MAINS- 2010

Q.1 A thin circular ring of mass M and radius r is rotating about its axis with constant angular velocity ω. Two objects each of mass m are attached gently to the opposite ends of a diameter of the ring. The ring now rotates with angular velocity given by -

(1) $\frac{2M\omega}{M+2m}$ (2) $\frac{(M+2m)\omega}{M}$

(3) $\frac{M\omega}{M+2m}$ (4) $\frac{(M+2m)\omega}{2m}$

Q.2 From a circular disc of radius R and mass 9M, a small disc of mass M and radius R / 3 is removed concentrically. The moment of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through its centre is -

(1) MR^2 (2) $4\,MR^2$

(3) $\frac{4}{9}MR^2$ (4) $\frac{40}{9}MR^2$

Q.3 A particle of mass M starting from rest undergoes uniform acceleration. If the speed acquired in time T is V, the power delivered to the particle is -

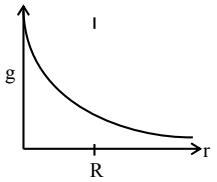
(1) $\frac{1}{2}\frac{MV^2}{T^2}$ (2) $\frac{MV^2}{T^2}$

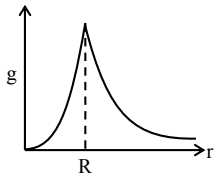
(3) $\frac{1}{2}\frac{MV^2}{T}$ (4) $\frac{MV^2}{T}$

Q.4 A solid cylinder and a hollow cylinder both of the same mass and same external diameter are released from the same height at the same time on an inclined plane. Both roll down without slipping. Which one will reach the bottom first-

(1) Both together
(2) Hollow cylinder
(3) Solid cylinder
(4) Both together only when angle of inclination of plane is 45º

Q.5 The dependence of acceleration due to gravity 'g' on the distance 'r' from the centre of the earth, assumed to be a sphere of radius R of uniform density is as shown in figure below-

(a)


(b)


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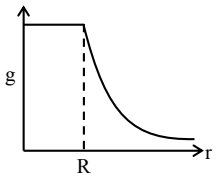
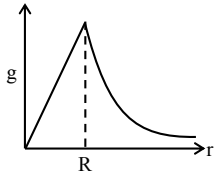


(d)


The correct figure is

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

Q.6 The additional kinetic energy to be provided to a satellite of mass m revolving around a planet of mass M, to transfer it from a circular orbit of radius R_1 to another of radius R_2 ($R_2 > R_1$) is -

(1) $GmM\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

(2) $2\,GmM\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

(3) $\frac{1}{2}GmM\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

(4) $GmM\left(\frac{1}{R_1^2}-\frac{1}{R_2^2}\right)$

Q.7 A student measures the distance traversed in free fall of a body, initially at rest in a given time. He uses this data to estimate g, the accelration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e_1 and e_2 respectively, the percentage error in the estimation of g is -

(1) $e_1 + 2e_2$ (2) $e_1 + e_2$

(3) $e_1 - 2e_2$ (4) $e_2 - e_1$

Q.8 The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is -

(1) 15º (2) 30º (3) 45º (4) 60º

Q.9 (a) Centre of gravity (C, G) of a body is the point at which the weight of the body acts.

(b) Centre of mass coincides with the centre of gravity if the eath is assumed to have infinitely large radius.

(c) To evaluate the gravitational field intensity due to any body at an external point, the entire mass of the body can be considered to be concentrated at its C.G.

(d) The radius of gyration of any body rotation about an axis is the length of the perpendicular dropped from the C.G. of the body to the axis.

Which one of the following pairs of statements is correct -

(1) (a) and (b) (2) (b) and (c)

(3) (c) and (d) (4) (d) and (a)

Q.10 The electric field of an electromagnetic wave in free space is given by –

$\vec{E} = 10 \cos (10^7 t + kx)\ \hat{j}$ V/m, where t and x are in seconds and metres respectively. It can be inferred that -

(a) The wavelength λ is 188.4 m

(b) The wave number k is 0.33 rad / m

(c) The wave amplitude is 10 V / m

(d) The wave is propagating along + x direction

Which one of the following pairs of statements is **correct** ?

(1) (a) and (b) (2) (b) and (c)

(3) (a) and (c) (4) (c) and (d)

Q.11 A particule moves in x – y plane acording to rule x = a sin ωt and y = a cos ωt. The particle follows

(1) a circular path

(2) a parabolic path

(3) a straight line path inclined equally to x and y-axes

(4) an elliptical path

Q.12 The speed of light in media M_1 and M_2 is 1.5×10^8 m/s and 2.0×10^8 m/s respectively. A ray of light enters from medium M_1 to M_2 at an incidence angle i. If the ray suffers total internalreflection the value of i is -

(1) Equal to or less than $\sin^{-1}\left(\frac{3}{5}\right)$

(2) Equal to or greater than $\sin^{-1}\left(\frac{3}{4}\right)$

(3) less than $\sin^{-1}\left(\frac{2}{3}\right)$

(4) Equal to $\sin^{-1}\left(\frac{2}{3}\right)$

Q.13 A ray of light is incident on a 60º prism at the minimum deviation position. The angle of refraction at the first face (i.e. incident face) of the prism is-

(1) 30º (2) 45º

(3) 60º (4) Zero

Q.14 A monoatomic gas at pressure P_1 and volume V_1 is compressed adiabatically to $1/8^{th}$ its original volume. What is the final pressure of gas -

(1) P_1 (2) 16 P_1

(3) 32 P_1 (4) 64 P_1

Q.15 If C_p and C_v denote the specific heats (per unit mass) of an ideal gas of molecular weight M.-

