gradeup

NEET 2018

Question Paper

with Solutions

Prep Smart. Score Better. Go gradeup

www.gradeup.co

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

   A. $HC \equiv C - C \equiv CH$

   B. $CH_2 = CH - C \equiv CH$

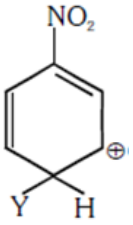
   C. $CH_2 = CH - CH = CH_2$

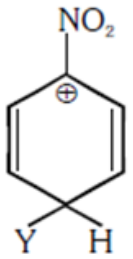
   D. $CH_2 - CH = CH - CH_3$

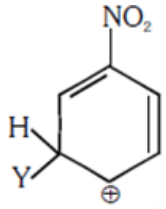
   Ans. B

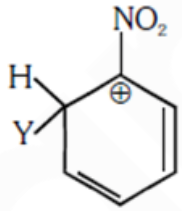
Sol. $\underset{sp^2}{CH_2} = \underset{sp^2}{CH} - \underset{sp}{C} \equiv \underset{sp}{C} - H$

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

   A. 

   B. 

   C. 

   D. 

   Ans. C

Sol. Nitro group is the strongest electron withdrawing group. So the carbocation formed will be destabilised due to electron withdrawing effect of NO_2. At para position, the electron withdrawing effect of NO_2 will be least hence, option C is the most stabilised carbocation.

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

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

   B. $-NR_2 < -OR < -F$

   C. $-NH_2 > -OR > -F$

   D. $-NR_2 > -OR > -F$

   Ans. A

Sol. It is a bonus question. Its correct answers are options A and B Due to EN difference
$-NH_2 < -OR < -F$
$-NR_2 < -OR < -F$

4. 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
a. Co^{3+}
b. Cr^{3+}
c. Fe^{3+}
d. Ni^{2+}
Column II
i. $\sqrt{8}$ B.M.
ii. $\sqrt{35}$ B.M.
iii. $\sqrt{3}$ B.M.
iv. $\sqrt{24}$ B.M.
v. $\sqrt{15}$ B.M.
A. a-iv b-v c-ii d-i
B. a-i b-ii c-iii d-iv
C. a-iv b-i c-ii d-iii
D. a-iii b-v c-i d-ii
Ans. A

Sol. Magnetic moment = $\mu = \sqrt{n(n+2)}$

$CO^{+3} = [Ar]\ 3d^6 \quad n = 4 \quad \mu = \sqrt{24}$

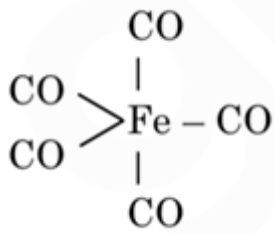
$Cr^{+3} = [Ar]\ 3d^3 \quad n = 3 \quad \mu = \sqrt{15}$

$Fe^{+3} = [Ar]\ 3d^5 \quad n = 5 \quad \mu = \sqrt{35}$

$Ni^{+2} = [Ar]\ 3d^8 \quad n = 2 \quad \mu = \sqrt{8}$

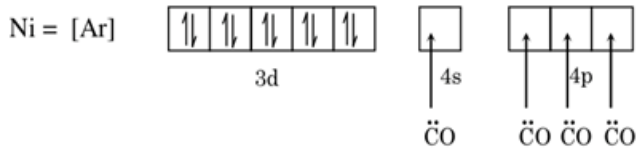
5. Iron carbonyl, $Fe(CO)_5$ is
A. tetranuclear
B. mononuclear
C. trinuclear
D. dinuclear
Ans. B

Sol. $Fe(CO)_5$ is mononuclear carbonyl because it contains one metal atom



6. The geometry and magnetic behaviour of the complex $[Ni(CO)_4]$ are
A. square planar geometry and diamagnetic
B. tetrahedral geometry and diamagnetic
C. square planar geometry and paramagnetic
D. tetrahedral geometry and paramagnetic
Ans. B

Sol. $Ni(CO)_4$
Ni= $[Ar]3d^8 4s^2$



$Ni(CO)_4$ is a diamagnetic and sp^3 hybridisation so shape is tetrahedral

7. Which one of the following ions exhibits d–d transition and paramagnetism as well?

A. CrO_4^{2-}

B. $Cr_2O_7^{2-}$

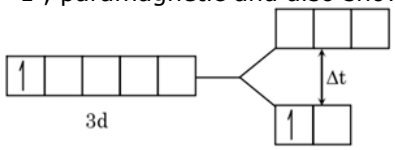
C. MnO_4^-

D. MnO_4^{2-}

Ans. D

Sol. MnO_4^{2-} => Mn^{6+} = $[Ar]3d^1$

N=1 , paramagnetic and also show d-d transition



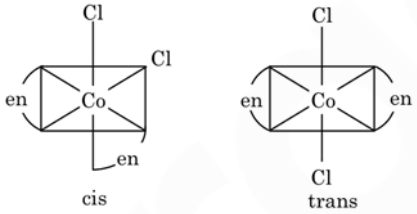
d^0 and d^{10} complex ion does not shows d-d transition

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

A. Geometrical isomerism
B. Coordination isomerism
C. Ionization isomerism
D. Linkage isomerism

Ans. A

Sol. $[COCl_2(en)_2]$ Shows geometrical isomerism and exist in cis and trans form.



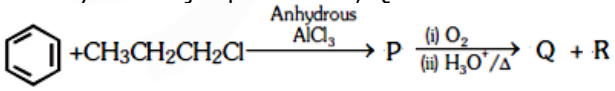
9. Which of the following compounds can form a zwitterion?

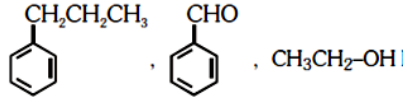
A. Aniline
B. Acetanilide
C. Benzoic acid
D. Glycine

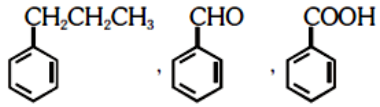
Ans. D

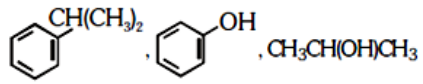
Sol. $\underset{\text{[Glycine]}}{NH_2-CH_2-COOH} \rightleftharpoons \underset{\text{Zwitter ion [Dipolar ion]}}{\overset{\oplus}{N}H_3-CH_2-COO^{\ominus}}$

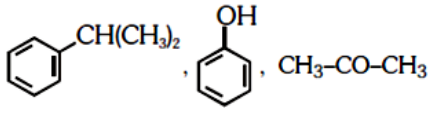
10. Identify the major products P, Q and R in the following sequence of reaction :



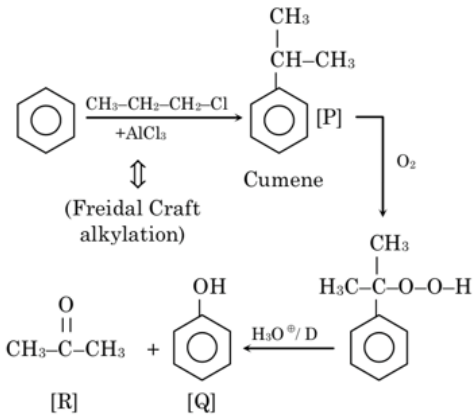
A. 

B. 

C. 

D. 

Ans. D

Sol. 

11. The bond dissociation energies of X_2, Y_2 and XY are in the ratio of 1 : 0.5 : 1. ΔH for the formation of XY is −200 kJ mol^{-1}. The bond dissociation energy of X_2 will be
    A. 200 kJ mol^{-1}
    B. 100 kJ mol^{-1}
    C. 800 kJ mol^{-1}
    D. 400 kJ mol^{-1}
    Ans. C

Sol. 1/2 X_2 + 1/2 Y_2→ XY
x_2:y_2:xy
$\Delta H^{o}_{reaction} = BE_R - BE_P$
= a/2 + 0.5a/2 − a
-200 = -0.25a
A=800 kJ/mole

12. When initial concentration of the reactant is doubled, the half-life period of a zero order reaction
    A. is halved
    B. is doubled
    C. is tripled
    D. remains unchanged
    Ans. B

Sol. Reactant (R)--->Product(P)
Rate=-d(R)/dt=k[R]^{o}=k
Half life of zero order, $T_{1/2}$ = a/2k
Hence the rate is doubled when concentration is doubled.

13. The correction factor 'a' to the ideal gas equation corresponds to
    A. density of the gas molecules
    B. volume of the gas molecules
    C. electric field present between the gas molecules
    D. forces of attraction between the gas molecules
    Ans. D

Sol. The correction factor 'a' in real gas equation accounts for the force attraction between molecules which is neglected in ideal gas equation.

14. Which one of the following conditions will favour maximum formation of the product in the reaction,

$$A_2(g) + B_2(g) \rightleftharpoons X_2(g)\,\Delta_r H = -X\,kJ?$$

    A. Low temperature and high pressure
    B. Low temperature and low pressure

C. High temperature and high pressure
D. High temperature and low pressure
Ans. A

Sol. According to Le-Chatelier's principal
Exothermic reaction when $\Delta n_g<0$
Then favorable conditions are low temperature and high pressure.

15. For the redox reaction

$$MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$$

the correct coefficients of the reactants for the balanced equation are MnO_4^- $C_2O_4^{2-}$ H^+

A. 16 5 2
B. 2 5 16
C. 2 16 5
D. 5 16 2
Ans. B

Sol.

Acc to ion electron method

Oxidation half reaction	Reduction Half reaction
$C_2O_4^{2-} \rightarrow 2CO_2 + 2e$	$MnO_4^- + 8H^+ + 5e \rightarrow Mn^{2+} + 4H_2O$
Multiply x5	Multiply x2

$5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \rightarrow 10CO_2 + 2Mn^{2+} + 8H_2O$

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

A. N_2O_5
B. NO_2
C. N_2O
D. NO
Ans. A

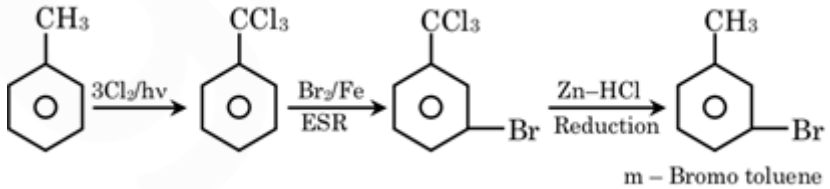
Sol. N_2O_5 is highest oxidation number oxide which will not easily formed by common or natural oxidation of lower oxides of nitrogen.

17. The compound C_7H_8 undergoes the following reactions :

$$C_7H_8 \xrightarrow{3Cl_2/\Delta} A \xrightarrow{Br_2/Fe} B \xrightarrow{Zn/HCl} C$$

The product 'C' is
A. m–bromotoluene
B. o–bromotoluene
C. 3–bromo–2,4,6–trichlorotoluene
D. p–bromotoluene
Ans. A

Sol.



m – Bromo toluene

18. 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. $CH \equiv CH$
B. $CH_2 = CH_2$
C. $CH_3 - CH_3$
D. CH_4
Ans. D

$$CH_4 \xrightarrow{Br_2/Hr} CH_3 - Br$$

$$CH_3 - Br \xrightarrow[Ether]{Na/Dry} CH_3 - CH_3$$

Sol.
Less than four carbon
n=1 to n=4 → (gaseous)

19. The compound A on treatment with Na gives B, and with PCl_5 gives C. B and C react together to give diethyl ether. A, B and C are in the order

A. $C_2H_5OH, C_2H_6, C_2H_5CI$

B. $C_2H_5OH, C_2H_5CI, C_2H_5ONa$

C. $C_2H_5CI, C_2H_6, C_2H_5OH$

D. $C_2H_5OH, C_2H_5ONa, C_2H_5CI$

Ans. D

$$\underset{(A)}{C_2H_5OH} \xrightarrow{PCl_5} \underset{(C)}{C_2H_5Cl}$$

$$\downarrow Na$$

$$\underset{(B)}{C_2H_5\overset{\ominus}{O}\overset{\oplus}{Na}} + \frac{1}{2}H_2\uparrow$$

$$\underset{(B)}{C_2H_5\overset{\ominus}{O}\overset{\oplus}{Na}} + \underset{(C)}{Cl - C_2H_5} \longrightarrow \underset{\text{Diethylether}}{C_2H_5OC_2H_5}$$

Sol.

20. Given van der Waals constant for NH_3, H_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. NH_3

B. H_2

C. O_2

D. CO_2

Ans. A

Sol. NH_3 is the most easily liquefiable gas because its critical temperature is high which means it has high van der Waals's constant.

21. The solubility of BaSO4 in water $2.42*10^{-3}gL^{-1}$ at 298 K. The value of solubility product (Ksp) will be
(Given molar mass of $BaSO_4$ = 233 $gmol_{-1}$)

A. $1.08 \times 10^{-10} mol^2 L^{-2}$

B. $1.08 \times 10^{-12} mol^2 L^{-2}$

C. $1.08 \times 10^{-14} mol^2 L^{-2}$

D. $1.08 \times 10^{-8} mol^2 L^{-2}$

Ans. A

Sol. Convert solubility in mol/lit
$S = 2.42x10^{-3}/233 = 1.03 \times 10^{-5}$
$K_{sp}=s^2 (1.03x10^{-5})^2 = 1.08x10^{-10}$

22. Following solutions were prepared by mixing different volumes of NaOH and HCl of different concentrations :

1) $60mL\frac{M}{10}HCI + 40mL\frac{M}{10}NaOH$

2) $55mL\frac{M}{10}HCI + 45mL\frac{M}{10}NaOH$

3) $75mL\frac{M}{5}HCI + 25mL\frac{M}{5}NaOH$

4) $100mL\frac{M}{10}HCI + 100mL\frac{M}{10}NaOH$

pH of which one of them will be equal to 1?
A. 2
B. 1
C. 4
D. 3
Ans. D

Sol. As
For every option

$N_{HCl}V_{HCl} > N_{NaOH}V_{NaOh}$

So, HCl will remain at the end of the reaction.

$$N_{\text{final solution}} = \frac{N_{HCl}V_{HCl} + N_{NaOH}V_{NaOH}}{V_{HCl} + V_{NaOH}} = [H^+]$$

For option C: $[H^+] = \frac{\frac{1}{5}\times 75 - \frac{1}{5}\times 25}{75+25} = 0.1$

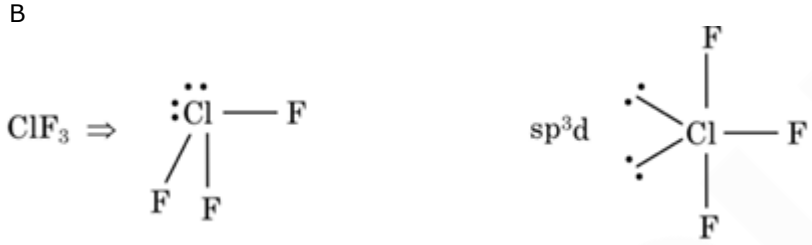
$pH = 1$

23. On which of the following properties does coagulating power of an ion depend?
A. The magnitude of the charge on the alone
B. Size of the ion alone
C. Both magnitude and sign of the charge the ion
D. The sign of charge on the ion alone
Ans. C
Sol. According to Hardy Schulze law, Greater is the valency of the oppositely charged ion of the electrolyte being added, the faster is the coagulation.
24. The correct order of N-compounds in its decreasing order of oxidation states is
A. HNO_3, NO, N_2, NH_4CI
B. HNO_3, NO, NH_4CI, N_2
C. HNO_3, NH_4CI, NO, N_2
D. NH_4CI, N_2, NO, HNO_3
Ans. A
Sol. $HNO_3 \rightarrow 1+x-6=0$; $x=5$
$NO \rightarrow x-2=0$; $x=2$
$N_2 \rightarrow x=0$
$NH_4^+ \rightarrow x+4=1$; $x=-3$
25. The correct order of atomic radii in group 13 elements is
A. B < Al < In < Ga < Tl
B. B < Al < Ga < In < Tl
C. B < Ga < Al < Tl < In
D. B < Ga < Al < In < Tl
Ans. D

Sol. Ga is slightly smaller than Al due poor shielding of d-electrons, so the correct order of ionic size is B < Ga < Al < In < T

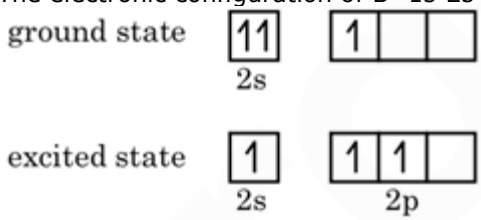
26. Considering Ellingham diagram, which of the following metals can be used to reduce alumina?
A. Fe
B. Zn
C. Mg
D. Cu
Ans. C
Sol. In Ellingham diagram, Mg is in the lower part as compared to alumina which indicates that Mg has more negative value of ΔG than Alumina and therefore can reduce it.

27. In the structure of ClF_3, the number of lone pairs of electrons on central atom 'Cl' is
A. one
B. two
C. four
D. three
Ans. B



Sol.
Two lone pairs of electrons are present on central Cl atom.

28. Which one of the following elements is unable to form MF_6^{3-} ion?
A. Ga
B. AI
C. B
D. In
Ans. C
Sol. Boron does not form BF_6^{3-} due to absence of vacant d orbitals.
The electronic configuration of B=$1s^2 2s^2 2p^1$



29. Which of the following statements is **not** true for halogens?
A. All form monobasic oxyacids.
B. All are oxidizing agents.
C. All but fluorine show positive oxidation states.
D. Chlorine has the highest electron-gain enthalpy.
Ans. C
Sol. Fluorine shows only-1 oxidation state and other halogen shows negative and positive oxidation state.

