# NEET-UG EXAMINATION PAPER-2006

## (Solved)

Time allowed : 3 hours | Maximum Marks : 800

**General Instructions :**

Read the following instructions carefully and follow them :

i. This question paper contains **200 questions.** All questions are **compulsory.**

ii. This question paper is divided into **1 sections.**

iii. **Section A** – questions number **1 to 200** are multiple choice questions

iv. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

v. Use of calculator is NOT allowed.

## Section A

**Question 1.**

The velocity v of a particle at time t is given by v = at + b / t + c , where a, b and c are constant. The dimensions of a, b and c are respectively

[4 Marks]

**(A) [$LT^{-2}$, L and T]**

(B) [L, LT and $T^2$]

(C) [$L^2$, T and $LT^2$]

(D) [$LT^2$, LT and L]

**Explanation:**

Dimension of a.t = dimension of velocity a.t = $[LT^{-1}]$

$\Rightarrow [a = LT^{-2}]$

Dimension of c = dimension of t

(two physical quantity of same dimension can only be added)

So, dimension of c = [T]

Dimension of b / t + c = Dimension of velocity

$[b] / [T] = [LT^{-1}] \Rightarrow [b \cdot T^{-1}] = [LT^{-1}] \Rightarrow b = [L]$

So, answer is $[LT^{-2}]$, [L] and [T]

**Question 2.**

A particle moves along a straight line OX. At a time t (in seconds) the distance x (in metres) of the particle from O is given by $x = 40 + 12t - t^3$.

How long would the particle travel before coming to rest?

[4 Marks]

(A) 40 m

**(B) 56 m**

(C) 16 m

(D) 24 m

**Explanation:**

$x = 40 + 12t - t^3$

$v = dx / dt = 12 - 3t^2$

For $v = 0$; $t = \sqrt{(12 / 3)} = 2$ sec

So, after 2 seconds velocity becomes zero.

Value of x in 2 sec.

$= 40 + 12 \times 2 - 2^3$

$= 40 + 24 - 8 = 56$ m

**Question 3.**

Two bodies, A (of mass 1 kg), and B (of mass 3 kg), are dropped from heights of 16 m and 25 m, respectively. The ratio of the time taken by them to reach the ground is

[4 Marks]

(A) 5 / 12

(B) 12 / 5

**(C) 4 / 5**

(D) 5 / 4

**Explanation:**

Let $t_1$ & $t_2$ be the time taken by A and B respectively to reach the ground then from the formula,
$h = (1 / 2)gt^2$,
For first body,
$16 = (1 / 2)gt_1^2$

For second body, $25 = (1 / 2)gt_2^2$
$\therefore 16 / 25 = t_1^2 / t_2^2 \Rightarrow t_1 / t_2 = 4 / 5$.

**Question 4.**

For angles of projection of a projectile $(45° - \theta)$ and $(45° + \theta)$, the horizontal ranges described by the projectile are in the ratio of

[4 Marks]

(A) 1 : 3

(B) 1 : 2

(C) 2 : 1

**(D) 1 : 1**

**Explanation:**

Horizontal range for projection angle
$(45° - \theta)$ is, $R_1 = u^2 \sin 2(45 - \theta) / g$
Horizontal range projection
angle $(45° + \theta)$ is, $R_2 = u^2 \sin 2(45 + \theta) / g$
According to the condition,
$\Rightarrow R_1 / R_2 = u^2 \sin 2(45 - \theta) / u^2 \sin 2(45 + \theta) = \sin(90 - 2\theta) / \sin(90 + 2\theta)$
$\Rightarrow R_1 / R_2 = \cos 2\theta / \cos 2\theta = 1 / 1$
So, $R_1 : R_2 : 1 : 1$

**Question 5.**

A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 seconds in every circular loop. The average velocity and average speed for each circular loop are respectively,

[4 Marks]

**(A) 0, 10 m/s**

(B) 10 m/s, 10 m/s

(C) 10 m/s, 0

(D) 0, 0

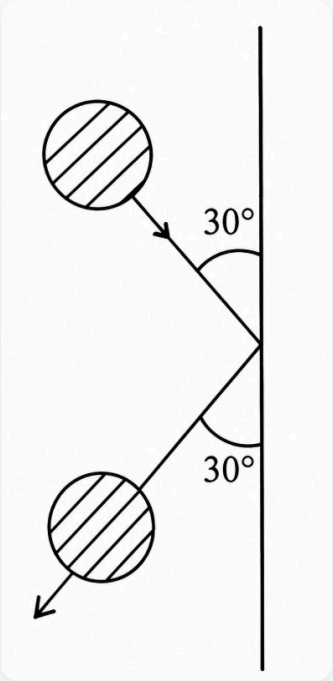
**Explanation:**

Distance covered in one circular loop = 2πr
= 2 × 3.14 × 100 = 628 m
avg Speed = 628 / 62.8 = 10 m/sec
Displacement in one circular loop = 0
avg Velocity = 0 / time = 0

**Question 6.**

A 0.5 kg ball moving with speed of 12 m/s strikes a hard wall at an angle of 30° with the wall. It is reflected with the same speed and at the same angle. If the ball is in contact with the wall for 0.25 seconds, the average force acting on the wall is

[4 Marks]




**(A) 24 N**

(B) 96 N

(C) 12 N

(D) 48 N

**Explanation:**

The magnitude of both velocity $\mathbf{v_1}$ and $\mathbf{v_2}$ are equal. Components of velocity along the wall are equal and are in same direction.

But the component of velocity perpendicular to wall are equal but opposite in direction.

So, net change in momentum in perpendicular direction,

$\Delta P = mv_1 \sin 30° - (-mv_2 \sin 30°)$

$\Rightarrow 2mv \sin 30°$ [As $v_1 = v_2 = v$]

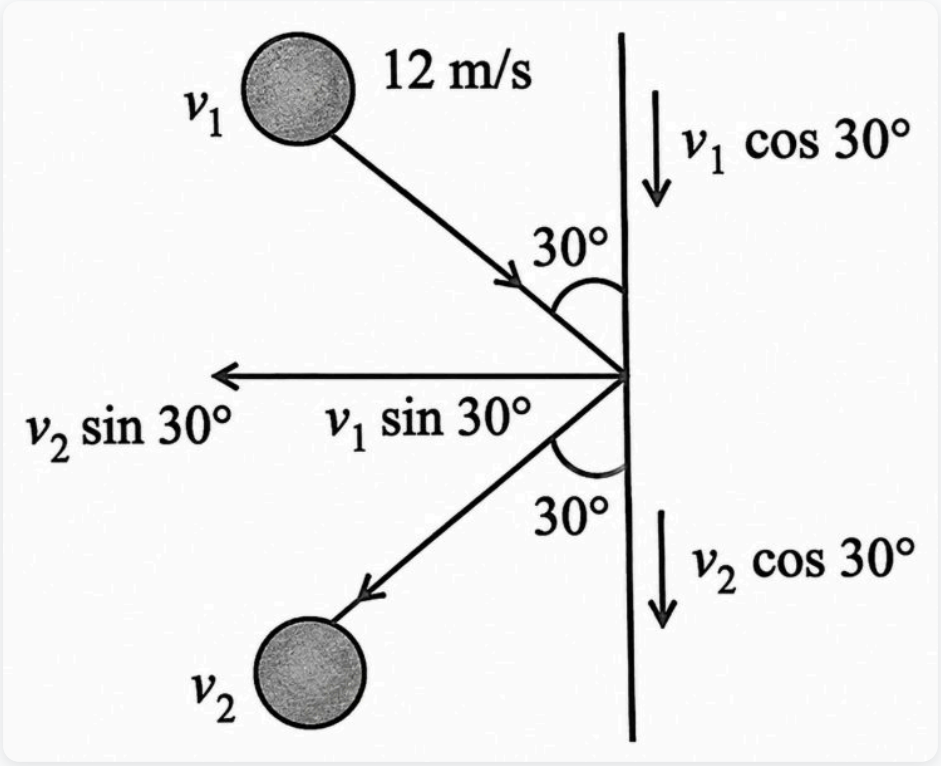
Average force acting on the wall will be given by

$\Rightarrow Ft = 2mv \sin 30°$

$\Rightarrow F = 2mv \sin 30° / t$

$\Rightarrow F = 2 \times 0.5 \times 12 \times 1 / 2 \times 0.25 = 24$

$F = 24$ N




**Question 7.**

The vectors □□ and □□ are such that

$|□□ + □□| = |□□ - □□|$

The angle between the two vectors is

[4 Marks]

(A) 45°

(B) 75°

(C) 60°

**(D) 90°**

**Explanation:**

$|\square\square + \square\square|^2 = |\square\square - \square\square|^2$
$= |\square\square|^2 + |\square\square|^2 + 2\square\square \cdot \square\square = A^2 + B^2 + 2AB \cos\theta$
and, $|\square\square - \square\square|^2 = |\square\square|^2 + |\square\square|^2 - 2\square\square \cdot \square\square$
$= A^2 + B^2 - 2AB \cos\theta$
So, $A^2 + B^2 + 2AB \cos\theta$
$= A^2 + B^2 - 2AB \cos\theta$
$4AB \cos\theta = 0 \Rightarrow \cos\theta = 0$
$\theta = 90°$
So, angle between A & B is 90°.

**Question 8.**

A body of mass 3 kg is under a constant force which causes a displacement s in metres in it, given by the relation $s = 1 / 3\ t^2$, where t is in seconds. Work done by the force in 2 seconds is

[4 Marks]

(A) (19 / 5)J

**(B) (8 / 3) J**

(C) (5 / 19)J

(D) (3 / 8)J

**Explanation:**

Acceleration $= d^2s / dt^2 = 2 / 3\ m/s^2$
Force acting on the body
$= 3 \times 2 / 3 = 2$ newton
Displacement in 2 secs $= 1 / 2 \times 2 / 3 \times 2^2 = (4 / 3)$ m
Work done $= 2 \times 4 / 3 = (8 / 3)$ J

**Question 9.**

300 J of work is done in sliding a 2 kg block up an inclined plane of height 10 m. Taking $g = 10\ m/s^2$, work done against friction is

[4 Marks]

**(A) 100 J**

(B) zero

(C) 200 J

(D) 1000 J

**Explanation:**

Work done against gravity = mg sin θ × d
(d sin θ = 10)
= 2 × 10 × 10
= 200 J
Actual work done = 300 J
Work done against friction = 300 − 200 = 100 J

**Question 10.**

A tube of length L is filled completely with an incompressible liquid of mass M and closed at both the ends. The tube is then rotated in a horizontal plane about one of its ends with a uniform angular velocity. The force exerted by the liquid at the other end is

[4 Marks]

(A) $ML^2\omega / 2$

(B) $ML\omega^2$

(C) $ML^2\omega^2 / 2$

**(D) $ML\omega^2 / 2$**

**Explanation:**

Rotation will create centrifugal force due to which pressure will be created at the other end. Now, this centrifugal force will depend on distance of the liquid from the axis as centrifugal force = $m\omega^2 r$.

Let us consider a small part dx of the liquid column which is at a distance of x.

Mass of this element will be,

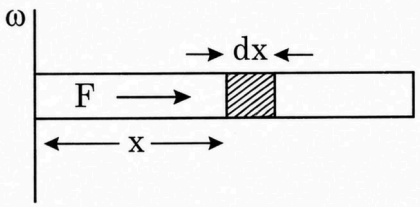
$dm = (M / L)dx$

So, force exerted on this element will be,

$\Rightarrow df = dm.\omega^2 x$

As the mass of liquid extends from x = 0 to x = L, the net force on the wall experienced by the mass of the liquid is,

Figure




$$\Rightarrow \int_0^f df = \frac{M}{L} \int_0^L \omega^2 \, x \, . \, dx$$

$$\Rightarrow \int_0^f df = \frac{M}{L} \omega^2 \int_0^L x \, . \, dx$$

$$\Rightarrow f = \frac{M}{L} \omega^2 \left[ \frac{L^2}{2} \right] = \frac{M\omega^2 L}{2}$$

**Question 11.**

The moment of inertia of a uniform circular disc of radius R and mass M about an axis touching the disc at its diameter and normal to the disc is

[4 Marks]

(A) (2 / 5)MR²

**(B) (3 / 2)MR²**

(C) (1 / 2)MR²

(D) MR²

**Explanation:**

M.I. of a uniform circular disc of radius ‘R’ and mass ‘M’ about an axis passing through C.M. and normal to the disc is

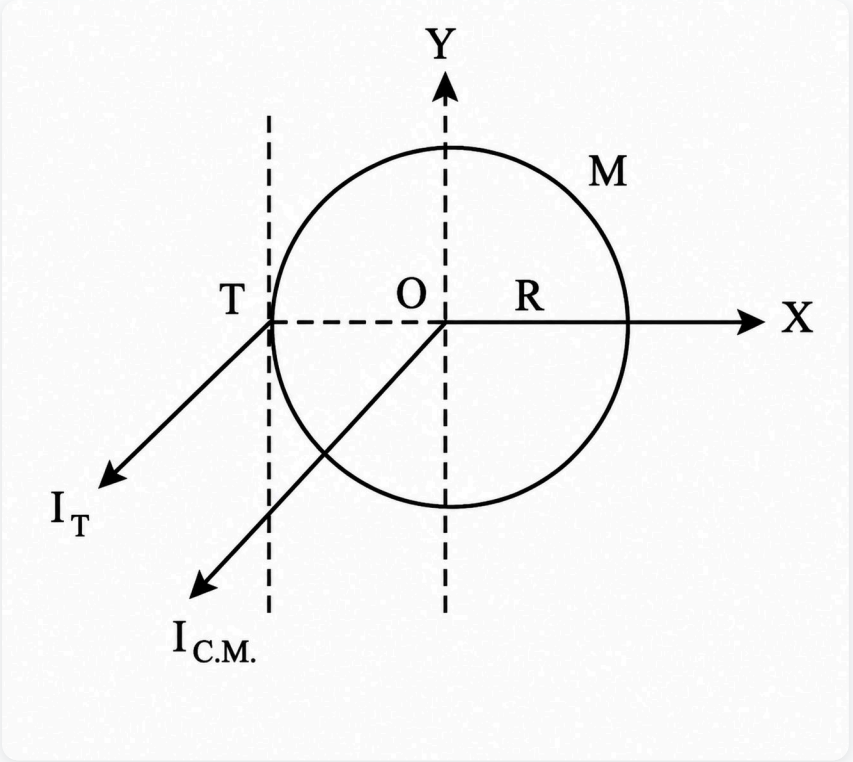
$I_{C.M.} = 1 / 2 MR^2$

From parallel axis theorem,

$I_T = I_{C.M.} + MR^2$

$= 1 / 2 MR^2 + MR^2$

$= 3 / 2 MR^2$




**Question 12.**

The Earth is assumed to be a sphere of radius R. A platform is arranged at a height R from the surface of the Earth. The escape velocity of a body from this platform is fv, where v is its escape velocity from the surface of the Earth. The value of f is

[4 Marks]

(A) √2

**(B) 1 / √2**

(C) 1 / 3

(D) 1 / 2

**Explanation:**

Potential energy at height R, PE = −GMm / 2R
If the mass of a body which is thrown with velocity $v_e$ so that it goes out of gravitational field from distance R, then
1 / 2 $mv_e^2$ = (GM / 2R).m
⇒ $v_e$ = √(GM / R)
or, $v_e$ = √gR
Now, v = √2gR, so, v = √2 $v_e$
or, $v_e$ = v / √2
Comparing it with given equation,
f = 1 / √2

**Question 13.**

A black body at 1227°C emits radiations with maximum intensity at a wavelength of 5000Å. If the temperature of the body is increased by 1000°C, the maximum intensity will be observed at

[4 Marks]

(A) 5000Å

(B) 6000Å

(C) 4000Å

**(D) 3000Å**

**Explanation:**

Applying Wien's displacement law,
$\lambda_m T$ = constant
5000 Å × (1227 + 273)
= (2227 + 273) × $\lambda_m$
$\lambda_m$ = (5000 × 1500) / 1000 = 3000 Å

**Question 14.**

A Carnot engine whose sink is at 300 K has an efficiency of 40%. By how much should the temperature of source be increased so as to increase the efficiency by 50% of original efficiency?

[4 Marks]

(A) 325 K

**(B) 250 K**

(C) 380 K

(D) 275 K

**Explanation:**

We know that efficiency of Carnot Engine
$\eta = (T_1 - T_2) / T_1$
where, $T_1$ is temp. of source and $T_2$ is temp. of sink
$\therefore 0.40 = (T_1 - 300) / T_1$
$\Rightarrow T_1 - 300 = 0.40T_1$
$0.6T_1 = 300 \Rightarrow T_1 = 300 / .6$
= 3000 / 6
= 500 K

Now efficiency to be increased by 50%

$\therefore 0.60 = (T_1 - 300) / T_1$

$\Rightarrow T_1 - 300 = 0.6T_1$

$0.4T_1 = 300$

$\Rightarrow T_1 = 300 / .4$

$= (300 \times 10) / 4$

$= 750$

Increase in temp. = 750 − 500 = 250 K

**Question 15.**

When volume of system is increased twice and temperature is decreased half of its initial temperature, then pressure becomes

[4 Marks]

(A) 2 times

(B) 4 times

(C) 1 / 2 times

**(D) 1 / 4 times**

**Explanation:**

PV / T = constant

**Question 16.**

The molar specific heat at constant pressure of an ideal gas is (7 / 2) R. The ratio of specific heat at constant pressure to that at constant volume is

[4 Marks]

(A) 8 / 7

**(B) 7 / 5**

(C) 9 / 7

(D) 5 / 7

**Explanation:**

C_P = 7 / 2 R; C_V = C_P − R

= (7 / 2)R − R = (5 / 2)R

$C_P / C_V = (7 / 2)R / (5 / 2)R = 7 / 5$

**Question 17.**

The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm, the potential energy stored in it is

[4 Marks]

(A) 4 U

**(B) 16 U**

(C) U / 4

(D) 8 U

**Explanation:**

The potential energy of a spring = $(1 / 2)\ kx^2$
$U = (1 / 2)\ k.(2)^2 = 4 \times (1 / 2)\ k$
For x = 8 cm,
Energy stored = $(1 / 2)\ k.(8)^2 = 64 \times (1 / 2)\ k$
$= 64 \times U / 4 = 16U$

**Question 18.**

A rectangular block of mass m and area of cross-section A floats in a liquid of density ρ. If it is given a small vertical displacement from equilibrium it undergoes oscillation with a time period T. Then-

[4 Marks]

(A) $T \propto \sqrt{\rho}$

(B) $T \propto 1/\rho$

**(C) $T \propto 1/\sqrt{A}$**

(D) $T \propto 1/\sqrt{m}$

**Explanation:**

Restoring force, $F = kx = Ax\rho g$
$\Rightarrow k = A\rho g$
$\therefore T = 2\pi \sqrt{(m / k)} = 2\pi\sqrt{(m / A\rho g)}$

**Question 19.**

Which one of the following statements is true ?

[4 Marks]

**(A) The sound waves in air are longitudinal while the light waves are transverse**

(B) Both light and sound waves in air are transverse

(C) Both light and sound waves in air are longitudinal

(D) Both light and sound waves can travel in vacuum

**Explanation:**

Sound waves in air are longitudinal and the light waves are transverse.

**Question 20.**

A transverse wave propagating along x-axis is represented by $y(x,t) = 8.0 \sin(0.5\pi x - 4\pi t - \pi/4)$ where x is in metres and t is in seconds. The speed of the wave is

[4 Marks]

(A) $4\pi$ m/s

**(B) 8 m/s**

(C) $0.5\ \pi$ m/s

(D) $(\pi / 4)$ m/s

**Explanation:**

Speed of a wave is represented by the equation
$y(x,t) = A \sin (kx - \omega t + \varphi)$ is $v = \omega / k$
By comparison, $\omega = - 4\pi$; $k = - 0.5\pi$
$v = \omega / k = 4\pi / 0.5\pi = 8$ m/sec

**Question 21.**

The time of reverberation of a room A is one second. What will be the time (in seconds) of reverberation of a room, having dimensions double of those of room A?

