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## NEET (UG) – 2021

### MOCK TEST -13

#### Solution

#### PHYSICS (SEC-A)

1. (4) Here  $m = 4 \text{ kg}$ ;  $k = 800 \text{ Nm}^{-1}$ ;  $E = 4 \text{ J}$

In SHM,  $E = \frac{1}{2}kA^2$

$$\therefore 4 = \frac{1}{2} \times 800 \times A^2$$

$$A^2 = \frac{8}{800} = \frac{1}{100}, A = 0.1 \text{ m}$$

Maximum acceleration,  $a_{\text{max}} = \omega^2 A$

$$= \frac{k}{m} A \left( \because \omega = \sqrt{\frac{k}{m}} \right)$$

$$= \frac{800 \text{ Nm}^{-1}}{4 \text{ kg}} \times 0.1 = 20 \text{ ms}^{-2}$$

2. (1)

3. (4)  $h\nu = \phi + \frac{1}{2}mv^2 \Rightarrow h\nu = \phi + \text{K.E.}$

$$v = \phi + \frac{1}{h} \text{K.E.}$$

This equation of a straight line, if we plot  $v$ , K-E curve.

The slope of the curve is  $\frac{1}{h}$  which is constant. So, it is independent of metal used.

4. (2) After 3 sec its velocity

$$v = u + gt = 0 + (10).(3) = 30 \text{ m/s}$$

$$\text{K.E.} = \frac{1}{2}mv^2 = \frac{1}{2} \times 3 \times 900 = (450).(3) = 1350 \text{ J}$$

5. (3)  $3\alpha = x(2\alpha)$

[Here,  $\alpha$  is coefficient of linear expansion so coefficient of cubical expansion =  $3\alpha$  and coefficient of superficial expansion =  $2\alpha$ ]

$$x = \frac{3}{2} = 1.5$$

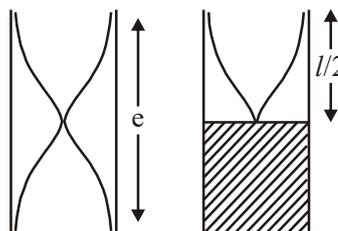
6. (2) For a minimum deviation, incident angle is equal to emerging angle.

$\therefore$  QR is horizontal

7. (3) 13.6 eV energy needed to liberate the electron from hydrogen atom. So, electron will liberate with kinetic energy

$$= 15 - 13.6 = 1.4 \text{ eV}$$

8. (3)



From the figure, it is clear that in both the cases wavelength is same. So, frequency of fundamental tone will also be same. Hence the answer will be (3).

9. (3) Since no external torque act on gymnast, so angular momentum ( $L = I\omega$ ) is conserved. After pulling her arms & legs, the angular velocity increases but moment of inertia of gymnast, decreases in, such a way that angular momentum remains constant.

$$10. (3) \quad C = C_v + \frac{R}{1-x} = \frac{f}{2}R + \frac{R}{1-x} = \frac{3}{2}R + \frac{R}{1-1/3}$$

$$\Rightarrow \frac{3}{2}R + \frac{3}{2}R = 3R$$

11. (3) Time period,

$$T_1 = 2\pi\sqrt{LC}, T_2 = 2\pi\sqrt{\frac{LC}{2}}, T_3 = 2\pi\sqrt{2LC}$$

Clearly,  $t_2 < t_1 < t_3$

12. (2)

13. (4) Due to malfunctioning of engine, the process of rocket fusion stops hence net force experienced by the spacecraft becomes zero. Afterwards the spacecraft continues to move with a constant speed.

14. (3) We shall apply conservation of angular momentum; that is

$$I_1\omega_1 = I_2\omega_2$$

$$\Rightarrow mv_1r_1 = mv_2r_2 \Rightarrow \omega_1r_1^2 = \omega_2r_2^2$$

$$\Rightarrow 44 \times (0.8)^2 \Rightarrow \omega_2 \times (1)^2$$

$$\Rightarrow \omega_2 = 44 \times 0.8 \times 0.8 = 28.16 \text{ radian/sec}$$

15. (4) Heat produced,  $H = \frac{V^2t}{R}$ . When voltage is halved,

the heat produced becomes one fourth. Hence time taken to heat the water becomes four times.

$$16. (2) \quad K = \frac{P^2}{2m} \Rightarrow P = \sqrt{2Km}$$

as K is made four times P will become two times.

17. (1) Energy stored in an inductor

$$= \frac{1}{2}Li^2 = [ML^2T^{-2}]$$

18. (2) Terminal velocity,

$$v_0 = \frac{2r^2(\rho - \rho_0)g}{9\eta}$$

$$= \frac{2 \times (2 \times 10^{-3})^2 \times (8 - 1.3) \times 10^3 \times 9.8}{9 \times 0.83} = 0.07 \text{ ms}^{-1}$$

19. (4) As capacitor offers infinite resistance in dc-circuit. So, current flows through  $2 \Omega$  resistance from left to right, given by

$$I = \frac{V}{R+r} = \frac{2.5 \text{ V}}{2+0.5} = \frac{2.5}{2.5} = 1\text{A}$$

So, the potential difference across  $2\Omega$  resistance

$$V = IR = 1 \times 2 = 2 \text{ volt}$$

Since, capacitor is in parallel with  $2\Omega$  resistance, so it also has 2V potential difference across it.