(1) $C_p - C_v = R$ (2) $C_p - C_v = R / M$

(3) $C_p - Cv = MR$ (4) $C_p - C_v = R / M^2$

Where R is the molar gas constant

Q.16 The magnetic moment of a diamagnetic atom is

(1) 1

(2) between zero and one

(3) equal to zero

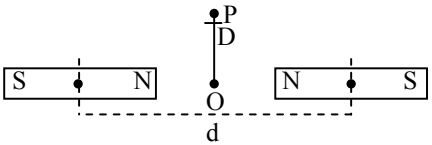
(4) much greater than one

Q.17 A current loop consists of two identical semicircular parts each of radius R, one lying in the x-y plane and the other in x-z plane. If the current in the loop is i. The resultant magnetic field due to the two semicircular parts at their common centre is -

(1) $\frac{\mu_0 i}{2R}$ (2) $\frac{\mu_0 i}{4R}$

(3) $\frac{\mu_0 i}{\sqrt{2}R}$ (4) $\frac{\mu_0 i}{2\sqrt{2}R}$

Q.18 Two identical bar magnets are fixed with their centres at a distance d apart. A stationary charge Q is placed at P in between the gap of the two magnets at distance D from the centre O as shwon in the figure -



The force on the charge Q is -

(1) direction along OP

(2) direction along PQ

(3) directed perpendicular to the plane of paper

(4) zero

Q.19 A closely wound solenoid of 2000 turns and area of cross-section $1.5 \times 10^{-4} m^2$ carries a current of 2.0 A. It is suspended through its centre and perpendicular to its length allowing it to turn in a horizontal plane in a uniform magnetic field 5×10^{-2} Tesla making an angle of 30º With the axis of the solenoid. The torque on the solenoid will be -

(1) 1.5×10^{-3} N.m (2) 1.5×10^{-2} N.m

(3) 3×10^{-2} N.m (4) 3×10^{-3} N.m

Q.20 A condenser of capicity C is charged to a potential difference of V_1. The plates of the condenser are then connected to an ideal inductor of inductance L. The current through the inductor when the potential difference across the condenser reduces to V_2 is -

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

(2) $\frac{C\left(V_1^2 + V_2^2\right)}{L}$

(3) $\left(\frac{C\left(V_1^2 - V_2^2\right)}{L}\right)^{1/2}$

(4) $\left(\frac{C(V_1 - V_2)^2}{L}\right)^{1/2}$

Q.21 Two parallel metal plates having charges +Q and –Q face each each other at a certain distance between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will -

(1) increase (2) decrease

(3) remain same (4) become zero

Q.22 The electric field at a distance $\frac{3R}{2}$ from the centre of a charged conducting spherical shell of radius R is E. The electric field at a distance $\frac{R}{2}$ from the centre of the sphere is -

(1) E (2) $\frac{E}{2}$

(3) $\frac{E}{3}$ (4) Zero

Q.23 The thermo e.m.f E in volts of a certain thermo-couple is found to vary with temperature difference θ in ºC between the two junctions according to the relation

$$E = 30\,\theta - \frac{\theta^2}{15}$$

The neutral temperature for the thermo-couple will be -

(1) 400ºC (2) 225ºC

(3) 30ºC (4) 450ºC

Q.24 A particle having a mass of 10^{-2} kg carries a charge of 5×10^{-8}C. The particle is given an initial horizoantal velocity of 10^5 ms^{-1} in the presence of electric field $\vec{E}$ and magnetic field $\vec{B}$. To keep the particle moving in a horizontal direction, it is necessary that -

(a) $\vec{B}$ should be perpendicular to the direction of velocity and $\vec{E}$ should be along the direction of velocity.

(b) Both $\vec{B}$ and $\vec{E}$ should be along the direction of velocity.

(c) Both $\vec{B}$ and $\vec{E}$ are mutually perpendicular and perpendicular to the direction of velocity

(d) $\vec{B}$ should be along the direction of velocity and $\vec{E}$ should be perpendicualr to the direction of velocity.

Which one of the following pairs of statements is possible ?

(1) (c) and (d) (2) (b) and (c)
(3) (b) and (d) (4) (a) and (c)

Q.25 When monochromatic radiation of intenisty I falls on a metal surface, the number of photoelectron and their maximum kinetic energy are N and T respectively. If the intensity of radiation is 2I, the number of emitted electrons and their maximum kinetic energy are respectively-

(1) 2N and T (2) 2N and 2T
(3) N and T (4) N and 2T

Q.26 The electrons in the hydrogen atom jumps from excited state (n = 3) to its ground state (n = 1) and the photons thus emitted irradiate a photosensitive matieral. If the work function of the material is 5.1 eV, the stopping potential is estimated to be (the energy of the electron in n^{th} state $E_n = -\frac{13.6}{n^2}$ eV) -

(1) 12.1 V (2) 17.2 V
(3) 7 V (4) 5.1 V

Q.27 The binding energy per nucleon in deutorium and helium nuclei are 1.1 MeV and 7.0 MeV, respectively. When two deuterium neclei fuse to form a helium nucleus the energy released in the fusion is -

(1) 2.2 MeV (2) 28.0 MeV
(3) 30.2 MeV (4) 23.6 MeV

Q.28 The decay constant of a radio isotope is λ. If A_1 and A_2 are its activities at times t_1 and t_2 respectively, the number of nuclei which have decayed during the time $(t_1 - t_2)$ -

(1) $A_1 - A_2$ (2) $(A_1 - A_2) / \lambda$
(3) $\lambda (A_1 - A_2)$ (4) $A_1t_1 - A_2t_2$

Q.29 For transistor action –

(a) Base, emitter and collector regions should have similar sizae and doping concentrations.

(b) The base region must be very thin and lightly doped.

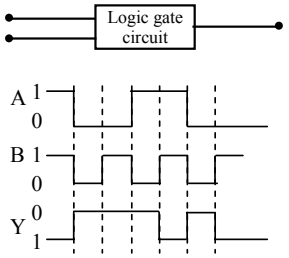
(c) The emitter-base junction is forward biased and base-collector junction is reverse biased.