30. Consider the following species:
CN^+, CN^-, NO and CN
Which one of these will have the highest bond order?
A. NO
B. CN^-
C. CN^+
D. CN
Ans. B
Sol. Bond order

NO= $\sigma_{1s}^2\sigma_{1s}^{*2}\sigma_{2s}^2\sigma_{2s}^{*2}\pi_{2p_x}^2\pi_{2p_y}^2\sigma_{2p_z}^2\pi_{2p_x}^{*1}$

$$BO=\frac{N_b-N_a}{2}=\frac{10-5}{2}=2.5$$

CN^+= $\sigma_{1s}^2\sigma_{1s}^{*2}\sigma_{2s}^2\sigma_{2s}^{*2}\pi_{2p_x}^2\pi_{2p_y}^2$

$$BO=\frac{N_b-N_a}{2}=\frac{8-4}{2}=2$$

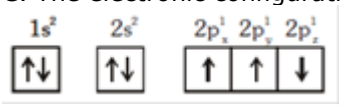
CN= $\sigma_{1s}^2\sigma_{1s}^{*2}\sigma_{2s}^2\sigma_{2s}^{*2}\pi_{2p_x}^2\pi_{2p_y}^2\sigma_{2p_z}^1$

$$BO=\frac{N_b-N_a}{2}=\frac{9-4}{2}=2.5$$

CN^-= $\sigma_{1s}^2\sigma_{1s}^{*2}\sigma_{2s}^2\sigma_{2s}^{*2}\pi_{2p_x}^2\pi_{2p_y}^2\sigma_{2p_z}^2$

$$BO=\frac{N_b-N_a}{2}=\frac{10-4}{2}=3$$

31. Which one is a wrong statement?
A. Total orbital angular momentum of electron in 's' orbital is equal to zero
B. An orbital is designated by three quantum numbers while an electron in an atom is designated by four quantum numbers.
C. The electronic configuration of N atom is



D. The value of m for d_{z^2} is zero
Ans. C
Sol. Option C is incorrect, as in degenerate half-filled orbitals all the electrons have the same spin. Rest all the options are correct.
32. Iron exhibits bcc structure at room temperature. Above 900 °C, it transforms to fcc structure. The ratio of 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. $\frac{\sqrt{3}}{\sqrt{2}}$
B. $\frac{4\sqrt{3}}{3\sqrt{2}}$
C. $\frac{3\sqrt{3}}{4\sqrt{2}}$
D. $\frac{1}{2}$

Ans. C

Sol.

$$Density = \frac{Z \times M_w}{N_A \times V}$$

$$For\ BCC,\ r = \frac{\sqrt{3}}{4}a$$

$$V = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3}\pi\left(\frac{\sqrt{3}}{4}a\right)^3$$

$$= \frac{4}{3}\pi\left(\frac{3\sqrt{3}}{64}a^3\right)$$

$$= \frac{\sqrt{3}\pi}{16}a^3$$

$$For\ FCC,\ r = \frac{a}{2\sqrt{2}}$$

$$V = \frac{\pi a^3}{12\sqrt{2}}$$

$$\frac{BCC}{FCC} = \frac{3\sqrt{3}}{4\sqrt{2}}$$

33. 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_3

B. MgX_2

C. Mg_2X

D. Mg_3X_2

Ans. D

Sol. Electronic configuration of X=$1s^2 2s^2 2p^3$

Mg form ionic compound with X valency of X is -3

$Mg^{2+} + X^{-3} \rightarrow Mg_3X_2$

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

A. 18 mL of water

B. 0.18 g of water

C. 0.00224 L of water vapours at 1 atm and 273 K

D. 10^{-3} mol of water

Ans. A

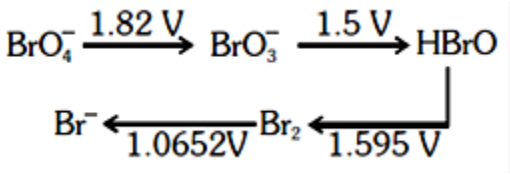
Sol. 1)18 ml water means 18 g H_2O means 1 mole H_2O so N_A molecule

2)n = 0.18/18 = 0.01 mole means 0.01 N_A molecule

3) n=0.00224/22.4 = 10^{-4} mole means 10^{-4} N_A molecule

4) 10^{-3} mol means 10^{-3} x N_A molecule

35. 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. BrO_3^-

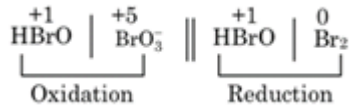
B. BrO_4^-

C. Br_2

D. HBrO

Ans. D

Sol. Only following combination give positive E^o_{cell} value.



E^o_{cell}=SOP of anode+ SRP of cathode

= -1.5 + 1.595

= 0.095V

Since E^o_{cell} is positive, so, ΔG^o will be negative. Hence, HBrO undergoes disproportionation reaction.

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

A. $BeH_2 < CaH_2 < BaH_2$

B. $CaH_2 < BeH_2 < BaH_2$

C. $BeH_2 < BaH_2 < CaH_2$

D. $BaH_2 < BeH_2 < CaH_2$

Ans. A

Sol. Ionic character ∝ size of cation

Down the group, size of the cation increases due to which ionic character of its hydride decreases. Since the order of ionic size of Be, Ca and Ba is Be<Ca<Ba, so the ionic character of the hydrides will be $BeH_2 < CaH_2 < BaH_2$

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

A. the rate of a first-order reaction does not depend on reactant concentration; the rate of a secondorder reaction does depend on reactant concentrations.

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. a first-order reaction can be catalyzed; a second-order reaction cannot be catalyzed.

D. the rate of a first-order reaction does depend on reactant concentrations; the rate of a second-order reaction does not depend on reactant concentrations

Ans. B

Sol. For first order, $t_{1/2}$ is independent of initial concentration

For second order

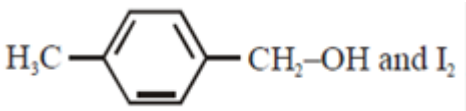
$T_{1/2} = 1/K$

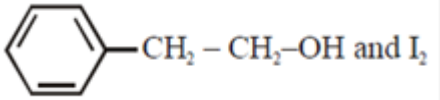
$a = 1/K[A]_o$

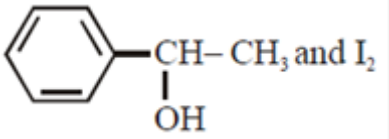
For second order reaction, $t_{1/2}$ depends on initial concentration $[A]_o$.

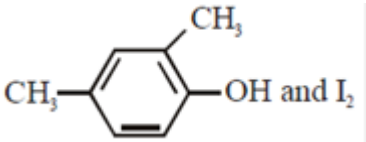
38. Compound A, $C_8H_{10}O$, is found to react with NaOI (produced by reacting Y with NaOH) and yields a yellow precipitate with characteristic smell.

A and Y are respectively

A. 

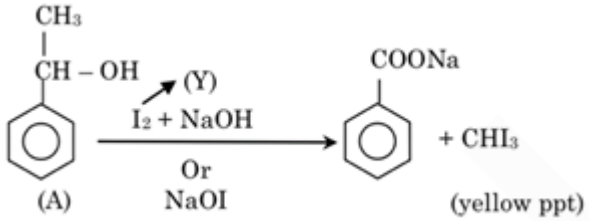
B. 

C. 

D. 

Ans. C

Sol. The given reaction is an Iodoform reaction in which compound containing CH_3-CHOH group on reaction with I_2 in the presence of NaOH gives yellow ppt of iodoform.



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

A. formation of intramolecular H-bonding

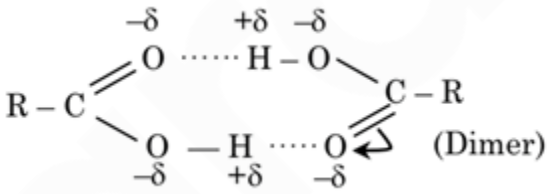
B. formation of carboxylate ion

C. more extensive association of carboxylic acid via van der Waals force of attraction

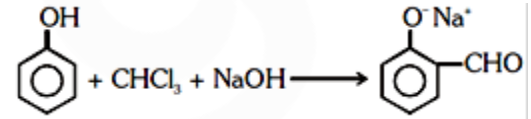
D. formation of intermolecular H-bonding.

Ans. D

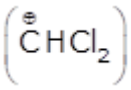
Sol. Due to intermolecular H-bonding between molecules boiling point increases as the intermolecular force of attraction increases.

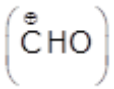


40. In the reaction

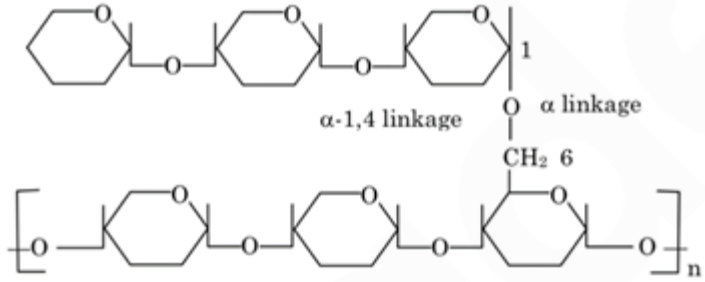


the electrophile involved is

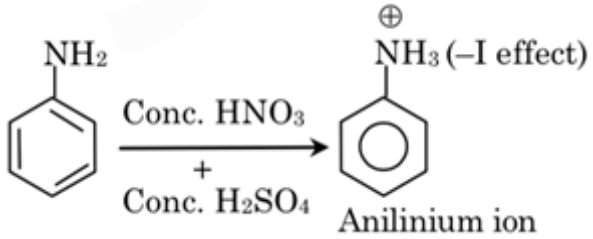
A. dichloromethyl cation 

B. formyl cation 

C. dichloromethyl anion $\left(\overset{\ominus}{C}HCl_2\right)$
D. dichlorocarbene ($:CCl_2$)
Ans. D
Sol. The given reaction is Reimer Tiemann Reaction which involves formation of chloro carbene which act as an electrophile.
41. Regarding cross-linked or network polymers, which of the following statements is ***incorrect***?
A. They contain covalent bonds between various linear polymer chains.
B. They are formed from bi-and tri-functional monomers.
C. Examples are bakelite and melamine.
D. They contain strong covalent bonds in their polymer chains.
Ans. D
Sol. Cross linked polymer contains strong covalent bonds between various linear polymer chains. Due to strong intermolecular force of attraction between chains they have high melting and boiling point.
42. The difference between amylose and amylopectin is
A. Amylopectin have $1 \rightarrow 4\,\alpha$ -linkage and $1 \rightarrow 6\,\alpha$ -linkage
B. Amylose have $1 \rightarrow 4\,\alpha$ -linkage and $1 \rightarrow 6\ \beta$ -linkage
C. Amylopectin have $1 \rightarrow 4\,\alpha$ -linkage and $1 \rightarrow 6\ \beta$ -linkage
D. Amylose is made up of glucose and galactose
Ans. A
Sol. In branched amylopectin having 1, 4 as well as 1, 6 α –glycosidic linkage



43. Which of the following oxides is most acidic in nature?
A. MgO
B. BeO
C. BaO
D. CaO
Ans. B
Sol. Basic strength of metal oxide is directly proportional to metallic character of the element. On going down the group, metallic character of element increases due to which basicity of its oxide increases. Hence, BeO is the most acidic oxide.
44. Nitration of aniline in strong acidic medium also gives m-nitroaniline because
A. In spite of substituents nitro group always goes to only m-position.
B. In electrophilic substitution reactions amino group is meta directive.
C. In absence of substituents nitro group always goes to m-position
D. In acidic (strong) medium aniline is present as anilinium ion.
Ans. D



Sol.
In the acidic medium, aniline forms anilinium ion which is a deactivating meta-directing group. Thus, nitration of aniline in strong acidic medium gives m-nitroaniline.

45. A mixture of 2.3 g formic acid and 4.5 g oxalic acid is treated with conc. H_2SO_4. The evolved gaseous mixture is passed through KOH pellets. Weight (in g) of the remaining product at STP will be

A. 1.4
B. 3.0
C. 2.8
D. 4.4

Ans. C

Sol.

	$HCOOH + H_2SO_4 \rightarrow$	H_2O +	CO
Initial	0.05ml	0	0
Final	0	0.05mol	0.05 mol

	$H_2C_2O_4 + H_2SO_4 \rightarrow$	H_2O +	CO +	CO_2
Initial	0.05ml	0	0	0
Final	0	0.05	0.05	0.05

KOH will absorb CO_2 and conc. H_2SO_4 will absorb water, so in final solution only CO will remain
Total moles of CO= 0.05 mol + 0.05 mol = 0.1 mol
Mass of CO = 0.1 × 28= 2.8g CO

46. 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 ?

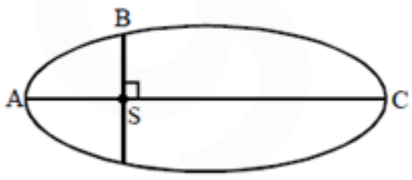
A. Angular velocity
B. Moment of inertia
C. Rotational kinetic energy
D. Angular momentum

Ans. D

Sol. Moment of inertia of solid sphere is $$I = \frac{2}{5}MR^2$$

As we know if $\vec{\tau}_{ext} = 0 \Rightarrow L = cons.$
Torque acting on body is zero thus angular momentum is conserved.

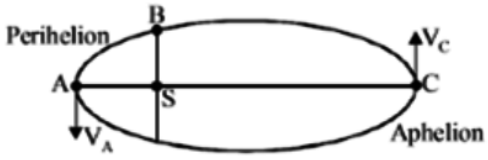
47. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and C are K_A, K_B and K_C respectively. AC is the major axis and SB is perpendicular to AC at the position of the Sun S as shown in the figure. Then



A. $K_A < K_B < K_C$
B. $K_A > K_B > K_C$
C. $K_B < K_A < K_C$
D. $K_B > K_A > K_C$

Ans. B

Sol. The speed of the planet will maximum when its distance from the sun is minimum as angular momentum (mvr) is constant.



Point A is perihelion and point C is Aphelion.
the velocity of the planet $V_A > V_B > V_C$
So $K_A > K_B > K_C$

48. 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 Kt : (K_t + K_r) for the sphere is
A. 7 : 10
B. 5 : 7
C. 10 : 7
D. 2 : 5
Ans. B

Sol. Moment of inertia of solid sphere $I = \frac{2}{5}MR^2$
Translational kinetic energy is $K_T = \frac{1}{2}mr^2\omega^2$
Total (Translational + Rotational) kinetic energy is

$$K_{t+r} = \frac{1}{2} \times \frac{2}{5} mR^2\omega^2 + \frac{1}{2}mr^2\omega^2 = \frac{7}{10}mr^2\omega^2$$

$$\frac{K_t}{K_t + K_r} = \frac{\frac{1}{2}mr^2\omega^2}{\frac{7}{10}mr^2\omega^2}$$

$$\frac{K_t}{K_t + K_r} = \frac{5}{7}$$

49. If the mass of the Sun were ten times smaller and the universal gravitational constant were ten time larger in magnitude, which of the following is *not* correct ?
A. Raindrops will fall faster
B. Walking on the ground would become more difficult
C. Time period of a simple pendulum on the Earth would decrease
D. 'g' on the Earth will not change
Ans. D

Sol. As $m'_s = \frac{m_s}{10}$ so $G' = 10G$

$$g_E = \frac{G'M_E}{R^2}$$

$$g_E = \frac{10GM_E}{R^2} = 10g$$

So raindrop will fall faster, walking on the ground would more difficult , time period of a simple pendulum on the earth would decreases.

50. 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. 40 Ω
B. 25 Ω
C. 250 Ω
D. 500 Ω

Ans. C
Sol. Current sensitivity 5div/mA, 5 div → 1 mA
Voltage sensitivity 20div/V, 20 div → 1V or 20 div → 4 mA

$$V = IR$$

$$1 = 4 \times 10^{-3} \times R$$

$$R = \frac{1}{4 \times 10^{-3}}$$

$$R = 250\,\Omega$$

51. A thin diamagnetic rod is placed vertically between the poles of an electromagnet. When the current in the electromagnet is switched on, then 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 current source
B. the magnetic field
C. the lattice structure of the material of the rod
D. the induced electric field due to the changing magnetic field
Ans. A
Sol. As the material is diamagnetic and is placed vertically between the electro magnet, it is pushed up due to the magnetic field. This happens due to the current source which makes current flow in the electro-magnet.

52. An inductor 20 mH, a capacitor 100 μF and a resistor 50 Ω are connected in series across a source of emf, V = 10 sin 314 t. The power loss in the circuit is
A. 0.79 W
B. 0.43 W
C. 2.74 W
D. 1.13 W
Ans. A
Sol. As given $V_o = 10V, \omega = 314\,\text{rad/s}$

$$P = V_{rms} I_{rms} \cos\phi$$

$$P = V_{rms}\left(\frac{V_{rms}}{Z}\right)\left(\frac{R}{Z}\right)$$

$$P = \frac{(V_{rms})^2 R}{Z^2}$$

And $X_L = \omega L = 314 \times 20 \times 10^{-3} = 6.280$

$$X_C = \frac{1}{\omega C} = \frac{1}{314 \times 100 \times 10^{-6}} = 31.84$$

Impedance of the circuit is

$$Z = \sqrt{(X_C - X_L)^2 + R^2}$$

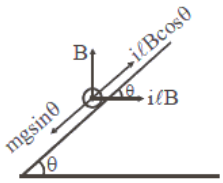
$$Z = \sqrt{(31.84 - 6.28)^2 + 50^2}$$

$$Z = 56\,\Omega$$

$$P = \frac{\left(\frac{10}{\pi}\right)^2 \times 50}{56^2}$$

$$P = 0.79$$

53. 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 stationary is
A. 7.14 A
B. 5.98 A
C. 14.76 A
D. 11.32 A
Ans. D

Sol. 

$$ilB\cos\theta = mg\sin\theta$$

$$i = \left(\frac{m}{l}\right)\frac{g\tan\theta}{B}$$

$$i = 0.5 \times \frac{9.8}{0.25} \times \frac{1}{\sqrt{3}}$$

$$i = 11.3\,\text{Amp}$$

54. At what temperature will the rms speed of oxygen molecules become just sufficient for escaping from the Earth's atmosphere?
(Given : Mass of oxygen molecule (m) = 2.76 x 10^{-26}kg Boltzmann's constant k_B = 1.38 × 10^{-23} J K^{-1}) :-
A. 2.508 × 10^4 K
B. 8.360×10^4K
C. 5.016 × 10^4 K
D. 1.254 × 10^4 K
Ans. B
Sol. To escape from the earth's atmosphere the rms velocity equals to the escape velocity.

$$V_{es} = V_{rms}$$

$$11.2\times10^3 = \sqrt{\frac{3kT}{m}}$$

$$T = \frac{\left(11.2\times10^3\right)^2 m}{3k}$$

$$T = \frac{\left(11.2\times10^3\right)^2 \times 2.76\times10^{-26}}{3\times1.38\times10^{-23}}$$

$$T = 8.360\times10^4\ \text{K}$$

55. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is :-
A. 26.8%
B. 20 %
C. 6.25 %
D. 12.5 %
Ans. A

$$\eta = \frac{T_1 - T_2}{T_1} \times 100$$

Sol. Efficiency of engine

$T_1 = 373, T_2 = 273$

$$\eta = \frac{100}{373} \times 100$$

$$\eta = 26.8\%$$

56. 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. 13.2 cm

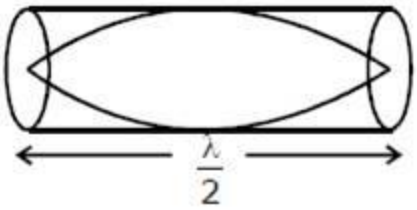
B. 8 cm

C. 12.5 cm

D. 16 cm

Ans. A

Sol. **For closed organ pipe**

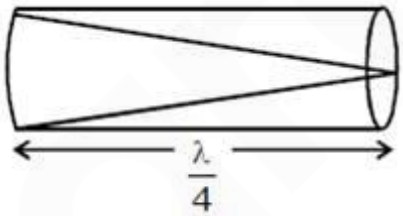


$$l = \frac{\lambda}{2}$$

$$\lambda = 2l$$

$$f_{open} = \frac{v}{\lambda} = \frac{v}{2l}$$

For Open Organ Pipe

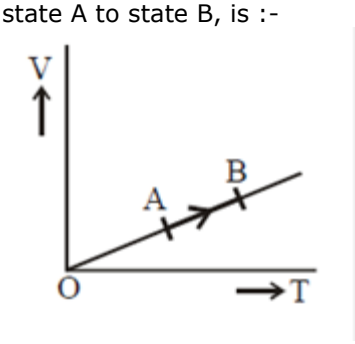


Fundamental frequency $f = \frac{v}{4l}$

As given: $\frac{3v}{4l_1} = \frac{v}{2l_2} \Rightarrow \frac{3}{4 \times 20} = \frac{1}{2l_2} \Rightarrow l_2 = 13.2$

57. 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. $\frac{2}{5}$ B. $\frac{2}{3}$

C. $\frac{1}{3}$ D. $\frac{2}{7}$

Ans. A

Sol. Work done is $W = P\Delta V = \mu R\Delta T$

$$\Delta Q = \mu C_p \Delta T$$

For monoatomic gas f = 3

$$C_p = \frac{f}{2}R + R = \frac{5}{2}R$$

So $$\frac{W}{\Delta Q} = \frac{\mu R\Delta T}{\mu C_p \Delta T} = \frac{2}{5}$$

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

A. small focal length and large diameter

B. large focal length and small diameter

C. large focal length and large diameter

D. small focal length and small diameter

Ans. C

Sol. For astronomical refracting telescope

Angular magnification is more for large focal length of objective lens $\left(MP = \frac{f_o}{f_e}\right)$

Resolving power = $\frac{d}{1.22\lambda}$

Resolving power is high for large diameter.