As current does not flow through capacitor branch so no potential drop will across  $10\Omega$  resistance. The charge on capacitor

$$q = CV = (4 \times \mu\text{F}) \times 2\text{V} = 8\mu\text{C}$$

$$20. (2) \text{ Stress} = \frac{F}{A} = \frac{400 \times 4}{\pi d^2} = 379 \times 10^6 \text{ N/m}^2$$

$$\Rightarrow d^2 = \frac{400 \times 4}{379 \times 10^6 \pi}$$

$$d = 1.15 \text{ mm}$$

21. (4)

22. (1) For Lyman series

$$\frac{1}{\lambda} = R \left[ \frac{1}{1^2} - \frac{1}{n^2} \right]$$

For shortest wavelength,  $n = \infty$

$$\therefore \frac{1}{\lambda^2} = R \Rightarrow \lambda_1 = \frac{1}{R}$$

$$\text{For Balmer series } \frac{1}{\lambda^2} = R \left[ \frac{1}{2^2} - \frac{1}{n^2} \right]$$

For shortest wavelength,  $n = \infty$

$$\therefore \frac{1}{\lambda^2} = \frac{R}{4} \Rightarrow \lambda_2 = \frac{4}{R}$$

$$\text{The ratio } \frac{\lambda_2}{\lambda_1} = \frac{4}{1}$$

23. (1)

$$24. (2) \quad m_1 = 1, m_2 = \frac{f}{u-f} = \frac{f}{5f-f} = \frac{3}{2}$$

$$\Rightarrow \frac{\Delta v}{\Delta u} = m_x = m_1 m_2 \Rightarrow \Delta v = \frac{2}{2} \times \frac{3}{3} = \frac{f}{2}$$

25. (1) The person suffers from short-sightedness because he is unable to see object at normal distance but can see objects at nearer distance. He will require concave lens. Things placed at 30 cm will appear to be placed at 10 cm.

So,  $u = 30$ ;  $v = 10$ ;  $f = ?$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow -\frac{1}{10} + \frac{1}{30} = \frac{1}{f}$$

$$\Rightarrow \frac{-3+1}{30} = \frac{1}{f} \Rightarrow f = -\frac{30}{2} = -15 \text{ cm}$$

26. (2)

27. (1) Let  $m$  be the mass of steam condensed. Then

$$m \times 540 + m \times 10 = 22 \times 70$$

$$\therefore m = 2.8 \text{ gm}$$

28. (3) 

The length of the rod ( $L$ )

$$= 0.2 = \frac{\lambda}{2} \Rightarrow \lambda = 0.4 \text{ m}$$

$\therefore$  the glass velocity of the sound in gas ( $v$ ),

$$= v \times \lambda = 4000 \times 0.4 = 1600 \text{ m/s}$$

29. (2) 

$$\frac{1}{F} = \frac{2}{f_l} + \frac{1}{f_m} = \frac{2}{60} + \frac{1}{30} = \frac{1}{30} + \frac{1}{30} = \frac{2}{30} \therefore F = 15 \text{ cm}$$

30. (2) A galvanometer can be changed into an ammeter by the use of low resistance in parallel. So that ammeter does not draw much current which may change the magnitude of main current.

31. (2) Loss in potential energy = Gain in kinetic energy

$$-\frac{GMm}{R} - \left( -\frac{3}{2} \frac{GMm}{R} \right) = \frac{1}{2} mv^2$$

$$\Rightarrow \frac{GMm}{2R} = \frac{1}{2} mv^2 \Rightarrow v = \sqrt{\frac{GM}{R}} = \sqrt{gR}$$

32. (1) The highest energy level occupied by an electron in the energy band at zero kelvin is called Fermi level and the energy associated is known as Fermi energy. So, it is independent of  $T$

33. (3) Weight of metal disc = buoyancy + force due to surface tension =  $W + 2\pi r T \cos\theta$

34. (1)  $I_{\max} = \frac{e}{r+R} = \frac{10}{0.5+0.5} = 10 \text{ Amp}$ , (where  $R = r$ )

$$P_{\max} = I_{\max}^2 \times R = 100 \times \frac{1}{2} = 50 \text{ W}$$

35. (2)  $\eta = 1 - \frac{Q_c}{Q_H} = 1 - \frac{600}{1000} = \frac{400}{1000} = \frac{40}{100} = 40\%$

$$\text{and } 1 - \frac{T_c}{T_H} = \frac{40}{100}$$

$$\frac{T_c}{T_H} = \frac{60}{100} \Rightarrow T_c = 400 \times \frac{60}{100} = 240 \text{ K} = 240 - 273 = -33 \text{ }^\circ\text{C}$$

### PHYSICS (SEC-B)

36. (4) As angular momentum,  $\vec{L} = \vec{r} \times \vec{p}$ , therefore direction of  $\vec{L}$  is along a line perpendicular to the plane of rotation.

37. (2) Kirchhoff's 1st law states that the algebraic sum of current (charges) meeting at the junction is zero or  $\sum i$  or  $\sum q = 0$ , hence, it is based on the conservation of charge.

Kirchhoff's 2nd law states that algebraic sum of the products of resistance and respective current in a closed mesh is zero.  $\sum iR = \sum E$ , hence, it is based on the conservation of energy.

