PHYSICS, CHEMISTRY AND BIOLOGY

Class	**II NEET 2018-20**	**Max. Marks**	**720**
	Intensive Revision Program	**Duration**	**3 Hours**
	Solution to Full Test – 01	**Date**	**07-06-2020**

PART I – PHYSICS

1. A body of mass 10 kg is moved with uniform speed on a rough horizontal surface for a distance of 2 m. The work done is 150 J. The same body is moved over the same surface of an inclined plane of inclination 30° with horizontal for a distance of 2 m. The work done against the friction will be (take g = 10 m/s^2)

(A) 250 J (B) 50 J (C) 150 J (D) $(75\sqrt{3})$J

Ans (D)

For motion on horizontal surface with uniform speed W = μ(mg)x

(∵ work will be done against friction only)

∴ 150 = μ(10 × 10) × 2 or μ = 0.75

When the surface is inclined, work done will be

$W_1 = \mu(mg\cos\theta)\,x$

$$= 0.75\times\left(10\times10\times\frac{\sqrt{3}}{2}\right)\times2 = (75\times\sqrt{3})\,J$$

2. An aeroplane requires for takeoff a speed of 81 km/hr, the run on ground being 100 m. The mass of aeroplane is 10,000 kg and co-efficient of friction between the plane and ground is 0.2. Assume that the plane accelerates uniformly during takeoff. The minimum force required by engine of the plane for takeoff is (g = 10 m/s^2)

(A) 4.53 N (B) 4.53×10^4 N (C) 4.53×10^2 N (D) 4.53×10^6 N

Ans (B)

$$a = \frac{v^2-u^2}{2s} = 2.53\ m\ s^{-2},\ F_{net} = Ma+\mu Mg = (\mu g+a)M = 4.53\times10^4\ N$$

3. A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration a_c is varying with time t as $a_c = k^2rt^2$, where k is a constant. The power delivered to the particle by the force acting on it is

(A) $2\pi mk^2r^2t$ (B) mk^2r^2t (C) $\frac{(mk^4r^2t^5)}{3}$ (D) zero

Ans (B)

The centripetal acceleration

$$a_c = k^2rt^2$$

$$\Rightarrow \frac{v^2}{r} = k^2rt^2$$

$$\Rightarrow \frac{1}{2}mv^2 = \frac{m}{2}k^2r^2t^2$$

$$\Rightarrow KE = \frac{m}{2}k^2r^2t^2$$

$\Rightarrow \frac{d}{dt}(KE) = mk^2r^2t$

$\Rightarrow$ Power $= mk^2r^2t$

Aliter

Since $v = krt$ and tangential acceleration

$a_t = \frac{dv}{dt} = kr$

Therefore, tangential force is equal to mkr.

Instantaneous power

$P = F \times v = mkr \times krt = mk^2r^2t$

4. A block of mass m is pulled along a horizontal surface by applying a force at an angle θ with the horizontal. If the block travels with a uniform velocity and has a displacement d and the coefficient of friction is μ, then the work done by the applied force is

(A) $\frac{\mu mgd}{\cos\theta + \mu\sin\theta}$ (B) $\frac{\mu mgd\cos\theta}{\cos\theta + \mu\sin\theta}$ (C) $\frac{\mu mgd\sin\theta}{\cos\theta + \mu\sin\theta}$ (D) $\frac{\mu mgd\cos\theta}{\cos\theta - \mu\sin\theta}$

Ans (B)

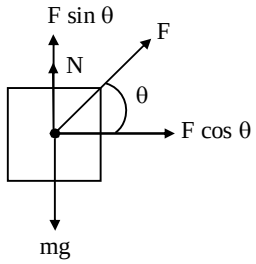
$N = mg - F\sin\theta$

Block moves with uniform velocity. Hence net force = 0

or, $F\cos\theta = \mu N = \mu(mg - F\sin\theta)$

$\therefore \quad F = \frac{\mu mg}{\cos\theta + \mu\sin\theta}$

$W = Fs\cos\theta = \frac{\mu\, mgd\cos\theta}{\cos\theta + \mu\sin\theta}$



5. The density of a newly discovered planet is twice that of earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of the earth. If the radius of the earth is R, the radius of the planet would be

(A) 4 R (B) $\frac{1}{4}$R (C) $\frac{1}{2}$R (D) 2 R

Ans (C)

Acceleration due to gravity on the surface of earth is given by

$g = \frac{GM}{R^2}$ …(1)

Also, mass M = volume × density

$= \frac{4}{3}\pi R^3 \times \rho$

Substituting the value in (1), we get $g = \frac{4}{3}\pi GR\rho$

$\Rightarrow g \propto R\rho$

$\Rightarrow \frac{g}{g'} = \frac{R\rho}{R'\rho'}$ …(2)

Since acceleration due to gravity on planet = acceleration due to gravity on surface of earth

that is, $g = g'$

So, from (2), we have $\frac{g}{g'} = \frac{R\rho}{R'\rho'}$ or $\frac{R'}{R} = \frac{\rho}{\rho'}$

Substituting $\rho' = 2\rho$, we get $R' = \frac{1}{2}R$

6. A rigid body of radius R, either hollow or solid, lies on a smooth horizontal surface. The body is pulled by a horizontal force acting tangentially from the highest point. The distance travelled by the body in the time in which it makes one full rotation is the same that it will make in one full rotation during pure rolling. The rigid body will be

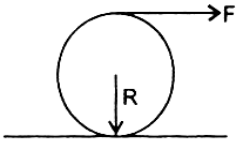
(A) solid sphere (B) hollow sphere

(C) circular disc (D) hollow cylinder

Ans (D)

$\tau = F \times R = I\alpha$ …(1)

In one full rotation,



$\theta = 2\pi = \frac{1}{2}\alpha t^2$

$t^2 = \frac{4\pi}{\alpha} = \frac{4\pi I}{FR}$

Linear acceleration, $a = \frac{F}{M}$

Distance travelled in one rotation = $2\pi R$ (given) $= \frac{1}{2}at^2 = \frac{1}{2}\frac{F}{M}\cdot\frac{4\pi I}{FR} = \frac{2\pi I}{MR}$

It gives $I = MR^2$ It is a hollow cylinder.

7. A particle starting from rest moves with a constant angular acceleration α in a circular path. The time at which the magnitudes of tangential and radial acceleration are equal is

(A) $\frac{1}{\alpha}$ (B) α (C) $\frac{1}{\sqrt{\alpha}}$ (D) $\sqrt{\alpha}$

Ans (C)

$a_t = r\alpha$,

$a_n = \frac{v^2}{r} = \frac{r^2\alpha^2t^2}{r} = r\alpha^2t^2$ [$\because v = r\alpha t$]

When $a_t = a_n$, $r\alpha^2t^2 = r\alpha \Rightarrow t = \frac{1}{\sqrt{\alpha}}$

8. Certain amount of an ideal gas is contained in a closed vessel. The vessel is moving with a constant velocity v. The molecular mass of gas is M_O. The rise in temperature of the gas when the vessel is suddenly stopped is $\left[\gamma = \frac{C_P}{C_V}\right]$

(A) $\frac{M_0v^2}{2R(\gamma+1)}$ (B) $\frac{M_0v^2(\gamma-1)}{2R}$ (C) $\frac{M_0v^2}{2R\gamma}$ (D) $\frac{M_0v^2\gamma}{2R(\gamma-1)}$

Ans (B)

When the vessel is suddenly stopped, the ordered motion of gas is converted into its disordered motion i.e., internal energy of the gas increases.

Hence, $\Delta U = \frac{1}{2}Mv^2 \Rightarrow nC_V\Delta T = \frac{1}{2}(nM_0)v^2 \Rightarrow \Delta T = \frac{M_0v^2}{2C_V}$

$$\Delta T = \frac{M_0v^2}{2\left(\frac{R}{\gamma-1}\right)} = \frac{M_0v^2(\gamma-1)}{2R}$$

9. During an adiabatic process, if the pressure of an ideal gas is proportional to the cube of its temperature, then ratio $\gamma = \frac{C_P}{C_V}$ is (specific heat of constant volume = C_V ; Specific heat of constant pressure = C_P)

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

Ans (D)

As pressure is proportional to the cube of temperature,

That is $P = kT^3$

Also $PV = RT \Rightarrow T = \frac{PV}{R}$

$\Rightarrow$ $P = \frac{kP^3V^3}{R^3}$

$\Rightarrow$ $P^2 = \frac{R^3}{kV^3}$

$\Rightarrow$ $PV^{3/2}$ = constant Therefore, $\gamma = \frac{3}{2}$

10. A particle executes linear simple harmonic motion with an amplitude of 2 cm. When the particle is at 1 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. The time period in second is

(A) $\frac{1}{2\pi\sqrt{3}}$ (B) $2\pi\sqrt{3}$ (C) $\frac{2\pi}{\sqrt{3}}$ (D) $\frac{\sqrt{3}}{2\pi}$

Ans (C)

Velocity $v = \omega\sqrt{A^2 - x^2}$ and acceleration = $\omega^2 x$

Now given, $\omega^2 x = \omega\sqrt{A^2 - x^2} \Rightarrow \omega^2 \cdot 1 = \omega\sqrt{2^2 - 1^2} \Rightarrow \omega = \sqrt{3} \therefore T = \frac{2\pi}{\omega} = \frac{2\pi}{\sqrt{3}}$

11. When a wave travels in a medium, the particle displacement is given by the equation $y = a \sin 2\pi (bt - cx)$ where a, b and c are constants. The maximum particle velocity will be twice the wave velocity if

(A) $c = \frac{1}{\pi a}$ (B) $c = \pi a$ (C) $b = ac$ (D) $b = \frac{1}{ac}$

Ans (A)

Equation of the harmonic progressive wave given $y = a \sin 2\pi (bt - cx)$

Here $2\pi\nu = \omega = 2\pi b \Rightarrow \nu = b$

$k = \frac{2\pi}{\lambda} = 2\pi c \Rightarrow \frac{1}{\lambda} = c$

(Here c is the symbol given for $\frac{1}{\lambda}$ and not the velocity)

$\therefore$ Velocity of the wave $= \nu\lambda = b\frac{1}{c} = \frac{b}{c}$

$\frac{dy}{dt} = a2\pi b\cos 2\pi(bt - cx) = a\omega\cos(\omega t - kx)$

Maximum particle velocity = $a\omega = a2\pi b = 2\pi ab$

given this is $2\times\frac{b}{c}$ i.e., $2\pi a = \frac{2}{c}$ or $c = \frac{1}{\pi a}$

12. When a drop of water is sprinkled on a red hot iron plate, it forms into small spheres but does not vapourise immediately because

(A) red hot iron is a poor conductor of heat

(B) a layer of water vapour in between the drop and the plate prevents the conduction of heat

(C) boiling point of water is raised

(D) boiling point of water decreases.

Ans (B)

When the water droplet comes in contact with the plate, a part of it is initially vapourised. But the vapour of water is locked between the plate and the drop. As the vapour is a poor conductor of heat, it prevents the conduction of heat from the plate to the drop.

