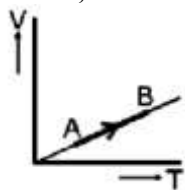


PHYSICS

1. The volume (V) of a monatomic gas varies with its temperature (T), as shown in the graph. The ratio of work done by the gas, to the heat absorbed by it, when it undergoes a change from state A to state B, is



- (a) $\frac{1}{3}$ (b) $\frac{2}{3}$
(c) $\frac{2}{5}$ (d) $\frac{2}{7}$

2. The fundamental frequency in an open organ pipe is equal to the third harmonic of a closed organ pipe if the length of the closed organ pipe is 20 cm, the length of the open organ pipe is.

- (a) 12.5 cm (b) 8 cm
(c) 13.2 cm (d) 16 cm

3. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is

- (a) 6.25% (b) 20%
(c) 26.8% (d) 12.5%

4. At what temperature will the rms speed of oxygen molecules become just sufficient for escape

from the Earth's atmosphere? (Given: Mass of oxygen molecule (m) = 2.76×10^{-26} kg)

- (a) 5.016×10^4 K (b) 8.360×10^4 K
(c) 2.508×10^4 K (d) 1.254×10^4 K

5. Unpolarized light is incident from air on a plane surface of a material of refractive index ' μ '. At a particular angle of incidence ' i ', it is found that the reflected and refracted rays are perpendicular to each other, which of the following options is correct for this situation?

- (a) $i = \sin^{-1}\left(\frac{1}{\mu}\right)$
(b) Reflected light is polarised with its electric vector perpendicular to the plane of incidence
(c) Reflected light is polarised with its electric vector parallel to the plane of incidence
(d) $i = \tan^{-1}\left(\frac{1}{\mu}\right)$

6. In Young's double slit experiment the separation d between the slits is 2mm, the wavelength λ of the light used is $5896 \text{ \AA}$ and distance D between the screen and slits is 100 cm. It is found that the angular width of the fringes is 0.20° . To increase the fringe angular width to 0.21° (with same λ and D) the separation between the slits needs to be changed to.

- (a) 2.1 mm (b) 1.9 mm
(c) 1.8 mm (d) 1.7 mm

7. An astronomical refracting telescope will have large angular magnification and high angular resolution, when it has an objective lens of.

- (a) large focal length and large diameter
(b) large focal length and small diameter
(c) small focal length and large diameter
(d) small focal length and small diameter

8. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and C are K_A , K_B and K_C , respectively, AC is the major axis and SB is perpendicular to AC at the position of the Sun S as shown in the figure. Then



- (a) $K_B < K_A < K_C$ (b) $K_B > K_A > K_C$
(c) $K_A < K_B < K_C$ (d) $K_B > K_A > K_C$

9. A solid sphere is in rolling motion. In rolling motion a body possesses translational kinetic energy (K_t) as well as rotational kinetic energy (K_r) simultaneously. The ratio $K_t : (K_t + K_r)$ for the sphere is

- (a) 10:7 (b) 5:7
(c) 7:10 (d) 2:5

10. If the mass of the Sun were ten times smaller and the universal gravitational constant were ten times larger in magnitude, which of the following is not correct?

- (a) Time period of a simple pendulum on the Earth would decrease.
(b) Walking on the ground would become more difficult.
(c) Raindrops will fall faster.
(d) 'g' on the Earth will not change

11. A solid sphere is rotating freely about its symmetry axis in free space. The radius of the sphere is increased keeping its mass same. Which of the following physical quantities would remain constant for the sphere?

- (a) Rotational kinetic energy
(b) Moment of inertia
(c) Angular velocity
(d) Angular momentum

12. A metallic rod of mass per unit length 0.5 kg m^{-1} is lying horizontally on a smooth inclined plane which makes an angle of 30° with the horizontal. The rod is not allowed to slide down by flowing a current through it when a magnetic field of induction 0.25 T is acting on it in the vertical direction. The current flowing in the rod to keep it stationary is.

- (a) 14.76 A (b) 5.98 A
(c) 7.14 A (d) 11.32 A

13. An inductor 20 mH , capacitor $100 \mu\text{F}$ and a resistor 50Ω are connected in series across a source of emf, $V = 10 \sin 314t$. The power loss in the circuit is

- (a) 2.74 W (b) 0.43 W
(c) 0.79 W (d) 1.13 W

14. A thin diamagnetic rod is placed vertically between the poles of an electromagnet.

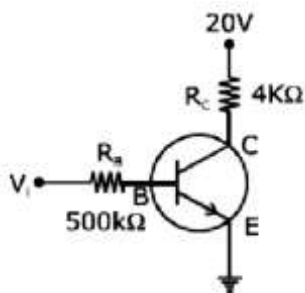
When the current in the electromagnet is switched on, the diamagnetic rod is pushed up, out of the horizontal magnetic field. Hence the rod gains gravitational potential energy. The work required to do this comes from

- (a) the lattice structure of the material of the rod
(b) the magnetic field
(c) the current source
(d) the induced electric field due to the changing magnetic field

15. Current sensitivity of a moving coil galvanometer is 5 div/mA and its voltage sensitivity (angular deflection per unit voltage applied) is 20 div/V . The resistance of the galvanometer is.

- (a) 250Ω (b) 25Ω
(c) 40Ω (d) 500Ω

16. In the circuit shown in the figure, the input voltage V_i is 20 V , $V_{BE} = 0$ and $V_{CE} = 0$. The values of I_B , I_C and β are given by.



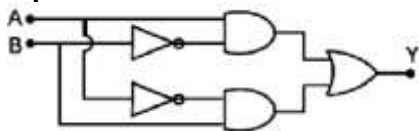
- (a) $I_B = 20 \mu\text{A}$, $I_C = 5 \text{ mA}$, $\beta = 250$
(b) $I_B = 25 \mu\text{A}$, $I_C = 5 \text{ mA}$, $\beta = 200$
(c) $I_B = 40 \mu\text{A}$, $I_C = 10 \text{ mA}$, $\beta = 250$

(d) $I_B = 40\mu A, I_C = 5mA, \beta = 125$

17. In a p-n junction diode, change in temperature due to heating

- (a) does not affect resistance of p-n junction
- (b) affects only forward resistance
- (c) affects only reverse resistance
- (d) affects the overall V - I characteristics of p-n junction.

18. In the combination of the following gates the output Y can be written in terms of inputs A and B as.



- (a) $\overline{A.B} + A.B$
- (b) $A.\overline{B} + \overline{A}.B$
- (c) $\overline{A.B}$
- (d) $\overline{A+B}$

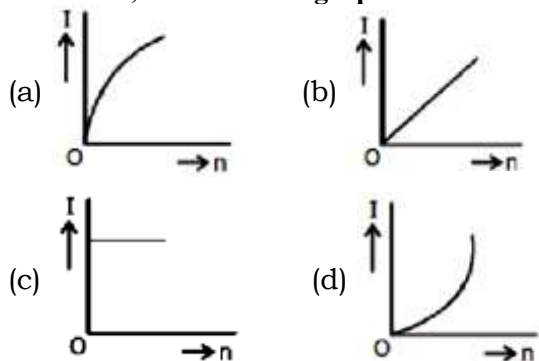
19. A carbon resistor of $(47 \pm 4.7)k\Omega$ is to be marked with rings of different colours for its identification. The colour code sequence will be.

