



SOLVED PAPER 2020 (Phase I)

Time : 3 Hours

Max. Marks : 720

Important Instructions :

1. The test is of 3 hours duration and test contains 180 questions. Each question carries 4 marks. For each correct response, the candidate will get 4 marks.
2. For each incorrect response, one mark will be deducted from the total scores.

PHYSICS

1. Assume that light of wavelength 600 nm is coming from a star. The limit of resolution of telescope whose objective has a diameter of 2 m is
(a) 1.83×10^{-7} rad (b) 7.32×10^{-7} rad
(c) 6.00×10^{-7} rad (d) 3.66×10^{-7} rad
2. When a uranium isotope ${}_{92}^{235}\text{U}$ is bombarded with a neutron, it generates ${}_{36}^{89}\text{Kr}$, three neutrons and
(a) ${}_{40}^{91}\text{Zr}$ (b) ${}_{36}^{101}\text{Kr}$ (c) ${}_{36}^{103}\text{Kr}$ (d) ${}_{56}^{144}\text{Ba}$
Out of Syllabus
3. A short electric dipole has a dipole moment of 16×10^{-9} C m. The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of 60° with the dipole axis is
$$\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2 \right)$$

(a) 200 V (b) 400 V (c) zero (d) 50 V
4. A ray is incident at an angle of incidence i on one surface of a small angle prism (with angle of prism A) and emerges normally from the opposite surface. If the refractive index of the material of the prism is μ , then the angle of incidence is nearly equal to
(a) $\frac{2A}{\mu}$ (b) μA (c) $\frac{\mu A}{2}$ (d) $\frac{A}{2\mu}$
5. A body weighs 72 N on the surface of the earth. What is the gravitational force on it, at a height equal to half the radius of the earth?
(a) 32 N (b) 30 N (c) 24 N (d) 48 N
6. For which one of the following, Bohr model is not valid?
(a) Singly ionized helium atom (He^+)
(b) Deuteron atom
(c) Singly ionized neon atom (Ne^+)
(d) Hydrogen atom
7. A capillary tube of radius r is immersed in water and water rises in it to a height h . The mass of the water in the capillary is 5 g. Another capillary tube of radius $2r$ is immersed in water. The mass of water that will rise in this tube is
(a) 5.0 g (b) 10.0 g (c) 20.0 g (d) 2.5 g
8. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is
(a) 0.25 mm (b) 0.5 mm (c) 1.0 mm (d) 0.01 mm
9. An iron rod of susceptibility 599 is subjected to a magnetising field of 1200 A m^{-1} . The permeability of the material of the rod is
($\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$)
(a) $8.0 \times 10^{-5} \text{ TmA}^{-1}$ (b) $2.4\pi \times 10^{-5} \text{ TmA}^{-1}$
(c) $2.4\pi \times 10^{-7} \text{ TmA}^{-1}$ (d) $2.4\pi \times 10^{-4} \text{ TmA}^{-1}$
10. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is
(a) $\frac{3\pi}{2}$ rad (b) $\frac{\pi}{2}$ rad (c) zero (d) π rad
11. The energy equivalent of 0.5 g of a substance is
(a) $4.5 \times 10^{13} \text{ J}$ (b) $1.5 \times 10^{13} \text{ J}$
(c) $0.5 \times 10^{13} \text{ J}$ (d) $4.5 \times 10^{16} \text{ J}$
12. A resistance wire connected in the left gap of a metre bridge balances a 10Ω resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of 1Ω of the resistance wire is
(a) $1.0 \times 10^{-1} \text{ m}$ (b) $1.5 \times 10^{-1} \text{ m}$
(c) $1.5 \times 10^{-2} \text{ m}$ (d) $1.0 \times 10^{-2} \text{ m}$
13. The average thermal energy for a mono-atomic gas is (k_B is Boltzmann constant and T absolute temperature)
(a) $\frac{3}{2} k_B T$ (b) $\frac{5}{2} k_B T$ (c) $\frac{7}{2} k_B T$ (d) $\frac{1}{2} k_B T$
14. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is ($c = \text{speed of electromagnetic waves}$)
(a) 1 : 1 (b) 1 : c (c) 1 : c^2 (d) $c : 1$
15. A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is ($g = 10 \text{ m/s}^2$)
(a) 340 m (b) 320 m (c) 300 m (d) 360 m

16. A long solenoid of 50 cm length having 100 turns carries a current of 2.5 A. The magnetic field at the centre of the solenoid is

$$(\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1})$$

- (a) $3.14 \times 10^{-4} \text{ T}$ (b) $6.28 \times 10^{-5} \text{ T}$
 (c) $3.14 \times 10^{-5} \text{ T}$ (d) $6.28 \times 10^{-4} \text{ T}$
17. Taking into account of the significant figures, what is the value of $9.99 \text{ m} - 0.0099 \text{ m}$?
 (a) 9.98 m (b) 9.980 m (c) 9.9 m (d) 9.9801 m
18. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled ?
 (a) Four times (b) One-fourth
 (c) Zero (d) Doubled
19. The colour code of a resistance is given below :



The values of resistance and tolerance, respectively, are

- (a) 47 k Ω , 10% (b) 4.7 k Ω , 5%
 (c) 470 Ω , 5% (d) 470 k Ω , 5%
20. Two particles of mass 5 kg and 10 kg respectively are attached to the two ends of a rigid rod of length 1 m with negligible mass. The centre of mass of the system from the 5 kg particle is nearly at a distance of
 (a) 50 cm (b) 67 cm (c) 80 cm (d) 33 cm

21. For transistor action, which of the following statements is correct?

- Out of Syllabus
- (a) Base, emitter and collector regions should have same size.
 (b) Both emitter junction as well as the collector junction are forward biased.
 (c) The base region must be very thin and lightly doped.
 (d) Base, emitter and collector regions should have same doping concentrations.

22. The mean free path for a gas, with molecular diameter d and number density n can be expressed as

(a) $\frac{1}{\sqrt{2}n\pi d^2}$ (b) $\frac{1}{\sqrt{2}n^2\pi d^2}$
 (c) $\frac{1}{\sqrt{2}n^2\pi^2 d^2}$ (d) $\frac{1}{\sqrt{2}n\pi d}$

23. A cylinder contains hydrogen gas at pressure 249 kPa and temperature 27°C

Its density is ($R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$)

- (a) 0.2 kg/m³ (b) 0.1 kg/m³
 (c) 0.02 kg/m³ (d) 0.5 kg/m³

24. A charged particle having drift velocity $7.5 \times 10^{-4} \text{ ms}^{-1}$ in an electric field of $3 \times 10^{-10} \text{ Vm}^{-1}$ has a mobility in $\text{m}^2 \text{ V}^{-1} \text{ s}^{-1}$ of

(a) 2.5×10^6 (b) 2.5×10^{-6}
 (c) 2.25×10^{-15} (d) 2.25×10^{15}

25. Dimensions of stress are

(a) $[\text{ML}^2\text{T}^{-2}]$ (b) $[\text{ML}^0\text{T}^{-2}]$
 (c) $[\text{ML}^{-1}\text{T}^{-2}]$ (d) $[\text{MLT}^{-2}]$

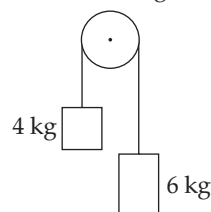
26. A wire of length L , area of cross section A is hanging from a fixed support. The length of the wire changes to L_1 when mass M is suspended from its free end. The expression for Young's modulus is

(a) $\frac{Mg(L_1 - L)}{AL}$ (b) $\frac{MgL}{AL_1}$
 (c) $\frac{MgL}{A(L_1 - L)}$ (d) $\frac{MgL_1}{AL}$

27. In a guitar, two strings A and B made of same material are slightly out of tune and produce beats of frequency 6 Hz. When tension in B is slightly decreased, the beat frequency of A is 530 Hz, the original frequency of B will be

(a) 524 Hz (b) 536 Hz (c) 537 Hz (d) 523 Hz

28. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is



(a) $g/2$ (b) $g/5$ (c) $g/10$ (d) g

29. The capacitance of a parallel plate capacitor with air as medium is 6 μF . With the introduction of a dielectric medium, the capacitance become 30 μF . The permittivity of the medium is

($\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$)

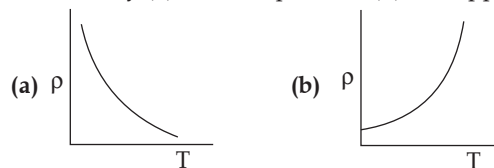
- (a) $1.77 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ M}^{-2}$
 (b) $0.44 \times 10^{-10} \text{ C}^2 \text{ N}^{-1} \text{ M}^{-2}$
 (c) $5.00 \text{ C}^2 \text{ N}^{-1} \text{ M}^{-2}$
 (d) $0.44 \times 10^{-13} \text{ C}^2 \text{ N}^{-1} \text{ M}^{-2}$
30. In Young's double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes

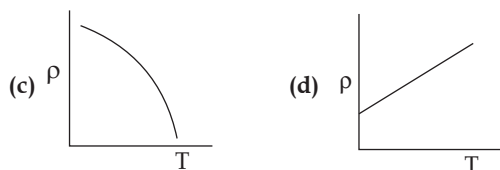
(a) half. (b) four times.
 (c) one-fourth. (d) double.

31. Light with an average flux of 20 W/cm^2 falls on a non-reflecting surface at normal incidence having surface area 20 cm^2 . The energy received by the surface during time span of 1 minute is

(a) $12 \times 10^3 \text{ J}$ (b) $24 \times 10^3 \text{ J}$
 (c) $48 \times 10^3 \text{ J}$ (d) $10 \times 10^3 \text{ J}$

32. Which of the following graph represents the variation of resistivity (ρ) with temperature (T) for copper ?



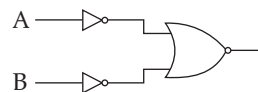


33. The quantities of heat required to raise the temperature of two solid copper spheres of radii r_1 and r_2 ($r_1 = 1.5 r_2$) through 1 K are in the ratio
 (a) $\frac{9}{4}$ (b) $\frac{3}{2}$ (c) $\frac{5}{3}$ (d) $\frac{27}{8}$
34. Find the torque about the origin when a force of $3 \hat{j}$ N acts on a particle whose position vector is $2 \hat{k}$ m.
 (a) $6 \hat{j}$ Nm (b) $-6 \hat{i}$ Nm (c) $6 \hat{k}$ Nm (d) $6 \hat{i}$ Nm
35. In a certain region of space with volume 0.2 m^3 , the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is
 (a) 0.5 N/C (b) 1 N/C (c) 5 N/C (d) zero
36. The Brewsters angle i_b for an interface should be
 (a) $30^\circ < i_b < 45^\circ$ (b) $45^\circ < i_b < 90^\circ$
 (c) $i_b = 90^\circ$ (d) $0^\circ < i_b < 30^\circ$
37. The increase in the width of the depletion region in a p - n junction diode is due to
 (a) reverse bias only.
 (b) both forward bias and reverse bias.
 (c) increase in forward current.
 (d) forward bias only.
38. A spherical conductor of radius 10 cm has a charge of $3.2 \times 10^{-7} \text{ C}$ distributed uniformly. What is the magnitude of electric field at a point 15 cm from the centre of the sphere?

$$\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2 \right)$$

 (a) $1.28 \times 10^5 \text{ N/C}$ (b) $1.28 \times 10^6 \text{ N/C}$
 (c) $1.28 \times 10^7 \text{ N/C}$ (d) $1.28 \times 10^4 \text{ N/C}$
39. The energy required to break one bond in DNA is 10^{-20} J . This value in eV is nearly
 (a) 0.6 (b) 0.06 (c) 0.006 (d) 6
40. A $40 \mu\text{F}$ capacitor is connected to a 200 V, 50 Hz ac supply. The rms value of the current on the circuit is, nearly
 (a) 2.05 A (b) 2.5 A (c) 25.1 A (d) 1.7 A

41. An electron is accelerated from rest through a potential difference of V volt. If the de-Broglie wavelength of the electron is $1.227 \times 10^{-2} \text{ nm}$, the potential difference is
 (a) 10^2 V (b) 10^3 V (c) 10^4 V (d) 10 V
42. Two cylinders A and B of equal capacity are connected to each other via a stop cock. A contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire systems is thermally insulated. The stop cock is suddenly opened. The Process is
 (a) adiabatic. (b) isochoric.
 (c) isobaric. (d) isothermal.
43. For the logic circuit shown, the truth table is



