NEET MOCK TEST 5

ANSWER KEY AND SOLUTIONS

ANSWER KEY

Physics

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

Botany

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

Chemistry

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

Zoology

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

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ANSWERS WITH EXPLANATION

PHYSICS

Section A

1. Option (c) is correct.

Let W_a be the work done by the resistive force of air. Then:

$$W_g + W_a = KE_f - KE_i$$

$$mgh + W_a = \frac{1}{2}mv^2 - 0$$

$$\text{Now, } 10^{-3} \times 10 \times 10^3 + W_a = \frac{1}{2} \times 10^{-3} \times (50)^2$$

On solving we see that work done due to air resistance is $W_a = -8.75$ J

Work done due to gravity = 10 J

2. 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 $n = 1$: $B = \mu_0 I/2r$;

Let the new radius of the coil with n turns be r'.

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

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

Now, $$B' = \mu_0 nI/2r'$$

$$= n^2 \times \mu_0 I/2r = n^2 B$$

3. Option (c) is correct.

Kinetic energy = Force × Displacement

So, as per the question, kinetic energy attained by the particle after moving a distance y will be qEy.

4. Option (b) is correct.

We have:

Power of pump = 2 kW = 2000 W

Time (t) = 60 s

Height (h) = 10 m

$$g = 10 \text{ m/s}^2$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

or, $$P = \frac{mgh}{t}$$

or, $$m = \frac{P \times t}{gh} = \frac{2000 \times 60}{10 \times 10} \text{ kg}$$

$$= 1200 \text{ kg}$$

1200 kg = 1200 litre (here water is raised, so 1 kg of water = 1 litre)

5. Option (c) is correct.

As dipole moment is along the direction of the electric field, the angle between p and E is zero, so the potential energy will be

$$U = -pE \cos 0°$$

$$= -pE = \text{minimum}$$

It is observed that in a uniform electric field, net force acting on dipole is $F_{net} = 0$.

6. Option (c) is correct.

Seeing from one end,

$h_1 = \mu \times (h)$

$$= \frac{3}{2} \times 5 = \frac{15}{2} \text{ cm}$$

From the other end of the slab,

$$h_2 = \mu \times h$$

$$= \frac{3}{2} \times 3 = \frac{9}{2} \text{ cm}$$

Now total height,

$$\frac{15}{2} + \frac{9}{2} = \frac{24}{2} = 12 \text{ cm}$$

7. Option (b) is correct.

Rotational Kinetic energy

$$E_r = \frac{1}{2} (MK^2\omega^2)$$

Here, K is the radius of gyration.

Total Energy,

$$E = \frac{1}{2} M\omega^2[K^2 + R^2]$$

The ratio of rolling energy to total energy

$$\frac{E_r}{E} = \frac{K^2}{K^2 + R^2}$$

Now for spherical ball $K^2 = \left(\frac{2}{5}\right)R^2$

On substituting the value of K^2 in the above equation

$$\frac{E_r}{E} = \frac{2}{7}$$

8. Option (b) is correct.

When the switch is closed, the current will only flow through R_2, the surface resistor arm.

So, $i = i_1$

$$= \frac{E}{R_2} = \frac{18}{9} = 2 \text{ A}$$

9. Option (c) is correct.

$_1H^2 + {}_1H^2 \rightarrow {}_2He^4$

Given:

$$1 \, u = 931 \text{ MeV}$$

Mass defect, $\Delta m = 0.02866 \, u$

Now, total energy liberated,

$$E = \Delta mc^2$$

$$= 0.02866 \times 931 \text{ MeV}$$

$$= 26.68 \text{ MeV}$$

Finally, the energy liberated per u is:

$$\frac{E}{A} = \frac{26.68}{4} = 6.678 \text{ MeV}$$

10. Option (b) is correct.

Let L_1 be the length of the open organ pipe.

On comparing the overtone of two pipes:

$$\frac{3V}{2L_1} = \frac{3V}{4L}$$

$$L_1 = 2L$$

11. Option (b) is correct.

We have $v^2 = u^2 + 2gh$

Here $u = 0$, thus,

$$v = \sqrt{(2gh)} = \sqrt{(2\times10\times20)}$$

$$= 20 \text{ m/s}$$

12. Option (d) is correct.

Work W is the scalar product (dot product) of force $\vec{F}$ and displacement $\vec{s}$.

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

Since the particle is displaced from position $(2\hat{\imath} + \hat{k})$ metre to position $(4\hat{\imath} + 3\hat{j} - \hat{k})$ metre, the displacement is given by

$$\vec{s} = (4\hat{\imath} + 3\hat{j} - \hat{k}) - (2\hat{\imath} + \hat{k}) = (2\hat{\imath} + 3\hat{j} - 2\hat{k})$$

Therefore work $W = \vec{F}\cdot\vec{s}$

$$= (3\hat{\imath} + \hat{j}).(2\hat{\imath} + 3\hat{j} - 2\hat{k}) = 6 + 3 = 9 \text{ J}$$

13. Option (a) is correct.

From the question,

Change in potential energy,

$\Delta U = U_f - U_i$

$$\text{Now, } \Delta U = \left(\frac{1}{4\pi\varepsilon_0}\right)\left[\left(\frac{q_1q_3}{0.4} + \frac{q_2q_3}{0.1}\right) - \left(\frac{q_1q_3}{0.4} + \frac{q_2q_3}{0.5}\right)\right]$$

$$\frac{q_3}{4\pi\,\varepsilon_0}k = \left(\frac{1}{4\pi\varepsilon_0}\right)[8q_2q_3]$$

Hence, $k = 8q_2$

14. Option (a) is correct.

In option **(a)** the anode is at higher potential with biasing voltage zero as compared to the cathode which is at –2 V.

15. Option (c) is correct.

By Charles's law: V = KT, so work done = nRΔT

Heat absorbed = $nC_p\Delta T$

$= n(5R/2)\Delta T = 5/2(n\text{R}\Delta\text{T})$

So, required ratio $= \dfrac{n\text{R}\Delta\text{T}}{\frac{5}{2}n\text{R}\Delta\text{T}} = \dfrac{2}{5}$

16. Option (b) is correct.

The work done $= \int_{x_1}^{x_2} F\,dx$

$= \int_0^{x_1} Cx\,dx$ (Here, $x_1 = 0$, $x_2 = x_1$)

$$= C\left[\frac{x^2}{2}\right]_0^{x_1}$$

$$= \frac{1}{2}Cx_1^2$$

17. Option (d) is correct.

A person sitting in an open car moving at constant velocity throws a ball vertically up into the air. The ball will fall exactly in the hand which threw it up as the horizontal component of velocity are the same for both car and ball, hence they cover equal horizontal distances in a given time interval.

18. Option (c) is correct.

Potential difference **(V)** = 1 V

Kinetic Energy acquired = qV

So, K.E. $= 1.6 \times 10^{-19} \times 1$

$= 1.6 \times 10^{-19}$ joules

$= 1$ eV

19. Option (a) is correct.

de-Broglie wavelength,

$$\lambda = \frac{h}{m_1v_1} = \frac{h}{m_2v_2}$$

Now, $\dfrac{v_1}{v_2} = \dfrac{m_2}{m_1} = \dfrac{4}{1}$

20. Option (c) is correct.

Potential energy $= \left(\dfrac{1}{4}\right)$ maximum Energy

or, $\dfrac{1}{2}m\omega^2y^2 = \dfrac{1}{4}\left(\dfrac{1}{2}m\,\omega^2a^2\right)$

$\therefore \quad y = \dfrac{a}{2}$

21. Option (a) is correct.

We see that heat produced is the power which is given as $6\pi\eta r\text{V}_\text{T}^2$

As terminal velocity, $\text{V}_\text{T} \propto r^2$, so the rate of production of heat $\text{P} \propto r^5$.

