Test Booklet Code

S

AIPMT - 2014

Do not open this Test Booklet until you are asked to do so.

Important Instructions :

1. The Answer Sheet is kept inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on **side-1** and **side-2** carefully with **blue/black** ball point pen only.
3. The test is of **3 hours** duration and Test Booklet contains of **180** questions. Each question carries **4** marks. For each correct response, the candidate will get **4** marks. For each incorrect response, **one mark** will be deducted from the total scores. The maximum marks are **720.**
3. Use ***Blue/Black Ball Point Pen only*** for writing particulars on this page / marking responses.
4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
5. **On completion of the test, the candidate must handover the Answer Sheet to the Invigilator before leaving the Room / Hall. The candidates are allowed to take away this Test Booklet with them.**
6. The CODE for this Booklet is **S**. Make sure that the CODE printed on **Side–2** of the Answer Sheet is the same as that on this booklet. In case of discrepancy, the candidate should immediately report the matter to the invigilator for replacement of both the Test Booklet and the Answer Sheet.
7. The candidates should ensure that the Answer Sheet is not folded. DO not make any stray marks on the Answer Sheet. Do not write your roll no. anywhere else except in the specified space in the Test Booklet / Answer Sheet.
8. Use of white fluid for correction is **NOT** permissible on the Answer Sheet.
9. Each candidate must show on demand his / her Admission Card to the Invigilator.
10. No candidate, without special permission of the Superintendent or Invigilator, would leave his / her seat.
11. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign the Attendance Sheet twice. Cases where a candidate has not signed the Attendance Sheet second time will be deemed not to have handed over Answer Sheet and dealt with as an unfair means case.
12. Use of Electronic / Manual Calculator is prohibited.
13. The candidates are governed by all Rules and Regulations of the Board with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of the Board.
14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.
15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet / Answer Sheet in the Attendance Sheet.

Name of the Candidate (in Capitals) : ________________________________

Roll Number : in figures ________________________________

: in words ________________________________

Centre of Examination (in Capitals) : ________________________________

Candidate's Signature : ____________________ Invigilator's Signature : ____________________

Fascimile signature stamp of Centre Superintendent ________________________________

Questions and Solutions

PHYSICS

1. The mean free path of molecules of a gas,(radius 'r') is inversely proportional to :

(1) r (2) $\sqrt{r}$ (3) r^3 (4) r^2

1. (4)

[Fact]

2. A particle is moving such that its position coordinates (x, y) are (2m, 3m) at time t = 0, (6m, 7m) at time t = 2s and (13m, 14m) at time t= 5s.

Average velocity vector $\left(\vec{V}_{av}\right)$ from t = 0 to t = 5s is :

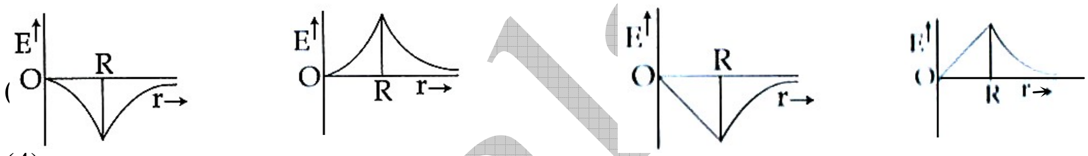
(1) $2\left(\hat{i}+\hat{j}\right)$ (2) $\frac{11}{5}\left(\hat{i}+\hat{j}\right)$ (3) $\frac{1}{5}\left(13\hat{i}+14\hat{j}\right)$ (4) $\frac{7}{3}\left(\hat{i}+\hat{j}\right)$

2. (2)

$$\overrightarrow{\Delta r} = \overrightarrow{r_5} - \overrightarrow{r_0} = \left(13\hat{i}+14\hat{j}\right)-\left(2\hat{i}-3\hat{j}\right) = 11\hat{i}+11\hat{j}$$

$$\therefore \quad <\vec{v}> = \frac{\overrightarrow{\Delta r}}{\Delta t} = \frac{11}{5}\left(\hat{i}+\hat{j}\right)$$

3. Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represented by:



3. (4)

[Fact]

4. When the energy of the incident radiation is increased by 20%, the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5 eV to 0.8 eV. The work function of the metal is :

(1) 1.3 eV (2) 1.5eV (3) 0.65 eV (4) 1.0 eV

4. (4)

Original energy of photon be E_0

$K_1 = E_0 - \phi \quad \Rightarrow 0.5 \text{ eV} = E_0 - \phi$ … (i)

$K_2 = 1.2\, E_0 - \phi \quad \Rightarrow 0.8 \text{ eV} = 1.2E_0 - \phi$ … (ii)

From equation (i) and (ii)

$0.2\phi = (0.8 - 1.2 \times 0.8) \text{ eV} \Rightarrow \phi = 1 \text{ eV}$

5. In an ammeter 0.2% of main current passes through the galvanometer. If resistance of galvanometer is G, the resistance of ammeter will be:

(1) 1/500 G (2) 500/499 G (3) 1/499 G (4) 499/500 G

5. (1)

Let the shunt resistance be S.

$$0.002 \times G = 0.998 \times S \quad \Rightarrow S = \frac{G}{499}$$

$$\therefore \text{ Resistance of ammeter} = \frac{\frac{G}{499}\times G}{G+\frac{G}{499}} = \frac{G}{500}$$

6. A balloon with mass 'm' is descending down with an acceleration 'a'(where a<g). How much mass should be removed from it so that it starts moving up with an acceleration 'a' ?

(1) $\frac{ma}{g+a}$ (2) $\frac{ma}{g-a}$ (3) $\frac{2ma}{g+a}$ (4) $\frac{2ma}{g-a}$

6. (3)

Let the up thrust on balloon be U.

$mq - U = ma$ … (i)

If Δm is removed.

$U = (m - \Delta m)g = (m - \Delta m)a$ … (ii)

$\Rightarrow \quad \Delta m = \left(\frac{2m}{a+g}\right)a$

7. The Binding energy per nucleon of ${}^{7}_{3}Li$ and ${}^{4}_{2}He$ nuclei are 5.60 MeV and 7.06 MeV , respectively. In the nuclear reaction ${}^{7}_{3}Li + {}^{1}_{1}H \longrightarrow {}^{4}_{2}He + {}^{4}_{2}He + Q$, the value of energy Q released is :

(1) 8.4 MeV (2) 17.3 MeV (3) 19.6 MeV (4) −2.4 MeV

7. (2)

${}^{7}_{3}Li + {}^{1}_{1}H \rightarrow {}^{4}_{2}He + {}^{4}_{2}He + Q$

$Q = -BE_4 + 2BE_{He} = -7 \times 5.60 + 2 \times 7.06 \times 4 = -39.20 + 14.12 \times 4$

$\Rightarrow Q = -39.20 + 56.48 = 17.28$

8. The angel of a prism is 'A'. One of its refracting surfaces is silvered. Light rays falling at an angle of incidence 2A on the first surface returns back through the same path after suffering reflection at the silvered surface. The refractive index μ, of the prism is :

(1) $\frac{1}{2}\cos A$ (2) tan A (3) 2 sin A (4) 2 cos A

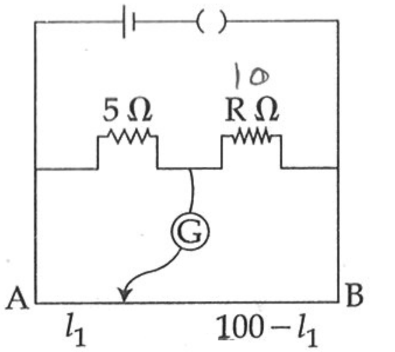
8. (4)

$r_1 + r_2 = A$: Here $r_2 = 0$

$\therefore \quad r_1 = A$

$\therefore \quad \frac{\sin i_1}{\sin r_1} = \mu \Rightarrow \frac{\sin 2A}{\sin A} = \mu \Rightarrow \mu = 2\cos A$

9. The resistance in the two arms of the meter bridge are 5 Ω and R Ω, respectively. When the resistance R is shunted with an equal resistance, the new balance point is at $1.6\ell_1$. The resistance 'R' is :



(1) 20 Ω (2) 25Ω (3) 10Ω (4) 15Ω

9. (D)

Before shunting

$$\frac{5}{l_i} = \frac{R}{(100-l_i)} \quad \ldots \text{(i)}$$

After shunting

$$\frac{5}{1.6\,l_1} = \frac{R}{2(100-1.6\,l_1)} \quad \ldots \text{(ii)}$$

$$\text{(i), (ii)} \Rightarrow 1.6 = \frac{2(100-1.6\,l_1)}{100-l_1} \Rightarrow 160 - 1.6\,l_1 = 200 - 3.2\,l_1 \Rightarrow 1.6\,l_1 = 40$$

$$\Rightarrow \quad l_1 = \frac{400}{16} = 25$$

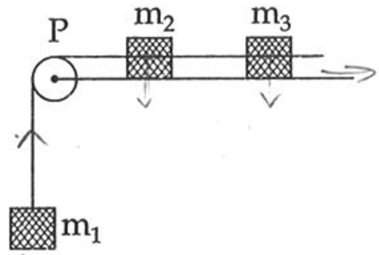
10. Two cities are 150 km apart. Electric power is sent from one city to another city through copper wires. The fall of potential per km is 8 volt and the average resistance per km is 0.5 Ω. The power loss in the wire is :

(1) 19.2 J (2) 12.2 kW (3) 19.2 W (4) 19.2 kW

10. (4)

$$P = \frac{v^2}{R} = \frac{(8\times150)^2}{0.5\times150} = 64 \times 150 \times 2 = 64 \times 300 = 19200 \text{ watt}$$

11. A system consists of three masses m_1, m_2 and m_3 connected by a string passing over a pulley P. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction = μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is : (Assume $m_1 = m_2 = m_3 = m$)