[4 Marks]

(A) 4

(B) 1 / 2

(C) 1

**(D) 2**

**Explanation:**

The time gap between the initial direct note and the reflected note upto the minimum andibility level is called reverberation time.
Sabine has shown that standard reverberation time for an auditorium is given by the formula
$T_R = K(V / \alpha S)$
Where, V is volume of the auditorium, S is the surface area. So,
$T_R = K.V / \alpha S = 1$ (given)
$T_R = K \cdot l^3 / 6\alpha l^2$
(Assuming auditorium to be cubic in shape)

$= (K / 6\alpha)l$
So, $T_R \propto l$

If dimension is doubled, reverberation time t will be doubled.
So, New $T_R = 2$ sec.

**Question 22.**

Two sound waves with wavelengths 5.0 m and 5.5 m respectively, each propagate in a gas with velocity 330 m/s. We expect the following number of beats per second

[4 Marks]

(A) 0

(B) 1

**(C) 6**

(D) 12

**Explanation:**

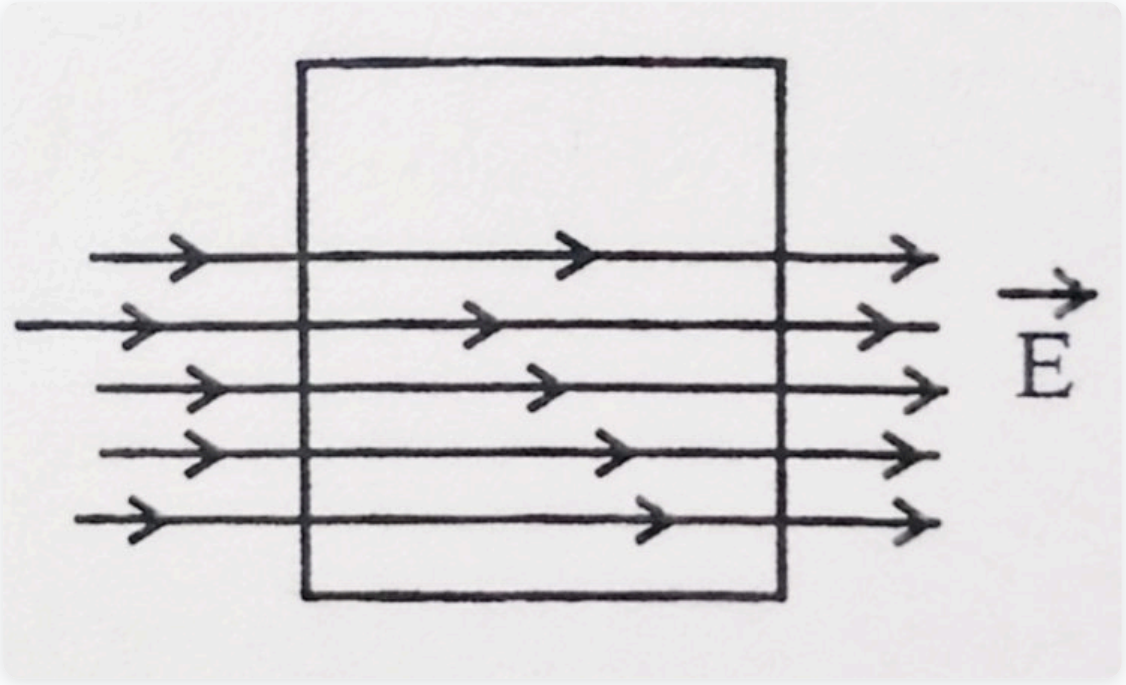
Frequencies of sound waves are 330 / 5 and 330 / 5.5 i.e., 66 Hz and 60 Hz
Frequency of beat = 66 − 60 = 6 per second

**Question 23.**

A square surface of side L metres is in the plane of the paper. A uniform electric field □□ (volt /m), also in the plane of the paper, is limited only to the lower half of the square surface (see figure). The

electric flux in SI units associated with the surface is

[4 Marks]




(A) $EL^2 / 2$

**(B) zero**

(C) $EL^2$

(D) $EL^2 / (2\varepsilon_0)$

**Explanation:**

Flux = □□. □□

□□ is electric field vector & □□ is area vector.
Here, angle between □□ & □□ is 90°.
So, □□. □□ = 0 ; Flux = 0

**Question 24.**

A parallel plate air capacitor is charged to a potential difference of V volts. After disconnecting the charging battery the distance between the plates of the capacitor is increased using an insulating handle. As a result the potential difference between the plates

[4 Marks]

(A) does not change

(B) becomes zero

**(C) increases**

(D) decreases

**Explanation:**

If we increase the distance between the plates its capacity
decreases resulting in higher potential as we know Q = CV. Since Q is constant (battery has been disconnected), on decreasing C, V will increase.

**Question 25.**

In producing chlorine through electrolysis, 100 watt power at 125 V is being consumed. How much chlorine per minute is liberated? E.C.E. of chlorine is $0.367 \times 10^{-6}$ kg coulomb.

[4 Marks]

**(A) 17.6 mg**

(B) 13.6 mg

(C) 24.3 mg

(D) 21.3 mg

**Explanation:**

Power = V × I
I = Power/ V = 100 / 125
E.C.E. of chlorine is $0.367 \times 10^{-6}$ kg/coulomb
Charge passing in one minute = (100 / 125) × 60
= 48 coulomb
Chlorine precipitated = $0.367 \times 10^{-6} \times 48$
= $17.6 \times 10^{-6}$ kg

= 17.6 mg

**Question 26.**

Kirchhoff's first and second laws for electrical circuits are consequences of

[4 Marks]

**(A) conservation of electric charge and energy respectively**

(B) conservation of electric charge

(C) conservation of energy

(D) conservation of energy and electric charge respectively

**Explanation:**

Kirchhoff's law deals with conservation of electrical charge and the second law deals with conservation of energy.

**Question 27.**

Two cells, having the same e.m.f., are connected in series through an external resistance R. Cells have internal resistances $r_1$ and $r_2$ ($r_1 > r_2$) respectively. When the circuit is closed, the potential difference across the first cell is zero. The value of R is

[4 Marks]

(A) $(r_1 + r_2) / 2$

(B) $r_1 + r_2$

**(C) $r_1 - r_2$**

(D) $(r_1 - r_2) / 2$

**Explanation:**

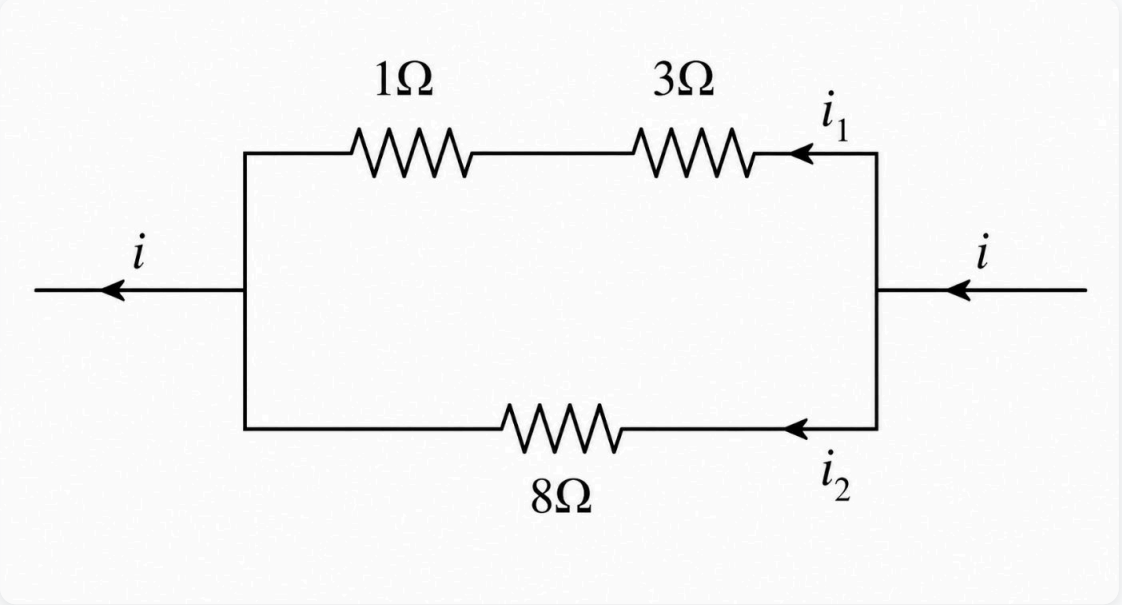
Current in the circuit
$= E + E / r_1 + r_2 + R = 2E / (r_1 + r_2) + R$
P.D. across first cell $= E - ir_1$
$E - ((2E \times r_1) / (r_1 + r_2) + R)$
Now, $E = 2Er_1 / (r_1 + r_2) + R) = 0$

$\Rightarrow E = 2Er_1 / (r_1 + r_2) + R) \Rightarrow 2r_1 = r_1 + r_2 + R$
$R = r_1 - r_2$

**Question 28.**

Power dissipated across the 8Ω resistor in the circuit shown here is 2 watt. The power dissipated in watt units across the 3Ω resistor is

[4 Marks]




(A) 1.0

**(B) 3.0**

(C) 0.5

(D) 2.0

**Explanation:**

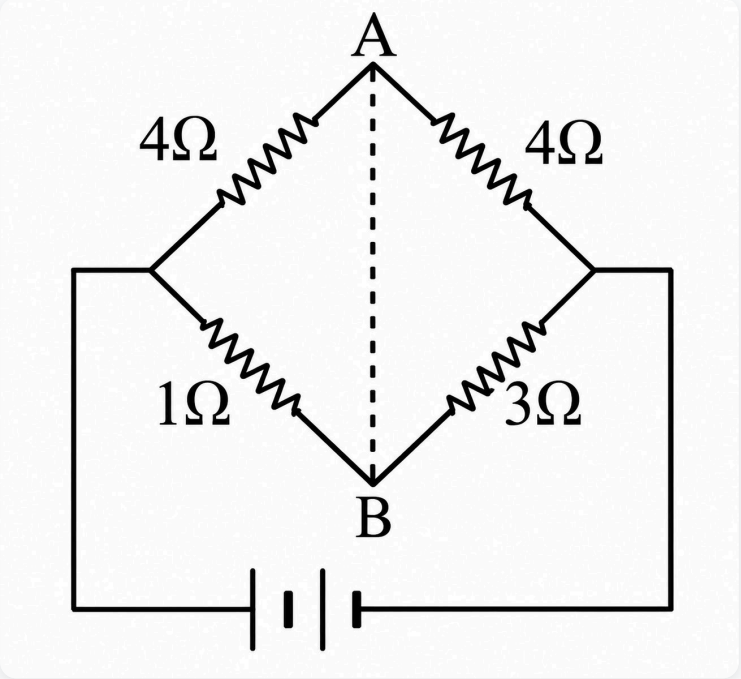
Power = V.I = $I^2R$
$i_2$ = √(Power / R) = √(2 / 8) = √(1 / 4) = (1 / 2)A

Potential over 8Ω = $Ri_2$ = 8 × 1 / 2 = 4V
This is the potential over parallel branch. So,
$i_1$ = 4 / 4 = 1A
Power of 3Ω = $i_1^2R$ = 1 × 1 × 3 = 3W

**Question 29.**

In the circuit shown, if a conducting wire is connected between points A and B, the current in this wire will

[4 Marks]




(A) flow in the direction which will be decided by the value of V

(B) be zero

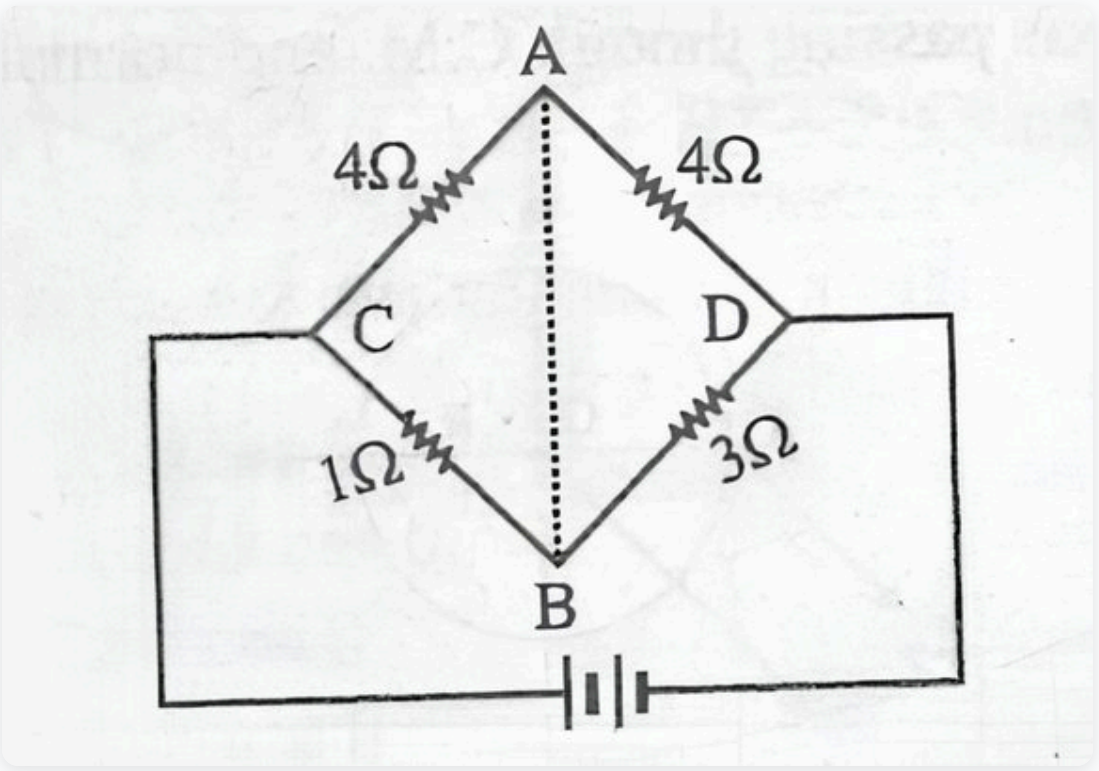
**(C) flow from B to A**

(D) flow from A to B

**Explanation:**

Current will flow from B to A.

Potential drop over the resistance CA will be more due to higher value of resistance. So potential at A will be less as compared with B. Hence, current will flow from B to A.



**Question 30.**

Two circular coils 1 and 2 are made from the same wire but the radius of the 1st coil is twice that of the 2nd coil. What potential difference in volts should be applied across them so that the magnetic field at their centres is the same?

[4 Marks]

(A) 3

(B) 2

(C) 6

**(D) 4**

**Explanation:**

Same wire ⇒ Resistance ∝ length ∝ radius.

$R_1 : R_2 = 2 : 1$

Magnetic field at the center:

$B = \mu_0 I/2r$

For equal magnetic fields:

$I_1/ r_1 = I_2 / r_2$

Since $r_1=2r_2$

$I_1 / 2I_2$

Using V= IR :

$V_1 / V_2 = I_1 / I_2$ $R_1 / R_2 = 2 * 2 = 4$

$V_1 : V_2$ 4 : 1

**Question 31.**

When a charged particle moving with velocity □□ is subjected to a magnetic field of induction □□, the force on it is non-zero. This implies that

[4 Marks]

**(A) angle between □□and □□ can have any value other than zero and 180°**

(B) angle between □□and □□ can have any value other than 90°

(C) angle between □□and □□ is either zero or 180°

(D) angle between □□and □□ is necessarily 90°

**Explanation:**

Force on a particle moving with velocity **v** in a magnetic field B is
F = q (□□and □□)
If angle between □□ & □□ is either zero or 180°, then value of F
will be zero as cross product of □□and □□ will be zero.

So option (angle between □□and □□ can have any value other than zero and 180°) is correct.

**Question 32.**

Curie temperature is the temperature above which

[4 Marks]

(A) ferromagnetic material becomes diamagnetic material

(B) paramagnetic material becomes ferromagnetic material

(C) paramagnetic material becomes diamagnetic material

**(D) ferromagnetic material becomes paramagnetic material**

**Explanation:**

Curie temperature is the temperature above which ferromagnetic material becomes paramagnetic material.

**Question 33.**

Two coils of self inductances 2 mH and 8 mH are placed so closely together that the effective flux in one coil is completely linked with the other. The mutual inductance between them is

[4 Marks]

(A) 10 mH

(B) 16 mH

**(C) 4 mH**

(D) 6 mH

**Explanation:**

Mutual Inductance of two coils
$M = \sqrt{(M_1 M_2)}$
$= \sqrt{(2mH \times 8mH)}$
$= 4mH$

**Question 34.**

A coil of inductance 31 Ω has a resistance of 8 Ω. It is placed in series with a condenser of capacitative reactance 25 Ω. The combination is connected to an a.c. source of 110 volt. The power factor of the circuit is

[4 Marks]

(A) 0.56

(B) 0.33

**(C) 0.80**

(D) 0.64

**Explanation:**

Power factor, $\cos \varphi = R / \sqrt{[(\omega L - 1 / \omega C)^2 + R^2]}$
$= 8 / \sqrt{((31 - 25)^2 + 8^2)}$
$= 8 / \sqrt{(6^2 + 8^2)}$
$= 8 / 10$
$= 0.8$

**Question 35.**

The core of a transformer is laminated because

[4 Marks]

(A) ratio of voltage in primary and secondary may be increased

**(B) energy losses due to eddy currents may be minimised**

(C) rusting of the core may be prevented

(D) the weight of the transformer may be reduced

**Explanation:**

When there is change of flux in the core of a transformer due to change in current around it, eddy current is produced. The direction of this current is opposite to the current which produces it, so it will reduce the main current. We laminate the core so that flux is reduced resulting in the reduced production of eddy current.

**Question 36.**

A transistor-oscillator using a resonant circuit with an inductor L (of negligible resistance) and a capacitor C in series produces oscillating frequency f. If L is doubled and C is changed to 4C, the frequency will be

[4 Marks]

(A) f /2

**(B) f / 2√2**

(C) f / 4

(D) 8 f

**Explanation:**

We know that frequency of electrical oscillation in L.C.
circuit is
$f = (1 / 2\pi)\sqrt{LC}$
Now, L = 2L & C = 4C
$f' = (1 / 2\pi)\sqrt{(1 / 2L \cdot 4C)} = (1 / 2\pi)\ \sqrt{(1 / LC)} \times 1 / 2\sqrt{2}$
$\Rightarrow f' = 1 / (2\sqrt{2}) \times f$

**Question 37.**

A convex lens and a concave lens, each having same focal length of 25 cm, are put in contact to form a combination of lenses. The power in diopters of the combination is

[4 Marks]

(A) infinite

(B) 50

**(C) zero**

(D) 25

**Explanation:**

From the formula,
$1 / f = (1 / f_1) + (1 / f_2) = (1 / 25) - (1 / 25) = 0$
Power of combination = $1 / f = 0$

**Question 38.**

A microscopic focused on a mark in a piece of paper and then a slab of glass of thickness 3 cm and refractive index 1.5 is placed over the mark. How should the microscope be moved to get the mark in focus again?

[4 Marks]

**(A) 1 cm upward**

(B) 2 cm upward

(C) 1 cm downward

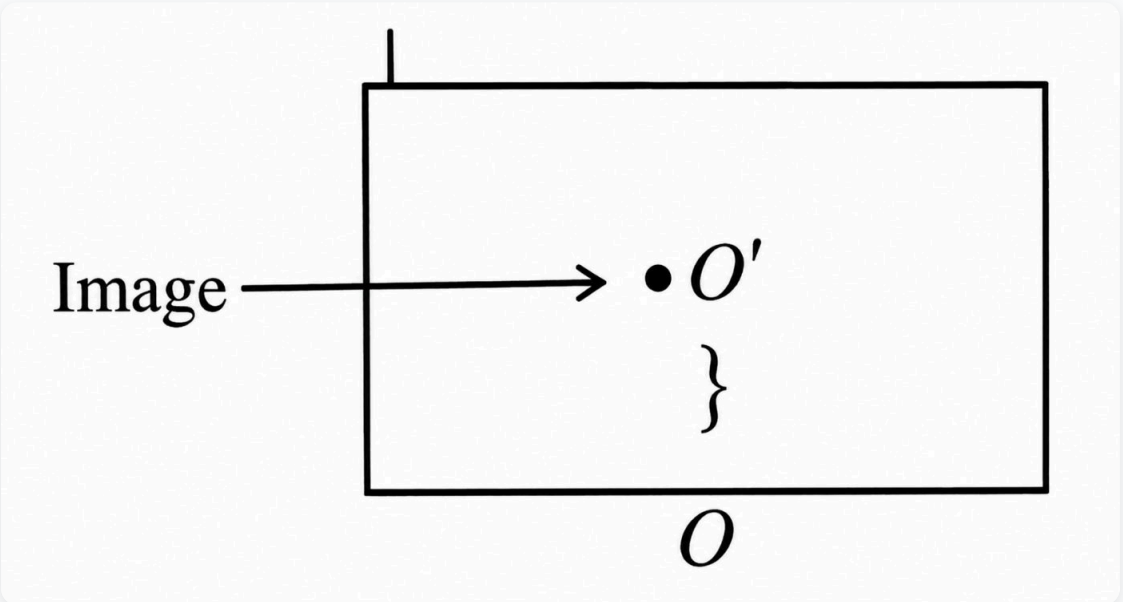
(D) 4.5 cm downward

**Explanation:**

In the later case microscope will be focussed for O′. So, it is required to be lifted by distance OO′.