13. On the horizontal surface of a truck, a block of mass 1 kg is placed (μ = 0.6) and truck is moving with acceleration 5 ms^{-2}. Then the frictional force on the block will be

(A) 5 N (B) 0.588 N

(C) 5.88 N (D) 8 N

Ans (C)

$F = \mu R = \mu Mg = 0.6 \times 1 \times 9.8 = 5.88$ N

14. An automobile of mass m is crossing over a convex upwards bridge with a speed v. If the radius of the bridge is r, the thrust on the bridge at the highest point will be

(A) $mg + \frac{mv^2}{r}$ (B) $mg - \frac{mv^2}{r}$ (C) $\frac{mv^2}{r}$ (D) mg

Ans (B)

Thrust = weight – centrifugal force.

15. A rope of length 8 m and linear density 0.5 kg m^{-1} is lying lengthwise on a horizontal smooth floor. It is pulled by a force of 12 N. The tension at the mid-point would be

(A) 12 N (B) 8 N (C) 6 N (D) 4 N

Ans (C)

Mass of the rope = $8 \times 0.5 = 4$ kg

Acceleration = $\frac{F}{m} = \frac{12}{4} = 3\ ms^{-2}$

Mass upto 4 m or mid-point = 2 kg

Force used to pull 2 kg = $2 \times 3 = 6$ N

So tension at the mid-point = 6 N

16. The stationary wave produced on a string is represented by the equation $y = 5\sin\left(\frac{\pi x}{3}\right)\cos 40\pi t$ where x and y are in cm and t is in seconds. The distance between two consecutive nodes is

(A) 5 cm (B) 3 cm (C) 6 cm (D) 40 cm

Ans (B)

The given stationary wave produced on a string in represented by

$y = 5\sin\left(\frac{\pi x}{3}\right)\cos 40\pi t$ …(i)

The standard stationary wave produced on a string is represented by

$y = 2A \sin(kx) \cos(\omega t)$ ...(ii)

Compare (i) and (ii), we get

$k = \frac{\pi}{3}$ or $\frac{2\pi}{\lambda} = \frac{\pi}{3}$ or $\lambda = 6$ cm

The distance between two consecutive node is $\frac{\lambda}{2} = \frac{6}{2}\text{cm} = 3$ cm

17. On sounding turning fork A with another tuning fork B of frequency 384 Hz, 6 beats are produced per second. After loading the prongs of A with some wax and then sounding it again with B, 4 beats are produced per second. The frequency of the tuning fork A is

(A) 388 Hz (B) 382 Hz (C) 380 Hz (D) 390 Hz

Ans (D)

Frequency of A = 384 + 6 or 384 – 6

= 390 Hz or 378 Hz

When A is loaded, its frequency decreases.

So, n_A – 384 gives reduced beats.

Thus n_A – 384 = 6

n_A = 390 Hz

18. The length, breadth and thickness of a block are given by l = 12 cm, b = 6 cm and t = 2.45 cm. The volume of the block according to the idea of significant figures should be

(A) 1×10^2 cm^3 (B) 2×10^2 cm^3 (C) 1.763×10^2 cm^3 (D) 1×10^2 cm^3

Ans (B)

Volume of the block is given by

$V = l \times b \times t$

Substituting l = 12 cm, b = 6 cm and t = 2.45 cm, we get

$V = 176.4$ cm^3 $= 1.764 \times 10^2$ cm^3

Since minimum number of significant figures is 1 in breadth, therefore volume will contains only one significant figure

$\Rightarrow$ $V = 2 \times 10^2$ cm^3

19. A body of mass 2 kg makes an elastic collision with another body at rest and continues to move in the original direction with one fourth of its original speed. The mass of the second body which collides with the first body is

(A) 2 kg (B) 1.2 kg (C) 3 kg (D) 1.5 kg

Ans (B)

$m_1 = 2$ kg and $v_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)u_1 = \frac{u_1}{4}$ [Given] By solving we get $m_2 = 1.2$ kg

20. A river is flowing from west to east at a speed of 5 m s^{-1}. A man on the south bank of the river, capable of swimming at 10 m s^{-1} in still water, wants to swim across the river in the shortest time. He should swim in a direction

(A) due north (B) 30° east of north

(C) 30° west of north (D) 60° east of north

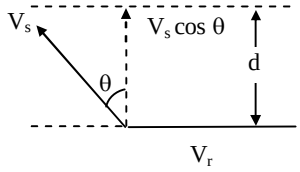
Ans (A)

Time taken to cross the river,

$t = \frac{d}{v_s \cos\theta}$

For time to be minimum $\cos\theta = \max \Rightarrow \theta = 0°$

Therefore, the swimmer should swim due north.



21. A bomb of 12 kg explodes into two pieces of masses 4 kg and 8 kg. The velocity of 8 kg mass is 6 m/s. The kinetic energy of the other mass is

(A) 48 J (B) 32 J (C) 24 J (D) 288 J

Ans (D)

From conservation of momentum $|\vec{P}_1| = |\vec{P}_2|$

$KE_2 = \frac{P_1^2}{2m_1} = \frac{P_2^2}{2m_2} = \frac{(8\times 6)^2}{2\times 4} = 288$ J

22. A negatively charged oil drop is prevented from falling under gravity by applying a vertical electric field of 100 Vm^{-1}. If the mass of the drop is 1.6×10^{-3} g, the number of electrons carried by the drop is ($g = 10\ ms^{-2}$)

(A) 10^{18} (B) 10^{15} (C) 10^{6} (D) 10^{12}

Ans (D)

$qE = mg$

$\Rightarrow q = 1.6 \times 10^{-7}$ C

$\therefore q = \pm ne \Rightarrow n = \frac{q}{e} = 10^{12}$

23. Out of two copper spheres of the same size, x is hollow while y is solid. If they are charged at the same potential, then

(A) Sphere y will have more charge (B) Sphere x will have more charge

(C) Charge on both the spheres is zero (D) Charge on both the spheres is equal

Ans (D)

Charge on both the spheres is equal (charge resides only on the surface of both spheres).

24. Electric current through a conductor varies with time as I (t) = 50 sin (100 πt). Here I is in ampere and t in second. Total charge that passes through any point form t = 0 to $t = \frac{1}{200}$s is

(A) 1.2 C (B) 0.36 C (C) 0.16 C (D) 0.02 C

Ans (C)

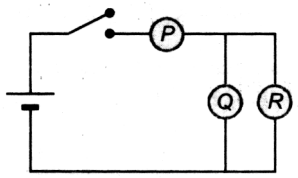
$$q = \int i dt = \int_0^{1/200} 50\sin(100\pi t)$$

$$= \frac{50}{100\pi}\left[-\cos(100\pi t)\right]_0^{1/200}$$

$$= \frac{1}{2\pi}\left[-\cos\left[100\pi\frac{1}{200}\right]+\cos 0°\right]$$

$$= \frac{1}{2\pi}\left[-\cos\frac{\pi}{2}+1\right] = \frac{1}{2\pi} = 0.16 \text{ C}$$

25. Three identical bulbs P, Q and R are connected to a battery as shown in figure. When the circuit is closed,



(A) Q and R will be brighter than P
(B) Q and R will be dimmer than P
(C) All the bulbs will be equally bright
(D) Q and R will not shine at all

Ans (B)

If I is the current through Q and R each, then 2 I is the current through P.
Therefore, Q and R will be dimmer than P.

26. A charge q moves with a velocity 2 ms^{-1} along X-axis in a uniform magnetic field $(\vec{B}) = (\hat{i} + 2\hat{j} + 3\hat{k})T$. The charge will experience a force that lies

(A) along – y axis (B) along - z axis
(C) along + z axis (D) in yz plane

Ans (D)

Since we know that $\vec{F} = q(\vec{v} \times \vec{B}) = q\left[2\hat{i} \times (\hat{i} + 2\hat{j} + 3\hat{k})\right]$

$\Rightarrow \vec{F} = 2q(-3\hat{j} + 2\hat{k})$

So, this force lies in the yz plane.

27. A proton experience a force $\vec{F}_1 = e(-\hat{j} + \hat{k})N$ in a magnetic field $\vec{B}$ when it has a velocity $\vec{v}_1 = 1\hat{i}\ ms^{-1}$. The force becomes $\vec{F} = e(\hat{i} - \hat{k})N$ when the velocity is changed to $\vec{v}_2 = 1\hat{j}\ ms^{-1}$. The magnetic induction vector at that point is

(A) $(\hat{i} - \hat{j} - \hat{k})T$ (B) $(-\hat{i} - \hat{j} + \hat{k})T$ (C) $(\hat{i} + \hat{j} - \hat{k})T$ (D) $(\hat{i} + \hat{j} + \hat{k})T$

Ans (D)

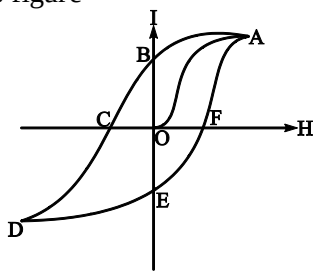
Let $\vec{B} = (x\hat{i} + y\hat{j} + z\hat{k})T$. since $\vec{F} = q(\vec{v} \times \vec{B})$,

So we get $e(-\hat{j} + \hat{k}) = e\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 0 & 0 \\ x & y & z \end{vmatrix} = e(-z\hat{j} + y\hat{k}) \Rightarrow z = 1,\ y = 1$

Also, we have $e(\hat{i} - \hat{k}) = e\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 1 & 0 \\ x & y & z \end{vmatrix} = e(z\hat{i} - x\hat{k})$

$\Rightarrow z = 1,\ x = 1 \Rightarrow \vec{B} = \hat{i} + \hat{j} + \hat{k}$

28. The I – H curve for a ferromagnetic material is as shown in the figure. In this figure



(A) OC is a measure of the retentivity.
(B) OB is a measure of coercivity.
(C) Area enclosed by the curve ABCDEA represents the energy lost during one cycle of magnetisation.
(D) Area enclosed by the curve ABCDEA represents the work done in orientating the molecular dipoles along the direction of the external field.

Ans (C)

29. Two coils P and S have 2000 turns and 5000 turns respectively. A current of 1A in coil P causes a flux per turn of 0.8×10^{-3} weber to link with P and 0.4×10^{-3} weber through S. The ratio of coefficient of self-inductance of P and the coefficient of mutual inductance of P and S is

(A) $\left(\frac{2}{3}\right)$ (B) $\left(\frac{3}{4}\right)$ (C) $\left(\frac{4}{5}\right)$ (D) $\left(\frac{5}{4}\right)$

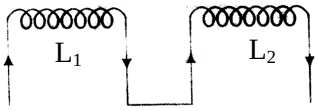
Ans (C)

$N_P\phi_P = L_P I_P \Rightarrow 2000 \times 0.8 \times 10^{-3} = L_P \times 1$

$N_S\,\phi_S = MI_P \Rightarrow 5000 \times 0.4 \times 10^{-3} = M \times 1$

$\therefore \quad \frac{L_P}{M} = \frac{4}{5}$

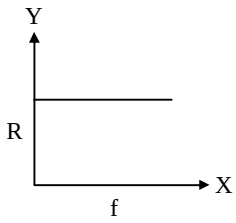
30. A circuit contains two inductors of self-inductance L_1 and L_2 in series. If M is the mutual inductance then the effective inductance of the circuit shown will be

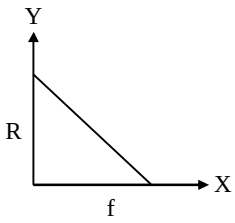


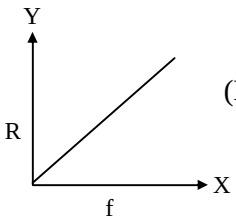
(A) $L_1 + L_2$
(B) $L_1 + L_2 - 2M$
(C) $L_1 + L_2 + M$
(D) $L_1 + L_2 + 2M$

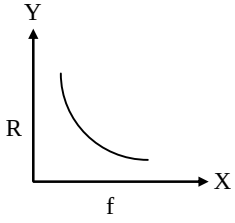
Ans (D)

31. The correct graph between the resistance of a conductor with frequency is

(A) 

(B) 

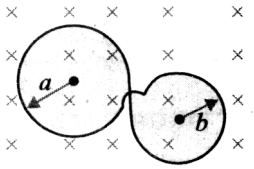
(C) 

(D) 

Ans (A)

Resistance does not vary with frequency. i.e., $R \propto f^{\circ}$.