(d) Both the emitter-base junctions as well as the base collector juction are forward biased.

Which one of the following pairs of statements is correct ?

(1) (a), (b) (2) (b), (c)
(3) (c), (d) (4) (d), (a)

Q.30 The following firugre shows a logic gate citrcuit with two inputs A and B the output Y. The voltage waveforms of A, B and Y are as given –



The logic gate is –

(1) OR gate (2) AND gate
(3) NAND gate (4) NOR gate

Q.31 For vaporization of water at 1 atmospheric pressure, the values of ΔH and ΔS are 40.63 kJ mol^{-1} and 108.8 JK^{-1} mol^{-1}, respectively. The temperature when Gibbs energy change (ΔG) for this transformation will be zero, is -

(1) 393.4 K (2) 373.4 K

(3) 293.4 K (4) 273.4 K

Q.32 A 0.66 kg ball is moving with a speed of 100 m/s. The associated wavelength will be ($h = 6.6 \times 10^{-34}$ Js)-

(1) 6.6×10^{-34} m (2) 1.0×10^{-35} m

(3) 1.0×10^{-32} m (4) 6.6×10^{-32} m

Q.33 Three moles of an ideal gas expanded spontaneously into vaccum. The work done will be

(1) 3 Joules (2) 9 Joules

(3) Zero (4) Infinite

Q.34 The following two reactions are known

$Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$;

$\Delta H = -26.8$ kJ

$FeO(s) + CO(g) \rightarrow Fe(s) + CO_2(g)$;

$\Delta H = -16.5$ kJ

The value of ΔH for the following reaction

$Fe_2O_3(s) + CO(g) \rightarrow 2FeO(s) + CO_2(g)$ is

(1) – 43.3 kJ (2) – 10.3 kJ

(3) + 6.2 kJ (4) + 10.3 kJ

Q.35 The reaction

$2A(g) + B(g) \rightleftharpoons 3C(g) + D(g)$

is begun with the concentrations of A and B both at an intial value of 1.00 M. When equilibrium is reached, the concentration of D is measured and found to be 0.25 M. The value for the equilibrium constant for this reaction is given by the expression.

(1) $[(0.75)^3 (0.25)] \div [(0.50)^2 (0.75)]$

(2) $[(0.75)^3 (0.25)] \div [(0.50)^2 (0.25)]$

(3) $[(0.75)^3 (0.25)] \div [(0.75)^2 (0.25)]$

(4) $[(0.75)^3 (0.25)] \div [(1.00)^2 (1.00)]$

Q.36 The pressure exerted by 6.0 g of methane gas in a 0.03 m^3 vessel at 129 ºC is

(Atomic masses : C = 12.01, H = 1.01 and R = 8.314 $JK^{-1}mol^{-1}$)

(1) 13409 Pa (2) 41648 Pa

(3) 31684 Pa (4) 215216 Pa

Q.37 Which of the following expressions correctly represents the equivalent conductance at infinite dilution of $Al_2(SO_4)_3$? Given that $\Lambda^{o}_{Al^{3+}}$ and $\Lambda^{o}_{SO_4^{2-}}$ are the equivalent conductances at infinite dilution of the respective ions.

(1) $\Lambda^{o}_{Al^{3+}} + \Lambda^{o}_{SO_4^{2-}}$

(2) $(\Lambda^{o}_{Al^{3+}} + \Lambda^{o}_{SO_4^{2-}}) \times 6$

(3) $\frac{1}{3}\Lambda^{o}_{Al^{3+}} + \frac{1}{2}\Lambda^{o}_{SO_4^{2-}}$

(4) $2\Lambda^{o}_{Al^{3+}} + 3\Lambda^{o}_{SO_4^{2-}}$

Q.38 How many bridging oxygen atoms are present in P_4O_{10} ?

(1) 4 (2) 2 (3) 5 (4) 6

Q.39 Among the following which one has the highest cation to anion size ratio?

(1) CsF (2) LiF (3) NaF (4) CsI

Q.40 Which of the following oxidation states is the most common among the lanthanoids ?

(1) 2 (2) 5 (3) 3 (4) 4

Q.41 Some of the properties of the two species, NO_3^- and H_3O^+ are described below. Which one of them is correct?

(1) Isostructural with same hybridization for the central atom

(2) Isostructural with different hybridization for the central atom

(3) Similar in hybridization for the central atom with different structures

(4) Dissimilar in hybridization for the central atom with different structures.

Q.42 The compound A on heating gives a colourless gas and a residue that is dissolved in water to obtain B. Excess of CO_2 is bubbled through aqueous solution of B, C is formed which is recovered in the solid form. Solid C on gentle heating gives back A. The compound A is -

(1) Na_2CO_3 (2) K_2CO_3

(3) $CaSO_4.2H_2O$ (4) $CaCO_3$

Q.43 Among the elements Ca, Mg, P and Cl, the order of increasing atomic radii is -

(1) Cl < P < Mg < Ca

(2) P < Cl < Ca < Mg

(3) Ca < Mg < P < Cl

(4) Mg < Ca < Cl < P

Q.44 Which one of the following complexes is **not** expected to exhibit isomerism ?

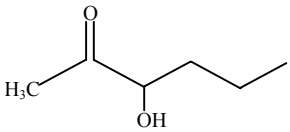
(1) $[Pt\ (NH_3)_2\ Cl_2]$

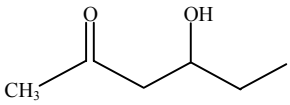
(2) $[Ni\ (NH_3)_2Cl_2]$

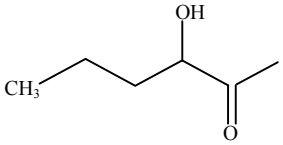
(3) $[Ni\ (en)_3]^{2+}$

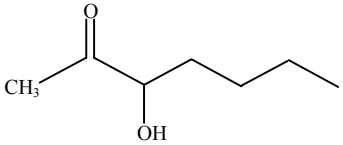
(4) $[Ni\ (NH_3)_4\ (H_2O)_2]^{2+}$

Q.45 Which one of the following compounds will be most readily dehydrated ?