- (a) Yellow-Green - Violet-Gold
- (b) Yellow- Violet-Orange-Silver
- (c) Violet- Yellow-Orange-Silver
- (d) Green-Orange -Violet -Gold

20. A set of 'n' equal resistors, of value 'R' each, are connected in series to a battery of emf 'E' and internal resistance 'R'. The current drawn is I. Now, the 'n' resistors are connected in parallel to the same battery. Then the current drawn from battery becomes 10 I. The value of n is.

- (a) 20
- (b) 11
- (c) 10
- (d) 9

21. A battery consists of a variable number 'n' of identical cells (having internal resistance 'r' each) which are connected in series. The terminals of the battery are short-circuited and the current I is measured, Which of the graphs shows the correct relationship between I and n?



22. A body initially at rest and sliding along a frictionless track from a height h (as shown in the figure) just completes a vertical circle of diameter AB = D. The height h is equal to.

- (a) $\frac{7}{5}D$
- (b) D
- (c) $\frac{3}{2}D$
- (d) $\frac{5}{4}D$

23. Three objects, A: (a solid sphere), B: (a thin circular disk) and C: (a circular ring), each have the same mass M and radius R. They all spin with the same angular speed ω about their own symmetry axes. The amounts of work (W) required to bring them to rest, would satisfy the relation.

- (a) $W_A > W_B > W_C$
- (b) $W_A > W_B > W_C$
- (c) $W_C > W_B > W_A$
- (d) $W_A > W_C > W_B$

24. Which one of the following statements is incorrect?

- (a) Friction force opposes the relative motion
- (b) Limiting value of static friction is directly proportional to normal reaction

- (c) Rolling friction is smaller than sliding friction,
(d) Coefficient of sliding friction has dimensions of length.

25. A moving block having mass m , collides with another stationary block having mass $4m$. The lighter block comes to rest after collision. When the initial velocity of the lighter block is v , then the value of coefficient of restitution (e) will be.

- (a) 0.8 (b) 0.25
(c) 0.5 (d) 0.4

26. A tuning fork is used to produce resonance in a glass tube, The length of the air column in this tube can be adjusted by a variable piston. At room temperature of 27°C two successive resonances are produced at 20 cm and 73 cm of column length, If the frequency of the tuning fork is 320 Hz, the velocity of sound in air at 27°C is.

- (a) 350 m/s (b) 339 m/s
(c) 330 m/s (d) 300 m/s

27. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A is.

- (a) proportional to the square root of the distance between the plates.
(b) linearly proportional to the distance between the plates.
(c) independent of the distance between the plates.
(d) inversely proportional to the distance between the plates,

28. A pendulum is hung from the roof of a sufficiently high building and is moving freely to and fro like a simple harmonic oscillator. The acceleration of the bob of the pendulum is 20 m/s^2 at a distance of 5 m from the mean position, The time period of oscillation is.

- (a) 2s (b) π s
(c) 2π s (d) 1s

29. An electron falls from rest through a vertical distance h in a uniform and vertically upward directed electric field E . The direction of electric field is now reversed, keeping its magnitude the same. A proton is allowed to fall from rest in it through the same vertical distance h . The time of fall of the electron, in comparison to the time of fall of the proton is.

- (a) 10 times greater
(b) 5 times greater
(c) Smaller
(d) equal

30. An electron of mass m with an initial velocity $\vec{V} = V_0 \hat{i}$ ($V_0 > 0$) enters an electric field

$\vec{E} = -E_0 \hat{i}$ ($E_0 = \text{constant} > 0$) at $t=0$. If λ_0 its de-Broglie wavelength initially, then de- Broglie wavelength initially, then de-Broglie wavelength at time is.

- (a) $\lambda_0 t$ (b) $\lambda_0 \left(1 + \frac{eE_0}{mV_0} t \right)$
(c) $\frac{\lambda_0}{\left(1 + \frac{eE_0}{mV_0} t \right)}$ (d) λ_0

31. For a radioactive material, half -life 10 minutes. If initially there are 600 number nuclei, the time taken (in minutes) for the disintegration of 450 nuclei is.

- (a) 30 (b) 10
(c) 20 (d) 15

32. When the light of frequency $2\nu_0$ (where ν_0 threshold frequency), is incident on a metal plate, the maximum velocity of electrons emitted is v_1 When the frequency of the incident radiation is increased to $5\nu_0$, the maximum velocity of electrons emitted from the same plate is v_2 . The ratio of v_1 to v_2 is.

- (a) 4:1 (b) 1:4
(c) 1:2 (d) 2:1

33. The ratio of kinetic energy to the total energy an electron in a Bohr orbit of the hydrogen atomic is.

- (a) 2:-1 (b) 1:-1
(c) 1: 1 (d) 1:-2

34. An em wave is propagating in a medium with a velocity $\vec{V} = V\hat{i}$. The instantaneous oscillating electric field of this +y wave is along +y axis. Then the direction of oscillating magnetic field of the em wave will be along.

- (a) -y direction (b) +z direction
(c) -z direction (d) -x direction

35. The refractive index of the material of a prism is $\sqrt{2}$ and the angle of the prism is 30° . One of the two refracting surfaces of the prism is made a mirror inwards, by silver coating. A beam of monochromatic light entering the prism from the other face will retrace its path (after reflection from the silvered surface) if its angle of incidence on the prism is -

- (a) 30° (b) 45°
(c) 60° (d) zero

36. The magnetic potential energy stored in a certain inductor is 25 mJ, when the current in the inductor is 60 mA. This inductor is of inductance.

- (a) 1.389H (b) 138.88 H
(c) 0.138H (d) 13.89H

37. An object is placed at a distance of 40 cm from a concave mirror of focal length 15 cm. If the object is displaced through a distance of 20 cm towards the mirror, the displacement of the image will be.