59. In Young's double slit experiment the separation d between the slits is 2 mm, the wavelength λ of the light used is 5896 Å 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. 1.8 mm B. 1.9 mm

C. 2.1 mm D. 1.7 mm

Ans. B

Sol. As we know the angular width is

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

$$\frac{\theta_1}{\theta_2} = \frac{d_2}{d_1}$$

$$\frac{0.20}{0.21} = \frac{d_2}{2}$$

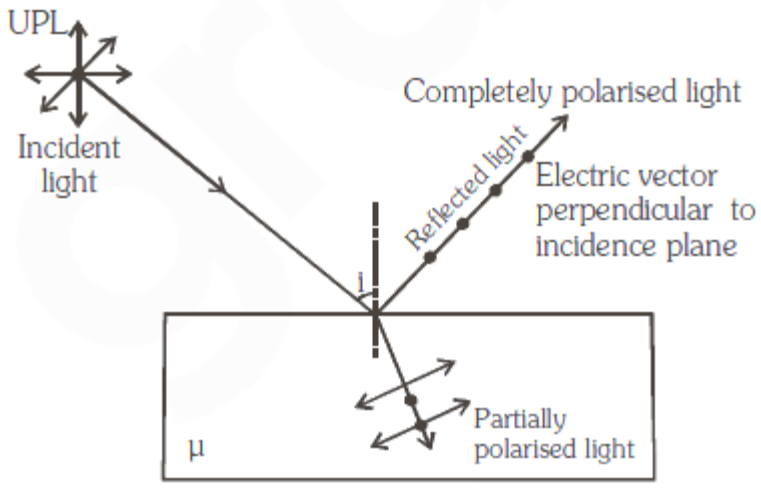
$$d_2 = 2 \times \frac{0.20}{0.21} = 1.9\,\text{mm}$$

60. Unpolarised 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. Reflected light is polarised with its electric vector parallel to the plane of incidence
B. Reflected light is polarised with its electric vector perpendicular to the plane of incidence

C. $i=\sin^{-1}\left(\frac{1}{\mu}\right)$

D. $i=\tan^{-1}\left(\frac{1}{\mu}\right)$

Ans. B
Sol.
Brewster' law - When unpolarized light is incident at a particular angle θ_p, so that the reflected ray is completely polarized. The angle $\theta_p$is known as the Brewster angle.
$\mu = \tan\theta_p$



This is the condition of polarization in which light is incident on an interface at Brewster's angle.

Thus reflected light is polarized with its $\bar{E}$ perpendicular to the plane of incidence.

61. 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 zero 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. 0.521 cm
B. 0.525 cm
C. 0.053 cm
D. 0.529 cm

Ans. D
Sol. Reading of screw gauge is

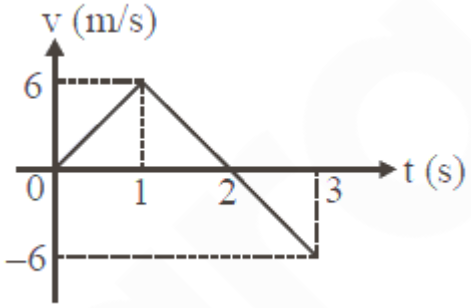
$$= MSR + VSR \times LC + \text{zero error}$$

$$= 0.5\,\text{cm} + 25 \times 0.001\,\text{cm} + 0.004\,\text{cm}$$

$$= 0.529\,\text{cm}$$

62. 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. 2 m/s, 4 m/s
B. 1 m/s, 3 m/s
C. 1 m/s, 3.5 m/s
D. 1.5 m/s, 3 m/s

Ans. B
Sol. 0 < t < 1s : velocity increases from 0 to 6 m/s
1 < t < 2s : velocity decreases from 6 to 0 m/s
but car continues to move forward
2 < t < 3s : Since field strength is same
same acceleration $\therefore$ car's velocity increases from 0 to –6 m/s



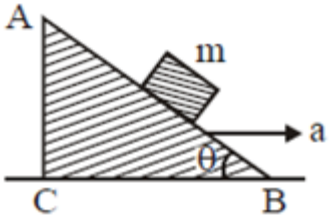
Distance travelled in first second, $S = \left(\frac{u+v}{2}\right)t = \left(\frac{0+6}{2}\right) \times 1 = 3\,\text{m}$

Distance = 9m, so average speed is = $\frac{9m}{3s} = 3m/s$

Displacement = 3m, so average velocity is = $\frac{3m}{3s} = 1m/s$

63. 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 θ for

the block to remain stationary on the wedge is :-



A. $a=\frac{g}{\text{cosec}\theta}$

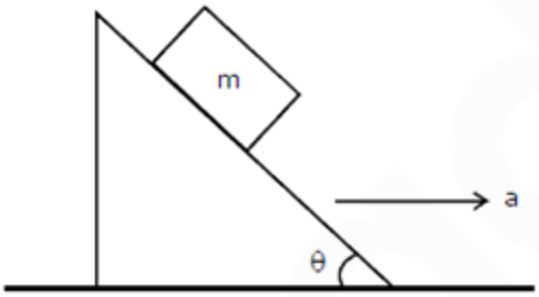
B. $a=\frac{g}{\sin\theta}$

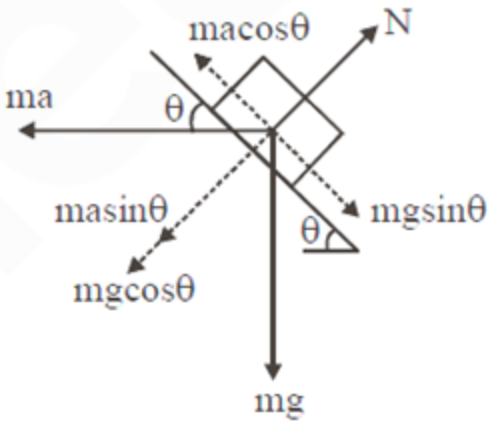
C. $a = g\cos\theta$

D. $a = g\tan\theta$

Ans. D

Sol. Free body diagram of system is





For block at rest,

$$ma\cos\theta = mg\sin\theta$$

$$a = g\tan\theta$$

64. 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. $-8\hat{i}-4\hat{j}-7\hat{k}$

B. $-4\hat{i}-\hat{j}-8\hat{k}$

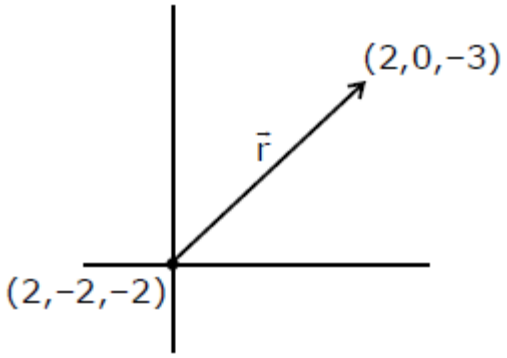
C. $-7\hat{i}-8\hat{j}-4\hat{k}$

D. $-7\hat{i}-4\hat{j}-8\hat{k}$

Ans. D

Sol. As given $\bar{F} = 4\hat{i} + 5\hat{j} - 6\hat{k}$ and

$$\bar{r} = (2-2)\hat{i} + (0-(-2))\hat{j} + (-3-(-2))\hat{k} = 2\hat{j} - \hat{k}$$



Torque, $\vec{\tau} = \vec{r} \times \bar{F}$

$$\vec{\tau} = (2\hat{j} - \hat{k}) \times (4\hat{i} + 5\hat{j} - 6\hat{k})$$

$$\vec{\tau} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 2 & -1 \\ 4 & 5 & -6 \end{vmatrix}$$

$$\vec{\tau} = (-12+5)\hat{i} - (0+4)\hat{j} + (0-8)\hat{k}$$

$$\vec{\tau} = -7\hat{i} - 4\hat{j} - 8\hat{k}$$

65. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom is:
A. 1 : 1
B. 1 : -1
C. 2 : -1
D. 1 : -2

Ans. B

Sol. Kinetic energy of hydrogen atom is $KE = \frac{13.6}{n^2}$

Total energy of the hydrogen atom is $TE = -\frac{13.6z^2}{n^2} = -\frac{13.6}{n^2}$

$$\frac{KE}{TE} = -1$$

66. When the light of frequency $2v_o$ (where v_o is 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 $5v_o$, the maximum velocity of electrons emitted from the same plate is v_2. The ratio of v_1 to v_2 is
A. 1 : 2
B. 1 : 4
C. 4 : 1

D. 2 : 1

Ans. A
Sol. From Einstein's equation of photoelectric effect

$$\frac{1}{2}mv_1^2 = 2hv_o - hv_o \quad \text{or} \quad \frac{1}{2}mv_1^2 = hv_o \qquad .....(1)$$

$$\frac{1}{2}mv_2^2 = 5hv_o - hv_o \quad \text{or} \quad \frac{1}{2}mv_2^2 = 4hv_o \qquad .....(2)$$

$$\text{eq}(1)/(2)$$

$$\frac{v_1}{v_2} = \sqrt{\frac{1}{4}} = \frac{1}{2}$$

67. For a radioactive material, half-life is 10 minutes. If initially there are 600 number of nuclei, the time taken (in minutes) for the disintegration of 450 nuclei is :-
A. 20
B. 10
C. 30
D. 15

Ans. A
Sol. As given $N_o = 600$,N' = 450
$N = N_o - N'$
$N = 600 - 450 = 150$
As we know that

$$\frac{N}{N_o} = \left(\frac{1}{2}\right)^{t/t_h}$$

$$\frac{150}{600} = \left(\frac{1}{2}\right)^{t/10}$$

$$\left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^{t/10}$$

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

$$t = 20 \text{ min}$$

68. An electron of mass m with an initial velocity $\vec{V} = V_0\hat{i}(V_0 > 0)$ enters in an electric field $\vec{E} = -E_o\hat{i}$ (E_o = constant >0) at t = 0. If λ_0 is its de-Broglie wavelength initially, then its de-Broglie wavelength at time t is:-

A. $\frac{\lambda_0}{\left(1+\frac{eE_0}{mV_0}t\right)}$

B. $\lambda_0\left(1+\frac{eE_0}{mV_0}t\right)$

C. $\lambda_0 t$

D. λ_0

Ans. A

Sol. As given $\bar{V}=V_o\hat{i}$ and $\bar{E}=-E_o\hat{i}$

Acceleration is $\bar{a}=\frac{\bar{F}}{m}=\frac{q\bar{E}}{m}=\frac{(-e)(-E_o)\hat{i}}{m}=\frac{eE_o}{m}\hat{i}$

As we know $V=u+at$ or $V=V_o+\frac{eE_o}{m}t$

Since $\lambda=\frac{h}{mV}$

$$\lambda=\frac{h}{m\left(V_o+\frac{eE_o}{m}t\right)}$$

$$\lambda=\frac{h}{mV_o\left(1+\frac{eE_o}{mV_o}t\right)}$$

$$\lambda=\frac{\lambda_o}{\left(1+\frac{eE_o}{mV_o}t\right)}$$

69. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A, is
A. independent of the distance between the plates.
B. linearly proportional to the distance between the plates
C. proportional to the square root of the distance between the plates.
D. inversely proportional to the distance between the plates

Ans. A

Sol. Force (F) = QE

$$F = \frac{Q\sigma}{2\varepsilon_o} = \frac{Q^2}{2A\varepsilon_o}$$

So electrostatic force is independent of the distance between plate.

70. 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. 2 π s
B. π s
C. 2 s
D. 1 s

Ans. B

Sol. Time period is

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

$$T = 2\pi\sqrt{\frac{5}{20}}$$

$$T = \pi \text{ second}$$

71. 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 through the same vertical distance h. The time fall of the electron, in comparison to the time fall of the proton is :-

A. smaller
B. 5 times greater
C. 10 times greater
D. equal

Ans. A

Sol. acceleration of the electron is $a = \frac{qE}{m}$, So $a \propto \frac{1}{m}$

Since the mass of an electron is less than the mass of a proton,

Therefore $a_e >> a_p$, so $t_e << t_p$

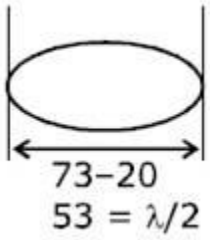
Electron will take less time.

72. 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 column length. If the frequency of the tuning fork is 320 Hz, the velocity of sound in air at 27°C is :-

A. 330 m/s
B. 339 m/s
C. 350 m/s
D. 300 m/s

Ans. B

Sol. Two successive resonance produce at 20 cm and 73 cm of column length



$$\frac{\lambda}{2} = (73-20)\times 10^{-2} m$$

$$\lambda = 2\times(73-20)\times 10^{-2} m$$

$$\lambda = 106\times 10^{-2} m$$

The frequency of the tunning fork is $f = \frac{v}{\lambda}$

$$320 = \frac{v}{106\times 10^{-2}}$$

$$v = 339\,\text{m/s}$$

73. 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 about their own symmetry axes. The amounts of work (W) required to bring them to rest, would satisfy the relation :-

A. $W_C > W_B > W_A$
B. $W_A > W_B > W_C$
C. $W_B > W_A > W_C$
D. $W_A > W_C > W_B$

Ans. A

Sol. Amount of work, W = loss in KE = $\frac{1}{2}I\omega^2$

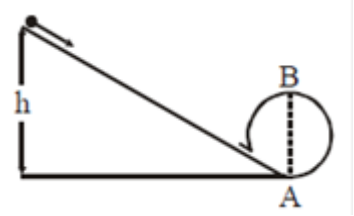
Moment of inertia of solid sphere is $I_A = \frac{2}{5}MR^2 = 0.4MR^2$

Moment of inertia of thin circular disc is $I_B = \frac{1}{2}MR^2 = 0.5MR^2$

Moment of inertia of circular ring is $I_C = MR^2$

$$\therefore W_C > W_B > W_A$$

74. 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 :-

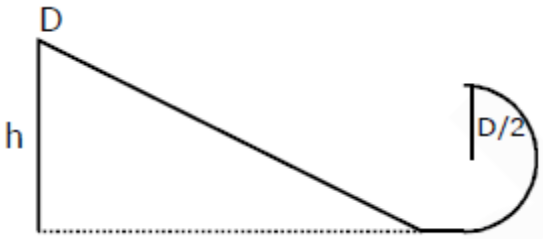


A. $\frac{3}{2}D$
B. D
C. $\frac{7}{4}D$
D. $\frac{5}{4}D$

Ans. D
Sol. According to the conservation of energy

$$\frac{1}{2}mv^2 = mgh$$

$$h = \frac{v^2}{2g} \qquad .....(1)$$



critical velocity for completing the circle $v > \sqrt{5gR}$
From equation (1)

$$h = \frac{5gR}{2g}$$

$$h = \frac{5}{2}R$$

Or, $h = \frac{5}{4}D$

75. 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 resistitution (e) will be :-
A. 0.5
B. 0.25
C. 0.8
D. 0.4

Ans. B
Sol. Let us assume that after the collision velocity of the heavier block is v'.
By conservation of linear momentum

$$mv = 4mv'$$

$$v' = \frac{v}{4}$$

Coefficient of restitution (e) = $\frac{\text{Velocity of seperation}}{\text{Velocity of approach}}$

$$e=\frac{\frac{v}{4}-0}{v-0}$$

$$e=\frac{1}{4}=0.25$$

76. Which one of the following statements is ***incorrect*** ?
A. Rolling friction is smaller than sliding friction
B. Limiting value of static friction is directly proportional to normal reactions
C. Frictional force opposes the relative motion
D. Coefficient of sliding friction has dimensions of length

Ans. D
Sol. **Friction-** Friction is a contact force that opposes the relative motion or tendency of relative motion of two bodies. It is self-adjusting in nature.
Types of friction

- **Static Friction –***S*tatic friction is a type of friction force that acts on a body when there is no relative motion between the object and the surface. Static friction force is, $f_s=\mu_s N$, where μ_s is the coefficient of static friction, N is the normal force
- **Kinetic Friction-**Kinetic friction is a type of friction that oppose relative motion between surfaces in contact. It is also known as sliding friction. Kinetic friction force is, $f_k=\mu_k N$, where μ_k is the coefficient of kinetic friction, N is the normal force.
- **Rolling Friction-**Rolling friction is a type of friction that resist the motion of the body when body rolls on the surface. It is also known as sliding friction. Rolling friction is smaller than sliding friction.

77. A carbon resistor (47 ± 4.7) kΩ is to be marked with rings of different colours for its identification. The colour code sequence will be :-
A. Violet – Yellow – Orange – Silver
B. Yellow – Violet – Orange – Silver
C. Yellow – Green – Violet – Gold
D. Green – Orange – Violet – Gold

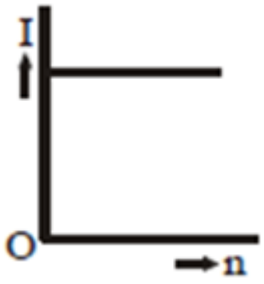
Ans. B
Sol. Resistance

$$R=(47\pm4.7)\times10^3$$

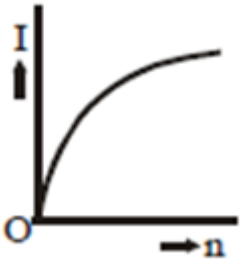
$$R=47\times10^3\pm10\%$$

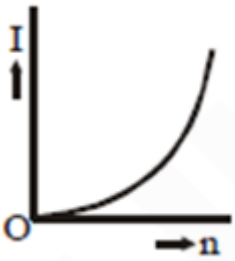
As per color code, 3- Orange, 4- yellow, 7- Violet, $10^{\%}$- Silver

78. 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?