(1) $\frac{g(1-2\mu)}{3}$ (2) $\frac{g(1-2\mu)}{2}$

(3) $\frac{g(1-g\mu)}{9}$ (4) $\frac{2g\mu}{3}$

11. (1)

$$a = \frac{m_1 - \mu(m_2+m_3)}{m_1+m_2+m_3}.g = \left(\frac{1-2\mu}{3}\right)g$$

12. If the kinetic energy of the particle is increased to 16 times its previous value, the percentage change in the de−Broglie wavelength of the particle is :

(1) 60 (2) 50 (3) 25 (4) 75

12. (4)

$$\lambda = \frac{h}{p} = \frac{\lambda_2}{\lambda_1} = \frac{p_1}{p_2} = \sqrt{\frac{E_1}{E_2}} = \frac{\lambda_2}{\lambda_1} = \frac{1}{4} \Rightarrow \frac{\Delta\lambda}{\lambda_1} = \frac{-3}{4}$$

13. A beam of light of λ=600 nm from a distant source falls on a single slit 1mm wide and the resulting diffraction pattern is observed on a screen 2m away. The distance between first dark fringes on either side of the central bright fringe is :

(1) 2.4 cm (2) 2.4 mm (3) 1.2 cm (4) 1.2 mm

13. (2)

b $\sin\theta = \lambda$ distance between dark fringes = $D(2\theta)$

$$\therefore \text{ required distance} = \frac{2D\lambda}{b} = \frac{2\times 2\times 600\times 10^{-6}}{10^{-3}} = 2400 \times 10^{-6} = 2.4 \text{ mm}$$

14. A block hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass = 5.98×10^{24} kg) have to be compressed to be a black hole ?

(1) 10^{-2} m (2) 100 m (3) 10^{-9} m (4) 10^{-6} m

14. (1)

$$v_e = \sqrt{\frac{2GM}{R}} = c \Rightarrow R = \frac{2GM}{c^2} = \frac{2\times 6.67\times 10^{-11}\times 5.98\times 10^{24}}{9\times 10^{16}} = 8.8\times 10^{-3} \approx 10^{-2} \text{ m}$$

15. The oscillation of a body on a smooth horizontal surface is represented by the equation,

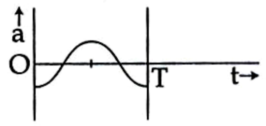
X = A cos (ωt)

Where X = displacement at time t

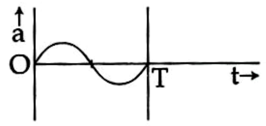
ω = frequency of oscillation

Which one of the following graphs shows correctly the variation 'a' with 't' ?

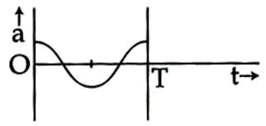
(1)



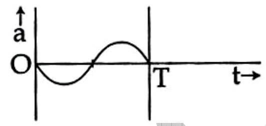
(2)



(3)



(4)



Here, a = acceleration at time 't' and T = time period

15. (1)

$\vec{a} = -\omega^2 \vec{x}$

16. A solid cylinder of mass 50 kg and radius 0.5 m is free to rotate about the horizontal axis. A massless string is wound round the cylinder with one end attached to it and other hanging freely. Tension in the string required to produce an angular acceleration of 2 revolutions s^{-2} is :

(1) 78.5 N (2) 157 N (3) 25 N (4) 50 N

16. (1)

$$T = \frac{I\alpha}{R} = \frac{1}{2}\times\frac{50\times 0.5\times 0.5\times 2\times \pi}{0.5} = 25\,\pi N$$

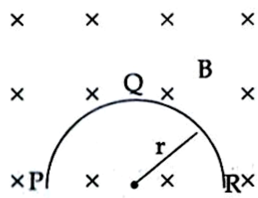
17. The ratio of the accelerations for a solid sphere (mass 'm' and radius 'R') rolling down an incline of angle 'θ' without slipping and slipping down the incline without rolling is :

(1) 2 : 5 (2) 7 : 5 (3) 5 : 7 (4) 2 :3

17. (3)

Required ratio $= \dfrac{1}{1+\dfrac{I}{MR^2}} = \dfrac{1}{1+\dfrac{2}{5}} = \dfrac{5}{7}$

18. A thin semicircular conducting ring (PQR) of radius 'r' is falling with its plane vertical in a horizontal magnetic field B, as shown in figure. The potential difference developed across the ring when its speed is v, is :



(1) πrBv and R is at higher potential
(2) $2rBv$ and R is at higher potential
(3) Zero
(4) $Bv\pi r^2/2$ & P is at higher potential

18. (2)

Effective length $= 2r$
Potential developed $= 2rBv$

19. In the Young's double−slit experiment, the intensity of light at a point on the screen where the path difference is λ is K,(λ being the wave length of light used). The intensity at a point where the path difference is $\lambda/4$, will be :

(1) K/2 (2) Zero (3) K (4) K/4

19. (1)

$I = 4I_o \cos^2\left(\dfrac{S}{2}\right)$

$4I_0 = K \quad \because \delta = 2\pi$ if path different $= \lambda$

Phase difference when path difference $= \dfrac{\Delta}{4}$ is equal to $\dfrac{2\Delta}{\lambda}\cdot\dfrac{\lambda}{4} = \dfrac{\pi}{2}$

$\therefore\ I = k\cos^2\left(\dfrac{\pi}{4}\right)$

20. A radio isotope 'X' with a half life 1.4×10^9 years decays to 'Y' which is stable. A sample of the rock from a cave was found to contain 'X' and 'Y' in the ratio 1 : 7. The age of the rock is

(1) 4.20×10^9 years
(2) 8.40×10^9 years
(3) 1.96×10^9 years
(4) 3.92×10^9 years

20. (1)

$\therefore\ x = 8x\, e^{-\lambda t}$

$\Rightarrow\ t = \dfrac{3\,\ell n2}{\lambda} = 3t_{1/2}$

$= \dfrac{6.6\times10^{-34}\times10^{8}}{325\times10^{-10}\times1.6\times10^{-19}}$

$= \dfrac{33}{325\times8}\times10^3 = 3$

$= 13.6 - \dfrac{13.6}{m^2} = 12.73$

21. Light with an energy flux of $25 \times 10^4 Wm^{-2}$ falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 cm^2, the average force exerted on the surface is

(1) 1.20×10^{-6} N (2) 3.0×10^{-6} N (3) 1.25×10^{-6} N (4) 2.50×10^{-6} N

21. (4)

$$\text{Force} = \frac{2\,I_A}{c} = \frac{2\times 2^5 \times 10^4 \times 5 \times 10^{-4}}{3\times 10^8} = 250 \times 10^{-8}\text{ N}$$

22. Certain quantity of water cools from 70°C to 60°C in the first 5 minutes and to 54° C in the next 5 minutes. The temperature of the surroundings is

(1) 42°C (2) 10°C (3) 45°C (4) 20°C

22. (3)

$$\Delta T = \Delta T_o\, e^{-kt}$$

$$\therefore \quad (60 - T_S) = (70 - T_s)\, e^{-k \times 5}$$

$$54 - T_S = (60 - T_s)\, e^{k5}$$

$$\Rightarrow \quad (60 - T_S)_2 = (54 - T_S)(70 - T_S)$$

$$\Rightarrow \quad 3600 + T_S^2 - 120\,T_S = 3780 - 124\,T_S + T_S^2$$

$$\Rightarrow \quad T_S = \frac{180}{4} = 45°\text{ C}$$

23. A monoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2v and then adiabatically to a volume 16v. The final pressure of the gas is: (Take $\gamma = 5/3$)

(1) P/64 (2) 16P (3) 64P (4) 32P

23. (1)

$$P_2V_2 = P_1V_1$$

$$P_2 = \frac{PV}{2V} = \frac{P}{2}$$

$$P_2\,V_2^{\gamma} = P_3\,V_3^{\gamma}$$

$$\frac{P}{2}(2v)^{\gamma} = P_3\,(16V)^{\gamma}$$

$$P_3 = \frac{P}{2}\left(\frac{2V}{16V}\right)^{\gamma} = \frac{P}{2}\left(\frac{1}{8}\right)^{\frac{5}{3}}$$

$$= \frac{P}{2(32)} = \frac{P}{64}$$

24. A projectile is fired from the surface of the earth with a velocity of 5ms−1 and angle θ with the horizontal. Another projectile fired from another planet with a velocity of 3 m/s at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in ms−2) is : (given g = 9.8 m/s2)

(1) 16.3 (2) 110.8 (3) 3.5 (4) 5.9

24. (3)

$$R_1 = R_2$$

$$\frac{(5)^2 \sin 2\theta}{2g} = \frac{(3)^2 \sin 2\theta}{2g'}$$

$$g' = \left(\frac{3}{5}\right)^2 g = \frac{9}{25}(9.8) = 3.5\text{ m/s}^2$$

25. In a region, the potential is represented by V(x, y, z) = 6x − 8xy − 8y + 6yz, where V is in volts and x, y, z are in meters. The electric force experienced by a charge of 2 coulomb situated at point (1,1,1) is:

(1) 24N (2) $4\sqrt{35}$N (3) $6\sqrt{5}$N (4) 30N

25. (2)

$$E = \left(\frac{\delta v}{\delta x}\hat{i} + \frac{\delta v}{\delta y}\hat{j} + \frac{\delta v}{\delta z}\hat{k}\right)$$

(at 1, 1, 1)

$$E_x = \frac{-\delta v}{\delta a} \quad = -(6-8y) \quad = -(6-8(1) \quad = 2$$

$$E_y = -\frac{\delta v}{\delta y} \quad = -(-8x-8+6z) \quad = -(-8-8+6) \quad = 10$$

$$E_z = -\frac{\delta v}{\delta z} \quad = -(6y) \quad = -6$$

$$|\vec{F}| = q|\vec{E}| = q\sqrt{(2)^2+(6)^2+10^2}\ N$$

$$= 2\sqrt{140}\ N$$

$$= 4\sqrt{35}\ N$$

26. Hydrogen atom in ground state is excited by a monochromatic radiation of λ = 975 Å . Number of spectral lines in the resulting spectrum emitted will be:

(1) 6 (2) 10 (3) 3 (4)2

26. (1)

$$\Delta E = \frac{hc}{\lambda} = \frac{6.64\times10^{-34}\times3\times10^{8}}{9.75\times10^{-8}\times1.6\times10^{-19}}ev$$

$$= \frac{6.64\times30}{9.75\times1.6}$$

$$= 12.77\ ev$$

$$12.77 = 13.6\left(1-\frac{1}{n^2}\right)$$

$$\frac{13.6}{n^2} = 13.6 - 12.77$$

$$\frac{13.6}{n^2} = 0.83$$

$$n^2 = \frac{13.6}{0.83} = 16.38$$

$\Rightarrow$ n = 4

No of line 6

27. The barrier potential of a p-n junction depends on:

(a) type of semi conductor material

(b) amount of doping

(c) temperature

Which one of the following is correct?