- | | | | | | | | |
|-----|----------|----------|----------|-----|----------|----------|----------|
| (a) | A | B | Y | (b) | A | B | Y |
| | 0 | 0 | 0 | | 0 | 0 | 1 |
| | 0 | 1 | 1 | | 0 | 1 | 1 |
| | 1 | 0 | 1 | | 1 | 0 | 1 |
| | 1 | 1 | 1 | | 1 | 1 | 0 |
- | | | | | | | | |
|-----|----------|----------|----------|-----|----------|----------|----------|
| (c) | A | B | Y | (d) | A | B | Y |
| | 0 | 0 | 1 | | 0 | 0 | 0 |
| | 0 | 1 | 0 | | 0 | 1 | 0 |
| | 1 | 0 | 0 | | 1 | 0 | 0 |
| | 1 | 1 | 0 | | 1 | 1 | 1 |
44. The solids which have the negative temperature coefficient of resistance are
 (a) insulators only.
 (b) semiconductors only.
 (c) insulators and semiconductors.
 (d) metals.
45. A series LCR circuit is connected to an ac voltage source. When L is removed from the circuit, the phase difference between current and voltage is $\frac{\pi}{3}$. If instead C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$ between current and voltage. The power factor of the circuit is
 (a) 0.5 (b) 1.0 (c) -1.0 (d) zero

CHEMISTRY

46. Hydrolysis of sucrose is given by the following reaction.

$$\text{Sucrose} + \text{H}_2\text{O} \rightleftharpoons \text{Glucose} + \text{Fructose}$$

 If the equilibrium constant (K_c) is 2×10^{13} at 800 K, the value of $\Delta_r G^\ominus$ at the same temperature will be
 (a) $8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
 (b) $8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})$
 (c) $-8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(4 \times 10^{13})$
 (d) $-8.314 \text{ J mol}^{-1}\text{K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
47. Which one of the following has maximum number of atoms?
 (a) 1 g of Mg(s) [Atomic mass of Mg = 24]
 (b) 1 g of O_2 (g) [Atomic mass of O = 16]
 (c) 1 g of Li(s) [Atomic mass of Li = 7]
 (d) 1 g of Ag(s) [Atomic mass of Ag = 108]
48. Which of the following is not correct about carbon monoxide?
 (a) It reduces oxygen carrying ability of blood.
 (b) The carboxyhaemoglobin (haemoglobin bound to CO) is less stable than oxyhaemoglobin.
 (c) It produced due to incomplete combustion.
 (d) It forms carboxyhaemoglobin.
49. The calculated spin only magnetic moment of Cr^{2+} ion is
 (a) 4.90 BM (b) 5.92 BM (c) 2.84 BM (d) 3.87 BM

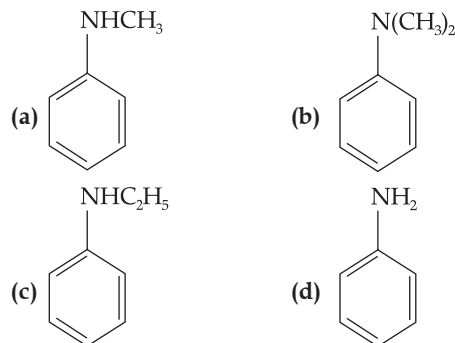
50. Which of the following is a natural polymer?
 (a) poly (Butadiene-styrene)
 (b) polybutadiene
 (c) poly (Butadiene-acrylonitrile)
 (d) *cis*-1, 4-polyisoprene
51. Which of the following is a basic amino acid?
 (a) Alanine (b) Tyrosine (c) Lysine (d) Serine
52. A mixture of N_2 and Ar gases in a cylinder contains 7 g of N_2 and 8 g of Ar. If the total pressure of the mixture of the gases in the cylinder is 27 bar, the partial pressure of N_2 is
 [Use atomic masses (in $g\ mol^{-1}$) : N = 14, Ar = 40]
 (a) 12 bar (b) 15 bar (c) 18 bar (d) 9 bar
53. Paper chromatography is an example of
 (a) partition chromatography.
 (b) thin layer chromatography.
 (c) column chromatography.
 (d) adsorption chromatography.
54. For the reaction, $2Cl(g) \rightarrow Cl_2(g)$, the correct option is
 (a) $\Delta_r H > 0$ and $\Delta_r S < 0$ (b) $\Delta_r H < 0$ and $\Delta_r S > 0$
 (c) $\Delta_r H < 0$ and $\Delta_r S < 0$ (d) $\Delta_r H > 0$ and $\Delta_r S > 0$
55. Urea reacts with water to form A which will decompose to form B. B when passed through Cu^{2+} (aq), deep blue colour solution C is formed. What is the formula of C from the following?
 (a) $[Cu(NH_3)_4]^{2+}$ (b) $Cu(OH)_2$
 (c) $CuCO_3 \cdot Cu(OH)_2$ (d) $CuSO_4$
56. On electrolysis of dil. sulphuric acid using platinum (Pt) electrode, the product obtained at anode will be
 (a) oxygen gas. (b) H_2S gas.
 (c) SO_2 gas. (d) hydrogen gas.
57. An element has a body centered cubic (bcc) structure with a cell edge of 288 pm. The atomic radius is
 (a) $\frac{\sqrt{2}}{4} \times 288$ pm (b) $\frac{4}{\sqrt{3}} \times 288$ pm
 (c) $\frac{4}{\sqrt{2}} \times 288$ pm (d) $\frac{\sqrt{3}}{4} \times 288$ pm
58. An increase in the concentration of the reactants of a reaction leads to change in
 (a) heat of reaction. (b) threshold energy.
 (c) collision frequency. (d) activation energy.
59. Which of the following alkane cannot be made in good yield by Wurtz reaction?
 (a) 2, 3-Dimethylbutane (b) *n*-Heptane
 (c) *n*-Butane (d) *n*-Hexane
60. Identify the incorrect statement.
 (a) The transition metals and their compounds are known for their catalytic activity due to their ability to adopt multiple oxidation states and to form complexes.
 (b) Interstitial compounds are those that are formed when small atoms like H, C or N are trapped inside the crystal lattices of metals.
 (c) The oxidation states of chromium in CrO_4^{2-} and $Cr_2O_7^{2-}$ are not the same.
 (d) Cr^{2+} (d^4) is a stronger reducing agent than Fe^{2+} (d^6) in water.
61. Which of the following is a cationic detergent?
 (a) Sodium stearate
 (b) Cetyltrimethyl ammonium bromide
 (c) Sodium dodecylbenzene sulphonate
 (d) Sodium lauryl sulphate
62. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following?
 (a) +R effect of $-CH_3$ groups
 (b) -R effect of $-CH_3$ groups
 (c) Hyperconjugation
 (d) -I effect of $-CH_3$ groups
63. Which of the following is the correct order of increasing field strength of ligands to form coordination compounds?
 (a) $SCN^- < F^- < CN^- < C_2O_4^{2-}$
 (b) $F^- < SCN^- < C_2O_4^{2-} < CN^-$
 (c) $CN^- < C_2O_4^{2-} < SCN^- < F^-$
 (d) $SCN^- < F^- < C_2O_4^{2-} < CN^-$
64. Identify the correct statement from the following
 (a) Blister copper has blistered appearance due to evolution of CO_2 .
 (b) Vapour phase refining is carried out for Nickel by Van Arkel method.
 (c) Pig iron can be moulded into a variety of shapes.
 (d) Wrought iron is impure iron with 4% carbon.
65. Which of the following set of molecules will have zero dipole moment?
 (a) Boron trifluoride, hydrogen fluoride, carbon dioxide, 1, 3-dichlorobenzene
 (b) Nitrogen trifluoride, beryllium difluoride, water, 1, 3-dichlorobenzene
 (c) Boron trifluoride, beryllium difluoride, carbon dioxide, 1, 4-dichlorobenzene
 (d) Ammonia, beryllium difluoride, water, 1, 4-dichlorobenzene
66. Match the following and identify the correct option.
- | | | | |
|-----|-----------------------------|-------|-------------------------------|
| (A) | $CO(g) + H_2(g)$ | (i) | $Mg(HCO_3)_2 + Ca(HCO_3)_2$ |
| (B) | Temporary hardness of water | (ii) | An electron deficient hydride |
| (C) | B_2H_6 | (iii) | Synthesis gas |
| (D) | H_2O_2 | (iv) | Non-planar structure |
- (A) (B) (C) (D)
 (a) (iii) (ii) (i) (iv)
 (b) (iii) (iv) (ii) (i)
 (c) (i) (iii) (ii) (iv)
 (d) (iii) (i) (ii) (iv)
67. The number of protons, neutrons and electrons in $^{175}_{71}Lu$, respectively, are
 (a) 104, 71 and 71 (b) 71, 71 and 104
 (c) 175, 104 and 71 (d) 71, 104 and 71

68. The number of Faradays (F) required to produce 20 g of calcium from molten CaCl_2 (Atomic mass of Ca = 40 g mol^{-1}) is
 (a) 2 (b) 3 (c) 4 (d) 1
69. Elimination reaction of 2-Bromo-pentane to form pent-2-ene is
 (A) β -Elimination reaction
 (B) Follows Zaitsev rule
 (C) Dehydrohalogenation reaction
 (D) Dehydration reaction
 (a) (A), (C), (D) (b) (B), (C), (D)
 (c) (A), (B), (D) (d) (A), (B), (C)
70. Identify the correct statements from the following
- Out of Syllabus
- (A) $\text{CO}_2(\text{g})$ is used as refrigerant for ice-cream and frozen food.
 (B) The structure of C_{60} contains twelve six-carbon rings and twenty five carbon rings.
 (C) ZSM-5, a type of zeolite, is used to convert alcohols into gasoline.
 (D) CO is colourless and odourless gas.
 (a) (A) and (C) only (b) (B) and (C) only
 (c) (C) and (D) only (d) (A), (B) and (C) only
71. Identify the incorrect match.

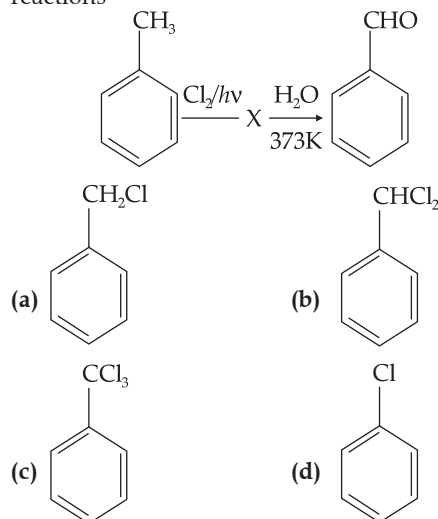
Name		IUPAC Official Name	
(A)	Unnilunium	(i)	Mendelevium
(B)	Unniltrium	(ii)	Lawrencium
(C)	Unnilhexium	(iii)	Seaborgium
(D)	Unununnium	(iv)	Darmstadtium

- (a) (B), (ii) (b) (C), (iii) (c) (D), (iv) (d) (A), (i)
72. The freezing point depression constant (K_f) of benzene is $5.12 \text{ K kg mol}^{-1}$. The freezing point depression for the solution of molality 0.078 m containing a non-electrolyte solute in benzene is (rounded off upto two decimal places)
 (a) 0.80 K (b) 0.40 K (c) 0.60 K (d) 0.20 K
73. What is the change in oxidation number of carbon in the following reaction?
 $\text{CH}_4(\text{g}) + 4\text{Cl}_2(\text{g}) \rightarrow \text{CCl}_4(\text{l}) + 4\text{HCl}(\text{g})$
 (a) 0 to +4 (b) -4 to +4 (c) 0 to -4 (d) +4 to +4
74. The rate constant for a first order reaction is $4.606 \times 10^{-3} \text{ s}^{-1}$. The time required to reduce 2.0 g of the reactant to 0.2 g is
 (a) 200 s (b) 500 s (c) 1000 s (d) 100 s
75. The mixture which shows positive deviation from Raoult's law is
 (a) benzene + toluene
 (b) acetone + chloroform
 (c) chloroethane + bromoethane
 (d) ethanol + acetone
76. Which of the following oxoacid of sulphur has $-\text{O}-\text{O}-$ linkage?
 (a) H_2SO_4 , sulphuric acid
 (b) $\text{H}_2\text{S}_2\text{O}_8$, peroxodisulphuric acid
 (c) $\text{H}_2\text{S}_2\text{O}_7$, pyrosulphuric acid
 (d) H_2SO_3 , sulphurous acid
77. Measuring zeta potential is useful in determining which property of colloidal solution? Out of Syllabus

- (a) Solubility
 (b) Stability of the colloidal particles
 (c) Size of the colloidal particles
 (d) Viscosity
78. Sucrose on hydrolysis gives
 (a) α -D-Glucose + β -D-Glucose
 (b) α -D-Glucose + β -D-Fructose
 (c) α -D-Fructose + β -D-Fructose
 (d) α -D-Fructose + β -D-Glucose
79. Find out the solubility of $\text{Ni}(\text{OH})_2$ in 0.1M NaOH. Given that the ionic product of $\text{Ni}(\text{OH})_2$ is 2×10^{-15} .
 (a) $2 \times 10^{-8} \text{ M}$ (b) $1 \times 10^{-13} \text{ M}$
 (c) $1 \times 10^8 \text{ M}$ (d) $2 \times 10^{-13} \text{ M}$
80. The correct option for free expansion of an ideal gas under adiabatic condition is
 (a) $q = 0, \Delta T < 0$ and $w > 0$
 (b) $q < 0, \Delta T = 0$ and $w = 0$
 (c) $q > 0, \Delta T > 0$ and $w > 0$
 (d) $q = 0, \Delta T = 0$ and $w = 0$
81. Which of the following amine will give the carbylamine test?