38. (4) Eddy current is the current produced in the body of a conductor due to electromagnetic induction. Moving coil galvanometer, electric brakes and induction motor based on electromagnetic induction. Hence they used eddy current. Dynamo doesn't use it.

39. (4) When charged particle enters perpendicularly in a magnetic field, it moves in a circular path with a constant speed. Hence its kinetic energy also remains constant.

40. (2)

41. (1)

$$42. (1) \quad \phi = \vec{E} \cdot \vec{A} = \left( \frac{3}{5} E_0 \hat{i} + \frac{4}{5} \hat{j} \right) \cdot A \hat{i} = \left( \frac{3}{5} E_0 \right) (A)$$

$$= \frac{3}{5} \times 2 \times 10^3 \times 0.2 = 240 \text{ Nm}^2 \text{c}^{-1}$$

43. (1) Given,

Number of turns,  $N = 1000$

Face area,  $A = 4 \text{ cm}^2 = 4 \times 10^{-4} \text{ m}^2$

Change in magnetic field,  $\Delta B = 10^{-2} \text{ wbm}^{-2}$

Time taken,  $t = 0.01 \text{ s} = 10^{-2} \text{ sec}$

Emf induced in the coil,  $e = ?$

Applying formula,

Induced emf,

$$e = \frac{-d\phi}{dt} = N \left( \frac{\Delta B}{\Delta t} \right) A \cos \theta$$

$$= \frac{1000 \times 10^{-2} \times 4 \times 10^{-4}}{10^{-2}} = 400 \text{ mV}$$

44. (1) At series resonance frequency  $\omega_0 = \frac{1}{\sqrt{LC}}$  current is maximum

At parallel circuit  $\omega_0 = \frac{1}{\sqrt{LC}}$  current is minimum

$$45. (3) t = k(\sqrt{h_1} - \sqrt{h_2})$$

$$\therefore t_1 = k \left( \sqrt{h} - \sqrt{\frac{h}{2}} \right)$$

$$\text{and } t_2 = k \left( \sqrt{\frac{h}{2}} - 0 \right)$$

$$\therefore \frac{t_1}{t_2} = \sqrt{2} - 1$$

46. (1) fringes pattern shifting  $\Delta x = \frac{\beta}{\lambda} (\mu - 1)t$

$$= \frac{\beta}{5000 \times 10^{-10}} \times (1.5 - 1) \times 2 \times 10^{-6}$$

$$= \frac{\beta}{5 \times 10^{-7}} \times 10^{-6} = \frac{\beta}{5} \times 10 = 2\beta$$

$$47. (4) \frac{mv^2}{r^2} = Bqu \therefore mv = Bqr \quad \therefore \lambda = \frac{h}{p} = \frac{h}{Bqr} \propto \frac{1}{q}$$

$$\therefore \frac{\lambda_x}{\lambda_p} = \frac{q_p}{q_a} = \frac{1}{2}$$

48. (2) Angular momentum,  $mvr = I\omega$

Moment of Inertia (I) of cubical block is given by

$$I = m \left( \frac{R^2}{6} + \left( \frac{R}{\sqrt{2}} \right)^2 \right)$$

$$\therefore \omega = \frac{m \cdot 2 \frac{R}{2}}{m \left[ \frac{R^2}{6} + \left( \frac{R}{\sqrt{2}} \right)^2 \right]}$$

$$\Rightarrow \omega = \frac{12}{8R} = \frac{3}{2 \times 0.3} = \frac{10}{2} = 5 \text{ rad/s}$$

49. (2) Force of interaction

$$F = -\frac{du}{dr} = -\frac{k}{r^3} = -Ve \text{ (attractive force)}$$

$$\text{central force} \quad \frac{mv^2}{r} = \frac{k}{r^3} \quad \therefore mv^2 = \frac{k}{r^2}$$