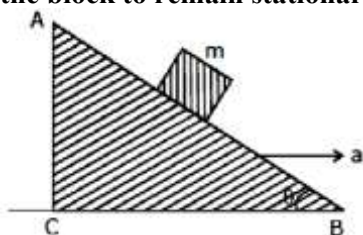
- (a) 30 cm towards the mirror
(b) 36 cm away from the mirror
(c) 30 cm away from the mirror
(d) 36 cm towards the mirror

38. A toy car with charge q moves on a frictionless horizontal plane surface

under the influence of a uniform electric field $\vec{E}$. Due to the force $q\vec{E}$, its velocity increases from 0 to 6 m/s in one second duration. At that instant the direction of the field is reversed. The car continues to move for two more seconds under the influence of this field. The average velocity and the average speed of the toy car between 0 to 3 seconds are respectively

- (a) 1 m/s, 3.5 m/s
(b) 1 m/s, 3 m/s
(c) 2 m/s, 4 m/s
(d) 1.5 m/s, 3 m/s

39. A block of mass m is placed on a smooth inclined wedge ABC of inclination θ as shown in the figure. The wedge is given an acceleration 'a' towards the right. The relation between a and g for the block to remain stationary on the wedge is -



- (a) $a = g \cos \theta$ (b) $a = \frac{g}{\sin \theta}$
(c) $a = \frac{g}{\cos \theta}$ (d) $a = g \tan \theta$

40. A student measured the diameter of a small steel ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and 0 of circular scale division coincides with 25 divisions above the reference level. If screw gauge has a zero error of -0.004 cm, the correct diameter of the ball is -

- (a) 0.053cm (b) 0.525cm
(c) 0.521 (d) 0.529cm

41. The moment of the force $\vec{F} = 4\hat{i} + 5\hat{j} - 6\hat{k}$ at (2, 0, -3), about the point (2, -2, -2), is given By.

- (a) $-7\hat{i} - 8\hat{j} - 4\hat{k}$

(b) $-4\hat{i} - j - 8k$

(c) $-8\hat{i} - 4j - 7k$

(d) $-7\hat{i} - 4j - 8k$

42. The power radiated by a black body is P and it radiates maximum energy at wavelength λ_0 . If the temperature of the black body is now changed so that it radiates maximum energy at wavelength $\frac{3}{4}\lambda_0$, the power radiated by it becomes nP . The value of n is.

(a) $\frac{256}{81}$

(b) $\frac{4}{3}$

(c) $\frac{3}{4}$

(d) $\frac{81}{256}$

43. Two wires are made of the same material and have the same volume. The first wire has cross-sectional area A and the second wire has cross-sectional area $3A$. If the length of the first wire is increased by Δl on applying a force F , how much force is needed to stretch the second wire by the same amount?

(a) $4F$

(b) $6F$

(c) $9F$

(d) $5F$

44. A sample of 0.1 g of water at 100°C and normal pressure ($1.013 \times 10^5 \text{ Nm}^{-2}$) requires 54 cal of heat energy to convert to steam at 100°C . If the volume of the steam produced is 167.1 CC, the change in internal energy of the sample, is -

(a) 42.4 J

(b) 208.7 J

(c) 104.3 J

(d) 84.5 J

45. A small sphere of radius ' r ' falls from rest in a viscous liquid. As a result, heat is produced due to viscous force. The rate of production of heat when the sphere attains its terminal velocity, is proportional to -

(a) r^5

(b) r^2

(c) r^3

(d) r^4

CHEMISTRY

46. Following solutions were prepared by mixing different volumes of NaOH and HCl of different concentration:

(a) $60\text{mL } \frac{M}{10} \text{ HCl} + 40\text{mL } \frac{M}{10} \text{ NaOH}$

(b) $55\text{mL } \frac{M}{10} \text{ HCl} + 45\text{mL } \frac{M}{10} \text{ NaOH}$

(c) $75\text{mL } \frac{M}{5} \text{ HCl} + 25\text{mL } \frac{M}{5} \text{ NaOH}$

(d) $100 \text{ mL } \frac{M}{10} \text{ HCl} + 100\text{mL } \frac{M}{10} \text{ NaOH}$

pH of which one of them will be equal to 1?

(a) d

(b) a

(c) b

(d) c

47. On which of the following properties does the coagulating power of an ion depend?

(a) Both magnitude and sign of the charge on the ion

(b) Size of the ion alone

(c) The magnitude of the charge on the ion alone

(d) The sign of charge on the ion alone

48. The solubility of BaSO_4 in water is $2.42 \times 10^{-3} \text{ gL}^{-1}$ at 298 K . The value of its solubility product (K_{sp}) will be (Given molar mass of $\text{BaSO}_4 = 233 \text{ g mol}^{-1}$)

(a) $1.08 \times 10^{-14} \text{ mol}^2\text{L}^{-2}$

(b) $1.08 \times 10^{-12} \text{ mol}^2\text{L}^{-2}$

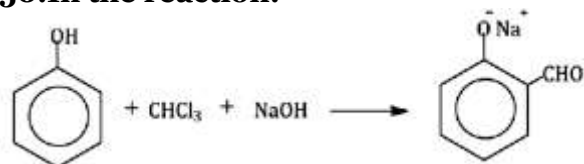
(c) $1.08 \times 10^{-10} \text{ mol}^2\text{L}^{-2}$

(d) $1.08 \times 10^{-8} \text{ mol}^2\text{L}^{-2}$

49. Given van der Waals constant for NH_3 , H_2 , O_2 and CO_2 are respectively 4.17, 0.244, 1.36 and 3.59, which one of the following gases is most easily liquefied?

- (a) O_2 (b) H_2
(c) NH_3 (d) CO_2

50. In the reaction.



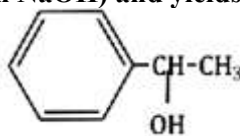
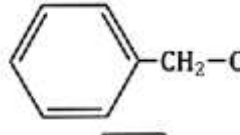
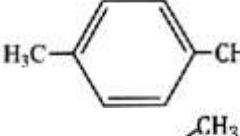
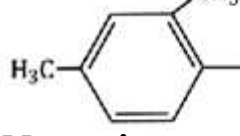
The electrophile involved is

- (a) dichloromethyl anion
(b) formyl cation (CHO)
(c) dichloromethyl cation $2(\text{CHCl})$
(d) dichlorocarbene ($:\text{CCl}_2$)

51. Carboxylic acids have higher boiling points than aldehydes, ketones and even alcohols of comparable molecular mass. It is due to their.

- (a) more extensive association of carboxylic acid via van der Waals force of attraction
(b) formation of carboxylate ion
(c) formation of intramolecular H-bonding
(d) formation of intermolecular H-bonding

52. Compound A, $\text{C}_8\text{H}_{10}\text{O}$, is found to react with NaOI (produced by reacting Y with NaOH) and yields a yellow precipitate with characteristic smell. A and Y are respectively.

- (a)  and I_2
(b)  and I_2
(c)  and I_2
(d)  and I_2

53. Magnesium reacts with an element (X) to form an ionic compound. If the ground state electronic configuration of (X) is $1s^2 2s^2 2p^3$, the simplest formula for this compound is.