(1) (b) and (c) only (2) (a),(b) and (c) (3) (a) and (b) only (4) (b) only

27. (2)

Factual

28. If n_1, n_2, and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by:

(1) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$ (2) $n = n_1 + n_2 + n_3$

(3) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$ (4) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

28. (3)

$$\ell_1 + \ell_2 + \ell_3$$

$$\ell = \frac{V}{2n}$$

$$\Rightarrow \quad \frac{V}{2n} = \frac{V}{2n_1} + \frac{V}{2n_2} + \frac{V}{2n_3}$$

$$\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$$

29. If force (F), velocity (V) and time(T) are taken as fundamental units, then the dimensions of mass are:

(1) $[F\ V^{-1}\ T^{-1}]$
(2) $[F\ V^{-1}\ T]$
(3) $[F\ V\ T^{-1}]$
(4) $[F\ V\ T^{-2}]$

29. (2)

$$F = \frac{mV}{t} \Rightarrow (m) = F\,V^{-1}\,T$$

30. If the focal length of objective lens is increased then magnifying power of :

(1) microscope and telescope both will decrease.
(2) microscope will decrease but that of telescope will increase
(3) microscope will increase but that of telescope will decrease
(4) microscope and telescope both will increase

30. (2)

$$m_T = \frac{f_o}{f_e}$$

$$m_m = \frac{-\ell}{f_o}\frac{D}{f_e}$$

if f_0 is increased

m_T will increase, m_m will decrease.

31. A potentiometer circuit has been set up for finding the internal resistance of a given cell. The main battery, used across the potentiometer wire, has an emf of 2.0 V and a negligible internal resistance. The potentiometer wire itself is 4 m long. When the resistance, R connected across the given cell, has value of.

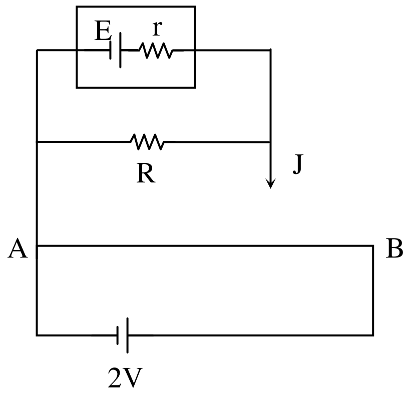
(i) infinity
(ii) 9.5Ω,

the 'balancing lengths' , on the potentiometer wire are found to be 3m and 2.85m, respectively.

The value of internal resistance of the cell is:

(1) 0.5Ω (2) 0.75Ω (3) 0.25Ω (4) 0.95Ω

31. (1)



AB = 4m

When R = ∞; E α (3m)

When R = 9.5Ω

$$\Rightarrow 1 + \frac{r}{9.5} = \frac{300}{285}$$

$$R = \frac{9.5E}{9.5 + r} \alpha 2.85$$

$$\Rightarrow r = \frac{9.5}{19} = 0.5\ \Omega$$

32. Copper of fixed volume 'V' is drawn into wire of length 'l'. When this wire is subjected to a constant force 'F', the extension produced in the wire is 'Δl'.
Which of the following graphs is straight line?

(1) Δl versus $1/l^2$ (2) Δl versus l (3) Δl versus $1/l$ (4) Δl versus l^2

32. (4)

$$Y = \frac{F}{A\frac{\Delta \ell}{\ell}}$$

$$Y = \frac{F\ell}{A\Delta\ell} = \frac{F\ell^2}{(A\ell)\Delta\ell} = \frac{F\ell^2}{VA\ell}$$

$$\Delta\ell = \frac{F}{VY}\ell^2$$

$$\Delta\ell \propto \ell^2$$

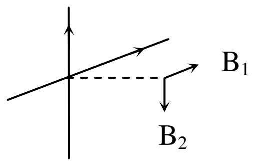
$\Delta\ell$ vs ℓ^2 will be next line.

33. Two identical long conducting wires AOB and COD are placed at right angle to each other, with one above other such that 'O' is their common point for the two. The wires carry I_1 and I_2 currents, respectively. Point 'P' is lying at distance 'd' from 'O' along a direction perpendicular to the plane containing the wires. The magnetic field at the point 'P' will be :

(1) $\frac{\mu_0}{2\pi d}\left(I_1^2 - I_2^2\right)$ (2) $\frac{\mu_0}{2\pi d}\left(I_1^2 + I_2^2\right)^{1/2}$

(3) $\frac{\mu_0}{2\pi d}\left(I_1 / I_2\right)$ (4) $\frac{\mu_0}{2\pi d}\left(I_1 + I_2\right)$

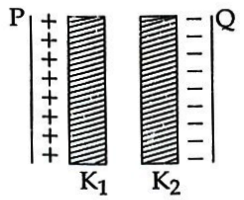
33. (2)

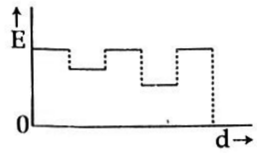


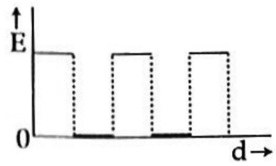
$$\Rightarrow B = \sqrt{B_1^2 + B_2^2}$$

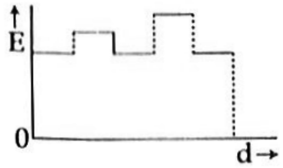
$$= \frac{\mu_0}{2\pi d}\sqrt{I_1^2 + I_2^2}$$

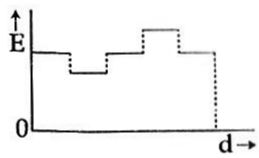
34. Two thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by :



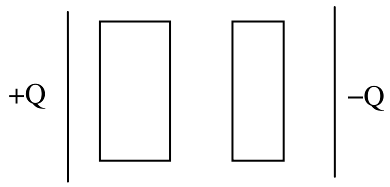
(1)


(2)


(3)


(4)


34. (1)

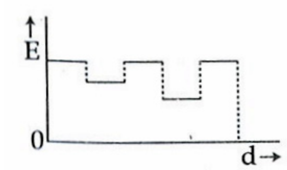


$E_V = E_0$

$E_k = \dfrac{E_0}{k}$

$k_2 > k_1$

$E_2 < E_1$



35. The number of possible natural oscillations of air column in a pipe closed at one end of length 85 cm whose frequencies lie below 1250 Hz are : (velocity of sound = 340 ms^{-1})

(1) 7 (2) 6 (3) 4 (4) 5

35. (2)

$(2n+1)\dfrac{V}{4\ell} < 1250$

$(2n + 1) < \dfrac{1250(4)(0.85)}{340}$

$< \dfrac{1250}{100}$

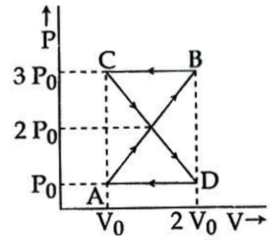
$(2n + 1) < 12.5$

Possible odd no. are

1, 3, 5, 7, 9, 11

i.e. 6

36. A thermodynamics system undergoes cyclic process ABCDA as shown in fig. The work done by the system in the cycle is :



(1) $\frac{P_0V_0}{2}$ (2) Zero

(3) P_0V_0 (4) $2\ P_0V_0$

36. (2)

$W_{AB} = \frac{1}{2}(P_o + 3P_o)\ V_o = 2P_0V_0$

$W_{BC} = -\ 3P_o(V_0) = -\ 3P_oV_0$

$W_{CD} = \frac{1}{2}(3P_o + P_o)V_o = 2\ P_o\ V_0$

$W_{DA} = -\ P_oV_o$

$W_{nc} = 2\ P_oV_o - 3\ P_oV_o + 2P_o\ V_o - P_oV_o = 0$

37. A transformer having efficiency of 90% is working on 200 V and 3 kW power supply. If the current in the secondary coil is 6A, the voltage across the secondary coil and the current in the primary coil respectively are :

(1) 450 V, 13.5 A (2) 600 V, 15 A (3) 300 V, 15 A (4) 450 V, 15 A

37. (4)

$I_i = \frac{p_i}{v_i} = \frac{3000}{200} = 15\ A$

$P_o = nP_i = 2700$

$V_o = \frac{P_o}{I_o} = \frac{2700}{6} = 450\ v$

38. Steam at 100°C is passed into 20 g of water at 10°C. When water acquires a temperature of 80°C, the mass of water present will be :

[Take specific heat of water = 1 cal $g^{-1}\ °C^{-1}$ and latent heat of steam = 540 cal g^{-1}]

(1) 42.5 g (2) 22.5 g (3) 24 g (4) 31.5 g

38. (2)

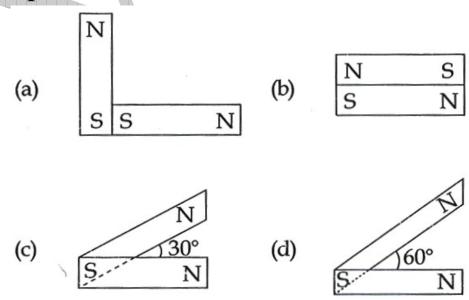
$\Delta Q_{gain} = 20\ (1)\ (70) = 1400\ Cal$

$\Delta Q_{loss} = mLv + m\ (1)\ (20) = m\ (540 + 20) = 560\ m$

$560\ m = 1400$

$m = \frac{1400}{560} = \frac{10}{4} = 2.5\ gm \Rightarrow m_w = 20 + m = 22.5\ gm$

39. Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment $\vec{m}$. Which configuration has highest net magnetic dipole moment?