$$k.E = \frac{1}{2} mv^2 = \frac{k}{2r^2}, \quad E_T = E_K + E_P = 0$$

50. (3) Heat required to boil water

$$= mc\Delta\theta$$

$$= 2 \times 4200 \times (100 - 20)$$

$$= 6.72 \times 10^3 \text{ J}$$

If t be the time of boil then

$$\eta \times 500 \times t = 6.72 \times 10^3$$

$$\text{or, } t = \frac{6.72 \times 10^3}{0.8 \times 500} = 28 \text{ minutes}$$

### CHEMISTRY (SEC-A)

51. (2)
52. (2) Ans 'a' against Hund's rule. Ans 'b' is against Aufbau principle.
53. (2)
54. (2)
55. (3)
56. (1)
57. (2)
58. (3)  $K_p = \frac{p_c}{p_A \times p_B} = \frac{0.30}{0.15 \times 0.1} = 20$
- Again,  $K_p = \frac{p_c}{p_A \times p_B}$
- Or,  $20 = \frac{p_c}{0.3 \times 0.2}$
- Or,  $p_c = 1.2$
59. (1)  $[H^+] = K_a \frac{[\text{Acid}]}{[\text{Salt}]}$
- $\therefore [H^+] = K_a$
- On 50% neutralisation,  $[\text{Acid}] = [\text{Salt}]$ ,
- Or,  $K_a = 10^{-5}$ .
60. (4)
- CaOCl<sub>2</sub> is infact  $\overset{+2}{Ca}(\overset{+1}{OCl})\overset{-1}{Cl}$
61. (3)
62. (3)
63. (2) I and III have complete octet on each atom. III is less stable than I because less electronegative carbon has negative charge. IV is less stable than II because IV has -ve charge on less electronegative carbon. In II and IV octet is not complete of all the atom.
64. (2)
65. (3)
66. (3) Moles of X =  $\frac{4}{40} = 0.1$
- Atoms =  $0.1 \times N_A$
- One bcc unit cell has 2 atoms.
- Therefore, number of unit cells =  $\frac{0.1 \times N_A}{2}$
67. (2)
68. (3)
- For reaction (1)  $\Delta G_1^\circ = -nFE_1^\circ = -F(0.77)$
- For reaction (2)  $\Delta G_2^\circ = -nFE_2^\circ = -3F(-0.04)$
- For required reaction (3)  $\Delta G_3^\circ = -nFE_3^\circ = -2FE_3^\circ$
- But required reaction = Eq. (2) - Eq. (1)
- $\therefore \Delta G_3^\circ = \Delta G_2^\circ - \Delta G_1^\circ$
- Or,  $2E_3^\circ = -0.12 - 0.77$
- Or,  $E_3^\circ = -0.445 \text{ V}$
69. (2) For a first order reaction  $t_{1/2}$  does not depend upon the concentration  $[A]_0$  of the reactant. For a first order reaction,  $t_{1/2} = \frac{2.303}{k} \log 2 = \frac{0.693}{k}$
70. (2) In answer (2) metal oxide is being converted into metal by carbon.
71. (1)
72. (2) Acidic strength increases with the increase in the electronegativity of halogen atom, i.e.,  $\text{HClO}_4 > \text{HBrO}_4 > \text{HIO}_4$
73. (4)
74. (4)
75. (2) Yb is an element of 4d series. La is an element of 5d series. The ionic radius of  $\text{Yb}^{3+}$  is lowest. The element Lu and Eu are elements of 4f series. Their ionic radii decreases with the increases in atomic number due to lanthanide contraction.
76. (3) Fe atom has  $3d^6 4s^2$  configuration. These 8 electrons get paired and occupy four d-orbitals. Two d-orbitals remain vacant. Hybridisation on Fe atom is  $d^2 sp^3$ .
77. (2)  $S_N1$  reaction proceeds in two steps. A planar carbonium ion is formed. This will give both d- and l-forms. A racemic mixture is formed.
78. (3) Read the preparation of phenol;
79. (3)  $\text{CH}_3\text{COOC}_2\text{H}_5$  gives acetone. It again reacts with  $\text{CH}_3\text{MgBr}$  and forms  $(\text{CH}_3)_3\text{C}-\text{OH}$ .
80. (3)

81. (4)

82. (1)  $H_2$  reacted =  $\frac{0.1 \times 20}{100} = 0.02$  mole

HI formed = 0.04 mole

Mass of HI formed =  $0.04 \times 128 = 5.12$  g

83. (2)

84. (3) Except (3) all have  $(4n + 2) \pi$ -electrons. Structure (3) has  $4\pi$ -electrons.

85. (3) Earlier rate =  $k[A]^n [B]^m$

New rate =  $k[2A]^n [B/2]^m$

$$\frac{\text{New rate}}{\text{Earlier rate}} = \frac{[2A]^n [B]^m}{2^m [A]^n [B]^m} = 2^{(n-m)}$$

### CHEMISTRY (SEC-B)

86. (3)

87. (3)

88. (1)

89. (2)

90. (2)

91. (3)

92. (1)

93. (4) In natural rubber, configuration at all double bonds is *cis*.

94. (3)

95. (1)

96. (3)

97. (1)

98. (1) In answer (a)— $SO_2NHCH_3$  has one acidic H-atom which forms sodium salt with NaOH and dissolves in it.

99. (4)

100. (2)

### BOTANY (SEC-A)

101. (2) Phycomycetes are characterised by the presence of coenocytic multinucleate and branched mycelium. They are lower fungi, which typically form a non-septate mycelium.

102. (4) *In situ* conservation is the process of conserving biodiversity, where all living species, mainly the wild and endangered species are saved in their natural habitat and environment. This includes biosphere reserves, national parks, wildlife sanctuaries, etc.

103. (1) Root and shoot tip of an actively growing plant has high meristematic activity. The cells in this region are highly active and keep dividing. So, the cells do not get differentiated to epidermal tissue, so epidermis is absent in root and shoot tips.

104. (1) Fusion gametes is called syngamy.

105. (1) The method of producing thousands of plants in very short time through tissue culture is called micropropagation.

106. (1) According to Chargaff's rule, for a double standard DNA, the ratio between adenine and thymine and guanine and cytosine are constant and equals one ( $A+G = C+T$ ). It also states that in natural DNA, the base ratio  $A/T$  is close to unity and  $C/G$  is also close to unity. Whereas, the  $A+T/G+C$  ratio is species specific and it is constant for a particular species and varies between the species.

107. (4) Incomplete or partial or intermediate dominance is observed when a red-flowered plant of *Mirabilis jalapa* is crossed with white-flowered plants. The plants in of  $F_1$  generation have pink flower and on selfing, with pink-flowered plants, the red, pink, and white-flowered plants are produced in 1:2:1 genotypic as well as phenotype ratio in the  $F_2$  generation.

108. (4) During double fertilization triple fusion occurs i.e., the fusion of two polar bodies with secondary male nucleus takes place. This results in the formation of triploid primary endosperm nucleus. This is the characteristic feature of angiosperm.

