

$$= 6.57 \times 10^{15} \text{ rev/s}$$

50. Option (d) is correct.
EM waves travels with a speed of light ($c = 3 \times 10^8$ m/s)
Velocity = frequency × wavelength
$c = f\lambda$

$$\lambda = \frac{c}{f} = \frac{3\times 10^8}{2\times 10^{10}} = 1.5\times 10^{-2} \text{ m}$$

CHEMISTRY

Section A

51. Option (d) is correct.
As w/w ratio of H_2 and O_2 is 1 : 4. Let us assume that height of H_2 is 1 g and O_2 is 4 g.

Now, the number of moles of $H_2 = \frac{1\text{ g}}{2\text{ g mol}^{-1}}$

$$= \frac{1}{2}\text{mol}$$

Number of moles of $O_2 = \frac{4\text{ g}}{32\text{ g mol}^{-1}}$

$$= \frac{1}{8}\text{mol}$$

Thus, the molar ratio of H_2 and O_2 is $\frac{1}{2}:\frac{1}{8} = 4:1$

52. Option (d) is correct.
For Lyman series, $n_1 = 1$ and $n_2 = 2, 3, ...$ Since electron jumps to first excited state ($n = 2$) hence no line will be observed in Lyman series.
For Paschen series, $n_1 = 3$ and $n_2 = 4, 5, ...$ Hence number of lines obtained will be 3.
Total number of lines obtained will be 10.

53. Option (c) is correct.
Angular momentum can be calculated by the following expression :

$$\sqrt{l(l+1)}\,h$$

For d-orbital, the value of $l = 2$

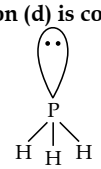
Thus, angular momentum $= \sqrt{2(2+1)}\,\hbar = \sqrt{6}\hbar$

54. Option (c) is correct.
–I effect increases on increasing electronegativity of an atom. So, the correct order of –I affect is:

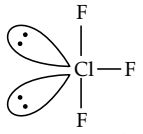
$$-NH_2 < -OR < -F.$$

The most appropriate answer is an option **(c)**, however option **(b)** may also be the correct answer.

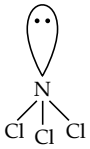
55. Option (d) is correct.



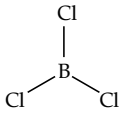
(1 lone pair + 3 bond pairs)
(pyramidal)
(Bond angle = 93.5°)



(2 lone pairs + 3 bond pairs)
(T-shaped)
(Bond angle = 90°)



(1 lone pair + 3 bond pairs)
(pyramidal)
(Bond angle = 107.8°)



(3 bond pairs only)
(Trigonal planar)
(Bond angle = 120°)

56. Option (a) is correct.
Ar, K^+, and Ca^{2+} are isoelectronic species with each having 18 electrons. In isoelectronic species, radius decreases with an increase in nuclear charge. Thus, the order of radii is $Ca^{2+} < K^+ < Ar$.

57. Option (a) is correct.

$$\underset{S}{BaSO_4}(s) \rightarrow \underset{S}{Ba^{2+}}(aq) + \underset{S}{SO_4^{2-}}(aq)$$

$$K_{sp} = \left[Ba^{2+}\right]\left[SO_4^{2-}\right] = S^2$$

Solubility of $BaSO_4 = 2.42\times 10^{-3}$ gL^{-1}

$$\therefore \quad S = \frac{2.42\times 10^{-3}}{233} = 1.038\times 10^{-5} \text{ mol L}^{-1}$$

$$K_{sp} = S^2 = (1.038\times 10^{-5})^2$$

$$= 1.08\times 10^{-10} \text{ mol}^2 \text{ L}^{-2}$$

58. Option (c) is correct.
Initial temperature, $T_1 = 20 + 273 = 293$ K
Final temperature, $T_2 = 35 + 273 = 308$ K
$R = 8.314$ JK^{-1} mol^{-1}

As the rate becomes double on raising the temperature

$\therefore r_2 = 2r_1$ or $\frac{r_2}{r_1} = 2$

As rate constant, $k \propto r$

$\therefore \quad \frac{k_2}{k_1} = 2$

According to the Arrhenius equation, we know that

$$\log \frac{k_2}{k_1} = -\frac{E_a}{2.303\,R}\left[\frac{T_1 - T_2}{T_1 T_2}\right],$$

$$\log 2 = \frac{-E_a}{2.303 \times 8.314}\left[\frac{293-308}{293\times 308}\right],$$

$\Rightarrow \quad E_a = 34.7 \text{ kJ mol}^{-1}$

59. Option (a, d) is correct.

Electron gain enthalpy decreases from top to bottom in a group but due to the small size of fluorine, it has lower electron gain enthalpy than chlorine. Hence, the correct order is I < Br < F < Cl.

Also, ionization enthalpy increases on moving towards right along a period but due to the extra stability of nitrogen due to the half-filled outer orbital, there is higher exchange energy hence, it achieves higher stability due to which it has higher ionization energy than oxygen. Therefore, the correct order is B < C < O < N.

