

PART A : CLASS XII

PHYSICS

Q1

A charge q has been placed at the centre of the line joining two equal positive charges Q . The system of the three charges will be in equilibrium if q is equal to:

(a) $-\frac{Q}{2}$

(b) $-\frac{Q}{4}$

(c) $+\frac{Q}{4}$

(d) $+\frac{Q}{2}$

Q2

Three concentric metallic spherical shells of radii $R, 2R, 3R$ have been given charges Q_1, Q_2 and Q_3 , respectively. It has been found that the surface charge densities on the outer surface of the shells are equal. Then, the ratio of the charges given to the shells, $Q_1: Q_2: Q_3$, is:

(a) 1: 2: 3

(b) 1: 3: 5

(c) 1: 4: 9

(d) 1: 8: 18

[IIT 2009]

Q3

A positively charged thin metal ring of radius R has been fixed in the XY -plane, with its centre at the origin O . A negatively charged particle P is released from rest of the point $(0, 0, z_0)$, where $z_0 > 0$. Then, the motion of P is:

(a) Periodic for all the values of z_0 satisfying $0 < z_0 < \infty$

(b) SHM for all the values of z_0 satisfying $0 < z_0 < R$

(c) nearly SHM provided $z_0 \ll R$

(d) so that P crosses O and continues to move along the negative Z -axis towards $z = -\infty$

Q4

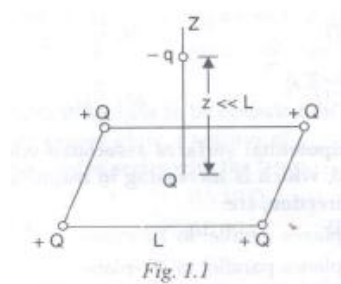
A charged oil drop has been suspended in uniform field of $3 \times 10^4 \text{ V} - \text{m}^{-1}$ so that it neither falls nor rises. The charge on the drop (assume the mass of the charge to be $9.9 \times 10^{-15} \text{ kg}$ and $g=10 \text{ ms}^{-2}$) will be

- (a) $3.3 \times 10^{-18} \text{ C}$
- (b) $3.2 \times 10^{-18} \text{ C}$
- (c) $1.6 \times 10^{-18} \text{ C}$
- (d) 4.8×10^{-18}

[AIEEE 2004]

Q5

Four point positive charges of same magnitude Q have been placed at four corners of a rigid square frame as shown in fig. 1.1. The plane of the frame is perpendicular to Z -axis. If a negative point charge is placed at a distance z , away from the above frame, the



- (a) negative charge oscillates along the z -axis
- (b) It Moves away from the frame
- (c) It moves slowly towards the frame and stays in the plane of the frame,
- (d) It passes through the frame only once

[AIIMS 2005]

Q6

Two infinitely long parallel conducting plates, having surface charge densities $+\sigma$ and $-\sigma$, respectively, have been separated by a small distance. The medium between the plates is vacuum. If ϵ_0 is the dielectric permittivity of vacuum, the electric field in the region between the plates is:

- (a) $2\sigma\epsilon_0 \text{ v-m}^{-1}$
- (b) $\frac{\sigma\epsilon_0}{2} \text{ V-m}^{-1}$
- (c) $\frac{\sigma}{\epsilon_0} \text{ V-m}^{-1}$
- (d) 0 V-m^{-1}

Q7

A hollow insulated conducting sphere has been given a positive charge $10\mu\text{C}$. What will be the electric field at the centre of the sphere if its radius is 2 m?

- (a) $6\mu\text{C}\cdot\text{m}^2$
- (b) $8\mu\text{C}\cdot\text{m}^{-1}$
- (c) $0\mu\text{C}\cdot\text{m}^2$
- (d) $12\mu\text{C}\cdot\text{m}^{-2}$

Q8

Two charged spheres, separated by a distance d , exert some force F on each other. If they are immersed in a liquid of dielectric constant 2, the force exerted by them, if all other conditions are the same, is:

- (a) $4F$
- (b) $2F$
- (c) F
- (d) $\frac{F}{2}$

[VMC 2004]

Q9

A charged particle of mass m and charge q (initially at rest) is released in an electric field of magnitude E . Its kinetic energy after time t will be:

- (a) $\frac{2E^2t^2}{mq}$
- (b) $\frac{E^2q^2t^2}{2m}$
- (c) $\frac{Eq^2m}{2t^2}$
- (d) $\frac{Eqm}{2t}$

[VMC 2003]

Q10

The following is not a property of field lines:

- (a) Field lines are continuous curves without any breaks
- (b) Two field lines cannot cross each other
- (c) Field lines start at positive charges and end at negative ones
- (d) They form closed loops

[DPMT 2009]

Q11

Gauss's law is valid for:

- (a) any closed surface
- (b) only regular closed surfaces
- (c) any open surface
- (d) only irregular open surface

[DPMT 2009]

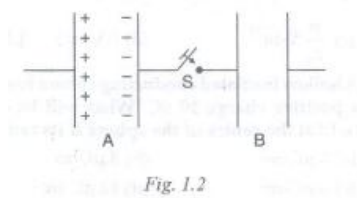
Q12

Two identical capacitors have the same capacitance C . One of them has been charged to potential V_1 ; the other to potential V_2 . The negative ends of the capacitors are connected. Thus, the decrease in energy of the combined system is:

- (a) $(V_1^2 - V_2^2)$
- (b) $\frac{1}{4}C(V_1^2 - V_2^2)$
- (c) $\frac{1}{4}C(V_1 - V_2)^2$
- (d) None of these

Q13

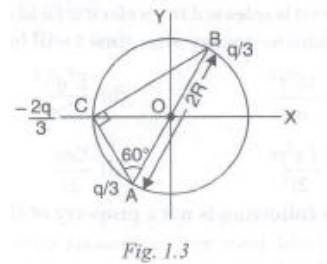
Refer Fig. 1.2 The capacitor A has charge q on it whereas B has not been charged. The charge appearing on the capacitor B, a long time after the switch S is closed, is:



- (a) Zero
- (b) $q/2$
- (c) q
- (d) $2q$

Q14

Refer fig. 1.3. There is a system of point charges. There are three charges $q/3, q/3$ and $-2q/3$. They have been placed on the three vertices of a triangle. If O is the centre of the circle with radius R and $\angle CAB = 60^\circ$, then which one of the following statements is true?



- (a) The electric field at point O is $\frac{q}{8\pi\epsilon_0 R^2}$ and it is directed along the x-axis.
- (b) The PE of the system is zero
- (c) The magnitude of the force between the charge at C and the one at B is $\frac{q^2}{54\pi\epsilon_0 R^2}$
- (d) The potential at point O is $\frac{q}{12\pi\epsilon_0 R}$

Q15

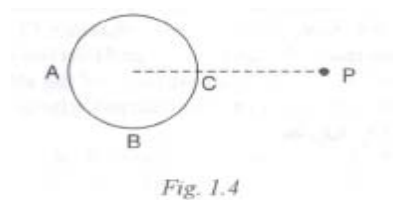
What is the angle between an electric field and an equipotential surface?

- (a) 90° (always) (b) 0° (always)
- (c) 0° to 90° (d) 0° to 180°

Q16

Refer Fig.1.4. A hollow conducting sphere has been placed in an electric field produced by a point charge placed at P as shown in Fig. 1.3. Let V_A, V_B and V_C be the potentials at points, A, B and C, respectively.

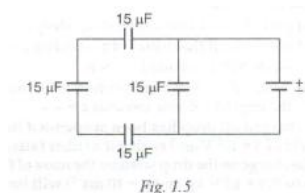
Thus, we confirm that:



- (a) $V_C > V_R$ (b) $V_B > V_C$
- (c) $V_A > V_B$ (d) $V_A = V_B$

Q17

Refer Fig.1.5. The equivalent capacitance is:



- (a) $15\mu\text{F}$ (b) $20\mu\text{F}$
 (c) $25\mu\text{F}$ (d) $30\mu\text{F}$

Q18

A capacitor is charged by connecting a battery across its plates. It stores energy U . Now the battery is disconnected across it, then the energy stored by both capacitors of the system will be:

- (a) U (b) $\frac{U}{2}$
 (c) $2U$ (d) $\frac{3}{2}U$

Q19

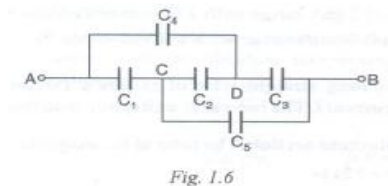
Equipotential surface associated with an electric field, which is increasing in magnitude along the X -direction, are:

- (a) Planes parallel to YZ -plane (b) Planes parallel to XY -plane
 (c) Planes parallel to XZ -plane (d) coaxial cylinders of increasing radii around the X -axis

[AIIMS 2004]

Q20

Refer Fig. 1.6. The capacitors C_1 , C_3 and C_4 have a capacitance $4\mu\text{F}$ each. If the capacitor C_2 has a capacitance $10\mu\text{F}$, the difference capacitance between A and B will be:



- (a) $2\mu\text{F}$ (b) $4\mu\text{F}$
 (c) $6\mu\text{F}$ (d) $8\mu\text{F}$

Q21

Identical charges(-q) have been placed at each corner of a cube of side b. Then, the electrostatic potential energy of charge (+q) placed at the centre of the cube will be:

(a) $-\frac{4\sqrt{2}q^2}{\pi\epsilon_0}$

(b) $\frac{8\sqrt{2}q^2}{\pi\epsilon_0 b}$

(c) $-\frac{4q^2}{\sqrt{3}\pi\epsilon_0 b}$

(d) $\frac{8\sqrt{2}q^2}{4\pi\epsilon_0 b}$

[CBSE 2002]

Q22

A Capacitors of capacitance C_1 has been charged up to a potential V and connected in parallel with an uncharged capacitors of capacitance C_2 . The final potential difference across each capacitor will be:

(a) $\frac{C_2 V}{C_1 + C_2}$

(b) $\frac{C_1 V}{C_1 + C_2}$

(c) $\left(1 + \frac{C_2}{C_1}\right) V$

(d) $\left(1 - \frac{C_2}{C_1}\right) V$

Q23

The mean free path of electrons in a metal is $4 \times 10^{-8} m$. The electric field that can give (On an average) energy of 2eV to an electron in the metal will be:

(a) $5 \times 10^{11} V - m^{-1}$

(b) $8 \times 10^{-11} V - m^{-1}$

(c) $5 \times 10^7 V - m^{-1}$

(d) $8 \times 10^7 V - m^{-1}$

[CBSE PMT 2009]

Q24

A 30V, 90 W lamp is to be operated on a 120V DC line. For proper glow, a resistor of ____ W should be connected in series with the lamp.

(a) 40Ω

(b) 10Ω

(c) 20Ω

(d) 30Ω

[IPUEE 2007]

Q25

In the balanced wheatstone's bridge circuit shown in Fig. 1.7. When the key is pressed, what will be the change in the reading of the galvanometer?

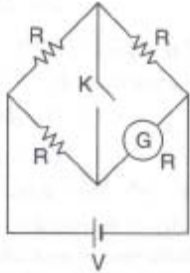


Fig. 1.7

- (a) It remains the same
- (b) It increases
- (c) It decreases
- (d) None of these

Q26

Resistances in the two gaps of a metre bridge are 10Ω and 30Ω , respectively. If the resistances are interchanged, the balance point shifts by:

- (a) 33.3 cm
- (b) 66.67 cm
- (c) 25cm
- (d) 50cm

Q27

A lead-acid battery of a car has an emf of 12V. If the internal resistance of the battery is 0.5Ω , the maximum current that can be drawn from the battery will be:

- (a) 30A
- (b) 20A
- (c) 6A
- (d) 24A

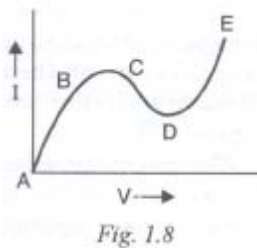
Q28

In a thermocouple, the neutral temperature is 270°C and the temperature of inversion is 525°C . The temperature of the cold junction would be:

- (a) 30°C
- (b) 255°C
- (c) 15°C
- (d) 25°C

Q29

Fig.1.8.shows the graph between current (I) and voltage (V). Identify the portion corresponding to negative resistance.



- (a) AB
- (b) BC
- (c) CD
- (d) DE

Q30

When a wire of uniform cross-section a , length l and resistance R is bent into a complete circle, resistance between any two of diametrically opposite points will be:

- (a) $\frac{R}{4}$
- (b) $4R$
- (c) $\frac{R}{8}$
- (d) $\frac{R}{2}$

Q31

Kirchhoff's First Law, i.e., $\Sigma I = 0$ at a junction, deals with the conservation of:

- (a) Charge
- (b) Energy
- (c) Momentum
- (d) Angular momentum

Q32

What length of the wire (specific resistance $48 \times 10^{-8} \Omega - m$) is needed to make a resistance of 4.2Ω ?
The diameter of the wire is 0.4 mm.

- (a) 1.1m
- (b) 3.1m
- (c) 2.1 m
- (d) 4.1 m

Q33

A carbon resistance reads Red-Red-Black. What is its resistance?

- (a) 2.2Ω
- (b) 220Ω
- (c) 22Ω
- (d) $0.22 \text{ k}\Omega$

Q34

The internal resistance of a cell:

- (a) always acts in the cell in open circuit
- (b) acts only in closed circuit it reduces the EMF
- (c) acts only in closed circuit and reduces the current
- (d) None of these

Q35

A hot electric iron has a resistance of 80Ω and is used on a 200V source. The electrical energy spent, if it is used for 2 hours, is:

- (a) 800 Wh
- (b) 2000 Wh
- (c) 1000 Wh
- (d) 8000 Wh .

[VMMC 2002; DPMT 1998, 2001]

Q36

A current I flows along the length of an infinitely long, straight and thin-walled pipe. Then, the magnetic field:

- (a) at all points inside the pipe is the same but not zero
- (b) at any point inside the pipe is zero
- (c) is zero only on the axis of the pipe
- (d) is different at different points inside the pipe

[IIT 1993]

Q37

Two thin long parallel wires have been separated by a distance and carry current. There can be two unique cases of attraction and repulsion. Which one of the following is correct?

- (a) Antiparallel currents attract and parallel currents repel
- (b) Antiparallel currents repel and parallel currents attract
- (c) Antiparallel and parallel currents do not affect another
- (d) Need more data to predict.

Q38

A microammeter has a resistance of 100Ω and a full scale range of $50\mu\text{A}$. It can be used as a voltmeter or as a higher range ammeter provided a resistance is added to it. Pick the correct range and resistance combination (s).

- (a) 50 V range with 10Ω resistance in series
- (b) 10 V range with $200\text{k}\Omega$ resistance in series
- (c) 5 mA range with 1Ω resistance in parallel
- (d) 10mA range with 1Ω resistance in parallel

[IIT 1991]

Q39

A long straight wire of radius a carries a steady current I . the current is uniformly distributed across its cross-section. The ratio of the magnetic field at $\frac{a}{2}$ and $2a$ is:

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

[AIEEE 2007]

Q40

The time period of a charged particle undergoing a circular motion in a uniform magnetic field is independent of its:

- (a) Speed
- (b) mass
- (c) charge
- (d) magnetic induction

[AIEEE 2002]

Q41

A bar magnet of magnetic moment M has been cut into two parts of equal lengths. The magnetic moment and pole strength of either part is:

- (a) $\frac{M}{2}, \frac{m}{2}$
- (b) $M, \frac{m}{2}$
- (c) $\frac{M}{2}, m$
- (d) M, m

[CBSE PMT 1997]

Q42

Two bar magnets having same geometry with magnetic moments M and $2M$ are firstly placed in such a way that their similar poles are on the same side and its period of oscillation is T_1 . Now the polarity of one of the magnets is reversed and its time period becomes T_2 . Then,

- (a) $T_1 < T_2$
- (b) $T_1 > T_2$
- (c) $T_1 = T_2$
- (d) $T_2 = \infty$

Q43

A bar magnet having a magnetic moment of $2 \times 10^4 \text{ J} - \text{T}^{-1}$ is free to rotate in a horizontal plane. A horizontal magnetic field $B = 6 \times 10^{-4} \text{ T}$ exists in the space. The work done in taking the magnet slowly from a direction parallel to the field to a direction 60° from the field is:

(a) 12J

(b) 6J

(c) 2J

(4) 93J

Q44

If a diamagnetic substance is brought near north or South Pole of a bar magnet, it is:

(a) attracted by the poles

(b) repelled by the poles

(c) repelled by the North Pole and repelled by the South Pole.

(d) attracted by the North Pole and repelled by the South Pole.

Q45

According to Curie's law, the magnetic susceptibility of a substance at the absolute temperature T is proportional to:

(a) T

(b) T^2

(c) $\frac{1}{T}$

(d) $\frac{1}{T^2}$

PART B: CLASS XII**CHEMISTRY****Q46**

A solid has a structure in which W atoms are located at the corners of a cubic lattice. The oxygen atoms are at the center of edges and Na atom is at the centre of the cube. The formula of this compound is :

(a) NaWO_4

(b) NaWO_3

(c) NaWO_3

(d) NaWO_2

Q47

The law stating that “the relative lowering of vapour pressure is equal to the mole fraction of a solute in the solution” is known as:

- (a) Henry’s Law
- (b) van’t Hoff’s Law
- (c) Raoult’s Law
- (d) Ostwald’s Dilution Law

Q48

The excess pressure that is applied to the solution for preventing the passage of solvent into it through a semipermeable membrane is referred to as:

- (a) critical solution pressure
- (b) normal pressure of the solvent
- (c) osmotic pressure of the solution
- (d) None of these

Q49

Which one of the following is a colligative property?

- (a) Adsorption
- (b) Absorption
- (c) Elevation in boiling point
- (d) Surface tension

Q50

Which disease involves mutation?

- (a) Sickle cell anaemia
- (b) Cancer
- (c) Goitre
- (d) Gout

Q51

What is chemotherapy?