OO′ = real depth of O - apparent depth of O.

$= 3 - 3 / 1.5$
[ μ = real depth / apparent depth ]
$= 3[(1.5 - 1) / 1.5]$
$= (3 \times .5) / 1.5 = 1$ cm



**Question 39.**

In a discharge tube ionization of enclosed gas is produced due to collisions between

[4 Marks]

(A) photons and neutral atoms / molecules

(B) positive ions and neutral atoms / molecules

(C) neutral gas atoms / molecules

**(D) negative electrons and neutral atoms /molecules**

**Explanation:**

When electrons emitted from cathode collide with gas molecules or atoms, they knock out outer electrons and produce positively charged ions. They become part of positive rays.

**Question 40.**

When photons of energy hν fall on an aluminium plate (of work function $E_0$), photoelectrons of maximum kinetic energy K are ejected. If the frequency of the radiation is doubled, the maximum kinetic energy of the ejected photoelectrons will be

[4 Marks]

(A) K

(B) 2K

(C) $K + E_0$

**(D) K + hν**

**Explanation:**

Applying Einstein's formula for photo-electricity
$h\nu = \phi + 1 / 2\ mv^2$; $h\nu = \phi + K$
$\phi = h\nu - K$
If we use 2ν frequency then let the kinetic energy becomes K′
So, $h \cdot 2\nu = \phi + K'$
$2h\nu = h\nu - K + K'$
$K' = h\nu + K$

**Question 41.**

A photo-cell employs photoelectric effect to convert

[4 Marks]

**(A) change in the intensity of illumination into a change in photoelectric current**

(B) change in the intensity of illumination into a change in the work function of the photocathode

(C) change in the frequency of light into a change in the electric current

(D) change in the frequency of light into a change in the electric voltage

**Explanation:**

A photo-cell employs photoelectric effect to convert light energy into photoelectric current.

**Question 42.**

The momentum of a photon of energy 1 MeV in kg m/s, will be

[4 Marks]

(A) $7 \times 10^{-24}$

**(B) $5 \times 10^{-22}$**

(C) $10^{-22}$

(D) $0.33 \times 10^{6}$

**Explanation:**

1 MeV = $10^{6} \times 1.6 \times 10^{-19}$ joule
Momentum of photon,
$p = E / c = 1.6 \times 10^{-13} / 3 \times 10^{8}$

$p = (1.6 / 3) \times 10^{-21} = 16 / 3 \times 10^{-22}$
$p = 5 \times 10^{-22}$ kg m/sec

**Question 43.**

Ionization potential of hydrogen atom is 13.6 eV. Hydrogen atoms in the ground state are excited by monochromatic radiation of photon energy 12.1 eV. According to Bohr's theory, the spectral lines emitted by hydrogen will be

[4 Marks]

**(A) Three**

(B) Four

(C) One

(D) Two

**Explanation:**

Energy of ground state = 13.6 eV
Energy of first excited state
= −13.6 / 4 = −3.4 eV
Energy of second excited state
= −13.6 / 9 = −1.5 eV

Difference between ground state and 2nd excited state
= 13.6 − 1.5 = 12.1 eV
So, electron can be excited upto 3rd orbit.
No. of possible transition
1 → 2, 1 → 3, 2 → 3
So, three lines are possible.

**Question 44.**

The radius of germanium (Ge) nuclei is measured to be twice the radius of $^{9}_{4}Be$. The number of nucleons in Ge are

[4 Marks]

(A) 74

(B) 75

**(C) 72**

(D) 73

**Explanation:**

We use the formula,
$R = R_0A^{1/3}$

This represents relation between atomic mass and radius of the nucleus.

For beryllium, $R_1 = R_0(9)^{1/3}$

For germanium, $R_2 = R_0(A)^{1/3}$

$R_1 / R_2 = (9)^{1/3} / (A)^{1/3} \Rightarrow 1 / 2 = (9)^{1/3} / (A)^{1/3}$
$\Rightarrow 1 / 8 = 9 / A \Rightarrow A = 8 \times 9 = 72$

**Question 45.**

The binding energy of deuteron is 2.2 MeV and that of $^4_2He$ is 28 MeV. If two deuterons are fused to form one $^4_2He$, the energy released is

[4 Marks]

(A) 19.2 MeV

**(B) 23.6 MeV**

(C) 30.2 MeV

(D) 25.8 MeV

**Explanation:**

$_1D^2 \rightarrow {}_2He^4$
Energy released
$= 28 - 2 \times 2.2$
$= 23.6$ MeV

**Question 46.**

In a radioactive material the activity at time $t_1$ is $R_1$ and at a later time $t_2$, it is $R_2$. If the decay constant of the material is λ, then

[4 Marks]

**(A) $R_1 = R_2e_(-\lambda(t_1-t_2))$**

(B) $R_1 = R_2e_(t_2/t_1)$

(C) $R_1 = R_2e_\lambda(t_1-t_2)$

(D) $R_1 = R_2$

**Explanation:**

Let at time $t_1$ & $t_2$, number of particles of Nucleus be $N_1$ & $N_2$. So,
$R_1 = dN_1 / dt = = -\lambda N_1$;
$R_2 = dN_2 / dt = -\lambda N_2$

$R_1 / R_2 = \lambda N_1 / \lambda N_2 = N_1 / N_1e_(-\lambda(t_2-t_1)) = e_\lambda(t_2-t_1)$
$= R_1 = R_2e_\lambda(t_2-t_1)$

= $R_2e_(-\lambda(t_1-t_2))$

**Question 47.**

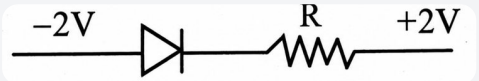
Which one of the following represents forward bias diode?

[4 Marks]

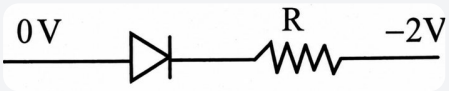
(A)



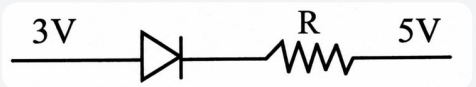

(B)




**(C)**

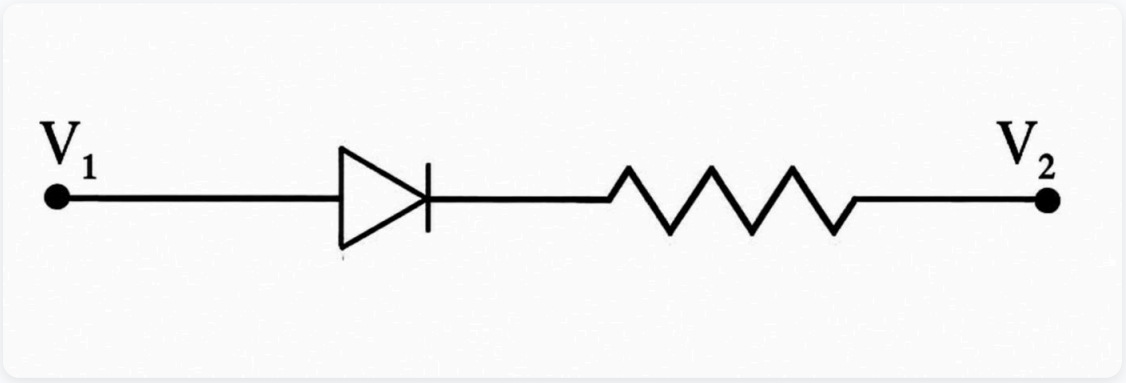



(D)




**Explanation:**

In forward bias, $V_1 > V_2$ i.e., in figure p-side is at higher potential w.r.t. n-side of p-n junction diode.




**Question 48.**

A transistor is operated in common emitter configuration at constant collector voltage V_c =1.5V such that a change in the base current from 100 μA to 150 μA produces a change in the collector current from 5 mA to 10 mA. The

current gain (β) is

[4 Marks]

(A) 75

**(B) 100**

(C) 67

(D) 50

**Explanation:**

$\Delta I_b = +50\ \mu A$, $\Delta I_c = 5 \times 10^{-3}$ A

$\beta = \Delta I_c / \Delta I_b$

$= (5 \times 10^{-3}) / (50 \times 10^{-6})$

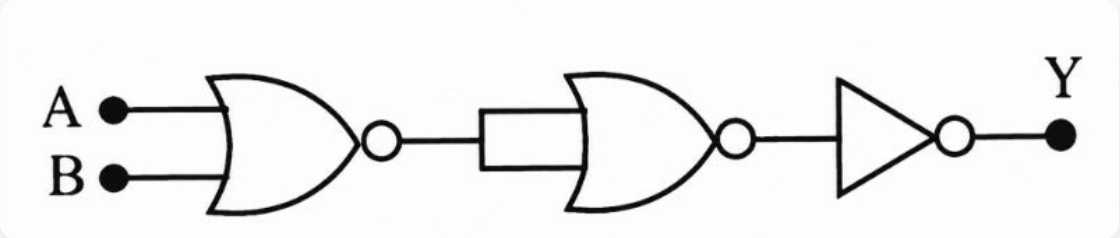
$= (5 \times 1000) / 50$

$= 100$

**Question 49.**

The given electrical network is equivalent to :

[4 Marks]



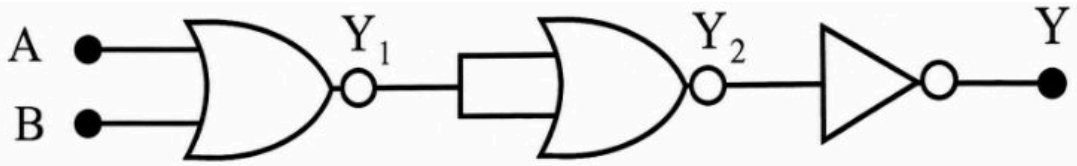

(A) OR gate

**(B) NOR gate**

(C) AND gate

(D) NOT gate

**Answer:**




$$Y_1 = \overline{A + B}$$

$$Y_2 = \overline{Y_1 + Y_1} = \overline{Y_1} = A + B$$

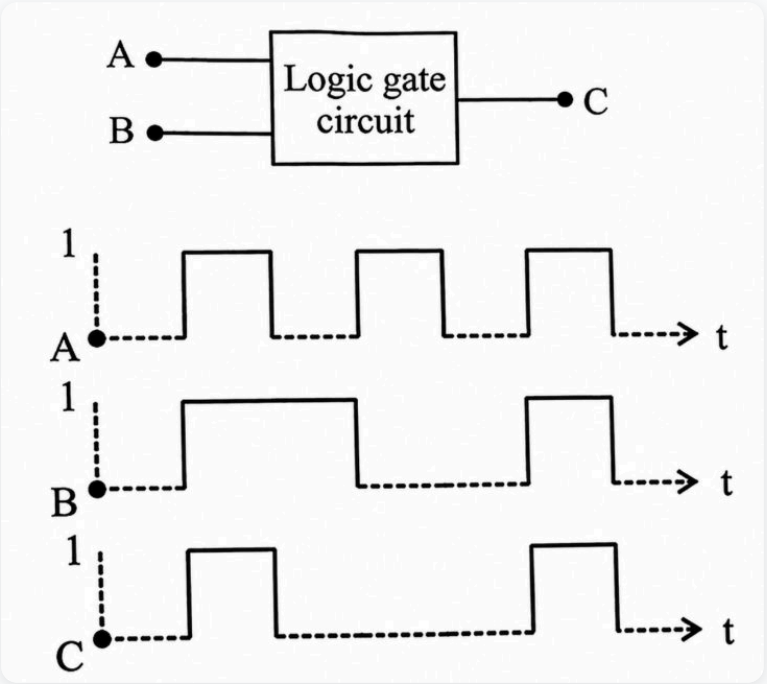
$$Y = \overline{Y_2} = \overline{A + B} \quad \text{i.e. NOR gate}$$

**Question 50.**

The following figure shows a logic gate circuit with two inputs A and B and the output C. The voltage waveforms of A , B and C are as shown below

The logic circuit gate is

[4 Marks]




(A) OR gate

**(B) AND gate**

(C) NOR gate

(D) NAND gate

**Explanation:**

On the basis of given graph, following table is possible.

It is the truth table of AND gate.

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 1 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |

**Question 51.**

Given : The mass of electron is $9.11 \times 10^{-31}$ kg Planck's constant is $6.626 \times 10^{-34}$ Js, the uncertainty involved in the measurement of velocity within a distance of 0.1 Å is

[4 Marks]

**(A) $5.79 \times 10^{6}$ $ms^{-1}$**

(B) $5.79 \times 10^{5}$ $ms^{-1}$

(C) $5.79 \times 10^{8}$ $ms^{-1}$

(D) $5.79 \times 10^{7}$ $ms^{-1}$

**Explanation:**

Weknow that

$\Delta x \cdot \Delta p \geq h / 4\pi$

$\Delta x \cdot m\Delta v > h / 4\pi \Rightarrow \Delta v > h / 4\pi \Delta xm$

$\Delta v = 6.626 \times 10^{-34} / 4\pi \times 0.1 \times 10^{-10} \times 9.11 \times 10^{-31}$

$= (66 / 4\pi \times 9) \times 10^{7} = 5.79 \times 10^{6}$ $ms^{-1}$

**Question 52.**

The orientation of an atomic orbital is governed by

[4 Marks]

(A) Azimuthal quantum number

(B) Principal quantum number

(C) Spin quantum number

**(D) Magnetic quantum number**

**Explanation:**

Magnetic quantum no. represents the orientation of atomic orbitals in an atom. For example $p_x$, p_y & p_z have orientation along X-axis, Y-axis & Z-axis.

**Question 53.**

Which of the following is not a correct statement?

[4 Marks]

(A) The electron-deficient molecules can act as Lewis acids

(B) The canonical structures have no real existence

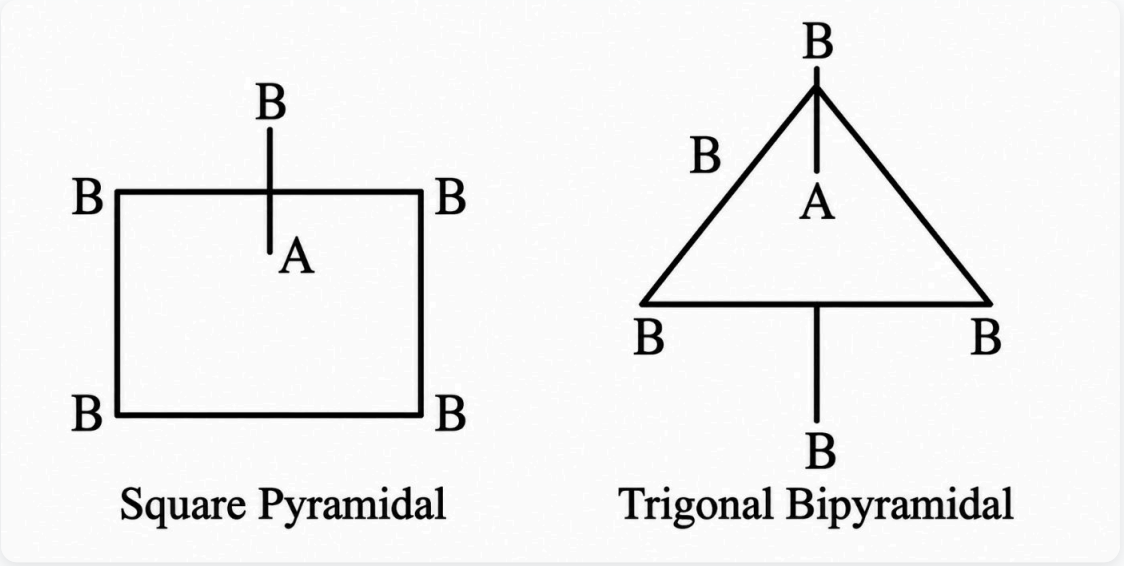
**(C) Every $AB_5$ molecule does in fact have square pyramidal structure**

(D) Multiple bonds are always shorter than corresponding single bonds

**Explanation:**

Statement (The canonical structures have no real existence), (Multiple bonds are always shorter than corresponding single bonds), (The electron-deficient molecules can act as Lewis acids) are correct. Statement (Every $AB_5$ molecule does in fact have square pyramidal structure) is incorrect statement.

$AB_5$ may have two structures as follows:




**Question 54.**

The electronegativity difference between N and F is greater than that between N and H yet the dipole moment of $NH_3$ (1.5 D) is larger than that of $NF_3$ (0.2 D). This is because

[4 Marks]

(A) in $NH_3$ as well as in $NF_3$ the atomic dipole and bond dipole are in the same directions

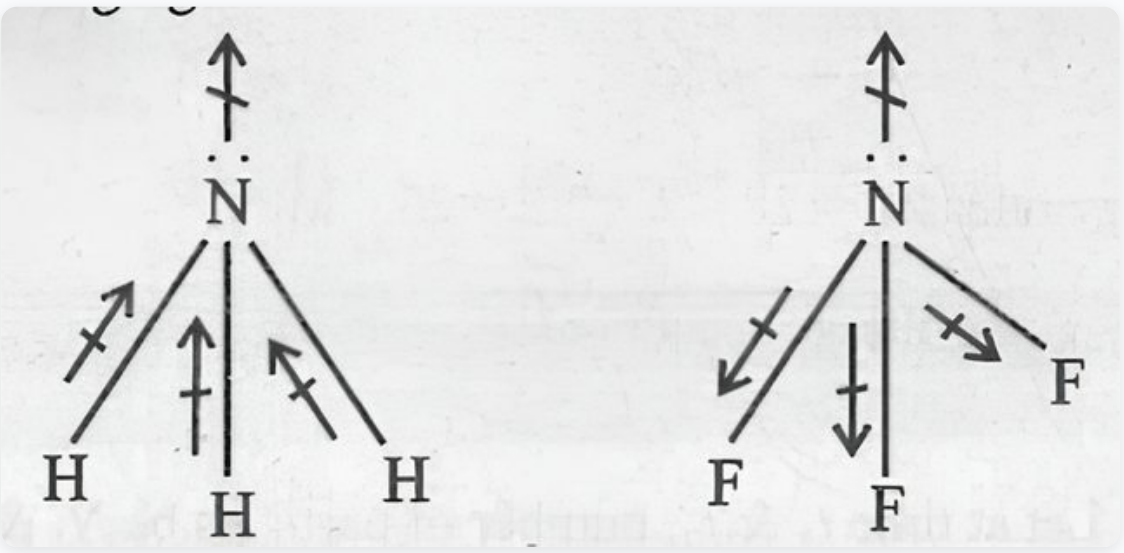
(B) in $NH_3$ the atomic dipole and bond dipole are in the opposite directions whereas in $NF_3$ these are in the same direction

(C) in $NH_3$ as well as $NF_3$ the atomic dipole and bond dipole are in opposite directions

**(D) in $NH_3$ the atomic dipole and bond dipole are in the same directions whereas in $NF_3$ these are in opposite directions**

**Explanation:**

In $NH_3$ the atomic dipole and bond dipole are in the same direction whereas in $NF_3$ these are in opposite direction so in the former case they are added up whereas in the latter case net result is reduction of dipole moment. It has been shown in the following figure :



**Question 55.**

Which of the following is not isostructural with $SiCl_4$?

[4 Marks]

(A) $PO_4^{3-}$

(B) $SO_4^{2-}$

(C) $NH_4^+$

**(D) $SCl_4$**

**Explanation:**

In $SiCl_4$ there is $sp^3$ hybridisation, so the structure is tetrahedral. In $SO_4^{2-}$, $PO_4^{3-}$, $NH_4^+$ the structure is tetrahedral with $sp^3$ hybridisation. But in $SCl_4$, $sp^3d$ hybridisation is present, so its shape is different i.e., see saw.