60. Option (a) is correct.

The strong electrolyte which furnishes ions completely in its aqueous solution will be the best conductor of electricity in an aqueous solution. Fructose is non-electrolyte while ammonia and acetic acids are weak electrolytes and HCl is the strong electrolyte which completely furnishes H^+ and Cl^- ions in an aqueous solution thus, HCl is the best conductor of electricity in aqueous solution.

61. Option (c) is correct.

For the first-order reaction

$A \rightarrow$ Product

Rate $\propto$ [A]

$$k = \frac{2.303}{t_2 - t_1}\log\frac{[A_1]}{[A_2]}$$

$$= \frac{2.303}{t_2 - t_1}\log\frac{(\text{rate})_1}{(\text{rate})_2}$$

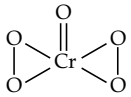
$$k = \frac{2.303}{(20-10)}\log\left(\frac{0.04}{0.03}\right) = 0.0287 \text{ sec}^{-1}$$

$$t_{1/2} = \frac{0.693}{k} = \frac{0.693}{0.0287 \text{ sec}^{-1}}$$

$= 24.14$ sec

62. Option (c) is correct.

CrO_5 has a butterfly-like structure having two peroxo bonds.



Peroxo oxygen has a –1 oxidation state.

Let the oxidation state of Cr be 'x'.

$CrO_5 : x + 4(-1) + 1(-2) = 0$

$\Rightarrow \quad x = +6$

63. Option (d) is correct.

Since, H_2O_2 acts as an oxidizing agent, hence when it reacts with hydrogen sulfide (H_2S), it oxidizes H_2S to sulfur **(S)**, and water is formed as a by-product. This is a redox reaction.

$$H_2O_2 + \overset{-2}{H_2S} \longrightarrow \overset{0}{S} + 2H_2O$$

increase in O.N.

$\Rightarrow$ Oxidation

64. Option (a) is correct.

$H_2O(l) \rightarrow H_2O(g)$ x kJ mol^{-1} ...(1)

$H_2(g) + \frac{1}{2}O_2(g) + H_2O(g)$ y kJ mol^{-1} ...(2)

Subtracting (1) from (2)

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ (y–x) kJ mol^{-1}

65. Option (b) is correct.

$[H^+]_{final} =$

$$\frac{V\times 10^{-1} + V\times 10^{-2} + V\times 10^{-3} + V\times 10^{-4}}{4V}$$

$[H^+]_{final} = 2.78 \times 10^{-2}$ M

66. Option (a) is correct.

At the anode, oxidation occurs.

At anode: $Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$; $E° = -0.76$ V

At cathode: $Ag_2O(s) + H_2O(l) + 2e^- \rightarrow 2Ag(s) + 2OH^-$; $E° = 0.34$ V

$E°_{cell} = E°_{cathode} - E°_{anode}$

$= 0.34 - (-0.76)$

$= 1.10$ V

67. Option (d) is correct.

Bond length values are:

C–H : 0.109 nm

C=C : 0.134 nm

C–O : 0.143 nm

C–C : 0.154 nm

Thus, the bond length order will be:

C–H < C = C < C–O < C–C

68. Option (d) is correct.

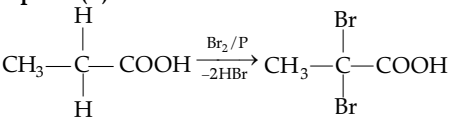
The order of bond dissociation enthalpy is :

$Cl_2 > Br_2 > F_2 > I_2$

69. Option (c) is correct.

$_{64}Gd = [Xe]\,4f^7\,5d^1\,6s^2$

70. Option (d) is correct.



This reaction is called as Hell-Volhard Zelinsky (HVZ) reaction.

71. Option (a) is correct.

As the temperature is constant in both the cases the only variables are pressure and volume. Thus, according to Boyle's law

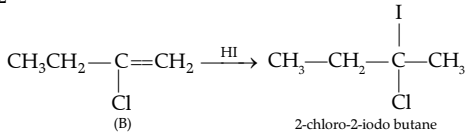
$$P_1V_1 = P_2V_2$$

$$730 \text{ mm} \times 380 \text{ mL} = 760 \text{ mm} \times V_2$$

$$V_2 = 365 \text{ mL}$$

72. Option (d) is correct.

$CH_3—CH_2—C\equiv CH + HCl \rightarrow$



(B) 2-chloro-2-iodo butane

73. Option (c) is correct.

The iodoform test is exhibited by ethyl alcohol, acetaldehyde, acetone, methyl ketones, those alcohols which possess $(CH_3\underset{\underset{OH}{|}}{CH}—)$ group, acetophenone, α-hydroxypropionic acid, keto acid, 2-aminoalkanes, etc.