32. Figure shows a pattern of loop of radii a and b (a > b) placed in a time varying magnetic field $\frac{dB}{dt} = k$, which is perpendicular to the plane of the loops. If the resistance per unit length of the wire is λ, then induced current is



(A) $\frac{k\left(a^2+b^2\right)}{2\lambda(+b)}$ (B) $\frac{k(a+b)}{2\lambda}$

(C) $\frac{k(a-b)}{2\lambda}$ (D) $\frac{k(a-b)}{\lambda}$

Ans (C)

The net flux through the loop is $I = \frac{1}{R}\left|\frac{d\phi}{dt}\right| = \frac{k\pi\left(a^2-b^2\right)}{2\pi(a+b)\lambda} = \frac{k(a-b)}{2\lambda}$

33. One requires 11 eV of energy to dissociate a carbon monoxide molecule into carbon and oxygen atoms. The minimum frequency of the appropriate electromagnetic radiation to achieve the dissociation lies in

(A) Visible region (B) Infrared region

(C) Ultraviolet region (D) Microwave region.

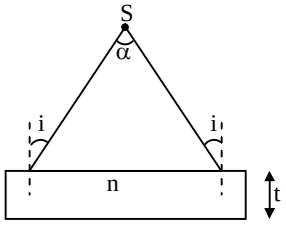
Ans (C)

$E\ (\text{in eV}) = \frac{hc}{e\lambda} = \frac{1242}{\lambda(\text{nm})}$

$\lambda(\text{in nm}) = \frac{1242}{11} = 113\ \text{nm} \Rightarrow \text{Frequency}, \nu = \frac{3\times10^8}{1.13\times10^{-7}} = 2.65\times10^{15}\ \text{Hz}$

This lies in ultraviolet region.

34. A diverging beam of light from a point source S having diverging angle α, falls symmetrically on a glass slab as shown in the figure. The angles of incidence of the two extreme rays are equal. If the thickness of the glass slab is t and the refractive index n, then the divergence angle of emergent beam is



(A) zero (B) α

(C) $\sin^{-1}\left(\frac{1}{n}\right)$ (D) $2\sin^{-1}\left(\frac{1}{n}\right)$

Ans (B)

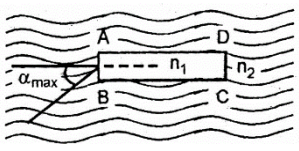
The emergent rays will be parallel to the corresponding incident rays.

Hence, the divergence angle between the emergent rays is also α.

35. A rectangular glass of slab ABCD, of refractive index n_1, is immersed in water of refractive index n_2 ($n_1 > n_2$). A ray of light is incident at the surface AB of the slab as shown. The maximum value of the angle of incidence α_{max} such that the ray comes out only from the other surface CD is given by

(A) $\sin^{-1}\left[\frac{n_1}{n_2}\cos^{-1}\left(\sin^{-1}\frac{n_2}{n_1}\right)\right]$ (B) $\sin^{-1}\left[n_1\cos\left(\sin^{-1}\frac{1}{n_2}\right)\right]$

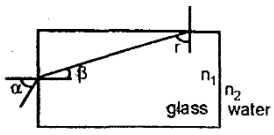
(C) $\sin^{-1}\left(\frac{n_1}{n_2}\right)$ (D) $\sin^{-1}\left(\frac{n_2}{n_1}\right)$



Ans (A)

Here r should be equal or less than the critical angle of glass and water.

That is $r \le c = \sin^{-1}\frac{n_2}{n_1}$. Also $\beta = 90 - r$



and $\frac{n_1}{n_2} = \frac{\sin\alpha}{\sin\beta} = \frac{\sin\alpha}{\cos r}$

That is $\sin\alpha = \frac{n_1}{n_2}\cos r$

$$\alpha = \sin^{-1}\left[\frac{n_1}{n_2}\cos^{-1}\left(\sin^{-1}\frac{n_2}{n_1}\right)\right]$$

36. Two identical metal plates show photoelectric effect by a light of wavelength λ_A falling on plate A and λ_B on plate B ($\lambda_A = 2\lambda_B$) . The maximum kinetic energies related as

(A) $2K_A = K_B$ (B) $K_A < \frac{K_B}{2}$ (C) $K_A = 2K_B$ (D) $K_A > \frac{K_B}{2}$

Ans (B)

$$\frac{hc}{\lambda} = W_0 + K_{max} \Rightarrow \frac{hc}{\lambda_A} = W_0 + K_A \quad \text{... (i)}$$

and $\frac{hc}{\lambda_B} = W_0 + K_B$ ... (ii)

Subtracting (i) from (ii), $hc\left[\frac{1}{\lambda_B} - \frac{1}{\lambda_A}\right] = K_B - K_A$

$$\Rightarrow hc\left[\frac{1}{\lambda_B} - \frac{1}{2\lambda_B}\right] = K_B - K_A \Rightarrow \frac{hc}{2\lambda_B} = K_B - K_A \quad \text{... (iii)}$$

From (ii) and (iii), $2K_B - 2K_A = W_0 + K_B$

$\Rightarrow K_B - 2K_A = W_0$

$\Rightarrow K_A = \frac{K_B}{2} - \frac{W_0}{2}$ which gives $K_A < \frac{K_B}{2}$

37. A surface irradiated with light of wavelength 480 nm gives out electrons with maximum velocity v m s^{-1}, the cut off wavelength being 600 nm. The same surface will release electron with maximum velocity 2v m/s if it irradiated by light of wavelength

(A) 260 nm (B) 300 nm (C) 360 nm (D) 400 nm

Ans (B)

$$\frac{1}{2}mv^2 = \frac{hc}{480\times10^{-9}} - \frac{hc}{600\times10^{-9}} = \frac{hc\times10^7}{24}$$

$$4\left(\frac{1}{2}mv^2\right) = \frac{hc}{\lambda} - \frac{hc}{600\times10^{-9}}$$

or $4\times\frac{hc\times10^7}{24} = \frac{hc}{\lambda} - \frac{hc}{6}\times10^7$

or $\frac{1}{\lambda} = 10^7\left(\frac{1}{6}+\frac{1}{6}\right) = \frac{10^7}{3}$

or $\lambda = 3\times10^{-7}\ m = 300\ nm$

38. If R is the Rydberg's constant for hydrogen, the wave number of the first line in the Lyman series will be

(A) $\frac{R}{4}$ (B) $\frac{3R}{4}$ (C) $\frac{R}{2}$ (D) 2R

Ans (B)

For Lyman series

$\bar{\nu} = \frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$ here n = 2, 3, 4, 5….

For first line $\bar{\nu} = R\left(\frac{1}{1^2} - \frac{1}{2^2}\right) \Rightarrow \bar{\nu} = R\left(1 - \frac{1}{4}\right) = \frac{3R}{4}$

39. When an electron in hydrogen atom in ground state absorbs a photon of energy 12.1 eV, its angular momentum

(A) decreases by 2.11×10^{-34} Js (B) increases by 1.055×10^{-34} Js

(C) decreases by 1.055×10^{-34} Js (D) increases by 2.11×10^{-34} Js

Ans (D)

When an electron in hydrogen atom in ground state (n = 1) absorbs 12.1 eV energy it goes over to second excited state (n = 3). Therefore, increase in its angular momentum.

$\Delta L = L_3 - L_1 = 3\left(\frac{h}{2\pi}\right) - 1\left(\frac{h}{2\pi}\right) = \frac{h}{\pi} = \frac{6.6 \times 10^{-34}}{22/7} = 2.11 \times 10^{-34}$ Js

40. The radioactivity of a sample is X at a time t_1 and Y at a time t_2. If the mean life of the specimen is τ, the number of atoms that have disintegrated in the interval $(t_2 - t_1)$ is

(A) $\frac{(X+Y)\tau}{2}$ (B) $\frac{(X-Y)}{\tau}$ (C) $(X-Y)\tau$ (D) $(X+Y)\tau$

Ans (C)

$N_1 = N_0 e^{-\lambda t_0}$

$\left(\frac{-dN_1}{dt}\right) = X = \left|-\lambda . N_1\right|$

Similarly $Y = \left|-\lambda . N_2\right|$

$\therefore\ N_1 - N_2 = \frac{X-Y}{\lambda} = \tau(X-Y).$

41. A transistor amplifier has $\beta = 75$, $R_L = 6\ k\Omega$ internal resistance of the base is $R_i = 1.5\ k\ \Omega$, then the voltage gain of the common emitter amplifier is

(A) 150 (B) 300 (C) 475 (D) 600

Ans (B)

Operating point of a transistor is zero signal value of I_c and V_{cc}.

42. A pure silicon crystal of length l(= 0.1 m) and area A (= 10^{-4} m^2) has the mobility of electrons and holes as 0.135 $m^2\ V^{-1}\ s^{-1}$ and 0.048 $m^2\ V^{-1}s^{-1}$ respectively. If the voltage applied across it is 2V and intrinsic charge concentration is $n_I = 1.5 \times 10^6\ m^{-3}$, then the total current flowing through the crystal is

(A) 4.39×10^{-17} A (B) 8.7×10^{-17} A

(C) 13.17×10^{-17} A (D) 2.19×10^{-17} A

Ans (B)

$$I = \frac{V}{R} = \frac{V}{\rho l / A} = \frac{VA}{l}\left[e\left(n_e\mu_e + n_h\mu_h\right)\right]$$

$$= \frac{2\times10^{-4}}{0.1}\left[1.6\times10^{-19}\left(1.5\times10^{6}\times0.135 + 1.5\times10^{6}\times0.048\right)\right] = 8.78 \times 10^{-17}\ \text{A}$$

43. The resonance frequency of the LCR circuit of an oscillator when $L = \frac{10}{\pi^2}$ mH and $C = 0.04\ \mu F$ are connected in parallel is

(A) 250 kHz (B) 25 kHz (C) 2.5 kHz (D) 25 MHz

Ans (B)

$$\nu = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi}\frac{1}{\sqrt{\frac{10}{\pi^2}\times10^{-3}\times0.04\times10^{-6}}} = 25\ \text{kHz}$$

44. A beam of natural light falls on a system of 6 polaroids, which are arranged in succession such that each polaroid is turned through 30° with respect to the preceding one. The percentage of incident intensity that passes through the system will be

(A) 100 % (B) 50 % (C) 30 % (D) 12 %

Ans (D)

If I is the final intensity and I_0 is the initial intensity then

$$I = \frac{I_0}{2}(\cos^2 30°)^5 \text{ or } \frac{I}{I_0} = \frac{1}{2}\times\left(\frac{\sqrt{3}}{2}\right)^{10} = 0.12$$

45. In Young's experiment, the distance between slits is 0.28 mm and distance between slits and screen is 1.4 m. Distance between central bright fringe and third bright fringe is 0.9 cm. The wavelength of light used is

(A) 5000 Å (B) 6000 Å (C) 7000 Å (D) 4358 Å

Ans (B)

Position of 3rd bright fringe $x_3 = \frac{3D\lambda}{d}$

$$\Rightarrow \lambda = \frac{x_3 d}{3D} = \frac{(0.9\times10^{-2})\times(0.28\times10^{-3})}{3\times1.4} = 6000\ \text{Å}$$

PART II – CHEMISTRY

46. The wave number of the series limiting line for the Paschen series for hydrogen atom is (R = 109678 cm^{-1})

(A) 82259 cm^{-1} (B) 109678 cm^{-1} (C) 12186 cm^{-1} (D) 9.1176×10^{-6} cm^{-1}

Ans (C)

$$\bar{\nu} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

For Paschen series $n_1 = 3$ and for limiting line $n_2 = \infty$

$$\therefore \bar{\nu} = 109678\left(\frac{1}{3^2} - \frac{1}{\infty}\right) = \frac{109678}{9} = 12186\ \text{cm}^{-1}$$

47. A species having only one electron has ionization energy of 11810 kJ mol^{-1}. The number of protons in its nucleus will be.