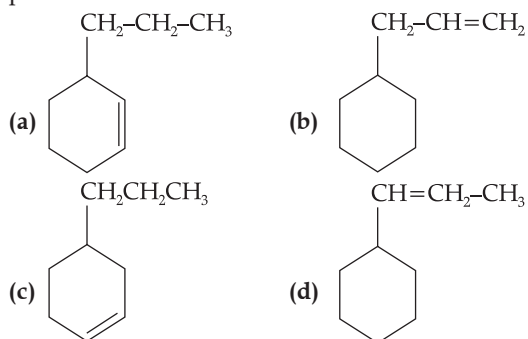


82. Identify compound X in the following sequence of reactions



83. Reaction between benzaldehyde and aceto-phenone in presence of dilute NaOH is known as
 (a) Cannizzaro's reaction.
 (b) Cross Cannizzaro's reaction.
 (c) Cross Aldol condensation.
 (d) Aldol condensation.
84. Identify a molecule which does not exist.
 (a) Li_2 (b) C_2 (c) O_2 (d) He_2

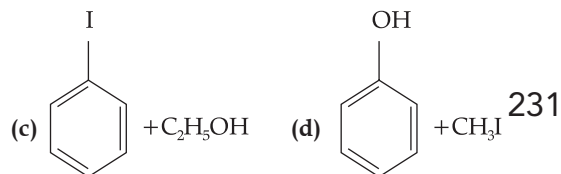
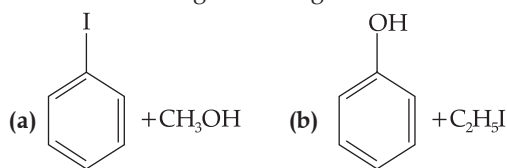
85. An alkene on ozonolysis gives methanal as one of the products. Its structure is



86. The following metal ion activates many enzymes, participates in the oxidation of glucose to produce ATP and with Na, is responsible for the transmission of nerve signals.

(a) Copper (b) Calcium (c) Potassium (d) Iron

87. Anisole on cleavage with HI gives



88. Match the following

Oxide	Nature
(A) CO	(i) Basic
(B) BaO	(ii) Neutral
(C) Al ₂ O ₃	(iii) Acidic
(D) Cl ₂ O ₇	(iv) Amphoteric

Which of the following is correct option?

- (A) (B) (C) (D)
- (a) (ii) (i) (iv) (iii)
- (b) (iii) (iv) (i) (ii)
- (c) (iv) (iii) (ii) (i)
- (d) (i) (ii) (iii) (iv)
89. HCl was passed through a solution of CaCl₂, MgCl₂ and NaCl. Which of the following compound(s) crystallise(s)? Out of Syllabus
- (a) Only NaCl
- (b) Only MgCl₂
- (c) NaCl, MgCl₂ and CaCl₂
- (d) Both MgCl₂ and CaCl₂
90. Reaction between acetone and methyl magnesium chloride followed by hydrolysis will give
- (a) Sec. butyl alcohol. (b) Tert. butyl alcohol.
- (c) Isobutyl alcohol. (d) Isopropyl alcohol.

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91. Strobili or cones are found in
(a) *Pteris*. (b) *Marchantia*.
(c) *Equisetum*. (d) *Salvinia*.
92. The QRS complex in a standard ECG represents
(a) depolarisation of auricles.
(b) depolarisation of ventricles.
(c) repolarisation of ventricles.
(d) repolarisation of auricles.
93. Match the following columns and select the correct option.

Column-I	Column-II
(A) Placenta	(i) Androgens
(B) Zona pellucida	(ii) Human Chorionic Gonadotropin (hCG)
(C) Bulbo-urethral glands	(iii) Layer of the ovum
(D) Leydig cells	(iv) Lubrication of the penis

- (A) (B) (C) (D)
- (a) (i) (iv) (ii) (iii)
- (b) (iii) (ii) (iv) (i)
- (c) (ii) (iii) (iv) (i)
- (d) (iv) (iii) (i) (ii)

94. In which of the following techniques, the embryos are transferred to assist those females who cannot conceive?
- (a) GIFT and ZIFT (b) ICSI and ZIFT
- (c) GIFT and ICSI (d) ZIFT and IUT

95. Select the correct match.
- (a) Phenylketonuria Autosomal dominant trait
- (b) Sickle cell anaemia Autosomal recessive trait, chromosome-11
- (c) Thalassemia X linked
- (d) Hemophilia Y linked
96. Dissolution of the synaptonemal complex occurs during
- (a) zygotene. (b) diplotene.
- (c) leptotene. (d) pachytene.
97. Which of the following is not an attribute of population?
- (a) Natality (b) Mortality
- (c) Species interaction (d) Sex ratio
98. Which of the following hormone levels will cause release of ovum (ovulation from the graffian follicle)?
- (a) High concentration of Progesterone
- (b) Low concentration of LH
- (c) Low concentration of FSH
- (d) High concentration of Estrogen
99. Identify the correct statement with reference to human digestive system. Out of Syllabus
- (a) Serosa is the innermost layer of the alimentary canal.
- (b) Ileum is a highly coiled part.
- (c) Vermiform appendix arises from duodenum.
- (d) Ileum opens into small intestine.
100. Identify the incorrect statement. Out of Syllabus
- (a) Sapwood is involved in the conduction of water

- and minerals from root to leaf.
- (b) Sapwood is the innermost secondary xylem and lighter in colour.
- (c) Due to deposition of tannin, resins, oils, etc., heart wood is dark in colour.
- (d) Heart wood does not conduct water but give mechanical support.
101. Goblet cells of alimentary canal are modified from
- (a) Columnar epithelial cells.
- (b) Chondrocytes.
- (c) Compound epithelial cells.
- (d) Squamous epithelial cells.
102. Snow-blindness in Antarctic region is due to
- (a) Inflammation of cornea due to high dose of UV-B radiation.
- (b) High reflection of light from snow.
- (c) Damage to retina caused by infrared rays.
- (d) Freezing of fluids in the eye by low temperature.
103. The process of growth is maximum during
- (a) lag phase. (b) senescence.
- (c) dormancy. (d) log phase.
104. From his experiments, S.L. Miller produced amino acid by mixing the following in a closed flask
- (a) CH_3 , H_2 , NH_4 and water vapour at 800°C
- (b) CH_4 , H_2 , NH_3 and water vapour at 600°C
- (c) CH_3 , H_2 , NH_3 and water vapour at 600°C
- (d) CH_4 , H_2 , NH_3 and water vapour at 800°C
105. The infectious stage of *Plasmodium* that enters the human body is
- (a) sporozoites. (b) female gametocytes.
- (c) male gametocytes. (d) trophozoites
106. Which of the following statement is correct?
- (a) Adenine pairs with thymine through one H-bond.
- (b) Adenine pairs with thymine through three H-bonds.
- (c) Adenine does not pair with thymine.
- (d) Adenine pairs with thymine through two H-bonds.
107. Choose the correct statement from the following
- (a) Polymerases break the DNA into fragments.
- (b) Nucleases separate the two strands of DNA.
- (c) Exonucleases make cuts at specific positions within DNA.
- (d) Ligases join the two DNA molecules.
108. If the head of cockroach is removed, it may live for few days because Out of Syllabus
- (a) the cockroach does not have nervous system.
- (b) the head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.
- (c) the head holds a $1/3^{\text{rd}}$ of a nervous system while the rest is situated along the dorsal part of its body.
- (d) the supra-oesophageal ganglia of the cockroach are situated in ventral part of the abdomen.
109. Some dividing cells exit the cell cycle and enter vegetative inactive stage. This is called quiescent stage (G_0). This process occurs at the end of
- (a) G_1 phase. (b) S phase.
- (c) G_2 phase. (d) M phase.
110. The ovary is half inferior in
- (a) mustard. (b) sunflower.
- (c) plum. (d) brinjal.
111. The sequence that controls the copy number of the linked DNA in the vector, is termed.
- (a) Ori site (b) Palindromic sequence
- (c) Recognition site (d) Selectable marker
112. In water hyacinth and water lily, pollination takes place by
- (a) water currents only. (b) wind and water.
- (c) insects and water. (d) insects or wind.
113. Match the organism with its use in biotechnology.
- | | |
|--------------------------------------|--|
| (A) <i>Bacillus thuringiensis</i> | (i) Cloning vector |
| (B) <i>Thermus aquaticus</i> | (ii) Construction of first rDNA molecule |
| (C) <i>Agrobacterium tumefaciens</i> | (iii) DNA polymerase |
| (D) <i>Salmonella typhimurium</i> | (iv) Cry proteins |
- | | | | |
|-----------|-------|-------|------|
| (A) | (B) | (C) | (D) |
| (a) (iv) | (iii) | (i) | (ii) |
| (b) (iii) | (ii) | (iv) | (i) |
| (c) (iii) | (iv) | (i) | (ii) |
| (d) (ii) | (iv) | (iii) | (i) |
114. Name the enzyme that facilitates opening of DNA helix during transcription.
- (a) DNA helicase (b) DNA polymerase
- (c) RNA polymerase (d) DNA ligase
115. Match the causative organism with its disease and select the correct option :
- | Column-I | | Column-II | |
|----------|------------|-----------|--------------------|
| (A) | Typhoid | (i) | <i>Wuchereria</i> |
| (B) | Pneumonia | (ii) | <i>Plasmodium</i> |
| (C) | Filariasis | (iii) | <i>Salmonella</i> |
| (D) | Malaria | (iv) | <i>Haemophilus</i> |
- | | | | |
|-----------|-------|-------|-------|
| (A) | (B) | (C) | (D) |
| (a) (iii) | (iv) | (i) | (ii) |
| (b) (ii) | (i) | (iii) | (iv) |
| (c) (iv) | (i) | (ii) | (iii) |
| (d) (i) | (iii) | (ii) | (iv) |
116. The first phase of translation is
- (a) recognition of DNA molecule.
- (b) aminoacylation of tRNA.
- (c) recognition of an anti-codon.
- (d) binding of mRNA to ribosome.
117. Meiotic division of the secondary oocyte is completed
- (a) at the time of copulation.
- (b) after zygote formation.
- (c) at the time of fusion of a sperm with an ovum.
- (d) prior to ovulation.
118. In gel electrophoresis, separated DNA fragments can be visualised with the help of
- (a) ethidium bromide in UV radiation.
- (b) acetocarmine in UV radiation.
- (c) ethidium bromide in infrared radiation.
- (d) acetocarmine in bright blue light.
119. Identify the correct statement with regard to G_1 phase

(Gap 1) of interphase.

(a) Reorganisation of all the cellular components takes place.

(b) Cell is metabolically active, grows but does not replicate its DNA.

(c) Nuclear division takes place.