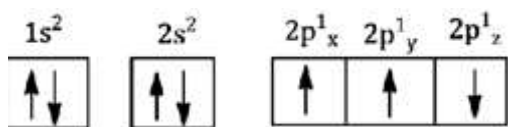
- (a) Mg_2X (b) MgX_2
(c) Mg_2X_3 (d) Mg_3X_2

54. Iron exhibits bcc structure at room temperature. Above 900°C , it transforms to fcc structure. The ratio for density of iron at room temperature to that at 900°C (assuming molar mass and atomic radii of iron remains constant with temperature) is.

- (a) $\frac{3\sqrt{3}}{4\sqrt{2}}$ (b) $\frac{4\sqrt{3}}{3\sqrt{2}}$
(c) $\frac{\sqrt{3}}{\sqrt{2}}$ (d) $\frac{1}{2}$

55. Which one is a wrong statement?

- (a) The electronic configuration of N atom is



(b) An orbital is designated by three quantum numbers while an electron in an atom is designated by four quantum numbers,

(c) Total orbital angular momentum of electron in 's' orbital is equal to zero

(d) The value of m for d_{z^2} is zero

56. Consider the following species:

CN^+ , CN^- , NO and CN

Which one of these will have the highest bond order?

(a) CN^-

(b) CN^-

(c) NO

(d) CN

57. In the structure of GIF_3 , the number of lone pairs of electrons on central atom 'Cl' is:

(a) four

(b) two

(c) one

(d) three

58. The correct order of atomic radii in group 13 elements is:

(a) $\text{B} < \text{Ga} < \text{Al} < \text{Tl} < \text{In}$

(b) $\text{B} < \text{Al} < \text{Ga} < \text{In} < \text{Tl}$

(c) $\text{B} < \text{Al} < \text{In} < \text{Ga} < \text{Tl}$

(d) $\text{B} < \text{Ga} < \text{Al} < \text{In} < \text{Tl}$

59. The correct order of N - compounds in its decreasing order of oxidation states is:

(a) $\text{HN} \text{O}_3$, NH_4Cl , NO, N_2

(b) $\text{HN} \text{O}_3$, NO, NH_4Cl , N_2

(c) $\text{HN} \text{O}_3$, NO, N_2 , NH_4Cl

(d) NH_4Cl , N_2 , NO, HNO_3

60. Which one of the following elements is unable to form MF_6^{3-} ion?

(a) B

(b) Al

(c) Ga

(d) In

61. Which of the following statements is not true for halogens?

(a) All shows positive oxidation states

(b) All are oxidation agents

(c) All form monobasic oxyacids

(d) Chlorine has the highest electron-gain enthalpy

62. Considering Ellingham diagram, which of the following metals can be used to reduce alumina?

(a) Mg

(b) Zn

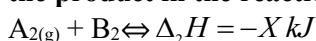
(c) Fe

(d) Cu

63. For the redox reaction $\text{MnO}_4^- + \text{C}_2\text{O}_4^{2-} + \text{H}^+ \rightarrow \text{Mn}^{2+} + \text{CO}_2 + \text{H}_2\text{O}$ the correct coefficients of the reactants for the balanced equation are:

	MnO_4^-	$\text{C}_2\text{O}_4^{2-}$	H^+
(a)	2	16	5
(b)	2	5	16
(c)	16	5	2
(d)	5	16	2

64. Which one of the following conditions will favour maximum formation of the product in the reaction:



(a) High temperature and high pressure

(b) Low temperature and low pressure

(c) Low temperature and high pressure

(d) High temperature and low pressure

65. The correction factor 'a' to the ideal gas equation corresponds to:

- (a) electric field present between the gas molecules
- (b) volume of the gas molecules
- (c) density of the gas molecules
- (d) forces of attraction between the gas molecules

66. When initial concentration of the reactant is doubled, the half-life period of a zero-order reaction:

- (a) is tripled
- (b) is doubled
- (c) is halved
- (d) remains unchanged

67. The bond dissociation energies of X_2 , Y_2 and XY are in the ratio of 1:05:1. ΔH for the formation of XY is -200 kJ mol^{-1} . The bond dissociation energy of X_2 will be:

- (a) 800 kJ mol^{-1}
- (b) 100 kJ mol^{-1}
- (c) 200 kJ mol^{-1}
- (d) 400 kJ mol^{-1}

68. Match the metal ions given in column I with the spin magnetic moments of the ions given

in Column II and assign the correct code: Column I Column II.

Column I	Column II
Co^{3+}	i. $\sqrt{8}B.M$
Cr^{3+}	ii. $\sqrt{35}B.M$
Fe^{3+}	iii. $\sqrt{3}B.M$
Ni^{2+}	iv. $\sqrt{24}B.M$
	v. $\sqrt{15}B.M$

- (a) iv i ii iii
- (b) i ii iii iv
- (c) iv v ii I
- (d) iii v i ii

69. Which one of the following ions exhibits d-d transition and paramagnetism as well?

- (a) MnO_4^-
- (b) $Cr_2O_7^{2-}$
- (c) CrO_4^{2-}
- (d) MnO_4^{2-}

70. The type of isomerism shown by the complex $[CoCl_2(en)_2]$ is.

- (a) Ionization isomerism
- (b) Coordination isomerism
- (c) Geometrical isomerism
- (d) Linkage isomerism

71. The geometry and magnetic behaviour of the complex $[Ni(CO)_4]$ are.

- (a) square planar geometry and paramagnetic
- (b) tetrahedral geometry and diamagnetic
- (c) square planar geometry and diamagnetic
- (d) tetrahedral geometry and paramagnetic

72. Iron carbonyl, $Fe(CO)_5$ is.

- (a) trinuclear
- (b) mononuclear
- (c) tetranuclear
- (d) dinuclear

73. The correct difference between first and second-order reaction is that.

- (a) A first-order reaction can be catalyzed; a second-order reaction cannot be catalyzed
- (b) The half-life of a first-order reaction does not depend on $[A]_0$; the half-life of a second-order reaction does depend on $[A]_0$
- (c) The rate of a first - order reaction does not depend on reaction concentrations; the rate of a second order reaction does depend on reactant concentrations
- (d) The rate of a first-order reaction does depend on reactant concentration; the rate of a second-order reaction does not depend on reactant concentrations

74. Among CaH_2 , BeH_2 , BaH_2 , the order of ionic character is.

- (a) $BeH_2 < BaH_3 < CaH_2$
- (b) $CaH_2 < BeH_3 < BaH_2$

- (c) $\text{BeH}_2 < \text{CaH}_3 < \text{BaH}_2$
 (d) $\text{BaH}_2 < \text{BeH}_3 < \text{CaH}_2$

75. Consider the change in oxidation state of Bromine corresponding to different emf values as shown in the diagram below:



Then the species undergoing disproportionation is.