22. Option (b) is correct.

$$\text{I} \propto \text{A}^2$$

Here, $a_1 = 8$, $a_2 = 6$

$$\text{A}_{\max} = a_1 + a_2$$

$$\text{A}_{\min} = a_1 - a_2$$

$$\frac{I_{\max}}{I_{\min}} = \left[\frac{a_1 + a_2}{a_1 - a_2}\right]^2 = \left[\frac{8+6}{8-6}\right]^2 = \frac{49}{1}$$

23. Option (b) is correct.

The First Law of Thermodynamics is a special case of the Law of Conservation of Energy and encompasses changes in internal energy. As per the law, the quantity of energy supplied to any isolated system in form of heat will be equal to the work done by the system and the change in internal energy of the system.

$$\Delta\text{U} = \text{Q} - \text{P}\Delta\text{V}.$$

$$\Delta\text{U} = \text{Q} - \text{W}$$

24. Option (c) is correct.

$v^2 = u^2 - 2a\text{S} = 0$ $\qquad u = 36$ km/hour $= 10$ m/s

$$\text{S} = \frac{u^2}{2a} = \frac{u^2}{2\mu g} = \frac{10^2}{2\times0.2\times9.8} = 25.1\,\text{m} \approx 25\,\text{m}$$

25. Option (b) is correct.

The total mechanical energy of the satellite is given by

$$\text{E} = -\text{GM}m/2r$$

Here, $r = \text{R} + h$

Here R and M are Earth's radius and its mass respectively.

And, $\text{GM} = g_o\text{R}^2$

So, $\text{E} = -mg_o\text{R}^2/2(\text{R}+h)$

26. Option (c) is correct.

Applying De Morgan's law:

Output $Y = [(A.B).C]' = A' + B' + C'$

When A, B, C are $0 \Rightarrow \text{Y} = 1$

When A, B, C are $1 \Rightarrow \text{Y} = 0$

27. Option (b) is correct.

Let x_m be maximum compression in the spring. Then:

Loss in K.E = Gain in P.E

$$\frac{1}{2}mv^2\left[1+\frac{K^2}{R^2}\right]=\frac{1}{2}kx_m{}^2$$

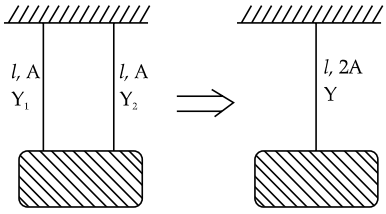
Here $\frac{K^2}{R^2}$ for solid cylinder $=\frac{1}{2}$

substituting

$3 \times 6^2 (1 + 0.5) = 200x_m^2$

$\therefore \quad x_m = \frac{8}{10} = 0.8$ m

28. Option (b) is correct.



Spring constant of a wire is given by

$$K = \frac{YA}{l}$$

For two wires shown above:

$$K_{eq} = K_1 + K_2$$

or $$\frac{Y(2A)}{l} = \frac{Y_1A}{l} + \frac{Y_2A}{l}$$

or $$Y = \frac{Y_1 + Y_2}{2}$$

29. Option (d) is correct.

In option **(a)**, the circuit is open, as a result, no current flows through it. So the potential difference across the internal resistor is zero and hence, a terminal potential difference is the same as the emf of the battery.

For option **(b)**, The terminal potential difference becomes zero as the battery is shorted, although emf remains the same.

In option **(c)**, discharging of the battery takes place, the current has been withdrawn from the battery, whose value is depending on the value of resistance, which in turn changes the value of terminal potential difference but emf remains the same.

30. Option (d) is correct.

Statement I is false and Statement II is true.

31. Option (c) is correct.

It is observed that standing waves are set on a stretched string fixed at both ends. Here waves traveling along the string are reflected back onto the string at each end. The wavelength of the described standing wave will be, $\lambda = 2l/n$, where, $n = 1, 2, 3, \ldots$.

32. Option (d) is correct.

When a disc rotates with uniform angular velocity, the angular acceleration of the disc is zero.

33. Option (a) is correct.

Here, $n_i = 10^{19}$ m^{-3}

and $n_h = 10^{21}$ m^{-3}

As $n_i^2 = n_e n_h$

$$n_e = \frac{n_i^2}{n_h} = \frac{10^{19} \times 10^{19}}{10^{21}} = 10^{17} \text{ m}^{-3}$$

34. Option (c) is correct.

Case 1:

$$(0.95\ u)^2 - u^2 = -2at$$

Where t = thickness of one plank.

So, $0.0975\ u^2 = 2at$ ...**(i)**

Case 2:

$$(0.5\ u)^2 - u^2 = -2nat$$

$$0.75\ u^2 = 2nat \quad \ldots(ii)$$

Dividing eqn. (ii) by eqn. **(i)**,

$$= 0.75\ u^2/0.0975\ u^2 = n$$

Therefore $n = 7.69$

Approximately $n = 8$.

35. Option (a) is correct.

At resonance $X_L = X_C$, but each one need not be equal to R. All the remaining relations are correct.

$Z = R$ because the circuit is purely ohmic at resonance.

Also $|V_L| = |V_C|$ at resonance. The resonance frequency, $f_r = \frac{1}{2\pi\sqrt{LC}}$.

Section B

36. Option (d) is correct.

The density is the same but the size is three times bigger, hence radius of the planet will be three times the radius of the Earth

For Earth, $g = \frac{GM}{R^2}$

and $M = \frac{4}{3}\pi R^3 \rho$

For Planet, $g' = \frac{GM'}{R'^2}$

and $M' = \frac{4}{3}\pi R'^3 \rho$

So, $M' = 27\ M$ or $R' = 3R$

Hence, $g' = \frac{G \times 27M}{(3R)^2}$

$$g' = 3\frac{GM}{R^2}$$

$$g' = 3g$$

37. Option (d) is correct.

The nucleus occupies a much smaller volume compared to the volume of the atom.

38. Option (a) is correct.

Distance between the plates,

$$x = \frac{V}{A} = \frac{5 \times 10^{-8}}{30 \times 10^{-4}} = \frac{5}{3} \times 10^{-5} \text{m}$$

$$\therefore \quad F = \frac{2T}{x}.A = \frac{2 \times 70 \times 10^{-3}}{\frac{5}{3} \times 10^{-5}} \times 30 \times 10^{-4}$$

$$F = 25.2 \text{ N}$$

39. Option (b) is correct.

Suppose a ball rebounds with speed v,

$$v = \sqrt{2gh} = \sqrt{2 \times 10 \times 20} = 20 \text{ m/s}$$

Energy of a ball just after rebound,

$$E = \frac{1}{2}mv^2 = 200 \text{ m}$$

As, 50% of energy is lost in collision, the energy of the ball before collision will be 400 m.

According to the law of conservation of energy, we have

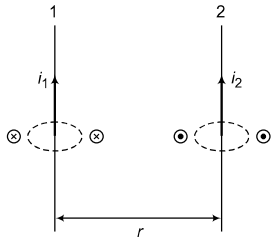
$$\frac{1}{2}mv_0^2 + mgh = 400 \text{ m}$$

$$\Rightarrow \quad \frac{1}{2}mv_0^2 + m \times 10 \times 20 = 400 \text{ m}$$

$$\Rightarrow \quad v_0 = 20 \text{ m/s}$$

40. Option (b) is correct.

As per Maxwell's right-hand rule, the magnetic field on the right hand of wire 1 is perpendicular to the paper which is going in shown by x. Also, the magnetic field on the left hand of wire 2 is perpendicular and coming out of the plane. So the two fields are opposite each other.