- (a) It is a branch of chemistry that deals with analgesics
- (b) It is the application of organic chemistry in the field of medicine
- (c) It is a set of chemicals used for curing disease and reducing pain of patients
- (d) It is a new branch of biochemistry

Q52

The effect of dilution on conduction is as follows:

- (a) Specific conductance increases, molar conductance decreases
- (b) Specific conductance decrease, molar conductance increases
- (c) Both of them increase with dilution
- (d) Both of them decrease with dilution

Q53

The amount of electricity required to deposit 1 mol of aluminium from a solution of AlCl_3 will be:

- (a) 0.33 ampere
- (b) 5 ampere
- (c) 3 ampere
- (d) 4.3 ampere

[C.E.ET.1991,A.I.I.MS,1992]

Q54

The following is not needed for the process of photosynthesis to occur

- (a) Chloophyll
- (b) CO_2
- (c) H_2O
- (d) O_2

Q55

A current of 2.0A is passed for 5 hours through molten metal salt deposits 22.2 grams of metal (Atomic weight=177). The oxidation state of the metal in the metal salt is :

- (a) +1
- (b) +2
- (c) +3
- (d) +4

Q56

For the reaction $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$, the rate of reaction in terms of O_2 is $[\text{O}_2]/dt$. In terms of N_2O_5 , it will be:

- (a) $-d[\text{N}_2\text{O}_5]/dt$
- (b) $+d[\text{N}_2\text{O}_5]/dt$
- (c) $-\frac{1}{2} \frac{d[\text{N}_2\text{O}_5]}{dt}$
- (d) $-2 \frac{d[\text{N}_2\text{O}_5]}{dt}$

Q57

For reaction $\text{NO}_2 + \text{CO} \rightarrow \text{CO}_2 + \text{NO}$, the expression is $\text{Rate} = k[\text{NO}_2]^2$

The number of molecules of CO involved in the slowest step will be:

- (a) 0
- (b) 1
- (c) 2
- (d) 3

Q58

The ionic reactions are usually very fast because:

- (a) the energy of interaction between charged ions is greater than between neutral molecules.
- (b) it does not involve bond breaking
- (c) the number of collisions between ions per unit volume per second are very large.
- (d) these reactions are highly exothermic.

Q59

In some photochemical reactions, there is a rise in the free energy because:

- (a) reactions are unstable
- (b) light radiation is UV
- (c) light energy absorbed by reactants is converted into free energy products
- (d) the reactions take place at high energy levels

Q60

In the first-order reaction, 75 percent of the reaction disappeared in 1.388 h. The rate constant of the reaction is:

- (a) $3.6 \times 10^{-3} \text{ s}^{-1}$
- (b) $2.8 \times 10^{-4} \text{ s}^{-1}$
- (c) $17.2 \times 10^{-3} \text{ s}^{-1}$
- (d) $1.8 \times 10^{-3} \text{ s}^{-1}$

Q61

In the reversible reaction $2\text{NO}_2 \xrightleftharpoons[k_2]{k_1} \text{N}_2\text{O}_4$ the rate of disappearance of NO_2 is equal to:

- (a) $\frac{2k_1}{k_2}[\text{NO}_2]^2$
- (b) $2k_1[\text{NO}_2]^2 - 2k_2[\text{N}_2\text{O}_4]$
- (c) $2k_1[\text{NO}_2]^2 - k_2[\text{N}_2\text{O}_4]$
- (d) $(2k_1 - k_2)[\text{NO}_2]$

Q62

Adsorption is a phenomenon in which the molecules of a gas:

- (a) go into the body of the other substance
- (b) remain close to the other substance
- (c) form a thin film on the surface of a solid.
- (d) None of these.

Q63

The diameter of the colloidal particle ranges between:

- (a) $10^{-2} \text{ cm to } 10^{-3} \text{ cm}$
- (b) $10^{-3} \text{ cm to } 10^{-5} \text{ cm}$
- (c) $10^{-7} \text{ cm to } 10^{-4} \text{ cm}$
- (d) $10^{-7} \text{ cm to } 10^{-8} \text{ cm}$

Q64

The protective action of different colloids can be expressed in terms of:

- (a) Oxidation number
- (b) Atomic number
- (c) Gold number
- (d) Avogadro's number

Q65

Ferric chloride is applied to stop the bleeding from a cut because:

- (a) Fe^{3+} ion coagulates blood which is a negatively charged sol
- (b) Fe^{3+} ion coagulates blood which is a positive charged sol
- (c) Cl^- ion coagulates blood which is a positively charged sol
- (d) Cl^- ion coagulates blood which is a negatively charged sol

Q66

Milk is:

- (a) fat dispersed in oil
- (b) fat dispersed in water
- (c) water dispersed in fat
- (d) water dispersed in oil

Q67

As₂S₃ sol is:

- (a) Positive colloid
- (b) negative colloid
- (c) neutral colloid
- (d) None of these

[A.F.M.C 1992]

Q68

In a chemical reaction, catalyst:

- (a) alters the amount of the products
- (b) alters the rate of reaction
- (c) decreases the ΔH of the forward reaction
- (d) Increases the ΔH of the forward reaction

[Pb. C.E.T.1993]

Q69

The disease Phenylketone urea is due to the deficiency of:

- (a) vitamin A
- (b) carbohydrates
- (c) Phenylalanine hydroxylase
- (d) Lysine

Q70

Enzymes belong to the following class of compounds:

- (a) Polysaccharidas
- (b) Polypeptides
- (c) Polynitro heterocyclic compounds
- (d) Hydrocarbons

[C.E.E.T, Kurukshetra 1996]

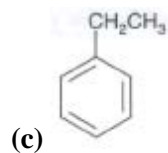
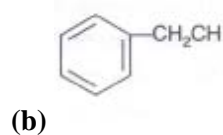
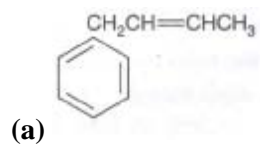
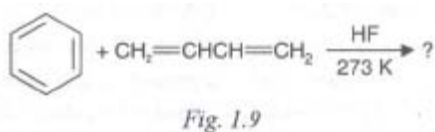
Q71

In the nitration of benzene with a mixture of concentrated nitric acid and concentrated sulphuric acid, the active species involves is:

- (a) Nitrite ion
- (b) Nitrate ion
- (c) Nitronium ion
- (d) Nitric oxide

Q72

Refer Fig. 1.9. What is the product of this reaction?



- (d) none of these

Q73

Which one of the following compounds does not react with NaNO_2 and HCl ?

- (a) $\text{C}_6\text{H}_5\text{OH}$
- (b) $\text{C}_6\text{H}_5\text{NH}_2$
- (c) $(\text{CH}_3)_3\text{CNO}_2$
- (d) $(\text{CH}_3)_2\text{CHNO}_2$

Q74

The hydrolysis of esters with caustic alkalis is called:

- (a) Esterification
- (b) Ammonolysis
- (c) Saponification
- (d) Trans-esterification

Q75

Carboxylic acids do not give reactions of the carbonyl group due to the:

- (a) inactive effect
- (b) absence of the CO group
- (c) resonance effect
- (d) electromeric effect

Q76

Upon heating, solution formate yields:

- (a) Oxalic acid and H_2
- (b) Sodium oxalate and H_2
- (c) CO_2 and NaOH
- (d) Sodium oxalate

Q77

Ethers are:

- (a) Neutral
- (b) Basic
- (c) Acidic
- (d) Amphoteric

Q78

Which one of the following cannot be made by using Williamson's synthesis?

- (a) Methoxybenzene
- (b) Benzyl-p-nitrophenyl ether
- (c) Tert-butyl methyl ether
- (d) Di-tert-butyl ether

Q79

The acidic strength of alcohols follows this sequence:

- (a) Primary > secondary > tertiary
- (b) Secondary > tertiary > primary
- (c) Tertiary > secondary > primary
- (d) Tertiary > primary > secondary

Q80

Phenol, when nitrated with concentrated HNO_3 in presence of concentrated H_2SO_4 , forms:

- (a) o- Nitrophenol
- (b) m-Nitrophenol
- (c) p-Nitrophenol
- (d) Picric acid

Q81

Two ions X^+ and Y^- have radii 88 pm and 200 pm, respectively. In the close packed crystal of compound XY, what is the co-ordinate number of X^+ ?

- (a) 3
- (b) 6
- (c) 8
- (d) 4

Q82

Glycerol, upon warming with a small amount of Hydriodic acid, gets converted to:

- (a) $\text{CH}_3\text{---CHI---CH}_3$
- (b) $\text{CH}_2\text{=CH---CH}_2\text{I}$
- (c) $\text{ICH}_2\text{---CHI---CH}_2\text{I}$
- (d) $\text{CH}_3\text{---CH=CH}_2$

Q83

Glycerol is commercially prepared from:

- (a) Ethylene
- (b) Acetylene
- (c) Propylene
- (d) 1,3-Butadiene

Q84

When ethylene is heated at 723°C in presence of chloride, it gives the following compound:

- (a) Polyvinyl chloride
- (b) No reaction
- (c) 1, 2-Dichloropropane
- (d) Ethylene chloride

Q85

Which reagent can be used for identifying the nickel ion?

- | | |
|-----------------------|----------------------------|
| (a) Reasorcinol | (b) Dimethyl glyoxime |
| (c) Diphenylbenzidine | (d) Potassium ferrocyanide |

Q86

Which one of the following would exhibit coordination isomerism?

- | | |
|--|---|
| (a) $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$ | (b) $[\text{Co}(\text{en})_2\text{Cl}_2]$ |
| (c) $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ | (d) $[\text{Cr}(\text{en})_2\text{Cl}_2]^+$ |

Q87

Which would exhibit ionisation isomerism?

- (a) $[\text{Co}(\text{NH}_3)_4][\text{Cr}(\text{C}_2\text{O}_4)_3]$
- (b) $[\text{Co}(\text{NH}_3)_5\text{Br}]_2^+ \text{SO}_4^{2-}$
- (c) $\text{K}_3[\text{Fe}(\text{CN})_6]$
- (d) $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$

Q88

Which one of the following statements is correct?

- (a) $[\text{Cu}(\text{NH}_3)_6]^{2+}$ is a colourless ion
- (b) $[\text{Ni}(\text{CN})_4]^{2-}$ ion has a tetrahedral shape
- (c) $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$ ion is blue coloured
- (d) Nickel dimethylglyoxime is red in colour

Q89

Which, from among the following complexes, has square pyramidal geometry?

- (a) Tetracarbonyl nickel (0)
- (b) Pentacarbonyliron (0)
- (c) Hexamminecobalt (II) nitrate
- (d) Bis (acetylacetonate) oxovanadium (IV)

Q90

In copolymers, the repeating structure units are derived from:

- (a) only one type of monomer unit
- (b) two or more types of monomer unit
- (c) Other polymers
- (d) homopolymers

PART C: CLASS XII

BOTANY

Q91

In the parlance of the sexual reproduction of flower plants, the fusing nuclei are as follows:

- (a) three polar nuclei and two male gametes
- (b) three polar nuclei and one male gamete
- (c) two polar nuclei and one male gamete
- (d) None of these

Q92

If you have taken scion of desi mango and stock of dussehrri mango, what type of mango will be born?

- (a) Dussehri
- (b) Desi
- (c) Hybrid
- (d) None of these

Q93

The vegetative propagation in which a branch is injured, defoliated and pegged down in the ground is known as:

- (a) Layering
- (b) Grafting
- (c) Cutting
- (d) bud grafting

Q94

Grafting in sugarcane cannot be performed because:

- (a) vascular bundles are scattered
- (b) phloem is internal to xylem
- (c) sugarcane plant is delicate
- (d) it is unable to bear injury

[AFMC 1998]

Q95

Vegetative propagation in mint occurs through:

- (a) offset
- (b) rhizome
- (c) sucker
- (d) runner

[CBSE PMT 2009]

Q96

The egg apparatus of angiosperm comprises:

- (a) an egg cell and two antipodals
- (b) an egg cell and two synergids
- (c) an egg cell and two polar nuclei
- (d) an egg cell and the central cell

[DUMET 2010]

Q97

The testa of a seed is produced from the:

- | | |
|-------------------------------|-------------|
| (a) ovary wall | (b) hilum |
| (c) outer integument of ovule | (d) funicle |

Q98

Anemophily occurs in:

- (a) salvia
- (b) vallisnaria
- (c) coconut
- (d) bottle brush

[CBSE 2001]

Q99

Intraspecific incompatibility is overcome by:

- | | |
|------------------------|------------------------|
| (a) self-pollination | (b) wetting of anthers |
| (c) wetting of stigmas | (d) mixed pollination |

[BHU 2002]

Q100

Cleistogamous flowers are:

- (a) self-pollinated
- (b) insect-pollinated
- (c) bird-pollinated
- (d) wind-pollinated

[KTET 2006]

Q101

In angiosperms, functional megaspore develops into:

- (a) endosperm
- (b) pollen sac
- (c) embryo sac
- (d) ovule

[CBSE Mains 2011]

Q102

Crop improvement is possible through:

- (a) a judicious combination of selection, introduction and hybridization
- (b) selection
- (c) the scientific improvement of cultivated plants
- (d) introduction

Q103

In callus culture, roots can be induced through the supply of:

- (a) auxin and no amount of cytokinin
- (b) higher concentration of auxin and lower concentration of cytokinin
- (c) higher concentration of cytokinin and lower concentration of auxin
- (d) both auxin and cytokinin in equal proportions

Q104

In tobacco callus, which one shall induce shoot differentiation in combination of auxin and cytokinin?

- (a) higher concentration of auxin and lower concentration of cytokinin
- (b) lower concentration of cytokinin and higher concentration of auxin
- (c) Only cytokinin and no amount of auxin
- (d) Only auxin and no amount of cytokinin

[DPMT 1997]

Q105

Totipotency means:

- (a) flowering in a culture medium
- (b) development of fruit from a flower in a culture
- (c) development of an organ from a cell in culture medium
- (d) All of these

[UPCPMT 2009]

Q106

‘Himgiri’, a plant developed through hybridisation and selection for disease resistance against rust pathogens, is a variety of:

- (a) chilli
- (b) maize
- (c) sugarcane
- (d) wheat

[AIPMT (Prelims)2011]

Q107

The term Molecular Scissors generally refers to:

- (a) DNA polymerases
- (b) RNA polymerases
- (c) restriction endonucleases
- (d) DNA ligases

[AMU (Medical 2011) 2011]

Q108

A natural genetic engineer is :

- (a) *Bacillus subtilis*
- (b) *Pseudomonas*
- (c) *Escherichia coli*
- (d) *Agrobacterium tumefaciens*

Q109

Transgenic plants are the ones:

- (a) generated by introducing foreign DNA into a cell and regenerating a plant from that cell
- (b) produced after protoplast fusion in artificial medium
- (c) grown in an artificial medium after hybridization in the field
- (d) produced by a somatic embryo in an artificial medium.

[CBSE PMT 2009]

Q110

Refer Fig.1.10. It is a sample of a portion of DNA strand giving the base sequence on the opposite strands. What is so special shown in it?

5'-----GAATTC'-----3'

3'-----CTTAAG-----5'

Fig.1.10

- (a) Replication competed
- (b) Deletion mutation
- (c) start codon at the 5' end
- (d) Palindromic sequence of base pairs

[AIPMT (Prelims) 2011]

Q111

Silencing of mRNA has been used in producing transgenic plants that would be resistant to:

- (a) bollworms
- (b) nematodes
- (c) white rusts
- (d) bacterial blights

[AIPMT (Mains) 2011]

Q112

Restriction enzymes are used to cut:

- (a) single- stranded RNA
- (b) double –stranded DNA
- (c) single –stranded DNA
- (d) double stranded RNA

[West Bengal JEE 2011]

Q113

c- DNA is:

- (a) formed by reverse transcriptase
- (b) cloned DNA
- (c) circular DNA
- (d) recombinant DNA

[Orissa JEE 2011]

Q114

The enzyme extracted from the stomach of calf and used for making cheese is:

- (a) lactase
- (b) rennin
- (c) calfine
- (d) cheecin

Q115

The recombinant DNA (rDNA) technology can be used for producing quantities of biologically active form of which one of the following products in E. coli?

- (a) Luteining hormone
- (b) Ecdysome
- (c) Rifamycin
- (d) Interferon

Q116

The variable Number of Tandem Repeats (VNTRs) in the DNA molecule are highly useful in:

- (a) recombinant DNA technology
- (b) DNA finger printing
- (c) monoclonal antibody production
- (d) stem cell culture

[Karnataka CET 2006]

Q117

What fraction of assimilated energy is used in respiration by herbivores?

- (a) 20%
- (b) 30%
- (c) 40%
- (d) 60%

Q118

Pick up the correct food chain:

- (a) Grass → Chamelion → Insect → Bird
- (b) Grass → Fox → Rabbit → Bird
- (c) Phytoplankton → Zooplankton → Fish
- (d) Fallen Leaves → Bacteria → Insect → Larvae

Q119

Which one of the following is a correct food chain:

- (a) Eagle → Snake → Grasshopper → Grass → Frog
- (b) Frog → Snake → Eagle → Grasshopper → Grass
- (c) Grasshopper → Grass → Snake → Frog → Eagle
- (d) Grass → Grasshopper → Frog → Snake → Eagle

[AIIMS 1996]

Q120

Energy enters a food chain through:

- (a) producers
- (b) decomposers
- (c) herbivores
- (d) carnivores

[CPMT 2003]

Q121

Lichen is a pioneer in the succession in:

- (a) hydrosere
- (b) lithosere
- (c) psammosere
- (d) xerosere

[BHU 2006]

Q122

Which one of the following shows a detritus food chain:

- (a) Grass → Insects → Snakes
- (b) Plankton → Small fish → Large Fish
- (c) Organic Waste → Bacteria → Molluscs
- (d) all of these

[DPMT 2008]

Q123

The breakdown of detritus into small particles by earthworm is a process, called

- (a) Mineralisation
- (b) Catabolism
- (c) Humification
- (d) Fragmentation

[CBSE Mains 2011]

Q124

Which one is not an endangered species?