74. Option (b) is correct.

(a) XeF4 is colourless crystalline solid and undergoes sublimation

(b) XeOF4 is colourless volatile liquid
(c) XeO3 is colourless explosive solid
Are correct statement

75. Option (d) is correct.
Total vapor pressure of the mixture
= Vapor pressure of pentane in the mixture
+ Vapor pressure of hexane in the mixture
As the ratio of pentane to hexane = 1 : 4
∴ Mole fraction of pentane = 1/5
Mole fraction of hexane = 4/5
Total vapor pressure

$$= \begin{pmatrix}\text{Mole fraction of}\\ \text{pentane}\end{pmatrix} \times \begin{pmatrix}\text{Vapor pressure}\\ \text{of pentane}\end{pmatrix} + \begin{pmatrix}\text{Mole fraction of}\\ \text{hexane}\end{pmatrix} \times \begin{pmatrix}\text{Vapor pressure}\\ \text{of hexane}\end{pmatrix}$$

$$= \left(\frac{1}{5}\times 440 + \frac{4}{5}\times 120\right)$$

= 184 mm of Hg
∴ Vapor pressure of pentane in mixture

$$= \begin{pmatrix}\text{Vapor pressure}\\ \text{of mixture}\end{pmatrix} \times \begin{pmatrix}\text{Mole fraction of}\\ \text{pentane in vapour phase}\end{pmatrix}$$

88 = 184 × mole fraction of pentane in vapour phase
∴ Mole fraction of pentane in the vapor phase

$$= \frac{88}{184} = 0.478$$

76. Option (a) is correct.
One mole of Al^{3+} discharged completely by using charge = 3F.

77. Option (d) is correct.

NO_2^- ⇒ 2 bond pairs + 1 lone pair
⇒ sp^2 hybridization

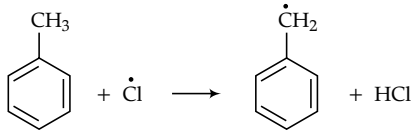
NH_2^- ⇒ 2 bond pairs + 2 lone pairs
⇒ sp^3 hybridization

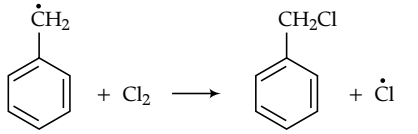
H_2O ⇒ 2 bond pairs + 2 lone pairs
⇒ sp^3 hybridization

BF_3 ⇒ 3 bond pairs only
⇒ sp^2 hybridization

78. Option (c) is correct.
It is an example of free radical substitution

$Cl\overset{\curvearrowleft}{-}\overset{\curvearrowright}{Cl} \longrightarrow \dot{2}Cl$ free radical (initiation)





$\dot{Cl} + \dot{Cl} \longrightarrow Cl_2$ (termination)

79. Option (c) is correct.

$$C_2H_5OH \xrightarrow{PBr_3} \underset{(X)}{C_2H_5Br} \xrightarrow[KOH]{alc.} \underset{\text{Ethene(Y)}}{CH_2=CH_2} \xrightarrow{H_2SO_4} CH_3CH_2{-}HSO_4 \xrightarrow{H_2O} C_2H_5OH$$

(Z)

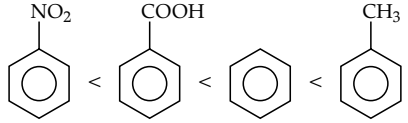
Hence, Z is ethanol.

80. Option (d) is correct.
Benzene + toluene will form an ideal solution.

81. Option (b) is correct.
The efficiency of a fuel cell $(\phi) = \frac{\Delta G}{\Delta H}\times 100$
Generally, fuel cells are expected to have an efficiency of 100 percent.

82. Option (c) is correct.
$CH_3{-}\underset{\underset{CH_3}{|}}{C}{=}CH{-}CH_2{-}CH_3$ will not show *cis-trans* isomerism because double-bonded carbon atom has two same groups (—CH_3, methyl group)

83. Option (c) is correct.
Presence of electron releasing groups like —R, —OH, etc. increases the electron density at *ortho* and *para* position and thus makes the benzene ring more reactive towards electrophile. On the other hand, electron withdrawing groups like —COOH, —NO_2, etc. reduces electron density and thus reduces the reactivity of benzene towards electrophile. Thus, the order of the given compounds towards electrophilic nitration is:



Nitro Benzene < Benzoic acid < Benzene < Toluene

84. Option (d) is correct.

$$BOH \rightleftharpoons B^+ + OH^-$$

$$K_b = \frac{[B^+][OH^-]}{[BOH]} = \frac{[OH^-]^2}{0.01}$$

$$1.0\times 10^{-12} = \frac{[OH^-]^2}{0.01}$$

$$\Rightarrow [OH^-] = \sqrt{1.0\times 10^{-14}} = 10^{-7}\ \text{mol}\ L^{-1}$$

85. Option (c) is correct.

$$H_2O(l) \xrightarrow{300\ K} H_2O(g)$$

$\Delta H = 30\ kJ\ mol^{-1}$

$$\Delta S = \frac{\Delta H}{T} = \frac{30\ kJ\ mol^{-1}}{300\ K} = \frac{30000}{300}\ J\ mol^{-1}\ K^{-1}$$

$= 100\ J\ mol^{-1}\ K^{-1}$

Section B

86. Option (a) is correct.
In sulphonation reaction breaking of C–H bond is rate determining step (slow step)

87. Option (b) is correct.
Acetone and ethanol both all give positive iodoform test. Acetone will react with 2, 4–DNP giving yellow precipitate. Ethanol will not react with 2, 4–DNP.