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

Ans (C)

I.E. $= \frac{1312}{n^2} \times Z^2$ kJ mol^{-1}

For one electron species in the ground state, n = 1

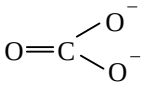
$\therefore 1312 \times Z^2 = 11810$ or $Z^2 = 9$ or $Z = 3$

48. The valency of carbon in CO_3^{2-} is

(A) 2 (B) 3 (C) 4 (D) – 3

Ans (C)

Carbon has a valency of 4 in CO_3^{2-} as it forms one double bond and two single bonds, i.e.,



49. Among of the following species, the one that has least bond angle is

(A) H_2O (B) H_2S (C) H_2Se (D) H_2Te

Ans (D)

Bond angle decreases with decrease of electronegativity or with increase of size of the central atom. Thus, the order is

$H_2O > H_2S > H_2Se > H_2Te$

50. The equilibrium constant at 717 K for the reaction $HI(g) \rightleftharpoons \frac{1}{2}H_2(g) + \frac{1}{2}I_2(g)$

if its value for the reaction $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ at 717 K is 64

(A) 64 (B) 8 (C) $\frac{1}{64}$ (D) $\frac{1}{8}$

Ans (D)

As the reaction is reversed and divided by 2, new eqm. Const. $= \sqrt{\frac{1}{64}} = \frac{1}{8}$.

51. Conjugate base of hydrazoic acid is

(A) HN_3^- (B) N_2^- (C) N_3^- (D) N^{-3}

Ans (C)

$N_3H \rightleftharpoons N_3^- + H^+$

52. The IUPAC name of the following compound $CH_2 = CH - CH_2OH$ is

(A) allyl alcohol (B) vinyl alcohol

(C) 3-hydroxyprop-1-ene (D) prop-2-en-1-ol

Ans (D)

$\overset{3}{C}H_2 = \overset{2}{C}H - \overset{1}{C}H_2OH$

Prop-2-en-1-ol

53. 0.765 g of an acid gives 0.505 g of CO_2 and 0.12 g of H_2O. Then, the ratio of the percentage of carbon and hydrogen is

(A) 19 : 2 (B) 18 : 11 (C) 20 : 17 (D) 9 : 1

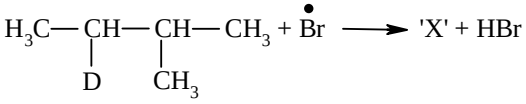
Ans (D)

$$\%C = \frac{12}{44} \times \frac{0.505}{0.765} \times 100 = 18.003$$

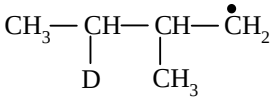
$$\%H = \frac{2}{18} \times \frac{0.138}{0.765} \times 100 = 2.004$$

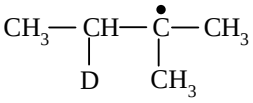
Ratio of C : H = 18 : 2 (approx.) = 9 : 1

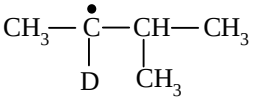
54. Consider the following reaction,

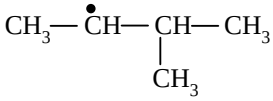


The structure of the major product 'X' is

(A) 

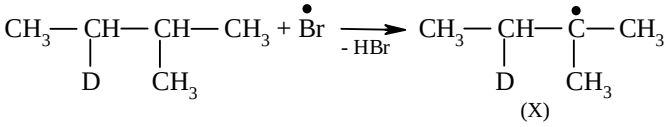
(B) 

(C) 

(D) 

Ans (B)

Since $\dot{B}r$ is less reactive but more selective, therefore, the most stable 3° free radical will be the major product, i.e., option (B) is correct.



(X)

3° Free radical
(most stable)

55. HC ≡ CH reacts with excess of acetic acid in presence of Hg^{2+} to give

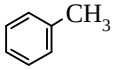
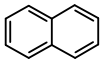
(A) $CH_3CH(OCOCH_3)_2$ (B) $\begin{matrix} CH(OOCCH_3)_2 \\ | \\ CH(OOCCH_3)_2 \end{matrix}$ (C) $CH_3CH_2OOCCH_3$ (D) $H_3C–CH_2–COOH$

Ans (A)

$$HC \equiv CH + CH_3COOH \xrightarrow{Hg^{2+}}$$

$$H_2C = CH.OCOCH_3 \xrightarrow{CH_3COOH/Hg^{2+}} CH_3 - CH\left(OCOCH_3\right)_2 .$$

56. A anti-aromatic compound among the following is

(A)  (B)  (C)  (D) 

Ans (C)

Cyclooctatetraene (COT)

It doesnot obey Huckel's rule i.e., $4n + 2\ \pi\ e^-$

57. Al_2O_3 is reduced by electrolysis at low potential and high current. If 4.0×10^4 amperes of current is passed through molten Al_2O_3 for 6 hours, the mass of aluminium produced is (At. mass of Al = 27 g mol^{-1})

(A) 8.1×10^4 g (B) 2.4×10^5 g (C) 7.5×10^4 g (D) 9.0×10^3 g

Ans (A)

$Al^{3+} + 3\,e^- \rightarrow Al$

Quantity of electricity passed

$= (4.0 \times 10^4\ A) \times (6 \times 60 \times 60\ s)$

$= 864 \times 10^6$ coulombs

3 F, i.e., 3×96500 C produce Al = 1 mole, i.e., 27 g

$\therefore\ 864 \times 10^6$ C will produce Al

$$= \frac{27}{3 \times 96500} \times 864 \times 10^6\ g$$

$= 8.058 \times 10^4$ g $\cong 8.1 \times 10^4$ g

58. Standard reduction potentials of the half reactions are given below

$F_2(g) + 2e^- \rightarrow 2F^-(aq)$; E° = + 2.85 V

$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq)$; E° = + 1.36 V

$Br_2(s) + 2e^- \rightarrow 2Br^-(aq)$; E° = + 1.06 V

$I_2(s) + 2e^- \rightarrow 2I^-(aq)$; E° = + 0.53 V

The strongest oxidizing and reducing agents respectively are

(A) Cl_2 and Br^- (B) Cl_2 and I_2 (C) F_2 and I_2 (D) F_2 and I^-

Ans (D)

Higher the reduction potential, more easily it is reduced and hence stronger is the oxidizing agent. F_2 has highest reduction potential. Hence, F_2 is strongest oxidizing agent. Considering the reverse reactions (oxidation reactions), higher the oxidation potential, more easily it is oxidized and hence stronger is the reducing agent.

Oxidation potential of I^- ion (– 0.53 V) is highest out of – 2.85, –1.36, –1.06 and – 0.53. Hence, I^- is strongest reducing agent.

59. A device that converts energy of combustion of fuels like hydrogen and methane directly into electrical energy is known as

(A) dynamo (B) Ni-Cd cell

(C) fuel cell (D) electrolytic cell

Ans (C)

60. Sulphur trioxide can be obtained from

(A) $CaSO_4 + C \xrightarrow{\Delta}$ (B) $Fe_2(SO_4)_3 \xrightarrow{\Delta}$

(C) $S + H_2SO_4 \xrightarrow{\Delta}$ (D) $H_2SO_4 + PCl_5 \xrightarrow{\Delta}$

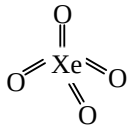
Ans (B)

$Fe_2(SO_4)_3 \xrightarrow{\Delta} Fe_2O_3 + 3\,SO_3$

61. The species having equal number of σ - and π- bonds is

(A) $(CN)_2$ (B) $CH_2(CN)_2$ (C) HCO_3^- (D) XeO_4

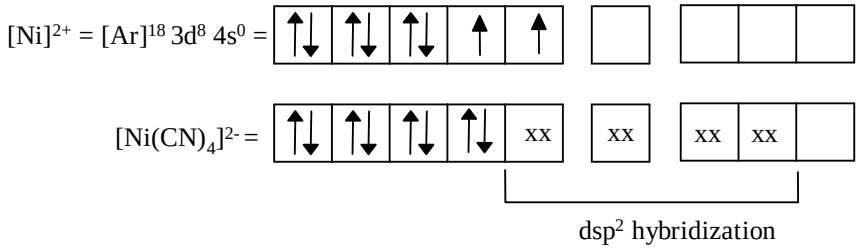
Ans (D)



4σ bonds
4π bonds

62. According to IUPAC nomenclature, sodium nitroprusside is named as
(A) Sodium nitroferricyanide (B) Sodium nitroferrocyanide
(C) Sodium pentacyanonitrosoniumferrate (II) (D) Sodium pentacyano nitrosylferrate (III)
Ans (C)
Sodium nitroprusside, Na_2 [Fe $(CN)_5$ NO], is named as sodium pentacyano nitrosyl ferrate (III). In this compound, NO is present as NO^+ and Fe has + 2 charge. On the basis of this, the actual name should be sodium pentacyanonitrosonium ferrate (II).