- (a) Asiatic Wild Ass
- (b) IdriIdri
- (c) Lion-tailed Macaque
- (d) Addax Antelopes

[AMU 2003]

Q125

In the context of vital environmental issues, which habitat is carefully planned and managed for the in situ protection of fauna and flora species?

- (a) Theme park (artificial)
- (b) Ladakh region
- (c) National Park
- (d) All these are being managed

[Kerala 2005]

Q126

An ex situ conversation method for endangered species is:

- (a) National Park
- (b) Cryopreservation
- (c) Wildlife Sanctuary
- (d) National Park, Sanctuary and Biosphere Reserve

[AIIMS 2008]

Q127

Biodiversity of a geographic region represents:

- (a) genetic diversity present in the dominant species of the region
- (b) species that are endemic to the region
- (c) endangered in species found in the region
- (d) diversity in organisms living in the region

Q128

A biodegradable pollutant is:

- (a) Mercury
- (b) sewage
- (c) Plastic
- (d) asbestos

Q129

An indicator of water pollution is:

- (a) Entamoeba histolytic
- (b) Cholera vibrio
- (c) Salmonella typhi
- (d) Escherichia coli

[CBSE 1997, 1998, AFMO 2008]

Q130

Photochemical smog comprises:

- (a) SO₂, CO₂ and hydrocarbons
- (b) O₃, SO₂ and hydrocarbons
- (c) O₃, PAN and NO_x
- (d) SO₂, PAN and smoke

[AIIMS 2003, 2008]

Q131

The following concentration level of Pb in the human blood is considered alarming:

- (a) 4-6 µg per 100 ml
- (b) 10 µg per 100 ml
- (c) 20 µg per 100 ml
- (d) 30 µg per 100 ml

[CBSE 2004]

Q132

The production of nonfunctional methemoglobin causes the blue baby syndrome. This is due to an/the:

- (a) excess of arsenic in drinking water
- (b) deficiency of iron in food
- (c) increased methane content in atmosphere
- (d) excess of nitrate in drinking water

[AIIMS 2005]

Q133

A pollutant that produces a burning sensation in throat and eyes and generates a feeling of vomiting, is:

- (a) Hydrogen sulphide
- (b) sulphur dioxide
- (c) Hydrogen cyanide
- (d) Arsenic

[Gujarat 2007]

Q134

The value of BOD in river waters:

- (a) remains unchanged when algal bloom occurs
- (b) increases when sewage gets mixed up with river waters
- (c) has no relationship with concentration of oxygen in water
- (d) None of these

[CBSE 2009]

Q135

Consider the following statements about organic farming : (i) Utilizes genetically modified crops like Bt Cotton (ii) Uses only naturally produced inputs like compost (iii) Does not use pesticides and urea. (iv) Produces vegetables rich in vitamins and minerals. Which ones of these statements are correct?

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

[CBSE Mains 2011]

PART D: CLASS XII

ZOOLOGY

Q136

The antidodies derived from a single clone of cells which recognize only one type of antigens are called:

- (a) Interferons
- (b) Monocotic Antigens
- (c) Monoclonal cysts
- (d) None of these

Q137

If a mammalian ovum fails to get fertilized, which one of the following is unlikely?

- (a) Croups luteum will disintegrate
- (b) Osetrogen secretion further decreases
- (c) Primary follicle starts developing
- (d) Progeterone secretin rapidly declines

[CBSE, PRE 2005]

Q138

The embryo at the stage is known as:

- (a) Morula
- (b) Gastrula
- (c) Blastula
- (d) Blastomere

[BHU 2006]

Q139

The inhibition of secretion of which one of the following hormones is necessary for the disintegration of corpus luteum?

- (a) LH
- (b) Progesterone
- (c) LTH
- (d)FSH

[Gujarat CET 2007]

Q140

Which foetal membrane takes part in the formation of placenta in humans?

- (a) HCg
- (b) Uterus
- (c) Chorion
- (d) Any one of these

Q141

Which one of the following embryonic membrane structures is excretory in terms of function?

- (a) Amnion
- (b) Allantois
- (c) Yolk sac
- (d) Vitellinechorion

[Chhattisgarh PMT 2009]

Q142

Menstruation is triggered by an abrupt decline in the amount of :

- (a) oestrogen
- (b) progesterone
- (c) inhibin
- (d) LH

[Orissa JEE 2009]

Q143

The signals for parturition originate from:

- (a) placenta only
- (b) placenta as well as fully developed foetus
- (c) oxytocin released from maternal pituitary
- (d) fully developed foetus only

Q144

Which one of the following is not a placenta type if histology is the criterion?

- (a) Haemochorial
- (b) Syndesmochorial
- (c) Yolk sac
- (d) Endothelichorial

Q145

Column I contains terms and Column II contains definitions. Match them correctly and choose the right answer.

Column I

- A. Parturition
- B. Gestation
- C. Ovulation
- D. Implantation
- E. Conception

Column II

- 1. Attachment of zygote to endometrium
- 2. Release of egg from Graafian follicle
- 3. Delivery of baby from uterus
- 4. Duration between pregnancy and birth
- 5. Formation of zygote by fusion of the egg and sperm
- 6. Stoppage of ovulation and menstruation

- (a) A-2, B-4, C-1, D-5, E-3
- (b) A-4, B-3, C-1, D-5, E-2
- (c) A-5, B-1, C-2, D-3, E-4
- (d) A-3, B-4, C-2, D-1, E-5

[Karnataka CET 2011]

Q146

The main function of the fimbriae of the Fallopian tube in females is:

- (a) the release of the ovum from the Graafian follicle
- (b) making necessary changes in the endometrium for implantation
- (c) helping in the development of corpus luteum
- (d) helping in the collection of the ovum after ovulation

[Kerala PMT 2011]

Q147

The following animal is the slowest breeder:

- (a) Cod fish
- (b) Elephant
- (c) Rabbit
- (d) Man

Q148

If the rate of addition of new members increases with respect to the individual host of the same population, in a graph obtained shows:

- (a) declined growth
- (b) exponential growth
- (c) zero population growth
- (d) None of these

Q149

What is correct about a test tube baby?

- (a) Fertilization inside female genital tract and growth in test tube
- (b) Rearing of prematurely born baby in incubator
- (c) Fertilization outside and gestation inside womb of mother
- (d) Both fertilization and development are effected outside the female genital tract

Q150

The first case of IVF-ET technique success was reported by:

- (a) Bayliss and starling Taylor
- (b) Roberts Steptoe and Gilbert Brown
- (c) Louis Joy Brown and Banting Best
- (d) Patrick Steptoe and Robert Edwards

Q151

Consider the statements given below regarding contraception and answer as directed thereafter:

- (I) Medical Termination of pregnancy (MTP) during first trimester is generally safe
- (II) Generally chances of conception are nil until mother breast –feeds the infant up-to two years
- (III) Intrauterine devices like copper-T are effective contraceptives
- (IV) Contraception pills may be taken up-to one week after coitus to prevent conception.

Which ones of the two aforementioned statements are correct?

- (a) III, IV (b) I, III (c) I, II (d) II, III

Q152

Amniocentesis is a process for:

- (a) identifying any disease of the heart
- (b) identifying any hereditary disease of the embryo
- (c) learning about the disease of brain
- (d) growing cell in a culture medium

Q153

A logistic growth curve depicting a population that is limited by a definite carrying capacity is shaped like the letter:

- (a) J
- (b) L
- (c) M
- (d) S

[DUMET 2010]

Q154

The logistic population growth is expressed by the equation:

- (a) $dt/dN = Nr \left(\frac{K-N}{K} \right)$
- (b) $dN/dt = rN \left(\frac{K-N}{K} \right)$
- (c) $dN/dt = rN$
- (d) $dN/dt = rN \left(\frac{N-K}{N} \right)$

[AIPMT (Mains) 2011]

Q155

Some organisms produce more numbers of offspring and some others produce less number of offspring.

This phenomenon is called:

- (a) Selective reproduction
- (b) Differential Reproduction
- (c) Rapid Multiplication
- (d) Differential Selection

Q156

How many autosomes occur in the liver cells of a woman?

- (a) 12
- (b) 22
- (c) 30
- (d) 26

Q157

Meiosis in AaBb will produce the following gametes:

- (a) Aa, Bb
- (b) Aa, bb
- (c) AB, ab
- (d) AB, aB, Ab, ab

[BHU 2001]

Q158

How many types of gamete are found in F_1 progeny of cross AA BB CC and aa bb cc:

- (a) 3
- (b) 8
- (c) 27
- (d) 68

[AIIMS 2004]

Q159

Test cross is the crossing between:

- (a) Genotype with a dominant trait
- (b) Genotype with a recessive trait
- (c) F_1 hybrid with double recessive
- (d) Two F_1 hybrids

Q160

Which condition describes the sex correctly:

- (a) XO condition as in Turner's syndrome determines the female sex
- (b) XX sex chromosomes produce male in drosophila birds
- (c) ZZ sex chromosomes determine female sex in birds
- (d) XO sex chromosomes determine male sex in Grasshopper

[CBSE 2011]

Q161

Human blood grouping is called ABO instead of ABC because O signifies:

- (a) No antigen
- (b) Overdominance
- (c) One antibody
- (d) Other antigen

[CBSE 2009]

Q162

Okazaki fragments are:

- (a) RNA primers
- (b) Short DNA fragments on leading strand
- (c) Short DNA fragments on lagging strand
- (d) DNA fragments from dimerization
- (e) DNA fragments form from radiation action

[Kerala 2001]

Q163

DNA molecules has small units called:

- (a) purines
- (b) adenine and thymine
- (c) cistron, muton and recon
- (d) adenine

[BHU 2002]

Q164

During transcription, RNA polymerase holoenzyme binds to gene promoter and assumes a saddle-like structure. The DNA binding sequence is:

- (a) AATT
- (b) TTAA
- (c) TATA
- (d) CACC

Q165

What is Antisense therapy?

- (a) RNA polymerase production DNA
- (b) A cell displaying foreign antigen
- (c) Production of somaclonal variations
- (d) An RNA complementary in sequence is used to stop expression of a specific gene.

[CBSE 2008]

Q166

DNA synthesis during the course of replication is:

- (a) discontinuous
- (b) continuous
- (c) semi-discontinuous
- (d) None of these

[MPPMT 2010]

Q167

Darwin's finches are an excellent example of:

- (a) seasonal migration
- (b) brood parasitism
- (c) connecting links
- (d) adaptive radiation

[CBSE 2008]

Q168

Miller and Urey performed an experiment to prove the origin of life. They took the following gases:

- (a) methane, ethane, ammonia, water vapour
- (b) methane, ammonia, hydrogen, water vapour
- (c) methane, ethane, hydrogen, ammonia
- (d) ammonia, water vapour, butane, hydrogen

[UP CPMT 2009]

Q169

The major cause behind the evolution of genes and protein is:

- (a) point mutation
- (b) chromosomal aberration
- (c) sexual reproduction
- (d) gene duplication and divergence

[DUMET 2009]

Q170

Wine and beer are produced directly by fermentation. Brandy and whisky require both fermentation and distillation because:

- (a) fermentation is inhibited at an alcohol level of 10-180%
- (b) distillation prolongs storage
- (c) distillation improves quality
- (d) distillation purifies the beverage

Q171

Azolla is used as biofertilizer as it has:

- (a) rhizobium
- (b) cyanobacteria
- (c) mycorrhiza
- (d) large quantity of humans

Q172

Which one of the following is a correct statement?

- (a) the term 'Bt' in "Bt-cotton" indicates that it is a genetically modified organism produced through biotechnology
- (b) somatic hybridization involves the fusion of two complete plant cells carrying desired genes
- (c) The anticoagulant Hirudin is produced from transgenic *Brassica napus* seeds
- (d) "FlavrSavr", a variety of tomato has enhanced the production of ethylene which improves its taste

[AIIMS 2005]

Q173

In the root modules of *Alnus*, the process of nitrogen fixation is done by:

- (a) *Clostridium*
- (b) *Azorhizobium*
- (c) *Bradyrhizobium*
- (d) *Frankia*

[CBSE 2008]

Q174

A free-living nitrogen fixing cyanobacterium which can also form symbiotic association with aquatic fern *Azolla* is:

- (a) *Nostoc*
- (b) *Anabaena*
- (c) *Chlorella*
- (d) *Tolypothrix*

Q175

The sewage treatment process in which part of decomposer microbes is recycled into the starting process is:

- (a) primary treatment
- (b) activated sludge treatment
- (c) catalytic treatment
- (d) tertiary treatment

[DPMT 2009]

Q176

Nowadays, the term 'gene' is being replaced by a new term. What is the name of the new term?

- (a) Polypeptide Chain
- (b) r-RNA
- (c) Cistron
- (d) Hereditary Mass

[AMU 2009]

Q177

The product of which one of the following organisms has been commercialised as an agent for lowering blood cholesterol?

- (a) *Trichodermapolysporum*
- (b) *MonascusPurpureus*
- (c) *Saccharomyces cerevisiae*
- (d) *Aspergillusniger*

[AMU 2009]

Q178

A prominent example of endomycorrhiza is:

- (a) *Glomus*
- (b) *Agaricus*
- (c) *Nostoc*
- (d) *Rhizobium*

[CBSE Mains 2010]

Q179

Which Transfer RNA constitutes nearly _____ of the total RNA:

- (a) 8 percent
- (b) 32 percent
- (c) 40 percent
- (d) 15 percent

Q180

Which one of the following has been wrongly matched:

- (a) *Clostridium butylicum* – Lactic acid
- (b) *Aspergillus niger*- Citric acid
- (c) Yeast- Statins
- (d) *Acetobacter aceti*- Acetic acid

[CBSE Mains 2011]

Answers and Explanations

PART A: PHYSICS

Sol.1 (b) for equilibrium, charge q must be negative. Refer **Fig.1.11**

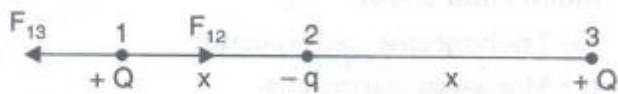


Fig. 1.11

Considering the equilibrium of charge 1,

$$F_{13} = F_{12}$$

$$\frac{kQ \times Q}{(2x)^2} = \frac{kQ \times 1}{x^2}$$

Or,

$$q = \frac{Q}{4}$$

The right option is (b).

Sol. 2 (b)

The surface charge densities on the outer surfaces of the shells will be equal if the charges on the shells are proportional to the squares of their radii. Hence, the charge distribution will be as shown in **Fig.1.12**

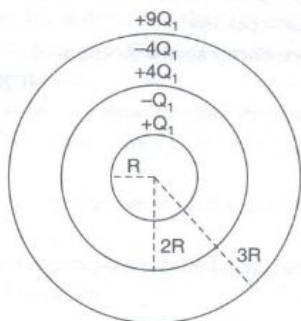


Fig. 1.12

$$\therefore Q_2 = 4Q_1 - Q_1 = 3Q_1$$

$$Q_3 = 9Q_1 - 4Q_1 = 5Q_1$$

$$Q_1 : Q_2 : Q_3 = 1 : 3 : 5$$

The right option is (b).

Sol. 3 (a) and (c) Refer Fig. 1.13

Let $OP = z_0$

Thus, the electric field at P is:

$$E = \frac{1}{4\pi\epsilon_0} \frac{Qz_0}{(R^2 + z_0^2)^{3/2}}$$

This field acts away from O.

The force on charge $-q$ placed at point P is:

$$F = -\frac{1}{4\pi\epsilon_0} \frac{Qqz_0}{(R^2 + z_0^2)^{3/2}}$$

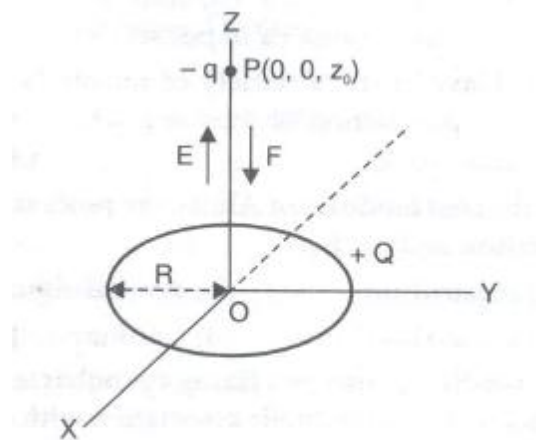


Fig. 1.13

This force acts towards the centre O.

So, the motion of the negatively charged particle is periodic in nature

For $z_0 \ll R, F \propto z_0$

The motion of the particle P will be approximately simple harmonic.

The right options are (a) and (c).

Sol. 4 (a)

For the stationary oil drop, Force due to electric field = Weight of the oil drop

$$qE = mg$$

$$\text{Or } q = \frac{mg}{E}$$

$$= \frac{9.9 \times 10^{-15}}{3 \times 10^4}$$

$$= 3.3 \times 10^{-18} \text{C.}$$

The right option is (a).

Sol.5 (a)

At the centre of the square frame, $E = a$ and $V = a$ constant positive value. The charge $-q$ held above the frame will be attracted towards the centre O. As it crosses O, a force begins to act on it in the upward direction. The charge $-q$ begins to oscillate about O along the Z-axis.

The right option is (a).

Sol. 6 (c)

$$E = \frac{\sigma}{2\epsilon_0} + \frac{\sigma}{2\epsilon_0}$$

$$= \frac{\sigma}{\epsilon_0} V - m^{-1}$$

The right option is (c).

Sol. 7 (c)

Inside a hollow conducting charged sphere, the electric field is zero.

The right option is (c).

Sol.8 (d)

$$F_{liq} = \frac{F_{air}}{k} = \frac{F}{2}$$

The right option is (d).