(1) 

(2) 

(3) 

(4) 

Q.46 Among the following four compounds

(a) Phenol (b) methyl phenol

(c) metanitrophenol (d) paranitrophenol

the acidity order is –

(1) c > d > a > b (2) a > d > c > b

(3) b > a > c > d (4) d > c > a > b

Q.47 Fructose reduces Tollen's reagent due to -

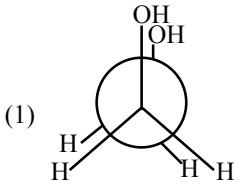
(1) primary alcoholic group

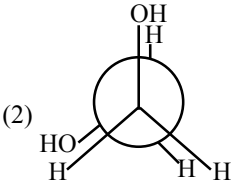
(2) secondary alcoholic group

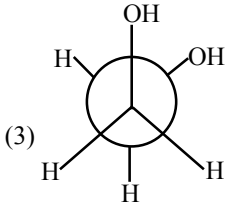
(3) enolisation of fructose followed by conversion to aldehyde by base

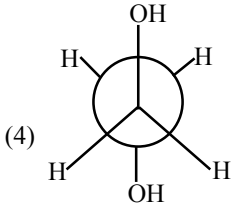
(4) asymmetric carbons

Q.48 Which of the following conformers for ethylene glycol is most stable ?

(1) 

(2) 

(3) 

(4) 

Q.49 The IUPAC name of the compound $CH_3CH = CHC \equiv CH$ is -

(1) Pent - 3 - en - 1 - yne

(2) Pent - 2 - en - 4 - yne

(3) Pent - 1 - yn - 3 - ene

(4) Pent - 4 - yn - 2 – ene

Q.50 When glycerol is treated with excess of HI, it produces -
(1) allyl iodide
(2) propene
(3) glycerol triiodide
(4) 2-iodopropane

Q.51 Which of the following species is not electrophilic in nature ?
(1) BH_3 (2) $\overset{\oplus}{H_3O}$
(3) $\overset{\oplus}{N}O_2$ (4) $\overset{\oplus}{Cl}$

Q.52 In the following reaction

$$C_6H_5CH_2Br \xrightarrow[2.\quad H_3O^+]{1.\ Mg,Ether} X,$$

The product 'X' is -
(1) $C_6H_5CH_2OH$
(2) $C_6H_5CH_3$
(3) $C_6H_5CH_2CH_2C_6H_5$
(4) $C_6H_5CH_2OCH_2C_6H_5$

Q.53 In which of the following molecules the central atom does not have sp^3 hybridization ?
(1) SF_4 (2) BF_4^-
(3) NH_4^+ (4) CH_4

Q.54 The rate of the reaction
$2NO + Cl_2 \rightarrow 2NOCl$ is given by the rate equation
$rate = k[NO]^2[Cl_2]$
The value of the rate constant can be increased by -
(1) increasing the concentration of NO.
(2) increasing the concentration of the Cl_2
(3) increasing the temperature
(4) doing all of these

Q.55 Match List – I (Equations) with List – II (Type of processes) and select the correct option.

List –I **Equation**	**List – II** **Type of processes**
(a) $K_p > Q$	(i) Non spontaneous
(b) $\Delta G^o < RT \ln Q$	(ii) Equilibrium
(c) $Kp = Q$	(iii) Spontaneous and endothermic
(d) $T > \frac{\Delta H}{\Delta S}$	(iv) Spontaneous

Options :

	(a)	(b)	(c)	(d)
(1)	(iii)	(iv)	(ii)	(i)
(2)	(iv)	(i)	(ii)	(iii)
(3)	(ii)	(i)	(iv)	(iii)
(4)	(i)	(ii)	(iii)	(iv)

Q.56 Match List-I (substances) with List-II (processes) employed in the manufacture of the substances and select the correct option.

List –I **Substances**	**List – II** **Processes**
(a) Sulphuric acid	(i) Haber's Process
(b) Steel	(ii) Bessemer's Process
(c) Sodium hydroxide	(iii) Leblanc Process
(d) Ammonia	(iv) Contact Process

Options :

	(a)	(b)	(c)	(d)
(1)	(i)	(ii)	(iii)	(iv)
(2)	(iv)	(iii)	(ii)	(i)
(3)	(iv)	(ii)	(iii)	(i)
(4)	(i)	(iv)	(ii)	(iii)

Q.57 Match the compounds given in List -I with their characteristic reactions given in List -II. Select the correct option.

List – I

Compounds

(a) $CH_3CH_2CH_2CH_2NH_2$
(b) $CH_3C{\equiv}CH$
(c) $CH_3CH_2COOCH_3$
(d) $CH_3CH(OH)CH_3$

List – II

Reactions

(i) alkaline hydroloysis
(ii) with KOH (alcohol) and $CHCl_3$ produces bad smell
(iii) gives white ppt. with ammonical $AgNO_3$
(iv) with Lucas reagent cloudiness appears after 5 minutes

Options :

	(a)	(b)	(c)	(d)
(1)	(iii)	(ii)	(i)	(iv)
(2)	(ii)	(iii)	(i)	(iv)
(3)	(iv)	(ii)	(iii)	(i)
(4)	(ii)	(i)	(iv)	(iii)

Q.58 Some statements about water are given below:

(a) Heavy water is used as a moderator in nuclear reactors

(b) Heavy water is more associated than ordinary water

(c) Heavy water is more effective solvent than ordinary water.

Which of the above statements are correct ?