- (a) Br_2 (b) BrO_4^-
 (c) BrO_3^- (d) HBrO

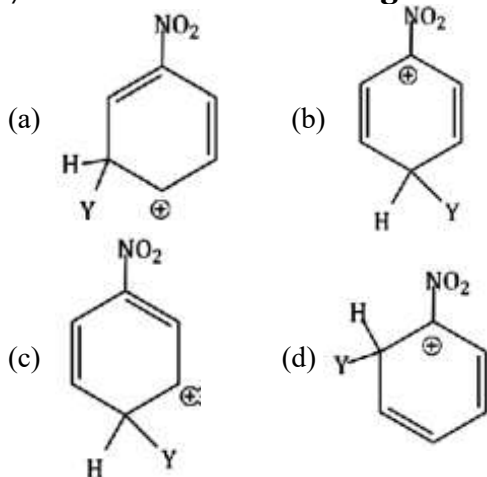
76. In which case is the number of molecules of water maximum?

- (a) 0.00224 L of water vapours at 1 atm and 273 K
 (b) 0.18 g of water
 (c) 18 mL of water
 (d) 10^3 mol of water

77. Which of the following molecules represents the order of hybridization sp^2 , sp^2 , sp , sp from left to right atoms?

- (a) $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$ (b) $\text{CH}_2=\text{CH}-\text{C}\equiv\text{CH}$
 (c) $\text{HC}\equiv\text{C}-\text{C}\equiv\text{CH}$ (d) $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_3$

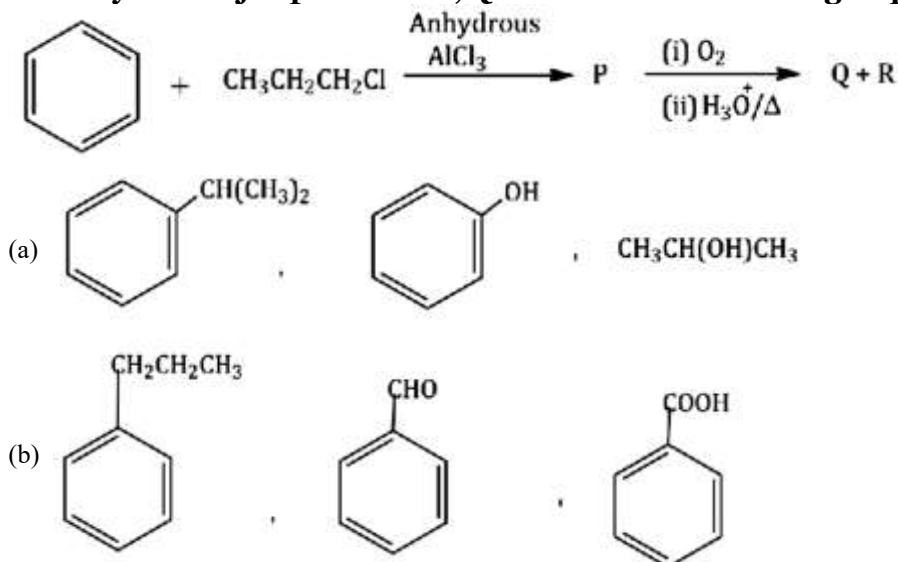
78. Which of the following carbocations is expected to be most stable?

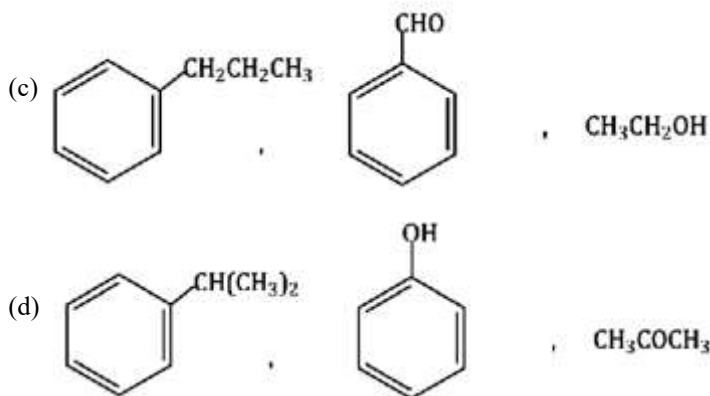


79. Which of the following is correct with respect to -I effect of the substituents? (R = alkyl)

- (a) $-\text{NH}_2 > -\text{OR} > -\text{F}$
 (b) $-\text{NR}_2 < -\text{F} < -\text{OR}$
 (c) $-\text{NH}_2 < -\text{OR} < -\text{F}$
 (d) $-\text{NR}_2 > -\text{OR} > -\text{F}$

80. Identify the major products P, Q and R in this following sequence of reactions:





81. Which of the following compounds can form a zwitterion?

- (a) Benzoic acid (b) Acetanilide
(c) Aniline (d) Glycine

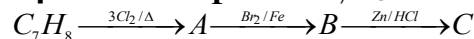
82. The compound A on treatment with Na gives B, and with PCl₅ gives C. B and C react together to give diethyl ether. A, B and C are in the order:

- (a) C₂H₅Cl, C₂H₆, C₂H₅OH
(b) C₂H₅OH, C₂H₅Cl, C₂H₅ONa
(c) C₂H₅OH, C₂H₆, C₂H₅Cl
(d) C₂H₅OH, C₂H₅ONa, C₂H₅Cl

83. Hydrocarbon (A) reacts with bromine by substitution to form an alkyl bromide which by Wurtz reaction is converted to gaseous hydrocarbon containing less than four carbon atoms (A) is:

- (a) CH₃-CH₃
(b) CH₂=CH₂
(c) CH≡CH
(d) CH₄

84. The compound C₇H₈ undergoes the following reactions:



The product 'C' is:

- (a) 3-bromo-2, 4, 6-trichlorotoluene
(b) o-bromotoluene
(c) m-bromotoluene
(d) p-bromotoluene

85. Which oxide of nitrogen is not a common pollutant introduced into the atmosphere both due to natural and human activity?

- (a) N₂O (b) NO₂
(c) N₂O₅ (d) NO

86. Regarding cross-linked or network polymers, which of the following statements is incorrect?

- (a) examples are bakelite and melamine.
(b) They are formed from bi- and tri-functional monomers.
(c) They contain covalent bonds between various linear polymer chains.
(d) They contain strong covalent bonds in their polymer chain.

87. Which of the following oxides is most acidic in nature?

- (a) BaO (b) BeO
(c) MgO (d) CaO

88. Nitration of aniline in strong acidic medium also gives m-nitro aniline because:

- (a) In absence of substituents nitro group always goes to m-position.
(b) In electrophilic substitution reactions amino group is Meta directive.
(c) In spite of substituents nitro group always goes to only m-position.
(d) In acidic [strong] medium aniline is present as anilinium ion.