(d) DNA synthesis or replication takes place.

120. Ray florets have

(a) superior ovary. (b) hypogynous ovary.

(c) half inferior ovary. (d) inferior ovary.

121. Bilaterally symmetrical and acoelomate animals are exemplified by

(a) Platyhelminthes. (b) Aschelminthes.

(c) Annelida. (d) Ctenophora.

122. Identify the substances having glycosidic bond and peptide bond, respectively in their structure

(a) Glycerol, trypsin (b) Cellulose, lecithin

(c) Inulin, insulin (d) Chitin, cholesterol

123. Select the correct events that occur during inspiration.

(i) Contraction of diaphragm

(ii) Contraction of external inter-costal muscles

(iii) Pulmonary volume decreases

(iv) Intra pulmonary pressure increases

(a) (iii) and (iv) (b) (i), (ii) and (iv)

(c) only (iv) (d) (i) and (ii)

124. Which of the following pairs is of unicellular algae?

(a) *Gelidium and Gracilaria*

(b) *Anabaena and Volvox*

(c) *Chlorella and Spirulina*

(d) *Laminaria and Sargassum*

125. Match the following columns and select the correct option.

Column-I		Column-II	
(A)	Eosinophils	(i)	Immune response
(B)	Basophils	(ii)	Phagocytosis
(C)	Neutrophils	(iii)	Release histaminase, destructive enzymes
(D)	Lymphocytes	(iv)	Release granules containing histamine

(A) (B) (C) (D)

(a) (iv) (i) (ii) (iii)

(b) (i) (ii) (iv) (iii)

(c) (ii) (i) (iii) (iv)

(d) (iii) (iv) (ii) (i)

126. Flippers of Penguins and Dolphins are examples of

(a) Convergent evolution. (b) Industrial melanism.

(c) Natural selection. (d) Adaptive radiation.

127. Cuboidal epithelium with brush border of microvilli is found in

(a) ducts of salivary glands.

(b) proximal convoluted tubule of nephron.

(c) eustachian tube.

(d) lining of intestine.

128. Match the following columns and select the correct option.

Out of Syllabus

Column-I		Column-II	
(A)	6-15 pairs of gill	(i)	Trygon slits
(B)	Heterocercal	(ii)	Cyclostomes caudal fin
(C)	Air Bladder	(iii)	Chondrichthyes
(D)	Poison sting	(iv)	Osteichthyes

(A) (B) (C) (D)

(a) (iii) (iv) (i) (ii)

(b) (iv) (ii) (iii) (i)

(c) (i) (iv) (iii) (ii)

(d) (ii) (iii) (iv) (i)

129. The plant parts which consist of two generations one within the other

(i) pollen grains inside the anther.

(ii) germinated pollen grain with two male gametes.

(iii) seed inside the fruit.

(iv) embryo sac inside the ovule.

(a) (i), (ii) and (iii) (b) (iii) and (iv)

(c) (i) and (iv) (d) (i) only

130. Montreal protocol was signed in 1987 for control of

(a) emission of ozone depleting substances.

(b) release of Greenhouse gases.

(c) disposal of e-wastes.

(d) transport of genetically modified organisms from one country to another.

131. Which one of the following is the most abundant protein in the animals?

(a) Collagen

(b) Lectin

(c) Insulin

(d) Haemoglobin

132. The specific palindromic sequence which is recognized by EcoRI is

(a) 5' - GGAACC - 3'
3' - CCTTGG - 5'

(b) 5' - CTTAAG - 3'
3' - GAATTC - 5'

(c) 5' - GGATCC - 3'
3' - CCTAGG - 5'

(d) 5' - GAATTC - 3'
3' - CTTAAG - 5'

133. If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is 6.6×10^6 kb, then the length of the DNA is approximately.

(a) 2.5 meters

(b) 2.2 meters

(c) 2.7 meters

(d) 2.0 meters

134. The product(s) of reaction catalysed by nitrogenase in root nodules of leguminous plants is/are

(a) nitrate alone.

(b) ammonia and oxygen.

(c) ammonia and hydrogen.

(d) ammonia alone.

135. Which of the following refer to correct example(s) of organisms which have evolved due to changes in environment brought about by anthropogenic action?

- (i) Darwin's Finches of Galapagos islands.
 (ii) Herbicide resistant weeds.
 (iii) Drug resistant eukaryotes.
 (iv) Man-created breeds of domesticated animals like dogs.

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

136. Which of the following regions of the globe exhibits highest species diversity?
 (a) Madagascar (b) Himalayas
 (c) Amazon forests (d) Western Ghats of India
137. Which is the important site of formation of glycoproteins and glycolipids in eukaryotic cells?
 (a) Peroxisomes
 (b) Golgi bodies
 (c) Polysomes
 (d) Endoplasmic reticulum
138. How many true breeding pea plant varieties did Mendel select, which were similar except in one character with contrasting traits?
 (a) 2 (b) 14 (c) 8 (d) 4

139. Match the following columns and select the correct option.

Column-I		Column-II	
(A)	Floating Ribs	(i)	Located between second and seventh ribs
(B)	Acromion	(ii)	Head of the Humerus
(C)	Scapula	(iii)	Clavicle
(D)	Glenoid	(iv)	Do not connect with cavity of the sternum

- (A) (B) (C) (D)
 (a) (i) (iii) (ii) (iv)
 (b) (iii) (ii) (iv) (i)
 (c) (iv) (iii) (i) (ii)
 (d) (ii) (iv) (i) (iii)

140. Select the option including all sexually transmitted diseases.
 (a) Gonorrhoea, Malaria, Genital herpes
 (b) AIDS, Malaria, Filariasis
 (c) Cancer, AIDS, Syphilis
 (d) Gonorrhoea, Syphilis, Genital herpes
141. Identify the wrong statement with regard to restriction enzymes.
 (a) They cut the strand of DNA at palindromic sites.
 (b) They are useful in genetic engineering.
 (c) Sticky ends can be joined by using DNA ligases.
 (d) Each restriction enzyme functions by inspecting the length of a DNA sequence.
142. Match the following columns and select the correct option.

Column-I		Column-II	
(A)	<i>Clostridium butylicum</i>	(i)	Cyclosporin-A

(B)	<i>Trichoderma polysporum</i>	(ii)	Butyric Acid
(C)	<i>Monascus purpureus</i>	(iii)	Citric Acid
(D)	<i>Aspergillus niger</i>	(iv)	Blood cholesterol lowering agent

- (A) (B) (C) (D)
 (a) (ii) (i) (iv) (iii)
 (b) (i) (ii) (iv) (iii)
 (c) (iv) (iii) (ii) (i)
 (d) (iii) (iv) (ii) (i)
143. Match the following with respect to meiosis
 (A) Zygotene (i) Terminalisation
 (B) Pachytene (ii) Chiasmata
 (C) Diplotene (iii) Crossing over
 (D) Diakinesis (iv) Synapsis
- (A) (B) (C) (D)
 (a) (iv) (iii) (ii) (i)
 (b) (i) (ii) (iv) (iii)
 (c) (ii) (iv) (iii) (i)
 (d) (iii) (iv) (i) (ii)
144. Identify the wrong statement with reference to transport of oxygen.
 (a) Partial pressure of CO₂ can interfere with O₂ binding with haemoglobin.
 (b) Higher H⁺ conc. in alveoli favours the formation of oxyhaemoglobin.
 (c) Low pCO₂ in alveoli favours the formation of oxyhaemoglobin.
 (d) Binding of oxygen with haemoglobin is mainly related to partial pressure of O₂.
145. Which of the following would help in prevention of diuresis?
 (a) Reabsorption of Na⁺ and water from renal tubules due to aldosterone.
 (b) Atrial natriuretic factor causes vasoconstriction.
 (c) Decrease in secretion of renin by JG cells.
 (d) More water reabsorption due to under secretion of ADH.
146. Which of the following statements about inclusion bodies is incorrect?
 (a) These are involved in ingestion of food particles.
 (b) They lie freely in the cytoplasm.
 (c) These represent reserve material in cytoplasm.
 (d) They are not bound by any membrane.
147. *Bt* cotton variety that was developed by the introduction of toxin gene of *Bacillus thuringiensis* (*Bt*) is resistant to
 (a) fungal diseases. (b) plant nematodes.
 (c) insect predators. (d) insect pests.
148. By which method was a new breed 'Hisardale' of sheep formed by using Bikaneri ewes and Marino rams?
 (a) Mutational breeding (b) Cross breeding
 (c) Inbreeding (d) Out crossing
149. Which of the following statements are true for the phylum-Chordata?
 (i) In Urochordata, notochord extends from head

to tail and it is present throughout their life.

- (ii) In Vertebrata, notochord is present during the embryonic period only.
- (iii) Central nervous system is dorsal and hollow.
- (iv) Chordata is divided into 3 subphyla : Hemichordata, Tunicata and Cephalo-chordata.
- (a) (iii) and (i) (b) (i) and (ii)
(c) (ii) and (iii) (d) (iv) and (iii)
150. Select the correct statement.
- (a) Glucagon is associated with hypoglycemia.
(b) Insulin acts on pancreatic cells and adipocytes.
(c) Insulin is associated with hyperglycemia.
(d) Glucocorticoids stimulate gluconeogenesis.
151. Match the following columns and select the correct option.

Column-I		Column-II	
(A)	Gregarious	(i)	<i>Asterias</i>
(B)	Adult with radial symmetry and larva with bilateral symmetry	(ii)	Scorpion
(C)	Book lungs	(iii)	<i>Ctenoplana</i>
(D)	Bioluminescence	(iv)	<i>Locusta</i>

- (A) (B) (C) (D)
- (a) (iv) (i) (ii) (iii)
(b) (iii) (ii) (i) (iv)
(c) (ii) (i) (iii) (iv)
(d) (i) (iii) (ii) (iv)
152. Match the trophic levels with their correct species examples in grassland ecosystem.

Column-I		Column-II	
(A)	Fourth trophic level	(i)	Crow
(B)	Second trophic level	(ii)	Vulture
(C)	First trophic level	(iii)	Rabbit
(D)	Third trophic level	(iv)	Grass

- Select the Correct option
- (A) (B) (C) (D)
- (a) (iii) (ii) (i) (iv)
(b) (iv) (iii) (ii) (i)
(c) (i) (ii) (iii) (iv)
(d) (ii) (iii) (iv) (i)
153. Name the plant growth regulator which upon spraying on sugarcane crop, increases the length of stem, thus increasing the yield of sugarcane crop
- (a) gibberellin. (b) ethylene.
(c) abscisic acid. (d) cytokinin.
154. Which of the following is not an inhibitory substance governing seed dormancy ?
- (a) Abscisic acid (b) Phenolic acid
(c) Para-ascorbic acid (d) Gibberellic acid
155. In relation of Gross primary productivity and Net primary productivity of an ecosystem, which one of the following statements is correct ?

- (a) Gross primary productivity is always more than net primary productivity.
(b) Gross primary productivity and Net productivity are one and same.
(c) There is no relationship between Gross primary productivity and Net primary productivity.
(d) Gross primary productivity is always less than net primary productivity.

156. The enzyme enterokinase helps in conversion of
- (a) trypsinogen into trypsin.
(b) caseinogen into casein.
(c) pepsinogen into pepsin.
(d) protein into polypeptides.
157. Match the following columns and select the correct option.

Column-I		Column-II	
(A)	<i>Bt</i> cotton	(i)	Gene therapy
(B)	Adenosine deaminase deficiency	(ii)	Cellular defence
(C)	RNAi	(iii)	Detection of HIV infection
(D)	PCR	(iv)	<i>Bacillus thuringiensis</i>

- (A) (B) (C) (D)
- (a) (iii) (ii) (i) (iv)
(b) (ii) (iii) (iv) (i)
(c) (i) (ii) (iii) (iv)
(d) (iv) (i) (ii) (iii)
158. Identify the basic amino acid from the following.
- (a) Glutamic Acid (b) Lysine
(c) Valine (d) Tyrosine
159. Match the following concerning essential elements and their functions in plants :

Column-I		Column-II	
(A)	Iron	(i)	Photolysis of water
(B)	Zinc	(ii)	Pollen germination
(C)	Boron	(iii)	Required for chlorophyll biosynthesis
(D)	Manganese	(iv)	IAA biosynthesis

- (A) (B) (C) (D)
- (a) (iv) (iii) (ii) (i)
(b) (iii) (iv) (ii) (i)
(c) (iv) (i) (ii) (iii)
(d) (ii) (i) (iv) (iii)
160. Presence of which of the following conditions in urine are indicative of Diabetes Mellitus ?
- (a) Uremia and Renal Calculi
(b) Ketonuria and Glycosuria
(c) Renal calculi and Hyperglycaemia
(d) Uremia and Ketonuria

161. Which of the following is correct about viroids?
 (a) They have free RNA without protein coat.
 (b) They have DNA with protein coat.
 (c) They have free DNA without protein coat.
 (d) They have RNA with protein coat.
162. Match the following columns and select the correct option.