A. 

B. 

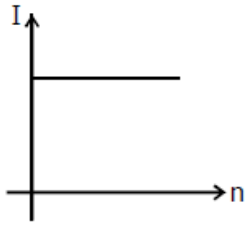
C. 

D. 

Ans. A

Sol. Short-circuited current, $i = \frac{nE}{nr} = \frac{E}{r}$

I is independent of number of batteries as the terminals of the battery are short circuited.



79. 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 becomes 10 I. The value of 'n' is :-

A. 10
B. 11
C. 20
D. 9

Ans. A

Sol. Current in the circuit is

$$I = \frac{E}{nR + R} \qquad .....(1)$$

$$10I = \frac{E}{\frac{R}{n} + R} = \frac{nE}{R + nR} \qquad .....(2)$$

From eq (1) & (2)

$$\frac{nE}{R + nR} = 10\frac{E}{nR + R}$$

$$n = 10$$

80. 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. $\frac{3}{4}$

B. $\frac{4}{3}$

C. $\frac{256}{81}$

D. $\frac{81}{256}$

Ans. C

Sol. As we know power radiated by black body is $P \propto T^4$

According to Wein's law $T \propto \frac{1}{\lambda_m}$ $P \propto \left(\frac{1}{\lambda_m}\right)^4$, So

$$\frac{P_2}{P_1} = \left(\frac{\lambda_{m1}}{\lambda_{m2}}\right)^4$$

$$\frac{P_2}{P_1} = \left(\frac{\lambda_0}{\frac{3}{4}\lambda_0}\right)^4$$

$$\frac{nP}{P} = \frac{256}{81}$$

$$n = \frac{256}{81}$$

81. 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. 9F
B. 6F
C. 4F
D. F

Ans. A

Sol. As we know Young's modulus is $Y = \frac{Fl}{A\Delta l}$

Since $V = Al \Rightarrow l = \frac{V}{A}$, So

$$F = \frac{YA\Delta l}{l} = \frac{YA^2\Delta l}{V}$$

$$\frac{F_1}{F_2} = \left(\frac{A_1}{A_2}\right)^2$$

$$\frac{F_1}{F_2} = \left(\frac{A}{3A}\right)^2 = \frac{1}{9}$$

$$F_2 = 9F$$

82. A sample of 0.1 g of water at 100° C and normal pressure (1.013×10^5 Nm^{-2}) requires 54 cal of heat energy to convert it into 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. 104.3 J
B. 208.7 J
C. 42.2 J
D. 84.5 J

Ans. B

Sol. According to the first law of thermodynamics

$$\Delta Q = \Delta U + \Delta W$$

$$\Delta U = \Delta Q - \Delta W$$

$$\Delta U = 54 \times 4.2 - P(\Delta V)$$

$$\Delta U = 54 \times 4.2 - \left(1.013 \times 10^5 \times 167.1 \times 10^{-6}\right)$$

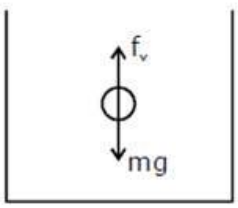
$$\Delta U = 208.7 \text{joule}$$

83. 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^3
B. r^2
C. r^5
D. r^4

Ans. C

Sol. If ball falls in a viscous liquid then



$$\frac{dQ}{dt} = F \times V \qquad \because V = \frac{2r^2}{g\eta}(\rho - \sigma)g$$

$$\frac{dQ}{dt} = 6\pi\eta r V \times V \qquad \therefore V \propto r^2$$

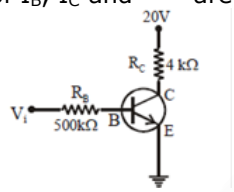
$$\frac{dQ}{dt} \propto rV^2$$

$$\frac{dQ}{dt} \propto r^5$$

84. In a p-n junction diode, change in temperature due to heating :-
A. affects only reverse resistance
B. affects only forward resistance
C. does not affect resistance of p-n junction
D. affects the overall V – I characteristics of p-n junction

Ans. D
Sol. On increasing the temperature of a PN junction diode. The number of electron-holes pairs increases so the overall resistance of diode changes. Hence it affects the overall V – I characteristics of p-n junction.

85. 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 :-



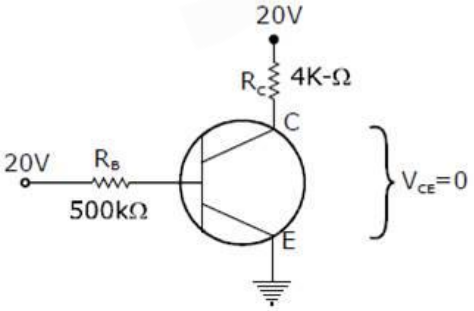
A. $I_B = 40\ \mu A, I_C = 10\ mA,\ \beta = 250$

B. $I_B = 25\ \mu A, I_C = 5\ mA,\ \beta = 200$

C. $I_B = 20\ \mu A, I_C = 5\ mA,\ \beta = 200$

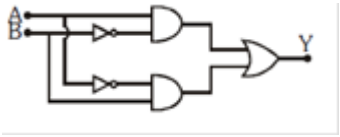
D. $I_B = 40\ \mu A, I_C = 5\ mA,\ \beta = 125$

Ans. D
Sol.



$$V_i = I_B R_B + V_{BE}$$
$$20 = I_B \times \left(500 \times 10^3\right) + 0$$
$$I_B = \frac{20}{500 \times 10^3} = 40\mu A$$
$$V_{CC} = I_C R_C + V_{CE}$$
$$20 = I_C \times \left(4 \times 10^3\right) + 0$$
$$I_C = 5 \times 10^{-3} = 5mA$$
$$\beta = \frac{I_C}{I_B} = \frac{5 \times 10^{-3}}{40 \times 10^{-6}} = 125$$

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



A. $\overline{A.B}$

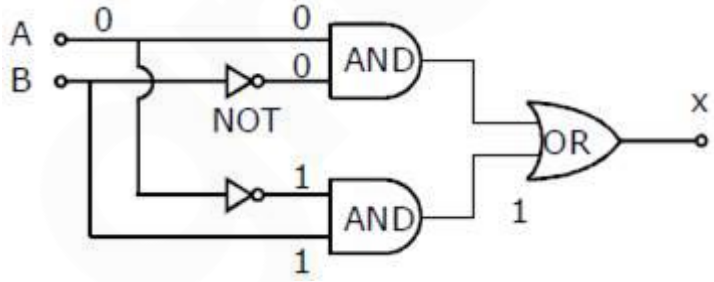
B. $A.\overline{B} + B.\overline{A}$

C. $\overline{A.B}$ +A.B

D. $\overline{A+B}$

Ans. B

Sol. Circuit diagram is

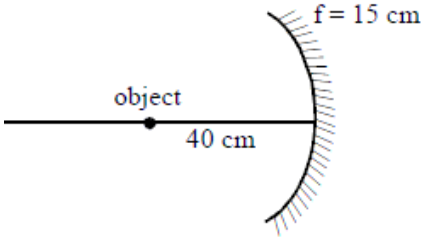


A (Input)	B (Input)	Y (Output)
0	0	0
0	1	1
1	0	1
1	1	0

From given truth table it X must be Exclusive OR- gate.

87. 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 away from the mirror
B. 36 cm away from the mirror
C. 30 cm towards the mirror
D. 36 cm towards the mirror

Ans. B
Sol. **In first condition**



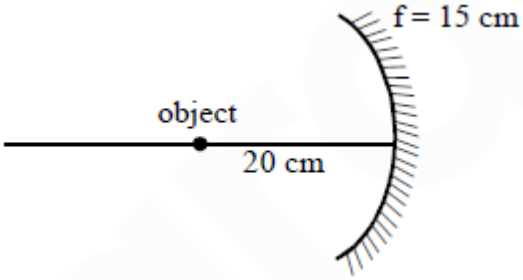
$$\frac{1}{f}=\frac{1}{v}+\frac{1}{u}$$

$$-\frac{1}{15}=\frac{1}{v}-\frac{1}{40}$$

$$\frac{1}{v}=\frac{1}{40}-\frac{1}{15}$$

$$\frac{1}{v}=-\frac{1}{24}\Rightarrow v=-24\text{ cm}$$

In second condition



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

$$-\frac{1}{15}=\frac{1}{v}-\frac{1}{20}$$

$$\frac{1}{v}=\frac{1}{20}-\frac{1}{15}$$

$$\frac{1}{v}=-\frac{1}{60}\Rightarrow v=-60\text{ cm}$$

Displacement of image = 60 – 24 = 36 cm

88. 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. 0.138 H
B. 138.88 H
C. 1.389 H
D. 13.89 H

Ans. D

Sol. Magnetic potential energy stored in the inductor is $$PE = \frac{1}{2}LI^2$$

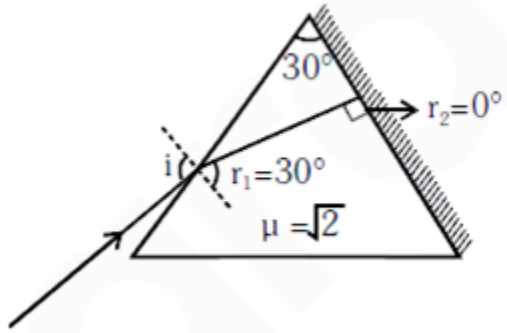
$$25\times10^{-3} = \frac{1}{2}L\left(60\times10^{-3}\right)^2$$

$$L = \frac{50\times10^{-3}}{36\times10^{-4}}$$

$$L = 13.89\,\text{H}$$

89. 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) the angle of incidence on the prism is:-
A. 60°
B. 45°
C. 30°
D. zero

Ans. B
Sol. For retracing the path, light ray should be normally incident on silvered face.



So from figure $r_2 = 0^0, r_1 = A = 30^o$
According to Snell's law

$$1\times\sin i = n\times\sin A$$

$$\sin i = \sqrt{2}\times\frac{1}{2}$$

$$i = 45^o \ \ (\text{No emergence})$$

90. An em wave is propagating in a medium with a velocity $\vec{V}=V$ ˆi. The instantaneous oscillating electric field of this em wave is along +y axis. Then the direction of oscillating magnetic field of the em wave will be along
A. -z direction
B. + z direction
C. –y direction
D. –x direction

Ans. B

Sol. As we know $\hat{V} = \hat{E} \times \hat{B}$ or $\hat{i} = \hat{j} \times \hat{k}$

Direction of propagation in $\hat{i}$ (x direction) and $\hat{E}$ is given in $\hat{j}$ direction $(\hat{j})$. So from right hand thumb rule B is in + z direction.

$\therefore \hat{B} = \hat{k}$

91. 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. Hydrilla
B. Yucca
C. Banana
D. Viola

Ans. B
Sol. **The yucca (Yucca spp.)** and the **yucca moth (Tegeticula spp.)** share a mutually beneficial relationship, each dependent on the other for survival. **The female yucca moth** is the sole pollinator of the yucca, and the yucca is the only **caterpillar host** plant of the yucca moth. In fact, the yucca and yucca moth share a s**ymbiotic relationship** that is so specialized, each yucca species is pollinated by only one type of yucca moth.
The yucca plant cannot pollinate itself it relies on the yucca moth for cross-pollination. The process is described as follows-

- After the male and female yucca moths mate in springtime, the female gathers the sticky pollen from the anthers of a yucca flower.
- Holding the clump of pollen in her tentacles, female yucca moth flies to another flower, usually on a different plant.
- She lays her eggs in the flower's ovary and deposits the pollen onto the stigma, thus fertilizing the flower and ensuring the production of seeds to feed the caterpillars when they hatch.

92. Which of the following elements is responsible for maintaining turgor in cells ?
A. Magnesium
B. Sodium
C. Potassium
D. Calcium

Ans. C
Sol. Potassium is absorbed as K^+ . In plants, it is required in more abundant quantities in meristem tissue buds, leaves and roots tips.

Role:

- Helps in maintaining turgidity of the cells.
- Involved in protein synthesis
- Helps in closing and opening of stomata
- Its deficiency causes scorched leaaf tips , loss of cambial activity and plastid disintegration.

93. Double fertilization is
A. Fusion of two male gametes of a pollen tube with two different eggs
B. Fusion of one male gamete with two polar nuclei
C. Fusion of two male gametes with one egg

D. Syngamy and triple fusion

Ans. D
Sol.
In double fertilization, after entering one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergids. Double fertilization and triple fusion was discovered by Nawaschin and Guignard in Lilium and Fritillaria
The events which take place in the embryo sac are

1. **Syngamy**: in his male gametes moves towards the egg cells and fuse with its nucleus that results in the formation of a diploid cell that is zygote.
2. **Triple fusion**: the other male gametes move towards the two polar nuclei located in the central cell and fuse with them to produce a triploid primary endosperm nucleus (PEN).

The two types of fusion i.e. syngamy and triple fusion occurs in an embryo sac, termed as **double fertilization.**

94. In which of the following forms is iron absorbed by plants?
A. Ferric
B. Ferrous
C. Free element
D. Both ferric and ferrous

Ans. A
Sol. Iron is required in a large amount in comparison to other micronutrients. the plants absorb iron in the form of ferric ions($Fe^{3+)}$ and are required everywhere in the body of plants.
Roles:

- Involved in the transfer of electron-like ferredoxin and cytochromes
- During electron transfer in photosynthesis and respiration, it is reversible oxidised fro Fe2+ to Fe^{3+}
- It activates catalyse and some other enzymes.
- It is essential for the formation of chlorophyll and other pigments.

95. Pollen grains can be stored for several years in liquid nitrogen having a temperature of
A. –120 °C
B. –80 °C
C. –196 °C
D. –160 °C

Ans. C
Sol. Cryopreservation is the process of freezing biological material at extreme temperatures most common -196 °C or -321 °F in liquid nitrogen (N_2). Cryopreservation of pollen grains is an efficient technique to overcome asynchronous flowering and to support actions for genetic improvement and conservation of important alleles.

- At these low temperatures, all biological activity stops, including the biochemical reactions that lead to cell death and DNA degradation.
- The challenge of cryopreservation is to help cells to survive both cooling to extreme temperatures and thawing back to the physiological condition
- There are several cryoprotectants which include dimethyl sulfoxide (DMSO), glycerol, ethylene, propylene, sucrose, mannose, glucose, proline and acetamide.

96. Oxygen is *not* produced during photosynthesis by
A. Green sulphur bacteria
B. Nostoc
C. Cycas
D. Chara

Ans. A
Sol. Green sulfur bacteria an purple sulphur bacteria are the most familiar example containing pigments like bacteriochlorophyll, bacteriopurpin and bacterioviridin respectively. Bacterial photosynthesis differs from photosynthesis in higher plants in not liberating oxygen and are termed as anoxygenic.

- In bacterial photosynthesis, water is not the source of the electron that acts as reducing power to converts $C0_2$ into glucose.

- They obtained reducing power from various compounds such as H_2S , thiosulphate and even some organic compounds
- No oxygen is evolved as it does not involve the splitting of water

97. What is the role of NAD^+ in cellular respiration?
A. It functions as enzymes
B. It functions as an electron carrier
C. It is a nucleotide source for ATP synthesis
D. It is the final electron acceptor for anaerobic respiration

Ans. B
Sol. NADH is a crucial coenzyme in making ATP, present in NAD^+ and NADH form in the cells. The first form, NAD^+, is called the oxidized form.

- When a molecule is in an oxidized state, it means it can accept electrons, tiny negatively charged particles, from another molecule. After it gets the electrons, it has a negative charge, so it also picks up a hydrogen atom from the surrounding environment, since hydrogen atoms are positively charged and NADH (reduced form) is formed.
- The molecule acts as a shuttle for electrons during cellular respiration. At various chemical reactions, the NAD^+ picks up an electron from glucose, at which point it becomes NADH. Then NADH, along with another molecule flavin adenine dinucleotide ($FADH_2$) will ultimately transport the electrons to the mitochondria, where the cell can harvest energy stored in the electrons.

98. After karyogamy followed by meiosis, spores are produced exogenously in
A. Neurospora
B. Alternaria
C. Agaricus
D. Saccharomyces

Ans. C
Sol. Fusion of two nuclei is called karyogamy. In some fungi, like agaricus , intervening dikaryotic staxe that is two nuclei per cell occurs, such condition is called as dikaryon and the phase is called dikarophases which is followed by meiosis takes place in basidium and produces four spores exogenously. These spores are called as basidiospores spores are produced exogenously in Agaricus.

- In Neurospora crassa each of the four products of meiosis undergoes a further mitotic division, resulting in an octad of eight ascospores within each ascus thus produced endogenously
- Alternaria, a genus of Deuteromycetes does not produce sexual spores.
- Saccharomyces, an Unicellular ascomycete produces ascospores, endogenously.

99. Winged pollen grains are present in
A. Mustard
B. Cycas
C. Mango
D. Pinus

Ans. D
Sol. In pinus, the male and female cones are produced on the same tree and are therefore the monoecious plants. Pollen grains are the reduced male gametophytes which are developed within the microsporangium. Microspores (pollen) winged exine inflated to form balloon-like.

- The pollen grains are released from the microsporangium and are carried in air currents i.e. wind pollination (known as Anemophily) and come in contact with the opening of ovules on megasporophylls.
- Pinus performs anemophily i.e., pollination by wind.
- Mango and Cycas perform Entomophily i.e. pollination by an insect.

100. Match the items given in Column I with those in Column II and select the *correct* option given below-
Column-I
(a) Herbarium
(b) Key
(c) Museum
(d) Catalogue

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

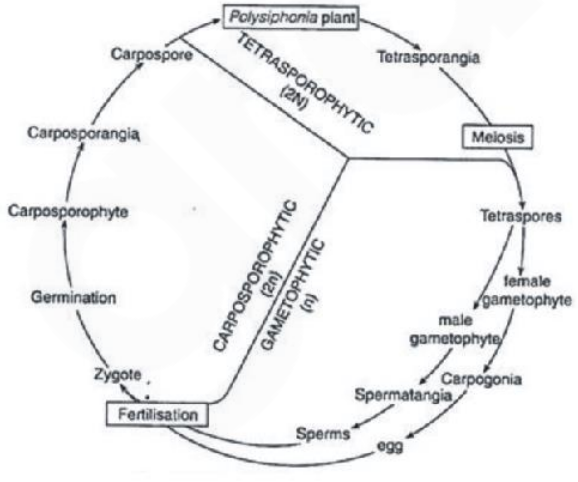
Ans. D
Sol.
The correct match is as follow:

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

101. Which one is *wrongly* matched?
A. Uniflagellate gametes - Polysiphonia
B. Biflagellate zoospores - Brown algae
C. Gemma cups - Marchantia
D. Unicellular organism - Chlorella

Ans. A
Sol. Red algae belong to classes of Rhodophyceae and are ancient algae. Example: Polysiphonia

- Red algae are multicellular. The life cycle of Polysiphonia is diplobiontic and there is no motile sage is found in the life cycle of red algae.