(1) (a), (b) and (c) (2) (b) and (c)

(3) (a) and (c) (4) (a) and (b)

Q.59 Consider the following relations for emf of a electrochemical cell :

(a) emf of cell = (Oxidation potential of anode) – (Reduction potential of cathode)

(b) emf of cell = (Oxidation potential of anode) + (Reduction potential of cathod)

(c) emf of cell = (Reduction potential of anode) + (Reduction potential of cathode)

(d) emf of cell = (Oxidation potential of anode) – (Oxidation potential of cathode)

Which of the above relations are correct ?

Options

(1) (a) and (b) (2) (c) and (d)

(3) (b) and (d) (4) (c) and (a)

Q.60 Follwoing compounds are given :

(a) CH_3CH_2OH (b) CH_3COCH_3

(c) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}HOH$ (d) CH_3OH

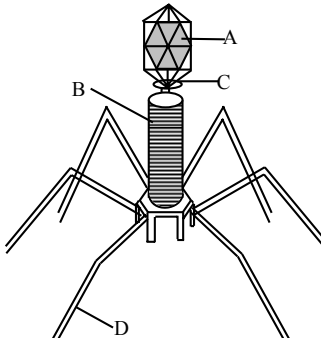
Which of the above compounds(s), on being warmed with iodine solution and NaOH, will give iodoform ?

Options

(1) Only (b) (2) (a), (b) and (c)

(3) (a) and (b) (4) (a), (c) and (d)

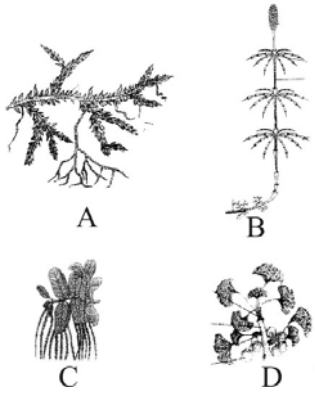
Q.61 Given below is the diagram of a bacteriophage. In which one of the options all the four parts A, B, C and D are correct –



Options

	A	B	C	D
(1)	Sheath	Collar	Head	Tail fibres
(2)	Head	Sheath	Collar	Tail fibres
(3)	Collar	Tail fibres	Head	Sheath
(4)	Tail fibres	Head	Sheath	Collar

Q.62 Examine the figures A, B, C and D. In which one of the four options all the items, A, B, C and D are correct ?



Options :

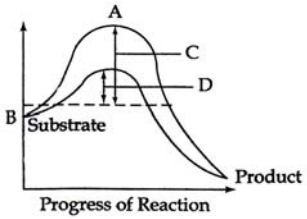
	A	B	C	D
(1)	*Equisetum*	*Ginkgo*	*Selaginella*	*Lycopodium*
(2)	*Selaginella*	*Equisetum*	*Salvinia*	*Ginkgo*
(3)	*Funaria*	*Adiantum*	*Salvinia*	*Riccia*
(4)	*Chara*	*Marchantia*	*Fucus*	*Pinus*

Q.63 In eukaryotic cell transcription, RNA splicing and RNA capping take place inside the -

(1) Nucleus (2) Dictyosomes

(3) ER (4) Ribosomes

Q.64 The figure given below shows the conversions of a substrate into product by an enzyme. In which one of the four options (1-4) the components of reaction labelled as A, B, C and D are identified correctly –



Options

	A	B	C	D
(1)	Transition state	Potential energy	Activation energy without enzyme	Activation energy with enzyme
(2)	Potential energy	Transition state	Activation energy with enzyme	Activation energy without enzyme
(3)	Activation energy with enzyme	Transition state	Activation energy without enzyme	Potential energy
(4)	Potential energy	Transition state	Activation energy with enzyme	Activation energy without enzyme

Q.65 An elaborate network of filamentous proteinaceous structures present in the cytoplasm which helps in the maintenance of cell shape is called -

(1) Endosplasmic Reticulum
(2) Plasmalemma
(3) Cytoskeleton
(4) Thylakoid

Q.66 In antirrhinum two plants with pink flowers were hybridized. The F_1 plants produced red, pink and white flowers in the proportion of 1 red, 2 pink and 1 white. What could be the genotype of the two plants used for hybridization ? Red flower colour is determined by RR, and White by rr genes -

(1) RR (2) Rr
(3) rr (4) rrrr

Q.67 The lac Operon consists of -

(1) One regulatory gene and three structural genes
(2) Two regulatory genes and two structural genes
(3) Three regulatory genes and three structure genes
(4) Four regulatory genes only

Q.68 A cross in which an organism showing a dominant phenotype in crossed with the recessive parent in order to know its genotype is called -

(1) Back cross (2) Test cross
(3) Dihybrid cross (4)Monohybrid cross

Q.69 Transport of food material in higher plants takes place through -

(1) Transfusion tissue (2) Tracheids
(3) Sieve elements (4) Companion cells

Q.70 Kranz anatomy is one of the characteristics of the leaves of -

(1) Wheat (2) Sugarcane
(3) Mustard (4) Patato

Q.71 Consider the following four statement A, B, C & D and select the right option for two correct statement

Statements

(A) In vaxillary aestivation, the large posterior petal is called standard, two lateral ones are wings and two small anterior petals are termed keel
(B) The floral formula for liliaceae is

$$\oplus \, ♂ \, P_{3+3} \, A_{3+3} \, \underline{G_{(3)}}$$

(C) In pea flower the stamens are monadelphous
(D) The floral formula for solanaceae is

$$\oplus \, ♂ \, K_{(3)} \, C_3 \, A_{(4)} \, \underline{G_{(2)}}$$

The correct statements are –

(1) A and B (2) B and C
(3) C and D (4) A and C

Q.72 Vegetative propagation in pistia occurs by –

(1) offset (2) Runner
(3) Sucker (4) Stolon

Q.73 Which one of the following is monoecious ?