**Question 56.**

Which of the following species has a linear shape?

[4 Marks]

(A) $NO_2^-$

(B) $O_3$

**(C) $NO_2^+$**

(D) $SO_2$

**Explanation:**

$NO_2^+$ will have linear shape as it will have sp hybridisation.

**Question 57.**

In which of the following molecules all the bonds are not equal?

[4 Marks]

**(A) $ClF_3$**

(B) $NF_3$

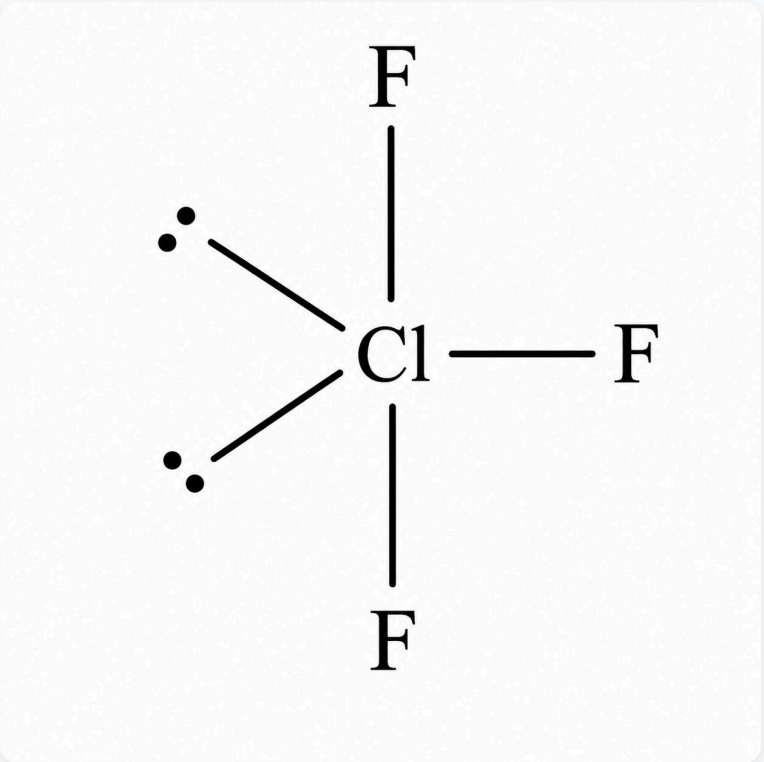
(C) $AlF_3$

(D) $BF_3$

**Explanation:**

In $BF_3$, $AlF_3$ & $NF_3$ all fluoride atoms are symmetrically oriented with respect to central metal atom but in $ClF_3$ three fluorine atoms are arranged as follows :

Here two bonds are in equatorial plane & one bond is in axial plane.




**Question 58.**

The number of unpaired electrons in a paramagnetic diatomic molecule of an element with atomic number 16

is

[4 Marks]

(A) 3

(B) 1

(C) 4

**(D) 2**

**Explanation:**

Electronic configuration of the molecule according to molecular orbital theory, is

$\sigma 1s^2\ \sigma^* 1s^2\ \sigma 2s^2\ \sigma^* 2s^2\ \sigma 2p_z^2\ (\pi 2p_x^2 = 2p_y^2)$

($\pi^*2p_x = \pi 2p_y$)

Last two electrons are unpaired. So no. of unpaired electron is 2.

**Question 59.**

Assume each reaction is carried out in an open container. For which reaction will $\Delta H = \Delta E$ ?

[4 Marks]

(A) $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$

(B) $C(s) + 2H_2O(g) \rightarrow 2H_2(g) + CO_2(g)$

**(C) $H_2(g) + Br_2(g) \rightarrow 2HBr(g)$**

(D) $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

**Explanation:**

We know that
$\Delta H = \Delta E + P\Delta V$
In the reaction, $H_2 + Br_2 \rightarrow 2HBr$
this is no change in volume or $\Delta V = 0$ as number of gaseous moles are same.
So, $\Delta H = \Delta E$ for this reaction

**Question 60.**

The enthalpy of hydrogenation of cyclohexene is $-119.5$ kJ $mol^{-1}$. If resonance energy of benzene is $-150.4$ kJ $mol^{-1}$, its enthalpy of hydrogenation would be

[4 Marks]

(A) $-269.9$ kJ $mol^{-1}$

(B) $-508.9$ kJ $mol^{-1}$

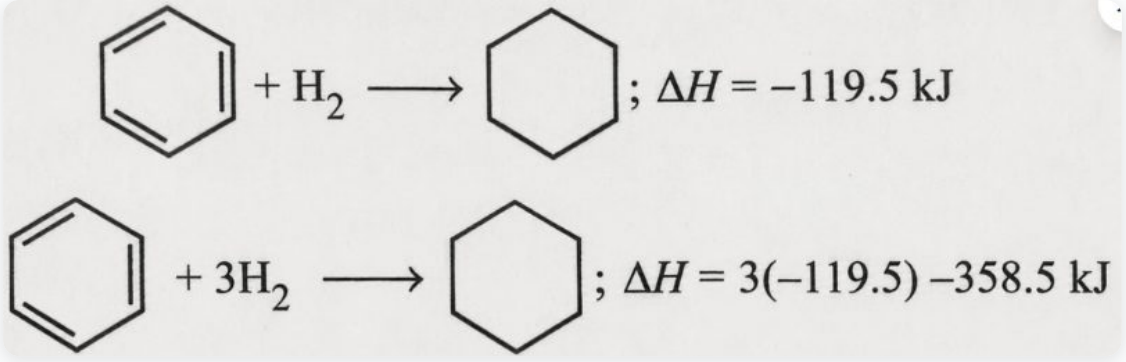
(C) $-358.5$ kJ $mol^{-1}$

**(D) $-208.1$ kJ $mol^{-1}$**

**Explanation:**

The resonance energy provides extra stability to the benzene molecule so it has to overcome for hydrogenation to take place.

So $\Delta H = -358.5 - (-150.4) = -208.1$ kJ




**Question 61.**

The enthalpy and entropy change for the reaction

$Br_2(l) + Cl_2(g) \rightarrow 2BrCl(g)$

are 30 kJ $mol^{-1}$ and 105 $JK^{-1}$ $mol^{-1}$ respectively. The temperature at which the reaction will be in equilibrium is

[4 Marks]

(A) 300 K

(B) 450 K

(C) 273 K

**(D) 285.7 K**

**Explanation:**

We know that
$\Delta G = \Delta H - T\Delta S$
When the reaction is in equilibrium, $\Delta G = 0$
$0 = \Delta H - T\Delta S$
$\Rightarrow T = \Delta H / \Delta S$

$T = (2 \times 30 \times 1000) / (2 \times 105) = 285.7$ K

**Question 62.**

Identify the correct statement for change of Gibbs free energy for a system ($\Delta G_{system}$) at constant temperature and pressure :

[4 Marks]

**(A) If $\Delta G_{system} = 0$, the system has attained equilibrium**

(B) If $\Delta G_{system} < 0$, the process is not spontaneous

(C) If ΔG_system = 0, the system is still moving in a particular direction

(D) If ΔG_system > 0, the process is spontaneous

**Explanation:**

If ΔG_system = 0 the system has attained equilibrium.
If ΔG < 0, the process is spontaneous
If ΔG > 0, the process does not occur in the forward direction.
If may occur in the backward direction.

**Question 63.**

For the reaction

$CH_4(g) + 2O_2(g) \rightleftharpoons CO_2(g) + 2H_2O(l)$, $\Delta rH = -170.8\ kJ\ mol^{-1}$
Which of the following statements is not true ?

[4 Marks]

(A) At equilibrium, the concentrations of $CO_2(g)$ and $H_2O(l)$ are not equal

(B) The reaction is exothermic

**(C) The equilibrium constant for the reaction is given by $K_p = [CO_2] / [CH_4][O_2]^2$**

(D) Addition of $CH_4(g)$ or $O_2(g)$ at equilibrium will cause a shift to the right

**Explanation:**

The equilibrium constant for the reaction is given by $K_p = [CO_2] / [CH_4][O_2]^2$ option is incorrect as the value of $K_p$ given is wrong.
It should have been
$K_P = P_{CO_2} / P_{CH_4} \times (P_{O_2})^2$

**Question 64.**

The hydrogen ion concentration of a $10^{-8}$ M HCl aqueous solution at 298 K ($K_w = 10^{-14}$) is

[4 Marks]

(A) $1.0 \times 10^{-8}$ M

(B) $1.0 \times 10^{-6}$ M

(C) $9.525 \times 10^{-8}$ M

**(D) $11 \times 10^{-8}$ M**

**Explanation:**

For a solution of $10^{-8}$ M HCl, $[H^+] = 10^{-8}$
$[H^+]$ of water = $10^{-7}$
Total $[H^+] = 10^{-7} + 10^{-8} = 10 \times 10^{-8} + 10^{-8}$
$10^{-8}$ (10 + 1) = $11 \times 10^{-8}$

**Question 65.**

Which of the following pairs constitutes a buffer?

[4 Marks]

(A) NaOH and NaCl

(B) $HNO_3$ and $NH_4NO_3$

(C) HCl and KCl

**(D) $HNO_2$ and $NaNO_2$**

**Explanation:**

$HNO_2$ is a weak acid and $NaNO_2$ is salt of that weak acid and strong base (NaOH).

**Question 66.**

The sequence of ionic mobility in aqueous solution is :

[4 Marks]

(A) $K^+ > Na^+ > Rb^+ > Cs^+$

**(B) $Cs^+ > Rb^+ > K^+ > Na^+$**

(C) $Rb^+ > K^+ > Cs^+ > Na^+$

(D) $Na^+ > K^+ > Rb^+ > Cs^+$

**Explanation:**

Smaller the ion more is its ionic mobility in aqueous solution.
Ionic radii of the given alkali metals is in the order $Na^+ < K^+ < Rb^+ < Cs^+$ and the expected ionic mobility will be in the same order
$Cs^+ < Rb^+ < K^+ < Na^+$. However due to high degree of solvation
(or hydration) and because of lower size or high charge density,
hydrated ion size follows the same order $Cs^+ < Rb^+ < K^+ < Na^+$ and
thus conductivity order is $Cs^+ > Rb^+ > K^+ > Na^+$.

**Question 67.**

$Al_2O_3$ can be converted to anhydrous $AlCl_3$ by heating

[4 Marks]

(A) $Al_2O_3$ with HCl gas

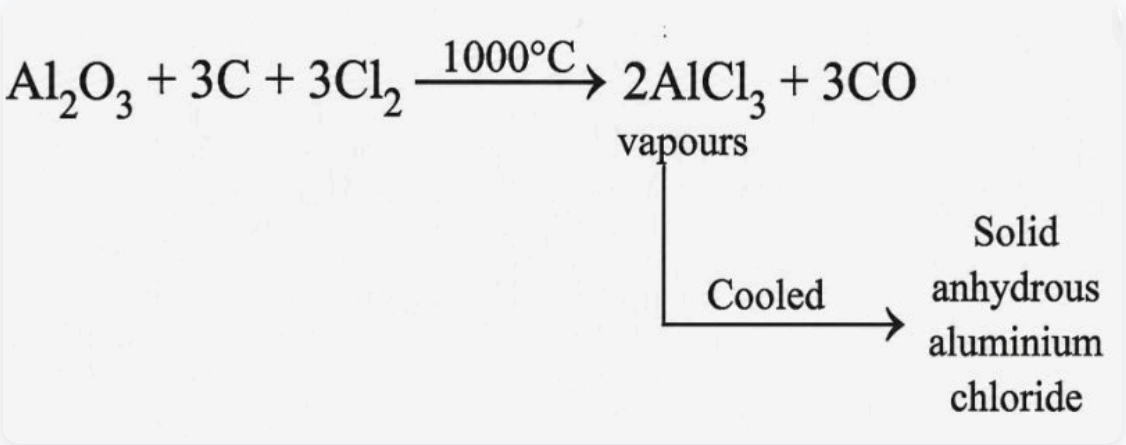
(B) $Al_2O_3$ with $Cl_2$ gas

(C) $Al_2O_3$ with NaCl in solid state

**(D) a mixture of $Al_2O_3$ and carbon in dry $Cl_2$ gas**

**Explanation:**

$Al_2O_3$ can be converted to anhydrous $AlCl_3$ by heating a mixture of $Al_2O_3$ and carbon in dry $Cl_2$ gas.




**Question 68.**

The general molecular formula, which represents the homologous series of alkanols is

[4 Marks]

(A) $C_nH_{2n}O$

(B) $C_nH_{2n}O_2$

**(C) $C_nH_{2n+2}O$**

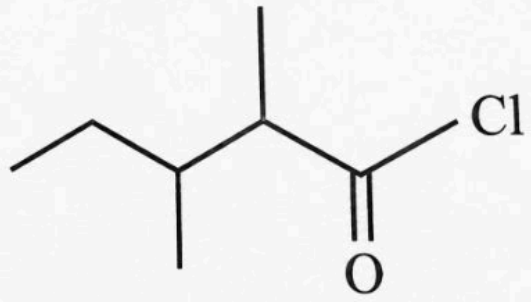
(D) $C_nH_{2n+1}O$

**Explanation:**

General molecular formula of alkanols is
$C_nH_{2n+2}O$, ($C_nH_{2n+1}OH$)

**Question 69.**

[4 Marks]

The IUPAC name of  is

(A) 2-ethyl -3- methylbutanoyl chloride

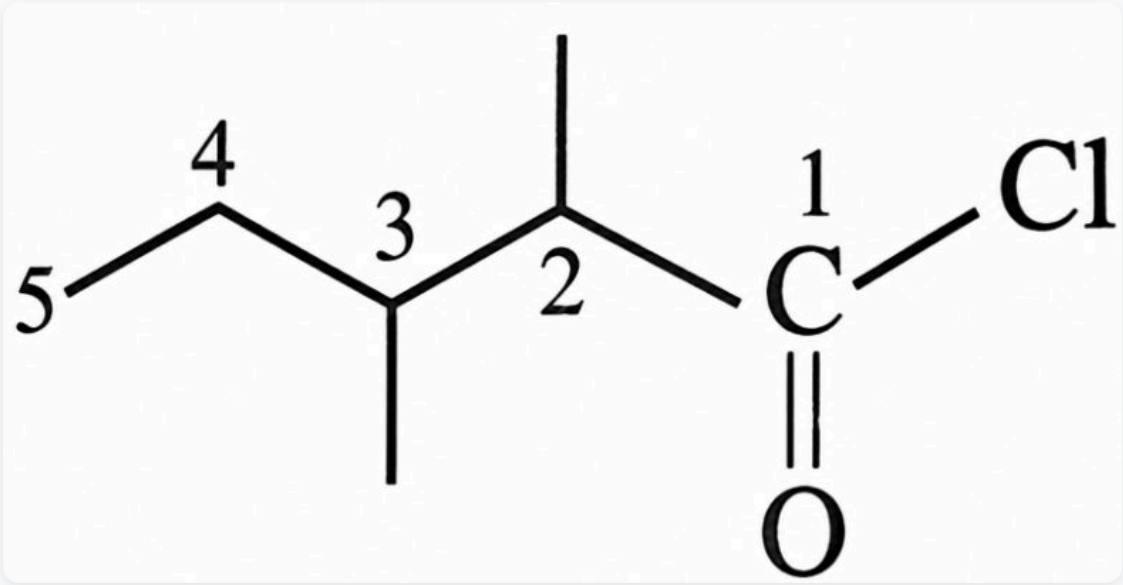
**(B) 2, 3-dimethylpentanoyl chloride**

(C) 1-chloro -1-0xo - 2, 3- dimethyl pentane

(D) 3, 4-dimethyl pentanoyl chloride

**Explanation:**

It is 2,3-dimethylpentanoyl chloride.




**Question 70.**

The correct order regarding the electrone-gativity of hybrid orbitals of carbon is

[4 Marks]

(A) $sp < sp^2 < sp^3$

(B) $sp > sp^2 < sp^3$

(C) $sp < sp^2 > sp^3$

**(D) $sp > sp^2 > sp^3$**

**Explanation:**

Among the three given hybrid orbitals, sp hybrid orbital is most electronegative.

**Question 71.**

CsBr crystallises in a body centred cubic lattice. The unit cell length is 436.6 pm. Given that the atomic mass of Cs = 133 and that of Br = 80 amu and Avogadro number being $6.02 \times 10^{23}$ $mol^{-1}$, the density of CsBr is

[4 Marks]

(A) 0.425 $g/cm^3$

(B) 8.25 $g/cm^3$

**(C) 4.25 $g/cm^3$**

(D) 42.5 $g/cm^3$

**Explanation:**

In body centred cubic lattice one molecule of CsBr is within one unit cell.
Atomic mass of unit cell = 133 + 80 = 213 a.m.u.
Volume of cell = $a^3 = (436.6 \times 10^{-10})^3$ $cm^3$
Density = $(Z \times M) / (N_A \times a^3)$
Density = $(1 \times 213) / (6.02 \times 10^{23} \times (436.6)^3 \times 10^{-30})$
$= 213 \times 10^7 / 6.02 \times (436.6)^3$
= 4.25 $g/cm^3$

**Question 72.**

The appearance of colour in solid alkali metal halides is generally due to

[4 Marks]

(A) Schottky defect

**(B) F-centres**

(C) Interstitial positions

(D) Frenkel defect

**Explanation:**

F-centres

**Question 73.**

A solution of acetone in ethanol

[4 Marks]

**(A) shows a positive deviation from Raoult's law**

(B) shows a negative deviation from Raoult's law

(C) behaves like a non ideal solution

(D) obeys Raoult's law

**Explanation:**

A solution of acetone in ethanol shows positive deviation from Raoult's law. It is because ethanol molecules has strong hydrogen bond. When acetone is added, they hydrogen bonds of ethanol becomes is weaker. Therefore, its volatility and vapour pressure increases.

**Question 74.**

The thalloid body of a slime mould (Myxomycetes) is known as

[4 Marks]

**(A) plasmodium**

(B) fruiting body

(C) mycelium

(D) protonema

**Explanation:**

The thalloid body of slime moulds is made up of multinucleate cell which lacks septa in between and hence it is multinucleated single celled mass called plasmodium.

**Question 75.**

What is common about Trypanosoma, Noctiluca, Monocystis and Giardia?

[4 Marks]

(A) These are all parasites

**(B) These are all unicellular protists**

(C) They produce spores

(D) They have flagella

**Explanation:**

Trypanosoma, Noctiluca, Monocystis & Giardia are all unicellular protists. unicellular eukaryotes.

**Question 76.**

Which of the following environmental conditions are essential for optimum growth of Mucor on a piece of bread?
(i) Temperature of about 25°C
(ii) Temperature of about 5°C

(iii) Relative humidity of about 5%

(iv) Relative humidity of about 95%

(v) A shady place

(vi) A brightly illuminated place

Choose the answer from the following options:

[4 Marks]

(A) (i), (iii) and (v) only

(B) (ii), (iii) and (vi) only

**(C) (i), (iv) and (v) only**

(D) (ii), (iv) and (v) only

**Explanation:**

Mucor is a fungus and most of the fungi require the optimum temperature of about 15–30°C, good moisture content in atmosphere and not very dark and not very lighted place. So Mucor requires a temperature of about 25°C, humidity about 95% and a shady place to grow fully.

**Question 77.**

The causative agent of mad-cow disease is a

[4 Marks]

(A) Worm

**(B) Prion**

(C) Bacterium

(D) Virus

**Explanation:**

Mad cow disease is actually Bovine Spongiform Encephalopathy or BSE. In this disease cattle in Britain got spongy brain and it ultimately gradual degradation of nervous system. It is caused by some virus like but nucleic acid devoid proteinaceous particles called prions (proteinaceous infectious particle).

**Question 78.**

Peat Moss is used as a packing material for sending flowers and live plants to distant places because

[4 Marks]

**(A) it is hygroscopic**

(B) It reduces transpiration

(C) it serves as a disinfectant

(D) it is easily available

**Explanation:**

Peat moss is used wherever we require to retain water in a long because peat mosses are hygroscopic in nature and they absorb the moisture from the atmosphere and this moisture keep living materials and flowers fresh for a long time.