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

39. (1)

$m_{net} = \sqrt{m_1^2 + m_2^2 + 2m_1m_2\cos\theta}$

So less angle high m_{net} i.e. 30°, (C)

40. A conducting sphere of radius R is given a charge Q. The electric potential and the electric field at the centre of the sphere respectively are :

(1) $\frac{Q}{4\pi\varepsilon_0 R}$ and $\frac{Q}{4\pi\varepsilon_0 R^2}$ (2) Both are zero

(3) Zero and $\frac{Q}{4\pi\varepsilon_0 R^2}$ (4) $\frac{Q}{4\pi\varepsilon_0 R}$ and zero

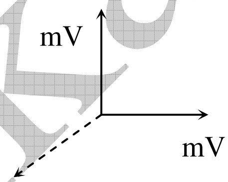
40. (4)

$$V = \frac{Q}{4\pi\varepsilon_\circ R}, \quad E = 0$$

41. A body of mass (4m) is lying in x−y plane at rest. It suddenly explodes into three pieces. Two pieces, each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to explosion is :

(1) $2\,mv^2$ (2) $4\,mv^2$ (3) mv^2 (4) $\frac{3}{2}mv^2$

41. (4)



$$2mV' = \sqrt{2}mv$$

$$V' = \frac{v}{\sqrt{2}}$$

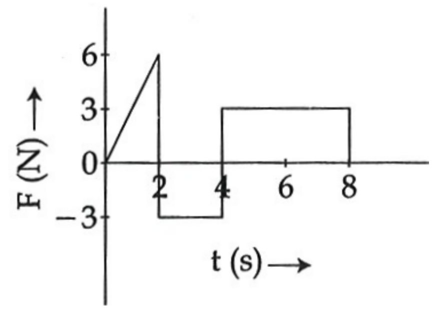
$$\Rightarrow K_f = 2\left(\frac{1}{2}mv^2\right) + \frac{1}{2}(2m)\left(\frac{v}{\sqrt{2}}\right)^2 = \frac{3mv^2}{2}$$

$$K_i = 0$$

$$\Rightarrow \Delta K = \frac{3mv^2}{2}$$

42. The force 'F' acting on a particle of mass 'm' is indicated by the force−time graph shown below. The change in momentum of the particle over the time interval from zero to 8 s is :

(1) 12 Ns
(2) 6 Ns
(3) 24 Ns
(4) 20 Ns



42. (1)

$$\Delta P = \int F\,dt = \text{Area under F-t}$$

$$= \frac{1}{2}6(2) - (3)(2) + 3(4) = 12\ N - S$$

43. A speeding motorcyclist sees traffic jam ahead of him. He slows down to 36 km/hour. He finds that traffic has eased and a car moving ahead of him at 18 km/hour is honking at a frequency of 1392 Hz. If the speed of sound is 343 m/s, the frequency of the honk as heard by him will be :

(1) 1412 Hz (2) 1454 Hz (3) 1332 Hz (4) 1372 Hz

43. (2)

$$V_o = 36\ km/hr = 10\ m/s$$

$$V_s = 18\ km/hr = 5\ m/s$$

$$f' = \left(\frac{v + v_o}{v + v_s}\right) = \left(\frac{343+10}{343+5}\right)1392$$

$$= \frac{353}{348}(1392) = 1412\ Hz$$

44. A certain number of spherical drops of a liquid of radius 'r' coalesce to form a single drop of radius 'R' and volume 'V'. If 'T' is the surface tension of the liquid, then :

(1) energy = $3VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released

(2) energy is neither released nor absorbed

(3) energy = $4VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released

(4) energy = $3VT\left(\frac{1}{r}+\frac{1}{R}\right)$ is absorbed

44. (1)

$V_i = \frac{V}{n}$

$r_i = \frac{R}{n^{\frac{1}{3}}} \Rightarrow n^{\frac{1}{3}} = \frac{R}{r}$

$\Delta U = U_f - U_i = T\,4\pi\,(R^2 - nr^2)$

$= T\,4\pi R^2\left(1-\frac{n}{n^{\frac{2}{3}}}\right)$

$= T\,4\pi R^2\left(1-\frac{R}{r}\right)$

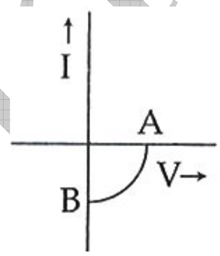
$= T\,4\pi R^3\left(\frac{1}{R}-\frac{1}{r}\right)$

$= T\,3\left(\frac{4}{3}\pi R^3\right)\left(\frac{1}{R}-\frac{1}{r}\right)$

$= 3VT\left(\frac{1}{R}-\frac{1}{r}\right)$

ΔU is −ve so energy released.

45. The given graph represents V−I characteristic for a semiconductor device.



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

(1) It is for a photodiode and points A and B represent open circuit voltage and current, respectively

(2) It is for a LED and points A and B represent open circuit voltage and short circuit current, respectively

(3) It is V−I characteristic for solar cell where, point A represents open circuit voltage and point B short circuit current

(4) It is for a solar cell and points A and B represent open circuit voltage and current, respectively

45. (3)

Factual

BIOLOGY

46. Planaria possess high capacity of :
(1) alternation of generation (2) bioluminescence
(3) metamorphosis (4) regeneration

46. (4)

47. An example of ex situ conservation is :
(1) Wildlife Sanctuary (2) Sacred Grove
(3) National Park (4) Seed Bank

47. (4)

48. To obtain virus−free healthy plants from a diseased one by tissue culture technique, which part/parts of the diseased plant will be taken?
(1) Both apical and axillary meristems (2) Epidermis only
(3) Apical meristem only (4) Palisade parenchyma

48. (3)

49. The motile bacteria are able to move by :
(1) cilia (2) pili (3) fimbriae (4) flagella

49. (4)

50. A marine cartilaginous fish that can produce electric current is :
(1) Trygon (2) Scoliodon (3) Pristis (4) Torpedo

50. (4)

51. You are given a fairly old piece of dicot stem and a dicot root. Which of the following anatomical structures will you use to distinguish between the two?
(1) Protoxylem (2) Cortical cells
(3) Secondary xylem (4) Secondary phloem

51. (3)

52. In a population of 1000 individuals 360 belong to genotype AA, 480 to Aa and the remaining 160 to aa. Based on this data, the frequency of allele A in the population is :
(1) 0.6 (2) 0.7 (3) 0.4 (4) 0.5

52. (1)

53. Fructose is absorbed into the blood through mucosa cells of intestine by the process called :
(1) simple diffusion (2) co−transport mechanism
(3) active transport (4) facilitated transport

53. (4)

54. Which of the following causes an increase in sodium reabsorption in the distal convoluted tubule?
(1) Decrease in aldosterone levels (2) Decrease in antidiuretic hormone levels
(3) Increase in aldosterone levels (4) Increase in antidiuretic hormone levels

54. (3)

55. A few normal seedlings of tomato were kept in a dark room. After a few days they were found to have become white−coloured like albinos. Which of the following terms will you use to describe them?
(1) Etiolated (2) Defoliated (3) Mutated (4) Embolised

55. (1)

56. Stimulation of a muscle fiber by a motor neuron occurs at :
(1) the myofibril (2) the sarcoplasmic reticulum
(3) the neuromuscular junction (4) the transverse tubules

56. (3)

57. In vitro clonal propagation in plants is characterized by :
(1) Electrophoresis and HPLC (2) Microscopy
(3) PCR and RAPD (4) Northern blotting

57. (3)

58. Deficiency symptoms of nitrogen and potassium are visible first in :
(1) Roots (2) Buds (3) Senescent leaves (4) Young leaves

58. (3)

59. Fight−or−flight reactions cause activation of :
(1) the adrenal medulla, leading to increased secretion of epinephrine and norepinephrene.
(2) the pancreas leading to a reduction in the blood sugar levels.
(3) the parathyroid glands, leading to increased metabolic rate.
(4) the kidney, leading to suppression of reninangiotensin−aldosterone pathway.

59. (1)

60. If 20 J of energy is trapped at producer level, then how much energy will be available to peacock as food in the following chain?
Plant $\rightarrow$ mice $\rightarrow$ snake $\rightarrow$ peacock
(1) 0.2 J (2) 0.0002 J (3) 0.02 J (4) 0.002 J

60. (3)

61. Male gametophyte with least number of cells is present in :
(1) Lilium (2) Pinus (3) Pteris (4) Funaria

61. (3)

62. A scrubber in the exhaust of a chemical industrial plant removes :
(1) gases like ozone and methane
(2) particulate matter of the size 2.5 micrometer or less
(3) gases like sulphur dioxide
(4) particulate matter of the size 5 micrometer or above

62. (3)

63. Fruit colour in squash is an example of :
(1) Complementary genes (2) Inhibitory genes
(3) Recessive epistasis (4) Dominant epistasis

63. (4)

64. A location with luxuriant growth of lichens on the trees indicates that the :
(1) location is highly polluted (2) location is not polluted
(3) trees are very healthy (4) trees are heavily infested

64. (2)

65. At which stage of HIV infection does one usually show symptoms of AIDS?
(1) When HIV damages large number of helper T−Lymphocytes.
(2) When the viral DNA is produced by reverse transcriptase.
(3) Within 15 days of sexual contact with an infected person.
(4) When the infected retro virus enters host cells.