Sol.9 (b)

$$F = ma = Eq \text{ or } a = \frac{Eq}{m}$$

$$v = u + at = 0 + \frac{Eq}{m} \cdot t$$

$$K.E = \frac{1}{2}mv^2 = \frac{1}{2}m \frac{E^2 q^2 t^2}{m^2} = \frac{E^2 q^2 t^2}{2m}$$

The right option is (b).

Sol. 10(d)

Electric field lines may not always form closed loops.

The right option is (d).

Sol. 11 (a)

Gauss's law is valid for any closed surface.

The right option is (a).

Sol.12 (c)

$$\Delta U = U_1 - U_2$$

$$= \frac{1}{2}(V_1^2 + V_2^2) - \frac{1}{2}(2C) \left(\frac{V_1 + V_2}{2} \right)^2$$

$$= \frac{1}{4}C(V_1 - V_2)^2$$

The right option is (c).

Sol.13. (a)

When switch S is closed, there is no transfer of charge from capacitor A to capacitor B because the charge -q of A is held by its charge +q.

The right option is (a).

Sol.14. (c)

Refer Fig. 1.14.

Electric field at

$$E = \frac{2q}{3} \times \frac{1}{4\pi\epsilon_0 R^2}$$
$$= \frac{q}{6\pi\epsilon_0 R^2}$$

Option (a) is wrong.

Potential energy of system,

$$U = \frac{1}{4\pi\epsilon_0} \left[\frac{q}{3} \times \frac{q}{3} \times \frac{1}{2R} + \frac{q}{3} \times \left(-\frac{2q}{3} \times \frac{1}{BC} \right) + \left(-\frac{2q}{3} \right) \times \frac{q}{3} \times \frac{1}{AC} \right]$$

$$AC = 2R \cos 60^\circ = R$$

$$BC = 2R \sin 60^\circ = \sqrt{3}R$$

$$U = \frac{1}{4\pi\epsilon_0} \left[\frac{q^2}{12R} - \frac{2q^2}{9\sqrt{3}R} - \frac{2q^2}{9R} \right] \neq 0$$

Option (b) is wrong.

Electric force between the charges at B and C:

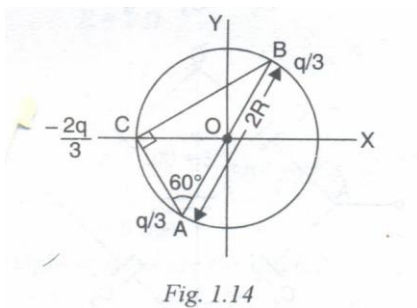
$$F = \frac{1}{4\pi\epsilon_0} \frac{q}{3} \times \frac{2q}{3(2R \sin 60^\circ)^2} = \frac{q}{54\pi\epsilon_0 R^2}$$

Option (c) is correct.

Potential at point O:

$$V = \frac{1}{4\pi\epsilon_0} \left[\frac{q}{3R} + \frac{q}{3R} - \frac{2q}{3R} \right]$$

Choice (d) is wrong.



The right option is (c).

Sol.15 (a)

Electric field is always perpendicular to the equipotential surface at any point.

The right option is (a).

Sol.16 (d)

Potential is same at every point of the conducting sphere.

$$\therefore V_A = V_B = V_C$$

The right option is (d).

Sol.17 (b)

Three 15 JF capacitors on the left are connected in series. Their equivalent capacitance C' is given by

$$\frac{1}{C'} = \frac{1}{15} + \frac{1}{15} + \frac{1}{15} = \frac{1}{5}$$

$$\text{Or } C' = 5\mu F$$

Now C' is in parallel with fourth $15\mu F$ capacitor

$$\therefore C_{eq} = C' + 15 = 5 + 15 = 20\mu F$$

The right option is (b).

Sol.18 (b)

Initial energy stored in one capacitor:

$$U = \frac{q^2}{2C}$$

When the battery is disconnected, charge q remains the same i.e., $q = \text{constant}$. The capacitors form a parallel combination.

$$C_{eq} = C + C = 2C$$

Final energy stored by the combination.

$$U' = \frac{q^2}{2C_{eq}} = \frac{q^2}{2 \times 2C} = \frac{1}{2} U$$

The right option is (b).

Sol.19 (a)

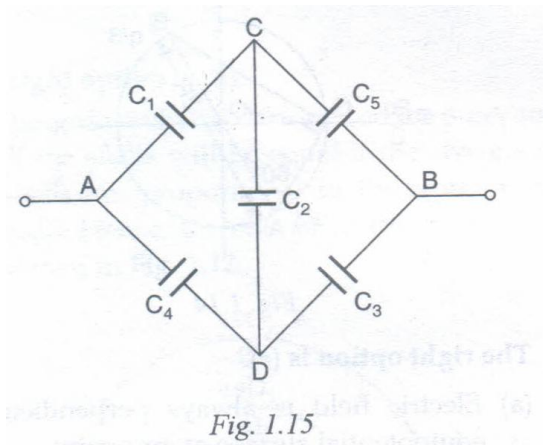
Planes perpendicular to X-direction i.e., planes parallel to YZ-plane will be the equipotential surfaces.

The right option is (b).

Sol.20 (b)

Refer Fig. 1.15.

$$\frac{C_1}{C_5} = \frac{C_4}{C_3} = \frac{4}{4}$$



The Wheatstone bridge is balanced, so C2 is of no use.

$$C_{ACB} = \frac{C_1 \times C_5}{C_1 + C_3} = \frac{4 \times 4}{4 + 4} = 2\mu F$$

$$C_{ADB} = \frac{C_3 \times C_4}{C_3 + C_5} = \frac{4 \times 4}{4 + 4} = 2\mu F$$

$$C_{AB} = C_{ACB} + C_{ADB} = 2 + 2 = 4\mu F$$

The right option is (b).

Sol.21(c)

Half diagonal of the tube:

$$r = \frac{\sqrt{b^2 + b^2 + b^2}}{2} = \frac{3\sqrt{b}}{2}$$

P.E. of the charge $+q$ at the centre due to eight charges (each $= -q$) at the corners of the cube is

$$\begin{aligned} U &= 8 \times \frac{1}{4\pi\epsilon_0} \frac{q \times (-q)}{r} \\ &= -8 \times \frac{1}{4\pi\epsilon_0} \frac{q^2}{\frac{\sqrt{3}b}{2}} = -\frac{4q^2}{\sqrt{3}\pi\epsilon_0 b} \end{aligned}$$

The right option is (c).

Sol.22 (b)

The common potential difference across the parallel combination of two capacitors:

$$V' = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$$

$$\text{But } V_1 = V, V_2 = 0$$

$$\therefore V' = \frac{C_1 V}{C_1 + C_2}$$

The right option is (b).

Sol.23 (c)

$$E = \frac{V}{d}$$

$$= \frac{2}{4 \times 10^{-8}}$$

$$= 0.5 \times 10^8 = 5 \times 10^7 \text{ V} - \text{m}^{-1}$$

The right option is (c).

Sol.24 (d)

Resistance of the lamp is given by:

$$R = \frac{V^2}{P} = \frac{30 \times 30}{90}$$

Safe current through the lamp:

$$I = \frac{V}{R} = \frac{30}{10} = 3A$$

When the lamp is operated on the 120 V line, the current should not exceed 3 A. Then,

$$R' = \frac{V'}{I} = \frac{120}{3} = 40\Omega$$

Required resistance to be put in series

$$= R' - R = 40 - 10 = 30\Omega$$

The right option is (d).

Sol.25 (a)

This Wheatstone bridge is balanced. So, the pressing of key K makes no effect. The reading of the galvanometer G will remain the same.

The right option is (a).

Sol. 26 (d)

$$\text{Case I: } \frac{R}{S} = \frac{l}{100-l} = \frac{10}{30}$$

$$\therefore l = 25\text{cm}$$

$$\text{Case II: } \frac{S}{R} = \frac{l'}{100-l'} = \frac{30}{10}$$

$$\therefore l' = 75\text{cm}$$

Shift-in the balance point:

$$= l' - l = 75 - 25 = 50\text{cm}$$

The right option is (d).

Sol.27 (d)

$$I_{\max} = \frac{\varepsilon}{r} = \frac{12}{0.5} = 24A \text{ The right option is (d).}$$

Sol.28 (c)

$$T_n = \frac{T_i + T_c}{2}$$

$$\therefore T_c = 2T_n - T$$

$$= 2 \times 270 - 525$$

$$= 15^\circ\text{C}$$

The right option is (e).

Sol.29 (c)

In the portion CD, the current I decreases with the increase in voltage V. So, this portion corresponds to negative resistance.

The right option is €.

Sol.30 (a)

The semicircular parts, each one having resistance R, form a parallel combination.

$$\therefore R_{eq} = \frac{\frac{R}{2} \times \frac{R}{2}}{\frac{R}{2} + \frac{R}{2}} = \frac{R}{4}$$

The right option is (a).

Sol.31 (a)

Kirchhoff's first law deals with the conservation of charge.

The right option is (a).

Sol.32 (a)

$$I = \frac{RA}{\rho} = \frac{R \times \pi D^2}{4\rho}$$
$$= \frac{4.2 \times 22 \times (0.4 \times 10^{-3})^2}{7 \times 4 \times 48 \times 10^{-8}} = 1.1m$$

The right option is (a).

Sol. 33 (c)

$$\begin{array}{ccc} \text{Red} & \text{Red} & \text{Black} \\ \downarrow & \downarrow & \downarrow \\ 2 & 2 & 2 \end{array}$$

$$R = 22 \times 10^0 = 22\Omega \text{ The right option is (e).}$$

Sol.34 (c)

The internal resistance of a cell acts only in a closed circuit and it reduces the current.

The right option is (e).

Sol.35 (c)

$$H = \frac{V^2 t}{R} = \frac{200 \times 200 \times 2 \times 60 \times 60}{80} J$$

$$= \frac{200 \times 200 \times 2 \times 60 \times 60}{80 \times 3600} \text{ Wh}$$

$$= 1000 \text{ Wh.}$$

The right option is (e).

Sol. 36 (b)

Take any point P inside the thin walled pipe. Consider a circular loop through this point and apply Ampere's circuital law. As net current inside the loop is zero, the magnetic field at any point inside the loop will be zero.

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I = \mu_0 \times 0 = 0$$

The right option is (b).

Sol.37 (b)

Antiparallel currents repel and parallel currents attract. All other options are not correct.

The right option is (b).

Sol.38 (b) and (c)

$$\text{For } S = 200 \Omega$$

$$V = I_g (G + S)$$

$$= 50 \times 10^{-6} (100 + 200000) = 10V$$

$$\text{For } R = 1 \Omega$$

$$I = \left(\frac{G + S}{S} \right) I_g$$

$$= \left(\frac{100+1}{1} \right) 50 \times 10^{-6} \text{ A}$$

The right options are (b) and (e).

Sol.39 (b)

$$B_1 = \frac{\mu_0 I}{2\pi a^2} \cdot \frac{q}{2} \text{ and } B_2 = \frac{\mu_0 I}{2\pi(2a)}$$

$$\therefore \frac{B_1}{B_2} = 1$$

The right option is (b).

Sol.40 (a)

T is Andependent of speed v.

The right option is (a).

Sol.41 (c)

When a bar magnet is cut into two parts of equal lengths, pole strength of each part is same as that of original magnet' but magnetic moment is halved because length has been halved.

The right option is (e).

Sol.42 (a)

In the sum position, we have:

$$\begin{aligned} T_1 &= 2\pi \sqrt{\frac{I_1 + I_2}{(M_1 + M_2)B_H}} \\ &= 2\pi \sqrt{\frac{I + I}{M + 2M}} \\ &= 2\pi \sqrt{\frac{2I}{3M}} \end{aligned}$$

In the difference position, we have:

$$\begin{aligned} T_1 &= 2\pi \sqrt{\frac{I_1 + I_2}{(M_1 - M_2)B_H}} \\ &= 2\pi \sqrt{\frac{I + I}{2M - M}} \\ &= 2\pi \sqrt{\frac{2I}{M}} \end{aligned}$$

$$\therefore \frac{T_1}{T_2} = \frac{1}{\sqrt{3}} < 1$$

Hence, we conclude that $T_1 < T_2$.

The right option is (a).

Sol.43 (b)

$$\begin{aligned} W &= mB(\cos \theta_1 - \cos \theta_2) \\ &= 2 \times 10^4 \times 6 \times 10^{-4} (\cos 0^\circ - \cos 60^\circ) \\ &= 6 \text{ J} \end{aligned}$$

The right option is (b).

Sol. 44 (b)

A diamagnetic substance is feebly repelled by a magnet.

The right option is (b).

Sol.45 (c)

According to Curie's law, $\chi_m \propto \frac{1}{T}$

The right option is (c).

PART B: CHEMISTRY

Sol.46(c)

The right formula of the compound is NaWO_3 .

The right option is (c).

Sol.47(c)

Raoult's law states that the relative lowering of vapour pressure equals the mole fraction of a solute in a solution. Thus, we have:

$$p_A = x_A \times p_A^0$$

where

p_A = partial pressure of A in the solution

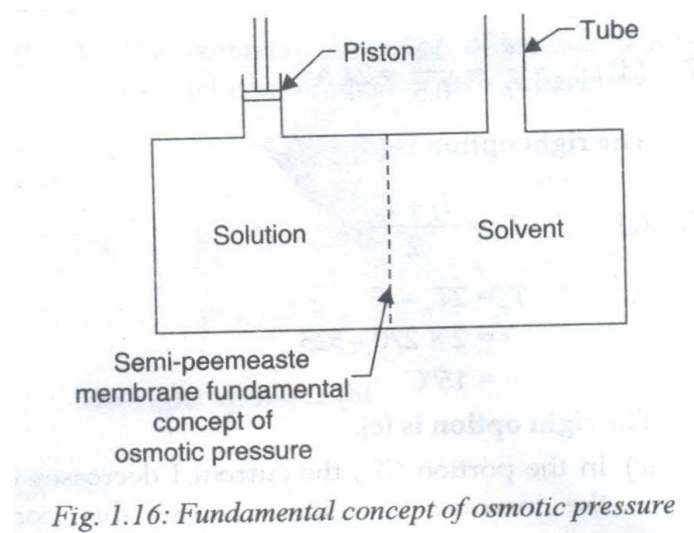
p_A^0 = partial pressure of A in the pure state

and x_A = mole fraction of A in the given solution

Thus, the right option is (c).

Sol.48 (c)

Osmotic pressure can be defined as the equilibrium hydrostatic pressure of the column set up as a result of osmosis. The concept has been visualized in a sketch form in **Fig. 1.16**.



The right option is (c).

Sol.49 (c)

The elevation in boiling point is essentially a colligative property. The list of colligative properties is as follows (in the context of solutions):

- (i) Relative lowering of vapour pressure
- (ii) Osmotic pressure.
- (iii) Elevation in boiling point
- (iv) Depression in freezing point.

Note that colligative properties depend only upon the number of particles of solute (molecules or ions) in a definite amount of solvent. They do not depend upon the nature of solute. Adsorption, absorption and surface tension are not colligative properties.

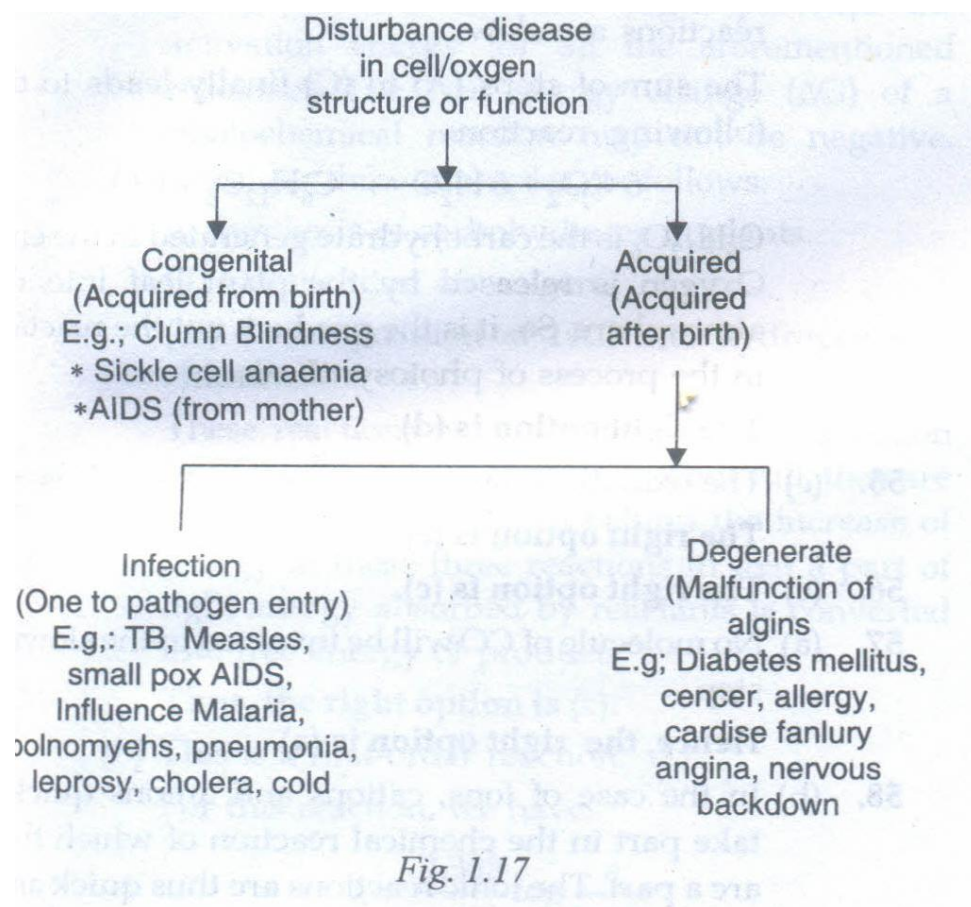
Hence, the right choice is (c).