88. Option (d) is correct.
In Swarts reaction alkyl fluorides is prepared from alkyl chloride or bromide.

89. Option (c) is correct.

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

For reaction to be spontaneous, $\Delta G < 0$

$$0 > \Delta H - T\Delta S$$

$$0 > 170\ kJ - T(170\ JK^{-1})$$
$$\Rightarrow \quad T(170\ JK^{-1}) > 170000\ J$$
$$T > 1000\ K$$

Among the given temperatures, only 1110K is greater than 1000K thus, at this temperature the reaction will be spontaneous.

90. Option (a) is correct.

Rate of reaction $= k[A]^m\,[B_2]^n$

where m and n are the orders w.r.t. A and B_2 respectively.

In following experiments

$$1.6\times10^{-4} = k[0.50]^m[0.50]^n \quad \text{...(i)}$$

$$3.2\times10^{-4} = k[0.50]^m[1]^n \quad \text{...(ii)}$$

$$3.2\times10^{-4} = k[1.00]^m[1]^n \quad \text{...(iii)}$$

From equations (ii) and (iii),

$$\frac{3.2\times10^{-4}}{3.2\times10^{-4}} = \frac{k[1]^m[1]^n}{k[0.50]^m[1]^n} \Rightarrow 1 = 2m \Rightarrow m = 0$$

From equation **(i)** and (ii),

$$\frac{3.2\times10^{-4}}{1.6\times10^{-4}} = \frac{[0.5]^m[1]^n}{[0.5]^m[0.5]^n} \Rightarrow 2 = 2n \Rightarrow n = 1$$

Hence, rate equation $= k[A]^0[B_2]^1 = k[B_2]$

91. Option (b) is correct.

SF_6 exist because of the pressures of $d\pi - p\pi$ bonding whereas no such bonding is possible in case of SH_6.

92. Option (a) is correct.

The correct IUPAC name of $[Cr(py)_3Cl_3]$ is trichlorotripyridinium chromium (III).

93. Option (c) is correct.

The six-membered cyclic structure of glucose is known as the pyranose structure. It exists in two forms *i.e.* α and β-glucopyranose.

94. Option (b) is correct.

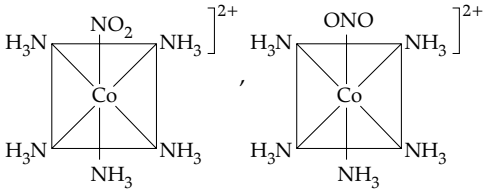
There will be 2 pairs of linkage isomers, 2 pairs of ionization isomers and 1 pair of geometrical isomerism. Thus, there are 10 possible isomers for complex $[Co(NH_3)_5NO_2](NO_3)_2$, which can be shown below:

$[Co(NH_3)_5(NO_2)](NO_3)_2$,$[Co(NH_3)_5(NO_3)](NO_3)NO_2$,

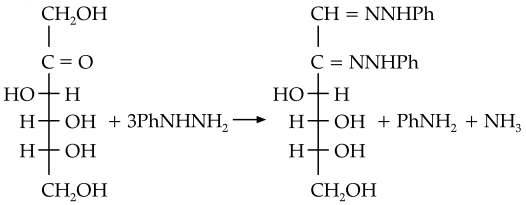
$[Co(NH_3)(ONO)](NO_3)_2$,$[Co(NH_3)_5(NO_3)](NO_3)(ONO)$,

$[Co(NH_3)_4NO_2NO_3]NO_3{\cdot}NH_3$,$[Co(NH_3)_4(NO_3)_2]NO_2{\cdot}NH_3$,

$[Co(NH_3)_4NO_3(ONO)]NO_3{\cdot}NH_3$,$[Co(NH_3)_4(NO_3)_2](ONO)NH_3$,



95. Option (c) is correct.



96. Option (d) is correct.

en and C_2O_4 are bidentate ligands thus the coordination number for the complex would be 6.

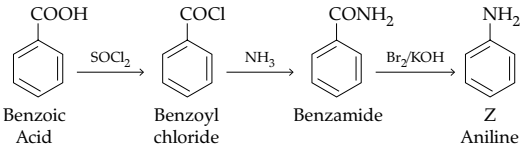
Let the oxidation number of Ni be x.

$\therefore\ x + 2(0) + (-2) \times 1 = +1$

$$x = +3$$

Therefore, the oxidation state of Ni is +3.

97. Option (a) is correct.



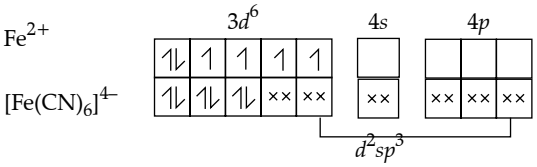
98. Option (a) is correct.

(A)-(ii), (B)-(i), (C)-(iii), **(D)**-(iv).

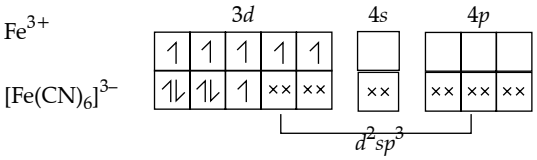
Proteins are polymers of α-amino acids. DNA is deoxyribonucleic acid. Glucogen is an example of polysaccharides. Maltose is an example of an enzyme.