63. The hybridization involved in the complex $[Ni(CN)_4]^{2-}$ is (At. No. Of Ni = 28)
(A) d^2sp^2 (B) d^2sp^3 (C) dsp^2 (D) sp^3
Ans (C)
$[Ni(CN)_4]^{2-}$ has Ni in +2 oxidation state



(In presence of strong field ligand CN^-, electrons in d-orbitals pair up)

64. Among the following compound, the one that will give a secondary alcohol on reaction with Grignard reagent followed by acid hydrolysis is
(1) HCHO (2) C_2H_5CHO (3) CH_3COCH_3 (4) $HCOOC_2H_5$
(A) 2 only (B) 3 only (C) 1 and 4 (D) 2 and 4
Ans (D)

65. Product C in the reaction, $C_2H_5Br \xrightarrow[(aqueous)]{NaOH} A \xrightarrow{Na} B \xrightarrow{CH_3I} C$ will be
(A) ethanol (B) ethyl iodide (C) ethane (D) ethyl methyl ether
Ans (D)

$$C_2H_5Br \xrightarrow[(aqueous)]{NaOH} C_2H_5OH \xrightarrow{Na}$$

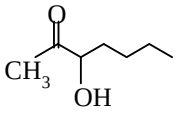
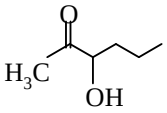
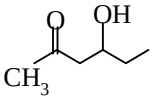
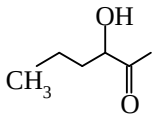
$$C_2H_5ONa \xrightarrow[(Williamson's\ synthesis)]{CH_3I} \underset{\text{Ethyl methyl ether}}{C_2H_5-O-CH_3} + NaI$$

66. The product 'B' in the sequence of reaction $CH \equiv CH \xrightarrow[HgSO_4]{30\%\ H_2SO_4} A \xrightarrow[\Delta]{NaOH} B$
(A) CH_3–CH=CH–CHO (B) CH_3COOH
(C) CH_3CHO (D) $CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CHO$
Ans (A)

$$HC \equiv CH \xrightarrow[HgSO_4]{30\%\ H_2SO_4} \underset{\text{Acetaldehyde (A)}}{CH_3-CHO} \xrightarrow[(Aldol\ condensation)]{NaOH} \underset{\text{Aldol (B)}}{CH_3-CHOH-CH_2-CHO}$$

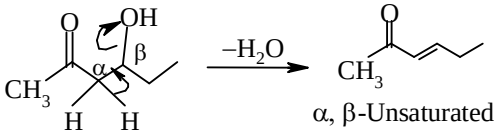
$$\xrightarrow{\Delta} CH_3 - CH = CH - CHO$$

67. Among the following compounds, the one that will be most readily dehydrated is

(A)  (B)  (C)  (D) 

Ans (C)

β-Hydroxy ketones readily undergo dehydration to give α, β-unsaturated ketone.



α, β-Unsaturated ketone

68. Propionic acid with Br_2/P yields a dibromo product. Its structure would be

(A) $CHBr_2–CH_2COOH$ (B) $CH_2Br–CH_2–COBr$

(C) $CH_3–CBr_2–COOH$ (D) CH_2Br-$CHBr–COOH$

Ans (C)

$$CH_3CH_2COOH \xrightarrow[\text{HVZ reaction}]{Br_2/P} CH_3 - \underset{Br}{CH} - COOH \xrightarrow{Br_2/P} CH_3 - CBr_2 - COOH$$

69. 4 g carbon is heated with 8 g of sulphur. The percentage purity of carbon disulphide (CS_2) in the final product obtained is

(A) 59.2% (B) 69.2% (C) 79.2% (D) 89.2%

Ans (C)

$$\underset{12\ g}{C} + \underset{2\times32=64\,g}{2S} \rightarrow \underset{12+2\times32=76\ g}{CS_2}$$

Obviously, sulphur will be the limiting reactant.

8 g sulphur will produce $CS_2 = \frac{76}{64} \times 8 = 9.5\,g$

Carbon reacted $= \frac{12}{64} \times 8 = 1.5\,g$

Carbon left $= 4 - 1.5 = 2.5$ g

Total mass of products = 9.5 + 2.5 = 12 g

$\therefore$ % Purity of CS_2 in the product $= \frac{9.5}{12} \times 100$

= 79.2 %

70. An open vessel at 27°C is heated until $\frac{3}{5}$ parts of the air in it has been expelled. Assuming that the volume of the vessel remains constant, the temperature to which the vessel has been heated is

(A) 500 K (B) 750 K (C) 1000 K (D) 1250 K

Ans (B)

As the vessel is open, pressure and volume remain constant. Thus, if n_1 moles are present at T_1 and n_2 moles are present at T_2, we can write $PV = n_1 RT_1$ and also $PV = n_2RT_2$

Hence, $n_1 RT_1 = n_2 RT_2$

or $n_1 T_1 = n_2T_2$

or $\frac{n_1}{n_2}=\frac{T_2}{T_1}$

Suppose the number of moles of air originally present = n

After heating, number of moles of air expelled $=\frac{3}{5}n$

$\therefore$ Number of moles left after heating $=n-\frac{3}{5}n=\frac{2}{5}n$

Thus, $n_1 = n$, $T_1 = 300$ K; $n_2 =\frac{2}{5}n$, $T_2 = ?$

Substituting in eqn. (i), we get

$\frac{n}{\frac{2}{5}n}=\frac{T_2}{300}$ or $\frac{5}{2}=\frac{T_2}{300}$ or $T_2 = 750$ K

Alternatively

OR

Suppose the volume of the vessel = V, i.e., Volume of air initially at 27 °C = V

Volume of air expelled $=\frac{3}{5}V$

$\therefore$ Volume of air left at 27°C $=\frac{2}{5}V$

However, on heating to T°K, it would become = V

As pressure remains constant (vessel being open)

$\frac{V_1}{T_1}=\frac{V_2}{T_2}$, i.e., $\frac{\frac{2}{5}V}{300\text{ K}}=\frac{V}{T_2}$ or $T_2 = 750$ K

71. When 100 g of water is electrolysed at constant pressure of 1 atmosphere and temperature of 20°C, the work of expansion is

(A) – 203.8 kJ (B) – 20.6 kJ (C) – 23.6 kJ (D) – 101.9 kJ

Ans (B)

Electrolysis of water takes place as:

$2\ H_2O\ (l) \rightarrow 2\ H_2\ (g) + O_2\ (g)$

Thus, 2 moles of H_2O, i.e., $2 \times 18 = 36$ g of H_2O on electrolysis produce 2 moles of H_2 gas and one mole of O_2 gas, i.e., total 3 moles of the gases

$\therefore$ 100 g of water will produce gases

$=\frac{3}{36}\times 100 = 8.33$ moles

Volume occupied by 8.33 moles of gases at 25°C and 1 atm pressure is given by $V=\frac{nRT}{P}$

$=\frac{(8.33\,\text{mole})(0.0821\text{ L atm K}^{-1}\text{mol}^{-1})(298\text{ K})}{1\text{ atm}}$ = 203.8 L

Taking the volume of liquid water as negligible (being 100 mL = 0.1 L), $\Delta V = 203.8$ L

$\therefore$ $w = -P_{ext}\,\Delta V = -1\text{ atm} \times 203.8\text{ L}$

$= -203.8\text{ L atm} = -203.8 \times 101.3$ J

= – 20.6 kJ

72. The correct decreasing order of their melting points is

(A) Si > Ge > Sn > Pb (B) Si > Ge > Pb > Sn

(C) Ge > Si > Pb > Sn (D) Sn > Pb > Ge > Si

Ans (B)

The correct decreasing order of the m.p. in K is

Si	>	Ge	>	Pb	>	Sn
1693		1218		600		505

73. If spheres of radius 'r' are arranged in ccp fashion (ABC ABC...), the vertical distance between any two consecutive A layers is

(A) $4r\sqrt{\frac{2}{3}}$ (B) $4r\sqrt{\frac{3}{2}}$ (C) 6 r (D) $r\sqrt{6}$

Ans (A)

Distance between two consecutive A layers (D) $= 2\sqrt{\frac{2}{3}}a$

But a = 2 r $\quad \therefore d = 2\sqrt{\frac{2}{3}} \times 2r = 4r\sqrt{\frac{2}{3}}$

74. The mass of concentrated nitric acid required to prepare 250 mL of 2.0 M HNO_3 is

(The concentrated nitric acid is 70% HNO_3)

(A) 45.0 g conc HNO_3 (B) 90.0 g conc HNO_3

(C) 70.0 g conc HNO_3 (D) 54.0 g conc HNO_3

Ans (A)

250 mL of 2.0 M HNO_3 will contain HNO_3

$= \frac{2}{1000} \times 250 = 0.5 \text{ mol} = 0.5 \times 63 \text{ g} = 31.5 \text{ g}$

As concentrated HNO_3 is 70%, therefore, concentrated HNO_3 required $= \frac{100}{70} \times 31.5\text{g} = 45\text{g}$

75. The correct ascending order of adsorption of the following gases on the same mass of charcoal at the same temperature and pressure is

(A) $CH_4 < H_2 < SO_2$ (B) $H_2 < CH_4 < SO_2$ (C) $SO_2 < CH_4 < H_2$ (D) $H_2 < SO_2 < CH_4$

Ans (B)

More easily a gas is liquefiable, higher is its critical temperature and greater is its adsorption. Critical temperatures in K are

$\underset{33.2}{H_2} < \underset{190.6}{CH_4} < \underset{430.3}{SO_2}$ or ease of liquefaction is $H_2 < CH_4 < SO_2$.

Hence, ascending order of adsorption is $H_2 < CH_4 < SO_2$.

76. The decomposition of N_2O_5 in CCl_4 at 318 K is studied by monitoring the concentration of N_2O_5 in the solution. Initially, the concentration of N_2O_5 is 2.4 mol L^{-1} and after 200 minutes, it is reduced to 2.00 mol L^{-1}. The rate of production of NO_2 during this period in mol L^{-1} min^{-1} is

(A) 4×10^{-3} (B) 2×10^{-3} (C) 5×10^{-3} (D) 7×10^{-3}

Ans (A)

$2\,N_2O_5 \rightarrow 4\,NO_2 + O_2$

Rate of reaction $= -\frac{1}{2}\frac{d[N_2O_5]}{dt} = +\frac{1}{4}\frac{d[NO_2]}{dt}$ ...(i)

Rate of disappearance of $N_2O_5\left(\frac{-d[N_2O_5]}{dt}\right)$

$= \frac{(2.4-2.0)}{200\,min}\,mol\,L^{-1} = \frac{0.4}{200}\,mol\,L^{-1}\,min^{-1}$

$= 2\times10^{-3}\ mol\,L^{-1}\ min^{-1}$

From eqn. (i)

Rate of production of $NO_2\left(+\frac{d[NO_2]}{dt}\right)$

$= -4\times\frac{1}{2}\frac{d[N_2O_5]}{dt}$

$= -2\times\left(-2\times10^{-3}\right)mol\ L^{-1}\ min^{-1}$

$= 4\times10^{-3}mol\ L^{-1}\ min^{-1}$

77. The incorrect statement about the interstitial compounds is

(A) They retain metallic conductivity.

(B) They are chemically reactive.

(C) They are much harder than the pure metal.

(D) They have higher melting points than the pure metal.

Ans (B)

Interstitial compounds are chemically inert and not reactive.

78. "Metals are usually not found as nitrates in their ores" Out of the following two (I and II) reasons, the one that is/are true for the above observation is

I. Metal nitrates are highly unstable.

II. Metal nitrates are highly soluble in water.

(A) I is false but II is true

(B) I is true but II is false

(C) I and II are true

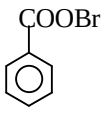
(D) I and II are false

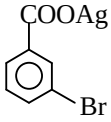
Ans (A)

All nitrates are water soluble and are quite stable.