89. A mixture of 2.3 g formic acid 4.5 g oxalic acid is treated with cone. H₂SO₄. The evolved gaseous mixture is passed through KOH pellets. Weight (in g) of the remaining product at STP will be:

- (a) 2.8 (b) 3.0
(c) 1.4 (d) 4.4

90. The difference between amylose and amylopectin is;

- (a) Amylopectin have $1 \rightarrow 4\alpha$ linkage and $1 \rightarrow 6\beta$ -linkage
- (b) Amylose have $1 \rightarrow 4\alpha$ - linkage and $1 \rightarrow 6\beta$ -linkage
- (c) Amylopectin have $1 \rightarrow 4\alpha$ - linkage and $1 \rightarrow 6\alpha$ -linkage
- (d) Amylose is made up of glucose and galactose

BIOLOGY

91. What is the role of NAD* in cellular respiration?

- (a) It is a nucleotide source for ATP synthesis.
- (b) It functions as an electron carrier.
- (c) It functions as an enzyme.
- (d) It is the final electron acceptor for anaerobic respiration

92. Oxygen is not produced during photosynthesis by.

- (a) Cycas
- (b) Nostoc
- (c) Green sulphur bacteria
- (d) Chara

93. Double fertilisation is.

- (a) Fusion of two male gametes with one egg
- (b) Fusion of one male gamete with two polar nuclei
- (c) Fusion of two male gametes of a pollen tube with two different eggs
- (d) Syngamy and triple fusion

94. In which of the following forms is iron adsorbed by plants?

- (a) Free element
- (b) Ferrous
- (c) Ferric
- (d) Both ferric and ferrous

95. Which of the following elements is responsible for maintaining turgor in cells?

- (a) Potassium
- (b) Sodium
- (c) Magnesium
- (d) Calcium

96. Which one of the following plants shows a very close relationship with a species of moth, where none of the two can complete, its life cycle without the other?

- (a) Banana
- (b) Yucca
- (c) Hydria
- (d) Viola

97. Pollen grains can be stored for several years in liquid nitrogen having temperature of.

- (a) -196°C
- (b) -80°C
- (c) -120°C
- (d) -160°C

98. What type of ecological pyramid would be obtained with the following data?

Secondary consumer: 120 g

Primary consumer: 60 g

Primary Producer: 10 g

- (a) Upright pyramid of numbers
- (b) Pyramid of energy
- (c) Inverted pyramid of biomass
- (d) Upright pyramid of biomass

99. Natality refers to.

- (a) Number of individuals leaving the habitat
- (b) Birth rate
- (c) Death rate
- (d) Number of individuals entering habitat

100. World Ozone Day is celebrated on.

- (a) 16th September
- (b) 21st April
- (c) 5th June
- (d) 22nd April

101. In stratosphere, which of the following elements acts as a catalyst in degradation of ozone and release of molecular oxygen?

- (a) Fe (b) Cl
(c) Carbon (d) Oxygen

102. Niche is.

- (a) The range of temperature that the organism needs to live.
(b) The physical space where an organism live.
(c) All the biological factors in the organism's environment.
(d) The functional role played by the organism where it lives.

103. Which of the following is a secondary pollutant?

- (a) SO₂ (b) CO₂
(c) CO (d) O₃

104. Which of the following statement is correct?

- (a) Horsetails are gymnosperms.
(b) Selaginella is heterosporous while Salvinia is homosporous.
(c) Ovules are not enclosed by ovary wall in gymnosperms.
(d) Stems are usually unbranched in both Cycas and Cedrus.

105. Pneumatophores occurs in.

- (a) Carnivorous plants
(b) Free-floating hydrophytes
(c) Halophytes
(d) Submerged hydrophytes

106. Sweet potato is a modified.

- (a) Tap root
(b) Adventitious root
(c) Stem
(d) Rhizome

107. Secondary xylem and phloem in dicot stem are produced by:

- (a) Phellogen
(b) Vascular cambium
(c) Apical meristems
(d) Axillary meristems

108. Select the wrong statement.

- (a) Pseudopodia are locomotory and feeding structures in protozoans.
(b) Mushrooms belong to Basidiomycetes.
(c) Cell wall is present in members of Fungi and Plantae.
(d) Mitochondria are the powerhouse of the cell in all kingdoms except Moneta.

109. Casparian strips occur in.

- (a) Cortex (b) Pericycle
(c) Epidermis (d) Endodermis

110. Plants having little or no secondary growth are.

- (a) Conifers
(b) Deciduous angiosperms
(c) Grasses
(d) Cycads

111. A 'new' variety of rice was patented by a foreign company, though such varieties have been present in India for a long time. This is related to

- (a) Lerma Rojo (b) Sharbati Sonora
(c) Co-667 (d) Basmati

112. Which of the following is commonly used as a vector for introducing a DNA fragment in human lymphocytes?

- (a) λ - phage (b) Ti plasmid
(c) Retrovirus (d) pBR322

113. Use of bioresources by multinational companies and organisation without authorisation from the concerned country and its people is called.

- (a) Bio-degradation
(b) Bio-piracy
(c) Bio-infringement
(d) Bio-exploitation

114. Select the correct match:

- (a) T.H.Morgan - Transduction
- (b) F_2 x Recessive parent - Dihybrid cross
- (c) Ribozyme - Nucleic acid
- (d) G. Mendel - Transformation

115. The correct order of steps in Polymerase Chain Reaction (PCR) is.

- (a) Denaturation, Extension, Annealing
- (b) Annealing Extension Denaturation
- (c) Extension, Denaturation, Annealing
- (d) Denaturation, Annealing, Extension

116. In India, the organization responsible for assessing the safety of introducing genetically modified organisms for public use is

- (a) Research Committee on Genetic Manipulation (RCGM)
- (b) Council for Scientific and industrial Research [CSIR]
- (c) Indian Council of Medical Research (ICMR)
- (d) Genetic Engineering Appraisal Committee (GEAC)

117. The stage during which separation of the paired homologous chromosomes begins is.

- (a) Diakinesis (b) Diplotene
- (c) Pachytene (d) Zygotene

118. The Golgi complex participates in.

- (a) Respiration bacteria
- (b) Formation of secretory vesicles
- (c) Fatty acid breakdown
- (d) Activation of amino acid

119. Stomatal movement is not affected by.

- (a) O_2 Concentration
- (b) Light
- (c) Temperature
- (d) CO_2 concentration

120. Stomata in grass leaf are.

- (a) Rectangular
- (b) Kidney shaped
- (c) Dumb-bell-shaped
- (d) Barrel shaped

121. The two functional groups characteristic of sugars are.

- (a) carbonyl and phosphate
- (b) carbonyl and methyl
- (c) hydroxyl and methyl
- (d) carbonyl and hydroxyl

122. Which of the following is not a product of light reaction of photosynthesis?

- (a) NADPH (b) NADH
- (c) ATP (d) Oxygen

123. Which of the following is true for nucleolus?

- (a) It takes part in spindle formation.
- (b) It is a membrane-bound structure.
- (c) Larger nucleoli are present in dividing cells.
- (d) It is a site for active ribosomal RNA synthesis.