109. (1) Boron is the micronutrient for plants, present in the soil in very small amounts. It is absorbed from the soil in the form of boric acid ( $H_3BO_3$ ) and tetraborate anions. Boron is required for pollen germination, seed germination and cell differentiation.

110. (4) NCERT (XII) Ch-16, Page-276

The highest DDT concentration in aquatic food chain shall in seagull.

111. (1) The complete degradation of a molecule of glucose produces molecules of NADPH in the Hexose monophosphate pathway.

112. (2) Cytochromes are proteins with characteristic strong absorption of visible light due to their iron-containing heme prosthetic groups. Mitochondria contain three classes of cytochromes designated a, b and c distinguished by difference in their light absorption spectra. The cytochrome of type a and b and some of type c are integral proteins of inner mitochondrial

membrane. The sequence of electron carriers in ETS is:

$\text{NADH} \rightarrow \text{Q} \rightarrow \text{Cyt } b \rightarrow \text{Cyt } c_1 \rightarrow \text{Cyt } c \rightarrow \text{Cyt } a \rightarrow \text{Cyt } a_3$

- 113.** (2) During photosynthesis one Calvin cycle takes in only one carbon (as  $\text{CO}_2$ ) at a time so, it takes six turns of the cycle to produce six-carbon compound (glucose). For the formation of one molecule of hexose sugar (glucose) 18 ATP and 12  $\text{NADPH}_2$  are used, whereas 30 ATP and 12  $\text{NADPH}_2$  are used during the  $\text{C}_4$  cycle. These ATP and  $\text{NADPH}_2$  (assimilatory power) are produced during the light reaction of photosynthesis.
- 114.** (1) The primary  $\text{CO}_2$  fixation product in the  $\text{C}_4$  cycle is oxaloacetic acid (OAA) in the mesophyll cells. It then forms the other 4-carbon compound malic acid in the mesophyll cells itself, which is then transported to the bundle sheath cells.
- 115.** (1) Plastocyanin is a copper-containing protein involved in electron-transfer. In photosynthesis, plastocyanin functions as an electron transfer agent between cytochrome of the cytochrome  $b_6/f$  complex from photosystem-II and  $\text{P}_{700}$  from photosystem-I. Cytochrome  $b_6/f$  complex and  $\text{P}_{700}$  are both membrane-bound proteins with exposed residues on the lumen-side of the thylakoid membrane of chloroplasts. Cytochrome  $f$  acts as an electron donor while  $\text{P}_{700}$  accepts electrons from reduced plastocyanin.
- 116.** (3) The primary acceptor of  $\text{CO}_2$  in  $\text{C}_4$  plants is Phosphoenolpyruvate or PEP. PEP in mesophyll cells combine with  $\text{CO}_2$  and converted into 4 carbon compound oxaloacetic acid by PEP carboxylase. In  $\text{C}_3$  plant ribulose 1, 5-diphosphate is the primary acceptor of  $\text{CO}_2$ .  
In the Krebs cycle, oxaloacetic acid combines with acetyl Co- A to form the first stable product called citric acid.
- 117.** (3) Crossing over is the exchange of genetic material between homologous chromosomes, which occurs during prophase I of meiosis and is called synapsis. The homologous chromosomes line at equator in pairs during metaphase-I and the sister chromatids migrate towards opposite poles during anaphase-I.
- 118.** (3) Plants obtain their carbon and most of their oxygen from  $\text{CO}_2$  in the atmosphere.
- 119.** (1) DNA replication occurs in the S phase of the cell cycle. S phase, or synthesis is the phase of the cell cycle when DNA packaged into chromosomes is replicated.

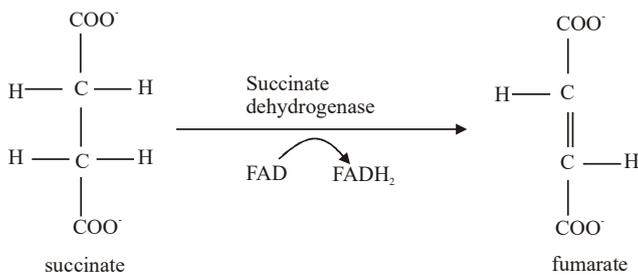
- 120.** (4) NCERT (XI) Ch-11, Page-192

In girdling - ringing experiments, a ring of bark is cut from the stem. It also removes phloem nutrients collect above the ring where the bark also swells up and may give rise to adventitious roots. The tissues below the ring (roots) show stoppage of growth and begin to shrivel.