Column-I		Column-II	
(A)	Organ of Corti	(i)	Connects middle-ear and pharynx
(B)	Cochlea	(ii)	Coiled part of the labyrinth
(C)	Eustachian tube	(iii)	Attached to the oval window
(D)	Stapes	(iv)	Located on the basilar membrane

- (A) (B) (C) (D)
 (a) (iii) (i) (iv) (ii)
 (b) (iv) (ii) (i) (iii)
 (c) (i) (ii) (iv) (iii)
 (d) (ii) (iii) (i) (iv)
163. Secondary metabolites such as nicotine, strychnine and caffeine are produced by plants for their
 (a) growth response. (b) defence action.
 (c) effect on reproduction. (d) nutritive value.
164. According to Robert May, the global species diversity is about
 (a) 20 million. (b) 50 million.
 (c) 7 million. (d) 1.5 million.
165. The body of the ovule is fused within the funicle at
 (a) micropyle. (b) nucellus.
 (c) chalaza. (d) hilum.
166. Which of the following statements is not correct?
 (a) The proinsulin has an extra peptide called C-peptide.
 (b) The functional insulin has A and B chains linked together by hydrogen bonds.
 (c) Genetically engineered insulin is produced in *E. Coli*.
 (d) In man, insulin is synthesised as a proinsulin.
167. Identify the wrong statement with reference to immunity.
 (a) When ready-made antibodies are directly given, it is called "Passive immunity".
 (b) Active immunity is quick and gives full response.
 (c) Foetus receives some antibodies from mother, it is an example for passive immunity.
 (d) When exposed to antigen (living or dead) antibodies are produced in the host's body. It is called "Active immunity".
168. The roots that originate from the base of the stem are
 (a) primary roots. (b) prop roots.
 (c) lateral roots. (d) fibrous roots.
169. The number of substrate level phosphorylations in one turn of citric acid cycle is

- (a) One (b) Two (c) Three (d) Zero
170. Experimental verification of the chromosomal theory of inheritance was done by
 (a) Sutton. (b) Boveri. (c) Morgan. (d) Mendel.
171. The process responsible for facilitating loss of water in liquid form from the tip of grass blades at night and in early morning is
 (a) root pressure (b) imbibition
 (c) plasmolysis (d) transpiration
172. The oxygenation activity of RuBisCo enzyme in photorespiration leads to the formation of
 (a) 1 molecule of 3-C compound.
 (b) 1 molecule of 6-C compound.
 (c) 1 molecule of 4-C compound and 1 molecule of 2-C compound.
 (d) 2 molecules of 3-C compound.
173. Identify the wrong statement with reference to the gene 'I' that controls ABO blood groups.
 (a) A person will have only two of the three alleles.
 (b) When I^A and I^B are present together, they express same type of sugar.
 (c) Allele 'i' does not produce any sugar.
 (d) When I^A and I^B are present together, they express same type of sugar.
174. Which of the following is put into anaerobic sludge digester for further sewage treatment?
 (a) Floating debris
 (b) Effluents of primary treatment
 (c) Activated sludge
 (d) Primary sludge
175. Embryological support for evolution was disapproved by
 (a) Alfred Wallace. (b) Charles Darwin.
 (c) Oparin. (d) Karl Ernst von Baer.
176. Floridean starch has structure similar to
 (a) amylopectin and glycogen.
 (b) mannitol and algin.
 (c) laminarin and cellulose.
 (d) starch and cellulose.
177. Match the following

Column-I		Column-II	
(A)	Inhibitor of catalytic activity	(i)	Ricin
(B)	Posses peptide bonds	(ii)	Malonate
(C)	Cell wall material in fungi	(iii)	Chitin
(D)	Secondary metabolite	(iv)	Collagen

- (A) (B) (C) (D)
 (a) (iii) (i) (iv) (ii)
 (b) (iii) (iv) (i) (ii)
 (c) (ii) (iii) (i) (iv)
 (d) (ii) (iv) (iii) (i)
178. Match the following columns and select the correct option.

Column-I	Column-II
----------	-----------

(A)	Pituitary gland	(i)	Grave's disease
(B)	Thyroid gland	(ii)	Diabetes mellitus
(C)	Adrenal gland	(iii)	Diabetes insipidus
(D)	Pancreas	(iv)	Addison's disease

- | | | | | |
|-----|-------|-------|------|-------|
| | (A) | (B) | (C) | (D) |
| (a) | (iii) | (ii) | (i) | (iv) |
| (b) | (iii) | (i) | (iv) | (ii) |
| (c) | (ii) | (i) | (iv) | (iii) |
| (d) | (iv) | (iii) | (i) | (ii) |

179. The transverse section of a plant shows following anatomical features

- (i) Large number of scattered vascular bundles surrounded by bundle sheath.

- (ii) Large conspicuous parenchymatous ground tissue.
 (iii) Vascular bundles conjoint and closed.
 (iv) Phloem parenchyma absent.

Identify the category of plant and its part

- (a) Monocotyledonous root
 (b) Dicotyledonous stem
 (c) Dicotyledonous root
 (d) Monocotyledonous stem

180. In light reaction, plastoquinone facilitates the transfer of electrons from

- (a) Cytb₆f complex to PS-I.
 (b) PS-I to NADP⁺.
 (c) PS-I to ATP synthase.
 (d) PS-II to Cytb₆f complex.



Booklet	Batch	RollNumber
<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
(A) 10+1 (S)		0 0 0 0 0 0 0 0 0 0
(B) 10-2 (V)		1 1 1 1 1 1 1 1 1 1
(C) 10-3 (A)		2 2 2 2 2 2 2 2 2 2
(D) Crash (C)		3 3 3 3 3 3 3 3 3 3
(E)		4 4 4 4 4 4 4 4 4 4
(F) Paper		5 5 5 5 5 5 5 5 5 5
(G)	<input type="checkbox"/>	6 6 6 6 6 6 6 6 6 6
(H) Paper 1 (1)		7 7 7 7 7 7 7 7 7 7
(I) Paper 2 (2)		8 8 8 8 8 8 8 8 8 8
(J)		9 9 9 9 9 9 9 9 9 9

Name

Test Date

Invigilator's Signature

Student's Signature

Certified that all the entries in this section have been properly filled by the student

The OMR Sheet will be computer checked. Fill the circles completely and dark enough for proper detection. Use ballpen (black or blue) for marking.

Avoid Improper Marking

Partially Filled

Lightly Filled

Test Center Code

0 0

1 1

2 2

3 3

4 4

5 5

6 6

7 7

8 8

9 9

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

ANSWER KEY

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



SOLVED PAPER 2020 (Phase I)

ANSWERS WITH EXPLANATIONS

PHYSICS

1. Option (d) is correct.

Limit of Resolution for a Telescope is

$$\theta = 1.22 \frac{\lambda}{d}$$

Given, $\lambda = 600 \times 10^{-9}$; $d = 2$ m

By substituting the values, we get

$$\theta = 3.66 \times 10^{-7} \text{ rad}$$

2. Out of Syllabus

3. Option (a) is correct.

Electric potential due to electric dipole (V)

$$= \frac{1}{4\pi\epsilon_0} \frac{p \cdot \cos \theta}{r^2}$$

$$V = \frac{9 \times 10^9 \times 16 \times 10^{-9} \times \cos 60^\circ}{0.36}$$

$$V = 200 \text{ V}$$

4. Option (b) is correct.

Since the light emerges normally from the other surface, the angle of emergence

$$e = 0$$

For the triangular prism, we know

$$r_1 + r_2 = A$$

But, $e = r_2 = 0$

So, $r_1 = A$

For surface 1,

$$\text{Snell's law is } \sin i = \mu \cdot \sin r_1$$

$$\sin i = \mu \cdot \sin A$$

For small angle $\sin \theta \approx \theta$

So, $i = \mu \cdot A$

5. Option (a) is correct.

We know, $W = mg$

At a height h , above the surface of earth, weight is given as,

$$F = \frac{mg}{\left[1 + \frac{h}{R}\right]^2}$$

$$= \frac{72}{\left(1 + \frac{R/2}{R}\right)^2}$$

$$= \frac{72}{\left(\frac{3}{2}\right)^2}$$

$$= \frac{4}{9} \times 72 = 32 \text{ N}$$

6. Option (c) is correct.

Singly ionized neon has electron count more than one. Bohr's model is valid for atoms with single electron. So option (c) is not valid.

7. Option (b) is correct.

The weight of water in the capillary is balanced by the surface tension force.

$$mg = 2\pi r \cdot T \cos \theta$$

m is directly proportional to r .

$$m \propto r$$

$$\Rightarrow \frac{m_2}{m_1} = \frac{r_2}{r_1}$$

$$\Rightarrow \frac{m_2}{5} = \frac{2r}{r}$$

$$\therefore m_2 = 10 \text{ g}$$

8. Option (b) is correct.

Least count of screw gauge

$$= \frac{\text{Pitch scale reading}}{\text{Circular scale reading}}$$

$$0.01 \text{ mm} = \frac{\text{Pitch}}{50}$$

$$\text{Pitch} = 0.5 \text{ mm}$$

9. Option (d) is correct.

$$X_m = 599$$

$$\mu_r = 1 + X_m = 600$$

$$\mu = \mu_r \mu_0 = 600 \times 4\pi \times 10^{-7}$$

$$= 2.4\pi \times 10^{-4} \text{ TmA}^{-1}$$

10. Option (d) is correct.

Displacement, $y = A \cdot \sin \omega t$

$$\text{Velocity, } v = \frac{dy}{dt} = A\omega \cdot \cos \omega t$$

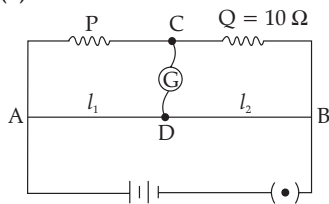
$$\begin{aligned} \text{Acceleration, } a &= -A\omega^2 \sin \omega t \\ &= A\omega^2 \sin (\omega t + \pi) \end{aligned}$$

So, the phase difference between y and a is π .

11. Option (a) is correct.

$$E = mc^2 = 0.5 \times 10^{-3} \times (3 \times 10^8)^2 = 4.5 \times 10^{13} \text{ J}$$

12. Option (a) is correct.



$$\text{Initially, } \frac{P}{10} = \frac{l_1}{l_2} = \frac{3}{2}$$

$$\Rightarrow P = \frac{30}{2} = 15 \Omega$$

$$\text{Now Resistance, } R = \frac{\rho l}{A}$$

$$\frac{R_1}{R_2} = \frac{l_1}{l_2}$$

$$\begin{aligned} \Rightarrow \frac{15}{1} &= \frac{1.5}{l_2} \\ l_2 &= 0.1 \text{ m} \\ &= 1.0 \times 10^{-1} \text{ m} \end{aligned}$$

13. Option (a) is correct.

The degree of freedom for monoatomic gas is 3.

So, average thermal energy per molecule,

$$\text{K.E.}_{\text{avg}} = \frac{3}{2} k_B T$$

14. Option (a) is correct.

The total energy of an electromagnetic wave is equally shared by E and B. So the ratio is 1 : 1.

15. Option (c) is correct.

From the Kinematic equation

$$\begin{aligned} v^2 &= u^2 + 2gh \\ v &= 80 \text{ m/s} \\ u &= 20 \text{ m/s} \\ h &= \frac{v^2 - u^2}{2g} \\ &= \frac{6400 - 400}{20} = 300 \text{ m} \end{aligned}$$

16. Option (d) is correct.

Magnetic field at centre of solenoid = $\mu_0 n I$

$$\begin{aligned} n &= \frac{N}{L} = \frac{100}{50 \times 10^{-2}} \\ &= 200 \text{ turns/m} \\ I &= 2.5 \text{ A} \end{aligned}$$

Now, substituting the values,

$$\begin{aligned} B &= 4\pi \times 10^{-7} \times 200 \times 2.5 \\ &= 6.28 \times 10^{-4} \text{ T} \end{aligned}$$

17. Option (a) is correct.

$$9.99 - 0.0099 = 9.9801 \text{ m}$$

Here, 9.98 is having the least number of decimal places of two, so answer should also have only two decimal places.