124. Which among the following is not a prokaryote?

- (a) Nostoc
- (b) Mycobacterium
- (c) Saccharomyces
- (d) Oscillatoria

125. Winged pollen grains are present in.

- (a) Mango (b) Cycas
- (c) Mustard (d) Pinus

126. After karyogamy followed by meiosis, spores are produced exogenously in.

- (a) Agaricus
- (b) Alternaria
- (c) Neurospora
- (d) Saccharomyces

127. Which one is wrongly matched?

- (a) Gemma cups - Marchantia
- (b) Biflagellate zoospores - Brown algae
- (c) Uniflagellate gametes - Polysiphonia
- (d) Unicellular organism - Chlorella

128. Match the items given in column I with those in column II and select the option given below:

	Column I		Column II
a.	Herbarium	(i)	It is a place having a collection of preserved plants and animals.
b.	Key	(ii)	A list that enumerates methodically all the species found in an area with brief description aiding identification.
c.	Museum	(iii)	Is a place where dried and pressed plant specimens mounted on sheets are kept.
d.	Catalogue	(iv)	A booklet containing a list of characters and their alternate which are helpful in identification of various taxa.

a b c d

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

129. Which of the following flowers only once in its life-time?

- (a) Mango
- (b) Jackfruit
- (c) Bamboo species
- (d) Papaya

130. Which of the following pairs is wrongly matched?

- (a) XO type sex determination - Grasshopper
- (b) ABO blood grouping - Co-dominance
- (c) Starch synthesis in pea - Multiple alleles
- (d) T.H. Morgan – Linkage

131. Offsets are produced by.

- (a) Parthenocarpy
- (b) Mitotic divisions
- (c) Meiotic divisions
- (d) Parthenogenesis

132. Which of the following has proved helpful in preserving pollen as fossils?

- (a) Oil content
- (b) Cellulosic intine
- (c) Pollenkitt
- (d) Sporopollenin

133. Select the correct statement:

- (a) Spliceosomes take part in translation,
- (b) Punnett square was developed by a British scientist.
- (c) Franklin Stahl coined the term "linkage".
- (d) Transduction was discovered by S. Altman

134. The experimental proof for semiconservative replication of DNA was first shown in a.

- (a) Plant (b) Bacterium
- (c) Fungus (d) Virus

135. Select the correct match:

- (a) Matthew Meselson and K Stahl - Pisum sativum
- (b) Alfred Hershey and Martha Chase - TMV
- (c) Alec Jeffreys - Streptococcus pneumoniae
- (d) Francois Jacob and Jacques Monod - Lac operon

136. Match the items given in Column I with those in Column II and select the correct option given below:

Column I		Column II	
a.	Tidal volume	i.	2500-3000 mL
b.	Inspiratory reserve volume	ii.	1100-1200 mL
c.	Expiratory reserve volume	iii.	500-550 mL
d.	Residual volume	iv.	1000-1100 mL

a b c d

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

137. Which of the following options correctly represents the lung conditions in asthma and emphysema respectively?

- (a) Increased respiratory surface; Inflammation of bronchioles
- (b) Increased number of bronchioles; Increased respiratory surface
- (c) Inflammation of bronchioles; Decreased respiratory surface
- (d) Decreased respiratory surface; Inflammation a bronchioles

138. Match the items given in Column I with those in Column II and select the correct option given below:

Column I		Column II	
a.	Tricuspid valve	i.	Between left atrium and left ventricle
b.	Bicuspid valve	ii.	Between right ventricle and pulmonary artery
c.	Semilunar valve	iii.	Between right atrium and right ventricle

a b c

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

139. All of the following are part of an operon except.

- (a) an enhancer
- (b) structural genes
- (c) an operator
- (d) a promoter

140. AGGTATCGCAT is a sequence from the coding strand of a gene. What will be the corresponding sequence of the transcribed mRNA?

- (a) ACCUAUGCGAU
- (b) UGGTUTCGCAT
- (c) AGGUAUCGCAU
- (d) UCCAUAGCGUA

141. According to Hugo de vries, the mechanism of evolution is.

- (a) Phenotypic variation
- (b) Saltation
- (c) Multiple step mutations
- (d) Minor mutations

142. Match the items given in column I with those in column II and select the correct option given below:

Column I

- a. Proliferative phase
- b. Secretory phase
- c. Menstruation

Column II

- i. Breakdown of endometrial lining
- ii. Follicular Phase
- iii. Luteal Phase

a b c

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

143. A woman has X-linked condition on one of her X chromosomes. This chromosome can be

inherited by.

- (a) Only grandchildren
- (b) Only sons
- (c) Only daughters
- (d) Both sons and daughters

144. Ciliates differ from all other protozoans in.

- (a) Using pseudopodia for capturing prey
- (b) Having a contractile vacuole for removing excess water
- (c) Using flagella for locomotion
- (d) Having two types of nuclei

145. Identify the vertebrate group of animals characterized by crop and gizzard in their digestive system.

- (a) Aves
- (b) Reptilia
- (c) Amphibia
- (d) Osteichthyes

146. Which of the following organism are known as chief producers in the ocean?

- (a) Cyanobacteria
- (b) Diatoms
- (c) Dinoflagellates
- (d) Euglenoids

147. Which of the following features is used to identify a male cockroach from a female cockroach?

- (a) Fore wings with darker tegmina
- (b) Presence of caudal styles
- (c) Presence of a boat shaped sternum on the 9th abdominal segment
- (d) Presence of anal cerci

148. Which of the following animals does not undergo metamorphosis?

- (a) Moth
- (b) Tunicate
- (c) Earthworm
- (d) Starfish

149. Which one of these animals does not a homeotherm?

- (a) Camelus
- (b) Chelone
- (c) Macropus
- (d) Psittacula

150. The transparent lens in the human eye is held in its place by.

- (a) Smooth muscles attached to the iris

- (b) Ligaments attached to the iris
(c) Ligaments attached to the ciliary body
(d) Smooth muscles attached to the ciliary body

151. Which of the following structure or regions is incorrectly paired with its function?

(a)	Hypothalamus	Production of releasing hormones and regulation of temperature, hunger and thirst
(b)	Limbic system	Consists of fibre tracts that interconnect different regions of brain; controls movement.
(c)	Medulla oblongata	Controls respiration and cardiovascular reflexes
(d)	Corpus callosum	Band of fibres connecting left and right cerebral hemispheres

152. Which of the following hormones can play a significant role in osteoporosis?

- (a) Estrogen and Parathyroid hormone
(b) Progesterone and Aldosterone
(c) Aldosterone and Prolactin
(d) Parathyroid hormone and Prolactin