- 121.** (2) Plasmodesmata are plasma membrane-lined pores that span the adjoining walls of plant cells. The symplast pathway is where water moves from cell to cell in the cytoplasm via the plasma membranes and plasmodesmata.
- 122.** (3) *Monotropa* is a saprophytic plant, whereas *Nepenthes*, *Sarracenia*, *Drosera*, and *Utricularia* are insectivorous plants.
- 123.** (2) The most important function of the inflorescence is to make the flower more conspicuous to pollinating agents (insects/birds) so that chances of cross-pollination are high.
- 124.** (4) The sporangia produce spores by meiosis in spore mother cells. The spores germinate to give rise to inconspicuous, small but multicellular, free-living, mostly photosynthetic thalloid gametophytes called prothallus.
- 125.** (3) Shape and number of chloroplast in a different member of algae is different.  
*Chlamydomonas* – cup-shaped, 1/cell  
*Zygnema* – Stellate. 2/ cell  
*Spirogyra* – Spiral, 1/cell  
*Ulothrix* – Collar shaped, 1/cell
- 126.** (4) Halophiles are organisms that thrive in high salt concentrations. They are a type of extremophile organisms. The name comes from the Greek word for “salt-loving”, as they survive in extremely saline conditions.
- 127.** (4)
- 128.** (3) In ferns, spores germinate to form a prothallus. Ferns are known as homosporous plants. The sporangia are usually in clusters known as sori, found on the underside of the fern leaves. Some ferns have a covering over the sporangia known as an indusium. When the spores are mature, they are released from the sporangia. If a spore lands on a suitable site, it will germinate and grow via mitosis into a mature gametophyte plant (prothallus). A gametophyte is a plant that produces gametes.
- 129.** (3) Sporophytic generation is represented only by the one-celled zygote. There are no free-living sporophytes.

Meiosis in the zygote results in the formation of haploid spores. The haploid spores divide mitotically and form the gametophyte. The dominant, photosynthetic phase in such plants is the free-living gametophyte. This kind of life cycle is termed as haplontic. Many algae such as *Volvox*, *Spirogyra* and some species of *Chlamydomonas* represent this pattern.

130. (3)



131. (1) Abscisic acid acts as a growth inhibitor and includes dormancy of buds towards the approach of winter. Dormancy of seeds is mainly caused by abscisic acid. Because of its action in inducing dormancy abscisic acid (ABA) is also called dormin. The buds, as well as seeds, sprout only when abscisic acid is overcome by gibberellins.

132. (3) In tissue culture, differentiation of shoot is controlled by high cytokinin: auxin ratio, while high auxin: cytokinin ratio is responsible for root formation.

133. (4) Wind pollinated flowers have generally single ovule in each ovary.

134. (3) The number of chromosomes in root cells is  $2n$ , while it is in synergid cells because it develops by reductional division. Root cells are diploid in nature and thus has  $2n = 14$ . Whereas, synergids are haploid,  $n = 7$ .

135. (1) The repressor is a protein produced by the regulator gene in the operon, which binds to the operator and stops the RNA polymerase to transcribe the structural genes. Hence, the repressor acts negatively in controlling the gene expression.

### BOTANY (SEC-B)

136. (4) The primary transcripts of eukaryotes (hn RNA) contain both the exons and the introns and are non-functional. Here, it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order. hnRNA undergoes additional processing called as capping and tailing. In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of hnRNA. In tailing, adenylate residues (200-300) are added at 3'-end in a template-

independent manner. It is the fully processed hnRNA, now called mRNA, that is transported out of the nucleus for translation.

137. (1) In several fungi and plants, terms such as homothallic and monoecious are used to denote the bisexual condition and heterothallic and dioecious are the terms used to describe unisexual condition.

138. (3) It is possible to induce mutations artificially in crop plants through the use of chemicals or radiations (like gamma radiation), and then selecting and using those plants that have the desirable character as a source in breeding. This process is called mutation breeding.

139. (1) The lac operon is gene system characterized in *Escherichia coli* for the regulation of the gene for the utilization of lactose. Lac operon genes Z, Y, and A represent the gene whose products are involved in digesting lactose. In the normal condition, the genes do not function because a repressor protein is active and bound to DNA preventing transcription. When the repressor protein is bound to the DNA, RNA polymerase cannot bind to the DNA. The protein must be removed before the genes can be transcribed. The repressor protein is produced by a regulator gene. The region of DNA where the repressor protein binds is the operator site. The promoter site is a region of DNA where RNA polymerase can bind. The entire unit (Promoter, Operator, and genes) is an operon.

140. (1)

141. (4) NCERT (XII) Ch-14, Page-246

The primary producers of the deep-sea hydrothermal vent ecosystem are chemosynthetic bacteria.

142. (2)

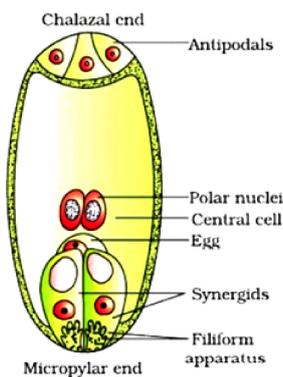
143. (2) The parts labeled as A,B,C,D in the given figure of female gametophyte are:

A – Three antipodal cells.

B – Two polar nuclei

C – Egg cell

D – The synergid



144. (4) The peripheral region of the secondary xylem, is lighter in colour and is known as the sap wood. It is involved in the conduction of water and minerals from shoot to leaf.

145. (1) Primary xylem is present in the centre of the root. As secondary growth occurs in the root the primary phloem is pushed outside whereas, primary xylem remains inside of the root.

146. (1) The two chromatids of a metaphase chromosome represent replicated chromosomes, arranged at the equatorial plane of the cell, to be separated at anaphase.

147. (2) (i)  $\text{NADH}_2 \xrightarrow{\text{ETC}} 3\text{ATP}$

(ii)  $\text{FADH}_2 \xrightarrow{\text{ETC}} 2\text{ATP}$

(iii) Small protein

(iv) Two copper centres

148. (2) NCERT (XI) Ch-12, Page-198

Elements that are actively mobilised exported to young developing tissues. Hence, deficiency symptoms appear first in older tissues.