**Question 79.**

Conifers differ from grasses in the

[4 Marks]

(A) production of seeds from ovules

**(B) formation of endosperm before fertilisation**

(C) absence of pollen tubes

(D) lack of xylem tracheids

**Explanation:**

Conifers Gymnosperms differ from grasses angiosperms (angiosperms) because in gymnosperms the female gametophyte is actually endosperm which is made before fertilisation, while in angiosperm it is a tissue formed by the fertilisation of second male gamete to polar nuclei. Moreover in gymnosperms the endosperm is a haploid tissue while in angiosperms it is triploid.

**Question 80.**

Two common characters found in centipede, cockroach and crab are

[4 Marks]

(A) Green gland and tracheae

**(B) Jointed legs and chitinous exoskeleton**

(C) Book lungs and antennae

(D) Compound eyes and anal cerci

**Explanation:**

Jointed legs & chitinous exoskeleton are the common characters found in centipede, cockroach & crab.

**Question 81.**

Biradial symmetry and lack of cnidoblasts are the characteristics of

[4 Marks]

**(A) Ctenoplana and Beroe**

(B) Aurelia and Paramecium

(C) Hydra and starfish

(D) Starfish and sea anemone

**Explanation:**

Aurelia, Hydra & Sea anemone have the characteristic cnidoblast cells. Cnidoblast is shown in the given figure.

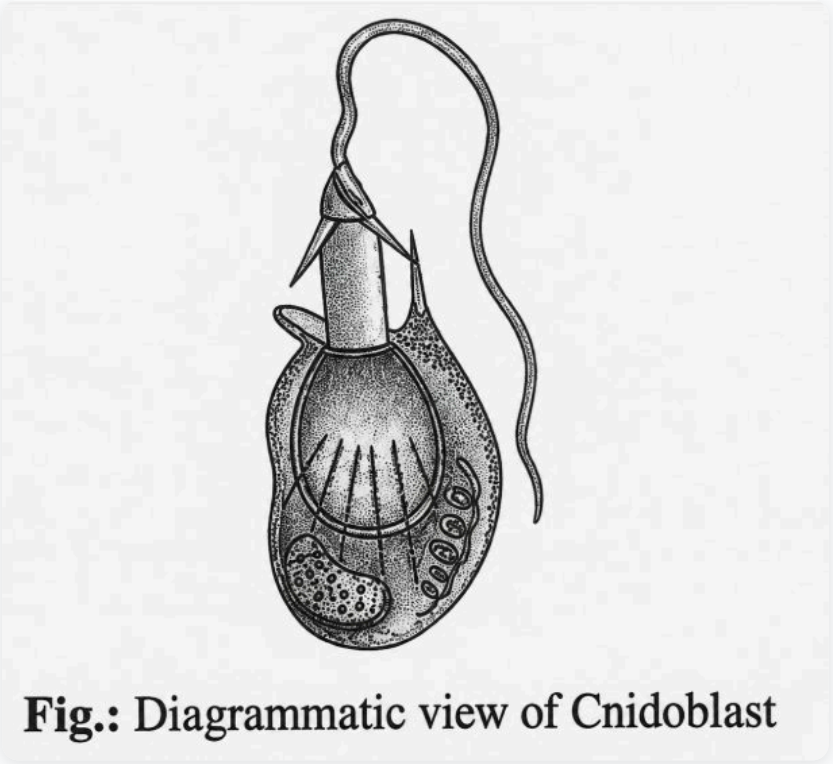


**Fig.:** Diagrammatic view of Cnidoblast

**Question 82.**

Metameric segmentation is the characteristic of

[4 Marks]

(A) Echinodermata and Annelida

**(B) Annelida and Arthropoda**

(C) Mollusca and Chordata

(D) Platyhelminthes and Arthropoda

**Explanation:**

Metameric segmentation means body is divided externally as well as internally. This characteristic is present in annelida (e.g. earth worm) and arthropoda (e.g. cockroach). Their body is divided externally and internally as well.

**Question 83.**

Which one of the following is a matching set of a phylum and its three examples?

[4 Marks]

**(A) Mollusca – Loligo, Teredo, Octopus**

(B) Platyhelminthes – Planaria, Schistosoma, Enterobius

(C) Cnidaria – Bonellia, Physalia, Aurelia

(D) Porifera – Spongilla, Euplectella, Pennatula

**Explanation:**

Mollusca is the second-largest phylum of invertebrate animals after the Arthropoda. The members are known as molluscs or mollusks. They are soft-bodied, bilaterally symmetrical, segmented, coelomate animals; usually shelled having a mantle, ventral foot, anterior head, and a dorsal visceral mass. Loligo, Ptero, Octopus are some examples of Mollusca.

**Question 84.**

In which one of the following sets of animals do all the four give birth to young ones?

[4 Marks]

(A) Shrew, Bat, Cat, Kiwi

(B) Platypus, Penguin, Bat, Hippopotamus

(C) Lion, Bat, Whale, Ostrich

**(D) Kangaroo, Hedgehog, Dolphin, Loris**

**Explanation:**

Penguin, Kiwi & Ostrich all belong to class Aves of chordata (i.e. birds) and they do not give birth to young ones, they are oviparous, while Kangaroo, Hedgehog, Dolphin, Loris all belong to class mammalia and are viviparous.

**Question 85.**

Annual migration does not occur in the case of

[4 Marks]

(A) Siberian crane

**(B) Salamander**

(C) Salmon

(D) Arctic tern

**Explanation:**

Salamander does not undergo any annual migration as it occurs in Siberian crane. Arctic tern and Salmon mainly for the search of food or for breeding.

**Question 86.**

What type of placentation is seen in sweet pea?

[4 Marks]

(A) Axile

(B) Free central

**(C) Marginal**

(D) Basal

**Explanation:**

In sweet pea, the gynoecium is monocarpellary and bears a single locule along the junction of two fused margins, this is called marginal placentation.

**Question 87.**

Long filamentous threads protruding at the end of the young cob of maize are

[4 Marks]

**(A) styles**

(B) ovaries

(C) anthers

(D) hairs

**Explanation:**

Long filamentous threads of maize are the styles of ovaries. In fact, these are the longest styles in plants.

**Question 88.**

In a cereal grain the single cotyledon of embryo is represented by

[4 Marks]

**(A) scutellum**

(B) prophyll

(C) coleoptile

(D) coleorhiza

**Explanation:**

Single cotyledon of embryo in cereal grain is represented by scutellum. Coleoptile represents the covering of stem. Coleorhiza represents the covering of root.
Notes:
Prophyll is a plant structure resembling a leaf (as a bracteole) or consisting of a modified or rudimentary leaf (as a floral primordium). The coleoptile is a rigid piece of plant tissue that encloses the first few leaves (or plumule) of the corn seedling as the mesocotyl elongates and "pushes" the coleoptile to the soil surface during the emergence process. The coleorhiza is a protective sheath that envelops the radicle in certain plants that is penetrated by the root immediately. It helps in protecting the radicle.

**Question 89.**

Pineapple fruit develops from

[4 Marks]

**(A) a cluster of compactly borne flowers on a common axis**

(B) a multistipitate syncarpous flower on a common axis

(C) a unilocular polycarpellary flower

(D) a multilocular monocarpellary flower

**Explanation:**

Pineapple (Ananas sativus) is a sorosis fruit developed from a composite inflorescence which is actually a cluster of compactly borne flowers on a common axis.

**Question 90.**

Aril represents the edible part of

[4 Marks]

**(A) litchi**

(B) banana

(C) mango

(D) apple

**Explanation:**

Aril develops from ovule coat and is the edible part of litchi.
Notes:
An aril (or arillus) is a fleshy covering of certain seeds formed from the funiculus attachment point of the seed. The aril may create a fruit-like structure called a false-fruit and is produced by a few species of gymnosperms, notably the yews and related conifers in the families Taxaceae and Cephalotaxaceae.

**Question 91.**

A common structural feature of vessel elements and sieve tube elements are

[4 Marks]

(A) presence of P-protein

(B) pores on lateral walls

(C) thick secondary wall

**(D) enucleate condition**

**Explanation:**

In plants, conducting tissue xylem has an important integral cell as xylem vessel which is enucleate. The phloem on the other hand has a row of sieve tubes which are also enucleate at maturity.

**Question 92.**

Areolar connective tissue joins

[4 Marks]

**(A) integument with muscles**

(B) bones with muscles

(C) fat body with muscles

(D) bones with bones

**Explanation:**

Areolar connective tissue has rich supply of nerve fibres and blood vessels. It joins skin epithelia with muscles, nerves & blood vessels. Binding of body parts together is the main function of areolar connective tissue.

**Question 93.**

Mast cells secrete

[4 Marks]

(A) myoglobin

(B) hippurin

(C) hemoglobin

**(D) histamine**

**Explanation:**

Mast cell release histamine which increases the permeability of blood vessels at the site of inflammation so that more blood supply takes place. The site gets warm and red due to this.

**Question 94.**

A major break through in the studies of cells came with the development of electron microscope. This is because

[4 Marks]

(A) the resolving power of the electron microscope is 200–350 nm as compared to 0.1–0.2 for the light microscope

(B) electron beam can pass through thick materials, whereas light microscope requires thin sections

(C) the electron microscope is more powerful than the light microscope as it uses a beam of electrons which has wavelength much longer than that of photons

**(D) the resolution power of the electron microscope is much higher than that of the light microscope**

**Explanation:**

A major break through in cell studies came with the development of EM having great resolution power due to which we can see the ultrastructures of cell organelles.
Notes:
There are several different types of electron microscopes, including the transmission electron microscope (TEM), scanning electron microscope (SEM), and reflection electron microscope (REM). The electron microscope uses a beam of electrons and their wave-like characteristics to magnify an object's image, unlike the optical microscope that uses visible light to magnify images. This stream is

confined and focused using metal apertures and magnetic lenses into a thin, focused, monochromatic beam.

**Question 95.**

Which of the following statements regarding cilia is not correct?

[4 Marks]

(A) Microtubules of cilia are composed of tubulin.

**(B) Cilia are hair-like cellular appendages.**

(C) Cilia contain an outer ring of nine doublet microtubules surrounding two single microtubules.

(D) The organized beating of cilia is controlled by fluxes of $Ca^{2+}$ across the membrane.

**Explanation:**

Eukaryotic cilia are made up of tubulin protein. Cilia have a core of 2 microtubules and around there are 9 doublet microtubules. These are not all hair like structures.
Notes:
Microtubules are polymers of tubulin that form part of the cytoskeleton and provide structure and shape to eukaryotic cells. Microtubules can grow as long as 50 micrometres and are highly dynamic. The outer diameter of a microtubule is between 23 and 27 nm while the inner diameter is between 11 and 15 nm.

**Question 96.**

Which of the following statement regarding mitochondrial membrane is not correct?

[4 Marks]

**(A) The enzymes of the electron transfer chain are embedded in the outer membrane.**

(B) The inner membrane is highly convoluted forming a series of infoldings.

(C) The outer membrane resembles a sieve.

(D) The outer membrane is permeable to all kinds of molecules.

**Explanation:**

The enzymes of electron transport system are present in inner mitochondrial membrane.

**Question 97.**

β-form DNA is approximately

[4 Marks]

(A) 3.4 nm

**(B) 2 nm**

(C) 0.34 nm

(D) 20 nm

**Explanation:**

2nm is the correct answer

**Question 98.**

An organic substance bound to an enzyme and essential for its activity is called

[4 Marks]

(A) Isoenzyme

**(B) Holoenzyme**

(C) Apoenzyme

(D) Coenzyme

**Explanation:**

Length of one turn of DNA helix is 34 Å.
1 Å = $10^{-1}$ nm
$34^{-}$ = $10^{-1}$ × 34 = 34 × 1/10 nm
= 3.4 nm

**Question 99.**

What would be the number of chromosomes in the cells of the aleurone layer in a plant species with 8 chromosomes in its synergies?

[4 Marks]

(A) 16

(B) 24

**(C) 8**

(D) 32

**Explanation:**

Coenzyme is an organic substance that enhances the action of an enzyme by binding with the protein molecule. Holoenzyme is a biochemically active compound formed by the combination of an enzyme with a coenzyme. Apoenzyme is the protein part of an enzyme to which the coenzyme attaches to form an active enzyme. Isoenzyme is one of several forms of an enzyme that catalyse the same reaction but differ from each other in such properties as substrate affinity and maximum rates of enzyme substrate reaction.

**Question 100.**

The translocation of organic solutes in sieve tube members is supported by

[4 Marks]

(A) cytoplasmic streaming

(B) root pressure and transpiration pull

(C) mass flow involving a carrier and ATP

**(D) P-proteins**

**Explanation:**

P -Protein is the supporting factor for the translocation of organic solutes in sieve tubes.

**Question 101.**

Farmers in a particular region were concerned that premature yellowing of leaves of a pulse crop might cause decrease in the yield. Which treatment could be most beneficial to obtain maximum seed yield?

[4 Marks]

(A) Frequent irrigation of the crop

**(B) Application of iron and magnesium to promote synthesis of chlorophyll**

(C) Treatment of the plants with cytokinins along with a small dose of nitrogenous fertilizer

(D) Removal of all yellow leaves and spraying a remaining green leaves with 2,4,5-trichlorophenoxy acetic acid

**Explanation:**

Because iron promotes the formation of chlorophyll and magnesium is an integral part of chlorophyll molecule so in the absence of these nutrients plants show chlorosis & leaves get yellow. Application of

iron and magnesium to promote the synthesis of chlorophyll can cure the disease.
Notes:
The lack of iron is one of the more common nutrients associated with chlorosis. Manganese or zinc deficiencies in the plant will also cause chlorosis. The way to separate an iron deficiency from zinc or manganese deficiency is to check what foliage turned chlorotic first .

**Question 102.**

In photosystem-I the first electron acceptor is

[4 Marks]

(A) Cytochrome

(B) Plastocyanin

(C) Ferredoxin

**(D) An iron-sulphur protein**

**Explanation:**

In photosystem I electrons released by P-700 are accepted by a substance called iron-sulphur complex denoted as A(FeS) which is thus reduced and it passes these high electrons to oxidised ferredoxin and it gets reduced.

**Question 103.**

During photorespiration, the oxygen consuming reaction(s) occur in

[4 Marks]

**(A) stroma of chloroplast and peroxisomes**

(B) stroma of chloroplasts and mitochondria

(C) grana of chloroplasts and peroxisomes

(D) stroma of chloroplasts

**Explanation:**

Photorespiration is the process which occurs in $C_3$ plants. In this process, peroxisomes, chloroplast and mitochondria take part. The oxygen consuming reactions occur in peroxisomes and stroma of chloroplast while $CO_2$ releasing reaction occurs in mitochondria.

**Question 104.**

The bacterium Clostridium botulinum that causes botulism is

[4 Marks]

**(A) an obligate anaerobe**

(B) an obligate aerobe

(C) a facultative aerobe

(D) a facultative anaerobe

**Explanation:**

Clostridium botulinum is an obligate anaerobe i.e. it normally lives in the absence of oxygen. Facultative anaerobes are those who generally live in oxygen but may live without oxygen in suitable medium. Obligate aerobes can only live in the presence of oxygen while facultative aerobes generally live in oxygen but can also live without oxygen.
Notes:
Botulism is a rare and potentially fatal illness caused by a toxin produced by the bacterium Clostridium botulinum. The disease begins with weakness, blurred vision, feeling tired, and trouble speaking.

**Question 105.**

How many ATP molecules could maximally be generated from one molecule of glucose, if the complete oxidation of one mole of glucose to $CO_2$ and $H_2O$ yields 686 kcal and the useful chemical energy available in the high energy phosphate bond of one mole of ATP is 12 kcal?

[4 Marks]

**(A) Fifty-seven**

(B) Two

(C) Thirty

(D) One

**Explanation:**

12 kcal of energy is present in one molecule of ATP & on oxidation of one mole of glucose into $CO_2$ and $H_2O$ energy released is 686 kcal. So no. of ATP which can store this energy would be = 57.1 = 57 ATPs.

**Question 106.**

An enzyme that can stimulate germination of barley seeds is

[4 Marks]

(A) lipase

(B) protease

(C) invertase

**(D) a-amylase**

**Explanation:**

a-amylase enzyme stimulates the germination of barley seed. Barley seeds are rich in carbohydrate (starch). The starch is hydrolysed by α-amylase to monosaccharide unit at the time of germination of seeds.

**Question 107.**

How does pruning help in making the hedge dense?

[4 Marks]

(A) It releases wound hormones

(B) It induces the differentiation of new shoots from the rootstock

**(C) It frees axillary buds from apical dominance**

(D) The apical shoot grows faster after pruning

**Explanation:**

When an apical bud is present on a plant, it suppresses the growth of axillary buds, this is called apical dominance. When apical bud is cut off the axillary buds start growing & hedge become dense.

**Question 108.**

Treatment of seed at low temperature under moist condition to break its dormancy is called

[4 Marks]

(A) chelation

(B) vernalization

**(C) stratification**

(D) scarification

**Explanation:**

Treated seeds at a low temperature under moist conditions to break dormancy is called stratification.

**Question 109.**

Which one of the following statements is incorrect?

[4 Marks]

**(A) The residual area in lungs slightly decreases the efficiency of respiration in mammals.**

(B) The presence of non-respiratory air sacs increases the efficiency of respiration in birds.

(C) The principle of countercurrent flow facilitates efficient respiration in gills of fishes.

(D) In insects, circulating body fluids serve to distribute oxygen to tissues.

**Explanation:**

The amount of gases remaining in the lungs even after a forcible expiration is known as residual volume. Variation in the level of inspiratory and expiratory gases is maintained by the residual volume. So residual air in lungs does not affect the respiratory efficiency.

**Question 110.**

The majority of carbon dioxide produced by our body cells is transported to the lungs

[4 Marks]

**(A) as bicarbonates**

(B) as carbonates

(C) dissolved in the blood

(D) attached to haemoglobin

**Explanation:**

Transport of $CO_2$ is much easier than $O_2$ because of the higher solubility of $CO_2$ than $O_2$. Almost 7% of $CO_2$ is transported in dissolved state in plasma. About 20–25% $CO_2$ is transported by RBCs. 70% of $CO_2$ is transported in the form of bicarbonate ions. $CO_2$ reacts with water present in plasma.
Notes:
Carbonic acid is unstable & gives $H^+$ and $HCO_3^-$. $H^+$ bind with haemoglobin to maintain the pH of blood while $HCO_3^-$ remain in the blood and carries the $CO_2$ to lungs.

**Question 111.**

Which of the following has an open circulatory system?

[4 Marks]

**(A) Periplaneta**

(B) Hirudinaria

(C) Octopus

(D) Pheretima

**Explanation:**

Periplaneta (P. americana, the Indian Cockroach) is an insect & insects do not have closed blood circulation. Their blood (called haemolymph) even does not serve for respiration. They do not possess blood vessels in this circulatory system and hence blood is an open system.

**Question 112.**

Examination of blood of a person suspected of having anaemia, shows large, immature, nucleated erythrocytes without haemoglobin. Supplementing his diet with which of the following is likely to alleviate his symptoms?

[4 Marks]

(A) Thiamine

**(B) Folic acid and cobalamine**

(C) Lipids

(D) Riboflavin

**Explanation:**

Folic acid and cobalamine is the correct answer.

**Question 113.**

Match List I with List II.
Choose the correct answer from the options given below:

[4 Marks]

| List I | | List II | |
|---|---|---|---|
| A. | Taenia | I. | Nephridia |
| B. | Paramoecium | II. | Contractile vacuole |
| C. | Periplaneta | III. | Flame cells |
| D. | Pheretima | IV. | Urecose gland |

**(A) A–III, B–II, C–IV, D–I**

(B) A–II, B–I, C–IV, D–III

(C) A–I, B–II, C–III, D–IV

(D) A–I, B–II, C–IV, D–III

**Explanation:**

The correct matching will be:
• Protonephridia or flame cells are the excretory structures in platyhelminthes.
• Nephridia are the tubular excretory structures of earthworms (Phretima) and other annelids.
• Single celled organisms like Paramoecium have contractile vacuoles for excretion.
• Urecose glands are present in cockroach.

**Question 114.**

Which one of the following options gives the correct categorization of six animals according to the type of nitrogenous wastes (A, B, C) they give out?