(1) Cycas (2) Pinus

(3) Date palm (4) Marchantia

Q.74 The correct floral formula of soyabean is –

(1) % ♂♀ $K_5\ C_{1+(2)+2}\ A_{(9)+1}\ \underline{G}_1$

(2) % ♂♀ $K_{(5)}\ C_{1+2+(2)}\ A_{(9)+1}\ \underline{G}_1$

(3) % ♂♀ $K_{(5)}\ C_{1+2+(2)}\ A_{1+(9)}\ \underline{G}_1$

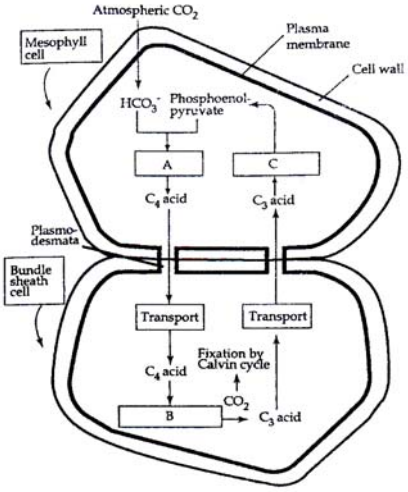
(4) % ♂♀ $K_{(5)}\ C_{1+(2)+2}\ A_{(9)+1}\ \bar{G}_1$

Q.75 Aestivation of petals in the flower of cotton is correctly shown in –

(1)  (2) 

(3)  (4) 

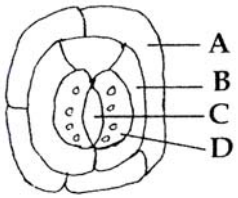
Q.76 Study the pathway given below-



In which of the following options correct words for all the three blanks A, B and C are indicated?

	A	B	C
(1)	Fixation	Transamination	Regeneration
(2)	Fixation	Decarboxylation	Regeneration
(3)	Carboxylation	Decarboxylation	Reduction
(4)	Decarboxylation	Reduction	Regeneration

Q.77 Given below is the diagram of a stomatal apparatus. In which of the following all the four parts labelled as A, B, C and D are correctly identified –



	A	B	C	D
(1)	Guard cell	Stomatal aperture	Subsidiary Cell	Epidermal Cell
(2)	Epidermal Cell	Guard Cell	Stomatal aperture	Subsidiary cell
(3)	Epidermal Cell	Subsidiary Cell	Stomatal aperture	Guard Cell
(4)	Subsidiary Cell	Epidermal Cell	Guard Cell	Stomatal aperture

Q.78 Read the following four statements A, B, C and D and select the right option having both correct statements –

STATEMENTS

(A) Z-scheme of light reaction takes place in presence of PSI only

(B) Only PSI functional in cyclic photophosphorylation

(C) Cyclic photophosphorylation result into synthesis of ATP and $NADPH_2$

(D) Stroma lamellae lack PSII as well as NADP

Options

(1) A and B (2) B and C

(3) C and D (4) B and D

Q.79 One of the commonly used plant growth hormone in tea plantations is -

(1) Abscisic acid (2) Zeatin

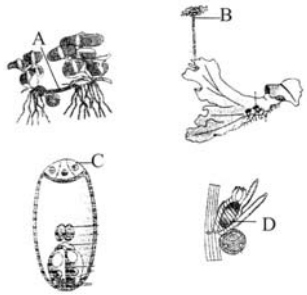
(3) Indole-3- acetic acid (4) Ethylene

Q.80 Root development is promoted by -

(1) Auxin (2) Gibberellin

(3) Ethylene (4) Abscisic acid

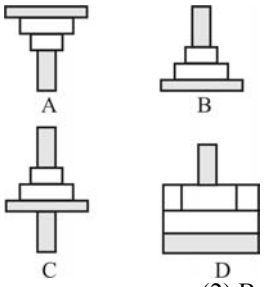
Q.81 Examine the figure (A-D) given below and select the right option out of 1-4, in which all the four structures A, B, C and D –



Options

	A	B	C	D
(1)	Runner	Archegoniophore	Synergid	Antheridium
(2)	Offset	Antheridiophore	Antipodals	Oogonium
(3)	Sucker	Seta	Megaspore mother cell	Gamma cup
(4)	Rhizome	Sporangiophore	Polar cell	Globule

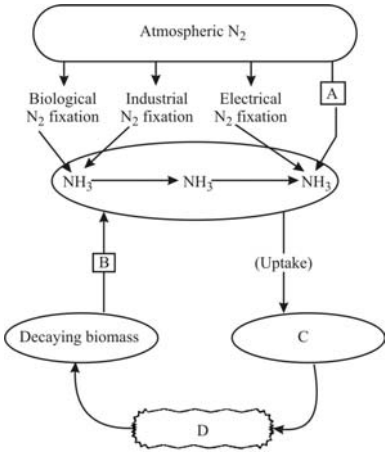
Q.82 Which of the following representations shows the pyramid of numbers in a forest ecosystem –



(1) A (2) B

(3) C (4) D

Q.83 Study the cycle shown below and select the option which gives correct words for all the four blanks A, B, C and D-



Options :

	A	B	C	D
(1)	Denitrification	Ammonification	Plants	Animals
(2)	Nitrification	Denitrification	Animals	Plants
(3)	Denitrification	Nitrification	Plants	Animals
(4)	Nitrification	Ammonification	Animals	Plants

Q.84 Which one of the following is a xerophytic plant in which the stem is modified into a flat green and succulent structure –

(1) Casurina (2) Hydrilla

(3) Acacia (4) Opuntia

Q.85 An example of endomycorrhiza is -

(1) Glomus (2) Agaricus

(3) Rhizobium (4) Nostoc

Q.86 Leguminous plants are able to fix atmospheric nitrogen through the process of symbiotic nitrogen fixation. Which one of the following statements is **not** correct during this process of nitrogen fixation -