99. Option (a) is correct.

The oxidation of Fe in both the complexes $[Fe(CN)_6]^{4-}$ and $[Fe(CN)_6]^{3-}$ will be +2 and +3 respectively. The electronic configuration of Fe^{2+} is $3d^6$.



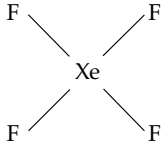
Here, there are no unpaired electrons. Thus, the complex will be diamagnetic.



Here, there is one unpaired electron. Thus, the complex will be paramagnetic.

100. Option (c) is correct.

The geometry of XeF_4 is square planar and thus the molecule is symmetrical and therefore has zero dipole moment.



BOTANY

Section A

101. Option (d) is correct.

As we go down in hierarchy characters become less general.

102. Option (b) is correct.

Fact.

103. Option (b) is correct.

The isolated lysosomal vesicles have been found to be very rich in almost all types of hydrolytic enzymes

(hydrolases – lipases, proteases, carbohydrases) optimally active at the acidic pH.

104. Option (c) is correct.
A flower in which floral parts arise from around the ovary is called perigynous. In this, the ovary is half inferior and half superior. It can be seen in the flowers of plum, peach, etc.

105. Option (c) is correct.
Under anaerobic conditions in some bacteria or muscles of animals, pyruvate is reduced to lactate to regenerate NAD^+.

106. Option (a) is correct.
Bt toxin protein, an inactive protoxin is converted into an active form once an insect ingests it. This is due to the alkaline pH of the gut.

107. Option (a) is correct.
Oxysome is differentiated into base, stalk, and headpiece. The headpiece contains the enzyme ATP synthetase which brings about oxidative phosphorylation coupled with the release of ATP.

108. Option (a) is correct.
Albugo candida affects Brassicaceae species including mustard and causes the sickness known as white rust.

109. Option (a) is correct.
Explanation: The chiasmata become visible during the diplotene stage of prophase I of meiosis. The beginning of diplotene is recognised by the dissolution of the synaptonemal complex and the tendency of the recombined homologous chromosomes of the bivalents to separate from each other except at the sites of crossovers. These X-shaped structures, are called chiasmata.

110. Option (b) is correct.
Explanation: The translation is composed of the following three stages: initiation, elongation and termination. In initiation stage, the small subunit of ribosome gets attached to the start of mRNA and then methionine containing tRNA or met-tRNA binds to the start codon of the sequence of mRNA. When a large subunit of the ribosome attaches to the start of the mRNA sequence, the initiation.

111. Option (c) is correct.
The use of radioactive ^{14}C in algal photosynthesis studies led to the discovery that the first CO_2 fixation product was a 3-carbon organic acid.

112. Option (d) is correct.
Swiss cheese is ripened with help of a bacterium *Propionibacterium sharmanii*.

113. Option (a) is correct.
Restriction enzymes are DNA cutting enzymes found in bacteria. A restriction enzyme recognizes and cuts DNA only at a particular sequence of nucleotides.

114. Option (c) is correct.
RER helps in protein synthesis SER helps in lipid synthesis.

115. Option (b) is correct.
Pea plants having recessive traits can express its feature only in pure line conditions.

116. Option (d) is correct.
Date palm and papaya both are dioecious plants.

117. Option (a) is correct.
In a protein structure, the last amino acid is called the C-terminal amino acid.

118. Option (b) is correct.
Archaebacteria have negatively supercoiled DNA but histones are chemically different in composition from eukaryotes.

119. Option (c) is correct.
Explanation: Cell envelope in a prokaryotic cell is a three-layered structure with outer glycocalyx, middle cell wall and inner plasma membrane. Glycocalyx is present as either slime layer (loose sheath) or capsule (tough). It is a layer of glycoproteins and glycolipids.

120. Option (c) is correct.
Total number of pollen grains (n) = 1200
Therefore, the number of pollen mother cells = $\frac{n}{4} = \frac{1200}{4} = 300$

121. Option (c) is correct.
Aspergillus niger → Citric acid,
Acetobacter aceti → Acetic acid,
Clostridium butylicum → Butyric acid,
Lactobacillus → Lactic acid.

122. Option (a) is correct.
The cell wall is made up of cellulose in eukaryotes.

123. Option (b) is correct.
1 : 1

124. Option (a) is correct.
(Conjugate enzyme) → (Protein part) + (Non protein part)
Holoenzyme A → proenzyme + Cofactor/Coenzyme

125. Option (b) is correct.
Halophytes grow in saline swampy soil and show vivipary which is the *in-situ* seed germination. Pneumatophores are for gaseous exchange.

126. Option (b) is correct.
In double-stranded DNA, adenine **(A)** must be equal to thymine **(T)** and cytosine **(C)** must be equal to guanine **(G)**. In RNA thymine remain absent.

127. Option (a) is correct.
Normally, the genes encoding resistance to antibiotics such as ampicillin, chloramphenicol, tetracycline or kanamycin, etc., are considered useful selectable markers for *E. coli*.

128. Option (b) is correct.
E. coli is a prokaryote.

129. Option (b) is correct.
Fermentation is the incomplete oxidation of glucose under anaerobic condition by a series of reactions in which pyruvic acid is converted to CO_2 and ethanol.