149. (4) Crop plants which can grow in nitrogen deficiency soils without external supply of nitrogen are sweet clover, lentils, alfalfa, garden pea, sweet pea, broad beans and clover beans (legumes).

150. (3) Chlorine – Evolution of  $\text{O}_2$  in photosynthesis

### ZOOLOGY (SEC-A)

151. (2) Cnidarians exhibit two basic body forms called polyp and medusa. The former is a sessile and cylindrical form like *Hydra*, *Adamsia*, etc. Whereas, the latter is umbrella-shaped and free-swimming like *Aurelia* or jellyfish. Those cnidarians which exist in both forms exhibit alternation of generation (Metagenesis), i.e., polyps produce medusae asexually and medusa form the polyps sexually (e.g. *Obelia*).

152. (4) Diploblasty is a condition of the blastula in which there are two primary germ layers: the ectoderm and endoderm. They do not show the mesodermal layer.

Roundworms, earthworms and liver fluke have bilateral symmetry. These are elongated worm-like organisms.

Hydra is radially-symmetrical. The body of the organism can be divided into equal halves in any plane of the axis. The tentacles radiate outward around the mouth. This type of arrangement of the tentacles gives the organisms a radial form of symmetry.

153. (1) Lacunae are connected to one another by small canals called canaliculi.

154. (3) The intestinal mucosal epithelium has goblet cells which secrete mucus. The secretions of the brush border cells of the mucosa along with the secretions of the goblet cells constitute the intestinal juice or succus entericus.

155. (1)

156. (3) Cellulose is made up of  $\beta$ -glucose molecules which are joined by  $\beta$ -1, 4 linkage.

157. (3) In an organism, each enzyme has its own different favourable pH values but generally has the same optimum temperature.

158. (4) Collagen is the most abundant protein in the animal world and Ribulose biphosphate Carboxylase-Oxygenase (RuBisCO) is the most abundant protein in the whole of the biosphere.

159. (3) The alveoli represent the ultimate structural and physiological units of the lung. Alveoli provide a large surface area for gaseous exchange by diffusion. The alveolar wall is very thin, consisting of squamous epithelium and an extensive network of blood capillaries with the alveoli, the exchange of gases takes place smoothly.

160. (3) Due to low oxygen tension and high carbon dioxide tension, oxyhaemoglobin at the tissue level liberates the oxygen to the cells. This oxyhaemoglobin after reaching tissue dissociates into oxygen and haemoglobin because the amount of oxygen in tissue is low. Oxygen dissociates from the haemoglobin and diffuses into the tissue.

161. (2) Every 100 ml of deoxygenated blood delivers approximately 4 ml of  $\text{CO}_2$  to the alveoli.

162. (2) Fibroblast cells are rich in rough endoplasmic reticulum. Their main function is to produce fibres and secrete matrix.

163. (1) In male cockroach, sperms are stored in the seminal vesicles. The sperms are produced in testes, while the cockroach is still young, is brought by the vasa deferentia into the semina; vesicles are glued together in the form of bundles called spermatophores.

164. (2) The most important factor controlling the rate of RBC production is the oxygen content of the arterial blood, a decrease in oxygen content stimulates erythropoiesis.

165. (4) About 7% of carbon dioxide is transported as dissolved in plasma, and 70% as bicarbonates.

166. (4) Animals that excrete their nitrogenous waste mainly in the form of urea are known as ureotelic and the phenomenon is known as ureotelism.

Urea can be stored in the body for considerable periods of time and is least toxic. It is eliminated in the form of urine. Ureotelism is exhibited by semi-terrestrial animals, e.g. some earthworms, adult amphibians, elasmobranch (cartilaginous fishes), and mammals. The frog like other amphibians is ammonotelic in tadpole state and ureotelic in a mature state. The earthworm is similarly ammonotelic when sufficient water is available and ureotelic when water availability is reduced.

167. (2) A nephron is the excretory unit of the human excretory system. Each nephron has a Bowman's Capsule, a proximal convoluted tubule (PCT), Loop of Henle (Descending & Ascending limbs), distal convoluted tubule (DCT), and collecting duct.

168. (4) The renal pyramids consists of loops of Henle, collecting ducts, peritubular capillaries. The renal cortex consists of convoluted tubules together with the renal corpuscles.

169. (4) Each myofibril contains many serially arranged units called sarcomere which is the functional unit of muscle fibres. Each sarcomere has a central 'A' band of thick myosin filaments, and two half 'I' bands made of thin actin filaments on either side of it marked by 'Z' lines.

170. (4) Half of the vertebrate pelvic girdle consists of three bones ilium, ischium and pubis which fuse together in adult to be called in nominate bone (Hip bone).

171. (1) Bones become fragile in osteoporosis, i.e., reduction in bone tissue mass causing weakness of skeletal strength. It is characterized by pain in the bone, specifically in the back and vertebral crush, usually in weight-bearing vertebrae.

Arthritis : Inflammation of joints.

Gout : Inflammation of joints due to the accumulation of uric acids crystals.

172. (1) Hindbrain includes three parts, i.e., cerebellum, pons varolii, and medulla oblongata. Thalamus is present in the forebrain.