[4 Marks]

| | I | II | III |
|---|---|---|---|
| | A-Ammonotelle | B-Ureotelic | C-Uricotelle |
| (a) | Pigeon, Humans | Aquatic Amphibia, Lizards | Cockroach, Frog |
| (b) | Frog, Lizards | Aquatic Amphibia, Humans | Cockroach, Pigeon |
| (c) | Aquatic Amphibia | Frog, Humans | Pigeon, Lizards, Cockroach |
| (d) | Aquatic Amphibia | Cockroach, Humans | Frog, Pigeon, Lizards |

(A) a

(B) b

(C) d

**(D) c**

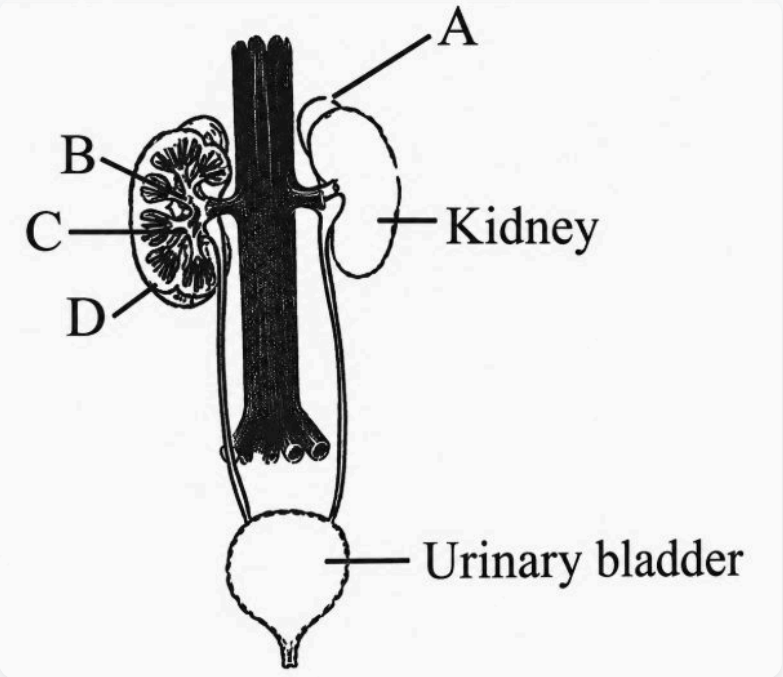
**Explanation:**

Those animals that excrete ammonia are called ammonotelic, e.g. aquatic amphibia. Those animals that excrete urea are called ureotelic, e.g. frog, humans.
Those animals that excrete uric acid are called uricotelic, e.g. pigeon, lizards, and cockroach.

**Question 115.**

Figure shown human urinary system with structures labelled A to D. Select option which correctly identifies them and gives their functions.

[4 Marks]




(A) C-Medulla: inner zone of kidney and contains complex nephrons.

(B) B-pelvis: broad funnel shaped space inner to hilum, directly connected to loops of Henle.

(C) D-Cortex: outer part of kidney and do not contain any part of nephrons.

**(D) A-Adrenal gland: located at the anterior part of kidney. Secrete Catecholamines which stimulate glycogen breakdown.**

**Explanation:**

A – Adrenal gland – located at the anterior part of kidney, secrete Catecholamines which stimulate glycogen breakdown.

**Question 116.**

Angiotensin is a protein produced and secreted by

[4 Marks]

**(A) liver cells**

(B) endothelial cells (lining the blood vessels)

(C) macula densa cells

(D) juxtaglomerular (JG) cells

**Explanation:**

Angiotensinogen is a protein secreted by the liver cells.

**Question 117.**

Which of the following is the contractile protein of a muscle?

[4 Marks]

(A) Tropomyosin

**(B) Myosin**

(C) Actin

(D) Tubulin

**Explanation:**

Actin and tropomyosin are part of thin filaments of skeletal muscle. Tubulin is present in microtubules. Myosin is muscle protein.

**Question 118.**

Bowman's capsule found in

[4 Marks]

(A) external auditory canal

(B) cortical nephrons only

(C) juxtamedullary nephrons

**(D) olfactory epithelium**

**Explanation:**

Bowman's glands are found in olfactory epithelium which secrete mucus to keep the olfactory epithelium moist and free from germs.
Notes:
Smell detects volatile chemicals in the inhaled air, and taste detects dissolved chemicals in food and drink. Olfactory receptor cells have long cilia that protrude into a mucus layer that is secreted by Bowman's glands in the olfactory epithelium.

**Question 119.**

Which one of the following statement is correct?

[4 Marks]

(A) Neither hormones control neural activity nor the neurons control endocrine activity

**(B) Endocrine glands regulate endocrine activity, and nervous system regulates endocrine glands**

(C) Endocrine glands regulate neural activity, but not vice versa

(D) Neurons regulate endocrine activity, but not vice versa

**Explanation:**

Endocrine glands regulate neural activity as endocrine glands secrete epinephrine & norepinephrine which have their effects over neuron activity.

**Question 120.**

Sertoli cells are regulated by the pituitary hormone known as

[4 Marks]

(A) Prolactin

(B) GH

(C) LH

**(D) FSH**

**Explanation:**

During spermatogenetic developments spermatids get nourished by nurse or Sertoli cells. The spermatogenesis is under the direct influence of follicle-stimulating hormone (FSH) that is secreted by adenohypophysis of pituitary gland.

**Question 121.**

Which of the following is an accumulation and release centre of neurohormones?

[4 Marks]

(A) Intermediate lobe of the pituitary

(B) Hypothalamus

(C) Anterior pituitary lobe

**(D) Posterior pituitary lobe**

**Explanation:**

Neurohormones are actually secreted by the neurosecretory cells of the hypothalamus. They are circulated to the posterior part of the pituitary gland through the blood & stored there and released when required.

**Question 122.**

Which hormone causes dilation of blood vessels, increased oxygen consumption and glucogenesis?

[4 Marks]

**(A) Adrenaline**

(B) Insulin

(C) Glucagon

(D) ACTH

**Explanation:**

Adrenaline (called Fight-Flight hormone) is responsible for the dilation of blood vessels, increased oxygen consumption by tissues & glycogenesis to prepare the body for emergency reactions under life threatening conditions.

**Question 123.**

A steroid hormone which regulates glucose metabolism is

[4 Marks]

(A) Cortisone

(B) 11-deoxycorticosterone

(C) Cortisone

**(D) Cortisol**

**Explanation:**

Cortisol is the steroid hormone secreted by adrenal cortex and plays an important role in carbohydrate metabolism. It retards the glucose consumption & hence level of glucose in blood increases & blood pressure increases.

**Question 124.**

Which one of the following is not a second messenger in hormone action?

[4 Marks]

(A) Calcium

**(B) Sodium**

(C) cGMP

(D) cAMP

**Explanation:**

There is no role of sodium in hormonal action. In heart cells cAMP acts as secondary messenger which is made in the response of adrenaline and it stimulates $Ca^{2+}$ ions to come out from the sarcoplasmic reticulum of muscle fibres which causes muscle contraction.
cGMP (Cyclic Guanosine Monophosphate) which acts as secondary messenger works on the action of acetylcholine, increase in flow of $Ca^{2+}$ into muscle fibres & hence causes muscle relaxation.

**Question 125.**

Which one of the following does not act as a neurotransmitter?

[4 Marks]

(A) Norepinephrine

(B) Epinephrine

**(C) Cortisone**

(D) Acetylcholine

**Explanation:**

Epinephrine (adrenaline), norepinephrine (noradrenaline) and acetylcholine are the neurotransmitters. These are released by the nerve fibres to transmit the impulse to the next neuron. Cortisone is not the neurotransmitter.

**Question 126.**

The arrangement of the nuclei in a normal embryo sac in the dicot plants is

[4 Marks]

**(A) 3 + 2 + 3**

(B) 3 + 3 + 2

(C) 2 + 4 + 2

(D) 2 + 3 + 3

**Explanation:**

In dicot plant general arrangement of nuclei in the embryo sac is that 3 nuclei in 3 cells of egg apparatus (one egg cell & 2 synergids) at micropylar end and 2 polar nuclei at almost middle region and 3 nuclei in the form of antipodals at the distal end of micropyle, towards nucellus. So total nuclei = 3 + 2 + 3.

**Question 127.**

What would be the number of chromosomes in the cells of the aleuron layer in a plant species with 8 chromosomes in its synergids?

[4 Marks]

**(A) 24**

(B) 32

(C) 8

(D) 16

**Explanation:**

Aleurone layer is the layer formed by the endospermic tissue in the members of family Graminae e.g. wheat, rice, maize etc. Obviously it will be a triploid tissue. So if synergids have 8 no. of chromosomes which are haploid then aleurone-layer must have 24 chromosomes.

**Question 128.**

Withdrawal of which of the following hormones is the immediate cause of menstruation?

[4 Marks]

(A) FSH

(B) FSH-RH

(C) Estrogen

**(D) Progesterone**

**Explanation:**

Progesterone hormone is secreted by the corpus luteum on ovaries and is responsible to stop ovulation (during pregnancy) and fixes the foetus to the uterine wall, facilitates placentation and controls the foetus development in uterus. If this hormone is withdrawn then fixation of foetus to uterine wall will not take place, formation of placenta will also not take place, ovulation starts from the ovaries and hence in human female menstruation starts.

**Question 129.**

Which one of the following is an example of polygenic inheritance?

[4 Marks]

**(A) Skin colour in humans**

(B) Pod shape in garden pea

(C) Production of male honey bee

(D) Flower colour in Mirabilis jalapa

**Explanation:**

Polygenic inheritance is the inheritance of traits which are dependent on the number of genes such as the skin colour of human beings, e.g. three genes A, B and C. Genotype AABBCC will have darkest skin colour and genotype aabbcc will have light skin colour. The number of each type of alleles in the genotype would determine the darkness or lightness of the skin of an individual.
Notes:
Polygenic inheritance was discovered in 1909 by the Swedish scientist H. Nilsson-Ehle, who studied the inheritance of grain colour in wheat by the analytical dissociation of the character.

**Question 130.**

In Mendel's experiment with garden pea, round seed shape (RR) was dominant over wrinkled seeds (rr), yellow cotyledon (YY) was dominant over green cotyledon (yy). What are the expected phenotypes in the $F_2$ generation of the cross RRYY × rryy?

[4 Marks]

(A) only wrinkled seeds with yellow cotyledons

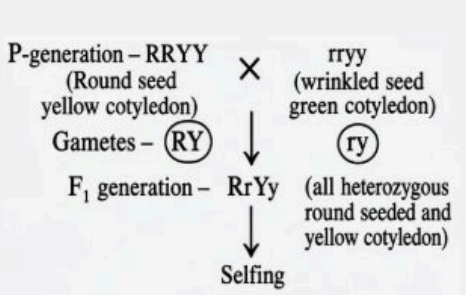
(B) only wrinkled seeds with green cotyledons

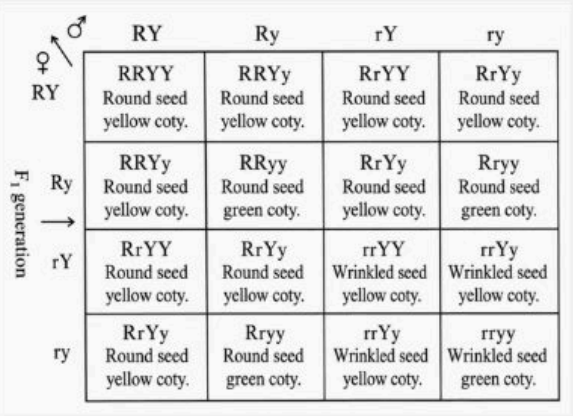
(C) only round seeds with green cotyledons

**(D) Round seeds with yellow cotyledons, and wrinkled seeds with yellow cotyledons**

**Explanation:**

So the ratio of Round seeded with yellow cotyledons : Round seeded with green cotyledons : Wrinkled seeded yellow cotyledons : Wrinkled seeded green cotyledons is 9 : 3 : 3 : 1. So in the $F_2$ generation, the round seeded character remains with yellow cotyledons & wrinkled seeds will be yellow cotyledons.




**Question 131.**

Test cross involves

[4 Marks]

(A) crossing between two $F_1$ hybrids

**(B) crossing the $F_1$ hybrid with a double recessive genotype**

(C) crossing between two genotypes with dominant trait

(D) crossing between two genotypes with recessive trait

**Explanation:**

A cross of $F_1$ hybrid with its recessive homozygous parent is called the test cross. It is done to determine the genotype of a given plant. If the given plant has homozygous dominant traits then test cross gives all dominant trait plants but if it is heterozygous dominant then it gives dominant and recessive phenotypes in 1 : 1 ratio.

**Question 132.**

Phenotype of an organism is the result of

[4 Marks]

(A) cytoplasmic effects and nutrition

(B) environmental changes and sexual dimorphism

**(C) genotype and environment interactions**

(D) mutations and linkages

**Explanation:**

Phenotype is the appearance of one organism while genotype is the genetic complement it has from its ancestors. These genes only show their effect in phenotype but environmental also plays an important role in this. Hence phenotype is a result of genotype and environmental interaction.

**Question 133.**

How many different kinds of gametes will be produced by a plant having the genotype AABbCC?

[4 Marks]

(A) Nine

(B) Four

**(C) Two**

(D) Three

**Explanation:**

It would make only two types of gametes, these are ABC & AbC.

**Question 134.**

In which mode of inheritance do you expect more maternal influence among the offspring?

[4 Marks]

**(A) Cytoplasmic**

(B) Autosomal

(C) Y-linked

(D) X-linked

**Explanation:**

The genes of cytoplasmic characters occur outside the chromosome, in cytoplasm, they inherit their traits like chromosomal genes do. In a zygote formation, the cytoplasmic comes from the mother's ova and hence the cytoplasmic characters must come from maternal side and this is the reason that cytoplasmic inheritance is also known as maternal inheritance.

**Question 135.**

If a colour blind woman marries a normal visioned man, their children will be

[4 Marks]

(A) one-half colour blind and one-half normal

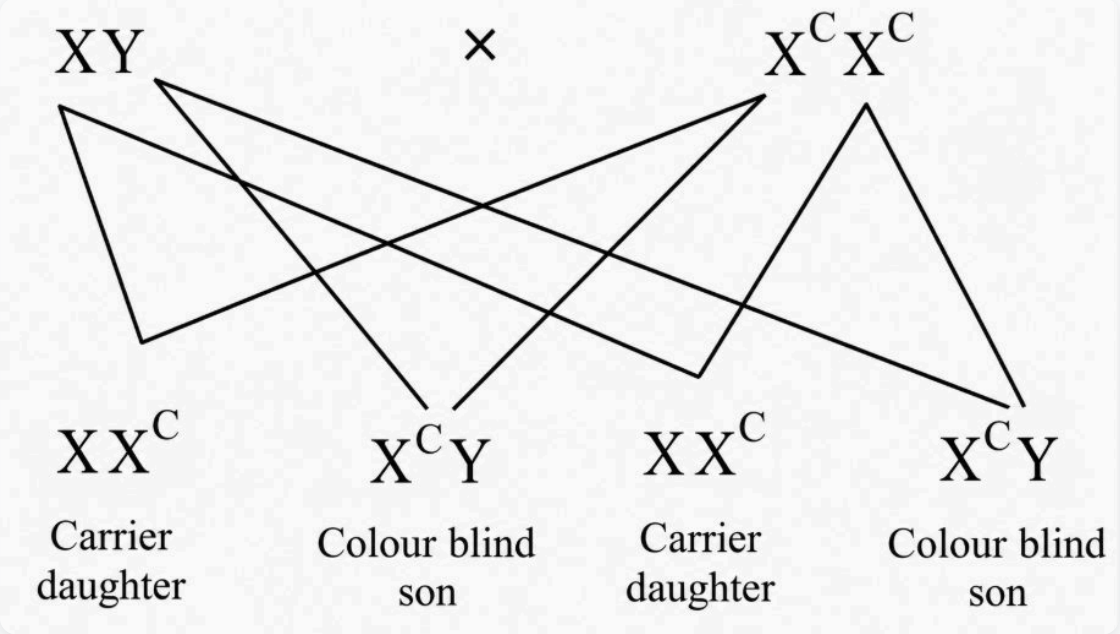
(B) three-fourths colour blind and one-fourth normal

**(C) all colour blind**

(D) all normal visioned

**Explanation:**

Colour blindness is X chromosome linked character. So they'll be having all colour blind sons & carrier daughters.




**Question 136.**

Cri-du-chat syndrome in humans is caused by the

[4 Marks]

(A) loss of half of the long arm of chromosome 5

**(B) loss of half of the short arm of chromosome 5**

(C) trisomy of 21st chromosome

(D) fertilization of an XX egg by a normal Y-bearing sperm

**Explanation:**

Cri-du-chat syndrome in humans is caused by the partial deletion of the short arm of chromosome no. 5. This child has abnormalities in his/her facial expressions, mental retardation, they speak and cry like that of cat, heart does not work properly.

**Question 137.**

Both sickle cell anaemia and Huntington's chorea are

[4 Marks]

(A) bacteria-related diseases

(B) virus-related diseases

(C) pollutant-induced disorders

**(D) congenital disorders**

**Explanation:**

Sickle cell anaemia is a biochemical disorder in which shape of RBCs become sickle-shaped due to the defective haemoglobin. Haemoglobin becomes useless for oxygen transport.
Huntington's Chorea is a disease in which atrophy of brain occurs resulting in respiratory irregularities, articulation of speech and irregular limb movements. They both are genetic diseases present in any person since birth hence congenital diseases. .

**Question 138.**

Sickle cell anaemia has not been eliminated from the African population because

[4 Marks]

(A) it is controlled by recessive genes

(B) it is controlled by dominant genes

**(C) it provides immunity against malaria**

(D) it is not a fatal disease

**Explanation:**

In sickle cell anaemia, RBCs become sickle shaped

which are not supportive for the growth of malarial parasite

Plasmodium so it provides immunity against malaria disease.

**Question 139.**

Which antibiotic inhibits interaction between tRNA and mRNA during bacterial protein synthesis?

[4 Marks]

**(A) Neomycin**

(B) Streptomycin

(C) Erythromycin

(D) Tetracycline

**Explanation:**

Neomycin is the antibiotic which inhibits the translation of bacterial cell so that it cannot affect the host cell.

**Question 140.**

One gene-one enzyme hypothesis was postulated by

[4 Marks]

(A) Hershey and Chase

(B) A. Garrod

(C) R. Franklin

**(D) Beadle and Tatum**

**Explanation:**

Beadle & Tatum postulated the theory of "One gene-one enzyme" in which they stated that in any living cell there are numerous of genes present on chromosomes in a linear fashion. One single gene controls the synthesis of one particular enzyme (or protein) which is responsible for its phenotypic character.

**Question 141.**

Which one of the following amino-acid was not found to be synthesized in Miller's experiment?

[4 Marks]

(A) Glycine

(B) Alanine

(C) Aspartic acid

**(D) Glutamic acid**

**Explanation:**

Glutamic Acid is one of the non-essential amino acids, biochemically related to glutamine. The two constitute a substantial fraction of the amino acids in many proteins (10–20% in many cases and up to 45% in some plant proteins). An important metabolic intermediate as well as a neurotransmitter molecule in the central nervous system, glutamic acid finds uses in medicine and biochemical research.
Notes:

Its sodium salt is the food flavour enhancer monosodium glutamate (MSG).

**Question 142.**

Evolutionary history of an organism is known as

[4 Marks]

(A) Ancestry

(B) Paleontology

**(C) Phylogeny**

(D) Ontogeny

**Explanation:**

Paleontology is the study of fossils. Ontogeny is the process of development of organism in the embryo stage and phylogeny is known as the history of an organism through ages during evolution.

**Question 143.**

An important evidence in favour of organic evolution is the occurrence of

[4 Marks]

(A) Analogous and vestigial organs

(B) Homologous and analogous organs

(C) Homologous organs only

**(D) Homologous and vestigial organs**

**Explanation:**

Homologous organs represent the divergent evolution. These are the organs belonging to different organisms of different species may be for dissimilar function but they all have the same basic structure. On the other hand vestigial organs

show that how a species evolved from its ancestors through the

ages according to the use and disuse of organs
Notes:
These are the organs which were sometime functional in humans (or may be any other organisms) but during the course of evolution their utility gradually declined and now they are present as non-functional and vestigial organs.

**Question 144.**

Jurassic period of the Mesozoic era was characterised by

[4 Marks]

(A) Radiation of reptiles and origin of mammal-like reptiles

**(B) Gymnosperms were dominant plants and first birds appeared**

(C) Flowering plants and first dinosaurs appeared

(D) Dinosaurs become extinct and angiosperms appeared

**Explanation:**

Jurassic period of Mesozoic era was about 19–20 crore years ago & lasted for about 5.5–6 crore years. The climate was hot and damp. It is called the age of dinosaurs. Its primitive bird Archaeopteryx evolved from reptiles. Its angiosperm appeared as dicotyledon but gymnosperms were dominant.