130. Option (b) is correct.
The vacuole is the membrane-bound space found in the cytoplasm. It regulates osmotic expansion of a cell if kept in water.

131. Option (d) is correct.
Fact.

132. Option (b) is correct.
Fact.

133. Option (d) is correct.
tRNA is also called transfer RNA. These are the molecules that act as the carriers of amino acids and read the genetic code.

134. Option (d) is correct.
Chromosomal Theory of Inheritance was proposed independently by Walter Sutton and Theodor Boveri in 1902. Whereas, linkage in *Drosophila* was discovered by Thomas Hunt Morgan. On the other hand, three botanists, Hugo de Vries, Carl Correns, and Erich von Tschermak rediscovered Mendel's work independently.

135. Option (c) is correct.

Explanation: In Bryophytes, a dominant, independent, photosynthetic, thalloid or erect phase is represented by haploid gametophyte. Sporophyte is short lived, multicellular and depends totally or partially on gametophyte for nutrition and anchorage.

Section B

136. Option (c) is correct.

The guard cells are surrounded by some cells that are quite distinct from other epidermal cells. These are called subsidiary or accessory cells.

137. Option (a) is correct.

Explanation: The genetic variation shown by the medicinal plant *Rauwolfia vomitoria* growing in different Himalayan ranges may be in terms of the potency and concentration of the active chemical (reserpine) that the plant produces. It is an example for genetic diversity.

138. Option (b) is correct.

Bast fibre - Phloem fibre.

139. Option (b) is correct.

Explanation: A constant input of solar energy is the basic requirement for any ecosystem to function and sustain.

140. Option (b) is correct.

Explanation: A constant input of solar energy is the basic requirement for any ecosystem to function and sustain. Thus, option (b) is the answer.

141. Option (a) is correct.

Explanation: Microbes are also used for commercial and industrial production of certain chemicals like organic acids, alcohols and enzymes. *Saccharomyces cerevisiae* is used to produce the enzyme Invertase. Thus, option **(a)** is the answer.

Pectinase is obtained from *Sclerotinia libertine* and *Aspergillus niger*.

Lipase is obtained from *Candida lipolytica*.

Cellulase is obtained from *Trichoderma konigii*.

142. Option (b) is correct.

Both biotic and abiotic factors affect the magnitude of primary productivity.

143. Option (c) is correct.

When cambium is not present in the vascular bundle it is called closed. These vascular bundles do not undergo secondary growth. Open vascular bundles have cambium between xylem and phloem.

144. Option (b) is correct.

Explanation: Free-living or non-symbiotic N_2 fixing microorganisms are *Azotobacter, Nostoc* (Cyanobacteria or BGA), *Clostridium, Beijerinkia, Klebsiella*, etc.

145. Option (d) is correct.

Explanation: DNA replication is semiconservative, meaning that each strand in the DNA double helix acts as a template for the synthesis of a new, complementary strand. The complementary base sequence to the sequence CATGATTAC would be GTACTAATG. In DNA, each nitrogenous base has its own complement. A, or adenine, is complementary to T, or thymine. The same goes for C, or cytosine, which is complementary to G, or guanine.

146. Option (c) is correct.

The correct pattern of arrangement of reproductive structures of gymnosperms is spores → sporangia → sporophylls → strobili.

Gymnosperms produce haploid microspores and megaspores. The two types of spores are created within sporangia that are borne on sporophylls which are placed spirally along an axis to form close strobili or cones. Two kinds of sporophylls, i.e., microsporophylls and megasporophylls aggregated to create different strobili or cones (pollen cones - male cones) and seed cones (female cones), respectively.

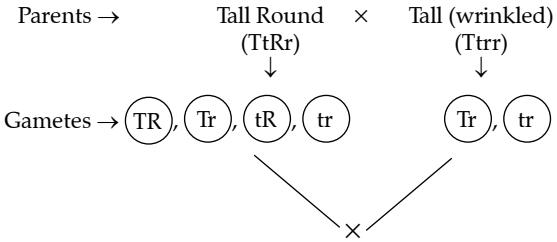
147. Option (b) is correct.

During the cause of evolution in plants, vascular plants originated in the Silurian period. Herbaceous lycopods and arborescent lycopods evolved from the *Zosterophyllum* of the Palaeozoic era.

148. Option (a) is correct.

Out of all the given codons, only two, i.e., GUA and GUU codes for valine. On the other hand, UUA, CUC codes for leucine; AUU - isoleucine, UCC - serine, CCU - proline, and ACA codes for threonine.

149. Option (a) is correct.



♂ \ ♀	Tr	tr
TR	TTRr (Tall, Round)	TtRr (Tall, Round)
Tr	TTrr (Tall, Wrinkled)	Ttrr (Tall, Wrinkled)
tR	TtRr (Tall, Round)	ttRr (Dwarf, Round)
tr	Ttrr (Tall, Wrinkled)	ttrr (Dwarf, Wrinkled)

Phenotype ratio :

(A) Tall and wrinkled - 37.5% or 3/8

(B) Dwarf and wrinkled - 12.5% or 1/8

150. Option (b) is correct.

Matthew Meselson and Franklin Stahl experimented with *E. coli* to prove that DNA replicates semiconservative. Initially, many generations of *E. coli* were grown in a medium that contained ^{15}N. The result was that ^{15}N was incorporated into the newly synthesized DNA and the DNA becomes ^{15}N. ^{15}N. The cells were then transferred into a medium containing ^{14}N. After the first round of replication, both stands were ^{14}N-^{15}N forming a single band (as they have the same density). In the second round, two bands were formed, i.e., ^{14}N-^{14}N and ^{14}N-^{15}N.