173. (4) Vestibular apparatus, located above the cochlea is the complex system of the inner ear. It is the complex

system of the inner ear. It is composed of the membranous labyrinth of the inner ear consists of three semicircular ducts three semi-circular canals and the otolith organ consisting of the saccule and utricle. The saccule and utricle contain a projecting ridge called macula. This crista and macula are responsible for the maintenance of a balance of the body.

174. (3)

175. (2) The pancreas secretes insulin which is hypoglycemic affecting glycogenesis; pituitary controls the carbohydrate metabolism indirectly through ACTH and thyroid stimulates the absorption of monosaccharides from the intestine and stimulates glycogenolysis.

176. (3)

177. (3) The secretory phase is also called as the luteal phase. The luteinizing hormone or LH is secreted by the anterior lobe of the pituitary gland. LH causes ovulation. LH stimulates cells of ovarian follicles to develop corpus luteum. Corpus luteum secretes a large amount of progesterone.

178. (2) Progesterone is an endogenous steroid sex hormone involved in the menstrual cycle, pregnancy, and embryogenesis in human females.

179. (3) Flocs are masses of bacteria associated with fungal filaments to form mesh-like structures.

180. (3) Karyotypic studies of somatic cells are done to determine abnormalities due to change in chromosome numbers, e.g. Down's syndrome, Turner's syndrome, etc. By enzyme analysis, metabolic disorders like detected. It is prenatal diagnostic technique.

181. (2) The vaginal diaphragm, cervical caps and vaults are dome-shaped rubber plastic covers or barriers inserted into the female reproductive tract to cover the cervix during coitus. They prevent conception by blocking the entry of sperms through the cervix.

182. (2) The restriction enzymes and exonuclease both break down nucleic acid chains by cleaving the phosphodiester bond.

183. (4) *Bacillus thuringiensis* forms protein crystals during a particular phase of their growth. These crystals contain a toxin insecticidal protein. Actually, the Bt toxin protein exists as inactive protoxin but once an insect ingests the inactive toxin it is converted into an active form of toxin, due to the alkaline pH of the gut which solubilizes the crystals. The activated toxin binds to the surface of mid gut epithelial and creates pores that cause cell swelling and lysis and eventually cause the death of the insect. Bt is not harmful to humans, other mammals, birds, fish,

or beneficial insects. Specific Bt toxin genes were isolated from *Bacillus thuringiensis* and incorporated into several crop plants such as cotton.

184. (2) DNA ligases are also called genetic gum. They join two individual fragments of double- standard DNA by forming phosphodiester bonds between them thus help in sealing of DNA fragments. Therefore, it acts as a molecular glue. The enzyme used most often is the T<sub>4</sub> DNA ligase.

185. (4)

### ZOOLOGY (SEC-B)

186. (2) NCERT (XI) Ch-16, Page-258

During swallowing, glottis can be covered by a thin elastic cartilaginous flap called epiglottis to prevent the entry of food into the larynx.

187. (2) Reticular tissue helps in filtering blood, removing antigens, and old RBCs in the spleen. The cornea has no sensory epithelium. Simple squamous epithelium lines the blood vessels.

188. (1) Lacteals absorb chylomicrons

189. (2)

190. (2) Starch is a plant storage polysaccharide. It is chemically non-reactive and osmotically inactive polysaccharides of much greater molecular weight. Carbohydrates perform a vital role in living organisms. Starch and other polysaccharides serve as energy storage in plants, particularly in seeds, tubers, etc. Which provide a major energy source for animals, including humans

191. (3) Blood does not become acidic due to buffering action. Bicarbonates act as buffering agents



192. (2) In cockroach, the male and female can identified easily with the presence or absence of one pair of anal style are unjoined, thread like structures present on the 9th sternum of male.

193. (3) NCERT (XI) Ch-7, Page-112

Male bear a pair of short, threadlike anal styles which are absent in females. In both sexes, the 10th segment bears a pair of joined filamentous structures called anal cerci.

194. (1) NCERT (XII) Ch-7, Page-137

The Hardy-Weinberg equilibrium can be disturbed

by a number of factors including mutations, natural selection, non-random mating, genetic drift and gene flow (immigration, emigration, or migration)

195. (4)

196. (2) The inheritance pattern in the given figure shows criss-cross inheritance ( X-linked disorder), an example of such a pattern is haemophilia. Haemophilia is a group of inherited blood disorders in which the blood does not clot properly.

197. (4) Hypertension is the term for blood pressure that is higher than normal (120/80). In this measurement 120mm Hg (millimeters of mercury pressure) is the systolic, or pumping, pressure, and 80mm Hg is the diastolic, or resting, pressure. If repeated check of blood pressure of an individual are 140/90 (140 over 90) or higher, it shows hypertension. High blood pressure leads to heart diseases and also affects vital organs like the brain and kidney

198. (2) ELISA does not contribute to DNA fingerprinting. PCR is an automated procedure that generates lots of copies of a specific sequence of DNA., important in DNA fingerprinting. Restriction enzymes are used in cutting DNA samples and analyzing the resulting DNA fragments by DNA fingerprinting indicates which DNA samples have similar restriction sequences. DNA hybridization DNA fingerprinting, hypervariable and repetitive sequences are detected with hybridization probes.

199. (1) Transgenic plants contain a gene or genes which have been artificially inserted of the plants acquiring them through pollination. Inserted gene sequences (transgene) may come from other unrelated plants, or from a completely different species.

200. (3)