Hence net magnetic field,

$$B = B_1 - B_2 = \mu_0 i_1/2\pi r_1 - \mu_0 i_2/2\pi r_2$$

At mid point,

$$r_1 - r_2 = r = 5/2 = 2.5 \text{ m}$$

$$B = \mu_0/2\pi\,(i_1/r - i_2/r)$$

$$= \mu_0/2\pi\,(5/2.5 - 2.5/2.5)$$

$$= \mu_0/2\pi\,(2-1) = \mu_0/2\pi \text{ T}$$

41. Option (a) is correct.

Quantities having different dimensions can not be added or subtracted, but they can be divided.

So option **(a)** is correct.

In option **(b)**, the power of e should be a dimensionless number. So, A and B cannot have different dimensions.

42. Option (c) is correct.

Centripetal force $= \dfrac{mv^2}{r} = F$

Angular momentum $= mvr = L$

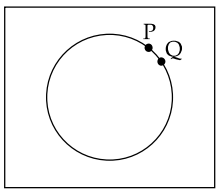
$$v = \frac{L}{mr}$$

$$F = \frac{m}{r}v^2$$

$$= \frac{m}{r}\left(\frac{L}{mr}\right)^2 = \frac{mL^2}{m^2r^3}$$

$$F = \frac{L^2}{mr^3}$$

43. Option (a) is correct.



When we heat the sheet the radius of hole will increase.

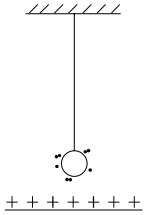
If we consider two points on the surface then upon increasing temperature the distance between two points will increase, so size of the hole increases.

44. Option (a) is correct.

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

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

where, $g' = g + a$



$$g' = g + \frac{qE}{m} \qquad \left[\begin{matrix} F = qE = ma \\ a = \dfrac{qE}{m} \end{matrix}\right]$$

$$T' = 2\pi\sqrt{\frac{L}{+\dfrac{E}{}}}$$

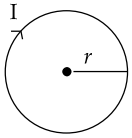
So, the time period will decrease.

45. Option (c) is correct.

$$\longleftarrow\ L\ \longrightarrow$$

$$L = 2\pi r$$

$$r = \frac{L}{2}$$



Magnetic Moment = Current × Area

$$= I \times \pi r^2$$

$$= I \times \pi\left(\frac{L}{2\pi}\right)^2 = \frac{IL^2}{4\pi}$$

46. Option (c) is correct.

Comparing equations of voltage and current with standard equations $V_0 = 10$ and $I_0 = 2$

The phase difference between current and voltage

$$= \frac{\pi}{12} - \left(-\frac{\pi}{6}\right)$$

Phase difference $\phi = \dfrac{\pi}{4}$

$$P_{av} = V_{rms} \cdot I_{rms} \cdot \cos\phi$$

$$= \frac{10}{\sqrt{2}} \times \frac{2}{\sqrt{2}} \times \cos\frac{\pi}{4}$$

$$= \frac{10}{\sqrt{2}} \times \frac{2}{\sqrt{2}} \times \frac{1}{\sqrt{2}}$$

$$\Rightarrow \quad \frac{10}{\sqrt{2}}$$

$$\Rightarrow \quad \frac{10}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = 5\sqrt{2}$$

47. Option (c) is correct.

$u = 100$ cm, $f = \dfrac{R}{2} = 10$ cm

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{-10} = \frac{1}{v} + \frac{1}{-100}$$

$$\frac{1}{100} - \frac{1}{10} = \frac{1}{v}$$

$$\frac{1-10}{100} = \frac{1}{v}$$

$$\frac{-9}{100} = \frac{1}{v}$$

$$v = \frac{-100}{9}$$

$$m = \frac{h_i}{h_o} = -\left(\frac{v}{u}\right)$$

$$\frac{h_i}{+5} = -\left(\frac{-100/9}{-100}\right)$$

$$h_i = \frac{-5}{9} = -0.55 \text{ cm}$$

The negative sign indicates the formation of inverted image.

48. Option (c) is correct.

For dark fringe

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

For third dark fringe $n = 3$

$$\text{Path difference } \Delta x = \frac{5\lambda}{2}$$

$$\text{Phase difference} = \frac{2\pi}{\lambda} \times \text{path difference}$$

$$\Delta = \frac{2\pi}{\lambda} \times \frac{5\lambda}{2} = 5\pi$$

49. Option (c) is correct.

$$\text{Current} = \frac{\text{Charge}}{\text{Time}}$$

$$\text{Time} = \frac{2\pi r}{v}$$

$$I = \frac{e}{2\pi/v} = \frac{ev}{2\pi r}$$

$$I = \frac{e}{2\pi\left[\frac{\varepsilon_0 n^2 h^2}{\pi m e^2}\right]} \cdot \frac{e^2}{2\varepsilon_0 nh} = \frac{e^5 \pi m}{4\varepsilon_0^2 n^3 h^3}$$

$$I \propto e^5$$

50. Option (d) is correct.

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

$$T = \frac{2E}{3k} = \frac{2 \times 7.7 \times 10^{-14}}{2 \times 1.38 \times 10^{-23}}$$

$$= 3.72 \times 10^9 \text{ K} \approx 10^9 \text{ K}$$

CHEMISTRY

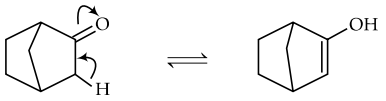
Section A

51. Option (b) is correct.

Ionization potential though increases on moving from left to right along a period but in the case of Be and B, the values are not according to this trend. The reason behind that is the filled valence orbital of Be which provides more stability and hence requires high ionization potential. In Be, the electronic configuration is $1s^2\ 2s^2$ while for B is $1s^2\ 2s^2\ 2p^1$. Thus, the 2*s* subshell is filled while the 2*p* subshell in B is incomplete and less stable than that of the electronic configuration of Be. Thus, the correct order is Li < B < Be < C.

52. Option (a) is correct.

α-hydrogen at bridge carbon never participates in tautomerism as the ring is small so it will not be stable. Thus, only (III) exhibits tautomerism.



keto form *enol*-form

53. Option (c) is correct.

The first few members of the lanthanoid series are quite reactive, almost like calcium. However, with increasing atomic numbers their behavior becomes similar to that of aluminum.

54. Option (d) is correct.

In group 13 due to transition contraction,

[Al > Ga]

Atomic Radius

So, Ga is slightly smaller than Al due to poor shielding of *d* electrons so Z effective increases.

So, Atomic size: B < Ga < Al < In < Tl

55. Option (c) is correct.

According to Werner's theory.