ZOOLOGY

Section A

151. Option (b) is correct.
Musca domestica is a housefly, *Panthera tigris* is an Indian tiger, *E. coli* is *Escherichia* coli. Hence, option **(b)** is correct.

152. Option (a) is correct.
Pitocin is a synthetic form of oxytocin but given only to induce labor while prolactin helps in the formation of milk by the mammary glands.

153. Option (c) is correct.
*t*RNA is synthesized by RNA polymerase III in the nucleus, therefore removal of RNA polymerase III will affect the synthesis of *t*RNA.

154. Option (c) is correct.
Explanation: Sea anemones are ocean-dwelling members of the phylum Cnidaria whereas Sea cucumber – *Cucumaria*, Sea urchin – *Echinus* and Sea Lily – *Antedon* belongs to the Phylum Echinodermata.

155. Option (d) is correct.
Ionizing radiation like X-rays and non-ionizing radiation like UV cause DNA damage leading to neoplastic transformation.

156. Option (a) is correct.
Metagenesis is found in *Obelia*.

157. Option (a) is correct.
Reptiles and birds excrete uric acid and hence are uricotelic.

158. Option (a) is correct.
Marshall Nirenberg's cell-free system for protein synthesis finally helped the code to be deciphered.

159. Option (a) is correct.
Lippe's loop is a non-medicated IUD whereas progestagen is a hormone-releasing IUD. Multiload 375 and LNG – 20 are copper releasing IUDs.

160. Option (a) is correct.
Parasympathetic neural signals decrease the rate of heart beat, speed of conduction of action potential and thereby the cardiac output.

161. Option (d) is correct.
Fibroblasts form cells and matrix in all connective tissues except blood. Blood cells are formed within the bone marrow.

162. Option (d) is correct.
Fact.

163. Option (d) is correct.
In humans, insulin is synthesised as pro-hormone which needs to be processed before it becomes a fully mature and functional hormone. It contains an extra stretch called the C peptide which is removed during maturation into insulin.

164. Option (d) is correct.
All species belonging to Echinodermata, Ctenophora and Cephalochordata are marine.

165. Option (c) is correct.
In the given diagram :
A - pulmonary vein, B - Pulmonary artery, C - vena cava, D - Dorsal aorta vena cava takes blood from body parts to right auricle and pCO_2 45 mm Hg.

166. Option (d) is correct.
Gonorrhea - *Neisseria gonorrhea*
Genital warts- *Human* papillomavirus
Syphilis - *Treponema palladium*

167. Option (c) is correct.
Glucagon is secreted by alpha cells. Thymosin secretion decreases with aging.

168. Option (c) is correct.
Macrophages act as HIV factories.
Morphine extracted from *Papaver somniferum*.
The amoebic dysentery Route of transmission is the fecal-oral route.

169. Option (b) is correct.
Protocooperation is the interaction between two living organisms of different species in which both are mutually benefited but can live without each other. It is the non-obligatory, mutually beneficial relationship, that develops when two different organisms get associated.

170. Option (c) is correct.
This gradient is mainly caused by NaCl and urea.

171. Option (d) is correct.
H-zone gets reduced during muscle contraction.

172. Option (c) is correct.
Cyclostomes do not have paired appendages and scales but have a sucking circular mouth.

173. Option (a) is correct.
The fovea is a thinned-out portion of the retina where only the cones are densely packed. It is the point where the visual acuity (resolution) is the greatest.

174. Option (b) is correct.
Sertoli cells donot produce smegma. Preputial glands produce smegma.

175. Option (c) is correct.
Axons that originate within the hypothalamus extend along the stalk of the pituitary as a tract.

176. Option (d) is correct.
Explanation: The oxygen in the lung alveoli has to pass through several membranous surfaces; these are the endothelium of alveolus, its basement membrane, basement membrane of the blood capillary, endothelium of capillary and the cell membrane of the body cell. Thus, the oxygen from the alveoli has to pass through five membranes to reach to the haemoglobin inside a R. B. C.

177. Option (b) is correct.
HIV does not spread by insect bites and saliva; People taking intravenous drugs are at high risk of infection.

178. Option (d) is correct.
The sex-linked recessive disease shows its transmission from unaffected carrier female to some male progeny. *e.g.*, Haemophilia.

179. Option (a) is correct.
The formation of urine is the result of three main processes namely, glomerular filtration, reabsorption, and secretion. These processes take place in different parts of the nephron. A comparison of the volume of the filtrate formed per day (180 liters per day) with that of the urine released (1.5 liters) suggests that as much as 99% of the filtrate is reabsorbed by the renal tubules. The other statements can be corrected as The ascending limb is impermeable to water but allows transport of electrolytes actively or passively. The descending limb of the loop of Henle is permeable to water but almost impermeable to electrolytes. Active reabsorption of Na^+ and water takes place in the distal convoluted tubule. It is also capable of reabsorption of HCO_3^-.