18. Option (c) is correct.

$$v = \frac{3}{2} v_0$$

$$\text{and } v' = \frac{v}{2} = \frac{3}{4} v_0$$

Here, we see $v' < v < v_0$

Below threshold frequency, no photoelectric emission takes place.

19. Out of Syllabus

20. Option (b) is correct.

Let's assume both the particles are lying on X-axis.

Let the 5 kg particle is at the origin.

Then the X-coordinate of the centre of mass of the system is,

$$\begin{aligned} X_{\text{CM}} &= \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2} \\ &= \frac{5 \times 0 + 10 \times 100}{5 + 10} \\ &= \frac{200}{3} \approx 67 \text{ cm} \end{aligned}$$

21. Out of Syllabus

22. Option (a) is correct.

As per the formula,

$$\lambda = \frac{1}{\sqrt{2n\pi d^2}}$$

23. Option (a) is correct.

From the ideal gas equation, $PV = nRT$ also

$$\text{Volume (V)} = \frac{\text{mass (M)}}{\text{density } (\rho)}$$

$$\begin{aligned} \text{So, } PM &= \rho RT \\ P &= 249 \times 10^3 \text{ N/m}^2 \\ M &= 2 \times 10^{-3} \text{ kg} \\ T &= 300 \text{ K} \end{aligned}$$

$$\begin{aligned} \rho &= \frac{(249 \times 10^3)(2 \times 10^{-3})}{8.3 \times 300} \\ &= 0.2 \text{ kg/m}^3 \end{aligned}$$

24. Option (a) is correct.

The relation between the mobility and drift velocity is,

$$\begin{aligned} \text{Mobility, } \mu &= \frac{v_d}{E} \\ &= \frac{7.5 \times 10^{-4}}{3 \times 10^{-10}} \\ &= 2.5 \times 10^6 \text{ m}^2 \text{V}^{-1} \text{s}^{-1} \end{aligned}$$

25. Option (c) is correct.

$$\begin{aligned}\text{Stress} &= \frac{\text{Force}}{\text{Area}} \\ &= \left[\frac{\text{MLT}^{-2}}{\text{L}^2} \right] \\ &= [\text{ML}^{-1}\text{T}^{-2}]\end{aligned}$$

26. Option (c) is correct.

$$\begin{aligned}\text{Stress} &= \frac{Mg}{A} \\ \text{Strain} &= \frac{\Delta L}{L} = \frac{L_1 - L}{L} \\ \text{Young's modulus} &= \frac{\text{Stress}}{\text{Strain}} = \frac{MgL}{A(L_1 - L)}\end{aligned}$$

27. Option (a) is correct.

Difference of f_A and f_B is 6 Hz
If tension decreases, f_B decreases and become f'_B .
Now, difference of f_A and $f'_B = 7$ Hz (increases)
So, $f_A > f_B$
 $f_A - f_B = 6$ Hz

$$\begin{aligned}f_A &= 530 \text{ Hz} \\ f_B &= 524 \text{ Hz (original)}\end{aligned}$$

28. Option (b) is correct.

Acceleration of the masses is given to be :

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

where, $m_1 > m_2$

$$\Rightarrow a = \frac{(6-4)g}{6+4}$$

$$\Rightarrow a = \frac{g}{5}$$

29. Option (b) is correct.

The capacitance increases with dielectric constant K

$$C = KC_0 \text{ (or) } K = \frac{C}{C_0} = \frac{30}{6} = 5$$

$$\varepsilon = K\varepsilon_0 = 5 \times 8.85 \times 10^{-12} = 0.44 \times 10^{-10}$$

30. Option (b) is correct.

Given that the slit distance is made half and the screen distance made double than the original value, then,

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

$$\text{Now, } d' = \frac{d}{2} \text{ and } D' = 2D$$

$$\text{So, } \beta' = \frac{\lambda(2D)}{d/2} = \frac{4\lambda D}{d}$$

$$\Rightarrow \beta' = 4\beta$$

31. Option (b) is correct.

$$\begin{aligned}\text{Energy} &= \text{intensity} \times \text{time} \times \text{area} \\ &= 20 \times 60 \times 20 \\ E &= 24 \times 10^3 \text{ J}\end{aligned}$$

32. Option (b) is correct.

For very low temperatures the graph will not be straight line for metals.

33. Option (d) is correct.

$$\begin{aligned}\Delta Q &= ms\Delta T \\ \Rightarrow DQ &= (V \times r) \times sDT \\ \Rightarrow \Delta Q &= \frac{4}{3} \pi r^3 \rho \cdot s\Delta T \\ \frac{\Delta Q_1}{\Delta Q_2} &= \frac{r_1^3}{r_2^3} = 1.5^3 = \frac{27}{8}\end{aligned}$$

34. Option (b) is correct.

Torque is the moment of force applied.

$$\begin{aligned}\vec{\tau} &= \vec{r} \times \vec{F} \\ \Rightarrow \vec{\tau} &= 2\hat{k} \times 3\hat{j} \\ \Rightarrow \vec{\tau} &= -6\hat{i} \text{ Nm}\end{aligned}$$

35. Option (d) is correct.

Potential V is constant. Electric field E is the differentiation of potential V with respect to distance. Differentiation of a constant is zero. So E = 0.

36. Option (b) is correct.

Refractive index μ is equal to tangent of Brewster's angle i_b

$$\begin{aligned}\mu &= \tan i_b \\ 1 &< \mu < \infty \\ 1 &< \tan i_b < \infty \\ \tan^{-1}(1) &< i_b < \tan^{-1}(\infty) \\ 45^\circ &< i_b < 90^\circ\end{aligned}$$

37. Option (a) is correct.

The width of depletion layer will increase with reverse bias.

38. Option (a) is correct.

The electric field for the conducting sphere, away from the surface is given by,

$$\begin{aligned}E &= \frac{1}{4\pi\varepsilon_0} \frac{Q}{r^2} \\ &= \frac{9 \times 10^9 \times 3.2 \times 10^{-7}}{225 \times 10^{-4}} \\ &= 0.128 \times 10^6 \\ &= 1.28 \times 10^5 \text{ N/C}\end{aligned}$$

39. Option (b) is correct.

$$\begin{aligned}1 \text{ eV} &= 1.6 \times 10^{-19} \text{ J} \\ 1 \text{ J} &= \frac{1}{1.6 \times 10^{-19}} \text{ eV}\end{aligned}$$

$$10^{-20} \text{ J} = \frac{10^{-20}}{1.6 \times 10^{-19}} \text{ eV}$$

$$= 0.06 \text{ eV}$$

40. Option (b) is correct.

$$i_{\text{rms}} = C\omega \epsilon_{\text{rms}}$$

$$C = 40 \times 10^{-6} \text{ F}$$

$$\omega = 2\pi f = 100\pi$$

$$\epsilon_{\text{rms}} = 200 \text{ V}$$

$$\therefore i_{\text{rms}} = 200 \times 40 \times 10^{-6} \times 2\pi \times 50$$

$$= 2.5 \text{ A}$$

41. Option (c) is correct.

The de-Broglie wavelength and the accelerated potential is related as follows,

$$\lambda = \frac{12.27}{\sqrt{V}} \text{ \AA}$$

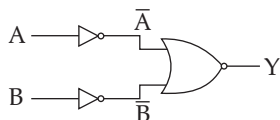
$$\sqrt{V} = \frac{12.27 \times 10^{-10}}{1.227 \times 10^{-11}} = 10^2$$

$$\therefore V = 10^4 \text{ V}$$

42. Option (a) is correct.

The system is insulated thermally. So no heat exchange takes place. Therefore the process is adiabatic.

43. Option (d) is correct.



$$Y = \overline{\overline{A + B}} = \overline{\overline{A} \cdot \overline{B}}$$

$$= A \cdot B \Rightarrow \text{AND Gate}$$

44. Option (c) is correct.

The temperature coefficient of resistance is negative for semiconductor and insulators, and it is positive for metals.

45. Option (b) is correct.

The power factor for the LCR circuit will be :

When L is removed,

$$\tan \phi = \frac{|X_C|}{R}$$

$$\Rightarrow \tan \frac{\pi}{3} = \frac{X_C}{R} \quad \dots(i)$$

When C is removed,

$$\tan \phi = \frac{|X_L|}{R}$$

$$\Rightarrow \tan \frac{\pi}{3} = \frac{X_L}{R} \quad \dots(ii)$$

Since, $X_L = X_C$, the circuit is in resonance,

$$Z = R$$

$$\text{Power factor} = \cos \phi = \frac{R}{Z} = 1$$

CHEMISTRY

46. Option (d) is correct.

$$\Delta G = \Delta G^\circ + RT \ln Q$$

$$\text{At equilibrium } \Delta G = 0, Q = K_{\text{eq}}$$

$$\text{So, } \Delta_r G^\circ = -RT \ln K_{\text{eq}}$$

$$\Delta_r G^\circ = -8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$$

47. Option (c) is correct.

Number of atoms

$$= \frac{w}{\text{molar mass}} \times N_A \times \text{Atomicity}$$

$$\text{Number of Mg atoms} = \frac{1}{24} \times N_A$$

$$\text{Number of O atoms} = \frac{1}{32} \times 2 \times N_A$$

$$\text{Number of Li atoms} = \frac{1}{7} \times N_A$$

$$\text{Number of Ag atoms} = \frac{1}{108} \times N_A$$

48. Out of Syllabus

49. Option (a) is correct.

Electronic configuration of Cr : $[\text{Ar}] 3d^5 4s^1$

Electronic configuration of Cr^{2+} : $[\text{Ar}] 3d^4$

No. of unpaired electrons = 4

Spin only magnetic moment

$$= \sqrt{n(n+2)}$$

n = number of unpaired electrons

Spin only magnetic moment

$$= \sqrt{4(4+2)}$$

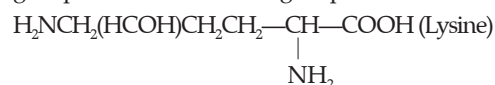
$$= \sqrt{24} \text{ BM}$$

$$= 4.9 \text{ BM}$$

50. Out of Syllabus

51. Option (c) is correct.

Lysine is a basic amino acid. It contains two $-\text{NH}_2$ groups and one $-\text{COOH}$ groups.



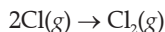
52. Out of Syllabus

53. Option (a) is correct.

Paper chromatography is a type of partition chromatography because the substances are partitioned or distributed between liquid phases. The two phases are water held in pores of the paper and the other phase is a mobile phase, which passes through the paper.

54. Option (c) is correct.

Given reaction,

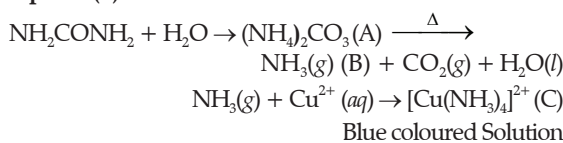


So, the reaction is exothermic

$$\Delta_r H < 0$$

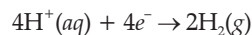
Also, two gaseous atoms combine together to form 1 gaseous molecule.

So, the randomness, $\Delta_r S < 0$

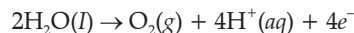
55. Option (a) is correct.**56. Option (a) is correct.**

During the electrolysis of dil. sulphuric acid using Pt electrodes following reaction will take place.

At cathode :



At anode :



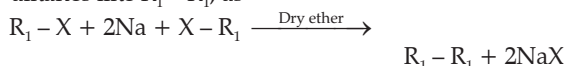
At the anode, oxygen gas will be released.

57. Out of Syllabus**58. Option (c) is correct.**

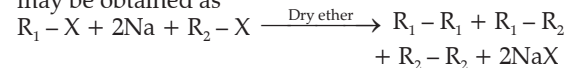
Collision frequency is directly proportional to the concentration of reactants of a reaction.