$CoCl_3 \cdot 6NH_3 \rightarrow [Co(NH_3)_6]^{3+}3Cl^-$

$CoCl_3 \cdot 5NH_3 \rightarrow [Co(NH_3)_6Cl]^{2+}2Cl^-$

$CoCl_3 \cdot 4NH_3 \rightarrow [Co(NH_3)_4Cl_2]^{+}Cl^-$

When $AgNO_3$ in excess is treated with these complexes then following reactions take place:

$$[Co(NH_3)_6]^{3+}3Cl^- + AgNO_3 \xrightarrow[\text{(Excess)}]{} 3AgCl + [Co(NH_3)_6]^{3+}$$

$$[Co(NH_3)_5Cl]^{2+}2Cl^- + AgNO \xrightarrow[\text{(Excess)}]{} 2AgCl + [Co(NH_3)_5Cl]^{2-}$$

$$[Co(NH_3)_4Cl_2]^{+}Cl^- + AgNO_3 \xrightarrow[\text{(Excess)}]{} AgCl + [Co(NH_3)_4Cl_2]^{-}$$

56. Option (b) is correct.

$$\text{Molality} = \frac{\text{Number of moles of solute}}{\text{Mass of solvent (in kg)}}$$

$$\text{Molarity} = \frac{\text{Number of moles of solute}}{\text{Volume of solution (in L)}}$$

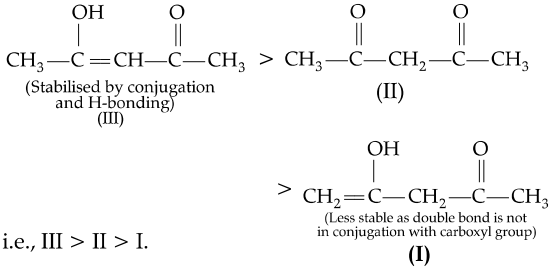
$$\text{Mole fraction} = \frac{\text{Number of moles of component}}{\text{Total number of moles of all components}}$$

$$\text{Weight percentage} = \frac{\text{Weight of a component}}{\text{Total weight of solution}} \times 100$$

Among the above concentration units, only molarity depends on the volume of the solution which increases with increasing temperature and decreases with decreasing temperature. The rest of the three terms either depends on the number of components or the weight of components which are independent of temperature.

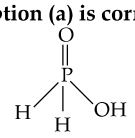
57. Option (b) is correct.

The enols of β-dicarboxyl compounds are more stable because of conjugation and intramolecular H-bonding. Thus, the order of stability is:

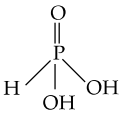


i.e., III > II > I.

58. Option (a) is correct.



(H_3PO_2)
Hypophosphorus acid
or Phosphinic acid
(Monoprotic)

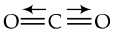


(H_3PO_3)
Orthophosphours acid
or Phosphonic acid
(Diprotic)

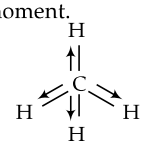
Since, phosphinic acid contains one P—OH bond, so it is monoprotic and phosphonic acid contains two P—OH bonds, so it is diprotic.

59. Option (c) is correct.

In the case of CO_2 and CH_4, though the C—O and C—H bonds are polar but due to their symmetrical structure, they have zero dipole moment.

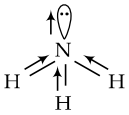


Net dipole moment = 0

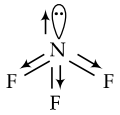


Net dipole moment = 0

Among NH_3 and NF_3, the dipole moment of NH_3 is higher due to the direction of the dipole of N—H bond is in a similar direction of lone pair but for NF_3 the dipole moment of N—F bond is in the opposite direction to the lone pair which results from a lower value of net dipole moment.



Net dipole moment is of higher
value due to sum of dipoles
in same direction



Net dipole moment is lower due to
resultant of 3 N-F bonds in opposite direction
due to the dipole of lone pair

60. Option (a) is correct.

$NaNH_2$ is used to distinguish between 1-butyne and 2-butyne.

1-butyne will react with $NaNH_2$ while 2-butyne does not show any reaction.

$$CH_3CH_2C{\equiv}CH \xrightarrow{NaNH_2} CH_3CH_2C{\equiv}CNa + \tfrac{1}{2}H_2\uparrow$$

1-butyne

$$CH_3{-}C{\equiv}C{-}CH_3 \xrightarrow{NaNH_2} \text{No reaction}$$

2-butyne

61. Option (a) is correct.

$$H_2O(l) \xrightarrow{100^\circ C} H_2O(g)$$

$$\Delta H^\circ = 40.66 \text{ kJ mol}^{-1}$$

$$\Delta H^\circ = \Delta U^\circ + \Delta n_g RT$$

$$\Delta n_g = 1,\ R = 8.314 \times 10^{-3} \text{ kJ mol}^{-1} \text{ K}^{-1}$$

$$T = 100 + 273 = 373 \text{ K}$$

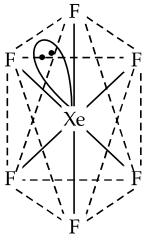
$$\Rightarrow 40.66 = \Delta U^\circ - (1)\ (8.314 \times 10^{-3}) \times 373$$

$$\Delta U^\circ = 37.56 \text{ kJ mol}^{-1}$$

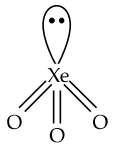
62. Option (a) is correct.

Nucleophiles are electron rich species and acts as a Lewis base not as Lewis acid.

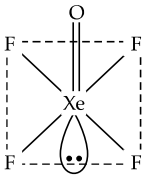
63. Option (c) is correct.



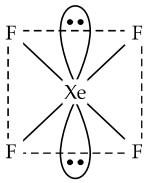
XeF_6
Distorted octahedral
sp^3d^3



XeO_3
Pyramidal
sp^3



$XeOF_4$
Square
Pyramidal
sp^3d^2



XeF_4
Square Planar
sp^3d^2

64. Option (d) is correct.

$$MY \rightarrow M^+ + Y^-$$
$$S \quad S \quad S$$
$$K_{sp} = S \cdot S$$

$$\Rightarrow \quad 6.2 \times 10^{-13} = S^2 \Rightarrow S = \sqrt{6.2 \times 10^{-13}}$$
$$= 7.87 \times 10^{-7} \text{ mol L}^{-1}$$

$$NY_3 \rightleftharpoons N^+ + 3Y^-$$
$$S \quad S \quad 3S$$
$$K_{sp} = S.(3S)^3 = 27S^4$$

$$\Rightarrow \quad 6.2 \times 10^{-13} = 27S^4$$

$$\Rightarrow \quad S = 3.89 \times 10^{-4} \text{ mol L}^{-1}$$

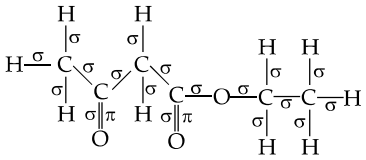
Hence, molar solubility of MY in water is less than that of NY_3.

65. Option (c) is correct.

Both S and P are sp^3 hybridized in 2-4 SO and 3-4 PO respectively.

66. Option (a) is correct.

The given structure has 18σ bonds and 2π bonds.



67. Option (a) is correct.

Number of equivalents of

$H^+ = 20.0 \times 0.050$ milliequivalents
$= 1.0$ milliequivalents

Number of equivalents of OH^-

$= 2 \times 30.0 \times 0.10$
$= 6.0$ milliequivalents

Thus, equivalents of OH^- left after neutralization

$= 6 - 1 = 5$ milliequivalents

Total volume after neutralization

$= 20.0 + 30.0$ mL $= 50.0$ mL

$$[OH^-] = \frac{5 \text{ milliequivalents}}{50 \text{ mL}} = 0.1 \text{ M}$$

68. Option (a) is correct.

According to depression in freezing point,

$$\Delta T_f = iK_f m$$

where, K_f = cryoscopic constant

(given $K_f = 1.86°C\ mol^{-1}\ kg^{-1}$)

$$i = \frac{\Delta T_f \times W_{solvent}}{K_f \times n_{solute} \times 1000}$$

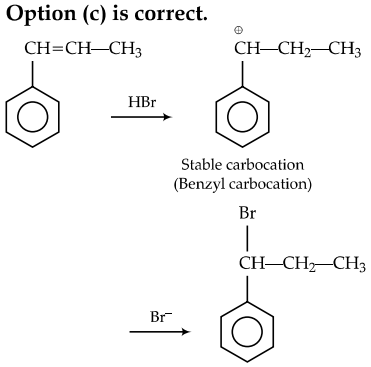
$$= \frac{3.82 \times 45}{1.86 \times \left(\frac{5}{142}\right) \times 1000} \qquad \left[\because n_{solute} = \frac{5}{142}\right]$$

$$i = 2.63$$

69. Option (d) is correct.

Attacking reagent is dichlorocarbene

70. Option (c) is correct.



71. Option (b) is correct.

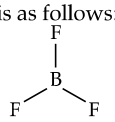
The ease of adsorption of the hydrated alkali metal ions on an ion exchange resins decreases as the size of the alkali metal ion increases.