(1) Nodules act as sites for nitrogen fixation

(2) The enzyme nitrogenase catalyses the conversion of atmospheric N_2 to NH_3

(3) Nitrogen is insensitive to oxygen

(4) Leghaemoglobin scavenges oxygen and is pinkish in colour

Q.87 Black (stem) rust of wheat is caused by -

(1) Ustilago nuda (2) Puccinia graminis

(3) Xanthomonas oryzae (4) Alternaria solani

Q.88 Which of the following are used in gene cloning-

(1) Lomasomes (2) Mesosomes

(3) Plasmids (4) Nucleoids

Q.89 Which one of the following can **not** be used for preparation of vaccines against plague -

(1) Avirulent live bacteria

(2) Synthetic capsular polysaccharide material

(3) Heat-killed suspensions of virulent bacteria

(4) Formalin-inactivated suspensions of virulent bacteria

Q.90 Which one of the following is now being commercially produced by biotechnological procedures -

(1) Morphine (2) Quinine

(3) Insulin (4) Nicotine

Q.91 Crocodile and Penguin are *similar* to Whale and Dogfish in which one of the following features ?

(1) Lay eggs and guard them till they hatch

(2) Possess bony skeleton

(3) Have gill slits at some stage

(4) Possess a solid single stranded central nervous system

Q.92 Select the correct combination of the statements (a-d) regarding the *characteristics* of certain organisms –

(a) Methanogens are Archaebacteria which produce methane in marshy areas

(b) *Nostoc* is a filamentous blue-green alga which fixes atmospheric nitrogen

(c) Chemosynthetic autotrophic bacteria synthesize cellulose from glucose

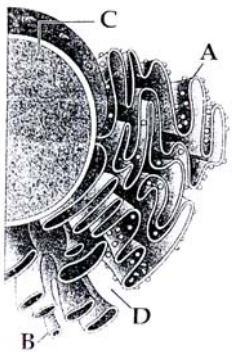
(d) Mycoplasma lack a cell wall and can survive without oxygen

The correct statements are -

(1) (a), (b) (c) (2) (b), (c), (d)

(3) (a), (b) (d) (4) (b), (c)

Q.93 Identify the components labelled A, B, C and D in the diagram below from the list (i) to (viii) given along with –



Components :

(i) Cristae of mitochondria

(ii) Inner membrane of mitochondria

(iii) Cytoplasm

(iv) Smooth endoplasmic reticulum

(v) Rough endoplasmic reticulum

(vi) Mitochondrial matrix

(vii) Cell vacuole

(viii) Nucleus

The correct components are :

	A	B	C	D
(1)	(i)	(iv)	(viii)	(vi)
(2)	(vi)	(v)	(iv)	(vii)
(3)	(v)	(i)	(iii)	(ii)
(4)	(v)	(iv)	(viii)	(iii)

Q.94 Three of the following statements about enzymes are correct and one is **wrong**. Which one is **wrong**

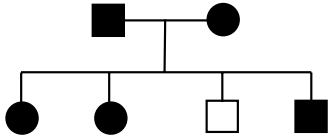
(1) Enzymes are denatured at high temperature but in certain exceptional organisms they are effective even at temperatures 80º - 90ºC

(2) Enzymes are highly specific

(3) Most enzymes are proteins but some are lipids

(4) Enzymes require optimum pH for maximal activity

Q.95 Study the pedigree chart of a certain family given below and select the **correct** conclusion which can be drawn for the character –



(1) The parents could not have had a normal daughter for this character

(2) The trait under study could not be colour-blindness

(3) The male parent is homozygous dominant

(4) The female parent is heterozygous

Q.96 The most apparent changes during the evolutionary history of ***Homo sapiens*** is traced in

(1) Walking upright
(2) Shortening of the jaws
(3) Remarkable increase in the brain size
(4) Loss of body hair

Q.97 Given below are four statements (A-D) each with one or two blanks. Select the option which **correctly** fills up the blanks in **two** statements –

Statements :

(A) Wings of butterfly and birds look alike and are the results of ——(i)——, evolution

(B) Miller showed that CH_4, H_2, NH_3 and ——(i)——, when exposed to electric discharge in a flask resulted in formation of ——(ii)——.

(C) Vermiform appendix is a ——(i)—— organ and an ——(ii)—— evidence pf evolution.

(D) According to Darwin evolution took place due to ——(i)—— and ——(ii)—— of the fittest.

Options :

(1) (A) - (i) convergent,
(B) - (ii) oxygen, (ii) nucleosides
(2) (B) - (i) water vapour, (ii) amino acids,
(C) - (i) rudimentary (ii) anatomical
(3) (C) - (i) vestigial, (ii) anatomical,
(D) - (i) mutations, (ii) multiplication
(4) (D) - (i) small variations, (ii) survival,
(A) - (i) convergent

Q.98 Fastest distribution of some injectible material / medicine and with no risk of any kind can be achieved by injecting it into the -

(1) arteries (2) veins
(3) lymph vessels (4) muscles

Q.99 Select the answer with *correct matching* of the structure, its location and function –

	A	B	C
(1)	Cerebellum	Mid brain	Controls respiration and gastric secretions
(2)	Hypothalamus	Fore brain	Controls body temperature, urge for eating and drinking
(3)	Blinds spot	Near the place where optic nerve leaves the eye	Rods and cones are present but inactive here
(4)	Eustachian tube	Anterior part of internal ear	Equalizes air pressure on either sides of tympanic membrane

Q.100 ABO blood grouping is controlled by gene I which has three alleles and show co-dominance. There are six genotypes. How many phenotypes in all are possible -

(1) three (2) four
(3) five (4) six

Q.101 Which one of the following is the *correct description* of a certain part of a normal human skeleton-

(1) First vertebra is axis which articulates with the occipital condyles
(2) The 9^{th} and 10^{th} pairs of ribs are called the floating ribs
(3) Glenoid cavity is a depression to which the thigh bone articulates
(4) Parietal bone and the temporal bone of the skull are joined by fibrous joint

Q.102 In which one of the following organisms its *excertory organs* are **correctly** stated ?