59. Option (b) is correct.

Wurtz reaction is used to prepare symmetrical alkanes like $\text{R}_1 - \text{R}_1$, as



If R_1 and R_2 are different, then mixture of alkanes may be obtained as



Using Wurtz reaction, *n*-Heptane can not be produced in good yield because it is an unsymmetrical alkane.

60. Option (c) is correct.

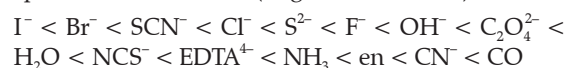
Oxidation state of Cr in CrO_4^{2-} and $\text{Cr}_2\text{O}_7^{2-}$ is + 6.

61. Out of Syllabus**62. Option (c) is correct.**

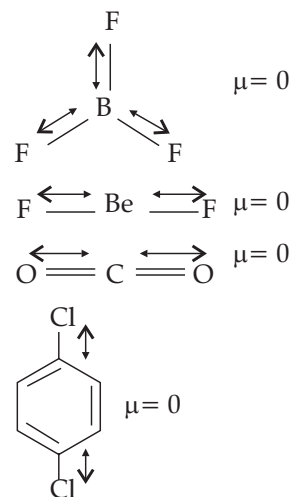
More the number of α -H atoms, more will be the hyper conjugation effect hence more will be the stability of carbocation. Hence 3° carbocation is more stable than 2° carbocation.

63. Option (d) is correct.

Spectrochemical series (as given in NCERT):

**64. Out of Syllabus****65. Option (c) is correct.**

Due to their symmetrical structure, BF_3 , BeF_2 , CO_2 and 1, 4-dichloro benzene molecules have a zero dipole moment.

**66. Out of Syllabus****67. Option (d) is correct.**

No. of Protons = 71 = No. of Electrons

No. of Neutrons = Mass No. - No. of Protons
= 175 - 71 = 104

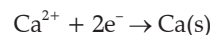
68. Option (d) is correct.

1 equivalent of any substance is deposited by 1 F of charge.

We have 20 g calcium.

$$\text{No. of equivalent} = \frac{\text{given mass}}{\text{equivalent mass}}$$

$$= \frac{20}{10} = 2$$



v.f. = 2

According to Faraday's first law

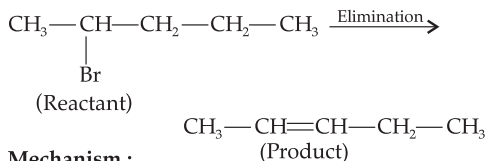
Charge passed in Faraday

= g. equivalent of product

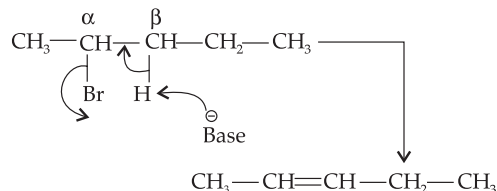
$$= \frac{20}{40} \times 2 = 1 \text{ F}$$

So, 1 F of charge is required.

69. Option (d) is correct.



Mechanism :



Since β -hydrogen is abstracted it is β -elimination.

Since more substituted alkene is formed (stable and major product), it follows Zaitsev's rule or Saytzev's rule.

Since H and Br are removed, it is dehydrohalogenation.

70. Out of Syllabus

71. Option (c) is correct.

Ununonium

Atomic number = 111

IUPAC official name : Roentgenium (Rg)

72. Option (b) is correct.

$$\begin{aligned} \Delta T_f &= k_f m \\ &= 5.12 \times 0.078 \\ &= 0.399 \text{ K} = 0.4 \text{ K} \end{aligned}$$

73. Option (b) is correct.

Change in oxidation state of carbon is from -4 to $+4$.

74. Option (b) is correct.

$$k = \left(\frac{2.303}{t} \right) \log \left(\frac{A_0}{A} \right) \text{ for first order reaction}$$

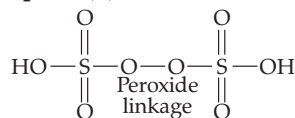
$$4.606 \times 10^{-3} = \left(\frac{2.303}{t} \right) \log \left(\frac{2}{0.2} \right)$$

$$t = 500 \text{ s}$$

75. Option (d) is correct.

Pure ethanol molecules are hydrogen bonded. On adding acetone, its molecules get in between the ethanol molecules and break some of the hydrogen bonds between them. This weakens the intermolecular attractive interactions and the solution shows positive deviation from Raoult's law.

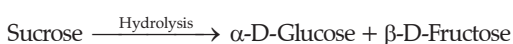
76. Option (b) is correct.



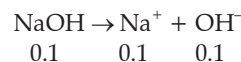
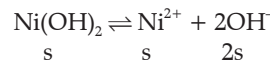
Peroxodisulphuric acid

77. Out of Syllabus

78. Option (b) is correct.



79. Option (d) is correct.



$$\text{Total } [\text{OH}^-] = 2s + 0.1 \approx 0.1$$

$$\text{Ionic product} = [\text{Ni}^{2+}][\text{OH}^-]^2$$

$$2 \times 10^{-15} = s(0.1)^2$$

$$s = 2 \times 10^{-13}$$

80. Option (d) is correct.

Free expansion, so $p_{ex} = 0$

$$\text{So, } w = -p_{ex} \Delta V = 0$$

Since, adiabatic process, so $q = 0$

Since both q and w are equal to zero. Then according to first law of thermodynamics $\Delta E = q + w$

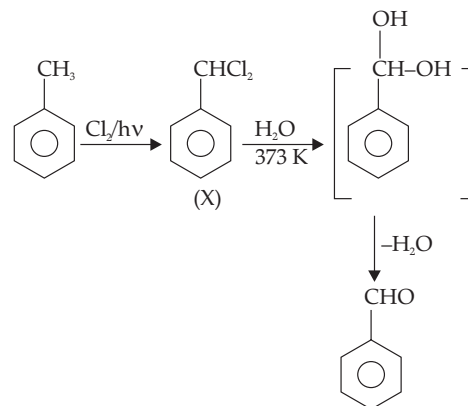
$$\Delta U = 0$$

Hence, $\Delta T = 0$.

81. Option (d) is correct.

Aliphatic and aromatic primary amines gives carbylamine reaction (isocyanide test).

82. Option (b) is correct.



83. Option (c) is correct.

In the presence of dil. OH^- , benzaldehyde and acetophenone will react to undergo cross-aldol condensation.

84. Option (d) is correct.

For He_2 molecule

Total number of electron = 4

Electronic configuration is $\sigma 1s^2, \sigma^* 1s^2$

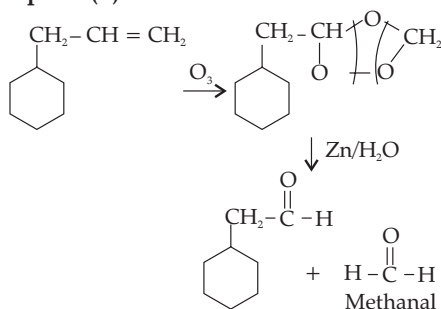
$$\text{Bond order} = \frac{[N_b - N_a]}{2}$$

$$= \frac{[2 - 2]}{2}$$

$$= 0$$

Since, bond order is zero, so He_2 molecule does not exist.

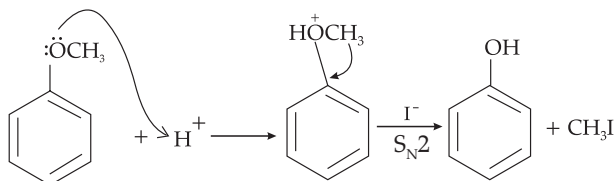
85. Option (b) is correct.



86. Option (c) is correct.

Potassium (K) activates many enzymes participate in the oxidation of glucose to produce ATP and helps in the transmission of nerve signal along with Na.

87. Option (d) is correct.



88. Option (a) is correct.

CO : Neutral oxide

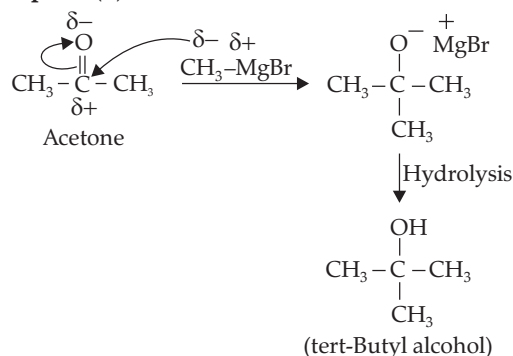
BaO : Basic oxide

Al_2O_3 : Amphoteric oxide

Cl_2O_7 : Acidic oxide

89. Out of Syllabus

90. Option (b) is correct.



BIOLOGY

91. Option (c) is correct.

The sporangia present on the sporophyte are subtended by a leaf-like structure called sporophyll. Equisetum forms a different compact structure called strobili. Meiosis occurs in the spore of the mother to produce sporangia.

92. Option (b) is correct.

The electrical activity of the heart represented graphically during a cardiac cycle in a machine is called an electrocardiography. The depolarisation of the ventricle is represented with a QRS complex that occurs in the form of waves.

93. Option (c) is correct.

Human Chorionic Gonadotropin (hCG) secreted by the placenta (the intimate connection between mother and foetus). Zona pellucida is a layer of secondary oocyte surrounding it. The **bulbourethral gland** secretes a fluid that helps in the lubrication of the penis. Leydig cells synthesise a hormone called androgen. Androgen stimulates spermatogenesis.

94. Option (d) is correct.

The fertilisation that takes place outside of the female body is called in vitro fertilisation. In this method, ova and sperms are collected from the parents and allowed to fertilise in a test tube with a nutrient medium. This is called test-tube baby. After fertilisation, the blastomere is transferred into the fallopian tube of the woman who does not conceive. This is called zygote intrafallopian transfer. If the embryo is transferred to uterus, it is called intrauterine transfer.

95. Option (b) is correct.

The genetic trait inherited on both the alleles of a given gene in an autosome is called autosomal recessive inheritance. Sickle cell anemia is an autosomal recessive disorder. If both the parents are carriers of the gene, it can be transferred to off-springs. The individuals with $Hb^S Hb^S$ homozygotes show the diseased trait. The individuals with heterozygous $Hb^A Hb^S$ are unaffected but they are carriers of the disease. The β -globin chain is abnormal. Valine is replaced with glutamic acid in the seventh amino acid of the beta chain. This leads to an abnormally shaped i.e., sickle-shaped hemoglobin.

96. Option (b) is correct.

During zygotene stage, chromosomes start pairing which is accompanied by a complex structure known as synaptonemal complex. During diplotene stage of prophase I of meiosis I dissolution of the synaptonemal complex occurs.

97. Option (c) is correct.

Natality, mortality, immigration, emigration, and sex ratio are population growth attributes while species interaction is an attribute of population interaction. It can be of two types called interspecific interaction and intra-specific interaction.

98. Option (d) is correct.

High level of estrogen increases the level of LH by positive feedback leading to LH surge. LH surge leads to ovulation.