72. Option (d) is correct.

The structure of H_2O is as follows:

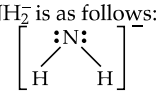
Thus, it has two bond pairs of electrons and two lone pairs of electrons.

The structure of BF_3 is as follows:



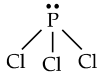
Here, boron has three bond pairs of electrons and no lone pair of electrons.

The structure of NH_2^- is as follows:



Here, nitrogen has two bond pairs of electrons and two lone pairs of electrons.

The structure of PCl_3 is as follows:



Thus, the phosphorus atom has three bond pairs of electrons and one lone pair of electrons.

73. Option (c) is correct.

Among the given molecules, only diborane is electron deficient *i.e.*, it does not complete octet.

Thus, it acts as a Lewis acid.

NH_3 and H_2O being electron rich species behaves as Lewis base.

74. Option (a) is correct.

We know that, $\lambda_{eq} = \kappa \times V$

On dilution the number of current-carrying particles per cm^3 decreases but the volume of solution increases. As a result, the ionic mobility increases which in turn increases the equivalent conductance of strong electrolytes.

75. Option (d) is correct.

Rate = $k[A]^x\,[B]^y$

For the given situations

(I) rate = $k(0.1)^x(0.1)^y = 6 \times 10^{-3}$

(II) rate = $k(0.3)^x(0.2)^y = 7.2 \times 10^{-2}$

(III) rate = $k(0.3)^x(0.4)^y = 2.88 \times 10^{-1}$

(IV) rate = $k(0.4)^x(0.1)^y = 2.40 \times 10^{-2}$

Dividing rate **(I)** by rate (IV) we get

$$\left(\frac{0.1}{0.4}\right)^x \left(\frac{0.1}{0.1}\right)^y = \frac{6.0 \times 10^{-3}}{2.4 \times 10^{-2}}$$

$$\left(\frac{1}{4}\right)^x = \left(\frac{1}{4}\right)^1$$

$$\Rightarrow \quad x = 1$$

On dividing rate (II) by rate (III) we get

$$\left(\frac{0.3}{0.3}\right)^x \left(\frac{0.2}{0.4}\right)^y = \frac{7.2 \times 10^{-2}}{2.88 \times 10^{-1}}$$

$$\left(\frac{1}{2}\right)^y = \frac{1}{4}$$

$$\Rightarrow \quad y = 2$$

$$\text{rate} = k[A]^1\,[B]^2$$

76. Option (a) is correct.

Given, $m = 0.0020$ m

$$\Delta T_f = 0°C - 0.00732°C = -0.00732°C$$

$$K_f = -1.86°C$$

$$\Delta T_f = iK_f m$$

$$i = \frac{\Delta T_f}{K_f \cdot m} = \frac{0.00732}{1.86 \times 0.0020} = 1.96 \approx 2$$

Hence, 2 moles of ions are produced.

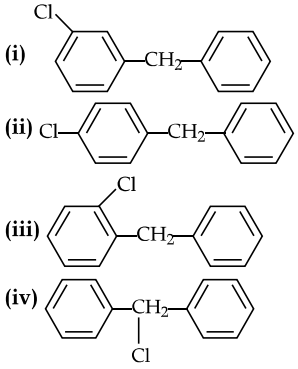
77. Option (a) is correct.

The carbanion which has more *s*-character will be more stable. Thus, the order of stability is:

$$RC \equiv \bar{C} > C_6H_5^- > R_2C = \bar{C}H > R_3C - \bar{C}H_2$$

78. Option (b) is correct.

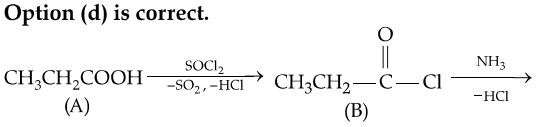
It shows four isomers in the form of mono chloro derivatives as:

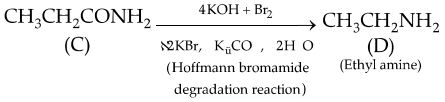


79. Option (c) is correct.
The activation energy of a reverse reaction decides whether the given reaction is exothermic or endothermic, so the energy of activation of the reverse reaction is either greater or less than 50 kcal.
On the other hand, for an exothermic reaction, the activation energy for the reverse reaction is more than the activation energy of the forward reaction and in the case of an endothermic reaction, the activation energy for the reverse reaction is less than the activation energy of the forward reaction.

80. Option (c) is correct.
The acidity of halogenated acid increases with increase in electronegativity of the halogen present.
∴ Acidity order will be:
$FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$

81. Option (d) is correct.





82. Option (c) is correct.
This reaction is known as Williamson synthesis which is the best method for the preparation of ethers.

83. Option (a) is correct.
CO_2 has zero dipole moment.

84. Option (c) is correct.
For the given value of n, the possible values of l are 0 to $n-1$. For the given value of l, the permissible value of m_l $= -l$ to $+l$. Also, for each m_l there are two values of s, *i.e.*, $+½$ and $-½$.
Thus, options **(a)**, **(b)**, and **(d)** satisfy these conditions and permissible arrangements of electrons. However in option **(c)**, $n = 3$ so possible values of l are 0, 1 and 2. Now for $l = 2$, m can have values. $-2, -1, 0, 1$, and 2 only but $m = -3$ is not possible.

85. Option (d) is correct.
$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$ $\Delta H^\circ_f = ?$

$\Delta H^\circ_f = \Sigma(\text{B.E.})_{reactants} - \Sigma(\text{B.E.})_{products}$

$= (\text{B.E.})_{H-H} + (\text{B.E.})_{Br-Br} - 2(\text{B.E.})_{H-Br}$

$= [433 + 192] - 2(364)$ kJ mol^{-1}

$= (625 - 728)$ kJ mol^{-1} $= -103$ kJ mol^{-1}

Section B

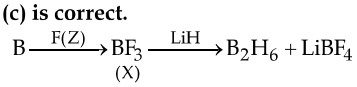
86. Option (a) is correct.
During electrlolysis of conc sulphuric acid H_2 is liberated at catode and O_2 is liberated at anode.

87. Option (c) is correct.
o-nitrophenol is weaker acid than HCO_3^-.

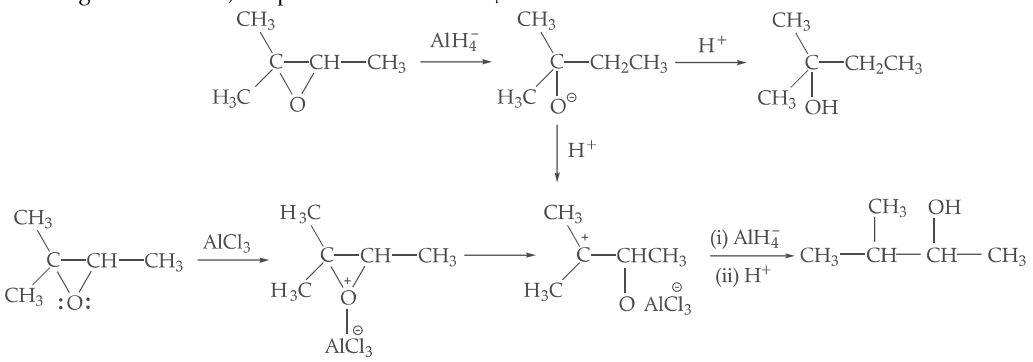
88. Option (c) is correct.
$H^+ + OH^- \rightarrow H_2O$ DH = –13.7 kcal/eq

89. Option (c) is correct.
Aquatic species are more comfortable in cold water than in warm water. This is because the solubility of oxygen increases with a decrease in temperature.