Sol. 50 (b)

Sickle cell anaemia is a hereditary disease. Patients suffering from this disease experience physical exertion, heart murmuring and short breaths. This disease occurs due to a defective haemoglobin molecule in which one of the glutamic acid residues is replaced by valine.

Mutations occur in the case of cancer. When a carcinogen enters the human body, it is transformed into water-soluble chemical, Dihydroxy epoxide. It combines with purine bases like guanine and adenine present in DNA and RNA (in the human cell). Dihydroxy epoxide is a large hydrocarbon molecule. Its association with adenine or guanine prevents it from sticking to the double helix of DNA. This damage triggers the process of mutation. The mutation, in turn, leads to cancer.

Goitre is the disease of the thyroid gland. It occurs due to the deficiency of iodine. Due to the lack of iodine, the thyroid gland gets enlarged so that it may extract iodine from blood to a large extent. Gout is a disease of the joints and urinary tract. It is caused by the deposition of Sodium urate in soft tissues, especially in or around joints. It leads to severe pain in joints. For the benefit of students, we are listing the disease types in **Fig. 1.17**. The topic covered is *Chemistry in Everyday Life*.



The right option is (b).

(c) The branch of science that deals with the treatment of diseases using suitable chemical substances is called Chemotherapy. These chemical substances, called Drugs, are used for curing diseases and reducing the agony of patients. The elementary classification of drugs is as follows:

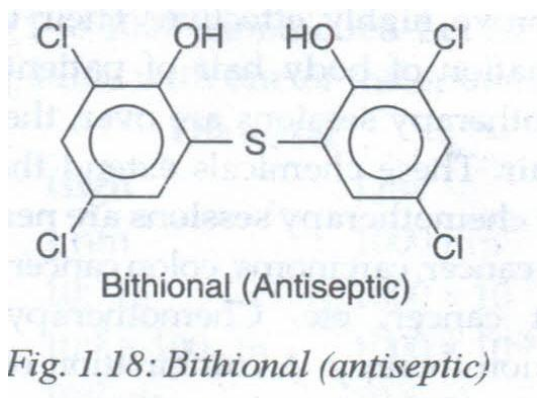
(A) **Antipyretics:** They are used for bringing down body temperature during high fever. E.g. paracetamole (4-Acetamidophenol), Phenacetin (p-Etoxyacetanilide), Aspirin (Acetysalicyclic acid), Analgin, novelgin, etc.

(B) **Antimalarials:** They are used for bringing down body temperature during the course of malaria fever. E.g.: Quinine (an alkaloid) is a natural drug. Synthetic drugs are-paraquine, prime quine and chloroquine.

(C) **Analgesics:** They kill pain in short durations to reduce the suffering of patient. They have two subtypes. The first subtype is Narcotics. They induce sleep. Most of them are opium products. Morphine acetate (Heroin) is used as an analgesic in operation theatres. These alkaloids are habitforming. The second subtype is **Non-narcotics**. The most important among them is Butazolidine.

(D) **Antiseptics and Disinfectants:** They prevent the growth of micro-organisms and .kill them. The examples of antiseptics are Dettol (which is a mixture of Chloroxymenol and Terpinol), Savlon, breath purifiers (in either spray form or liquid form), face powders, talc for removing itching (like Nycil), etc. Disinfectants kill micro-organisms but ought not to be applied on live tissues. Examples include Lyzol, Phenyl, Harpic, etc.

Refer **Fig. 1.18**. It shows Bithional, a popular antiseptic.



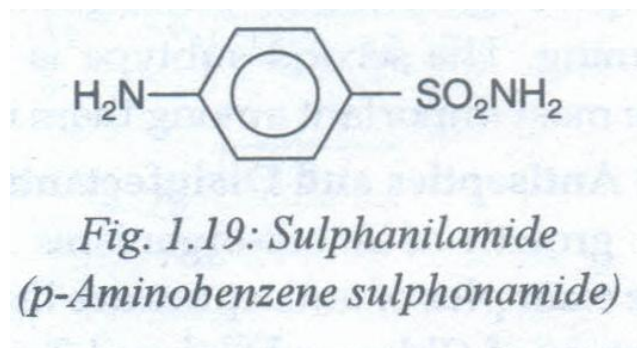
The tincture of iodine (2-3 percent solution of iodine in water) is a good antiseptic. Further, iodoform (CHI_3) produces iodine when applied to skin; it is an antiseptic .

(E) **Tranquillizers:** They act on the central nervous system and reduce anxiety. Examples include Barbituric acid, Luminal, Seconal, Reserpine, etc.

(F) **Antibiotics:** They are produced from bacteria, fungi and moulds. They kill the micro-organisms that cause infection.

Examples: Penicillin, Amoxicillin, Ampicillin, Chloromycetin, Norflox TZ (brand name of antibiotic for removing stomach infection), Ofloxacin, Ornidazole, etc. Infection can be caused by gram positive or gram negative bacteria. The antibiotics used for treating the infection produced by these two bacteria genres are different. Broad-spectrum antibiotics kill a complete range of micro-organisms. Examples include tetracycline, Chloramphenicol and mixtures of antibiotics. For example; Novaclox LB is a mixture of two antibiotics and lactic acid bacillus has also been added to it. Antibiotic combinations are more effective for curing stomach and throat infection.

(g) **Sulpha Drugs:** They are the derivatives of sulphanilamide. Refer **Fig. 1.19**.



Examples of these drugs are Sulphadiazine, Sulphapyridine, Sulpha guanidine and Sulphanilamide.

(H) **Chemotherapy Drugs for the Treatment of Cancer:** Nowadays, Chemotherapy refers to the drug and treatment regime used for treating and curing the patients of cancer. A host of synthetic drugs have been developed in the top laboratories of the world. These chemicals are prepared carefully, are costly and prove highly effective. Their use leads to the elimination of body hair of patient. But when the chemotherapy sessions are over, the patient regains his hair. These chemicals extend the life of patient. Many chemotherapy sessions are needed for treating blood cancer, carcinoma, colon cancer, stomach cancer, breast cancer, etc. Chemotherapy is safer than radiation therapy. A combination of chemotherapy, radiation therapy and surgery may be employed to save the patient or to extend his life by five to seven years.

The right option is (c)

Sol.52 (b)

When a solution is diluted, its specific conduction comes down but its molar conductance rises.

The right option is (b).

Sol.53 (c)

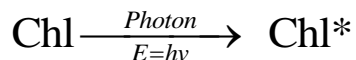
The amount of electricity needed to deposit 1mol of Al from a solution of $AlCl_3$ is 3A.

The right option is (c).

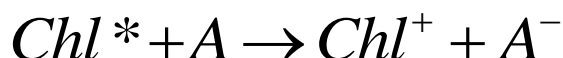
Sol.54 (d)

The process of photosynthesis occurs through the following steps:

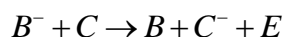
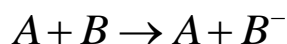
(A) Chlorophyll absorbs a photon or red light and becomes excited



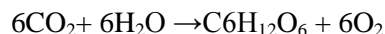
(B) In a few picoseconds, after absorbing light, the excited chlorophyll molecule loses an electron either to CO_2 or to H_2O . Here, A represents CO_2 or H_2O . A is an electron acceptor in this reaction.



(C) Nearly 150 picoseconds later, the electron acceptor transfers an electron to another molecule. After a few milliseconds, that molecule transfers the electron to yet another molecule. This chain of reactions releases energy. All molecules act as electron acceptors



This energy produces the energy-rich molecules of CO_2 . Many other reactions occur in a jiffy. Some reactions are slow. The sum of steps (A) to (C) finally leads to the following reaction:



$\text{C}_6\text{H}_{12}\text{O}_6$ is the carbohydrate generated in the end. Oxygen is released by the plant leaf into the atmosphere. So, it is the product, not the reactant in the process of photosynthesis.

The right option is (d).

Sol.55 (c)

The oxidation state of the metal in the salt is +3.

The right option is (c).

Sol.56 (c) The right option is (c).**Sol.57 (a)**

No molecule of CO will be involved in the slowest step.

Hence, the right option is (a).

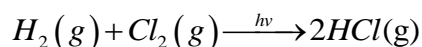
Sol58 (b)

In the case of ions, cations and anions quickly take part in the chemical reaction of which they are a part. The ionic reactions are thus quick and, at times, highly volatile. If reactants are already in an ionic state, the reaction is completed almost instantaneously when the reactants are mixed for effecting the reaction. Bonds are not to be broken which is the case with most reactions sans ions. Thus, ionic reactions give quick results because bonds are not to be broken and cations as well as anions are quick enough to form compounds (because they want to become stable).

The right option is (b).

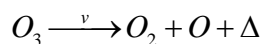
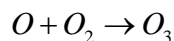
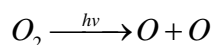
Sol.59 (c)

Photochemical reactions take place in the presence of light or some other radiation. Read this reaction:



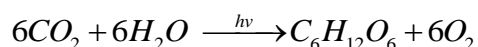
This is the reaction of photosynthesis of HCl.

Read this reaction:



This is the reaction of formation and break-up of ozone, a gas in the upper part of stratosphere. It takes place at a height of 11-50 km from the earth's surface.

Read this reaction now:



This is the reaction of the photosynthesis of carbohydrates in plants. Chlorophyll acts as a catalyst in this reaction. Light provides the activation energy for all the aforementioned reactions. The free energy change (ΔG) of a photochemical reaction may not be negative. Consider three examples, as follows:

- (i) Synthesis of carbohydrates in plants.
- (ii) Ozonization of oxygen.
- (iii) Decomposition of HCl into hydrogen and chlorine.

These reactions were discussed in this question itself. In these three cases $\Delta G > 0$ but still, they are spontaneous. The reason behind the increase of energy in these three reactions is that a part of light energy absorbed by reactants is converted into free energy of products.

Thus, the right option is (c).

Sol.60 (b)

This is a first-order reaction. For this reaction, we have:

$$k = \frac{2.303}{t} \log \frac{a}{a-x}$$

Here, $x = \frac{75}{100} a = 0.75a$

$$t = 1.3884$$

$$= 1.388 \times 3600$$

$$= 4996.8 \text{ second}$$

$$\Rightarrow k = \frac{2.303}{t} \log \frac{a}{a-x}$$

$$= \frac{2.303}{4996.8} \log \frac{a}{a-0.75a}$$

$$= \frac{2.303}{4996.8} \log \frac{a}{0.25a}$$

$$= \frac{2.303}{4996.8} \log \left(\frac{1}{0.25} \right)$$

$$= \frac{2.303}{4996.8} 0.6021$$

$$= 0.0002775$$

$$= 2.775 \times 10^{-4} \text{ s}^{-1}$$

$$= 2.8 \times 10^{-4} \text{ s}^{-1}$$

The right option is (b).

Sol. 61 (c)

The right option is (c).

Sol.62 (c)

In the process of adsorption, the molecules of a gas form a thin film on the surface of solid. Adsorption is the adhesion of atoms, ions or molecules from a gas, liquid or dissolved solid on to a surface. This process creates a film of adsorbate on the surface of the adsorbent. This process differs from absorption in which a fluid (absorbate) permeates or is dissolved by a liquid or solid (the absorbent). Be clear that adsorption is a surface-based process. On the contrary, absorption involves the entire volume of the material! Adsorption is a surface phenomenon. The term Sorption encompasses both processes while Desorption is the *reverse* of Adsorption.

The right option is (c).

Sol. 63 (c)

The diameter of a colloidal-sized particle ranges from 1 to 1000 nanometres. Let us try to make it compatible with one of the options given to us

	Diameter	
	High	Low
⇒	1 nm	1000nm
⇒	10^{-9}m	$1000 \times 10^{-9}\text{m}$
⇒	$10^{-9} \times 100\text{cm}$	$1000 \times 10^{-9} \times 100\text{cm}$
⇒	10^{-7}cm	10^{-4}cm

Now, 10^{-4} cm is more while 10^{-7} cm is less. Range should be written as: Colloidal particle diameter H 10^{-7} cm to 10^{-4} cm . The other options should have been written in the reverse order (to show the range). E.g.: 10^{-3} cm to 10^{-2} cm .

Here, the right option is (c).

Sol.64 (c)

The protective action of different protective colloids is expressed in terms of Gold Number. The protective action of a lyophilic colloid is expressed in terms of Congo Rubin Number. This term was discovered by Ostwald. Let us define Gold Number. The Gold Number of a protective colloid is the minimum weight of it in milligrams which must be added to 10 ml of a substance red gold sol so that no coagulation of the gold sol takes place when 1 ml of 10 percent NaCl solution is rapidly added to it. Note that smaller the Gold Number of "a protective colloid, the greater its protective action will be.

The right option is (c).

Sol. 65 (a)

Ferric chloride is used for stopping bleeding because Fe^{3+} ion coagulates blood, a negatively charged sol.

The right option is (a).

Sol.66 (b)

Nearly 87 percent of milk is water. Other NO_2 constituents are vital parts of it and are known to have contributed a lot towards its image as a 1 complete food. But milk fat is the chief constituent of milk, next only to H_2O . Hence, milk is considered to be a fat dispersed in water.

The right option is (b).

Sol.67 (b)

Arsenious sulphide (As_2S_3) is a colloidal solution. It is negatively charged. It is prepared through the process of laser ablation. It is a negative colloid. **The right option is (b).**

Sol.68 (b)

A catalyst itself is not affected during the course of a chemical reaction. It alters the rate of reaction. It lowers the activation energy. It facilitates the conversion of reactants into products. The greatest natural catalyst is chlorophyll present in green plant leaves. It helps in photosynthesis and ensures that leaves form food. Platinum, Nickel, Tungsten and many other metals are used as catalysts in industrial enterprises. Hydrogenation of vegetable oil is done in the presence of nickel.

The right option is (b).

Sol.69 (c)

This disease is caused due to the deficiency of Phenylalanine hydroxylase.

The right option is ©.

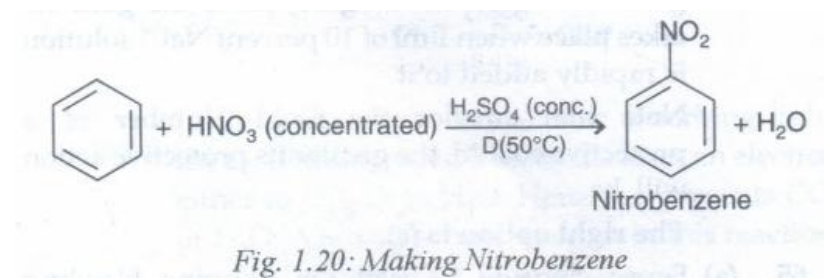
Sol.70 (b)

Enzymes are the biological substances that act as catalysts and facilitate complex reactions. They fall under the genre Polypeptides. They help in digestion in the human stomach. The formation of alcohols and many other beverages essentially involves the use of enzymes.

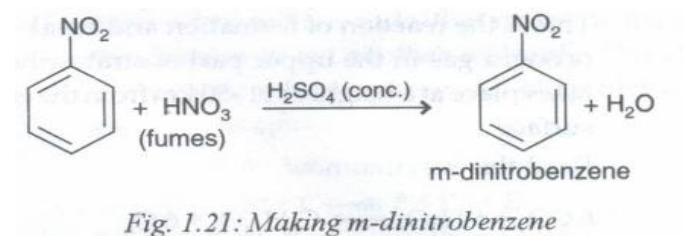
The right option is (b).

Sol.71 (c)

Benzene is treated with concentrated HNO_3 in the presence of concentrated H_2SO_4 , The temperature is 50°C . The products are nitrobenzene and water. Refer **Fig. 1.20**



This can be nitrated further to give a meta-isomer. Refer **Fig. 1.21**.

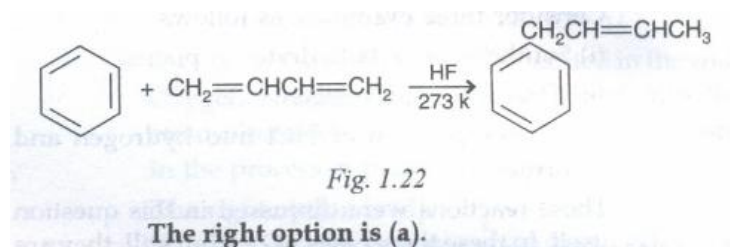


The active species involved in the first reaction is the nitronium ion.

The right option is (c).

Sol. 72 (a)

Refer **Fig. 1.22**. Benzene reacts with Hydrofluoric acid, as follows:



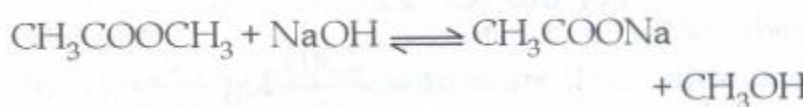
Sol.73 (c)

$(\text{CH}_3)_3\text{CNO}_2$ does not react with NaNO_2 and HCl . All other compounds do react with these two chemicals.

The right option is (c).

Sol. 74 (c)

This is the saponification reaction. The reaction is as follows:



The right option is (c).

Sol. 75 (c)

Carboxylic acids do not show the properties of the carbonyl group. Refer **Fig. 1.2**. The reason behind this phenomenon is the resonance effect.

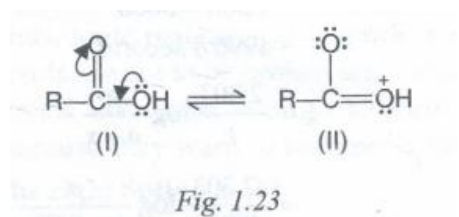


Fig. 1.23 shows two resonating forms of carboxylic acid. The $\text{C}=\text{O}$ double bond character is reduced to a considerable degree. The carbon-oxygen double bond length in carboxylic acids is slightly longer than the carbon-oxygen double bond length in carbonyl compounds. Further, the carbon-oxygen single bond length is slightly less than the standard carbon-oxygen bond length. Due to these reasons, carbonyl-group properties are missing in carboxylic acids.

The right option is (c).

Sol.76 (b)

When sodium formate is heated, it yields sodium oxalate and hydrogen gas.