99. Out of Syllabus

100. Out of Syllabus

- 101. Option (a) is correct.**
Columnar epithelial or cuboidal cells are modified to form unicellular glandular goblet cells and multicellular clusters of cells like salivary glands. Goblet cell secretes mucus and plays an important role in lubrication.
- 102. Option (a) is correct.**
The inflammation of the cornea caused due to the excessive absorption of ultraviolet-B radiations is called snow-blindness cataract.
- 103. Option (d) is correct.**
Process of growth is maximum during log phase or exponential phase.
- 104. Option (d) is correct.**
S.L. Miller is an American scientist who designed an experimental setup to explain the first form of life. He conducted experiments in an electric discharge in a closed flask container. He took a mixture of CH_4 , H_2 , NH_3 , and water vapour at 800°C in electric discharge to produce amino acids.
- 105. Option (a) is correct.**
Female *Anopheles* mosquito injects sporozoites (sickle-shaped) into the human body.
- 106. Option (d) is correct.**
Adenine pairs with thymine through two hydrogen bonds. Cytosine pairs with guanine through three hydrogen bonds.
- 107. Option (d) is correct.**
Nucleases cut the DNA molecules and ligase join DNA molecules. Polymerase adds nucleotides making nucleic acid polymer and exonuclease removes nucleotides from the ends.
- 108. Out of Syllabus**
- 109. Option (d) is correct.**
Some dividing cells exit the cell cycle and enter the vegetative inactive stage, called the quiescent stage (G_0). This process occurs at the end of the M-phase and the exit of the G_1 phase. The cell is metabolically active, but do not divide until received message to proliferate.
- 110. Option (c) is correct.**
If the ovary is located in the center and other parts are located on the rim of the thalamus, such type of flower is called perigynous. The ovary is half inferior. Plum has half inferior ovary.
- 111. Option (a) is correct.**
The specific sequence of DNA in a chromosome where the replication starts is called the origin of replication. It plays an important role in the initiation of replication. It is linked to the DNA of a vector to replicate and control the copy number of DNA.
- 112. Option (d) is correct.**
In water hyacinth and water lily, pollination takes place by insects or wind.
- 113. Option (a) is correct.**
Bacillus thuringiensis has insecticidal crystalline protein (Cry protein). *Thermus aquaticus* has heat-stable DNA polymerase. *Agrobacterium tumefaciens* is a cloning vector for dicot plants. The first recombinant DNA molecule was created using a plasmid from *Salmonella typhimurium*.
- 114. Option (c) is correct.**
DNA helix is opened during transcription by RNA polymerase.
- 115. Option (a) is correct.**
Typhoid is caused by *Salmonella*, Pneumonia by *Haemophilus*, Filariasis by *Wuchereria* and Malaria by *Plasmodium*.
- 116. Option (b) is correct.**
The first phase of translation involves activation of amino acid in the presence of ATP and linked to their cognate tRNA-a process commonly called as charging of tRNA or aminoacylation of tRNA.
- 117. Option (c) is correct.**
At the time of fertilisation, the meiotic division of the secondary oocyte is completed. This process stimulates the completion of the second meiotic division of the secondary oocyte. It is unequal and leads to the formation of ootid and a second polar body, to which the sperm cell unites.
- 118. Option (a) is correct.**
DNA fragments can be visualised by staining with ethidium bromide and examining under UV radiation.
- 119. Option (b) is correct.**
During the G_1 phase, the cell is metabolically active and continuously growing but does not replicate its DNA. DNA synthesis takes place in S-phase. Nuclear division occurs during karyokinesis. Reorganisation of all the cellular components takes place in M-Phase.
- 120. Option (d) is correct.**
Ray florets have an inferior ovaries.
- 121. Option (a) is correct.**
Bilateral symmetry and acoelomate conditions are found in Platyhelminthes.
- 122. Option (c) is correct.**
Inulin—polymer of fructose having a glycosidic bond. Insulin—protein having peptide bond.
- 123. Option (d) is correct.**
Diaphragm and external intercostal muscles contract during inspiration.
- 124. Option (c) is correct.**
Chlorella and *Spirulina* are unicellular algae. *Gelidium*, *Gracilaria*, *Laminaria*, and *Sargassum* are multicellular. *Volvox* is colonial.
- 125. Option (d) is correct.**
Eosinophils release histaminase and destructive enzymes responsible for allergic reactions. **Basophils** secrete granules that have histamines, **Neutrophils** are phagocytic and destroy foreign material that enters into the body. Lymphocytes provide immunity to our bodies.

126. Option (a) is correct.

The organs which are anatomically dissimilar in structure, but can do similar functions are called analogous organs. This type of evolution is called convergent evolution. Flippers of penguins and dolphins are anatomically dissimilar but have the same functions.

127. Out of Syllabus**128. Out of Syllabus****129. Option (c) is correct.**

The plant parts which consist of two generations one within the other are pollen grains inside the anther and embryo sac inside the ovule. The pollen grain is haploid inside the diploid anther. The embryo sac is a haploid inside the diploid ovule.

130. Option (a) is correct.

Montreal protocol was signed to check the emission of ozone-depleting substances.

131. Option (a) is correct.

The most abundant protein in animals is collagen. The most abundant plant protein in the entire biosphere is RuBisCo.

132. Option (d) is correct.

The sequence of the first half of one strand will be like a mirror image with the second half of the complementary strand. This is called a palindromic sequence.

5'-GAATTC-3'

3'-CTTAAG-5' is the specific palindromic sequence recognised by EcoRI restriction endonuclease.

133. Option (b) is correct.

Length of DNA = $[0.34 \times 10^{-9}]m \times 6.6 \times 10^9 \text{ bp} = 2.2 \text{ m}$

Distance between 2 base pair in DNA helix
= 0.34 nm

= $0.34 \times 10^{-9} \text{ m}$ Total number of base pair

= $6.6 \times 10^9 \text{ bp}$.

134. Option (c) is correct.

Products of reaction catalysed by nitrogenase in root nodules of leguminous plants are ammonia and hydrogen.

135. Option (b) is correct.

Examples of evolution by anthropogenic action include herbicide-resistant weeds, drug-resistant eukaryotes and man-created breeds of domesticated animals like dogs.

136. Option (c) is correct.

Amazon forests exhibit the highest species diversity.

137. Option (b) is correct.

Site of formation of glycoproteins and glycolipids is Golgi bodies.

138. Option (b) is correct.

A true-breeding plant is one that produces the same phenotype no matter for how many generations

it is crossed. Mendel selected 14 true-breeding varieties.

139. Option (c) is correct.

Floating ribs are not connected with the sternum. The clavicle articulates with this acromion. The scapula is at the dorsal side of the thorax between the second and seventh ribs. The glenoid cavity is located below the acromion. It articulates with the humerus head to form the shoulder joint.

140. Option (d) is correct.

Gonorrhoea is caused by *Neisseria gonorrhoea*, Syphilis is caused by *Treponema palladium*, Genital herpes is caused by HSV-2.

141. Option (c) is correct.

The restriction enzyme endonucleases are called molecular scissors which cut the DNA at a specific sequence. They cleave the DNA molecule at unique sites. Restriction endonucleases cannot join DNA molecules.

142. Option (a) is correct.

Several microbes are used for the production of commercial and industrial chemicals such as organic acids, enzymes, and alcohol. *Clostridium butylicum* is used to produce butyric acid, *Trichoderma polysporum* is used to produce cyclosporin-A, *Monascus purpureus* is used to produce cholesterol-reducing agent in the blood, and *Aspergillus niger* is used to produce citric acid.

143. Option (a) is correct.

Zygotene → Synapsis, Pachytene → Crossing over, Diplotene → Chiasmata formation, Diakinesis → Terminalisation.

144. Option (b) is correct.

High H^+ concentration causes dissociation of oxyhaemoglobin.

145. Option (a) is correct.

Aldosterone reabsorbs water and Na^+ from the renal tubule preventing diuresis.

146. Option (a) is correct.

Inclusion bodies are not involved in the ingestion of food particles.

147. Option (d) is correct.

Bt cotton is resistant to insect pests. It kills the insects by damaging gut epithelial cells. Insects die of thirst and starvation.

148. Option (b) is correct.

The method in which desired characters of two different breeds are combined i.e., Superior breeds of males and females are mated to produce hybrid animals for commercial production is called cross-breeding. A new breed 'Hisardale' of sheep is formed by using Bikaneri ewes and Marino rams.

149. Option (c) is correct.

The phylum-Chordata is divided into three sub-phyla called Urochordata, Cephalochordata, and Vertebrata.

The members belong to vertebrata contain notochord during the embryonic stages. The notochord is replaced by vertebrae. The central nervous system is located on the dorsal side and it is hollow.

- 150. Option (d) is correct.**
Adrenal cortex secretes several hormones called corticoids. The corticoids that regulate carbohydrate metabolism are called glucocorticoids. The corticoids that regulate the water and electrolyte balance are called mineralo-corticoids. The glucocorticoids stimulate the process of gluconeogenesis by breaking down carbohydrates.
- 151. Option (a) is correct.**
Locusta is a gregarious pest. In Echinoderms, adults are radially symmetrical but larvae are bilaterally symmetrical. Scorpions respire through book lungs. Bioluminescence is well marked in ctenophores.
- 152. Option (d) is correct.**
First trophic level (T_1) Grass. Second trophic level (T_2)–Rabbit. Third trophic level (T_3)–Crow. Fourth trophic level (T_4)–Vulture.
- 153. Option (a) is correct.**
Gibberellin is essential for stem elongation.
- 154. Option (d) is correct.**
Gibberellic acid breaks seed dormancy. It activates the synthesis of α -amylase which breakdowns starch into simple sugar.
- 155. Option (a) is correct.**
Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis. Net primary productivity is GPP-respiration. Hence gross primary productivity is always more than NPP.
- 156. Option (a) is correct.**
Enterokinase in succus entericus activates trypsinogen into trypsin.
- 157. Option (d) is correct.**
In *Bt* cotton *cry* gene was isolated from *Bacillus thuringiensis*. The first clinical gene therapy was done for adenosine deaminase (ADA) deficiency. RNA interference is a new method used to prevent infestation. This strategy is used in eukaryotes as a cellular defense mechanism. PCR is used to detect HIV in suspected AIDS patients.
- 158. Option (b) is correct.**
Lysine and arginine are basic amino acids.
- 159. Option (b) is correct.**
Iron is essential for the formation of chlorophyll. Zinc is needed for synthesis of auxin. Boron has role in pollen grain germination. Manganese helps to break down the water molecule during photosynthesis to release oxygen.
- 160. Option (b) is correct.**
Glucose in urine (Glycosuria) and ketone bodies in urine (Ketonuria). Ketone bodies are formed because fats are burnt to give energy.
- 161. Option (a) is correct.**
Free RNA without protein coat is found in viroids.
- 162. Option (b) is correct.**
Organ of Corti, responsible for hearing is located on the basilar membrane. The snail-like coiled portion of the labyrinth is called the cochlea. The eustachian tube connects the middle ear cavity with the nasopharynx, The middle ear contains an ossicle called stapes that is attached to the oval window of the cochlea.
- 163. Option (b) is correct.**
Secondary metabolites such as nicotine, strychnine, and caffeine are produced by plants to protect them from being grazed (Defence).
- 164. Option (c) is correct.**
According to Robert May, estimated global species is 7 million.
- 165. Option (d) is correct.**
Hilum is the point of attachment of funicle and ovule. Hilum is the place where the ovule fuses with the funicle. It is the junction between the funicle and the ovule.
- 166. Option (b) is correct.**
A and B chains of insulin are joined by disulphide bridges.
- 167. Option (b) is correct.**
Active immunity is slow acting. Passive immunity gives a quick response.
- 168. Option (d) is correct.**
Fibrous roots originate from the base of the stem.
- 169. Option (a) is correct.**
Number of substrate-level phosphorylation in one turn of a citric acid cycle is one.
- 170. Option (c) is correct.**
Morgan did experimental verification of the chromosomal theory of inheritance.
- 171. Option (a) is correct.**
Water loss in liquid form from the tip of grass is due to root pressure.
- 172. Option (a) is correct.**
In photorespiration, O_2 binds to RuBisCo. As a result, RuBP instead of being converted to 2 molecules of PGA, binds with O_2 to form one molecule each of phosphoglycerate (3 carbon compound) and phosphoglycolate (2 carbon compound).
- 173. Option (b) is correct.**
When IA and IB are present together, they express a different types of sugar.
- 174. Option (c) is correct.**
Activated sludge is pumped into an anaerobic sludge digester for sewage treatment.
- 175. Option (d) is correct.**
Karl Ernst von Baer disapproved embryological support for evolution.

176. Option (a) is correct.

Floridean starch has a structure similar to amylopectin and glycogen.

177. Option (d) is correct.

Malonate acts as an inhibitor of catalytic activity. It inhibits succinic dehydrogenase. Collagen is a protein that contains peptide bonds. Chitin is a component of the cell wall in fungi. Ricin is a kind of toxic secondary metabolite.

178. Option (b) is correct.

Graves disease is due to hyperthyroidism. Diabetes mellitus is due to insulin deficiency, the hormone which is released from pancreas. Diabetes insipidus is due to hyporelease of ADH from the

posterior pituitary. Addison's disease is due to the hyposecretion of hormone from the adrenal cortex.

179. Option (d) is correct.

The transfer section of the monocotyledonous stem shows the presence of sclerenchyma in the hypodermis, vascular bundles are scattered randomly, conjoint, and closed. The phloem parenchyma is absent. The vascular bundles show the presence of water-containing cavities.

180. Option (d) is correct.

Plastoquinone facilitates transfer of electrons from PS-II to Cytb₆f complex.

□□□