65. (1)

66. The first human hormone produced by recombinant DNA technology is :
(1) Thyroxin (2) Progesterone (3) Insulin (4) Estrogen

66. (3)

67. The main function of mammalian corpus luteum is to produce :
(1) human chorionic gonadotropin (2) relaxin only
(3) estrogen only (4) progesterone

67. (4)

68. In which one of the following processes CO_2 is not released?
(1) Alcoholic fermentation (2) Lactate fermentation
(3) Aerobic respiration in plants (4) Aerobic respiration in animals

68. (2)

69. The zone of atmosphere in which the ozone layer is present is called :
(1) Stratosphere (2) Troposphere (3) Ionosphere (4) Mesosphere

69. (1)

70. Transformation was discovered by :
(1) Griffith (2) Watson and Crick
(3) Meselson and Stahl (4) Hershey and Chase

70. (1)

71. Select the option which is not correct with respect to enzyme action :
(1) A non−competitive inhibitor binds the enzyme at a site distinct from that which binds the substance
(2) Malonate is a competitive inhibitor of succinic dehydrogenase.
(3) Substrate binds with enzyme at its active site.
(4) Addition of lot of succinate does not reverse the inhibition of succinic dehydrogenase by malonate.

71. (4)

72. Which one of the following is wrongly matched?
(1) Repressor protein − Binds to operator to stop enzyme synthesis
(2) Operon − Structural genes, operator and promoter
(3) Transcription − Writing information from DNA to t−RNA
(4) Translation − Using information in m−RNA to make protein.

72. (3)

73. Which one of the following statements is not correct?
(1) Retinal is a derivative of Vitamin C.
(2) Rhodopsin is the purplish red protein present in rods only
(3) Retinal is the light absorbing portion of visual photo pigments
(4) In retina the rods have the photopigment rhodopsin while cones have three different photopigments.

73. (1)

74. During which phase(s) of cell cycle, amount of DNA in a cell remains at 4C level if the initial amount is denoted as 2C?
(1) Only G_2 (2) G_2 and M (3) G_0 and G_1 (4) G_1 and S

74. (1)

75. Non−albuminous seed is produced in :
(1) Wheat (2) Pea (3) Maize (4) Castor
75. (2)

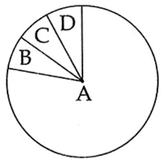
76. Select the Taxon mentioned that represents both marine and fresh water species :
(1) Cephalochordata (2) Cnidaria (3) Echinoderms (4) Ctenophora
76. (2)

77. Five kingdom system of classification suggested by R.H. Whittaker is **not** based on :
(1) Mode of nutrition
(2) Complexity of body organization
(3) Presence or absence of a well defined nucleus
(4) Mode of reproduction.
77. (3)

78. Select the correct option ;
78. (3)

	Direction of RNA synthesis	Direction of reading of the template DNA strand
(1)	5'−3'	5'−3'
(2)	3'−5'	3'−5'
(3)	5'−3'	3'−5'
(4)	3'−5'	5'−3'

79. Given below is the representation of the extent of global diversity of invertebrates. What groups the four portions (A-D) represent respectively?



Options :

	A	B	C	D
(1)	Molluscs	Other animal groups	Crustaceans	Insects
(2)	Insects	Molluscs	Crustaceans	Other animal groups
(3)	Insects	Crustaceans	Other animal groups	Molluscs
(4)	Crustaceans	Insects	Molluscs	Other animal groups

79. (2)

80. An analysis of chromosomal DNA using the Southern hybridization technique **does not** use:
(1) Autoradiography (2) PCR
(3) Electrophoresis (4) Blotting
80. (4)

81. Which is the particular type of drug that is obtained from the plant whose one flowering branch is shown below?

(1) Stimulant (2) Pain−killer (3) Hallucinogen (4) Depressant
81. (3)

82. Assisted reproductive technology, IVF involves transfer of :
(1) Zygote into the uterus
(2) Embryo with 16 blastomeres into the fallopian tube.
(3) Ovum into the fallopian tube.
(4) Zygote into the fallopian tube.

82. (2)

83. Which of the following is responsible for peat formation?
(1) Funaria (2) Sphagnum (3) Marchantia (4) Riccia

83. (2)

84. Select the correct option describing gonadotropin activity in a normal pregnant female:
(1) High level of hCG stimulates the synthesis of estrogen and progesterone.
(2) High level of hCG stimulates the thickening of endometrium.
(3) High level of FSH and LH stimulates the thickening of endometrium.
(4) High level of FSH and LH facilitate implantation of the embryo.

84. (1)

85. Tubectomy is a method of sterilization in which :
(1) small part of vas deferens is removed or tied up.
(2) uterus is removed surgically
(3) small part of the fallopian tube is removed or tied up.
(4) ovaries are removed surgically.

85. (3)

86. Dr. F. Went noted that if coleoptile tips were removed and placed on agar for one hour, the agar would produce a bending when placed on one side of freshly-cut coleoptile stumps. Of what significance is this experiment?
(1) It supports the hypothesis that IAA is auxin.
(2) It demonstrated polar movement of auxins.
(3) It made possible the isolation and exact identification of auxin.
(4) It is the basis for quantitative determination of small amounts of growth-promoting substances.

86. (2)

87. Person with blood group AB is considered as universal recipient because he has :
(1) no antigen on RBC and no antibody in the plasma.
(2) both A and B antigens in the plasma but no antibodies.
(3) both A and B antigens on RBC but no antibodies in the plasma.
(4) both A and B antibodies in the plasma.

87. (3)

88. Function of filiform apparatus is to :
(1) Produce nectar (2) Guide the entry of pollen tube
(3) Recognize the suitable pollen at stigma (4) Stimulate division of generative cell

88. (2)

89. Injury localized to the hypothalamus would most likely disrupt :
(1) executive functions, such as decision making.
(2) regulation of body temperature.
(3) short−term memory.
(4) co−ordination during locomotion.

89. (2)

90. Which one of the following living organisms completely *lacks* a cell wall?
(1) Saccharomyces (2) Blue−green alage
(3) Cyanobacteria (4) Sea−fan (Gorgonia)
90. (4)

91. Which of the following is a hormone releasing Intra Uterine Device (IUD)?
(1) Cervical cap (2) Vault
(3) Multiload 375 (4) LNG − 20
91. (3)

92. Archaebacteria differ from eubacteria in :
(1) Cell shape (2) Mode of reproduction
(3) Cell membrane structure (4) Mode of nutrition
92. (3)

93. Tracheids differ from other tracheary elements in :
(1) lacking nucleus (2) being lignified
(3) having casparian strips (4) being imperforate
93. (1)

94. Which one of the following shows isogamy with non−flagellated gametes?
(1) Ulothrix (2) Spirogyra (3) Sargassum (4) Ectocarpus
94. (2)

95. A species facing extremely high risk of extinction in the immediate future is called :
(1) Critically Endangered (2) Extinct
(3) Vulnerable (4) Endemic
95. (1)

96. Viruses have :
(1) Single chromosome (2) Both DNA and RNA
(3) DNA enclosed in a protein coat (4) Prokaryotic nucleus
96. (3)

97. Anoxygenic photosynthesis is characteristic of :
(1) Chlamydomonas (2) Ulva
(3) Rhodospirillum (4) Spirogyra
97. (3)

98. Commonly used vectors for human genome sequencing are :
(1) Expression Vectors (2) T/A Cloning Vectors
(3) T− DNA (4) BAC and YAC
98. (4)

99. Which one of the following fungi contains hallucinogens?
(1) Neurospora sp. (2) Ustilago sp.
(3) Morechella esculenta (4) Amanita muscaria
99. (4)

100. Which structures perform the function of mitochondria in bacteria?
(1) Cell wall (2) Mesosomes (3) Nucleoid (4) Ribosomes
100. (2)

101. In 'S' phase of the cell cycle :
(1) chromosome number is increased.
(2) amount of DNA is reduced to half in each cell.
(3) amount of DNA doubles in each cell.
(4) amount of DNA remains same in each cell.

101. (3)

102. When the margins of sepals or petals overlap one another without any particular direction, the condition is termed as :
(1) Twisted (2) Valvate (3) Vexillary (4) Imbricate

102. (4)

103. A man whose father was colour blind marries a women who had a colour blind mother and normal father. What percentage of male children of this couple will be colour blind?
(1) 50% (2) 75% (3) 25% (4) 0%

103. (3)

104. Which one of the following is a non-reducing carbohydrate?
(1) Lactose (2) Ribose5-phosphate(3) Maltose (4) Sucrose

104. (4)

105. Forelimbs of cat, lizard used in walking, forelimbs of whale used in swimming and forelimbs of bats used in flying are an example of:
(1) Homologous organs (2) Convergent evolution
(3) Analogous organs (4) Adaptive radiation

105. (1)

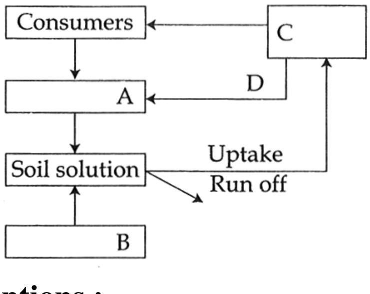
106. Which one of the following statements is correct?
(1) A proteinaceous aleurone layer is present in maize grain.
(2) A sterile pistil is called a staminode.
(3) The seed in grasses is not endospermic.
(4) Mango is parthenocarpic fruit.

106. (1)

107. Pollen tablets are available in the market for :
(1) Supplementing food (2) Ex situ conservation
(3) In vitro fertilization (4) Breeding programmes

107. (1)

108. Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (A-D). Identify the blanks.