90. Option (c) is correct.



91. Option (c) is correct.



92. Option (b) is correct.
CO shows synergic bonding with metal atom where M—C bond is formed by donation of lone pair of electrons of carbonyl carbon into a vacant orbital of metal.

Also, a π bond is formed by the back donation of electrons from a filled orbital of metal to the vacant orbital of carbon monoxide.

This effect strengthens the bond and thus is a stronger complexing reagent than NH_3.

93. Option (b) is correct.
1 mole of hydrogen gas has maximum entropy as it shows maximum randomness due to less molar mass than all the given substances and also in the gas phase.

94. Option (d) is correct.
The paramagnetic octahedral complexes use outer *d*-orbitals and are thus called the spin-free or high spin complexes.

95. Option (b) is correct.
Acidic radicals caries negative charge.

96. Option (b) is correct.
Zero standard molar enthalpy of formation is possible for pure elements. Chlorine is a gas at room temperature but bromine is a liquid.

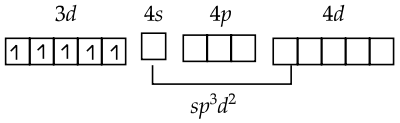
97. Option (c) is correct.
The IUPAC name of complex $K_3[Al(C_2O_4)]$ is Potassium trioxalatealuminate (III).

98. Option (d) is correct.
Among the given options, Zn does not show the variable oxidation state. This is because of completely filled *d*-orbital which do not take part in exhibiting an oxidation state.

99. Option (a) is correct.
In equation $CaF_2 + 2H_2SO_4 \rightarrow CaSO_4 + 2HF$, H_2SO_4 is not acting as an oxidising agent as it is not providing oxygen to CaF_2.

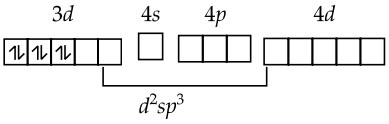
100. Option (c) is correct.
The spin only magnetic moment of given complexes are as follows:

$[MnCl_4]^{2-}$



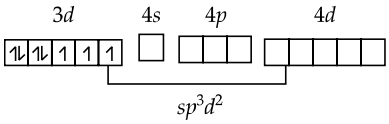
The spin magnetic moment will be 5.87 B.M.

$[Fe(CN)_6]^{4-}$



The spin magnetic moment will be 0 B.M.

$[CoCl_4]^{4-}$



The spin magnetic moment will be 3.87 BM.
Thus the correct order will be $[Fe(CN)_6]^{4-} < [CoCl_4]^{2-} < [MnCl_4]^{2-}$

BOTANY

Section A

101. Option (a) is correct.
Fragmentation is a mode of asexual reproduction that involves breaking the parent body into several fragments and each fragment develops into a new individual. Multicellular fungi, filamentous algae, and protonema of mosses show the fragments.

They have a thin thread-like multicellular vegetative structure called hyphae/filaments/protonema which under certain environmental conditions may undergo irregularly sized pieces or fragments, with each having the capacity to develop into a new fungal hyphae or the plant.

102. Option (b) is correct.
RNA enzymes are ribonucleases or ribozymes.

103. Option (d) is correct.
The *y* gene codes for permease, which increases permeability of the cell to β-galactosidase.

104. Option (d) is correct.
Ribophorins are dome shaped transmembrane glycoproteins which are located in the membrane of the rough endoplasmic reticulum.

105. Option (a) is correct.
Multi carpellary: Having many carpels

Apocarpous: The pistil is apocarpous when it has several distinct carpels, each with ovary, style, and stigma.

When many fruits which are small, each being called a fruitlet, develop from a single flower, then such fruit is called aggregate fruit or etaerio of fruitlets. Such fruit develops from multicarpellary and apocarpous ovary.

106. Option (a) is correct.
Aspergillus niger (a fungus) is used in the production of citric acid.

107. Option (b) is correct.
Dikaryophase is found in basidiomycetes and ascomycetes.

108. Option (d) is correct.
Non-**cyclic** photophosphorylation occurs in both the photosystems I and II; produce both NADPH and ATP; oxygen is released whereas Cyclic photophosphorylation happens only in the photosystem I; only ATP is produced; oxygen is not released.

109. Option (c) is correct.
The cell synthesizes the additional histones that will be needed. The centriole present in the cytoplasm also duplicates. All these take place in the S-phase.

110. Option (a) is correct.
Wind pollination also requires that the pollen grains are light and non-sticky so that they can be transported by wind currents. They often possess well-exposed stamens (so that the pollens are easily dispersed into wind currents and large often-feathery stigma to easily trap air-borne pollen grains.

111. Option (d) is correct.
Endemic species are those species which are confined to a particular area and not found anywhere else, such as species found in Wstern Ghats.

112. Option (b) is correct.
In prokaryotes, a single RNA polymerase species transcribes all types of RNA.

113. Option (b) is correct.
Cyanobacteria have structures called chromatophores. These contain the pigments necessary for photosynthesis.

114. Option (c) is correct.
An elaborate network of filamentous proteinaceous structures present in the cytoplasm is collectively referred to as the cytoskeleton.

115. Option (b) is correct.
Asexual buds produced in *Marchantia* are gemmae. Gemmae are green, haploid, and multicellular.

116. Option (d) is correct.
DNA has thymine (5-methyl uracil) in place of uracil. It provides the scope of mutation at a slow rate.

117. Option (c) is correct.
HIV-1 is composed of two copies of noncovalently linked, unspliced, positive-sense single-stranded RNA enclosed by a conical capsid composed of the viral protein p24.

118. Option (b) is correct.
Restriction sites are palindromic sequences.

119. Option (b) is correct.
The number of cells in male gametophyte decreases in the order, Bryophytes > Pteridophytes > Gymnosperms > Angiosperms. Since, *Lilium* belong to Angiosperms, the male gametophytes with least number of cells must be *Lilium*.

120. Option (c) is correct.
Initial fixation of CO_2 occurs in mesophyll cells and the primary acceptor of CO_2 is a PEP. Malic acid is then transferred to the bundle sheath cells where it gets decarboxylated to release CO_2.

121. Option (d) is correct.
Species area relationship.

122. Option (c) is correct.

Hexokinase phosphorylates glucose using ATP as the source of the phosphate, producing glucose-6-phosphate, a more reactive form of glucose.

123. Option (c) is correct.
Chloroplast contains 70S ribosome.

124. Option (b) is correct.
Genus name starts with a capital letter, species name starts with a small letter.

125. Option (d) is correct.
Nucleus, mitochondria and chloroplast are double membraned bound organelles. Lysosomes are single membrane bound organelles.

126. Option (c) is correct.
A test cross is performed to determine the genotype of a dominant parent if it is a heterozygous or homozygous-dominant. For the purpose, the hybrid is crossed with homozygous recessive parent.

127. Option (a) is correct.
Lichens are the best indicator of environmental pollution mainly SO_2. Lichen is a mutualistic association of algae and fungi. In areas of excessive SO_2 pollution, lichens cannot grow but only green algae may be seen, thus acting as an indicator for SO_2.

128. Option (d) is correct.
Floridean starch is stored food of red algae.

Gracilaria, *Gelidium*, *Polysiphonia* } Red algae

129. Option (a) is correct.
A plasmid is a small, circular double-stranded DNA molecule that is separate from the main chromosome. It is found in bacteria and some yeast.