180. Option (b) is correct.
Thrombin converts soluble fibrinogen to insoluble fibrin, necessary for thrombus formation.

181. Option (d) is correct.
If one kidney is damaged, the other kidney will enlarge to compensate for the work of the damaged kidney *i.e.*, the kidney shows compensatory hypertrophy.

182. Option (c) is correct.
A cardiac notch is an indentation on the medial surface of the left lung which allows space for the heart.

183. Option (a) is correct.
Hyaline is the glass-like transparent cartilage found on many joint surfaces.

184. Option (b) is correct.
Reptiles are cold-blooded animals with monocondylic skull.

185. Option (d) is correct.
Monokines, lymphokines, interleukins, and interferons are cytokines that are of low molecular weight soluble protein or glycoprotein. Interferon is cytokines produced by cells in response to virus infections.

Section B

186. Option (d) is correct.

Explanation: The relationship between HbO_2 saturation and oxygen tension (pO_2) is called oxygen dissociation curve. This oxygen - haemoglobin dissociation curve is a sigmoid curve and it shifts towards the right due to decrease in pH (acidity) while an increase in pH (alkalinity) shifts the dissociation curve to the left.

187. Option (a) is correct.

Explanation: A primary spermatocyte completes the first meiotic division leading to formation of two equal, haploid cells called secondary spermatocytes, which have only 23 chromosomes each. The secondary spermatocytes undergo the second meiotic division to produce four equal, haploid spermatids which are transformed into spermatozoa (sperms) by the process called spermiogenesis.

188. Option (b) is correct.

In a diploid, p and q are the frequencies of alleles A and a respectively. The frequency of AA = p^2 (i.e. the probability of an allele A with frequency p is the product of the probabilities, *i.e.*, p^2) The frequency of aa = q^2; The frequency of Aa = $2pq$.

189. Option (b) is correct.

Explanation: The second trimester is the middle three months of pregnancy. Progesterone is responsible for maintaining pregnancy in the second trimester. It maintains the endometrium lining of the uterus due to which menstrual cycle does not occur during the pregnancy.

190. Option (a) is correct.

FRC is functional residual capacity. Vital capacity (VC) is defined as the maximum volume of air, a person can breathe in after a forceful expiration the maximum volume of air, a person can breathe out after a forceful inspiration. Expiratory reserve volume (ERV) is defined as the additional or extra volume of air, a person can expire by forceful expiration. Inspiratory reserve volume is defined as the additional or extra volume of air, a person inspire by forceful inspiration.

191. Option (a) is correct.
The P-wave represents the electrical excitation (or depolarisation) of the atria, which leads to the contraction of both the atria.

192. Option (b) is correct.
Fact

193. Option (c) is correct.
MALT stands for Mucosal Associated Lymphoid Tissues. It constitutes about 50 percent of the lymphoid tissues in the human body.

194. Option (d) is correct.
Explanation: Mutations are large, sudden, random and discontinuous variations in a population the changes are inheritable and non-directional. It is one of the main feature of mutation theory given by Hugo de Vries. Thus potion **(d)** is incorrect whereas the remaining statements are correct.

195. Option (a) is correct.
'P'-A, AB; 'Q'-B, AB; 'R'-AB, A, B, O; 'S'-O. A person with blood group O is known as a universal donor. Hence, he/she can donate blood to persons with any of the other blood groups (*i.e.*, either A, B, AB, and O). Whereas, persons with blood group AB are known as universal recipients. They can accept blood from any blood group (*i.e.*, AB as well as A, B, and O).

196. Option (d) is correct.
The ellipsoid joint is also known as the Condyloid joint. This allows movement in two planes (*i.e.*, back-forth and side-side), e.g., joint between metacarpals and phalanges of the fingers. On the other hand, the ball and socket joint are present between the pectoral girdle and the head of the humerus.

197. Option (b) is correct.
Statements (iii) and (iv) are true for the sickle-cell Anaemia. The other two statements can be corrected as –

Sickle-cell Anaemia is an autosomal linked recessive trait that can be transmitted from parents to the offsprings, when both the partners are carrier for the gene.

It is caused by the substitution of Glutamic acid (Glu) by Valine (Val) at the sixth position of the beta globin chain of haemoglobin molecule.

198. Option (c) is correct.
Chromosome 1 was the last human chromosome of the Human Genome Project whose sequence was completed in 2006. This was the last among 24 human chromosomes – 22 autosomes and X and Y to be sequenced.

199. Option (a) is correct.
'A' represents the cellular level of organization, in which the body consists of loose cell aggregates but the cells do not form tissues. 'B' represents bilateral symmetry, *i.e.*, when the body can be divided into two similar halves by any plane passing through the central axis of the body. 'C' represents coelomates (the animals having the coelom).

200. Option (a) is correct.
(A) - (iii), **(B)** - (ii), **(C)** - (iv), **(D)** - **(i)**
The pedigree analysis supplies a powerful tool, which is utilized to delineate the heritage of a characteristic trait, anomaly, or disorder.

❑❑❑