The right option is (b).

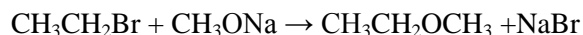
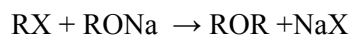
Sol. 77(b)

Ethers are basic in nature.

The right option is (b).

Sol.78 (d)

Williamson's synthesis is a method for preparing ethers. When alkyl halide is heated with sodium alkoxide, we get ether.



Note that Di-tert-butyl ether cannot be prepared with the help of this reaction. Further, if tertalkyl halide is used in the reaction, ether is not obtained. Rather, an alkene is produced. Finally, aryl halides do not respond to this test due to higher C-Cl bond dissociation energy.

The right option is (d).

Sol.79 (a)

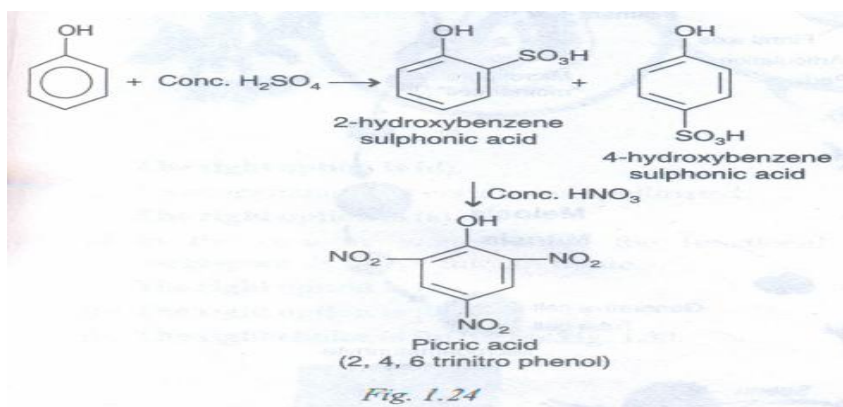
The acid strength of alcohols follows this pattern:

Primary > Secondary > Tertiary

The right option is (a).

Sol. 80 (d)

With a nitrating mixture, phenol yields Picric acid (2, 4, 6-trinitro phenol). Refer **Fig. 1.24**.



The right option is (d).

Sol.81 (b)

We have:

$$\frac{r_+}{r_-} = \frac{r(X^+)}{r(Y^-)} = \frac{88}{200} = 0.44$$

The ratio lies in the range of 0.414 to 0.732.

So, the co-ordination number of X^+ = 6.

The right option is (b).

Sol. 82 (b)

When glycerol is heated with a small quantity of hydro-iodic acid, we get an alkene, CH_2CHCH_2I .

The right option is (b).

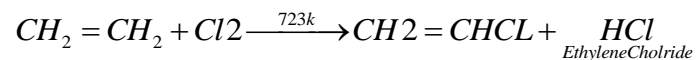
Sol.83 (c)

Propylene is used in industrial units for the preparation of glycerol.

The right option is (c).

Sol. 84(d)

When Ethylene ($CH_2 = CH_2$) is heated at a temperature of 723 K in the presence of Cl_2 , it yields ethylene chloride.



Ethylene

Note that carbon-carbon double bond is not broken in ethylene.

The right option is (d).

Sol.85 (b)

Dimethyl glyoxime is commonly used for identifying Nickel ions in solutions.

The right option is (b).

Sol.86 (a)

The right option is (a).

87. (b)

The right option is (b).

Sol. 88 (d) Option (d)

Gives a correct statement. Nickel dimethylglyoxima is red in terms of colour. All other options are incorrect.

The right option is (d).

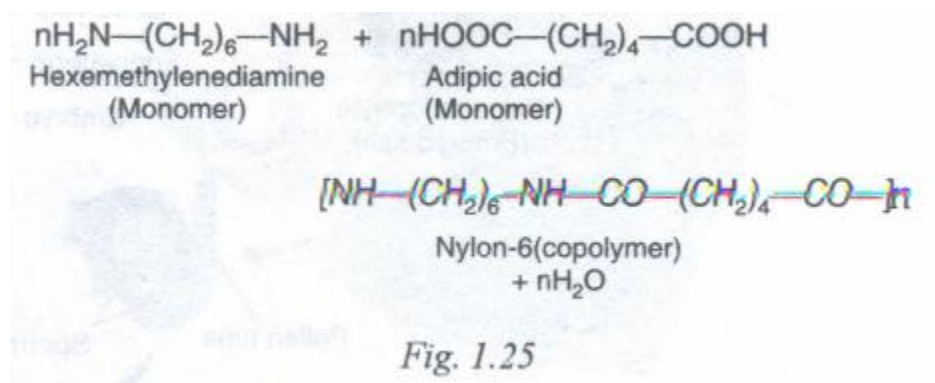
Sol. 89 (d)

Bis (acetylacetonate) oxovanadium (IV) has pyramid-shaped geometry.

The right option is (d)

Sol.90 (b)

A copolymer takes its repeating structural units from two or more types of monomer units. Refer **Fig. 1.25**.



Note that homopolymers take repeating structural units of only type of monomer. So, they are different from copolymers.

The right option is (b)

PART C: BOTANY

Sol.91 (c)

This is an example of vegetative fertilisation. It is also called Triple Fusion. In this type of fertilisation, three nuclei come together to get fused. Two polar nuclei and one male gamete are involved in the process of fusion.

The right option is (c).

Sol. 92 (b)

A desi variety of mango will be born and a hybrid will not be produced.

The right option is (b).

Sol.93 (a)

The branch is injured, defoliated and pegged down in the ground in the layering process.

The right option is (a).

Sol.94 (a)

The vascular bundles are scattered in sugarcane. Hence, grafting cannot be done in sugarcane.

The right option is (a).

Sol.95 (c)

In case of mint, vegetative propagation occurs through sucker. Refer **Fig. 1.26**.



The right option is (c).

Sol.96 (b)

The egg apparatus of an angiosperm has an egg Pollination and fertilization Fig. 1.27: Egg apparatus of an angiosperm cell and two synergids. Refer **Fig. 1.27**.

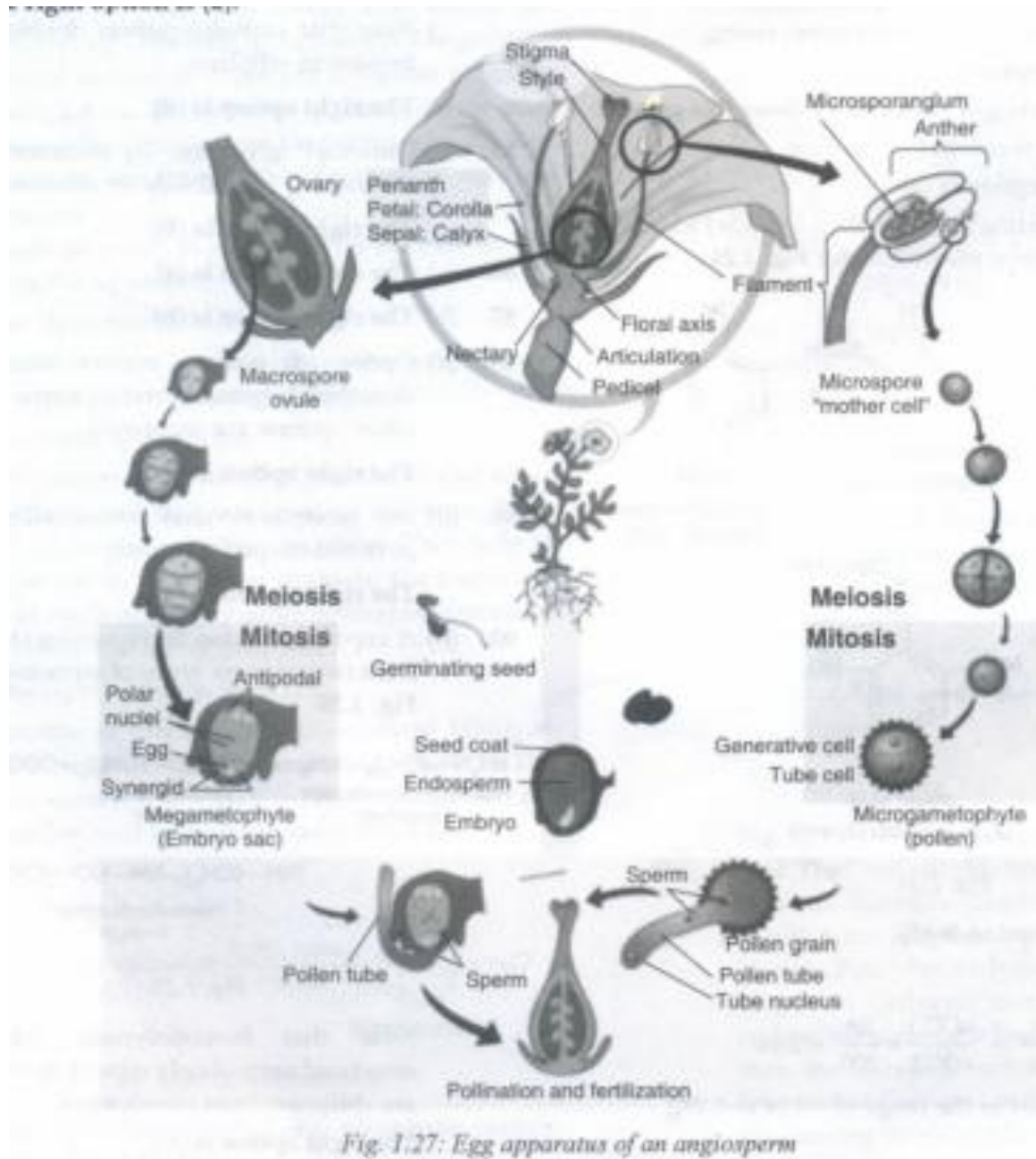
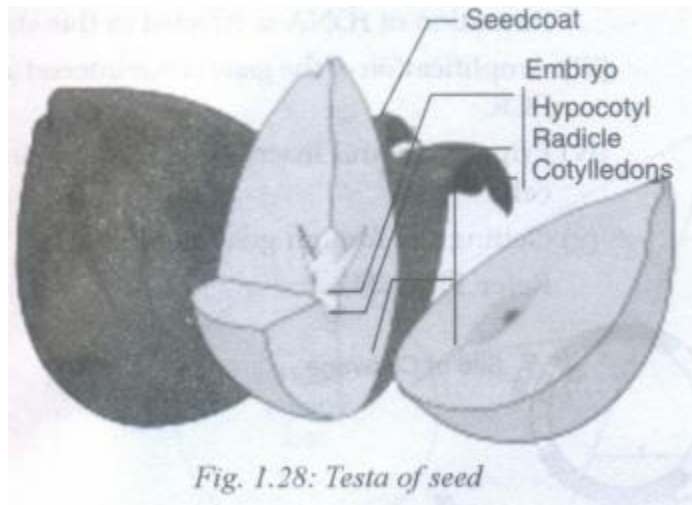


Fig. 1.27: Egg apparatus of an angiosperm

The right option is (b).

Sol. 97(c)

The right option is (c). Refer Fig. 1.28.



The right option is (c).

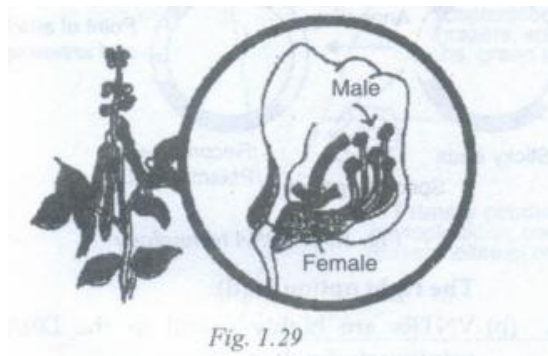
Sol.98 (c)

Anemophily occurs in coconut. Seed coat

The right option is (c).

Sol. 99 (d)

Mixed pollination is able to remove intra specific incompatibility. Refer **Fig. 1.29**



The right option is (d).

Sol.100 (a)

Cleistogamous flowers are self-pollinated.

The right option is (a).

Sol.101 (d)

In the case of angiosperms, the functional megaspore develops into an ovule.

The right option is (d).

Sol.102 (b)

The right option is (b).

Sol.103 (b)

The right choice is (b). Refer **Fig. 1.30**.



Sol.104 (a)

The right option is (a).

Sol.105 (c)

Totipotency refers to the development of an organ from a cell in a culture medium.

The right option is (c).

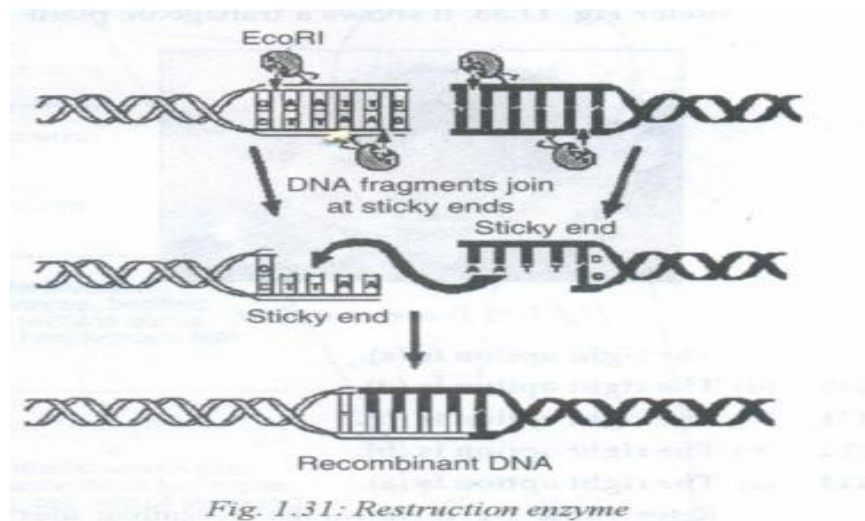
Sol.106 (d)

Himgiri is a variety of wheat. It is resistant to rust pathogens.

The right option is (d).

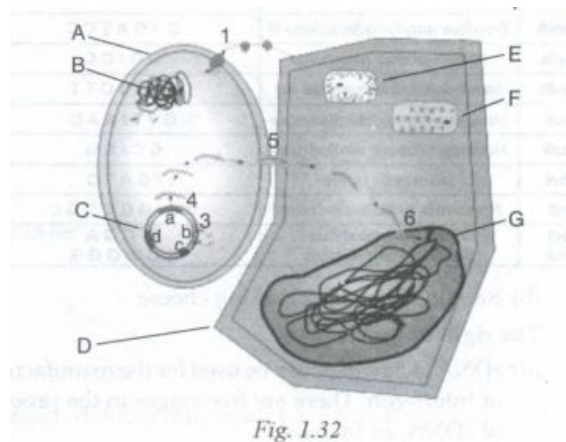
Sol.107 (c)

Restriction endonucleases act as molecular scissors. Refer **Fig. 1.31**



Sol. 108 (d)

Agrobacterium tumefaciens is a natural genetic engineer; that is what it is called by genetic researchers and botany connoisseurs. Refer **Fig. 1.32**.



The right option is (d).

Sol. 109 (a)

The plants in which foreign genes are introduced through the complex techniques of genetic engineering are called transgenic plants.

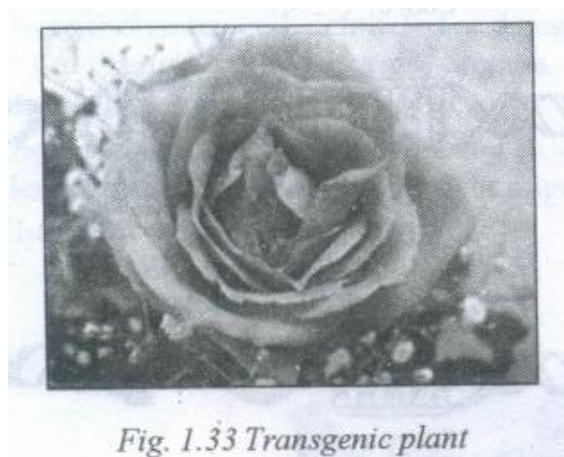
There are two techniques for introducing transgenes (foreign genes) into the plant cell genome, as follows:

(i) Through a vector

(ii) Through the direct introduction of DNA.

The foreign DNA is introduced into a plant cell (in technique (ii)) and the plant is regenerated from that cell.

Refer **Fig. 11.33**. It shows a transgenic plant.



The right option is (a).

Sol. 110 (d) The right option is (d).

Sol.111 (b) The right option is (b).

Sol.112 (b) The right option is (b).

Sol.113 (a)

The right option is (a).

Refer **Table 1-1**. It shows the recognition sites of a few restriction enzymes.

Table 1-1: Recognition Sites of Restriction Enzymes

Enzyme	Source	Recognition Sites
EcRoi	<i>Escherichia coli</i> RY·13	G/AATTC
BamHI	<i>Bacillus amyloliquefaciens</i> H	G/GATCC
HaeIII	<i>Haemophilus aegyptius</i>	GG/CC
HindIII	<i>Haemophilus influenzae</i> Rd	A/AGCTT
HpaI	<i>Haemophilus parainfluenzae</i>	GTT/AAC
HpaII	<i>Haemophilus parainfluenzae</i>	CC/GG
MboI	<i>Moraxella bovis</i>	/GATC
NotI	<i>Norcardia otitidis-caviarum</i>	GC/GGCCGC
TaqI	<i>Thermus aquaticus</i>	T/CGA
SmaI	<i>Serratia marcescans</i>	CCC/GGG

Sol.114 (b)

Rennin is used for making cheese.