153. Which of the following is an amino acid derived hormone?

- (a) Estradiol (b) Ecdysone
(c) Epinephrine (d) Estriol

154. Match the items given in column I with those in Column II and select the correct option given below:

	Column I		Column II
a.	Glycosuria	i.	Accumulation of uric acid in joints
b.	Gout	ii.	Mass of crystallised salts within the kidney
c.	Renal calculi	iii.	Inflammation in glomeruli
d.	Glomerulonephritis	iv.	Presence of glucose in urine

a b c d

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

155. Match the items given in Column I with those in Column II and select the correct option given below.

	Column I		Column II
a.	Ultrafiltration	i.	Henle's loop
b.	Concentration of urine	ii.	Ureter
c.	Transport of urine	iii.	Urinary bladder
d.	Storage of urine	iv.	Malpighian corpuscle

	v.	Proximal convoluted tubule
--	----	----------------------------

a b c d

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

156. Which of the following gastric cells indirectly help in erythropoiesis?

- (a) Goblet cell
(b) Mucous cell
(c) Chief cells
(d) Parietal cells

157. Match the items given in Column I with those in Column II and select the correct option given below

	Column I		Column II
a	Fibrinogen	i	Osmotic balance
b	Globulin	ii	Blood clotting
c	Albumin	iii	Defence mechanism

a b c

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

158. Calcium is important in skeletal muscle contraction because it.

- (a) Detaches the myosin head from the actin filament.
(b) Activates the myosin ATPase by binding to it.
(c) Binds to troponin to remove the masking of active site on actin for myosin.
(d) Prevents the formation of bonds between the myosin cross bridges and the actin filament

159. Which of the following is an occupational respiratory disorder?

- (a) Botulism
(b) Silicosis
(c) Anthracis
(d) Emphysema

160. Which of these statements is incorrect?

- (a) Glycolysis operates as long as it is supplied with NAD that can pick up hydrogen atoms.
(b) Glycolysis occurs in cytosol,
(c) Enzymes of TCA cycle are present mitochondrial matrix,
(d) Oxidative phosphorylation takes place in the outer mitochondrial membrane,

161. Nissl bodies are mainly composed of.

- (a) Nuclei acids and SER
(b) DNA and RNA
(c) Proteins and lipids
(d) Free ribosomes and RER

162. Select the incorrect match:

- (a) Sub-metacentric Chromosomes - L- shaped chromosomes
(b) Allosomes - Sex chromosomes
(c) Lampbrush chromosomes - Diplotene bivalents
(d) Polytene chromosomes - Oocytes of amphibians

163. Many ribosomes may associate with a single mRNA to form multiple copies of a polypeptide simultaneously. Such strings of ribosomes are termed as.

- (a) Plastosome (b) Polyhedral bodies
(c) Polysome (d) Nucleosome

164. Which of the following events does not occur in rough endoplasmic reticulum?

- (a) Cleavage of signal peptide

- (b) Protein glycosylation
- (c) Protein folding
- (d) Phospholipid synthesis

165. Which of the following terms describe human dentition?

- (a) Pleurodont, Monophyodont, Homodont
- (b) Thecodont, Diphyodont Heterodont
- (c) Thecodont, Diphyodont Homodont
- (d) Pleurodont, Diphyodont, Heterodont

166. In a growing population of a country.

- (a) Reproductive and pre-reproductive individuals are equal in number
- (b) Reproductive individuals are less than the post-reproductive individuals
- (c) Pre-reproductive individuals are more than the reproductive individuals
- (d) Pre-reproductive, individuals are less than the reproductive individuals

167. Match the items given in Column I with those in Column II and select the correct option given below:

	Column I		Column II
a.	Eutrophication	i	UV-B radiation
b.	Sanitary landfill	ii	Deforestation
c.	Snow blindness	iii	Nutrient enrichment
d.	Jhum cultivation	iv	Waste disposal

a b c d

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

168. Which part of poppy plant is used to obtain the drug "Smack"?

- (a) Roots
- (b) Latex
- (c) Flowers
- (d) Leaves

169. Which one of the following population interactions is widely used in medical science for

the production of antibiotics?

- (a) Parasitism
- (b) Mutualism
- (c) Commensalism
- (d) Amensalism

170. All of the following are included in 'ex-situ conservation' except.

- (a) Botanical gardens
- (b) Sacred groves
- (c) Wildlife safari parks
- (d) Seed banks

171. Hormones secreted by the placenta to maintain pregnancy are.

- (a) hCG, hPL, progesterone, estrogens
- (b) hCG, hPL, estrogens, relaxin, oxytocin
- (c) hCG, hPL, progesterone, prolactin
- (d) hCG, progesterone, estrogens, glucocorticoids

172. The contraceptive "SAHELI".

- (a) is an IUD.
- (b) increases the concentration of estrogen and prevent ovulation in females.
- (c) blocks estrogen receptors in the uterus, preventing eggs from getting implanted.
- (d) is a post-coital contraceptive.

173. The difference between spermiogenesis and spermiation is.

- (a) In spermiogenesis spermatozoa from Sertoli cells are released into the cavity of seminiferous tubules, while in spermiation spermatozoa are formed.
- (b) In spermiogenesis spermatozoa are formed, while in spermiation spermatids are formed.

- (c) In spermiogenesis spermatids are formed, while in spermiation spermatozoa are formed.
 (d) In spermiogenesis spermatozoa are formed, while in spermiation spermatozoa are released from Sertoli cells into the cavity of seminiferous tubule.

174. The amnion of mammalian embryo is derived from.

- (a) mesoderm and trophoblast
 (b) endoderm and mesoderm
 (c) ectoderm and mesoderm
 (d) ectoderm and endoderm

175. The similarity of bone structure in the forelimbs of many vertebrates is an example of

- (a) Convergent evolution
 (b) Analogy
 (c) Homology
 (d) Adaptive radiation

176. In which disease does mosquito transmitted pathogen cause chronic inflammation of lymphatic vessels?

- (a) Ringworm disease
 (b) Ascariasis
 (c) Elephantiasis
 (d) Amoebiasis

177. Which of the following is not an autoimmune disease?

- (a) Alzheimer's disease
 (b) Rheumatoid arthritis
 (c) Psoriasis
 (d) Vitiligo

178. Which of the following characteristics represent 'Inheritance of blood groups' in humans?

- | | |
|--------------------------|-------------------------|
| a. Dominance | b. Co-dominance |
| c. Multiple allele | d. Incomplete dominance |
| e. Polygenic inheritance | |
- (a) b, d and e
 (b) a, b and c
 (c) b, c and e
 (d) a, c and e

179. Among the following sets of examples for divergent evolution, select the incorrect option.

- (a) Brain of bat, man and cheetah
 (b) Heart of bat, man and cheetah
 (c) Forelimbs of man, bat and cheetah
 (d) Eye of octopus, bat and man

180. Conversion of milk to curd improves its nutritional value by increasing the amount of.

- (a) Vitamin B₁₂
 (b) Vitamin A
 (c) Vitamin D
 (d) Vitamin E