79. Silver benzoate reacts with bromine in refluxing CCl_4 to form

(A) 

(B) 

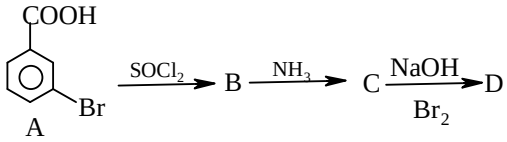
(C) 

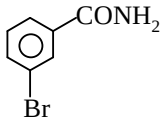
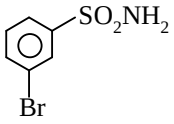
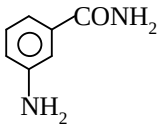
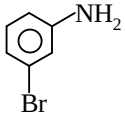
(D) C_6H_5Br

Ans (D)

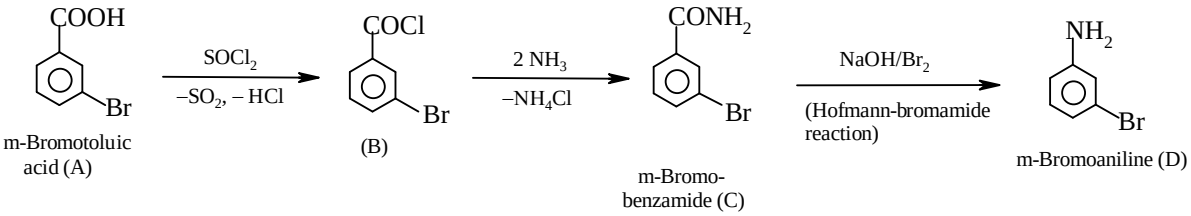
$C_6H_5COOAg \xrightarrow{Br_2,\ CCl_4} C_6H_5Br$. This is called Hunsdiecker reaction.

80. In the following reaction, m-bromobenzoic acid gives a product D. The product D is



(A)  (B)  (C)  (D) 

Ans (D)



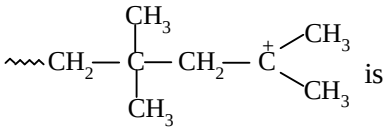
81. The amino acids with the lowest isoelectric point is

(A) glycine (B) alanine (C) aspartic acid (D) lysine

Ans (C)

Glycine and alanine are monoamino monocarboxylic acids and hence their pIs are close to pH 6.0. Aspartic acid being monoamino dicarboxylic acid, its pIs lies in acidic range. Therefore, its pIs is the lowest (i.e., pH 3.0). Lysine, on the other hand, is a diaminomonocarboxylic acid, therefore, its pIs lies in the basic range. Its actual pI is 9.7.

82. The monomer of the polymer

 is

(A) $CH_3CH = CHCH_3$ (B) $CH_3CH = CH_2$

(C) $(CH_3)_2C = C(CH_3)_2$ (D) $H_2C = C(CH_3)_2$

Ans (D)

Isobutylene, $H_2C = C(CH_3)_2$.

83. Antihistamine among the following is

(A) Ranitidine (B) Lansopyrazole (C) Terfenadine (D) Luminal

Ans (C)

84. The ion that are isoelectronic with F^- is

(A) S^{2-} and Mg^{2+} or Na^+ (B) O^{2-} and Ca^{2+} or K^+

(C) O^{2-} and Mg^{2+} or Li^+ (D) O^{2-} and Mg^{2+} or Na^+

Ans (D)

O^{2-} (8 + 2 = 10) and Mg^{2+} (12 – 2 = 10) are isoelectronic with

F^- (9 + 1 = 10) and Na^+ = (11 – 1 = 10)

85. The paramagnetic species is

(A) KO_2 (B) SiO_2 (C) TiO_2 (D) BeO_2

Ans (A)

KO_2 is paramagnetic because it has (19 + 16 = 35) odd number of electrons. All others have even number of electrons and are diamagnetic.

86. The decreasing order of the second ionization enthalpy of K, Ca and Ba is

(A) K > Ca > Ba (B) Ca > Ba > K

(C) Ba > K > Ca (D) K > Ba > Ca

Ans (A)

K > Ca > Ba. IE_2 of K is highest since the second electron is to be lost from inert gas core, i.e., Ar. Further, because of the larger size of Ba as compared to Ca, its IE_2 is lower than that of Ca.

87. The incorrect statement among photochemical smog is

(A) CO does not play any role in photochemical smog formation.

(B) Photochemical smog is an oxidising agent in character.

(C) Photochemical smog is formed through photochemical reaction involving solar energy.

(D) Photochemical smog does not cause irritation in eyes and throat.

Ans (D)

Photochemical smog causes irritation in eyes and throat.

88. When H_2O_2 is oxidised by a suitable oxidant, one of the product is

(A) O^{2-} (B) HO^{2-} (C) OH^- (D) O_2

Ans (D)

As a reductant, the key reaction involved in case of H_2O_2 is $H_2O_2 + O \rightarrow H_2O + O_2$.

89. Oxidation number of chlorine is + 5 in

(A) Cl^- (B) ClO^- (C) ClO_2^- (D) ClO_3^-

Ans (D)

(a) O.N. of Cl in $Cl^- = -1$

(b) O.N. of Cl in $ClO^- = x - 2 = -1$ or $x = +1$

(c) O.N. of Cl in $ClO_2^- = x + 2\times(-2) = -1$ or $x = +3$

(d) O.N. of Cl in $ClO_3^- = x + 3\times(-2) = -1$ or $x = +5$.

90. In acidic mediumH_3PO_3 gives

(A) H_3PO_2 (B) H_3PO_3 (C) H_3PO_4 (D) $(HPO_3)_n$

Ans (C)

$4H_3PO_3 \xrightarrow{H^+} PH_3 + 3H_3PO_4$

The reaction is disproportionation reaction.

PART III – BIOLOGY

91. PTH is a
(A) hypercalcemic hormone (B) hypocalcemic hormone
(C) endocalcemic hormone (D) exocalcemic hormone
Ans (A)

92. Regulators are the animals which
(A) does not maintain their body homeostasis (B) can maintain their body homeostasis
(C) can regulate their heart beat (D) can regulate their circulation
Ans (B)

93. The exotic species become invasive sometime and starts spreading fast because of
(A) natural predators (B) abundant natural competitor
(C) invaded land does not have its natural predators (D) mutation in their genome
Ans (C)

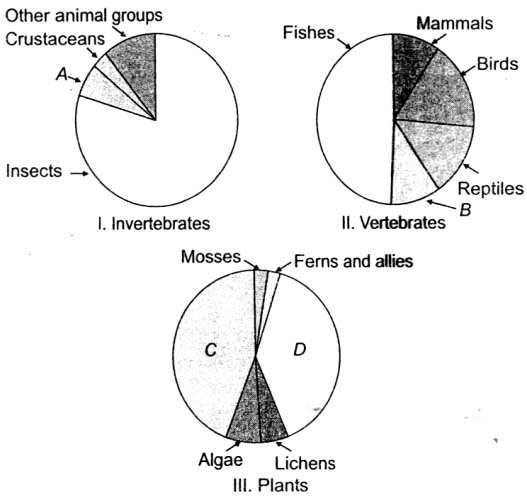
94. Match the following columns.

Column I		**Column II**	
(a)	Scavengers	1.	Autotrophs
(b)	Parasites	2.	Heterotrophs
(c)	Producers	3.	Consumers that feed on a small part of a living being
(d)	Phagotrophs	4.	Consumers of dead bodies

	a	**b**	**c**	**d**
(A)	4	3	1	2
(B)	3	1	2	4
(C)	1	2	4	3
(D)	4	3	2	1

Ans (A)

95. Given below are pie diagrams I, II and III related to the proportionate number of species of major taxa of invertebrates, vertebrates and plants respectively. Critically study and fill in the blanks A, B, C and D.
(A) A – Molluscs, B – Amphibians, C – Angiosperms, D – Gymnosperms
(B) A – Molluscs, B – Amphibians, C – Fungi, D – Angiosperms
(C) A – Turtles, B – Amphibians, C – Fungi, D – Angiosperms
(D) A – Hexapoda, B – Amphibians, C – Fungi, D – Angiosperms
Ans (B)



96. The first stable product of Calvin cycle is
(A) 3-phosphoglycerate (B) 1, 3 biphosphoglycerate
(C) glyceraldehyde - 3 phosphate (D) ribulose - 5 - phosphate
Ans (A)

97. The first carbon dioxide fixation product of C_4 plants is
(A) oxaloacetic acid (B) ribulose biphosphate
(C) phosphoenol pyruvate (D) phosphoglyceric acid
Ans (A)

98. Lophodont (presence of transverse ridges on grinding surface) type of teeth among the following is
(A) incisor and canine (B) canine and premolar
(C) premolar and molar (D) premolar and incisor
Ans (C)

99. Hiccups can be best described as
(A) forceful sudden expiration.
(B) forceful contraction of intercostals muscles during deep breathing.
(C) vibration of the soft palate during breathing while sleeping.
(D) jerky incomplete inspiration.
Ans (D)

100. When kidney of a person is damaged, he/she invariably suffers from anaemia because
(A) RBCs pass through the glomerulus
(B) sufficient erythropoietin is not produced
(C) haemoglobin is not synthesised sufficiently
(D) iron and vitamin B_{12} are not able to bind to haemoglobin.
Ans (B)

101. **Statement 1**: Crassulacean acid metabolism occurs in succulent plants which grow in xeric conditions.
Statement 2: Stomata are generally sunken in succulent plants.
(A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
(B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
(C) Statement 1 is correct and statement 2 is incorrect.
(D) Both statements 1 and 2 are incorrect.
Ans (B)

102. Temperature of the scrotum which is necessary for the functioning of testis is always around ____ below body temperature.
(A) 2 °C (B) 4 °C (C) 6 °C (D) 8 °C
Ans (A)

103. Which of the following have porous body and have cellular body organisation?
(A) *Aurelia* and *Obelia* (B) *Adamsia* and *Euplectella*
(C) *Leucosolenia* and *Spongilla* (D) *Sycon* and *Hydra*
Ans (C)

104. Select among the following, an approach used for treatment of cancer.

(A) Gene therapy and immunotherapy (B) Surgery

(C) Radiotherapy and Chemotherapy (D) All of (A), (B) and (C)

Ans (D)

105. A protozoan among the following is

(A) *Entamoeba histolytica* (B) *E.coli*

(C) *Streptococcus pneumonia* (D) *Trichophyton.*

Ans (A)

106. Match the following columns and select the correct option.

	Column I		**Column II**
(a)	*Panthera tigris*	(i)	Mango
(b)	*Mangifera indica*	(ii)	Common Indian frog
(c)	*Musca domestica*	(iii)	Cockroach
(d)	*Periplaneta americana*	(iv)	Tiger
(e)	*Rana tigrina*	(v)	House fly

(A) a - (ii), b - (v), c - (i), d - (iii), e - (iv) (B) a - (iv), b - (i), c - (v), d - (iii), e - (ii)

(C) a - (ii), b - (v), c - (iii), d - (i), e - (iv) (D) a - (iv), b - (i), c - (v), d - (ii), e - (iii)

Ans (B)

107. Choose a wrongly matched pair among the following.

(A) Haemoglobin in mammals - RBC (B) Haemozoin - *Plasmodium* infection by product

(C) Haemocyanin – *periplanata* species (D) Haemoglobin dissolved in blood - *Pheretima*