**Question 145.**

Which one of the following is not a living fossil?

[4 Marks]

(A) Sphenodon

**(B) Archaeopteryx**

(C) Peripatus

(D) King crab

**Explanation:**

Archaeopteryx is a fossil (dead) found from the Mesozoic rocks. It is a connecting link between reptiles and birds.

**Question 146.**

The 'blue baby' syndrome results from

[4 Marks]

(A) excess of dissolved oxygen

(B) excess of chloride

(C) excess of TDS (total dissolved solids)

**(D) methaemoglobin**

**Explanation:**

Infant Methemoglobinemia is also called "blue baby syndrome". It is a condition where a baby's skin turns blue. This happens when there is not enough oxygen in the blood. Methemoglobinemia is a condition that some babies are born with (congenital) or some develop early in life (acquired).

Notes:

The most common cause of blue baby syndrome is water contaminated with nitrates. After a baby drinks formula made with nitrate-rich water, the body converts the nitrates into nitrites. These nitrites bind to the haemoglobin in the body, forming methemoglobin, which is unable to carry oxygen.

**Question 147.**

Antibodies in our body are complex

[4 Marks]

(A) prostaglandins

(B) steroids

**(C) glycoproteins**

(D) lipoproteins

**Explanation:**

Whenever our body gets attacked by some foreign invaders, our body's immune system produces some chemicals to kill or react against the invader. These chemicals are actually made up of carbohydrates and proteins i.e. glycoproteins called antibody.

**Question 148.**

The cell in the human body invaded by the human immuno-deficiency virus (HIV) is

[4 Marks]

**(A) T-helper cell**

(B) Erythrocyte

(C) B-cell

(D) Macrophage

**Explanation:**

AIDS is characterized by reduction in the number of helper T-lymphocytes because of HIV infection. It suppresses human immune system due to which any secondary infection may lead to death. T-lymphocytes are main cells of immune system.

**Question 149.**

A person showing unpredictable moods, outbursts of emotion, quarrelsome behaviour and conflict with others is suffering from

[4 Marks]

**(A) Borderline personality disorder (BPD)**

(B) Addictive disorders

(C) Schizophrenia

(D) Mood disorders

**Explanation:**

In Borderline Personality Disorder (BPD) a person suffers from emotionally unstable personality, unpredictable moods, highly reactive, anxiety and irritability. While in Schizophrenia a person suffers from distorted thoughts, he/she shows some extreme responses, sometimes auditory hallucinations.

**Question 150.**

Which one of the following is the most suitable medium for culture of Drosophila melanogaster?

[4 Marks]

(A) Agar agar

**(B) Ripe banana**

(C) Cow dung

(D) Moist bread

**Explanation:**

The most suitable culture medium for Drosophila melanogaster is ripe banana.
Drosophila melanogaster is commonly called as fruitfly and is often used in genetic and developmental biology researches. Moist bread is a culture medium for the fungus Rhizopus while Agar-agar is used as a tissue culture medium.
Notes:
Ripe banana contains all essential nutrients such as carbohydrates, minerals and vitamins that are required for the growth of Drosophila melanogaster.

**Question 151.**

In maize, hybrid vigour is exploited by

[4 Marks]

**(A) crossing of two inbred parental lines**

(B) crossing between two unrelated reproductive plants

(C) inducing mutations

(D) bombarding the seeds with DNA

**Explanation:**

Hybrid vigour is also called Heterosis which is measured in terms of size, growth rate, yield and number of other characters. Hybridisation increases vigour and fertility. It is exploited by crossing of two inbred parental lines. It is best maintained in vegetatively reproducing crops because of genetic recombinations.

**Question 152.**

Crop plants grown in monoculture are

[4 Marks]

(A) low in yield

**(B) highly prone to pests**

(C) characterised by poor root system

(D) free from interspecific competition

**Explanation:**

Crop plants grown in monoculture are highly prone to pests.

**Question 153.**

Triticale, the first man-made cereal crop, has been obtained by crossing wheat with

[4 Marks]

(A) sugarcane

(B) pearl millet

(C) barley

**(D) rye**

**Explanation:**

Triticale is the 1st man-made cereal which is made by the crossing of wheat (Triticum aestivum) and rye (Secale cereale).

**Question 154.**

Curing of tea leaves is brought about by the activity of

[4 Marks]

(A) viruses

(B) mycorrhiza

(C) fungi

**(D) bacteria**

**Explanation:**

For curing of tea, a bacteria Micrococcus candidans is used. Curing of tea leaves is brought about by the activity of bacteria. It is essentially an oxidation, dry fermentation process, during which water is driven off, the green colour is lost and the leaves assume a tougher texture and undergo chemical changes.
Mycorrhiza is a mutually beneficial association between fungi and the roots of higher plants. Virus and fungi are not involved in the curing process of tea leaves.

**Question 155.**

Parthenocarpic tomato fruits can be produced by

[4 Marks]

(A) raising the plants from vernalized seeds

**(B) treating the plants with low concentrations of gibberellic acid and auxins**

(C) removing androecium of flowers before pollen grains are released

(D) treating the plants with phenylmercuric acetate

**Explanation:**

Gibberellins and Auxins are known to induce parthenocarpy in plants. If a tomato plant is treated with a low concentration of auxin and gibberellic acid it'll produce fruits without fertilization i.e.

parthenocarpic fruits.
Notes:
Vernalized seeds are treated at low temperature for breaking dormancy. Phenyl Mercuric Acetate is an antitranspirant.

**Question 156.**

In order to obtain virus-free plants through tissue culture the best method is

[4 Marks]

(A) Embryo rescue

(B) Anther culture

(C) Protoplast culture

**(D) Meristem culture**

**Explanation:**

Meristem culture is done for the development of virus-free plants. Meristematic tissue cell can be taken either from shoot or root tip.
Notes:
Meristem culture was developed by Morel and Martin in 1952 for virus elimination from Dahlia. Orchid Cymbidium was micropropagated using meristem culture by Morel in 1965.

**Question 157.**

Two microbes found to be very useful in genetic engineering are

[4 Marks]

(A) Vibrio cholerae and a tailed bacteriophage

(B) Crown gall bacterium and Caenorhabditis elegans

**(C) Escherichia coli and Agrobacterium tumefaciens**

(D) Diplococcus sp. and Pseudomonas sp.

**Explanation:**

Escherichia coli is a bacterium found in human colon. On this bacterium scientists have made extensive genetic experiments to make some valuable products like insulin. Another bacterium is Agrobacterium tumefaciens which causes crown gall in plants and is extensively used for genetic experiments.

**Question 158.**

Golden rice is a transgenic crop of the future with the following improved trait:

[4 Marks]

(A) high lysine (essential amino acid) content

(B) high protein content

**(C) high vitamin-A content**

(D) insect resistance

**Explanation:**

Golden rice is a transgenic crop of the future with high Vit. A content. Millions of people suffer from Vit. A deficiency which leads to vision impairment.

**Question 159.**

People living at sea level have around 5 million RBC per cubic mm of blood whereas those living at an altitude of 5400 metres have around 8 million. This is because at high altitude

[4 Marks]

(A) there is more UV radiation which enhances RBC production

**(B) atmospheric $O_2$ level is less and hence more RBCs are needed to absorb the required amount of $O_2$ to survive**

(C) people eat more nutritive food, therefore more RBCs are formed

(D) people get pollution-free air to breathe and more oxygen is available

**Explanation:**

At an altitude of 5400 metres the low atmospheric pressure of $O_2$ will be very low, so the solubility of oxygen in the blood will be very less; hence oxygen carried by each RBC will be low. To fulfil the oxygen requirement of the body, blood has to carry more oxygen to the body tissue and this is done by the increased number of RBCs.

**Question 160.**

Niche overlap indicates

[4 Marks]

(A) two different parasites on the same host

**(B) sharing of one or more resources between the two species**

(C) mutualism between two species

(D) active cooperation between two species

**Explanation:**

Niche indicate the habitat of a particular species and the interaction of that species with the resources present in the habitat. Niche overlap means that two or more species share the resources present in a particular niche.

**Question 161.**

The formula for exponential population growth is

[4 Marks]

**(A) dN/dt = rN**

(B) dt/dN = rN

(C) rN/dN = dt

(D) dN/rN = dt

**Explanation:**

The formula of exponential growth is dN/dt = rN where dN/dt is the rate of change in population size, r is the biotic potential and N is the population size.

**Question 162.**

Praying mantis is a good example of

[4 Marks]

(A) warning colouration

(B) social insects

**(C) camouflage**

(D) Mullerian mimicry

**Explanation:**

Praying mantis is a good example of camouflage. Camouflage is the natural colouring of an animal which enables it to blend in with its surroundings.

Notes:
A praying mantis, or praying mantid, is the common name for an insect of the order Mantodea. Often mistakenly spelled praying mantis (a tempting mistake, as they are notoriously predatory), they are in fact named for the typical "prayer-like" stance. The word mantis derives from the Greek word mantis for prophet or fortune teller.

**Question 163.**

The amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis is called:

[4 Marks]

(A) Net primary production

(B) Secondary production

(C) Gross primary production

**(D) Primary production**

**Explanation:**

Primary production is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. It is expressed in terms of weight (g $m^{-2}$) or energy (kcal $m^{-2}$). The rate of biomass production is called productivity. It is expressed in terms of g $m^{-2}$ $yr^{-1}$ (or kcal $m^{-2}$ $yr^{-1}$) to compare the productivity of different ecosystems. It can be divided into Gross Primary Productivity (GPP) and Net Primary Productivity (NPP). Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis. A considerable amount of GPP is utilised by plants in respiration. Gross primary productivity minus respiration losses (R), is the occurrence of vertical productivity (NPP).

**Question 164.**

Vertical distribution of different species occupying different levels in a biotic community is known as:

[4 Marks]

**(A) Stratification**

(B) Zonation

(C) Divergence

(D) Pyramid

**Explanation:**

Stratification is the occurrence of vertical zonation in an ecosystem and indicates the presence of favorable environmental conditions, for e.g., trees occupy top vertical strata or layer of a forest, shrub the second.

**Question 165.**

The greatest biomass of autotrophs in the oceans is that of

[4 Marks]

(A) sea grasses and slime moulds

**(B) free floating microalgae, cyanobacteria and nanoplankton**

(C) benthic brown algae, coastal red algae and aphids

(D) benthic diatoms and marine viruses

**Explanation:**

The greatest biomass of autotrophs in the oceans is that of free floating microalgae, cyanobacteria and nanoplankton.

**Question 166.**

Which one of the following is not a function of an ecosystem?

[4 Marks]

(A) Energy flow

(B) Decomposition

**(C) Stratification**

(D) Productivity

**Explanation:**

Four important functional aspects of the ecosystem are:
(i) Productivity
(ii) Decomposition
(iii) Energy flow
(iv) Nutrient cycling

**Question 167.**

Which one of the following is not used for construction of ecological pyramids?

[4 Marks]

(A) Number of individuals

(B) Rate of energy flow

**(C) Fresh weight**

(D) Dry weight

**Explanation:**

Fresh weight is not used for the construction of ecological pyramids because the total fresh weight does not change into energy. Hence we can say that fresh weight is not continuous in the trophic levels.

**Question 168.**

Which one of the following is the correct matched pair of an endangered animal and National Park?

[4 Marks]

| | | | |
|---|---|---|---|
| (a) | Rhinoceros | - | Kaziranga National Park |
| (b) | Wild ass | - | Dudhwa National Park |
| (c) | Great Indian bustard | - | Keoladeo National Park |
| (d) | Lion Park | - | Corbett National |

**(A) a**

(B) b

(C) c

(D) d

**Explanation:**

Kaziranga National Park in Assam is famous as a protection environmental park for rhinoceros.

**Question 169.**

Which of the following pairs of an animal and a plant represents endangered organisms in India?

[4 Marks]

(A) Cinchona and leopard

(B) Banyan and black buck

(C) Tamarind and Rhesus monkey

**(D) Bentinckia nicobarica and Red Panda**

**Explanation:**

Endangered plant is Benthamidia nicobarica and endangered animal is Red Panda (Ailurus fulgens).

**Question 170.**

Which one of the following is not included under in-situ conservation?

[4 Marks]

**(A) Botanical garden**

(B) Biosphere reserve

(C) National park

(D) Sanctuary

**Explanation:**

In-situ means keeping endangered species of animals or plants into natural environment and not in the environment that looks like natural but man made, like zoological & botanical gardens. In-situ includes, national parks, sanctuaries and biosphere reserve.

**Question 171.**

Which of the following is considered a hotspot of biodiversity in India?

[4 Marks]

(A) Indo-Gangetic Plain

(B) Eastern Ghats

**(C) Western Ghats**

(D) Aravalli Hills

**Explanation:**

Hotspots are those areas which were rich in biodiversity but now under threat due to direct or indirect interference of human activities. These regions are on the edge to get some of their species extinct due to humans. Western Ghats in India are under threat due to continuous developmental activities and Doon valley is under threat due to continuous mining activities.

**Question 172.**

Photochemical smog pollution does not contain

[4 Marks]

(A) Nitrogen dioxide

**(B) Carbon dioxide**

(C) PAN (peroxy acetyl nitrate)

(D) Ozone

**Explanation:**

Photochemical smog is made by the deposition of dust and carbon particles on the pollutant gases and water vapours. The gases found in photochemical smog are $NO_2$, PAN, $O_3$ etc.

**Question 173.**

Limit of BOD prescribed by Central Pollution Control Board for the discharge of industrial and municipal waste waters into natural surface waters, is

[4 Marks]

(A) < 10 ppm

(B) < 100 ppm

**(C) < 30 ppm**

(D) < 3.0 ppm

**Explanation:**

Biochemical Oxygen Demand (BOD) is the amount of oxygen required to destroy the organic waste by the bacteria. The more oxygen required for bacteria that means there is more organic waste. The limiting value that is acceptable for BOD is less than 30 ppm (mg/d).

**Question 174.**

During osmosis, flow of water through a semipermeable membrane is

[4 Marks]

(A) from both sides of semipermeable membrane with equal flow rates

**(B) from both sides of semipermeable membrane with unequal flow rates**

(C) from solution having lower concentration only

(D) from solution having higher concentration only

**Explanation:**

During osmosis, water flows through semipermeable membrane from both sides but the net flow is from solution having lower concentration to higher concentration.

**Question 175.**

A solution containing g 10 g $dm^{-3}$ of urea (molecular mass = 60g $mol^{-1}$) is isotonic with a 5% solution of a non-volatile solute. The molecular mass of this non-volatile solute is

[4 Marks]

(A) 200 g $mol^{-1}$

(B) 250 g $mol^{-1}$

(C) 350 g $mol^{-1}$

**(D) 300 g $mol^{-1}$**

**Explanation:**

Osmotic pressure = $\pi = cRT \Rightarrow \pi = nRT / V$

5% solution means
100 ml = 5 g
1000 ml = 50 g / L
For isotonic solution, $\pi_1 = \pi_2$
$(10 / 60) \times 0.0821 \times T = (50 / M) \times 0.0821 \times T$
[V = 1 $dm^3$ = 1 litre]
M = 300 g $mol^{-1}$

**Question 176.**

1.00 g of a non-electrolyte (molar mass = 250 g $mol^{-1}$) was dissolved in 51.2 g of benzene. If freezing point depression constant, $K_f$ of benzene is 5.12 K kg $mol^{-1}$, the freezing point of benzene will be lowered by

[4 Marks]

(A) 0.2 K

**(B) 0.4 K**

(C) 0.5 K

(D) 0.3 K

**Explanation:**

$\Delta T = K_f m = 5.12 \times 1 / 250 \times 1000 / 51.2 = 0.4$ K

**Question 177.**

If $E°_{Fe^{2+} / Fe} = -0.441$ V and $E°_{Fe^{3+} / Fe^{2+}} = +0.771$ V, the standard EMF of the reaction $Fe + 2Fe^{3+} \rightarrow 3Fe^{2+}$ will be

[4 Marks]

(A) 1.653 V

**(B) 1.212 V**

(C) 0.111 V

(D) 0.330 V

**Explanation:**

$Fe \rightarrow Fe^{2+} + 2e^-$ [Anode], E = −0.441 V

$[Fe^{3+} + e^- \rightarrow Fe^{2+}] \times 2$ [Cathode]: E = +0.771 V

_____

$Fe + 2Fe^{3+} \rightarrow 3Fe2+$ (overall)

$E°_{cell} = E°_{cathode} - E°_{anode}$

= 0.771 − (−0.441) = 0.771 + 0.441 = 1.212 V

**Question 178.**

A hypothetical electrochemical cell is shown below

$A | A^+ (xM) || B^+ (yM) | B$
The emf measured is +0.20 V. The cell reaction is

[4 Marks]

**(A) $A + B^+ \rightarrow A^+ + B$**

(B) $A^+ + B \rightarrow A + B^+$

(C) $A^+ + e^- \rightarrow A$; $B^+ + e^- \rightarrow B$

(D) The cell reaction cannot be predicted

**Explanation:**

The cell reaction is as follows:
$A \rightarrow A^+ + e^-$
$B^+ + e^- \rightarrow B$

_____
Adding $A + B^+ \rightarrow A^+ B$

**Question 179.**

For the reaction $2A + B \rightarrow 3C + D$

which of the following does not express the reaction rate?

[4 Marks]

(A) $-d[B] / dt$

(B) $d[D] / dt$

(C) $(-1 / 2) (d[A] / dt)$

**(D) $(-1 / 3) (d[C] / dt)$**

**Explanation:**

In the given options, $-d[C] / 3dt$ will not represent the reaction rate. It should not have −ve sign as it is product, since $(1 / 3)(d[C] / dt)$ show the rate of formation of product C, whose value should be positive.

**Question 180.**

Consider the reaction
$N_2$ (g) + $3H_2$ (g) → $2NH_3$ (g)
The equality relationship between $d[NH_3] / dt$ and $(- d[H_2] / dt)$ is

[4 Marks]

(A) $+d[NH_3]/dt = (-3 / 2)(d[H_2] / dt)$

**(B) $+ d[NH_3] / dt = (-2 / 3) (d[H_2] / dt)$**

(C) $d[NH_3] / dt = (-d[H_2] / dt)$

(D) $d[NH_3] / dt = (-1 / 3) (d[H_2] / dt)$

**Explanation:**

If we write rate of reaction in terms of concentration of $NH_3$ and $H_2$, then
Rate of reaction = $(1 / 2) (d[NH_3] / dt) = (-1 / 3) (d[H_2] / dt)$
So,
$d[NH_3] / dt = (-2 / 3) d[H_2] / dt$

**Question 181.**

For adsorption of a gas on a solid, the plot of log(x / m) vs log p is linear with slope equal to (n being whole number)

[4 Marks]

(A) k

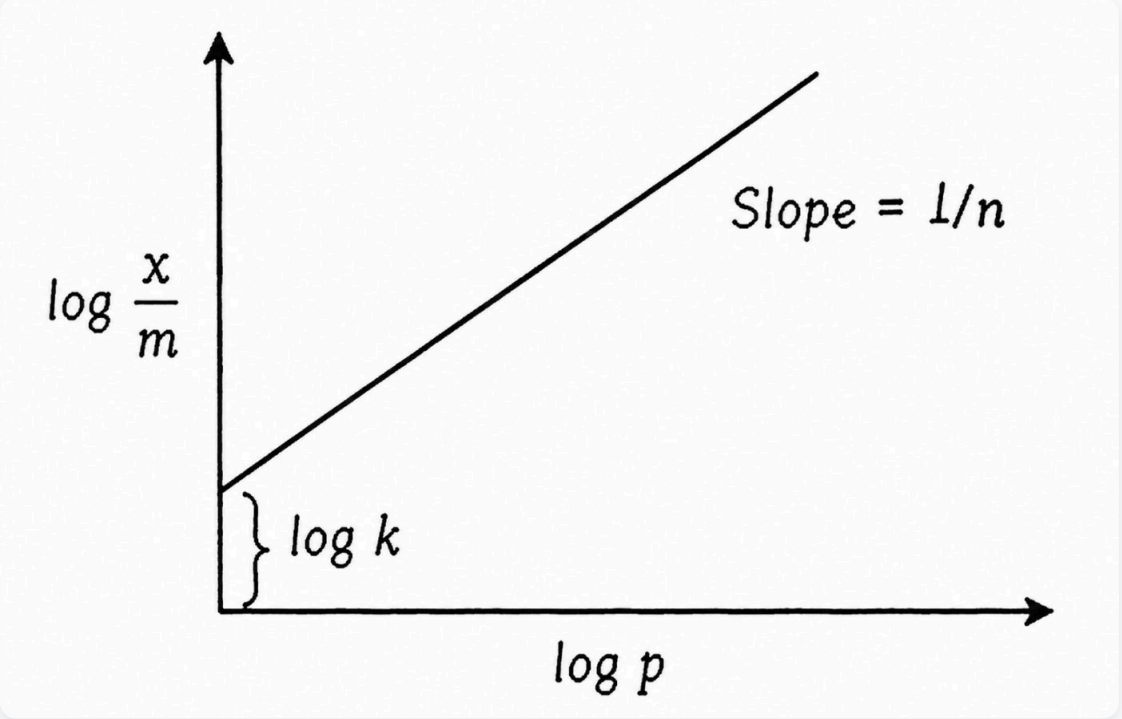
(B) log k

(C) n

**(D) 1 / n**

**Explanation:**

According to Freundlich adsorption isotherm.
At intermediate pressure, extent of adsorption
$x / m = kp^{1/n}$ or $\log (x / m) = \log k + (1 / n) \log p$;
Plot of log(x / m) vs log p is linear with slope = 1 / n.