Life Cycle of Polysiphonia Species

- Phaeophyceae or brown algae, the vegetative reproduction takes place by fragmentation. Asexual reproduction in most brown algae is by biflagellate zoospores that are pear-shaped and have two unequal laterally attached flagella.
- Gemmae is a widespread means of asexual reproduction in both liverworts and mosses. In liverworts such as Marchantia, the flattened plant body or thallus is a haploid gametophyte with gemma cups scattered about its upper surface. The gemma cups are cup-like structures containing gemmae.

- Most living organisms consist of many cells, a single cell of Chlorella is an independent life form and is called an unicellular organism.

102. Plants having little or no secondary growth are
A. Grasses
B. Deciduous angiosperms
C. Conifers
D. Cycads

Ans. A
Sol. Primary growth is growth that occurs as a result of cell division at the tips of stems and roots, causing them to elongate, and gives rise to primary tissue.

- Secondary growth is the growth that results from cell division in the cambia or lateral meristems and that causes the stems and roots to thicken.
- Secondary growth occurs in most seed plants but monocots, grasses usually lack secondary growth because of the absence of cambium in a vascular bundle in between xylem and phloem.
- The formation of secondary vascular tissues from the cambium is a characteristic feature of dicotyledons and gymnosperms.

103. Casparian strips occur in
A. Epidermis
B. Pericycle
C. Cortex
D. Endodermis

Ans. D
Sol. Casparian strips are a cellular feature found in the roots of all higher plants. They are ring-like,
hydrophobic cell wall impregnations.

- These impregnations occur in the endodermis, an inner cell layer that surrounds the central vascular and is chemically different from the rest of the cell wall - the cell wall is made of lignin and without suberin - whereas the Casparian strip is made of suberin and sometimes lignin.
- Casparian strips have pretty much the same function as tight junctions in animal epithelia. They provide an extracellular (paracellular) diffusion barrier within the plant roots, forcing nutrients to pass into the cells and thus to be subjected to the action of plasma membrane transport proteins.
- It is an 'apoplastic' barrir, because the interconnected cell wall space between cells is referred to collectively as the 'apoplast'.
- The extracellular apoplast contrasts with the 'symplast', which is the interconnected space of the cytoplasm of different plant cells (connected through plasmodesmata — another cool,plant-specific feature).

104. Select the *wrong* statement:
A. Cell wall is present in members of Fungi and Plantae
B. Mushrooms belong to Basidiomycetes
C. Pseudopodia are locomotory and feeding structures in Sporozoans
D. Mitochondria are the powerhouse of the cell in all kingdoms except monera

Ans. C
Sol. Protozoans are the unicellular organism with heterotropic nutrition. they are believed to be the primitive relative of animals.

- Sporozoans is the of the group of protozoans, in which the locomotory structure is absent and all are endoparasitic.
- The fungal body is made up of hyphae, which is made up of chitin or fungal cellulose, polysaccharides containing nitrogenous compound and is basically made up of acetylglucosamine and cell wall of Plantae is also made up of cellulose.
- Basidiomycetes re the most advanced and most common seen in fungi. Their fructification is often lare and conspious . Example: Mushrooms , Barcket fungi , Puffballs etc.
- Monera is unicellular, colonial or filamentous, a prokaryotic organism without nuclear membrane, nucleus chromatin and histone proteins. Monera lacks membrane-bounded organelles, thus mitochondria are absent

105. Which of the following statement is *correct?*

A. Ovules are not enclosed by ovary wall in gymnosperms
B. Selaginella is heterosporous, while Salvinia is homosporous
C. Horsetails are gymnosperms
D. Stems are usually unbranched in both Cycas and Cedrus

Ans. A
Sol. The gymnosperms are a group of seed-producing plants that includes conifers, cycads, Ginkgo, and gnetophytes. The term Gymnosperm (Gymnos: "naked" and sperma: "seed"), meaning "naked seeds". these are the plants in which the seeds are not enclosed within fruit wall that men they bear naked seeds. These seeded plants without fruits.

- Plants like Lycopodium, Dryopteris produces a single kind of spores and are known as homosporous whereas plant like selaginella, saivinia etc, produces two kinds of spores, macro and microspores and are known as heterosporous.
- Pteridophytes are the seedless vascular plants which include horsetails(Equisetum) and ferns.
- The stem is unbranched in case of Cycas or branched in Pinus and Cedrus

106. Sweet potato is a modified
A. Stem
B. Adventitious root
C. Tap root
D. Rhizome

Ans. B
Sol. There are some plants that have specialised roots called adventitious roots. These develop from any part of the plants other than radicle. Sweet potato is a modification of adventitious roots that are tuberous adventitious roots in which food is stored. Therefore, they can become swollen and irregular and having no definite shape. **Example**: Sweet potato

- The stem of plants it is modified to perform a different function in order to help plants to adapt to the present environmental conditions. Rhizome, an underground stem is the modification of stem. It grows parallel or horizontal to the soil surface and bears nodes internodes, buds and scaly leaves.
- In dicot plants, there s direct elongation of the radicals leads to the formation of primary roots. tap roots are also modified for respiration and roots are called pneumatophores.
- Stem develops from the plumule of the embryo of germinating seeds. the stems bear nodes and internodes. the modification can be the runner, stolen, sucker offsets etc.

107. Pneumatophores occur in
A. Halophytes
B. Free-floating hydrophytes
C. Carnivorous plants
D. Submerged hydrophytes

Ans. A
Sol. Some plants grow and complete their life cycle in the habitats with a high salt content. They are known as salt plants or halophytes. Pneumatophores occur in halophyte.

- In marshy/ swampy areas, scarcity of oxygen is found. Some branches of the taproot of the pants which grows in a region, grow vertically upward and grows and come on the surface. These roots are called pneumatophores, which have minute pores called pneumathodes or lenticles by which air enter in the plants and get oxygen for respiration. They are negatively geotropic.
- Rhizophora, Heritiera ad mangroves plants are the example of pneumatophores

108. Secondary xylem and phloem in dicot stem are produced by
A. Apical meristems
B. Vascular cambium
C. Phellogen
D. Axillary meristems

Ans. B
Sol. In dicot stem, the vascular cambium produces Secondary xylem and phloem. Continuous periclinal division takes place in fusiform initials, then few cells are formed towards the periphery and these cells are differentiated into secondary phloem or bast and the cells which are formed

towards the centre and differentiated into secondary xylem or wood More secondary xylem is formed compared to secondary phloem of wood.

- Apical meristems contain meristematic tissue located at the tips of stems and roots, which enable a plant to extend in length.
- Phellogen refers to cork cambium (secondary meristematic tissue) which is developed in the cortex region of dicot stem.

109. The correct order of steps in Polymerase Chain Reaction (PCR) is
A. Extension, Denaturation, Annealing
B. Annealing, Extension, Denaturation
C. Denaturation, Extension, Annealing
D. Denaturation, Annealing, Extension

Ans. D
Sol. Polymerase chain reaction (PCR) is a technique used in molecular biology to amplify a single copy or a few copies of a segment of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence. Developed in 1983 by Kary Mullis.

- The correct order of steps in Polymerase Chain Reaction (PCR) is-
  a. Denaturation: Two strand of DNA separates to form single-stranded DNA. It is generally carried out at 92^{o}C-96^{o}C for 2 minutes.
  b. Annealing: Annealing of primer to each strand is carried out at 45^{o}C-55^{o}C
  c. Extension: DNA polymerase adds dNTPs complementary to templates strands at 3'end of primer. It is carried out at a temperature of 72^{o}C

110. Use of bioresources by multinational companies and organizations without authorization from the
Concerned country and its people is called
A. Bio-infringement
B. Biopiracy
C. Biodegradation
D. Bioexploitation

Ans. B
Sol. Biopiracy refers to the practice of commercially exploiting naturally occurring biochemical or genetic material, especially by obtaining patents that restrict its future use, while failing to pay fair compensation to the community from which it originates.

- Biodegradation is the decay or breakdown of materials that occurs when microorganisms use an organic substance as a source of carbon and energy.
- A form of competition wherein organisms indirectly competes with other organisms for resources by exploiting resources to limit the resources available to other organisms.
- Patent infringement is the commission of a prohibited act with respect to a patented invention without permission from the patent holder.

111. Select the *correct* Match:
A. Ribozyme - Nucleic acid
B. F2 × Recessive parent - Dihybrid cross
C. T.H. Morgan - Transduction
D. G. Mendel - Transformation

Ans. A
Sol. Ribozymes are self-splicing that catalyzes cleavage and resealing of their own nucleotide chain. They were originally observed in the case of 'self-splicing' introns, i.e. segments of the immature non-protein-coding mRNA that remove themselves during the formation of mature RNA. The 1982 discovery of ribozymes demonstrated that RNA can be both genetic material (like DNA) and a biological catalyst (like protein enzymes)and contribute to the RNA world hypothesis

- In the monohybrid cross, F2 × Recessive parent.
- Norton Zinder and Joshua Lederberg discovered Transduction, the process by which foreign DNA is introduced into a cell by a virus or viral vector.
- Frederick Griffith discovered transformation, the genetic alteration of a cell resulting from the direct uptake and incorporation of exogenous genetic material from its surroundings through the cell membrane.

112. 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. Co-667
B. Sharbati Sonora
C. Lerma Rojo
D. Basmati

Ans. D
Sol. 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 'Basmati' .
In September 1997 a Texas company called Rice Tec won a patent on "basmati rice". The patent secured lines of basmati and basmati -like rice and way of selecting the rice for breeding.it has also caused a brief diplomatic crisis between India and US with India threatening to take the matter to world trade organisation as a violation of Trade-related aspects of intellectual property rights which could have resulted in major embarrassment for the United States.

113. In India, the organization responsible for assessing the safety of introducing genetically modified Organisms for public use is
A. Indian Council of Medical Research (ICMR)
B. Council for Scientific and Industrial Research (CSIR)
C. Research Committee on Genetic Manipulation (RCGM)
D. Genetic Engineering Appraisal Committee (GEAC)

Ans. D
Sol. Biosafety concerns have led to the development of regulatory regimes in various countries for research, testing, safe use and handling of GMOs and products thereof. India is one of the earliest countries to establish a biosafety system for regulation of GMOs.

- The Indian government has set up an organisation such as the Genetic Engineering Appraisal Committee (GEAC), which makes the decision regarding the validity of GM research and safety of introducing GM - organism for public services.
- The Indian Council of Medical Research (ICMR), is one of the oldest medical research bodies in the world. The apex body in India for the formulation, coordination and promotion of biomedical research.
- The Council of Scientific & Industrial Research (CSIR) provides financial assistance to promote research work in the fields of Science & Technology, including Agriculture, Engineering and Medicine.
- The Research Committee on Genetic Manipulation (RCGM) is constituted by the DBT to monitor the safety aspects of ongoing research projects and activities involving genetically engineered organisms.

114. Which of the following is commonly used as a vector for introducing a DNA fragment in human Lymphocytes?
A. Retrovirus
B. Ti plasmid
C. λ phage
D. pBR 322

Ans. A
Sol. Retroviruses are a family of viruses that are grouped together based on how they are structured and how they replicate within a host. Besides human immunodeficiency virus (HIV), the virus that causes AIDS there is an increasing interest in the development of efficient methods for gene delivery into haematopoietic and lymphocytic cells such as primary macrophages, lymphocytes and derivative cell lines

- retrovirus replaces the harmful genomic part with desirable DNA to make it disarmed pathogen and it will deliver desirable DNA in lymphocytes as normal infection process but it will not cause any harm.
- The only vectors routinely used to produce transgenic plants are derived from a soil bacterium called Agrobacterium tumefaciens causes crown gall disease. The key to tumour production is large infects a plant cell, a part of the Ti plasmid.

- pBR322 DNA is a commonly used plasmid cloning vector in *E. coli* and contains the genes for resistance to ampicillin and tetracycline, and can be amplified with chloramphenicol.
- Lambda phage is a temperate bacteriophage (virus) that infects Escherichia coli.

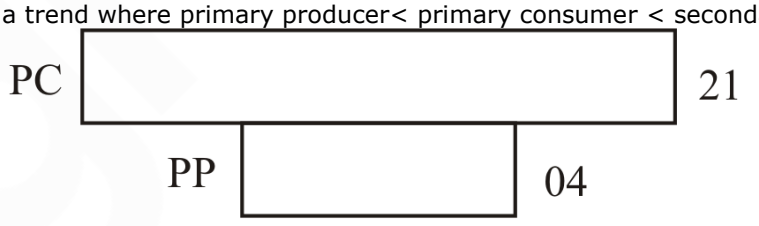
115. World Ozone Day is celebrated on
A. 5th June
B. 21st April
C. 16th September
D. 22nd April

Ans. C
Sol.

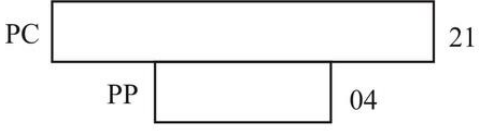
16th September	It is annually celebrated as the International Day for the preservation for Ozone layer with a lot of enthusiasm in all the countries. It was done to commemorate the signing of the Montreal Convention against the depletion of the ozone layer in the year 2000 on 19thof December.
21st April	The National Civil Services Day is celebrated every year on April 21, when civil servants rededicate themselves to cause of the citizens and renew their commitment to public service.
22nd April	Earth Day is an annual event celebrated on April 22. Worldwide, various events are held to demonstrate support for environmental protection.
5th June	World Environment Day (WED) is celebrated on the 5th of June every year and is the United Nation's principal vehicle for encouraging awareness and action for the protection of our environment.

116. What type of ecological pyramid would obtained with the following data?
Secondary consumer: 120 g
Primary consumer: 60 g
Primary producer: 10 g
A. Inverted pyramid of biomass
B. Pyramid of energy
C. Upright pyramid of numbers
D. Upright pyramid of biomass

Ans. A
Sol. Biomass pyramids represent the amount of energy that's stored in living tissue at the different trophic levels. The given data depicts the inverted pyramid of biomass, usually found in the aquatic ecosystem. Inverted biomass pyramid has the least number of primary producer, which supports primary consumer and the secondary consumers are maximum in number. The given data follows a trend where primary producer< primary consumer < secondary consumers.



Inverted pyramid of biomass - small standing crop of phytoplankton supports large standing crop of zooplankton



Inverted pyramid of biomass - small standing crop of phytoplankton supports large standing crop of zooplankton

- The inverted pyramid is possible because of the high turnover rate of the phytoplankton. They get rapidly eaten by the primary consumers (zooplankton), so their biomass at any point in time is small.
- They reproduce so fast that, despite their low steady-state biomass, they have high primary productivity that can support large numbers of zooplankton.
Numbers pyramids show how many individual organisms there are in each trophic level. They can be upright, inverted, or kind of lumpy, depending on the ecosystem.
An energy pyramid usually shows *rates* of energy flow through trophic levels, not absolute amounts of energy stored. It is always upright.

117. Natality refers to
A. Death rate
B. Birth rate
C. Number of individuals leaving the habitat
D. Number of individuals entering the habitat

Ans. B
Sol. **Natality** refers to the **number of births** during a given period in the population that are added to the initial density. It is represented by **(B)**.
Mortality is the **number of deaths** in the population during a given period. It is represented by **(D).**
Immigration is the **number of individuals of the same species that have come into the habitat** from somewhere else during the time period under consideration. It is represented by **(I).**
Emigration is the **number of individuals of the population who had left the habitat** and gone somewhere else during the time period under consideration. It is represented by **(E)**.

118. Niche is
A. All the biological factors in the organism environment
B. The physical space where an organism live
C. The range of temperature that the organism needs to live
D. The functional role played by the organism where it lives

Ans. D
Sol. Ecological niche concept was given by **J. Grinnel.** The ecological niche of an organism represents, **the range of conditions that it can tolerate, the resources it utilises and its functional role in the ecological system.** Each species has a distinct niche and no two species are believed to occupy exactly the same niche. Over, a period of time, the organisms evolved adaptations to optimize its survival and reproduction in its habitat through natural selection.

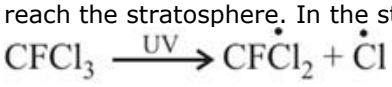
119. Which of the following is a secondary pollutant?
A. CO
B. CO2
C. SO2
D. O3

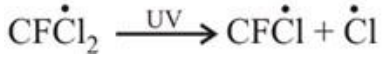
Ans. D
Sol.
- **Secondary pollutants** are any type of pollutant that is formed in the atmosphere. These pollutants are not emitted directly from a source, such as vehicles or power plants, instead, they form as a result of the pollutants emitted from vehicles or power plants.
- Ground-level ozone is a colorless and highly irritating gas that forms just above the earth's surface. It is called a secondary pollutant because it is produced when two primary pollutants react in sunlight and stagnant air. These two primary pollutants are nitrogen oxides (NOx) and volatile organic compounds (VOCs).

Carbon monoxide(CO)	Major air pollutant which is produced by the incomplete combustion of fossil fuels in automobiles.
Sulfur dioxide(SO_2)	It is produced in oil refineries smelters of ores combustion of sulfur-containing fuels.
Carbon dioxide(CO_2)	It is a Greenhouse gas.

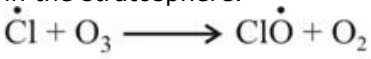
120. In stratosphere, which of the following element acts as a catalyst in degradation of ozone a release of molecular oxygen?
A. Carbon
B. Cl
C. Fe
D. Oxygen

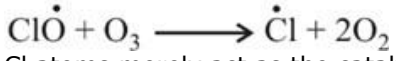
Ans. B
Sol. Chlorofluorocarbons or CFCs discharged in the lower part of the atmosphere move upward and reach the stratosphere. In the stratosphere, UV rays act on them releasing Cl atoms.





Chlorine reacts with ozone in chainamitic method converting into oxygen. One active chlorine can destroy 5000 molecules of ozone in one month and about 1 lakhs ozone molecules during its stay in the stratosphere.





Cl atoms merely act as the catalyst and are not consumed in the reaction. Thus, CFC's have permanent and continuing effects on ozone levels.

121. The Golgi complex participates in
A. Fatty acid breakdown
B. Formation of secretory vesicles
C. Respiration in bacteria
D. Activation of amino acid

Ans. B
Sol. The Golgi apparatus is an organelle present in most eukaryotic cells, except in mature sieve tubes of plants, mature RBCs of mammals, sperm cells of bryophytes and pteridophytes etc. It is absent in prokaryotic cells. It is membrane-bound cell organelle and is also called dictyosomes as Golgi apparatus is made up of unconnected units.
There are four parts of Golgi complex i.e., cisternae, tubules, vesicles, Golgian vacuoles.
(a) Cisternae- The Golgi cisternae are concentrically arranged near the nucleus with distinct convex cis or the forming face and concave trans or the maturing face.
(b) Tubules- Small, flat, interconnecting structures arising from the periphery of cisternae due to fenestrations (small opening or pore).
(c) Vesicles- Largely rounded sacs present at the edge of cisternae in clusters and are of two types-
(i) Smooth vesicles- **Smooth surfaced secretory vesicles and contain secretory granules.**
(ii) Coated vesicles- Rough surfaced, spherical protuberances arising from the tubules of cisternae.
(d) Golgian Vacuoles- Large, spherical vacuoles produced at maturing face. Some of them function as lysosomes.
The important function of Golgi apparatus is to **process, package and transport the materials for secretions** and it is the important site of formation of **glycoproteins and glycolipids**.