Options :

	A	B	C	D
(1)	Detritus	Rock minerals	Producer	Litter fall
(2)	Producers	Litter fall	Rock minerals	Detritus
(3)	Rock Minerals	Detritus	Litter fall	Producers
(4)	Litter fall	Producers	Rock minerals	Detritus

108. (1)

109. Match the following and select the **correct** answer :

(a) Centriole (i) Infoldings in mitochondria
(b) Chlorophyll (ii) Thylakoids
(c) Cristae (iii) Nucleic acid
(d) Ribozymes (iv) Basal body cilia or flagella

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

109. (3)

110. Which one of the following is **wrong** about *Chara* ?
(1) Upper antheridium and lower oogonium
(2) Globule is male reproductive structure
(3) Upper oogonium and lower round antheridium.
(4) Globule and nucule present on the same plant.

110. (1)

111. The initial step in the digestion of milk in humans is carried out by ?
(1) Rennin (2) Pepsin (3) Lipase (4) Trypsin

111. (2)

112. The shared terminal duct of the reproductive and urinary system in the human male is :
(1) Vas deferens (2) Vasa efferentia (3) Urethra (4) Ureter

112. (3)

113. An example of edible underground stem is :
(1) Sweet Potato (2) Potato (3) Carrot (4) Groundnut

113. (2)

114. An aggregate fruit is one which develops from :
(1) Complete inflorescence
(2) Multicarpellary superior ovary
(3) Multicarpellary syncarpous gynoecium
(4) Multicarpellary apocarpus gynoecium

114. (3)

115. Which one of the following growth regulators is known as ‘stress hormone’ ?
(1) GA_3 (2) Indole acetic acid
(3) Abscissic acid (4) Ethylene

115. (3)

116. Which of the flowing shows coiled RNA strand and capsomeres ?
(1) Measles virus (2) Retrovirus
(3) Polio virus (4) Tobacco mosaic virus

116. (2)

117. An alga which can be employed as food for human being is :
(1) Spirogyra (2) Polysiphonia (3) Ulothrix (4) Chlorella

117. (4)

118. Choose the correctly matched pair :
(1) Areolar tissue – Loose connective tissue
(2) Cartilage – Loose connective tissue
(3) Tendon – Specialized connective tissue
(4) Adipose Tissue – Dense connective tissue

118. (1)

119. Which one of the following are analogous structures?
(1) Thorns of Bougainvillea and Tendrils of Cucurbita
(2) Flippers of Dolphin and Legs of Horse.
(3) Wings of Bat and Wings of Pigeon.
(4) Gills of Prawn and Lungs of Man.

119. (3)

120. Approximately seventy percent of carbon-dioxide absorbed by the blood will be transported to the lungs:
(1) by binding to R.B.C
(2) as carbamino – haemoglobin
(3) as bicarbonate ions
(4) in the form of dissolved gas molecules

120. (3)

121. The osmotic expansion of a cell kept in water is chiefly regulated by:
(1) Plastids (2) Ribosomes (3) Mitochondria (4) Vacuoles

121. (4)

122. Placenta and pericarp are both edible portions in:
(1) Tomato (2) Potato (3) Apple (4) Banana

122. (1)

123. Match the following and select the **correct** option:

(a) Earthworm	(i) Pioneer species
(b) Succession	(ii) Detritivore
(c) Ecosystem service	(iii) Natality
(d) Population growth	(iv) Pollination

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

123. (2)

124. The organization which publishes the Red List of species is :
(1) UNEP (2) WWF (3) ICFRE (4) IUCN

124. (4)

125. What gases are produced in anaerobic sludge digesters ?
(1) Methane, Hydrogen Sulphide and O_2
(2) Hydrogen Sulphide and CO_2
(3) Methane and CO_2 only
(4) Methane, Hydrogen Sulphide and CO_2

125. (4)

126. Just as a person moving from Delhi to Shimla to escape the heat for the duration of hot summer, thousands of migratory birds from Siberia and other extremely cold northern regions move to:
(1) Corbett National Park (2) Keolado National Park
(3) Western Ghat (4) Meghalaya

126. (2)

127. Choose the correctly matched pair:
(1) Tubular parts of nephrons - Cuboidal epithelium
(2) Inner surface of bronchioles - squamous epithelium
(3) Inner lining of salivary ducts - Ciliated epithelium
(4) Moist surface of buccal cavity - Glandular epithelium

127. (1)

128. Geitonogamy involves:
(1) fertilization of a flower by the pollen from a flower of another plant in the same population.
(2) fertilization of a flower by the pollen from a flower of another plant belonging to a distant population.
(3) fertilization of a flower by the pollen from another flower of the same plant.
(4) fertilization of a flower by the pollen from the same flower.

128. (3)

129. A human female with Turner's syndrome :
(1) exhibits male characters.
(2) is able to produce children with normal husband.
(3) has 45 chromosomes with XO.
(4) has one additional X chromosome.

129. (3)

130. The enzyme recombinase is required at which stage of meiosis:
(1) Diplotene (2) Diakinesis (3) Pachytene (4) Zygotene

130. (3)

131. Identify the hormone with its **correct** matching of source and function:
(1) Progesterone-corpus-luteum, stimulation of growth and activities of female secondary sex organs.
(2) Atrial natriuretic factor - ventricular wall increases the blood pressure.
(3) Oxytocin - posterior pituitary, growth and maintenance of mammary glands.
(4) Melatonin - pineal gland, regulates the normal rhythm of sleepwake cycle.

131. (4)

132. The solid linear cytoskeletal elements having a diameter of 6 nm and made up of a single type of monomer are known as:
(1) Intermediate filaments (2) Lamins
(3) Microtubules (4) Microfilaments

132. (4)

133. How do parasympathetic neural signals affect the working of the heart ?
(1) Both heart rate and cardiac output increase.
(2) Heart rate decreases but cardiac output increases.
(3) Reduce both heart rate and cardiac output.
(4) Heart rate is increased without affecting the cardiac output.

133. (3)

134. Select the correct matching of the type of the joint with the example in human skeletal system:

Type of joint	**Example**
(1) Hinge joint	- between humerus and pectoral girdle
(2) Gliding joint	- between carpals
(3) Cartilaginous joint	- between frontal and pariental
(4) Pivot joint	- between third and fourth cervical vertebrae

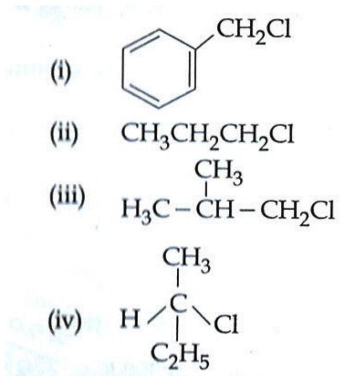
134. (2)

135. Which vector can clone only a small fragment of DNA ?
(1) Plasmid (2) Cosmid
(3) Bacterial artificial chromosome (4) Yeast artificial chromosome

135. (1)

Chemistry

136. Which of the following compounds will undergo racemisation when solution of KOH hydrolyses ?



(1) (iii) and (iv) (2) (i) and (iv)
(3) (i) and (ii) (4) (ii) and (iv)

136. (2)
Both (i) and (iv) undergo S_{N1} Reduction

137. Which of the following statements is correct for the spontaneous adsorption of a gas?
(1) ΔS is positive and, therefore, ΔH should be negative
(2) ΔS is positive and, therefore, ΔH should also be highly positive
(3) ΔS is negative and, therefore, ΔH should be highly positive
(4) ΔS is negative and therefore, ΔH should be highly negative

137. (4)
For spontaneous adsorption of a gas, ΔS is negative and ΔH should be highly negative.

138. For the reversible reaction :
$N_2(g) + 3\,H_2(g) \rightleftharpoons 2\,NH_3\,(g) + \text{heat}$
The equilibrium shifts in forward direction :
(1) by decreasing the concentrations of $N_2(g)$ and $H_2(g)$
(2) by increasing pressure and decreasing temperature
(3) by increasing the concentration of $NH_3(g)$
(4) by decreasing the pressure

138. (2)
$$N_2 + 3H_2 \rightleftharpoons 2NH_3 \quad \Delta H = -\text{ve}$$
Exothermic Reactions are favoured at low temperature.

139. Using the Gibbs energy change, $\Delta G^0 = +63.3$ kJ, for the following reaction,
$Ag_2CO_3(s) \rightleftharpoons 2Ag^+(aq) + CO_3^{2-}(aq)$
the K_{sp} of $Ag_2CO_3(s)$ in water at 25^o C is :
($R = 8.314\ JK^{-1}\ mol^{-1}$)
(1) 2.9×10^{-3} (2) 7.9×10^{-2}
(3) 3.2×10^{-26} (4) 8.0×10^{-12}

139. (4)
$\Delta G = -2.303\ RT\ \log_{10}K_{sp}$
$$\log_{10} K_{sp} = \frac{\Delta G}{-2.303\,RT} = -\frac{63.3\times10^3}{2.303\times8.314\times298} = -11.09$$
$$K_{sp} = 8.06\times10^{-12}$$

140. Magnetic moment 2.83 BM is given by which of the following ions ?
(At. Nos. Ti = 22, Cr = 24, Mn = 25, Ni = 28)
(1) Cr^{3+} (2) Mn^{2+} (3) Ti^{3+} (4) Ni^{2+}

140. (4)
Magnetic moment $= \sqrt{n(n+2)}$ B.M. $= 2.83$
i.e. n = 2 (Two unpaired electrons)
G^{3+} $(3d^3)$ $\rightarrow$ n = 3
Mn^{+2} $(3d^5)$ $\rightarrow$ n = 5
Ti^{+3} $(3d^1)$ $\rightarrow$ n = 1
Ni^{+2} $(3d^8)$ $\rightarrow$ n = 2

141. Which one of the following is **not** a common component of Photochemical Smog?
(1) Peroxyacetyl nitrate (2) Chloroflurocarbons
(3) Ozone (4) Acrolein

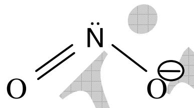
141. (4)
Common component of Photochemical smog are peroxyacetyl nitrate, chlorofluorocarbons and ozone etc.