Ans (C)

108. Cork cambium results in the formation of cork which becomes impermeable to water due to the accumulation of

(A) resin (B) suberin (C) lignin (D) tannin

Ans (B)

109. In the sieve elements, which one of the following is the most likely function of p-proteins?

(A) Deposition of callose on sieve plates

(B) Providing energy for active translocation

(C) Autolytic enzymes

(D) Sealing mechanism on wounding

Ans (D)

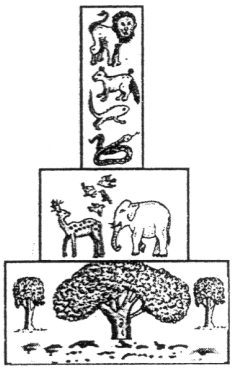
110. Cell theory was proposed by

(A) a botanist (B) a zoologist

(C) a botanist and a zoologist (D) a psychologist

Ans (C)

111. Identify the kind of pyramid represented by the given figure.



(A) Pyramid of numbers in a tree
(B) Pyramid of numbers in a parasitic food chain
(C) Pyramid of biomass in a forest ecosystem
(D) It is a wrong pyramid

Ans (C)

112. During the processing of proinsulin into the mature insulin
(A) C-peptide is added to proinsulin
(B) C-peptide is removed from proinsulin
(C) B-peptide is added to proinsulin
(D) B-peptide is removed from proinsulin
Ans (B)

113. Polyembryony commonly occurs in
(A) banana (B) tomato (C) potato (D) *citrus*.
Ans (D)

114. The two benefits from apiculture are
(A) honey (B) wax (C) flower formation (D) both (A) and (B)
Ans (D)

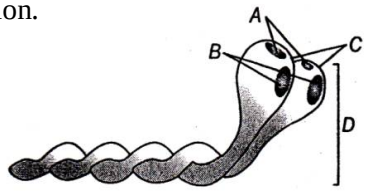
115. Select the odd one regarding pisciculture.
(A) Salmon (B) Pompfret (C) Lobster (D) Rohu
Ans (C)

116. At which vertebra does trachea divide into right and left primary bronchi?
(A) T5 (B) C5 (C) T9 (D) S4
Ans (A)

117. If husband is Rh^+ and wife is Rh^- then
(A) no problem with first child irrespective of Rh
(B) second child would have anaemia (erythroblastosis foetalis) if Rh^+
(C) second child would be normal in all cases
(D) both (A) and (B)
Ans (D)

118. Identify the true statements and choose the correct option accordingly.
I. Blood vessel leading to the glomerulus is called efferent arteriole.
II. Vasa-recta, peritubular capillaries and glomerulus, all have blood.
III. Cortical nephrons have highly reduced vasa-recta.
IV. Vasa-recta runs parallel to the Henle's loop in the juxta-medullary nephron.
(A) I, II and III
(B) I, III and IV
(C) I, III and IV
(D) II, III and IV
Ans (D)

119. Identify A, B, C and D, in the given diagram and choose the correct option.



(A) A-Actin binding site, B-ATP binding site, C-Head, D-Cross arm
(B) A-Actin binding site B-ATP binding site, C-Head, D-Side arm
(C) A-Actin binding site, B-ATP binding site, C-Head, D-Long arm
(D) A-Actin binding site, B-ATP binding site, C-Head D-Short arm
Ans (A)

120. The electrical potential difference across the plasma membrane when concentration of K is high inside axon and low outside axon is called as the
(A) action potential (B) resting potential
(C) refractory potential (D) All of (A), (B) and (C)
Ans (B)

121. Match Column-I with Column-II and select the correct option from codes given below.

Column I		Column II	
a.	*Planaria*	(i)	Binary fission
b.	Fungi	(ii)	Asexual spores
c.	Yeast	(iii)	Budding
d.	*Amoeba*	(iv)	True regeneration
		(v)	Fragmentation

(A) a - (i), b - (ii), c - (iii), d - (iv) (B) a - (iv), b - (ii), (v), c - (iii), d - (i)
(C) a - (ii), b - (v), c - (i), d - (iv) (D) a - (v), b - (ii), (i), c - (iii), d - (iv)
Ans (B)

122. Choose a statement which does not support reverse osmosis.
(A) It is used for water purification.
(B) In this technique, pressure greater than osmotic pressure is applied to the system.
(C) It is a passive process.
(D) It is an active process.
Ans (C)

123. Name elements which are required for chlorophyll synthesis.
(A) Fe and Mg (B) Mo and Ca (C) Cu and Ca (D) Ca and K
Ans (A)

124. Hormone responsible for ageing is
(A) GA (B) IAA (C) ABA (D) cytokinin.
Ans (C)

125. Name the disease which is caused by the bite of a female mosquito vector.
(A) Filariasis (B) Amoebiasis (C) Typhoid (D) Pneumonia
Ans (A)

126. The term “inbreeding depression” is related to
(A) increased fertility and productivity (B) increased milk production
(C) decreased fertility and productivity (D) decreased diseases
Ans (C)

127. Match the following columns.

Column I		Column II	
a.	Exon	1.	Coding sequence
b.	Intron	2.	Non-coding sequence
c.	Genetic code	3.	Triplet bases on mRNA
d.	DNA packaging	4.	Nucleosome

Codes

	a	b	c	d
(A)	1	3	2	4
(B)	1	4	2	3
(C)	1	2	3	4
(D)	4	1	2	3

Ans (C)

128. Classical example of point mutation is

(A) colour blindness
(B) night blindness
(C) sickle-cell anaemia
(D) All of (A), (B) and (C)

Ans (C)

129. In the process of insertional inactivation

(A) a recombinant DNA is inserted within the coding sequence of enzyme β-galactosidase, resulting in inactivation of the enzyme
(B) a recombinant DNA is inserted within the coding sequence of proteins involved in the replication of the plasmid
(C) a recombinant DNA is inserted within the recognition site for EcoR I
(D) a nonrecombinant DNA is inserted within recognition site for BamH I

Ans (A)

130. Name the step which should be performed by a person in order to visualize the bands of DNA fragments by using gel electrophoresis among the following

(A) Exposure of DNA fragments to UV radiations
(B) Staining with bromophenol blue followed by exposure to UV radiations
(C) Staining with ethidium bromide followed by exposure to UV radiations
(D) Person can see the bands without staining

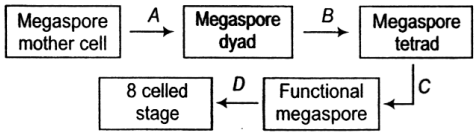
Ans (C)

131. Read the statements given below, select the one which is not a characteristic of pBR322 vector

(A) It was the first artificial cloning vector constructed in 1977 by Boliver and Rodriguez
(B) It is the most widely used, versatile and easily manipulated vector
(C) It has two antibiotic resistance genes tet^R and amp^R
(D) It does not have restriction site for Sal I

Ans (D)

132. Give the name of type of the cell division at A, B, C and D.



(A) A – Meiosis-I, B – Mitosis, C – Mitosis, D – Meiosis
(B) A – Meiosis-I, B – Meiosis-II, C – No division, D – Mitosis
(C) A – Mitosis, B – No division, C – Meiosis-II, D – Meiosis-I
(D) A – Mitosis, B – Mitosis, C – Meiosis-I, D – Meiosis-I
Ans (B)

133. Apomictic embryos in citrus arise from
(A) synergids
(B) maternal sporogenous tissue in ovule
(C) antipodal cell
(D) haploid egg
Ans (B)

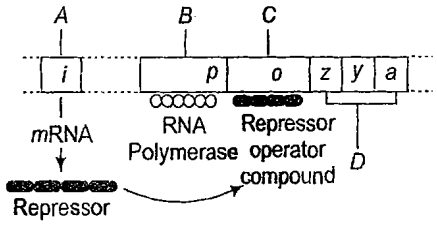
134. Match the column I (name of the organism) the column II (chromosome number in gamete) (*n*) and choose the correct option.

Column I		**Column II**	
a.	*Ophioglossum*	(1)	23
b.	Rice	(2)	24
c.	Potato	(3)	12
d.	Man	(4)	630

	a	**b**	**c**	**d**
(A)	1	2	3	4
(B)	2	3	4	1
(C)	3	4	2	1
(D)	4	3	2	1

Ans (D)

135. Identify A, B, C and D.
(A) A – Regulatory gene, B – Promoter, C – Operator, D – Structural gene
(B) A – Regulatory gene, B – Promoter, C – Structural gene, D – Operator
(C) A – Regulatory gene, B – Structural gene, C – Promoter, D – Operator
(D) A – Regulatory gene, B – Structural gene, C – Operator gene, D – Promoter gene



Ans (A)

136. Splicing is the removal of
(A) exons
(B) introns and joining of exons
(C) exons and introns
(D) exons and introns are joined
Ans (B)

137. Genetically modified plants have been useful in increasing
(A) crop yield
(B) nutritional value of food
(C) tolerance against abiotic stresses
(D) all of A, B, and C
Ans (D)

138. **Statement 1:** Test cross is used to determine an unknown genotype within one breeding generation.
Statement 2: Test cross is a cross between F1 hybrid and dominant parent.
(A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
(B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
(C) Statement 1 is correct and statement 2 is incorrect.
(D) Both statements 1 and 2 are incorrect.
Ans (C)

139. Possible blood groups of offspring when both parents have AB blood group is
(A) AB only
(B) A, B and AB
(C) A, B, AB and O
(D) A and B only
Ans (B)

140. Phenotypic and genotypic ratio is similar in case of
(A) complete dominance
(B) incomplete dominance
(C) over dominance
(D) epistasis.
Ans (B)

141. Name a 4-carbon compound among the following
(A) Oxaloacetic acid
(B) Phosphoglyceric acid
(C) Ribulose bisphosphate
(D) Phosphoenol pyruvate
Ans (A)

142. Ancient mammals enjoyed a release from competition when the dinosaurs became extinct. Should humans ensure that such releases from competition continue to occur for us or for other species?
(A) No, because it is impossible to predict which species will become dominant if other species become extinct.
(B) No, because the species that become dominant will cause the extinction of humans.
(C) Yes, because the organisms that are released from competition will always form more new species than the number that went extinct.
(D) Yes, because new species that evolve are always better organisms than those that went extinct.
Ans (A)

143. The factors involved in the formation of new species are
(A) isolation and gene flow
(B) gene flow and competition
(C) competition and cloning
(D) isolation and variation.
Ans (D)

144. Human female primary sex organ has
(i) primary follicle
(ii) graafian follicle
(iii) blood vessel
(iv) corpus luteum
(A) (i) and (ii)
(B) (ii), (iii) and (iv)
(C) (iii) and (iv)
(D) (i), (ii), (iii) and (iv)
Ans (D)

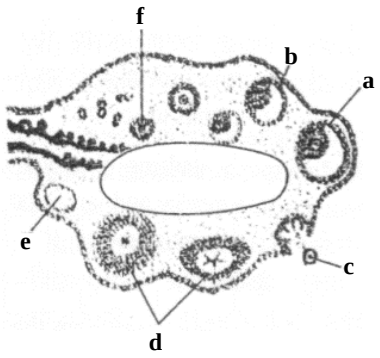
145. In the given T.S. of human ovary identify a to f and select the correct option.