122. Which of the following is true for nucleolus?
A. Larger nucleoli are present in dividing cells.
B. It is a membrane-bound structure.
C. It takes part in spindle formation.
D. It is a site for active ribosomal RNA synthesis.

Ans. D
Sol.
A nucleus in **non-dividing** phase is called **interphase nucleus** and differentiated into nuclear envelope, nucleoplasm or nuclear matrix, nucleolus and matrix.
(a) **Nuclear Envelope-** It bounds the nucleus on the outside and separates it from the cytoplasm.
(b) **Nucleoplasm**- It is a transparent, semi-fluid and colloidal substance which fills the nucleus. It

contains nucleolus and highly extended and elaborate nucleoprotein fibres called chromatin.
(c) **Nucleolus**- It is spherical structure found in the nucleoplasm and not separated from the rest of the nucleoplasm as it is not bounded by a membrane. **It is the site for ribosomal RNA (rRNA) synthesis. Thus, nucleoli are larger and more numerous in cells that are actively involved in protein synthesis.**
(d) **Chromatin**- The interphase nucleus contains a loose, extended and diffused network of nucleoprotein fibres called chromatin.

123. Which among the following is *not* a prokaryote?
A. Saccharomyces
B. Mycobacterium
C. Nostoc
D. Oscillatoria

Ans. A
Sol. Eukaryote, any cell or organism that possesses a clearly defined nucleus while Prokaryotes are single-celled organisms that are the earliest and most primitive forms of life on earth.

- Saccharomyces known as the brewer's yeast or baker's yeast, are single-celled organisms that possess a cellular organization similar to that of higher organisms.
- The genetic content of Saccharomyces is contained within a nucleus and classifies them as eukaryotic organisms, unlike their single-celled, Nostoc, Mycobacterium and Oscillatoria which do not have a nucleus and are considered prokaryotes.

124. Stomata in grass leaf are
A. Dumb-bell shaped
B. Kidney shaped
C. Rectangular
D. Barrel shaped

Ans. A
Sol. Stomata are tiny aperture found on the epidermis of leaves and young green stems. Each stoma is surrounded by two specialized epidermal cells, called guard cells. these guard cells are bounded by one or more modified epidermal cells called subsidiary cells or accessory cells. The major role of stomata is to facilitate the gas exchange and also facilitate transpiration, which helps the absorption of water from the soil and the transport of water through the xylem. The size of the stomata is controlled by a pair of guard cells. The main difference between stomata of monocot and dicot plants is that the guard cells of the monocots are dumbbell-shaped.

- In Dicotyledonous leaf lower surface has the greater number of stomata while Monocotyledonous leaf they are about equal on both sides.
- In Dicot, the guard cells of dicot plants are bean-shaped while in Monocots guards, cells are ellipsoidal or dumbbell-shaped, called graminaceous and poaceous stomata.

125. Which of the following is *not* a product of light reaction of photosynthesis?
A. ATP
B. NADH
C. NADPH
D. Oxygen

Ans. B
Sol. Photosynthesis begins with the Light reaction or photochemical phase, responsible for the formation of high energy chemical intermediates , ATP and NADPH and includes light absorption, water splitting and release oxygen.

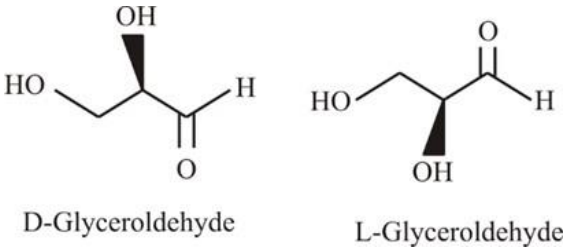
- The energy from sunlight is absorbed by the pigment chlorophyll in the thylakoid membranes of the chloroplast. The energy is then temporarily transferred to two molecules, ATP and NADPH, which are used in the second stage of photosynthesis. ATP and NADPH are generated by two electron transport chains. During the light reactions, water is used and oxygen is produced. These reactions can only occur during daylight as the process needs sunlight to begin.

126. The two functional groups characteristic of sugars are
A. Hydroxyl and methyl
B. Carbonyl and methyl
C. Carbonyl and phosphate

D. Carbonyl and hydroxyl

Ans. D
Sol.

- Carbohydrates are also known as **saccharides** and **sugars** when present in the small amount.
- These are organic compounds containing **-OH group** (polyhydroxy group) and aldehydes or ketones functional groups i.e., the carbonyl group **C=O.** Their general formula is **$C_nH_{2n}O_n$ or $C_n(H_2O)$**.
- In order to see which functional groups are present in carbohydrates, we must look at the functional groups present in the more basic building blocks.
- All carbohydrates contain at least one asymmetrical (chiral) carbon and are, therefore, optically active. In addition, carbohydrates can exist in either of two conformations, as determined by the orientation of the hydroxyl group about the asymmetric carbon farthest from the carbonyl. With a few exceptions, those carbohydrates that are of physiological significance exist in the **D-conformation.** The mirror-image conformations, called **enantiomers**, are in the L-conformation.



127. The stage during which separation of the paired homologous chromosomes begins is
A. Pachytene
B. Diplotene
C. Diakinesis
D. Zygotene

Ans. B
Sol. The two homologous chromosomes begin to separate from each other in the **diplotene stag**e and the following events take place during this stage:

- Synaptonemal complex dissolved which is formed during zygotene resulting in the separation of homologous chromosomes except in the region of crossing over.
- After the dissolution of the synaptonemal complex, the point of attachment between the homologous chromosomes is called **Chiasmata,** which is visible during the diplotene stage**.**
- Homologous chromosomes remain attached to chiasmata when they begin to separate.

Zygotene- It is the second stage of Prophase I. In this stage synapsis occurs i.e., pairing of the homologous chromosomes.
Pachytene- It is the third stage of Prophase I. In this stage crossing over takes place i.e., exchange of genetic material (DNA) between non-sister chromatids (two chromatids of two different homologous chromosomes) of the homologous chromosomes.
Diakinesis- It is the final stage of Prophase I. In this stage terminalization of chiasmata occurs.

128. Stomatal movement is not affected by
A. Temperature
B. Light
C. O_2 concentration
D. CO_2 concentration

Ans. C
Sol. Guard cells are specialized cells in the epidermis of leaves, stems and other organs that are used to control gas exchange. They are produced in pairs with a gap between them that forms a stomatal pore. The stomatal pores are largest when water is freely available and the guard cells turgid and closed when water availability is critically low and the guard cells become flaccid.

- Photosynthesis depends on the diffusion of carbon dioxide (CO_2) from the air through the stomata into the mesophyll tissues.
- light stimulates the process of transpiration by the heating effect on the leaf. The rate of respiration is faster in blue light than that of red. Because the stomata are completely opened as their full capacity in the blue light.

- Water holding capacity of air increased at high temperature resulting into the increased rate of respiration
- Oxygen (O_2), produced as a byproduct of photosynthesis, exits the plant via the stomata. As O_2 is being released from stomatal pores as byproduct it will not affect the opening and closing of stomatal pores.

129. Which of the following has proved helpful in preserving pollen as fossils?
A. Pollenkitt
B. Cellulosic intine
C. Oil content
D. Sporopollenin

Ans. D
Sol. Pollen grains are the thicked walled microspores and surrounded by two distinct wall layers. The outer wall layer is thick and rigid called the Exine, which is made up of sporopollenin and the inner wall of pollen grains is thin, soft and elastic in nature called intine, which is made up of cellulose.

- Sporopollenin is most resistant organic materials and non- biodegradable. It can withstand high temperatures and strong acids and alkali. So far no enzyme that degrades sporopollenin is known. Due to the presence of sporopollenin the fossils of pollen grains are found in good conditions. The presence of fossils of the pollen grains, make the possibility to forecast the presence of natural resources in the earth.

130. Select the *correct* match:
A. Alec Jeffreys – Streptococcus pneumoniae
B. Alfred Hershey and – TMV Martha Chase
C. Matthew Meselson – Pisum sativum and F. Stahl
D. Francois Jacob and – Lac operon and Jacques Monod

Ans. D
Sol. In 1961, Francois Jacob and Jacques Monod proposed the operon model of gene regulation in bacteria. The lac operon (lactose operon) is an operon required for the transport and metabolism of lactose in Escherichia coli and many other enteric bacteria. Although glucose is the preferred carbon source for most bacteria, the lac operon allows for the effective digestion of lactose when glucose is not available through the activity of beta-Galactosidase. Gene regulation of the lac operon was the first genetic regulatory mechanism to be understood clearly, so it has become a foremost example of prokaryotic gene regulation.

- Alec Jeffreys develope techniques for genetic fingerprinting used in the laboratory to establish a link between biological evidence and a suspect in a criminal investigation.
- Alfred Hershey and Martha Chase, through their experiment final proof DNA as the genetic material in which Bacteriophages, were the key element for their experiment.
- Meselson and Stahl experiment supported Watson and Crick's hypothesis that DNA replication was semiconservative. They conducted their experiment using an isotope of nitrogen to distinguish between parent and newly copied DNA.

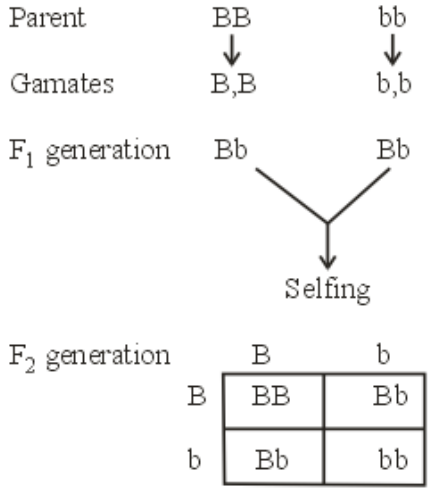
131. Which of the following flowers only once in its life-time?
A. Bamboo species
B. Jackfruit
C. Mango
D. Papaya

Ans. A
Sol. Monocarpic plants, flower once in a lifetime. Bamboos, an example of monocarpic plants which usually dies after flowering. Bamboo has a lifecycle around 40 to 80 years, varying among species. Normally, new bamboos grow up from bamboo shoots at the roots.
While mango, jackfruit and Papaya are an example of Polycapic plants that not die after flowering and fruiting and flower every year in particular season.

132. Which of the following pairs in *wrongly* matched?
A. Starch synthesis in pea: Multiple alleles
B. ABO blood grouping: Co-dominance
C. XO type sex determination: Grasshopper

D. T.H Morgan: Linkage

Ans. A
Sol. The gene controlling starch synthesis in pea shows a small degree of pleiotropy. Starch synthesis in pea seeds is controlled by one gene. It has two alleles B and b.



Starch is synthesized effectively by BB homozygotes and therefore, large starch grains are produced. In contrast, bb homozygotes have lesser efficiency in starch synthesis and produce small starch grains. After maturation of the seeds, BB seeds are round and the bb seeds are wrinkled. Heterozygotes Bb form round seeds but the starch grains are of intermediates size. It starch grain size is considered, Bb seed shows incomplete dominance but if seed shape is considered, B allele is dominant and b is recessive.

133. Offsets are produced by
A. Meiotic divisions
B. Mitotic divisions
C. Parthenocarpy
D. Parthenogenesis

Ans. B
Sol. An **Offsets** is the sub-aerial modification of the vegetative part of the stem or small complete daughter plant which remains attached to the mother body produced asexually and are genetically similar to the mother plant. This is a natural means of cloning. They are produced by mitotic division occurring in the meristematic cells of the mother plant. Plants which are produced through offsets are Lillies and Tulips.

- **Meiosis**- It is the reductional division in which the number of chromosomes is reduced to half.
- **Parthenocarpy**- Development of fruit without fertilization of ovules and the fruits produced are seedless E.g., Banana, Grape etc.
- **Parthenogenesis**- It is a type of asexual reproduction in which offsprings develop from an unfertilized egg.

134. Select the *correct* statement:
A. Franklin Stahl coined the term "linkage".
B. Punnett square was developed by a British scientist.
C. Spliceosomes take part in translation.
D. Transduction was discovered by S. Altman.

Ans. B
Sol. Reginald Crundall Punnett was a British geneticist who developed Punnett square to depict the number and variety of genetic combinations and played a role in shaping the Hardy-Weinberg law.

- The term linkage was coined by T.H. Morgan while Franklin Stahl with Meselson prove that DNA replication is semi-conservative using heavy nitrogen in E.coli.
- Transduction was discovered by Norton Zinder and Joshua Lederberg and S. Altman discovered the catalytic property of RNA.

- Spliceosome takes part in transcription mainly for the removal of non - coding region or intron, during transcription of DNA to RNA.

135. The experimental proof for semiconservative replication of DNA was first shown in a-
A. Fungus
B. Bacterium
C. Plant
D. Virus

Ans. B
Sol. The experimental proof for semi-conservative replication of DNA was first shown in Bacteria.

- The Meselson–Stahlexperiment supported Watson and Crick's hypothesis that DNA replication was semiconservative.
- E. coli was grown for several generations in a medium containing NH_4Cl with ^{15}N.
- When DNA is extracted from these cells and centrifuged on a salt (CsCl) density gradient, the DNA separates out at the point at which its density equals that of the salt solution.
- The DNA of the cells grown in ^{15}N medium had a higher density than cells grown in the normal ^{14}N medium. After that, E. coli cells with only ^{15}N in their DNA were transferred to a ^{14}N medium and were allowed to divide.DNA was extracted periodically and was compared to pure ^{14}N DNA and ^{15}N DNA.
- After one replication, the DNA was found to have intermediate density. Since conservative replication would result in equal amounts of DNA of the higher and lower densities, conservative replication was excluded.
- This result was consistent with both semi conservative replications.

136. Which of the following is an occupational respiratory disorder?"
A. Anthracis
B. Silicosis
C. Botulism
D. Emphysema

Ans. B
Sol. Continuous exposure to harmful substances like gases, fumes, and dust in the environment, where a person works are the main causes of occupational respiratory disorders. Silicosis and Asbestosis are the common examples and caused due to continuous exposure to silica and asbestos dust at the place of work. Symptoms are-

- The proliferation of fibrous tissues causing inflammation.
- Swelling and redness of the lungs.

Emphysema	It is a chronic disorder caused by excessive cigarette smoking. The walls of alveoli are damaged due to excessive smoking, the elasticity of alveoli and bronchioles walls are lost due to which surface area for exchange of gases is reduced.
Botulism	Botulism is a serious illness caused by the botulinum toxin. The toxin causes paralysis. Paralysis starts in the face and spreads to the limbs. If it reaches the breathing muscles, respiratory failure can result. The toxin is produced by Clostridium botulinum (C.botulinum), a type of bacterium.
Anthracis	Bacillus anthracis, the causative agent of anthrax, gets into the body after introduction of endospores through abrasions in the skin, by the ingestion of contaminated foods, or by inhalation

137. Calcium is important in skeletal muscle contraction because it:-
A. binds to troponin to remove the masking of active sites on actin for myosin.
B. activates the myosin ATPase by binding to it.
C. detaches the myosin head from the actinfilament.
D. prevents the formation of bonds between the myosin cross bridges and the actin filament.

Ans. A
Sol.

- **Calcium triggers contraction** by reaction with regulatory proteins that in the absence of calcium prevent interaction of actin and myosin. Two different regulatory systems are found in different muscles.
- In **actin-linked regulation troponin** and **tropomyosin regulate actin by blocking sites on actin** required for complex formation with myosin while in **myosin-linked regulation** sites on myosin are blocked in the absence of calcium.
- Tropomyosin is not only attached to actin but also to another molecule, **troponin.** Upon nervous system excitation for a contraction, calcium is released into the fiber.
- It binds with troponin and stimulates it to move tropomyosin, **exposing the active-binding sites on the actin ATP can then attach to myosin**, which allows the cross-bridge cycle to start again further muscle contraction can occur.

138. Match the items given in Column I with those in column II and select the correct option given below:-
Column I
a. Fibrinogen
b. Globulin
c. Albumin
Column II
i. Osmotic balance
ii. Blood clotting
iii. Defence mechanism
A. a-iii b-ii c-i
B. a-i b-ii c-iii
C. a-i b-iii c-ii
D. a-ii b-iii c-i

Ans. D
Sol. Plasma contains 6-8 percent proteins which are **Fibrinogens, globulins, and albumins.**

Fibrinogen	Important clotting factor produced by the liver.
Globulins	Involved in the defense mechanism and grouped into alpha, beta and gamma globulins. Gamma globulins are antibodies involved in the immune response of the body.
Albumins	Helps in osmotic balance. They maintain the osmotic pressure required to draw water from the surrounding tissue fluid into the capillaries.

139. Which of the following gastric cells indirectly help in erythropoiesis?
A. Chief cells
B. Mucous cells
C. Goblet cells
D. Parietal cells

Ans. D
Sol.
Parietal cells or Oxyntic cells secrete **HCl along with the intrinsic factor**. HCl converts iron present in the diet from ferric to ferrous form so that it can be absorbed easily and used during erythropoiesis (the process which produces red blood cells).
An intrinsic factor is essential for the absorption of vitamin B_{12} which is required for the synthesis of red blood cells and its deficiency caused pernicious anemia. Therefore, Parietal gastric cells indirectly help in erythropoiesis.

Chief Cells	The **gastric chief cell** (also known as a **zymogenic cell or peptic cell**) is a cell in the stomach that releases pepsinogen and chymosin. Pepsinogen is activated into the digestive enzyme pepsin when it comes in contact with acid (HCL) produced by gastric parietal cells.
Goblet Cells	Goblet cells are glandular and simple columnar cells present in the epithelia of most organisms. The important function of goblet cells is the secretion of **mucus.**
Mucous Cells	**Mucus** is produced by **mucous cells**, which are frequently clustered into small glands located on the mucous membrane that lines virtually the entire digestive

	tract. Large numbers of **mucous cells** occur in the mouth, where mucus is used both to moisten food and to keep the oral membranes moist.