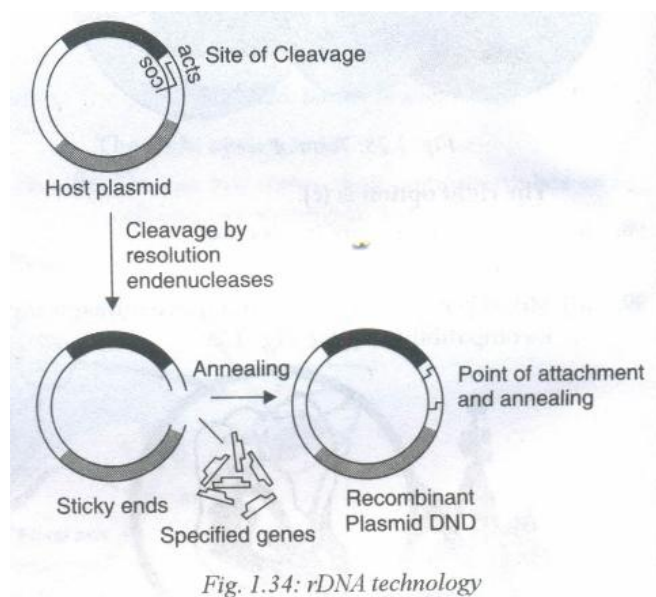
The right option is (b).

Sol.115 (d)

rDNA technology can be used for the manufacture of Interferon. There are five stages in the process of rDNA, as follows:

- (i) Isolation of the genetic material (DNA).
- (ii) Cutting of DNA at specific locations. The formation of rDNA is effected in this step
- (iii) Amplification of gene of our interest using PCR.
- (iv) Preparation and insertion of RDNA into host cell.
- (v) Getting the foreign gene product.

Refer **Fig.1.34**



The right option is (d).

Sol.116 (b)

VNTRs are highly useful in the DNA finger printing technology.

The right option is (b).

Sol. 117 (b)

A herbivore uses up nearly 30 percent of the assimilated energy in the respiration process.

The right option is (b).

Sol.118 (c)

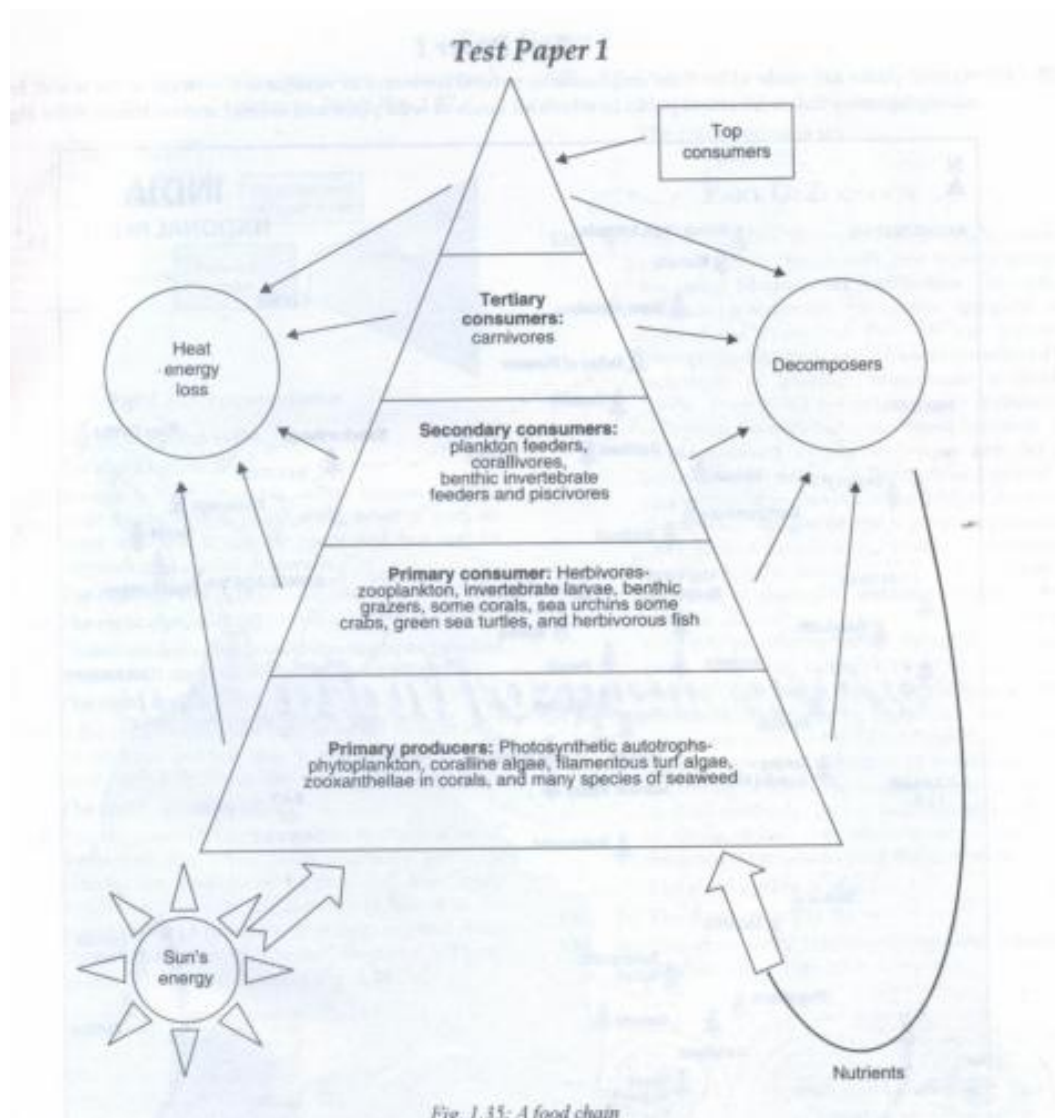
The right option is (c).

Sol. 119 (d)

The right option is (d).

Sol.120 (a)

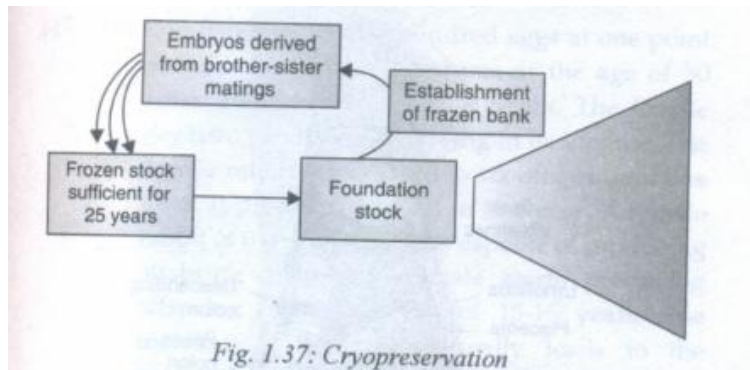
Green plants are the producers in all eco systems. They use chlorophyll, sunlight, CO_2 and H_2O to produce basic carbohydrate (sugar). They are the primary consumers or sunlight, a form of energy. From producers, the food chain starts in a natural process that almost always involves the deletion of the weak species. Energy goes up to the top level of every food chain. However, the entire energy consumed by plants does not go up the food chain. Refer **Fig. 1.35**.



The right option is (a).

Sol.126 (b)

Cryopreservation helps in saving endangered species from total extinction. Refer **Fig. 1.37**.



The right option is (b).

Sol. 127 (d)

The right option is (d).

Sol.128 (b)

Sewage is biodegradable. It has human excreta, plant leaves, water, salts, urine, acids of various types and silt. It can be processed but cost of processing is a vital deterrent.

The right option is (b).

Sol. 129 (d)

The right option is (d)

Sol.130 (c)

Photochemical smog results due to photochemical reactions. It comprises O_3 , PAN and NO_x .

The right option is (c).

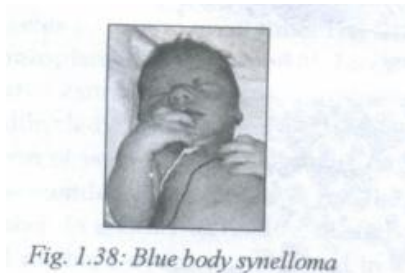
Sol.131 (d)

If the concentration of lead in blood stream is 30 micrograms per ml, this is a sign of danger. A level higher than this can even prove to be fatal.

The right option is (d)

Sol.132 (d)

Nitrate concentration in water is dangerous. If we drink the water with excessive levels of nitrate, we may have to face the blue body syndrome. Nitrates are commonly found in the waste water of factories. If people around these factories consume this water, they can fall prey to this killer disease. Refer **Fig. 1.38**.



Sol.133 (a)

H₂S causes burning sensation in throat and eyes.

The right option is (a).

Sol.134 (b)

The biological oxygen demand would naturally go up when the sewage is mixed with river water. If BOD is high, it means that the river water has less oxygen content.

The right option is (b)

Sol.135 (a)

Only statements (ii) and (iii) are correct. Statements (i) and (iv) are incorrect.

The right option is (a).

PART D: ZOOLOGY

Sol.136 (d)

The antibodies derived from a single clone of cells which recognize only one type of antigens are called Monoclonal Antibodies. The options mention interferons, monocotic antigens and monoclonal cysts but they all are incorrect. Georges Kohler and Cesar Milstein introduced the technique of making monoclonal antibodies (1970). They fused normal antibody-producing cells with the cells from cancerous tumours. The steps involved in this technique are: (a) the injection of an antigen in the body of a mouse; (b) production of antibodies in the body of the mouse the injected antigen (in the B-Lymphocyte cells in the spleen of the mouse); (c) removal of spleen of mouse and the isolation of B-lymphocytes; (d) isolation of myeloma cells (that produce bone marrow cancer); (e) fusion of myeloma cells and antibody-producing cells in suitable cultures (now, they are called Hybridomas); (f) the shifting of the entire culture to medium deficient in nutrients needed by myeloma cells (so that myeloma cells die but hybridoma cells survive); (g) separate multiplication of hybridoma cells; (h) testing of the clone for its ability to produce a desired antibody; (i) the isolation and culturing of those clones that show positive results; (j) commercial production of the antibody.

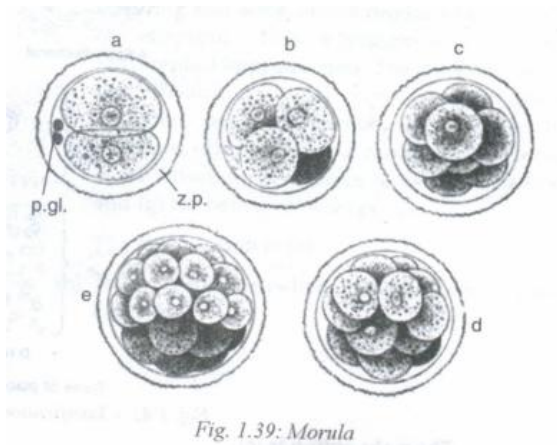
The right option is (d).

Sol.137 (b)

The right option is (b).

Sol.138 (a)

The embryo of the 16-cell stage is known as morula. Refer **Fig. 1.39**.



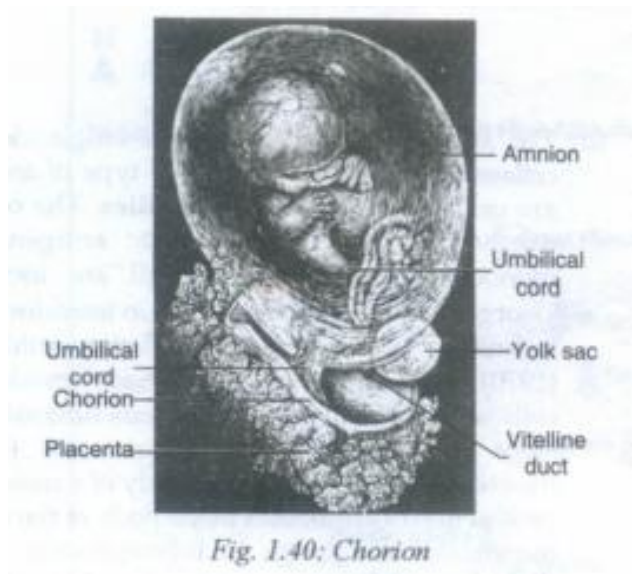
The right option is (a).

Sol.139 (b)

The right option is (b).

Sol. 140 (c)

Chorion takes part in the process of formation of placenta in humans. Refer **Fig. 1.40**.



The right option is (c)

Sol. 141 (b)

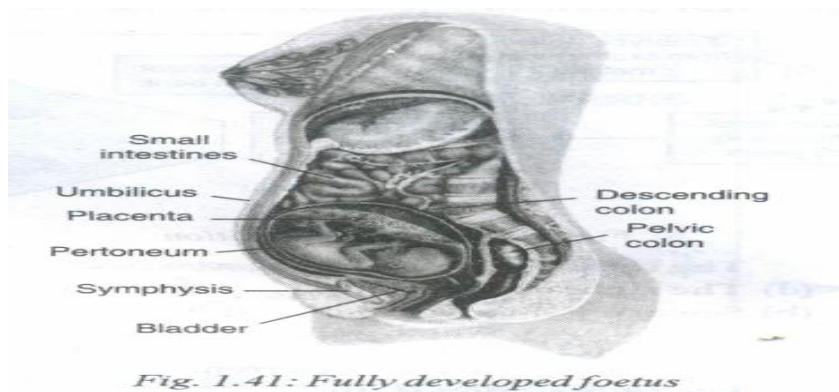
The right option is (b)

Sol.142 (b)

The right option is (b)

Sol. 143 (b)

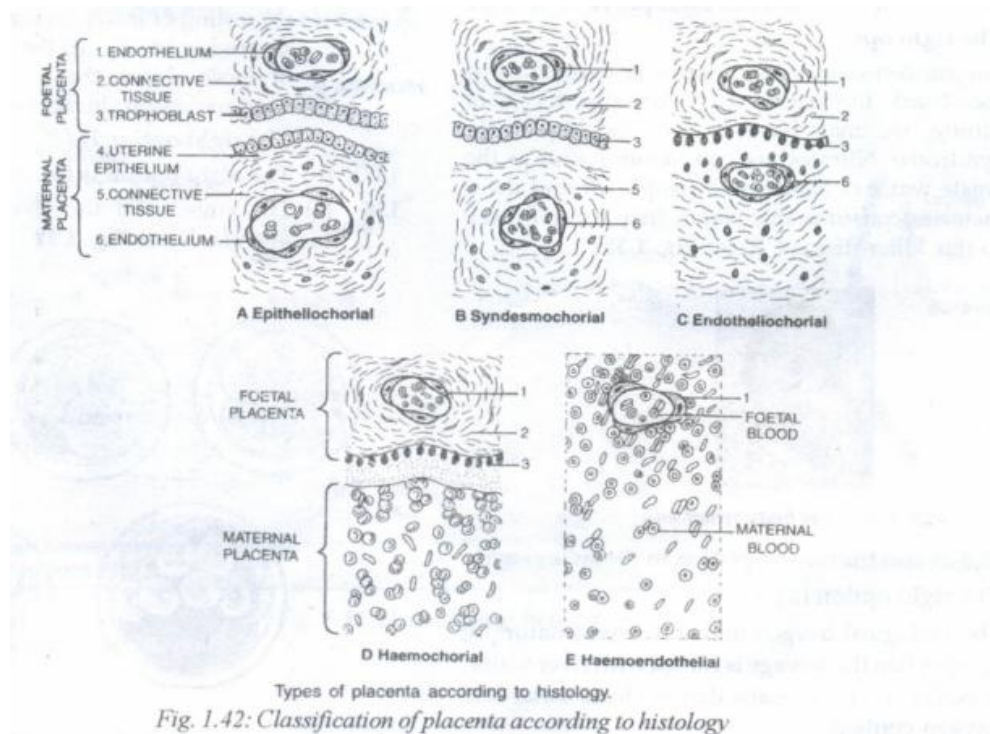
Both placenta and fully developed foetus give signals of parturition in the uterine of woman. The foetus is fully mature at nine months. It wants to come out of the uterus, head first. Placenta and foetus give signals to the doctor that the time has come for delivery. The woman also feels excessive pain, called carbon pain. Refer **Fig. 1.41**.



The right option is (b).

Sol.144 (c)

Yolk sac is a genre of placenta if the classification criterion is the nature of foetal membranes involved. All other genres are based on histology. Refer **Fig. 1.42**. It shows the classification of placenta based on histology (there are 5 classes in this classification).



The right option is (c).

Sol.145 (d)

The right option is (d).

Sol.146 (d)

The right option is (d).

Sol.147 (b)

Cod fish lays several hundred eggs at one point of time. An elephant matures at the age of 30 years. It lives for nearly 90 years. The female elephant produces 6 offspring in its lifetime. The female rabbit gives birth to six offspring in one litter. It produces 4 litters in one year. A female rabbit of 6 months of age is capable of producing offspring. A human female starts producing offspring from the age of 15-16 years. The marriage of humans normally leads to the production of 1 to 12 offspring in the productive period; some men have more than one wife.

Thus, the elephant is the slowest breeder among all the options given to us.

The right option is (b).

Sol.148 (b)

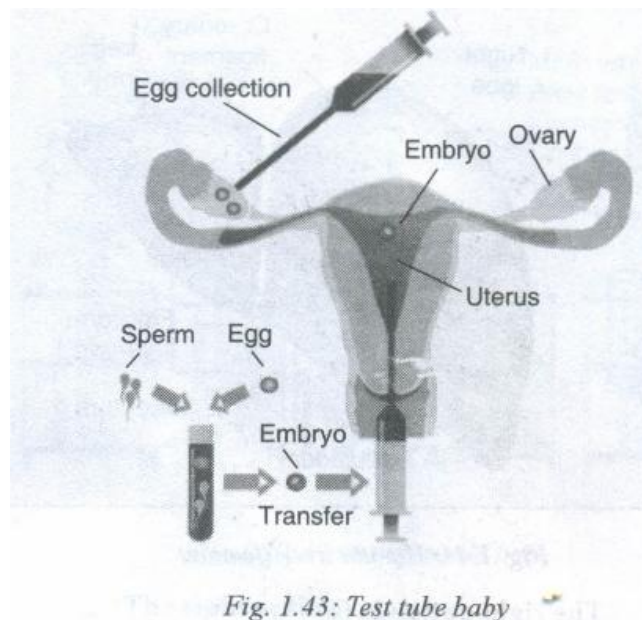
Such a graph would show an exponential growth. The case of India is also that of exponential growth. The lack of education, contraceptives and fresh outlook towards female children also led to high population growth. People do not want female children, for they are not their assets. They are supposed to be married off. The expenses incurred on them are deemed wastage. Many couples produce more children in the hope that the next child would be a male. But they end up producing many females. So, they are frustrated. The exponential growth of population in India is a reflection of our backwardness in both urban and rural centres.