130. Option (b) is correct.
During pachytene, crossing over occurs between the non-sister chromatids of the homologous chromosomes.

131. Option (b) is correct.
Fact.

132. Option (a) is correct.
The prime source of taxonomic studies of various species of plants, animals, and other organisms is the collection of actual specimens.

133. Option (c) is correct.
Cellulose does not contain complex helices and hence cannot hold I_2.

134. Option (c) is correct.
If overall the two frameshift mutations lead to a change of three or its multiple in the genetic code, the codons will again be in the same frame. This is an internal compensation, so intragenic suppression.

135. Option (c) is correct.
Generally, DNA is isolated for the process of recombinant DNA technology. Thus, to release DNA, bacterial cells are treated with lysozyme, fungal cells with chitinase, and plant cells with the enzyme cellulase.

Section B

136. Option (b) is correct.
Stems are unbranched in *Cycas* but branched in *Cedrus*
The gymnosperms are plants in which the ovules are not enclosed by any ovary wall and remain exposed, both before and after fertilisation. Horsetail are pteridophytes. *Sdaginella* and *salvinia* both are heterosporous.

137. Option (a) is correct.
In ginger, vegetative propagation occurs through rhizomes. Horizontal underground stem with nodes is called rhizome. From the nodes, new roots and shoots arise which give rise to new plantlets.

138. Option (b) is correct.
The ozone is found in the upper part of the atmosphere called the stratosphere, and it acts as a shield absorbing ultraviolet radiation from the sun.

139. Option (b) is correct.
Fact.

140. Option (b) is correct.
In the World Summit on sustainable development held in 2002 in Johannesburg, South Africa, 190 countries pledged their commitment to achieve by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and local levels.

141. Option (d) is correct.
Ethylene is derived from methionine.
Cytokinins are derived from adenine.
Auxins are derivatives of indole compounds.
Abscisic acid is derived from carotenoids.
The plant growth regulators (PGRs) could be indole compounds – Auxin: indole-3-acetic acid, IAA; adenine derivatives - N_6 -furfurylamino purine, kinetin/ Cytokinins; derivatives of carotenoids - Abscisic acid, ABA; terpenes - Gibberellic acid, GA_3 and from methionine - ethylene, C_2H_4.

142. Option (c) is correct.
Aerenchyma is a type of parenchyma.

143. Option (b) is correct.
The reaction center of photosystem I (PSI) is referred to as P700 where "P" stands for "Pigment" and "700" stands for the wavelength of light that this particular chlorophyll molecule absorbs most strongly. Thus, statement -I is correct.
The water splitting complex is associated with the PS II, which itself is physically located on the inner side of the membrane of the thylakoid. Thus, Statement-II is incorrect.

144. Option (c) is correct.
The ploidy level is not the same in secondary nucleus and endosperm. The two haploid polar nuclei of large central cell fuse to form diploid (2n) secondary nucleus or definitive nucleus whereas the endosperm is triploid (3n).
The ploidy level of nucellus and integuments is 2n.
The ploidy level of root tip and shoot tip is 2n.
The ploidy level of antipodals and synergids is n.

145. Option (c) is correct.
Unlike carbon and nitrogen, Phosphorus is always in short supply and hence acts as a limiting factor of the primary productivity in any ecosystem.

146. Option (b) is correct.
The correct match is as follows:-
Phytotron is a controlled condition chamber for tissue culture. It is used to study and research the effect of various environmental conditions on the growth of the plant.
Heterosis is related to hybridization. It is also known as hybrid vigor where the F1-progeny of a cross between inbreeding lines is superior to the parental lines.
Cybrid is also known as cytoplasmic hybrid or heteroplast. It is a hybrid in which the cytoplasm of two-parent cells is fused by retaining only one parental nucleus.

Totipotency is the ability of somatic cells to produce the complete organism.

147. Option (a) is correct.

The correct options are as follows:

Trait studied	Dominant	Recessive
Flower color	Violet	White
Seed shape	Round	Wrinkled
Pod color	Green	Yellow
Flower position	Axial	Terminal

148. Option (a) is correct.

Swiss cheese is formed with the help of *Propionibacterium shermanii*. This bacterium is responsible for the production of large holes in this cheese *Propionibacterium* converts lactic acid into carbon dioxide, propionic acid, and acetic acid. This CO_2 enters the cheese body and produces a large number of holes.

149. Option (b) is correct.

Out of all the given statements, three are true and only one is false it can be corrected as:-

Cannabis is a plant whose leaves, flower tops, and resins are used in various combinations for the production of marijuana, hashish, charas, and ganja. On the other hand, heroin and morphine are obtained from the opium plant.

150. Option (d) is correct.

The structure of lac operon consists of one regulatory gene (*i* gene), promoter gene (*p* gene), and three structural genes, *i.e.*, *z* gene, *y* gene, and *a* gene. In the presence of an inducer (i.e. lactose) in lac operon, the inducer binds to the repressor and forms an inactive repressor. Thus, the repressor fails to bind to the operator region.

The RNA polymerase binds to the operator and transcripts lac mRNA which further produces three enzymes, i.e., β-galactosidase, permease, and transacetylase.

ZOOLOGY

Section A

151. Option (d) is correct.

Lateral appendages, parapodia which help in swimming in *Nereis* - a member of Phylum Annelida

152. Option (c) is correct.

Hypothalamus is the region of the forebrain in the floor of the third ventricle and lies at the base of thalamus. It contains a number of centres which control body temperature, urge for eating and drinking.

153. Option (b) is correct.

'Smack' also called as brown sugar/Heroin is formed by acetylation of morphine. It is obtained from the latex of unripe capsule of Poppy plant.

154. Option (d) is correct.

A jawless vertebrate is *Petromyzon* which lays eggs in freshwater and whose ammocoetes larvae after metamorphosis return to the ocean.

155. Option (b) is correct.

Destruction of the anterior horn cells of the spinal cord would result in the loss of voluntary motor impulses because the anterior horn cells in the spinal cord contain motor neurons that affect the skeletal muscles.

156. Option (c) is correct.

Fact.

157. Option (b) is correct.

Blastopore is the pore of archenteron.

158. Option (a) is correct.

The hindbrain consists of the cerebellum, pons, and medulla oblongata.

159. Option (a) is correct.

A widely used diagnostic test for AIDS is enzyme-linked immunosorbent assay (ELISA).

160. Option (d) is correct.

The intercellular material of cartilage is solid and pliable and resists compression. Cartilage is present in the tip of nose, outer ear joints, between adjacent bones of the vertebral column, limbs and hands in adults.

161. Option (b) is correct.

MTPs are considered relatively safe during the first trimester, *i.e.*, upto 12 weeks of pregnancy.

162. Option (d) is correct.

Lung surfactant is secreted by Type-II pneumocytes which are also known as the alveolar type-II epithelial cells (AT-II). These cells line the alveolar compartment of the lungs and are essential for the exchange of gases and for maintaining the structural integrity of alveoli.

163. Option (b) is correct.

Both humans and adult frogs excrete urea and hence both exhibit a ureotelic mode of excretion.

164. Option (d) is correct.

Bartholin's gland is a female accessory gland.

165. Option (a) is correct.

Biopiracy refers to exploring molecular genetic and species level diversity for products of economic importance withouth proper authorisation and compensatory payments.

166. Option (d) is correct.

Parents $I^Ai \times I^Bi$

Offsprings I^AI^B, I^Ai, I^Bi, ii

AB A B O

167. Option (b) is correct.

Brush-bordered columnar epithelium	Secretion and absorption
Simple squamous epithelium	Diffusion boundary
Compound epithelium	Protection against chemical and mechanical stresses

168. Option (d) is correct.

Among animals, insects are the most species rich taxonomic group, making up more than 70 per cent of the total.