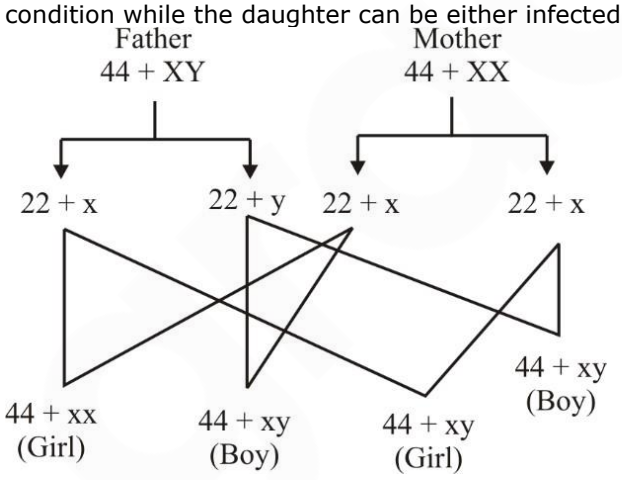
140. All of the following are part of an operon except:-
A. an operator
B. structural genes
C. an enhancer
D. a promoter

Ans. C
Sol. Francois Jacob and Monod proposed a model of a gene regulation, known as an operon model in bacteria. An operon is a coordinated group of genes such as structural, operator, promoter and a regulatory gene which function together and regulates a metabolic pathway as a unit.
Examples: trp operon, lac operon etc.

- Regulatory gene: It synthesis biochemical or regulatory proteins which can be positively as activator and negatively as a repressor.
- Operator gene : It is a gene which recive he products of a regulatory gene .
- Promoter gene: It provides attachment sites for RNA polymerase
- Structural gene: It transcribes mRNA for polypeptide synthesis.

141. A woman has an X-linked condition on one of her X chromosomes. This chromosome can be inherited by:-
A. Only daughters
B. Only sons
C. Only grandchildren
D. Both sons and daughters

Ans. D
Sol. X- chromosome is present in both males and females. Since mother contributes one X chromosome to the zygote, there are equal chances for either son or daughter to inherit that X-chromosome. The severity of the condition then depends on whether the father has the same X-linked condition or not. In either way, the son will show the characteristics of the X-linked condition while the daughter can be either infected or carrier.



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. a-iii b-ii c-i
B. a-i b-iii c-ii
C. a-ii b-iii c-i

D. a-iii b-i c-ii

Ans. C
Sol. **Proliferative phase**: During this phase, primary follicles In ovary grow and to become fully mature Graafian follicles, Hence, known as **Follicular Phase** and simultaneously the endometrium of the uterus through Proliferation.
Secretory phase/ Luteal Phase: As the secretion of gonadotropins increases, ovulation takes place and the remaining of the Graafian follicles is left behind as corpus luteum. It releases progesterone which helps in maintaining the endometrium layer.
Menstruation: Shedding of the endometrial layer along with blood and mucus out of the body through the vagina.

143. According to Hugo de Vries, the mechanism of evolution is:-
A. Multiple step mutations
B. Saltation
C. Phenotypic variations
D. Minor mutations

Ans. B
Sol. Hugo de Vries purposed the theory of mutation on the basis of his observation on the wild variety of evening primrose plants. According to him,

- Mutation was the cause of evolution.
- Mutation is the large changes arising suddenly in the genomic sequence of an organism.
- These mutations are suddenly in a population and these mutations arise in the germ cells of an organism pass on the next generation.
- The mutations are random and directionless.
- The single step large mutation which can cause speciation was named Saltation by Vries.

144. AGGTATCGCAT is a sequence from the coding strand of a gene. What will be the corresponding sequence of the transcribed mRNA?
A. AGGUAUCGCAU
B. UGGTUTCGCAT
C. ACCUAUGCGAU
D. UCCAUAGCGUA

Ans. A
Sol. The process of copying genetic information from one strand of the DNA into RNA is known transcription. DNA-dependent RNA polymerase catalyses the polymerization in 5’- 3’ direction. For this it requires the template from 3’-5’ direction. The coding strand has the direction of 5’-3’, hence the transcribed mRNA will be similar to the coding strand except for the replacement of Thymine with Uracil.

DNA strand: AGGTATCGCAT
mRNA strand: AGGUAUCGCAU

145. Match the items given Column I with those in Column II and select the correct option given below:
Column I
a. Tidal volume
b. Inspiratory Reserve
c. Expiratory Reserve
d. Residual volume
Column II
i. 2500-3000 mL
ii. 1100-1200 mL volume
iii. 500-550 mL volume
iv. 1000-1100 mL
A. a-iii b-ii c-i d-iv
B. a-iii b-i c-iv d-ii
C. a-i b-iv c-ii d-iii
D. a-iv b-iii c-ii d-i

Ans. B

Sol. **Tidal volume (TV)**- Volume of air inspired or Expired.
Inspiratory Reserve Volume (IRV)- Additional or extra volume of air, a person can inspire by forceful inspiration.
Expiratory Reserve Volume (ERV)- Additional or extra volume of air, a person can expire by forceful expiration.
Residual Volume (RV)- Volume of air remains in the lungs even after the forceful expiration.

Respiratory Volumes	Values
Tidal Volume (TV)	500-500 ml
Inspiratory Reserve Volume (IRV)	2500- 3000 ml
Expiratory Reserve Volume (ERV)	1000-1100 ml
Residual Volume (RV)	1100-1200 ml

146. Match the items given in Column I with those inColumn II and select the correct option givenbelow:
Column I
a. Tricuspid valve
b. Bicuspid valve
c. Semilunar valve
Column II
i. Between left atrium and left ventricle
ii. Between right ventricle and pulmonary artery
iii. Between right atrium and right ventricle
A. a-iii b-i c-ii
B. a-i b-iii c-ii
C. a-i b-ii c-iii
D. a-ii b-i c-iii

Ans. A
Sol.

- The openings between the atria and the ventricles are guarded by **atrioventricular (AV) valves**.
- The AV valve between the **right atrium and right ventricle** has three flaps or cusps and known as tricuspid valve.
- The AV valve between the **left atrium and left ventricle** has two flaps or cusps and is called the **bicuspid valve or mitral valve.** In the heart, these two valves prevent the backflow of blood.
- Once the blood has left the heart and entered the aorta, its return is prevented by the **semilunar valves**, which are present **between the pulmonary artery and the right ventricle** and consist of membranous sac like flaps that open away from the heart.
- If the flow of blood reverses, the flaps fill and are pressed against each other, thus blocking the re-entry of blood into the aorta.

147. Which of the following options correctly represents the lung conditions in asthma and emphysema, respectively?
A. Inflammation of bronchioles; Decreased respiratory surface
B. Increased number of bronchioles; Increased respiratory surface
C. Increased respiratory surface; Inflammation of bronchioles
D. Decreased respiratory surface; Inflammation of bronchioles

Ans. A
Sol. **Asthma** is caused due to an allergic reaction to foreign substances that affect the respiratory tract. Its symptoms are-

- Spasm of smooth muscles present in walls of the bronchiole.
- Coughing, Wheezing (means producing sound during breathing).
- Difficulty in breathing due to inflammation, i.e., swelling and redness of bronchi and bronchioles.
- **Emphysema** is a chronic disorder which is caused by excessive cigarette smoking. Its symptoms are-
- The walls of alveoli are damaged due to excessive smoking, loss of elasticity of walls of bronchioles and alveoli.
- Surface area for exchange of gases is reduced. Alveolar sacs remain filled with air even after expiration.

- The lungs remain inflated as exhalation becomes difficult.

148. Which of the following features is used to identifya male cockroach from a female cockroach?
A. Presence of a boat shaped sternum on the 9th abdominal segment
B. Presence of caudal styles
C. Forewings with darker tegmina
D. Presence of anal cerci

Ans. B
Sol. Presence of pair of **short thread-like anal styles also called caudal styles** which is very prominent in male cockroaches than females and it can be used as a distinguishing feature. Anal styles in male cockroach arises from the **9th abdominal segment**. The other differences between male and female cockroaches are as follows-

Male Cockroach	**Female Coachroach**
The abdomen is long and narrow.	The abdomen is short and broad.
All nine sterna are visible.	Only seven sterna are visible
Anal styles are present.	**Anal styles are absent.**
7th tergum covers 8th tergum	7th tergum covers 8th and 9th terga
Brood pouch is absent.	Brood pouch is present.
The antenna is longer in size.	The antenna is smaller in size.

149. Ciliates differ from all other protozoans in
A. using flagella for locomotion
B. having a contractile vacuole for removing excesswater
C. using pseudopodia for capturing prey
D. having two types of nuclei

Ans. D
Sol. The **ciliates** are a group of protists commonly found in freshwaters like lakes, ponds, rivers, and soil. The name ciliate comes from the many hair-like organelles called **cilia** that cover the cell membrane.

- Unlike other eukaryotes, ciliates have two different nuclei i.e., a large macronucleus and one or many small micronuclei.
- The macronucleus contains the genes that are used to regulate cell functions, and the micronuclei contain genes that are involved in sexual reproduction.
- The macronucleus has many copies of the genome and is generated from the micronucleus through replication of the genome. Periodically the macronucleus must be regenerated from the micronuclei.

150. Which one of these animals is not a homeotherm?
A. Macropus
B. Chelone
C. Camelus
D. Psittacula

Ans. B
Sol.

- **Homeotherms** are also known as **Warm blooded organisms or Endotherms**. These organisms can regulate their body temperature, which remains constant irrespective of surroundings. E.g., **birds and mammals.**
- Chelone is tortoise which belongs to class reptilia which come under Poikilotherms or cold-blooded animals i.e., the organisms can not regulate their body temperature with the changing environment.
- **Macropus** is a genus that belongs to the Family Macropodidae. It is a **Homeotherm** animal.
- **Camelus** is the scientific name of the camel. It is the **Homeotherm** animal.
- **Psittacula** is the Bird who is the members of the Parrot whose genus **is Psittacula**. It is also a **Homeotherm** animal.

151. Which of the following organisms are known as chief producers in the oceans ?

A. Dinoflagellates
B. Diatoms
C. Cyanobacteria
D. Euglenoids

Ans. B
Sol. Protista includes all unicellular eukaryotes, irrespective of their mode of nutrition. Protistan protists are popularly called as protistan algae, consisting the major portion of the phytoplankton.

- Diatoms are the golden brown photosynthetic protists and called as Chrysophyta(including both diatoms and desmids).they are both aquatic and terrestrial . some are marine and supports much of the marine life.
- They are basically unicellular but may form pseudofilaments and colonies, lacking flagella except in the reproductive stage.
- They may be free-floating, remaining a floats on the surface of water due to the presence of light weight lipids.

152. Identify the vertebrate group of animals characterized by crop and gizzard in its digestive system.
A. Amphibia
B. Reptilia
C. Aves
D. Osteichthyes

Ans. C
Sol. In the **avian digestive** system, food passes from the **crop** to the first of two stomachs, called the **proventriculus,** which contains digestive juices that break down food. From the proventriculus, the food enters the second stomach, called the **gizzard**, which grinds food. Some birds swallow stones or grit, which are stored in the gizzard, to aid the grinding process.
Amphibia- The digestive system consists of an alimentary canal and its appendages, the digestive glands. Digestion and absorption of food take place within the canal.
Reptilia- The digestive system of modern reptiles is similar in general plan to that of all higher vertebrates. It includes the mouth and its salivary glands, the esophagus, the stomach, and the intestine and ends in a cloaca.
Osteichthyes- At the end of the stomach, many bony fishes have blind sacs called pyloric caeca. The pyloric caeca are an adaptation for increasing the gut area; they digest food. The pancreas secretes enzymes into the intestine for digestion. Most food absorption takes place in the intestine.

153. Which of the following animals does not undergo metamorphosis?
A. Earthworm
B. Tunicate
C. Moth
D. Starfish

Ans. A
Sol. **Metamorphosis** is a biological process in which the organism goes through a series of changes from the birth till it grows into a full adult. Earthworms do not undergo any such changes because they undergo **direct development.**
Tunicate, also called **urochordate**, is the member of the **subphylum Tunicata (Urochordata)** of the phylum Chordata. They undergo metamorphosis.
Butterflies and **moths** are **holometabolous** meaning that they undergo a complete metamorphosis from egg to caterpillar and from chrysalis to adult.
The larvae of the **starfish** will eventually experience the **metamorphosis**. Then they will settle to the bottom of the ocean where they will become adults.

154. The transparent lens in the human eye is held in its place by
A. ligaments attached to the ciliary body
B. ligaments attached to the iris
C. smooth muscles attached to the iris
D. smooth muscles attached to the ciliary body

Ans. A
Sol. The **lens** is embedded in the anterior segment of the eye and held in place by a ring of fibrous tissue, it is curved and transparent. Its purpose is to reflect light rays onto the retina at the back

of the eye with the help of the cornea. The crystalline lens in the human eye is held at its place by ligaments attached to the ciliary body. They contract and relax to change the focal length of the lens.

155. Which of the following hormones can play a significant role in osteoporesis?
A. Aldosterone and Prolactin
B. Progesterone and Aldosterone
C. Estrogen and Parathyroid hormone
D. Parathyroid hormone and Prolactin

Ans. C
Sol.

Parathyroid hormone	**Parathyroid hormone** (**PTH**), also called **parathormone** or **parathyrin**, is a hormone secreted by the parathyroid glands that are important in bone remodeling, which is an ongoing process in which bone tissue is alternately resorbed and rebuilt over time. PTH is secreted in response to low blood serum calcium (Ca^{2+}) levels. PTH indirectly stimulates osteoclast activity within the bone marrow, in an effort to release more ionic calcium (Ca^{2+}) into the blood to elevate serum calcium (Ca^{2+}) levels.
Estrogen	**Estrogen**, or **oestrogen**, is the primary female sex hormone. It is responsible for the development and regulation of the female reproductive system and secondary sex characteristics. Estrogens are responsible for bone maturation and maintenance of bone mineral density throughout life. Due to hypoestrogenism, the risk of osteoporosis increases during menopause.
Progesterone	Progesterone belongs to a group of steroid hormones called progestogens. It is mainly secreted by the corpus luteum in the ovary during the second half of the menstrual cycle. It plays important roles in the menstrual cycle and in maintaining the early stages of pregnancy.
Aldosterone	Aldosterone is produced in the cortex of the adrenal glands, which are located above the kidneys. Aldosterone is closely linked to two other hormones: renin and angiotensin, which create the renin-angiotensin-aldosterone system. This system is activated when the body experiences a decrease in blood flow to the kidneys, such as after a drop in blood pressure, or a significant drop in blood volume after a hemorrhage or serious injury. Renin is responsible for the production of angiotensin, which then causes the release of aldosterone.
Prolactin	Prolactin promotes lactation (breast milk production) in mammals. Prolactin is released when a newborn baby suckles at his/her mother's breast, causing the production of milk.

156. Which of the following structures or regions is in correctly paired with its function ?
A. Medulla oblongata: controls respiration and cardiovascular reflexes.
B. Limbic system: consists of fibre tracts that interconnect differentregions of brain; controlsmovement.
C. Hypothalamus: production of releasing hormones and regulation of temperature, hunger and Thirst.
D. Corpus callosum: band of fibers connecting left and right cerebral hemispheres.

Ans. B
Sol. The inner parts of cerebral hemispheres and a group of associated deep structures like the **amygdala, hippocampus,** etc form a complex structure called**limbic system.** It's functions are-

- It along with Hypothalamus involved in the regulation of sexual behavior, expression of emotional reactions (excitement, pleasure etc.).
- Amygdala is an almond-shaped part of the brain and controls anger and rage.
- Hippocampus makes the lower portion of Limbic fork. It deals with a strange mix of signals about smells and memories.

Corpus Colosum	It connects right and left cerebral hemisphere. Its anterior part is called genu while posterior part is called splenium.

Hypothalamus	It is an important part of Forebrain. It controls body temperature, urge for eating and drinking, sexual drive, rage, anger etc. It contains neurosecretory cells which secrete hormones.
Medulla Oblongata	It is the posterior part that connects various parts of the brain and the Spinal cord. It controls respiration and cardiovascular reflexes.

157. Which of the following is an amino acid derived hormone?
A. Epinephrine
B. Ecdysone
C. Estradiol
D. Estriol

Ans. A
Sol.

Epinephrine	It is an amino acid derivative hormone secreted by the Adrenal medulla. Functions are meeting emergency conditions, Vasodilator in the brain, cardiac muscles, and liver. Vasoconstrictor in the skin, visceral organs, and spleen.
Ecdysone	In Arthropods, Ecdysone is a steroid hormone secreted by specific endocrine centers and circulated in the blood, which is the direct initiator of molting.
Estradiol	Estradiol is a steroid female sex hormone that is the predominant estrogen throughout a female's reproductive years. This hormone has a significant impact on the reproductive and sexual function as well as on other organs, including the bones.
Estriol	**Estriol** (**E_3**), also spelled **oestriol**, is a steroid, a weak estrogen, and a minor female sex hormone. It is one of three major endogenous estrogens, the others being estradiol and estrone. Levels of estriol in women who are not pregnant are almost undetectable. Relative to estradiol, both estriol and estrone have far weaker activity as estrogens. It plays the role as a natural hormone, estriol is used as a medication, for instance in menopausal hormone therapy.

158. Conversion of milk to curd improves its nutritionalvalue by increasing the amount of
A. Vitamin D
B. Vitamin A
C. Vitamin B12
D. Vitamin E

Ans. C
Sol. Microorganisms such as **Lactobacillus** and others commonly called **Lactic Acid Bacteria (LAB)** grow in milk and convert into curd. During growth, the LAB produces acids that coagulate and partially digest the milk proteins (like casein). A small amount of curd added to the fresh milk as inoculums or starter contain millions of LAB, which at suitable temperature multiply, thus, converting milk to curd, which also improves its nutritional quality by increasing **vitamin-B12.**

159. In which disease does mosquito transmitted pathogen cause chronic inflammation of lymphatic vessels?
A. Elephantiasis
B. Ascariasis
C. Ringworm disease
D. Amoebiasis

Ans. A
Sol.

Elephantiasis	It is the result of a tropical worm infection called filariasis. When infected mosquitoes transmit the parasitic worm Wuchereria bancrofti to people, the worm blocks the lymphatic system. The blockage causes swelling in the legs or other parts of the body, making these body parts appear large and puffy, or elephant-like.
Ascariasis	It is an infection of the small intestine caused by Ascaris lumbricoides (A. lumbricoides), which is a species of roundworm. Ascariasis is most common in places without modern sanitation. People get it through unsafe food and water. The infection usually causes no

	symptoms, but higher numbers of roundworms (heavier infestations) can lead to problems in the lungs or intestines.
Ringworm disease	Ringworm is a common fungal infection of the skin and is not due to a worm.The medical term for ringworm is tinea.Ringworm causes a scaly, crusted rash that may appear as round, red patches on the skin. Other symptoms and signs of ringworm include patches of hair loss or scaling on the scalp, itching, and blister-like lesions.
Amoebiasis	It is an inflammation of the intestines caused by a parasite, Entamoeba histolytica. This microscopic parasite enters the body through contaminated food or water. The infection is common in areas with poor sanitation or living conditions. This parasite can live in the intestine without causing symptoms, or it can produce severe symptoms.