The right option is (b).

Sol.149 (c)

In test tube baby pregnancy, the fertilization of gametes is done in a test tube. The fertilized egg is transplanted in the womb of the mother. If the mother cannot deliver ova, an ovum of another healthy lady is taken and got fertilized by the sperm of her husband. She holds the foetus for nine months, although she is not the biological mother. In another technique, the father's sperm and mother's ovum are fertilized in a test tube and fertilized egg is planted in a surrogate mother's womb. Upon birth, the child is given to true biological parents. The surrogate mother is compensated in terms of cash and kind. Refer **Fig. 1.43**.

The right option is (c).

**Sol.150 (d)**

The right option is (d).

Sol.151 (a)

MTP during the first trimester of pregnancy is fine. But after this period, MTP can hurt the mother.

The right option is (a).

Sol.152 (b)

The right choice is (b).

Sol.153 (d)

The right option is (d).

Sol.154 (b)

We have:

Logistic population growth

$$= \frac{dN}{dt} = rN \left(\frac{K - N}{K} \right)$$

The right option is (b).

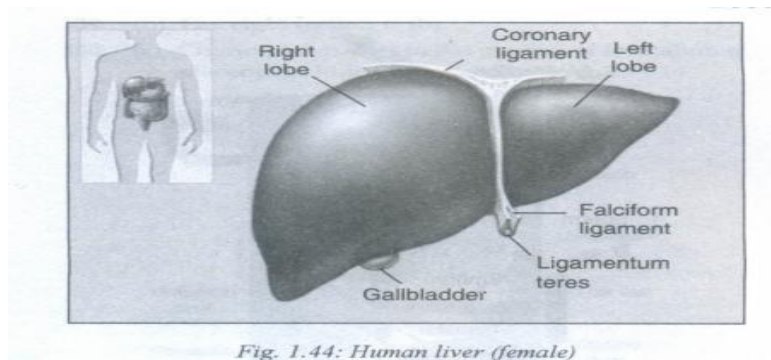
Sol.155 (b)

Some organisms produce more numbers of offspring and some others produce less number of offspring. This phenomenon is called Differential Reproduction. The chief features of this Theory are: (a) rapid multiplication; (b) differential reproduction; (c) struggle for Existence; (d) appearance of variations; (e) survival of the fittest; (f) inheritance of useful variations; and (g) formation of new species.

The right option is (b).

Sol.156 (b)

The female human's liver has 22 autosomes. Refer **Fig. 1.44**



The right option is (b)

Sol.157 (d)

The right option is (d).

Sol.158 (b)

There are eight types of gamete in the F₁ progeny of cross AA BB CC and aa bb cc.

Sol.159 (c)

The right option is (c).

Sol.160 (d)

The right option is (d).

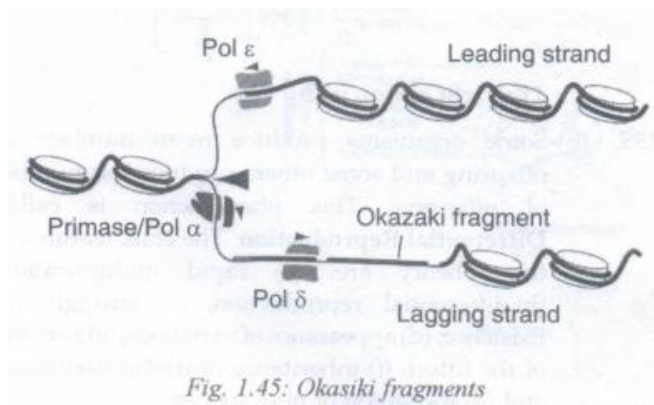
Sol.161 (a)

The symbol 0 in the human blood shows "no antigen."

The right option is (a).

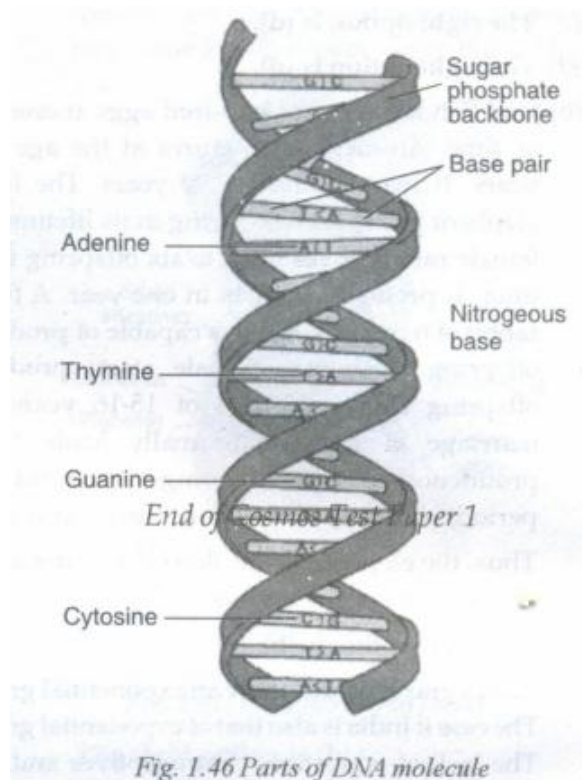
Sol.162 (c)

The right option is (c). Refer Fig. 1.45.



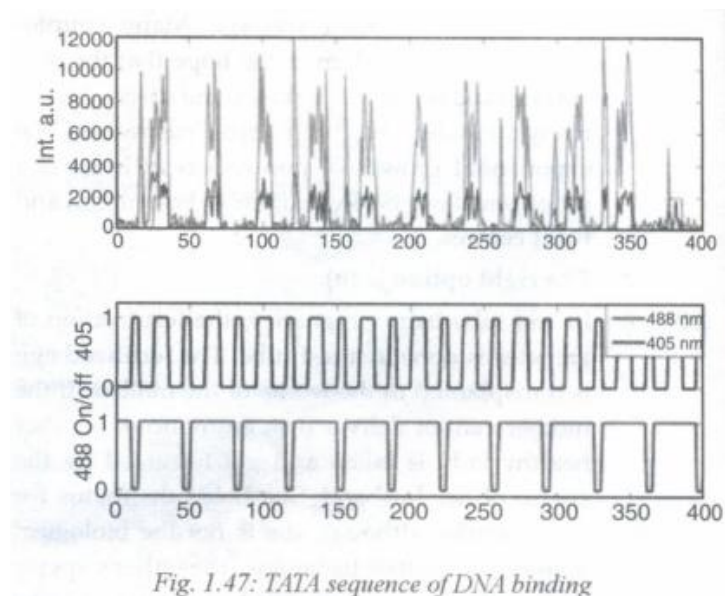
Sol.163 (c)

The three units of the DNA molecule are: deoxyribose sugar, phosphate group and nitrogenous base. Refer **Fig. 1.46**.



The right option is (c).

Sol.164 (c) The right option is (c). Refer Fig. 1.47.



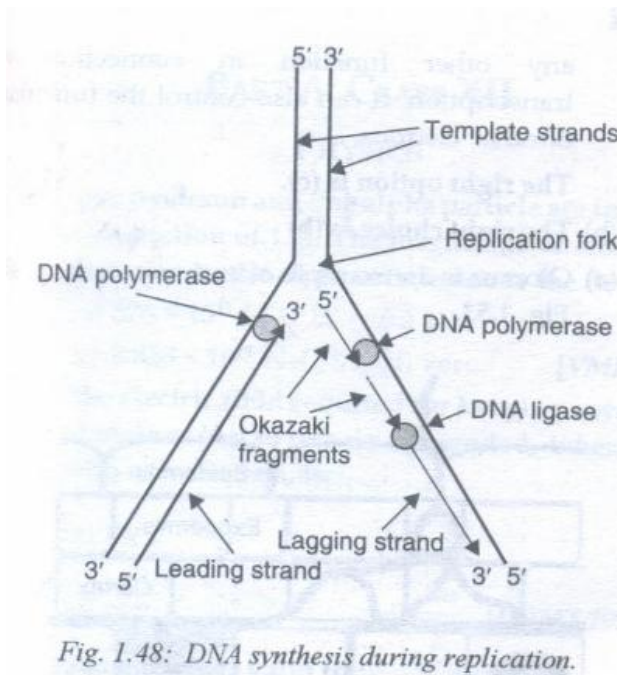
Sol.165 (d)

The right option is (d)

Sol.166 (c)

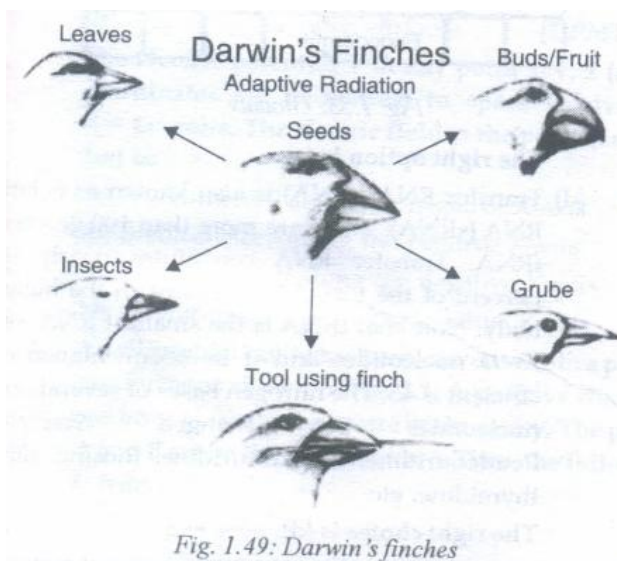
The right option is (c).

Refer Fig. 1.48.



The right option is (c).

Sol.167 (d) The right option is (d). Refer Fig. 1.49.



Sol. 168 (b)

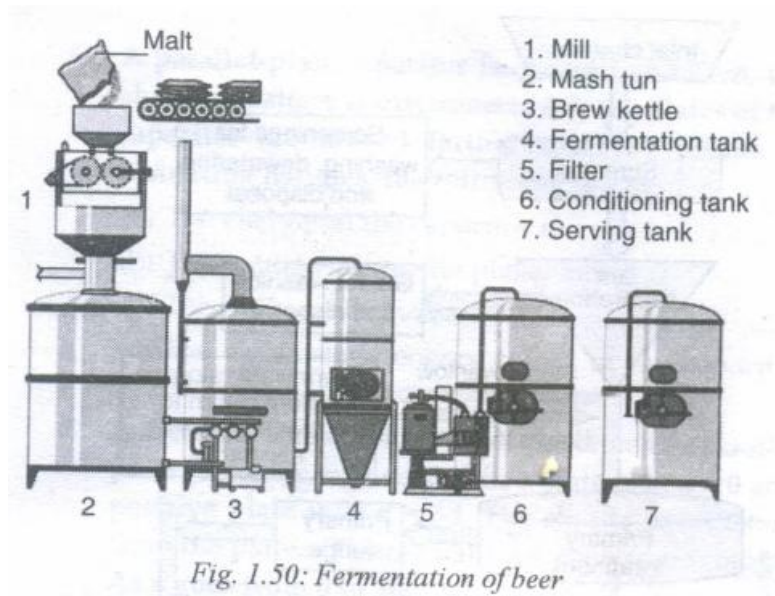
The right choice is (b).

Sol.169 (a)

The right choice is (a).

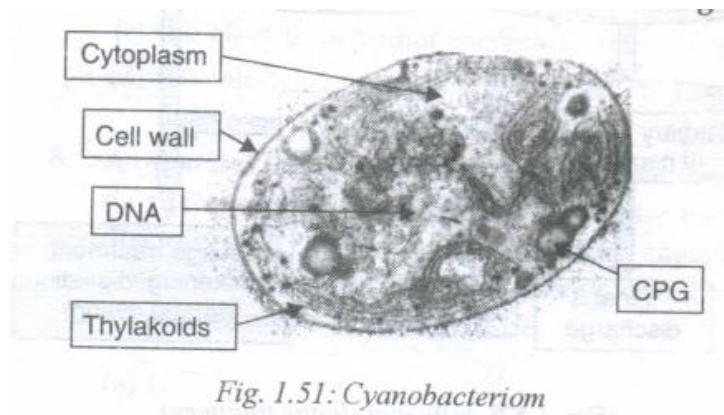
Sol.170 (a)

When alcohol level is between 10-18 percent, fermentation stops. Hence, fermentation and distillation both are needed for manufacturing brandy and whisky. Refer **Fig. 1.50**.



The right option is (a).

Sol.171 (b) Cyanobacteria are present in abundance in Azolla. So, It is an excellent biofertilizer. Refer **Fig. 1.51**



The right option is (b).

Sol.172 (c)

The statement in option (c) is correct. All others are incorrect.

The right option is (c).

Sol. 173 (d)

nitrogen fixation is done by Frankia in Alnus (in its root nodules).

The right option is (d).

Sol. 174 (b)

The right option is (b).

Sol. 175 (b)

The process of activated sludge treatment involves the recycling of decomposer microbes. Refer **Fig. 1.52**.

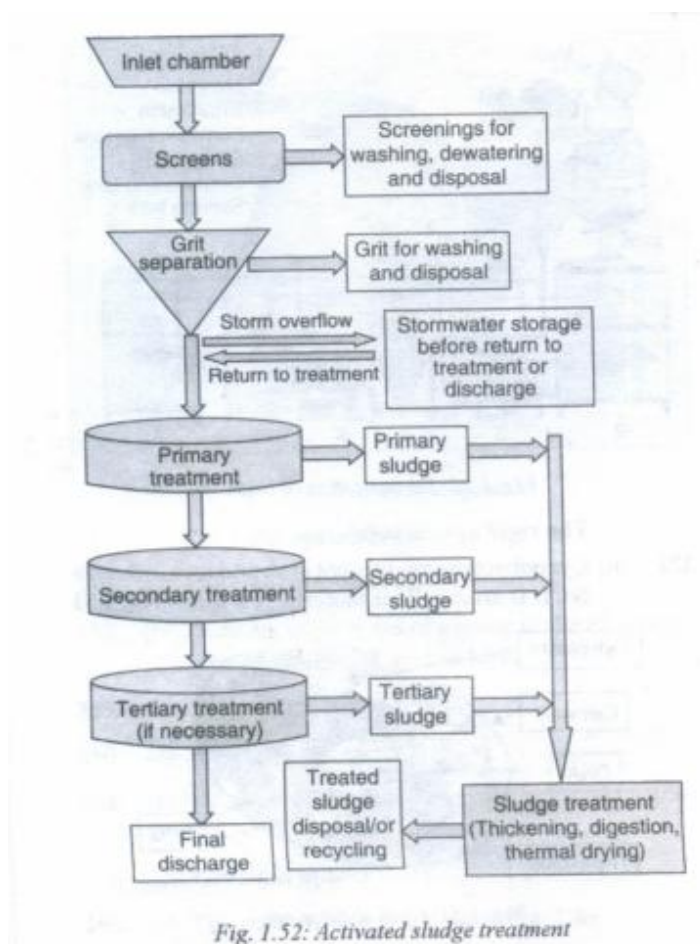


Fig. 1.52: Activated sludge treatment

The right choice is (b).

Sol. 175 (c)

Johannsen had described the gene as an elementary unit of inheritance which can be assigned to a particular character. Morganet. *al.* stated that gene is a segment of chromosome that can be separated through crossing over and is a unit of recombination. The latest term for the gene is Cistron. It is a segment of the DNA that comprises a stretch of base sequences that codes for one polypeptide chain, one transfer-RNA (tRNA) or ribosomal-RNA (rRNA) molecule or performs any other function in connection with transcription. It can also control the functioning of other cistrons.

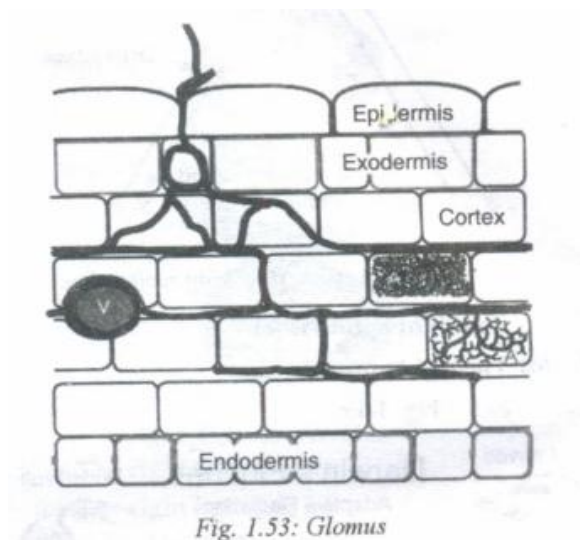
The right option is (c).

So.177 (b)

The right choice is (b)

Sol.178 (a)

Glomus is an example of endomycorrhiza. Refer **Fig. 1.53**.



The right option is (a).

Sol.179 (d)

Transfer RNA (tRNA) is also known as Soluble RNA (sRNA). There are more than 100 genres of tRNA. Transfer RNA constitutes nearly 145 percent of the total RNA present in the human body. Note that tRNA is the smallest RNA with 73-93 nucleotides and its sedimentation coefficient is 45. The nitrogen bases of several of its nucleotides get changed. Examples: Pseudouridine, Dihydrouridine, Inosine, Ribothymidine, etc.

The right choice is (d).

Sol.180 (a)

The options (b), (c) and (d) have correct matches. Option (a) has the wrongly matched entries.

The right option is (a).