(A) a - Secondary follicle, b - Tertiary follicle with antrum, c - Ovum, d - Corpus luteum, e - Primary follicle, f - Corpus albicans

(B) a - Graafian follicle, b - Tertiary follicle with antrum, c - Ovum, d - Corpus spongiosum, e - Primary follicle, f - Corpus albicans

(C) a - Graafian follicle, b - Tertiary follicle with antrum, c - Ovum, d - Corpus albicans, e - Primary follicle, f - Corpus luteum

(D) a - Graafian follicle, b - Tertiary follicle with antrum, c - Ovum, d - Corpus luteum, e - Corpus albicans, f - Primary follicle



Ans (D)

146. "When two pairs of traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters". The statement explains which of the following laws/principles of Mendel?

(A) Principle of paired factors (B) Principle of dominance

(C) Law of segregation (D) Law of independent assortment

Ans (D)

147. Fungi show sexual reproduction by all of the following processes except

(A) oospores (B) ascospores (C) basidiospores (D) zoospores

Ans (D)

148. Major photosynthetic pigments in green algae are

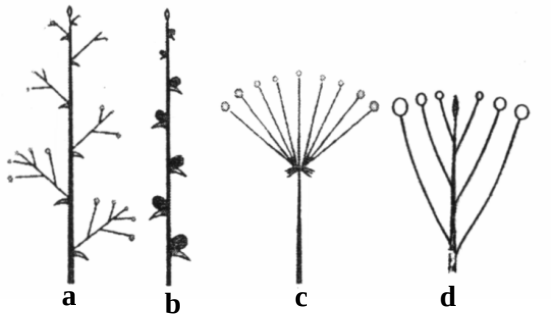
(A) Chl a and b (B) Chl a, c and fucoxanthin

(C) Chl a, d and phycoerythrin (D) Chl a and c.

Ans (A)

149. The given figure shows some types of inflorescences. Select the option that correctly identifies them.

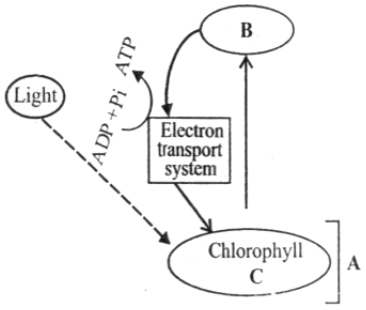
	a	b	c	d
(A)	Panicle	Spike	Corymb	Catkin
(B)	Spike	Panicle	Corymb	Catkin
(C)	Panicle	Catkin	Umbel	Spike
(D)	Panicle	Spike	Umbel	Corymb



Ans (D)

150. Study the given flow chart of cyclic photophosphorylation and select the correct answer for A, B and C.

	A	B	C
(A)	PS I	e^- acceptor Cytochrome	P680
(B)	PS I	e^- acceptor	P700
(C)	PS II	Cytochrome	P700
(D)	PS II	Cytochrome	P680



Ans (B)

151. IUDs prevent pregnancy by
(A) inhibiting physiological and morphological uterine changes required for implantation
(B) increasing phagocytosis of spermatozoa within uterus
(C) suppressing motility of sperms as well as their fertilizing capacity
(D) all of (A), (B) and (C)
Ans (D)

152. Biological Oxygen Demand (BOD) is a measure of
(A) industrial wastes poured into water bodies
(B) extent to which water is polluted with organic compounds
(C) amount of carbon monoxide inseparably combined with haemoglobin
(D) amount of oxygen needed by green plants during night.
Ans (B)

153. The Montreal Protocol refers to
(A) persistent organic pollutants
(B) global warming and climate change
(C) substances that deplete the ozone layer
(D) biosafety of genetically modified organisms
Ans (C)

154. Minamata disease was caused due to the consumption of
(A) sea food containing lot of cadmium
(B) fish contaminated with mercury
(C) oysters with lot of pesticide
(D) sea food contaminated with selenium
Ans (B)

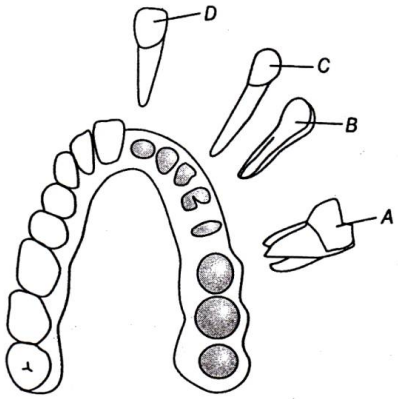
155. When a bacteriophage, in its lytic phase, carries some of the partially digested bacterial chromosome with it to another host cell, the process is called
(A) generalised transpiration
(B) conjugation
(C) transformation
(D) specialised transduction
Ans (D)

156. The biggest constraint of plant breeding is
(A) availability of desirable gene in the crop and its wild relatives
(B) infrastructure
(C) trained manpower
(D) transfer of genes from unrelated sources
Ans (A)

157. Mycorrhiza does not help the host plant in
(A) enhancing its phosphorus uptake capacity
(B) increasing its tolerance to drought
(C) enhancing its resistance to root pathogens
(D) increasing its resistance to insects.
Ans (D)

158. Fill in the blank with suitable option. _____'a'____ produced by bacterium *Streptococcus* and modified by genetic engineering is used as a clot buster for removing clots from the blood vessels of patients who have undergone myocardial infarction leading to heart attack.
(A) Lipase
(B) Streptokinase
(C) Cyclosporin A
(D) Antibiotic streptomycin
Ans (B)

159. The given schematic diagram depicts heterodont teeth and it's thecodont arrangement. Find the correct labelling for A-D from the options given below.



(A) A-Incisor, B-Canine, C-Premolar, D-Molar
(B) A-Molar, B-Premolar, C-Canine, D-Incisor
(C) A-Incisors, B-Premolar, C-Canine, D-Molar
(D) A-Molar, B-Premolar, C-Incisor, D-Canine

Ans (B)

160. The checkpoint in cell cycle plays important role in

(A) repairing DNA damage
(B) apoptosis inhibition
(C) assessing DNA damage
(D) inhibiting cell damage

Ans (C)

161. Select the true statement regarding excretion in humans.

(A) Glucose and amino acids are reabsorbed in PCT by simple diffusion.
(B) DCT is impermeable to water.
(C) On an average, 25-30 gm of urea is excreted out per day.
(D) Maximum reabsorption occurs in the loop of Henle.

Ans (C)

162. The H-zone in the skeletal muscle fibre is due to

(A) the central gap between actin filaments extending through myosin filaments in the A-band
(B) extension of myosin filaments in the central portion of the A-band
(C) the absence of myofibrils in the central portion of A-band
(D) the central gap between myosin filaments in the A-band.

Ans (A)

163. The action of insulin is represented by

(A) increase in blood glucose level by stimulating glucagon production.
(B) decrease in blood glucose level by forming glycogen.
(C) increase in blood glucose level by promoting cellular uptake of glucose.
(D) increase in blood glucose level by hydrolysis of glycogen.

Ans (B)

164. The source of somatostatin is same as that of

(A) thyroxine and calcitonin
(B) insulin and glucagon
(C) somatotropin and prolactin
(D) vasopressin and oxytocin

Ans (D)

165. The plant part which consists of two generations, one within the other, is
(A) germinated pollen grain (B) embryo
(C) unfertilised ovule (D) seed
Ans (D)

166. Select evidences which do not favour the Lamarckian concept of inheritance of acquired characters.
(A) Absence of limbs in snakes (B) Melanization in peppered moth
(C) Presence of webbed toes in aquatic birds (D) Lack of pigment in cave-dwelling animals
Ans (B)

167. The relationship in an ecosystem can be depicted in
(A) pyramid of energy (B) pyramid of biomass
(C) pyramid of numbers (D) all of (A), (B) and (C)
Ans (D)

168. Recent reports of acid rains in big industrial cities are due to the effect of atmospheric pollution by excessive release of
(A) NH_3 by coal gas industries
(B) NO_2 and SO_2 by burning of fossil fuels
(C) CO_2 by incomplete combustion of carbon fuel
(D) CO_2 by burning of coal/wood, cutting of forests.
Ans (B)

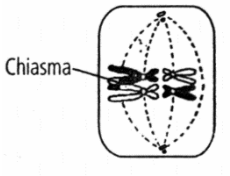
169. Both apical meristems and intercalary meristems are _____ meristems.
(A) primary (B) secondary (C) lateral (D) both (B) and (C)
Ans (A)

170. Read the following statements and select the correct ones.
(i) In simple cuboidal epithelium nuclei are rounded and lie in the centre of the cells.
(ii) Non-keratinized epithelium is highly impermeable to water.
(iii) Yellow elastic fibrocartilage makes cartilage flexible.
(iv) Areolar tissue forms a shock absorbing cushion around the eye balls and kidneys.
(A) (i) and (iii) (B) (i) and (ii) (C) (iii) and (iv) (D) (ii) and (iv)
Ans (A)

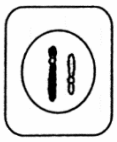
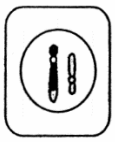
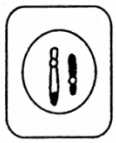
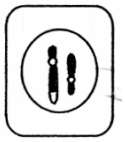
171. The type of ribosomes found in prokaryotes is
(A) 80S type (B) 70S type (C) 30S type (D) 50S type.
Ans (B)

172. The quarternary structure of proteins is due to
(A) formation of peptide bonds between amino acids
(B) coiling of one polypeptide chain
(C) folding of one coiled polypeptide chain
(D) linking together of two or more polypeptide chains.
Ans (D)

173. Consider the given cell at metaphase-I stage undergoing normal meisois.



Which of the following gametes will not be formed from this cell?

(A)  (B)  (C)  (D) 

Ans (D)

Assertion and Reason

(A) If both the assertion and the reason are true and the reason is a correct explanation of the assertion.
(B) If both the assertion and reason are true but the reason is not a correct explanation of the assertion.
(C) If the assertion is true but the reason is false
(D) If both the assertion and reason are false

174. **Assertion**: Coconut tree is distributed in coastal areas over a large part of the world.
Reason: Coconut fruit can float and get dispersed over thousands of kilometers before losing viability.
Ans (A)

175. **Assertion**: Presence of pneumatophores is a special adaptation of hydrophytes.
Reason: Pneumatophores are positively geotropic shoots that have lenticels and help in gaseous exchange.
Ans (D)

176. **Assertion**: Cartilage (protein matrix) and bone (calcium matrix) are rigid connective tissues.
Reason: Blood is a connective tissue in which plasma is the matrix.
Ans (B)

177. **Assertion**: In cells engaged in active secretion, as in pancreas, the rough endoplasmic reticulum is well developed.
Reason: Ribosomes attached to endoplasmic reticulum are actively engaged in protein synthesis
Ans (A)

178. **Assertion**: Many plants are propagated vegetatively even though they bear seeds.
Reason: Potatoes multiply by tubers and apple by cutting.
Ans (B)

179. **Assertion**: In some species of Asteraceae and poaceae seeds are formed without fertilisation.
Reason: Formation of fruit without fertilisation is called parthenocarpy.
Ans (B)

180. **Assertion**: Mammary glands are exocrine glands.
Reason: Mammary glands do not have ducts.
Ans (C)

* * *