142. For the reaction : $X_2O_4(\ell) \rightarrow 2XO_2(g)$
$\Delta U = 2.1$ k cal, $\Delta S = 20$ cal K^{-1} at 300 K
Hence, ΔG is :
(1) 9.3 k cal (2) −9.3 k cal (3) 2.7 k cal (4) −2.7 k cal

142. (4)
$\Delta H = \Delta U + \Delta n \ RT$
$= 2.1 \text{ kcal} + \dfrac{2\times2\times300}{1000} = 3.3 \text{ kcal}$
$\Delta G = \Delta H - T\Delta S = 3.3 - \dfrac{20\times300}{1000} = -2.7 \text{ kcal}$

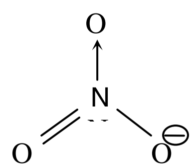
143. Which one of the following species has plane triangular shape ?
(1) NO_2^- (2) CO_2 (3) N_3 (4) NO_3^-

143. (4)



Angular

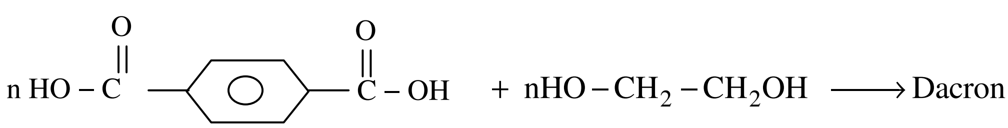
Linear



Triangular shape

144. Which of the following organic compounds polymerizes to form the polyester Dacron?
(1) Terephthalic acid and ethylene glycol
(2) Benzoic acid and para HO − (C_6H_4) − OH
(3) Propylene and para HO − (C_6H_4) − OH
(4) Benzoic acid and ethanol

144. (1)



145. Among the following complexes the one which shows Zero crystal field stabilization energy (CFSE) is :

(1) $[Co(H_2O)_6]^{2+}$ (2) $[Co(H_2O)_6]^{3+}$
(3) $[Mn(H_2O)_6]^{3+}$ (4) $[Fe(H_2O)_6]^{3+}$

145. (4)

Zero CFSE in weak ligand i.e. d^5

$[Co(H_2O)_6]^{+2} \Rightarrow d^7$

$[Co(H_2O)_6]^{+3} \Rightarrow d^6$

$[Mn(H_2O)_6]^{+3} \Rightarrow d^4$

$[Fe(H_2O)_6]^{+3} \Rightarrow d^5$

146. Acidity of diprotic acids in aqueous solutions increases in the order :

(1) $H_2Te < H_2S < H_2Se$
(2) $H_2Se < H_2Te < H_2S$
(3) $H_2S < H_2Se < H_2Te$
(4) $H_2Se < H_2S < H_2Te$

146. (3)

Acidic Nature order : $H_2S < H_2Se < H_2Te$

$K_a(H_2S) = 1.3 \times 10^{-7}$

$K_a(H_2Se) = 1.3 \times 10^{-4}$

$K_a(H_2Te) = 1.3 \times 10^{-3}$

147. When 0.1 mol MnO_4^{2-} is oxidised the quantity of electricity required to completely oxidise MnO_4^{2-} to MnO_4^- is :

(1) 9650 C (2) 96.50 C (3) 96500 C (4) 2×96500 C

147. (1)

$$\underset{0.1\,\text{mol}}{MnO_4^{-2}} \longrightarrow \underset{0.1\,\text{mol}}{MnO_4^-} + \underset{0.1\,\text{mol} = 0.1\,F = 9650\,C}{e^-}$$

148. 1.0 g of magnesium is burnt with 0.56 g O_2 in a closed vessel. Which reactant is left in excess and how much ?

(At. wt. Mg = 24; O = 16)

(1) Mg, 0.44 g (2) O_2, 0.28 g (3) Mg, 0.16 g (4) O_2, 0.16 g

148. (3)

$$Mg + \frac{1}{2}O_2 \longrightarrow MgO$$

1mol	0.5 mol	
24 g	16 g	
1.5 g	1 g	O_2 is Limiting Reagent
0.84 g consumed	0.56 g	unreacted Mg = 1 − 0.84 = 0.16 g

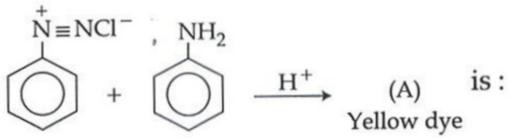
149. Which property of colloids is not dependent on the charge on colloidal particles?

(1) Electro–osmosis (2) Tyndall effect
(3) Coagulation (4) Electrophoresis

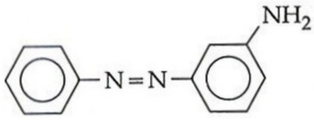
149. (2)

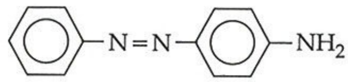
Fact

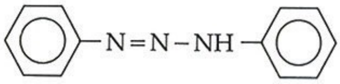
150. In the following reaction, the product (A)

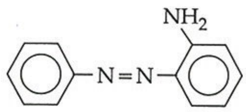


is :

(1) 

(2) 

(3) 

(4) 

150. (2)

151. Identity Z in the sequence of reactions :

$CH_3CH_2CH=CH_2 \xrightarrow{HBr/H_2O_2} Y \xrightarrow{C_2H_5ONa} Z$

(1) $CH_3(CH_2)_4-O-CH_3$ (2) $CH_3CH_2-CH(CH_3)-O-CH_2CH_3$

(3) $CH_3-(CH_2)_3-O-CH_2CH_3$ (4) $(CH_3)_2CH_2-O-CH_2CH_3$

151. (3)

$CH_3CH_2-CH=CH_2 \xrightarrow{HBr/R_2O_2} CH_3CH_2CH_2-CH_2-Br \xrightarrow{C_2H_5ONa} CH_3(CH_2)_3OC_2H_5$

152. Which of the following salts will give highest pH in water ?

(1) Na_2CO_3 (2) $CuSO_4$ (3) KCl (4) NaCl

152. (1)

Na_2CO_3 aq. is alkaline in nature.

153. Which of the following molecules has the maximum dipole moment ?

(1) NH_3 (2) NF_3 (3) CO_2 (4) CH_4

153. (1)

NH_3

154. For a given exothermic reaction, K_p and K'_p are the equilibrium constants at temperatures T_1 and T_2, respectively. Assuming that heat of reaction is constant in temperature range between T_1 and T_2, it is readily observed that :

(1) $K_p = K'_p$ (2) $K_p = \dfrac{1}{K'_p}$ (3) $K_p > K'_p$ (4) $K_p < K'_p$

154. (3)

For exothermic reactions, on increasing the temperature the value of equilibrium constant decreases.

$\therefore\ K_p > K'_p$

155. Be^{2+} is isoelectronic with which of the following ions ?

(1) Na^+ (2) Mg^{2+} (3) H^+ (4) Li^+

155. (4)

$Be^{2+}\ (1s^2)$ $Li^+(1s^2)$

156. What is the maximum number of orbitals that can be identified with the following quantum numbers ? $n = 3$, $\ell = 1$, $m_l = 0$

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

156. (1)

3p orbital can have $n = 3$, $\ell = 1$ and $m_\ell = 0$.

157. Which of the following hormones is produced under the condition of stress which stimulates glycogenolysis in the liver of human beings ?

(1) Adrenaline (2) Estradiol (3) Thyroxin (4) Insulin

157. (1)

158. Which of the following orders of ionic radii is correctly represented?

(1) $F^- > O^{2-} > Na^+$ (2) $Al^{3+} > Mg^{2+} > N^{3-}$

(3) $H^- > H^+ > H$ (4) $Na^+ > F^- > O^{2-}$

158. Bonus

159. Which of the following complexes is used to be as an anticancer agent?

(1) cis – $K_2[Pt\,Cl_2\,Br_2]$ (2) Na_2CoCl_4

(3) mer – $[Co\,(NH_3)_3Cl_3]$ (4) cis – $[Pt\,Cl_2\,(NH_3)_2]$

159. (4)

160. Reason of lanthanoid contraction is :

(1) Decreasing nuclear charge

(2) Decreasing screening effect

(3) Negligible screening effect of 'f ' orbitals

(4) Increasing nuclear charge

160. (3)

161. (a) $H_2O_2 + O_3 \rightarrow H_2O + 2O_2$

(b) $H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$

Role of hydrogen peroxide in the above reactions is respectively :

(1) reducing in (a) and (b)

(2) oxidizing in (a) and (b)

(3) oxidizing in (a) and reducing in (b)

(4) reducing in (a) and oxidizing in (b)

161. (1)

H_2O_2 acts as reducing agent in both the reactions.

$$H_2O_2 + O_3 \longrightarrow H_2O + 2O_2$$

$$H_2O_2 + Ag_2O \longrightarrow 2Ag + H_2O + O_2$$

162. Calculate the energy in joule corresponding to light of wavelength 45 nm :
(Planck's constant $h = 6.63 \times 10^{-34}$ Js; speed of light $c = 3 \times 10^8\ ms^{-1}$)

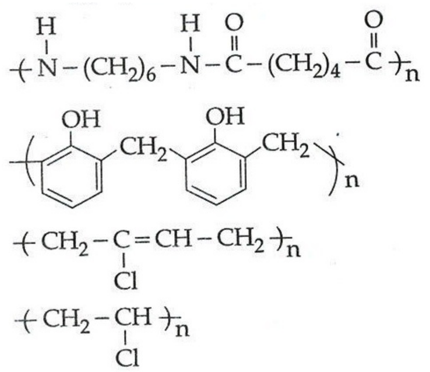
(1) 4.42×10^{-15} (2) 4.42×10^{-18} (3) 6.67×10^{15} (4) 6.67×10^{11}

162. (2)

$$\text{Energy} = \frac{hc}{\lambda} = \frac{6.6\times10^{-34}\times3\times10^{8}}{45\times10^{-9}} = 0.44\times10^{-17}$$

$$= 4.4 \times 10^{-18}\ \text{Joule}$$

163. Which one of the following is an example of a thermosetting polymer ?



163. (2)
Bakelite is a thermosetting polymer.