169. Option (b) is correct.

Emphysema means inflated or full of hair. Emphysema is caused by cigarette smoking. Loss of elasticity of alveolar wall.

170. Option (d) is correct.

Labia majora in female external genitalia is homologous to the scrotum of male external genitalia.

171. Option (d) is correct.

Meselson and Stahl's experiment is based on the semi-conservative replication of the DNA. It means that when a parental DNA undergoes replication, each strand of the parental DNA serves as a template and the new daughter

strand is synthesized on the template strand. Keeping the semi-conservative replication in view, and starting with DNA strands having ^{15}N and thereafter ^{14}N, after the fourth generation there will be 0 strands having ^{15}N ^{15}N , two strands having ^{15}N ^{14}N and ^{14}N strands having ^{14}N ^{14}N. So the ratio comes out to be 0 : 1 : 7.

172. Option (a) is correct.
Myelin or medullary sheath is produced by Schwann cells and oligodendrocytes. In the peripheral nervous system, Schwann cells form the myelin sheath around the axon while oligodendrocytes produce this sheath in the central nervous system.

173. Option (d) is correct.
Amniocentesis is used to check for any genetic abnormality of the foetus.

174. Option (d) is correct.
Estrogen is an ovarian hormone.

175. Option (c) is correct.
The man's father being colorblind has normal vision as he has a Y chromosome from his father and an X from his mother. His wife's mother was colorblind and her father was normal, so she must be a carrier of the trait. Their cross will produce

	Normal carrier female X^CX	Normal eyed male XY
♀ \ ♂	X	Y
X^C	X^CX	X^CY
X	XX	XY

50% of male children who will be colorblind.

176. Option (a) is correct.
Taenia belonging to phylum Platyhelminthes do not show tube within the tube plant.
Tube-within a tube body plan means that the animal body consists of two tubes, one formed by the body wall and second formed within it by the digestive tract. Mouth and anus are present at two separate ends of digestive system. This type of body plan is found in *Ascaris*, *Pheretima* and Leech.

177. Option (a) is correct.
CO_2 trapped as bicarbonate at the tissue level and transported to the alveoli is released out as CO_2.

178. Option (c) is correct.
Human development stage shown in the figure is Blastocyst. It occurs in the uterine wall in a pregnant woman.

179. Option (d) is correct.
Insulin used for diabetes was earlier extracted from pancreas of slaughtered cattle and pigs.

180. Option (b) is correct.
Fovea is a tiny pit in the macula of the retina that provides clearest vision of all.

181. Option (b) is correct.
The primary movement at the pivot joint is rotation. Two bones articulate with each other where end of one bone is rounded or pointed which fits into a shallow depression of the other bone. The rounded end of the bone is fixed or stationary whereas the other bone rotates over it *e.g.*, the joint between the radius and ulna just below the elbow and between atlas and axis.

Gliding joint - between tarsal and carpals. **Saddle joint** - between carpals and metacarpal of the human thumb.

Hinge joint - elbow joint, knee joint.

182. Option (c) is correct.
Genetic mode of sex determination is seen in eukaryotic microorganisms. In this case, there is no separate chromosome but the allele at the gene locus determines sex.

183. Option (a) is correct.
Out of the given pairs of hormones, two pairs are antagonistic (having opposite effects) to each other. These pairs are Insulin - Glucagon, and Calcitonin – Parathormone. In the pair of Insulin and Glucagon, Insulin lowers the blood sugar level while glucagon raises the level of blood sugar. In the other pair, Calcitonin reduces the level of calcium in the blood while Parathormone increases the level of calcium in the blood.

184. Option (b) is correct.
Only option **(b)** is incorrect and the rest other options are correct. The incorrect option is corrected as –

The middle ear opens into the Eustachian tube, which connects with the pharynx and maintains the pressure on either side of the tympanic membrane (eardrum).

185. Option (d) is correct.
The globular head has a site for binding actin and ATP. The globular head acts as an ATPase enzyme.

Section B

186. Option (d) is correct.
Neanderthal man used hides to protect their body and buried their dead.

187. Option (a) is correct.
The Atrioventricular (AV) valve in the frog's heart prevents the backflow of blood from the ventricle into the atria and is located between the atria, ensuring unidirectional blood flow.

188. Option (c) is correct.
The similarity in appearance and function is not necessary. The organs which have a common origin, embryonic development, and the same basic structure but perform different functions are called homologous organs.

189. Option (c) is correct.
Paget's disease is a disorder of bone and it is also known as Osteitis deformans. In this disease, bone resorption is very excessive as compared to normal and this is because of the highly active osteoclasts. To balance this issue, osteoblasts try to make new bones but they overreact and make an excessive amount of bones that are abnormally large, deformed, and fit together haphazardly.

190. Option (d) is correct.
Inner to cranium of the skull are the three protective membranes called meninges that protect the brain. Pia mater is the innermost delicate, highly vascular membrane which lies in close contact with the brain in humans.

191. Option (b) is correct.
Condition with increase in the number of RBCs is called polycythemia and with decrease in number of RBCs is called as erythrocytopenia. The process of formation of RBCs is called erythropoiesis.
Erythroblastosis fetalis, also called hemolytic disease of the newborn, in which the erythrocytes of a fetus are destroyed in a maternal immune reaction resulting from a blood group incompatibility between the fetus and its mother.

192. Option (b) is correct.
Anoxia is the possible reason for person's death. In anoxia, the brain or body completely loses its oxygen and ultimately severe injuries occur in the brain or body which permanently damage the brain and leads to death.

Anoxia is usually a result of hypoxia, in which a partial lack of oxygen occurs in body tissues. On the other hand, Pleurisy is a condition in which pleura (thin layers of tissue that separate the lungs from the chest wall) becomes inflamed.

Tachypnea is the biological term for rapid shallow breathing.

193. Option (a) is correct.
Brunner's glands perspire alkaline liquid comprised of mucin.

194. Option (c) is correct.
The treatment of sewage is mainly carried out in two stages, *i.e.*, primary and secondary but in some cases, the tertiary stage is also involved.
In primary treatment, initially floating debris is removed by sequential filtration. Then, the grit (small pebbles and soil) are removed by sedimentation. After the removal of suspended materials, primary effluent is taken for secondary treatment.
In secondary treatment, microbes are involved. The primary effluent is treated till the BOD is reduced and after the digestion of organic matter, the secondary effluent is passed to the next stage.
In tertiary treatment, removal of nitrates and phosphates is done with the help of precipitation technique and pure water is then released into natural water bodies like rivers and streams.

195. Option (b) is correct.
Enzymes that cut the phosphodiester bonds of polynucleotide chains are called nucleases. These are of two types – exonuclease and endonuclease.

196. Option (b) is correct.
Miller made an instrument of glass tubes and flasks in a laboratory where the ratio of methane, hydrogen, and ammonia in the big flask stood 2: 2: 1.

197. Option (a) is correct.
Cross overvalue or the frequency of recombination is calculated by using the formula.

$$\frac{\text{Number of Recombinants}}{\text{Total number of Progeny}} \times 100$$

198. Option (b) is correct.
Out of the given options, (ii) and (iii) are incorrectly matched. *Plasmodium* malariae cause quartan malaria and *Plasmodium vivax* cause benign tertian malaria. Rest other options are correctly matched.

199. Option (d) is correct.
The time interval from the invasion of a pathogen to the development of clinical manifestations, is known as Incubation period.

200. Option (a) is correct.
The human genome is said to have approximately 3×10^9 bp and if the cost of sequencing is US $3 per bp and the total cost would be about the US $9 billion approximately.

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