160. Which of the following characteristics represent 'Inheritance of blood groups' in humans?
a. Dominance
b. Co-dominance
c. Multiple dominance
d. Incomplete dominance
e. Polygenic inheritance
A. b, c and e
B. a, b and c
C. b, d and e
D. a, c and e

Ans. B
Sol. Inheritance of blood groups is represented by dominance, Co-dominance and multiple dominance.

Allele from parent 1	Allele from parent 2	genotypes	Antigen	Blood types
I^B	I^A	$I^A I^B$	A, B	AB
i	i	ii	NEITHER	O
I^A	I^A	$I^A I^A$	A	A
I^B	I^B	$I^B I^B$	B	B
I^A	i	I^A i	A	A
I^B	i	I^B i	B	B
I^B	I^A	$I^A I^B$	A, B	AB

a. The Rh group is also dominant and will be expressed if inherited from either parent.
b. Within the ABO Blood Group system, the A and B genes are co-dominant, i.e. these will be expressed whenever the gene is present. The O gene is silent and only expressed when neither A nor B is present.
c. Three alleles are responsible for the different types of blood groups in humans which shows multiple allelism.

161. Among the following sets of examples for divergent evolution, select the incorrect option:
A. Forelimbs of man, bat and cheetah
B. Heart of bat, man and cheetah
C. Brain of bat, man and cheetah
D. Eye of octopus, bat and man

Ans. D
Sol. The structures in the different organism which are not similar anatomically through they perform similar function are called an analogous organ, which are the result of convergent evolution.
Eye of octopus and of mammals have different internal structurre as they differ in the retinal postion but serves the comman functio of vision.

- Divergent evolution occurs when two different species share a common ancestor but have different characteristics from one another.
- Examples: Brain of bat, man and cheetah, Heart of bat, man and cheetah and Forelimbs of man, bat and cheetah

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

A. Psoriasis
B. Rheumatoid arthritis
C. Alzheimer's disease
D. Vitiligo

Ans. C
Sol. Autoimmune diseases occur if the body's immune system fails to recognize 'self' and 'non-self' and starts destroying the body's own cells.

Psoriasis	Psoriasis is a chronic skin condition caused by an overactive immune system. Symptoms include flaking, inflammation, and thick, white, silvery, or red patches of skin.
Rheumatoid arthritis	Rheumatoid arthritis (RA) is an autoimmune disease that can cause joint pain and damage throughout the body. The joint damage that RA causes usually happens on both sides of the body.
Alzheimer's disease	It is an irreversible, progressive brain disorder that slowly destroys memory and thinking skills, and eventually the ability to carry out the simplest tasks.
Vitiligo	Vitiligo is a common, genetic, autoimmune skin disease in which there is the loss of pigment from areas of the skin resulting in irregular white spots or patches. The skin has normal texture. Vitiligo may appear at any age.

163. The similarity of bone structure in the forelimbs of many vertebrates is an example of
A. evolution
B. Analogy
C. Convergent evolution
D. Adaptive radiation

Ans. A
Sol. The structures in different organisms which have similarity in their anatomy or the basic plan but serve different functions are known as the homologous structure.
this similarity in the anatomy is due to phenomena of comma ancestors. The similarity of bone structure in the forelimbs of many vertebrates like whales, bats, cheetah and humans is an example of homology.

- Analogy is similarity of function and superficial resemblance of structures that have different origins. For example, the wings of a fly, a moth, and a bird are analogous because they developed independently as adaptations to a common function—flying.
- Convergent evolution creates analogous structures that have similar form or function but were not present in the last common ancestor of those groups.
- Adaptive radiation is the evolutionary process by which many species originate from one species in an area and radiate to different areas.

164. Match the items given in Column I with thoseColumn II and select the correct option givenbelow:
Column I
(Function)
a. Ultra filtration
b. Concentration of urine
c. Transport of urine
d. Storage of urine
Column II
(Part of Excretory System)
i. Henle's loop
ii. Ureter
iii. Urinary bladder
iv. Malpighi an corpuscle
v. Proximal convoluted tubule
A. a-iv b-v c-ii d-iii
B. a-iv b-i c-ii d-iii
C. a-v b-iv c-i d-ii

D. a-v b-iv c-i d-iii

Ans. B
Sol.

Ultrafiltration	Glomerulus along with Bowman's capsule is known as the Malpighian body or renal corpuscles. Ultrafiltration occurs at the barrier between the blood and the filtrate in the glomerular capsule.
Concentration of urine	The ascending limb of Henle's loop is impermeable to water, but Na^+ and Cl^- are pumped out into the surrounding fluids by active transport. The result is concentrated urine.
Transport of Urine	The ureters use smooth muscle contractions to facilitate the flow of urine.
Storage of Urine	The urinary bladder is a hollow, muscular, and elastic organ that stores urine.
Reabsorption of water	All essential nutrients and 70-80% of electrolytes and water are reabsorbed by Proximal Convoluted Tubule.

165. Match the items given in Column I with those in Column II and select the correct option given below:
Column I
a. Glycosuria
b. Gout
c. Renal calculi
d. Glomerulonephritis
Column II
i. Accumulation of uric acid in joints
ii. Mass of crystallized salts within the kidney
iii. Inflammation in glomeruli
iv. Presence of glucose in nephritis urine
A. a-iii b-ii c-iv d-i
B. a-i b-ii c-iii d-iv
C. a-ii b-iii c-i d-iv
D. a-iv b-i c-ii d-iii

Ans. D
Sol.

Gout	It is a form of inflammatory arthritis that develops in some people who have high levels of uric acid in the blood.
Glomerulonephritis	Inflammation of glomeruli.
Glycosuria	Presence of glucose in urine.
Renal Calculi	Stone or insoluble mass of crystallized salts formed within kidney.

166. Which of the following terms describe human dentition?
A. Thecodont, Diphyodont, Homodont
B. Thecodont, Diphyodont, Heterodont
C. Pleurodont, Monophyodont, Homodont
D. Pleurodont, Diphyodont, Heterodont

Ans. B
Sol. Human teeth are **Thecodont, Heterodont, Diphyodont, and Bunodont**. Different type of Dentition is described as follows-

Thecodont	Each tooth is embedded in a socket of the jaw bone. E.g., mammals and crocodile.
Diphyodont	When temporary teeth are replaced by permanent teeth. E.g., mammals (humans).
Bunodont	Small, blunt and rounded cusps. E.g., human.

Heterodont	The human adult has 32 permanent teeth of four different types, namely Incisors (I), Canine (C), Premolars (PM), and molars (M).
Pleurodont	Teeth fixed to the lateral surface of jaw ridge e.g., fangs of snakes.
Monophyodont	The single set of teeth that lasts for the entire lifespan. E.g., mammals such as the edentates and cetaceans.
Homodont	Animals whose all teeth are of the same type. E.g., Most Vertebrates.

167. Nissl bodies are mainly composed of
A. Proteins and lipids
B. DNA and RNA
C. Nucleic acids and SER
D. Free ribosomes and RER

Ans. D
Sol. **Nissl bodies or granules** are present in the soma or cell body of a neuron. These granular bodies give a slight color appearance to the cytoplasm of the cell body of the neuron. When observed under the electron microscope, they appear to be composed of **rough endoplasmic reticulum with numerous attached and free ribosomes** hence, help in protein synthesis. This protein is mainly used for transmission of neurotransmitter from the cell body to the site of the synapse. During neuronal degeneration, Nissls granules dissolve out.

168.Select the incorrect match:
A. Lampbrush – Diplotene bivalents chromosomes
B. Allosomes – Sex chromosomes
C. Submetacentric – L-shaped chromosomes
D. Polytene – Oocytes of amphibians chromosomes

Ans. D
Sol. Polytene chromosomes are oversized chromosomes which have developed from standard chromosomes and are commonly found in the salivary glands of Drosophila melanogaster

- Lampbrush chromosomes are a special form of chromosome found in the growing oocytes (immature eggs) of most animals, except mammals.
- An allosome (also referred to as a sex chromosome) is a chromosome that differs from an ordinary autosome (not a sex chromosome)in form, size, and behaviour.
- Submetacentric having the centromere situated slightly away from the centre, so that one chromosome arm is somewhat shorter than the other. Their shape is L shape.

169. Many ribosomes may associate with a single mRNA to form multiple copies of a polypeptide simultaneously. Such strings of ribosomes are termed as
A. Polysome
B. Polyhedral bodies
C. Plastidome
D. Nucleosome

Ans. A
Sol. Polysome or polyribosome is an aggregation or cluster of ribosomes attached with a single mRNA in order to produce multiple copies of the polypeptide chain by carrying on translation simultaneously.

- Plastidome is referred to as the plastids of a cell when they are referred to a functional unit.
- The nucleosome is the smallest structural component of chromatin and is produced through interactions between DNA and histone proteins.
- Polyhedral bodies in the cyanobacterium in some chemotrophic bacteria that fixed carbon dioxide—many of them are sulfur reducers or nitrogen fixers.

170. Which of these statements is incorrect?
A. Enzymes of TCA cycle are present in mitochondrial matrix.
B. Glycolysis occurs in cytosol.
C. Glycolysis operates as long as it is supplied with NAD that can pick up hydrogen atoms.

D. Oxidative phosphorylation takes place in outermitochondrial membrane.

Ans. D
Sol. During glycolysis and Kreb cycles, the glucose is broken down completely but neither of involved in O_2 nor the production of a large number of ATP molecule. The steps involved in Electro transport System and Oxidative Phosphorylation in the respiratory process are able to release and utilize the energy stored in NADH+ H^+ and $FADH_2$. This is accomplished when they are oxidised through the electron transport system and the electrons are passes on to O_2 resulting in the formation of H_2O. the metabolic pathway through which the electron passes from one carrier to another is called the Electron transport system. This process occurs in the inner mitochondrial membrane.

171. Which of the following events does not occur in rough endoplasmic reticulum ?
A. Protein folding
B. Protein glycosylation
C. Cleavage of signal peptide
D. Phospholipid synthesis

Ans. D
Sol. **Smooth endoplasmic reticulum** (SER) is involved in the **synthesis of phospholipid and cholesterol.** The main functions of Rough Endoplasmic Reticulum (RER) are as follows-

- Many proteins that are synthesized in the RER are packaged into vesicles and transported to the Golgi apparatus.
- Protein synthesis begins in the cytosol with a process known as **translation,** in which the protein is assembled from an RNA sequence.
- A signal peptide is a short peptide that is present at the **N-terminus** of the newly synthesized proteins. It is cleaved by **signal peptidase in RER** and then enters the lumen of rough endoplasmic reticulum.
- **Protein folding** takes place in the **lumen** of the endoplasmic reticulum.
- Luminal side of Rough Endoplasmic reticulum possesses enzymes for processing polypeptide synthesized by attached ribosomes.
- In the RER lumen, proteins may undergo slight modifications, such as having their signal sequences cleaved or **undergoing glycosylation.**

172. Which one of the following population interactions is widely used in medical science for the production of antibiotics ?
A. Commensalism
B. Mutualism
C. Parasitism
D. Amensalism

Ans. D
Sol. **Amensalism** is an interaction between two organisms of different species in which one species inhibits the growth of other species by secreting certain chemicals. There are two basic modes i.e., **competition** in which a larger or stronger organism excludes a smaller or weaker one from living space or deprives it of food, and **antibiosis**, in which one organism is unaffected but the other is damaged or killed by a chemical secretion.
The classic demonstration of **antibiosis** is the **destructive effect that the bread mold Penicillium** has upon certain bacteria is the secretion, known as penicillin, has become a potent medicine in combating bacterial infections.

Commensalism	One species is benefitted and other species is neither benefitted nor harmed.
Mutualism	Both interacting species are benefitted.
Parasitism	The parasite is benefitted and the interaction is detrimental to the host.

173. Match the items given in Column I with those inColumn II and select the correct option givenbelow:
Column I

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

Ans. C
Sol.

Eutrophication	It is the accumulation of nutrients in the lakes or ponds due to the disposal of substances such as fertilizers, etc. These substances cause excessive growth of algae and other small plants on the surface of the lake.
Sanitary Landfills	These are the substitute for open burning dumps. The wastes are dumped in depression or trench after compaction and covered with dirt every day.
Snow Blindness	Excessive exposure to UV-B radiations causes burning of the cornea, leading to cloudiness, loss of vision, pain, and tears, hence called **snow blindness.**
Jhum Cultivation	It is also known as shifting cultivation is one of the oldest types of cultivation practices in India and is practiced majorly in the northeastern states of India. Initially, the vegetation or the forest on the land is cleared where the cultivation needs to be practiced and then the farming begins. After the harvest, the land is allowed to have its vegetation back.

174. Which part of poppy plant is used to obtain the drug Smack?
A. Flowers
B. Latex
C. Roots
D. Leaves

Ans. B
Sol. **Morphine** is extracted from the **latex of poppy plant Papaver Somniferum**. It is very effective sedative and painkiller. **Heroin** is obtained by **acetylation of morphine (diacetylmorphine)** commonly known as **smack** which is white, odourless and bitter crystalline compound. Generally, it is taken by snorting or injection. It is a depressant and slows down body functions.

175. All of the following are included in 'Ex-situconservation' except
A. Wildlife safari parks
B. Sacred groves
C. Botanical Gardens
D. Seed banks

Ans. B
Sol. In **Ex-situ approach**, threatened plants and animals are taken away from their natural habitat and placed in the special setting where they can be protected and given special care. **Sacred grooves** is an **In-situ approach** not included in Ex-situ approach of conservation as entire tracts of forests are venerated and provided protection whereas **Seed banks, wildlife safari parks and botanical gardens** are included in ex-situ conservation.

- **A Wildlife safari park** sometimes is known as a **wildlife park**, is a zoo-like commercial drive-in tourist attraction where visitors can drive their own vehicles or ride in vehicles provided by the facility to observe freely roaming animals.
- A seed bank is a place where **seeds** are stored in order to preserve genetic diversity and itis a type of gene **bank**.

- A **botanical garden** is a place where plants, especially ferns, conifers and flowering plants, are grown and displayed for the purposes of research and education.

176. In a growing population of a country
A. pre-reproductive individuals are more than the reproductive individuals.
B. reproductive individuals are less than the post-reproductive individuals.
C. reproductive and pre-reproductive individualsare equal in number.
D. pre-reproductive individuals are less than thereproductive individuals.

Ans. A
Sol. In a **growing population** or **expanding population**, the pre-reproductive population is always higher than the reproductive ones as when they become sexually mature, more and more offsprings would give rise to the immense increase in population. The rate of growth depends upon the size of the pre-reproductive population. This type of population growth is observed in developing countries like India, Brazil. The shape of the pyramid is usually **Triangular.**

177. The amnion of mammalian embryo is derived from
A. ectoderm and mesoderm
B. endoderm and mesoderm
C. mesoderm and trophoblast
D. ectoderm and endoderm

Ans. A
Sol. The **amnion** is an **extraembryonic membrane** that surrounds a developing amniote embryo. It acts as a protective sac along with three other extraembryonic membranes i.e., **the chorion, the yolk sac, and the allantois.**
The membrane is not part of the embryo itself but derives from tissues that emerged from the embryo. The amnion is made from two germ layers which are **mesoderm and the ectoderm.** The ectoderm forms the **inner portion of the amnion,** and a thin mesoderm layer **connects the amnion to the chorion.**

- The amnion, along with the chorion, yolk sac, and allantois, forms a series of protective barriers that **provide a life-support system for the developing embryo**.
- The four membranes work to exchange oxygen and carbon dioxide between the embryo and the placenta, to provide nutrients to the embryo, and to remove nitrogenous wastes from the embryo**.**

178. The difference between spermiogenesis and spermiation is
A. In spermiogenesis spermatids are formed, while in spermiation spermatozoa are formed.
B. In spermiogenesis spermatozoa are formed, while in spermiation spermatids are formed.
C. In spermiogenesis spermatozoa from Sertoli cells are released into the cavity of seminiferous tubules, 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 tubules.

Ans. D
Sol. The differences between spermiogenesis and spermiation are as follows-

Spermiogenesis	**Spermiation**
Spermiogenesis is defined as the final process of spermatogenesis where spermatids are transformed into mature spermatozoa.	Spermiation is a process through which mature spermatids resulted from spermiogenesis are released from the Sertoli cells of the testis.
In this process the maturation of spermatids takes place.	These mature spermatids are released into the lumen of the seminiferous tubules.
It composed of four major stages including Golgi phase, cap phase, tail formation phase and maturation phase.	It is an important process where it determines the number of sperms that enter to the epididymis and also the ejaculating sperm content.

The similarities between spermiogenesis and spermiation are-

- Both Spermiogenesis and Spermiation involve in the production of sperms.
- Both Spermiogenesis and Spermiation processes are two important parts of the spermatogenesis.

179. The contraceptive 'SAHELI'
A. blocks estrogen receptors in the uterus, preventing getting implanted.
B. increases the concentration of estrogen and prevents ovulation in females.
C. is an IUD
D. is a post-coital contraceptive.

Ans. A

Hormones	Functions
Human Chorionic Gonadotropin (HCG)	It stimulates corpus luteum of pregnancy to continue to secrete for the longer time than its normal time.
Human Placental Lactogen (hPL) or Chorionic Somatomammotropin	Works with estrogens and progesterone to stimulate maturation of the breasts for lactation, promotes the growth of the fetus, and exerts a glucose-sparing effect in the mother.
Human chorionic thyrotropin (HCT)	A glycoprotein hormone similar to the thyroid-stimulating hormone. it increases the rate of maternal metabolism throughout the pregnancy, causing hypermetabolism.
Estrogen	Development of female sexual characters.
Progesterone	Development of Placenta and maintenance of pregnancy.
Corticotropin (Glucocorticoids)	Gluconeogenesis, lipolysis, proteolysis, anti-inflammatory and anti-allergic, vasoconstrictive in case of excessive bleeding.
Relaxin	Causes pelvic ligaments and the pubic symphysis to relax, widen, and become more flexible.
Prolactin	It regulates the growth of mammary glands and milk production in them.
Oxytocin	Contraction of smooth muscles, childbirth and milk ejection.

Sol. **Saheli** is different from other birth control pills because it doesn't contain any hormones. Instead of using the hormone estrogen to prevent pregnancy, it contains a drug **Ormeloxifene**, also known as **centchroman**, is one of the **selective estrogen receptor modulators, or SERMs**, a class of medication which acts on the estrogen receptor. However, **by blocking estrogen in the uterus**, Saheli alters the uterus lining, which prevents a fertilised egg from implanting.

180. Hormones secreted by the placenta to maintain pregnancy are
A. hCG, hPL, progesterone, prolactin
B. hCG, hPL, estrogens, relaxin, oxytocin
C. hCG, hPL, progesterone, estrogens
D. hCG, progesterone, estrogens, glucocorticoids

Ans. C
Sol. The **placenta** is an organ which connects the foetus with uterine wall. The placenta acts as an **endocrine gland** as it synthesizes some hormones like **human chorionic gonadotropin (HCG), chorionic thyrotropin, Chorionic corticotropin (glucocorticoids), chorionic somatomammotropin or human placental lactogen (**hPL**), estrogens and progesterone.**
The functions of the hormones are as follows-

***