(1) Earthworm - Pharyngeal, integumentary and septal nephridia
(2) Cockroach - Malpighian tubules and entire caeca
(3) Frog - Kidneys, skin and buccal epithelium
(4) Humans - Kidney, sebaceous glands and fear glansds

Q.103 Select the *correct* matching of a hormone its source and functional –

	Hormone	Source	Function
(1)	Norepinephrine	Adrenal medulla	Increases heart beat, rate of respiration and altert ness
(2)	Glucagon	Beta-cells of Islets of langerhans	Stimulates glycogenolysis
(3)	Prolactin	Poasterior pituitary	Regulates growth of mammary glands and milk formation in females
(4)	Vasopressin	Posterior pituitary	Increases loss of water through urine

Q.104 Given below are four statements (a-d) regarding human blood circulatory system-

(a) Arteries are thick-walled and have narrow lumen as compared to veins

(b) Angina is acute chest pain when the blood circulation to the brain is reduced

(c) Persons with blood group AB can donate blood to any person with any blood group under ABO system

(d) Calcium ions play a very important role in blood clotting

Which two of the above statements are **correct ?**

(1) (a) and (b) (2) (b) and (c)

(3) (c) and (d) (4) (a) and (d)

Q.105 Which one of the follwoing statements about the particular entity is **true** -

(1) The *gene for producing insulin* is present in every body cell

(2) *Nucleosome* is formed of nucleotides

(3) DNA consists of a core of eight histones

(4) Centromere is found in animals cells, which produces aster during cell division

Q.106 Which one of the following pairs of structures is correctly matched with their correct description –

	Structure	Description
(1)	Cartilage and cornea	No blood supply but do require oxygen for respiratory need
(2)	Shoulder joint and elbow joint	Ball and socket type of joint
(3)	Premolars and molars	20 in all and 3- rooted
(4)	Tibia and fibula	Both form parts of knee joint

Q.107 If for some reason the parietal cells of the gut epithelium become partially non-functional, what is likely to happen -

(1) The pH of stomach will fall abruptly

(2) Steapsin will be more effective

(3) Proteins will not be adequately hydrolysed by pepsin into proteoses and peptones

(4) The pancreatic enzymes and specially the trypsin and lipase will not work efficiently

Q.108 In human female the *blastocyst*-

(1) gets implanted into uterus 3 days after ovulation

(2) gets nutrition from uterine endometiral secretion only after implanation

(3) gets implanted in endometrium by the trophoblast cells

(4) forms placenta even before implantation

Q.109 Secretions from which one of the following are rich in fructose, calcium and some enzymes -

(1) Liver

(2) Pancreas

(3) Salivary glands

(4) Male accessory glands

Q.110 When domestic sewage mixes with river water -

(1) The increased microbial activity releases micro-nutrients such as iron

(2) The increased microbial activity uses up dissolved oxygen

(3) The river water is still suitable for drinking as impurities are only about 0.1%

(4) Small animals like rats will die after drinking river water

Q.111 Which one of the following is *most appropriately* defined -

(1) *Amensalism* is a relationship in which one species is benefited where as the other is unaffected

(2) *Predator* is an organism that catches and kills other organism for food.

(3) *Parasite* is an organism which always lives inside the body of other organism and may kill it.

(4) Host is an organism which provides food to another organism.

Q.112 Jaundice is a disorder of -

(1) Skin and eyes (2) Digestive system

(3) Circulatory system (4) Excretory system

Q.113 A person suffering from a disease caused by *Plasmodium*, experiences recurring chill and fever at the time when -

(1) the trophozoites reach maximum growth and give out certain toxins

(2) the parasite after its rapid multiplication inside RBCs ruptures them, releasing the stage to enter fresh RBCs.

(3) the microgametocytes and megagametocytes are being destroyed by the WBCs.

(4) the sporozoites released from RBCs are being rapidily killed and broken down inside spleen

Q.114 Which one of the following techniques is safest for the detection of cancers -

(1) Radiography (X-ray)

(2) Computed tomography (CT)

(3) Histopathological studies

(4) Magnetic resonance imaging (MRI)

Q.115 The 3'-5' phosphodiester linkages inside a polynucleotide chain serve to join -

(1) One nucleoside with another nucleoside

(2) One nucleotide with another nucleotide

(3) One nitrogenous base with pentose sugar

(4) One DNA strand with the other DNA strand

Q.116 In genetic engineering, a DNA segment (gene) of interest,is transferred to the host cell through a vector. Consider the following four agents (A-D) in this regard and select the correct option about which one or more of these can be used as a vecotr / vectors –

(A) a bacterium (B) plasmid

(C) plasmodium (D) bacteriophage

Options :

(1) (A) only

(2) (A) and (C) only

(3) (B) and (D) only

(4) (A), (B) and (D) only

Q.117 The fruit fly *Drosophila melanogaster* was found to be very suitable for experimental verification of chromosomal theory of inheritance by Morgan and his collegues because –

(1) a single mating produces two young flies

(2) smaller female is easily reconisable from large male

(3) it completes life cycle in about two weeks

(4) it reproduces parthenogenetically

Q.118 Signals from fully developed foetus and placenta ultimately lead to parturition which requires the releas of -

(1) Oxytocin from maternal pituitary

(2) Oxytocin from foetal pituitary

(3) Relaxin from placenta

(4) Estrogen from placenta

Q.119 The Indian Rhinoceros is a natural inhabitant of which one of the Indian states -

(1) Uttar Pradesh

(2) Himachal Pradesh

(3) Assam

(4) Uttarakhand

Q.120 The haemoglobin content per 100 ml of blood of a normal healthy human adult is -

(1) 25-30 g (2) 17-20g

(3) 12-16 g (4) 5-11