164. Equal masses of H_2, O_2 and methane have been taken in a container of volume V at temperature 27^{o} C in identical conditions. The ratio of the volumes of gases H_2:O_2:methane would be :
(1) 16 : 1 : 2 (2) 8 : 1 : 2 (3) 8 : 16 : 1 (4) 16 : 8 : 1

164. (1)
$$V_{H_2} : V_{O_2} : V_{CH_4} = n_{H_2} : n_{O_2} : n_{CH_4}$$
$$= \frac{1}{2} : \frac{1}{32} : \frac{1}{16}$$
$$= 16 : 1 : 2$$

165. The weight of silver (at.wt. = 108) displaced by a quantity of electricity which displaces 5600 mL of O_2 at STP will be :
(1) 54.0 g (2) 108.0 g (3) 5.4 g (4) 10.8 g

165. (2)
$$\frac{\omega_{Ag}}{108} = \frac{5600}{5600} \Rightarrow \omega_{Ag} = 108\text{ g}$$

166. Of the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression?
(1) $Al_2(SO_4)_3$ (2) K_2SO_4 (3) KCl (4) $C_6H_{12}O_6$

166. (1)
$\Delta T_f = i\, k_f\, m$
$\Rightarrow \Delta T_f \propto i$

167. Which of the following will not be soluble sodium hydrogen carbonate?
(1) o−Nitrophenol (2) Benzenesulphonic acid
(3) 2, 4, 6 − trinitrophenol (4) Benzoic acid

167. (1)
O−nitrophenol does not react with $NaHCO_3$.

168. Which of the following will be most stable diazonium salt $RN_2^+X^-$?
(1) $CH_3CH_2N_2^+X^-$ (2) $C_6H_5CH_2N_2^+X^-$
(3) $CH_3N_2^+X^-$ (4) $C_6H_5N_2^+X^-$

168. (4)
Due to conjugation effect.

169. The pair of compounds that can exist together is :

(1) $FeCl_2, SnCl_2$ (2) $FeCl_2, KI$ (3) $FeCl_3, SnCl_2$ (4) $HgCl_2, SnCl_2$

169. (4)

Both $HgCl_2$ and $SnCl_2$ belong to same Gr (Gr II).

170. Which of the following organic compounds has same hybridization as its combustion product (CO_2)?

(1) Ethene (2) Ethanol (3) Ethane (4) Ethyne

170. (4)

$HC \equiv CH$ and $O = C = O$ both have sp−hybridised carbon.

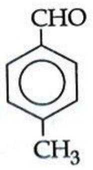
171. In the Kjeldahl's method for estimation of nitrogen present in a soil sample, ammonia evolved from 0.75 g of sample neutralized 10 mL of 1M H_2SO_4. The percentage of nitrogen in the soil is :

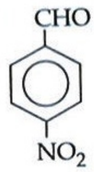
(1) 35.33 (2) 43.33 (3) 37.33 (4) 45.33

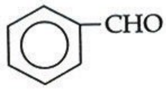
171. (3)

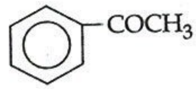
$$\% \text{ of Nitrogen in the soil} = \frac{1.4 \times 2 \times 10}{0.75} = 37.33\,\%$$

172. Which one is most reactive towards Nucleophilic addition reaction ?

(1) 

(2) 

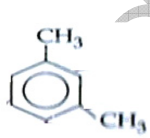
(3) 

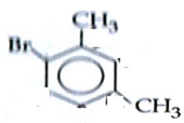
(4) 

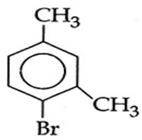
172. (2)

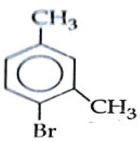
Aldehydes are more reactive than ketone towards nucleophillic addition reaction. Among aldehydes the one having electron withdrawing (−M) group is more reactive than that of electron supplying group(+M).

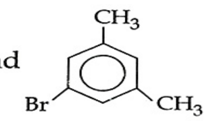
173. What products are formed when the following compound is treated with Br_2 in the presence of $FeBr_3$?

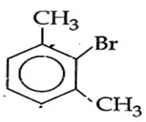


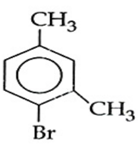
(1) 

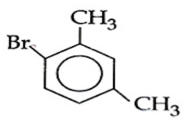
and 

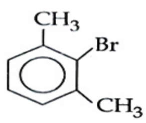
(2) 

and 

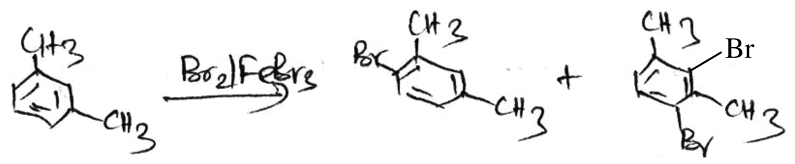
(3) 

and 

(4) 

and 

173. (4)



174. Among the following sets of reactants which one produces anisole?

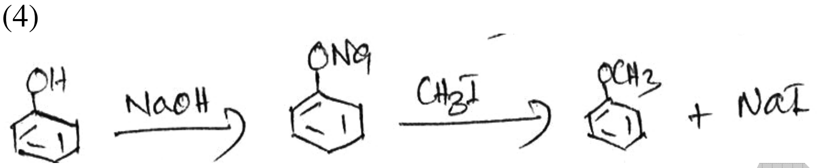
(1) C_6H_5OH ; neutral $FeCl_3$

(2) $C_6H_5-CH_3$; CH_3COCl; $AlCl_3$

(3) CH_3CHO; $RMgX$

(4) C_6H_5OH; NaOH; CH_3I

174. (4)



175. When 22.4 litres of $H_2(g)$ is mixed with 11.2 litres of $Cl_2(g)$, each at S.T.P., the moles of HCl (g) formed is equal to :

(1) 0.5 mol of HCl (g)
(2) 1.5 mol of HCl (g)
(3) 1 mol of HCl (g)
(4) 2 mol of HCl (g)

175. (3)

	$H_{2\,(g)}$	+ $Cl_{2\,(g)}$	$\longrightarrow$ $2HCl_{(g)}$
t = 0	1 mol	0.5 mol	0
t = t	0.5 mol	0	1 mol

176. The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives :

(1) Mn^{2+} and O_3 (2) Mn^{4+} and MnO_2
(3) Mn^{4+} and O_2 (4) Mn^{2+} and O_2

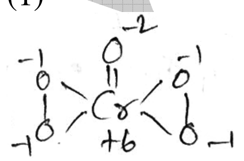
176. (4)

($2KMnO_4 + 3H_2SO_4 + 5H_2O_2 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$)

177. In acidic medium H_2O_2 changes Cr_2O_7 to CrO_5 which has two −O−O− bonds. Oxidation state of Cr in CrO_5 is :

(1) +6 (2) −10 (3) +5 (4) +3

177. (1)

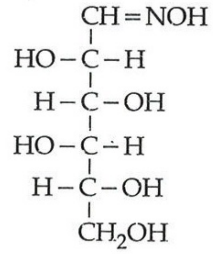


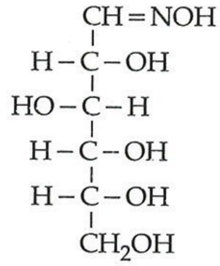
178. Artificial sweetner which is stable under cold conditions only is :

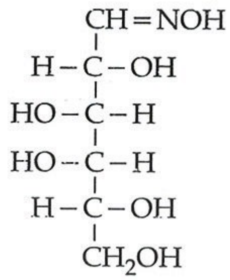
(1) Aspartame (2) Alitame (3) Saccharine (4) Sucralose

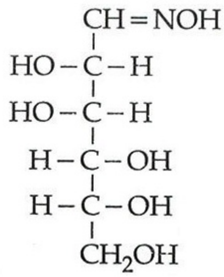
178. (1)

179. D(+) glucose reacts with hydroxyl amine and yields an oxime. The structure of the oxime would be :

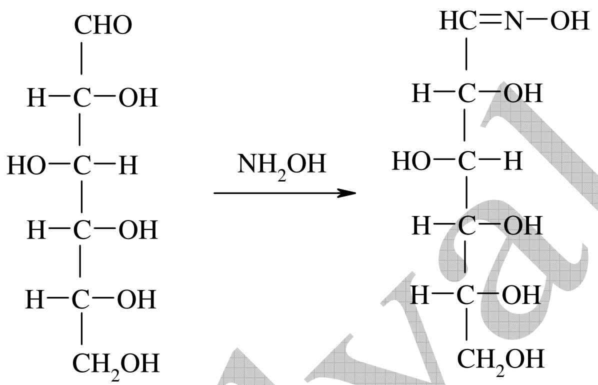
(1) 

(2) 

3) 

4) 

179. (2)



Glyco-oxine

180. If 'a' is the length of the side of a cube, the distance between the body centered atom and one corner atom in the cube will be :

(1) $\frac{\sqrt{3}}{4}$ a (2) $\frac{\sqrt{3}}{2}$ a (3) $\frac{2}{\sqrt{3}}$ a (4) $\frac{4}{\sqrt{3}}$ a

180. (2)

The distance between the body centered atom and corner atom

$$= \frac{\sqrt{3}\,a}{2}$$

❑ ❑ ❑ ❑ ❑ ❑