**Question 182.**

Which of the following is the most basic oxide?

[4 Marks]

(A) $Sb_2O_3$

**(B) $Bi_2O_3$**

(C) $SeO_2$

(D) $Al_2O_3$

**Explanation:**

More the oxidation state of the central atom (metal), more is its acidity. Hence, $SeO_2$ (O.S. of Se = +4) is acidic. Further for a given O.S., the basic character of the oxides increases with the increasing size of the central atom. Thus $Al_2O_3$ and $Sb_2O_3$ are amphoteric and $Bi_2O_3$ is basic.

**Question 183.**

In which of the following pairs are both the ions coloured in aqueous solutions?

(At. no.: Sc = 21, Ti = 22, Ni = 28, Cu = 29, Co = 27)

[4 Marks]

**(A) $Ni^{2+}$, $Ti^{3+}$**

(B) $Sc^{3+}$, $Co^{2+}$

(C) $Ni^{2+}$, $Cu^{+}$

(D) $Sc^{3+}$, $Ti^{3+}$

**Explanation:**

**$Sc^{3+}$ :** $1s^2$, $2s^2p^6$, $3s^2p^6d^0$, $4s^0$; no unpaired electron

**$Cu^{+}$ :** $1s^2$, $2s^2p^6$, $3s^2p^6d^{10}$,$4s^0$; no unpaired electron

**$Ni^{2+}$ :** $1s^2$, $2s^2p^6$, $3s^2p^6d^8$, $4s^0$; 2 unpaired electrons present

**$Ti^{3+}$ :** $1s^2$, $2s^2p^6$, $2s^2p^6d^1$, $4s^0$; 1 unpaired electron present

**$Co^{2+}$ :** $1s^2$, $2s^2p^6$, $3s^2p^6d^7$, $4s^0$; 3 unpaired electrons present

So, from the given option, the only correct combination is $Ni^{2+}$ and $Ti^{3+}$.

**Question 184.**

Copper sulphate dissolves in excess of KCN to give

[4 Marks]

(A) $Cu(CN)_2$

(B) CuCN

(C) $[Cu(CN)_4]^{2-}$

**(D) $[Cu(CN)_4]^{3-}$**

**Explanation:**

Copper sulphate on treatment with excess of KCN forms complex $K_3[Cu(CN)_4]$ or $[Cu(CN)_4]^{3-}$

$CuSO_4 + 2KCN \rightarrow Cu(CN)_2 + K_2SO_4$

$2Cu(CN)_2 \rightarrow Cu_2(CN)_2 + (CN)_2$

$Cu_2(CN)_2 + 3KCN \rightarrow K_3[Cu(CN)_4] + CuCN$

**Question 185.**

The main reason for larger number of oxidation states exhibited by the actinoids than the corresponding lanthanoids, is

[4 Marks]

(A) greater reactive nature of the actinoids than the lanthanoids.

(B) larger atomic size of actinoids than the lanthanoids.

(C) more energy difference between 5f and 6d orbitals than between 4f and 5d orbitals.

**(D) lesser energy difference between 5f and 6d orbitals than between 4f and 5d orbitals.**

**Explanation:**

Lesser energy difference between 5f and 6d orbitals than between 4f and 5d orbitals result in larger no. of oxidation state.

**Question 186.**

$[Co(NH_3)_4(NO_2)_2]$ Cl exhibits

[4 Marks]

(A) ionization isomerism, geometrical isomerism and optical isomerism

**(B) linkage isomerism, ionization isomerism and geometrical isomerism**

(C) linkage isomerism, geometrical isomerism and optical isomerism

(D) linkage isomerism, ionization isomerism and optical isomerism

**Explanation:**

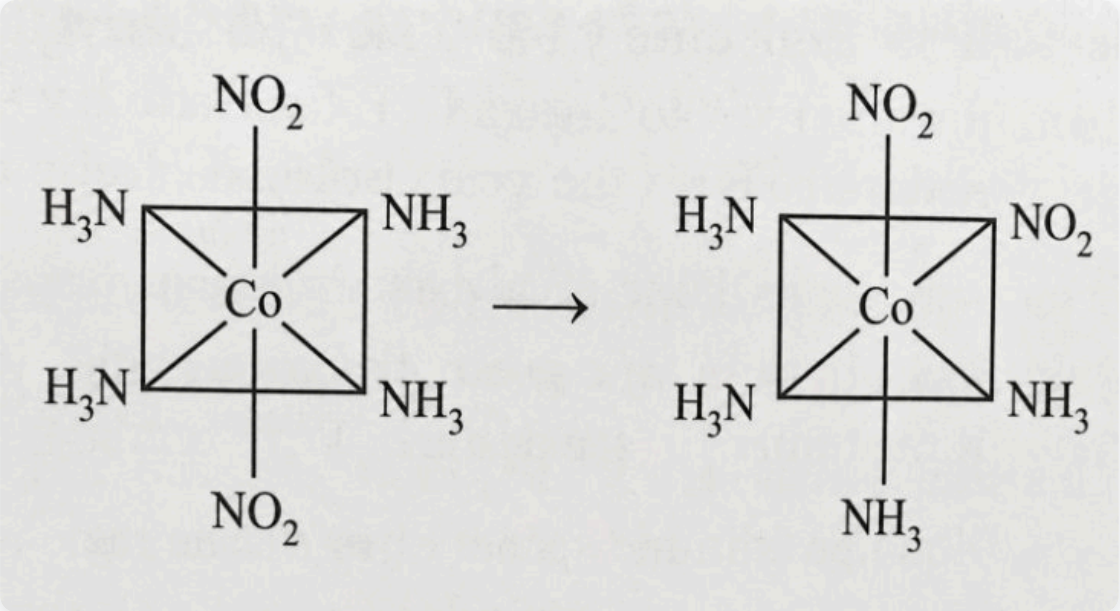
The given compound may have linkage isomerism due to presence of $NO_2$ group which may be in the form $–NO_2$ or –ONO. It may have ionisation isomerism due to presence of two ionisable group $–NO_2$ & –Cl. It may have geometrical isomerism in the form of cis-trans form as follows:

$[Co(NH_3)_4Cl(NO_2)]NO_2$ &

$[Co(NH_3)_4(NO_2)_2]Cl$ – ionisation isomers.

$[Co(NH_3)_4(NO_2)_2]Cl$ $[Co(NH_3)_4(ONO)_2]Cl$

– Linkage isomers.




**Question 187.**

$[Cr(H_2O)_6]Cl_3$ (at no. of Cr = 24) has a magnetic moment of 3.83 B.M. The correct distribution of 3d electrons in the chromium of the complex is

[4 Marks]

(A) $3d_{xy}^1, 3d_{yz}^1, 3d_{z^1z^2}$

(B) $(3d_{x^2-y^2})^1, 3d_{z^2}, 3d_{xz}^1$

(C) $3d_{xy}^1, (3d_{x^2-y^2})^1, 3d_{yz}^1$

**(D) $3d_{xy}^1, 3d_{yz}^1, 3d_{xz}^1$**

**Explanation:**

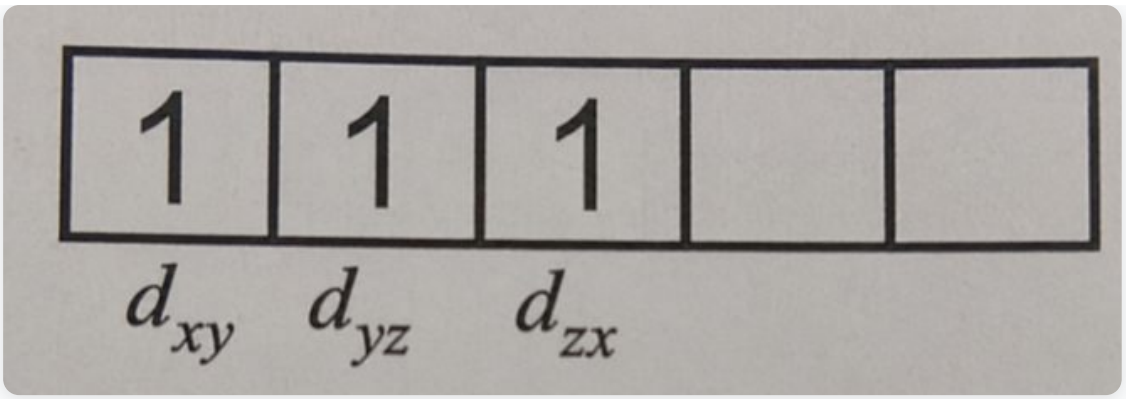
$\mu = \sqrt{(n(n + 2))}$

$3.83 = \sqrt{(n(n + 2))}$, on solving n = 3

As per magnetic moment, it has three unpaired electron.

$Cr^{3+}$ will have configuration as = $[Ar]3d^3$

So, $3d_{xy}^1\ 3d_{yz}^1\ 3d_{xz}^1$




**Question 188.**

Which of the following is not chiral ?

[4 Marks]

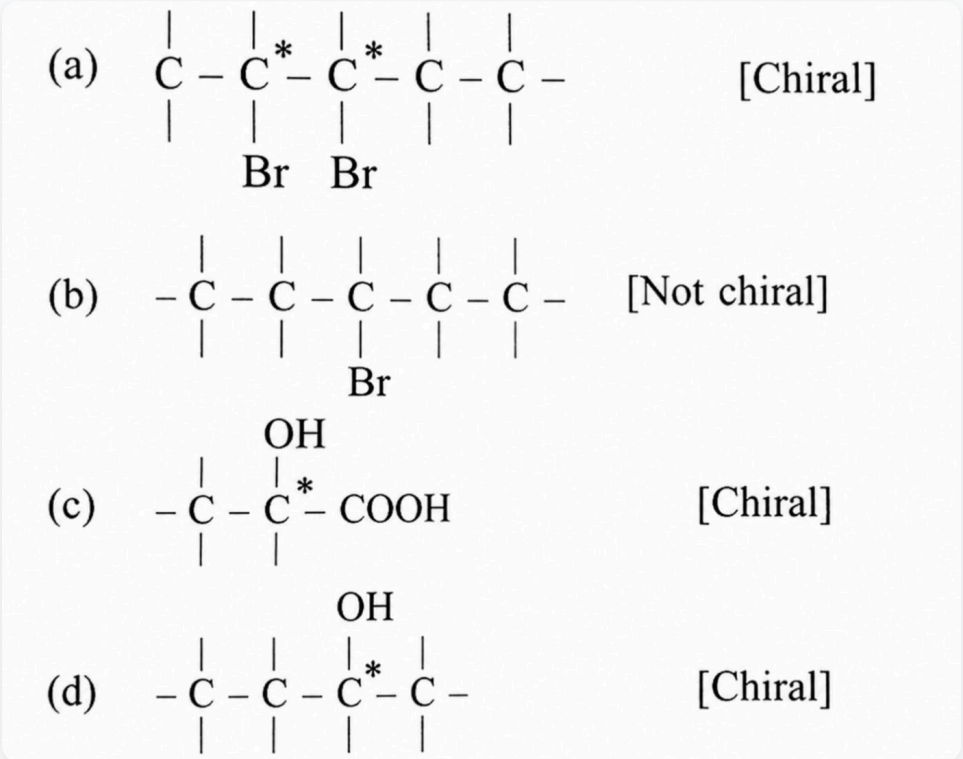
(A) 2, 3-Dibromopentane

(B) 2-Hydroxypropanoic acid

**(C) 3-Bromopentane**

(D) 2-Butanol

**Explanation:**




**Question 189.**

Ethylene oxide when treated with Grignard reagent yields

[4 Marks]

**(A) Primary alcohol**

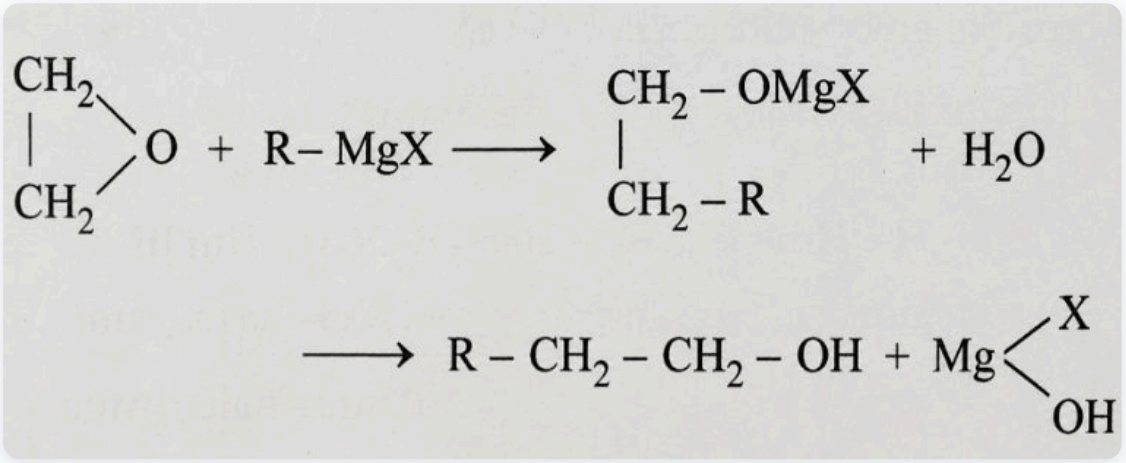
(B) Cyclopropyl alcohol

(C) Secondary alcohol

(D) Tertiary alcohol

**Explanation:**

Ethylene oxide when treated with Grignard reagent gives primary alcohol.



**Question 190.**

The major organic product in the reaction,

$CH_3—O—CH(CH_3)_2 + HI \rightarrow$ Product is

[4 Marks]

(A)

$ICH_2OCH(CH_3)_2$

**(B)**

$CH_3I + (CH_3)_2CHOH$

(C)

$CH_3OC(CH_3)_2$ with I below

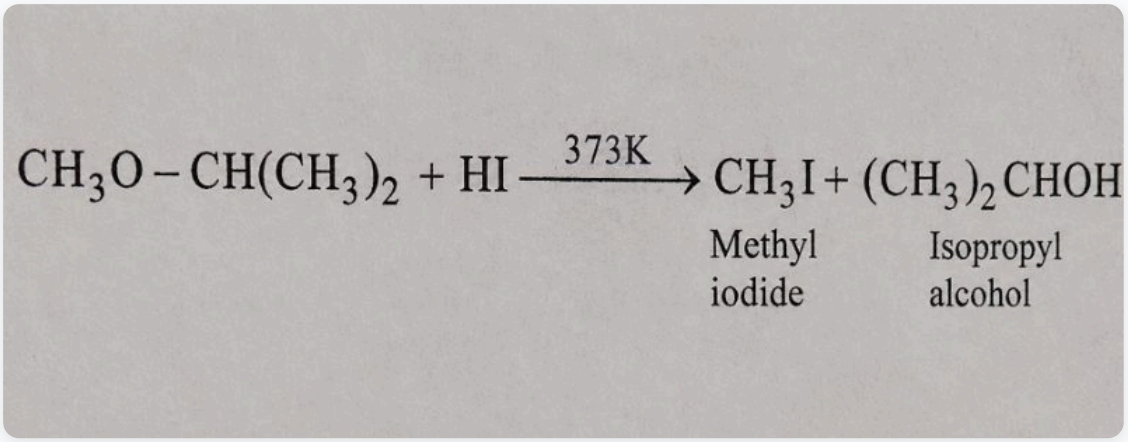
(D)

$CH_3OH + (CH_3)_2CHI$

**Explanation:**

In case of unsymmetrical ethers, the site of cleavage depends on the nature of alkyl group e.g.,

The alkyl halide is always formed from the smaller alkyl group.




**Question 191.**

A carbonyl compound reacts with hydrogen cyanide to form cyanohydrin which on hydrolysis forms a racemic mixture of α-hydroxy acid. The carbonyl compound is

[4 Marks]

**(A) Acetaldehyde**

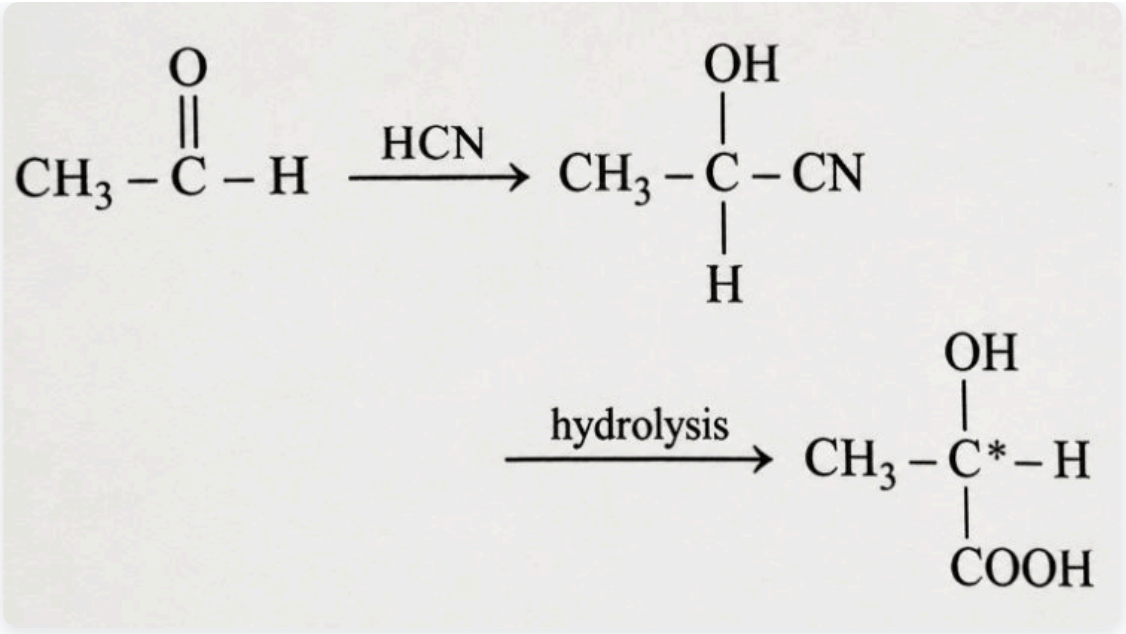
(B) Acetone

(C) Diethyl ketone

(D) Formaldehyde

**Explanation:**

Out of given compound only acetaldehyde can form optical active hydroxy acid as it contains one asymmetric carbon atom as marked below :




**Question 192.**

Nucleophilic addition reaction will be most favoured in

[4 Marks]

(A)

$CH_3CH_2CHO$

(B)

$(CH_3)_2C = O$

**(C)**

$CH_3CHO$

(D)

$CH_3 — CH_2 — CH_2 – \overset{\overset{O}{\|}}{C} — CH_3$

**Explanation:**

Aldehydes are more reactive than ketones due to +I effect of $–CH_3$ group. There are two $–CH_3$ group in acetone which reduces +ve charge density on carbon atom of carbonyl group. More hindered carbonyl group too becomes less reactive. So, in the given case $CH_3CHO$ is the right choice.

**Question 193.**

Self condensation of two moles of ethyl acetate in presence of sodium ethoxide yields

[4 Marks]

**(A) acetoacetic ester**

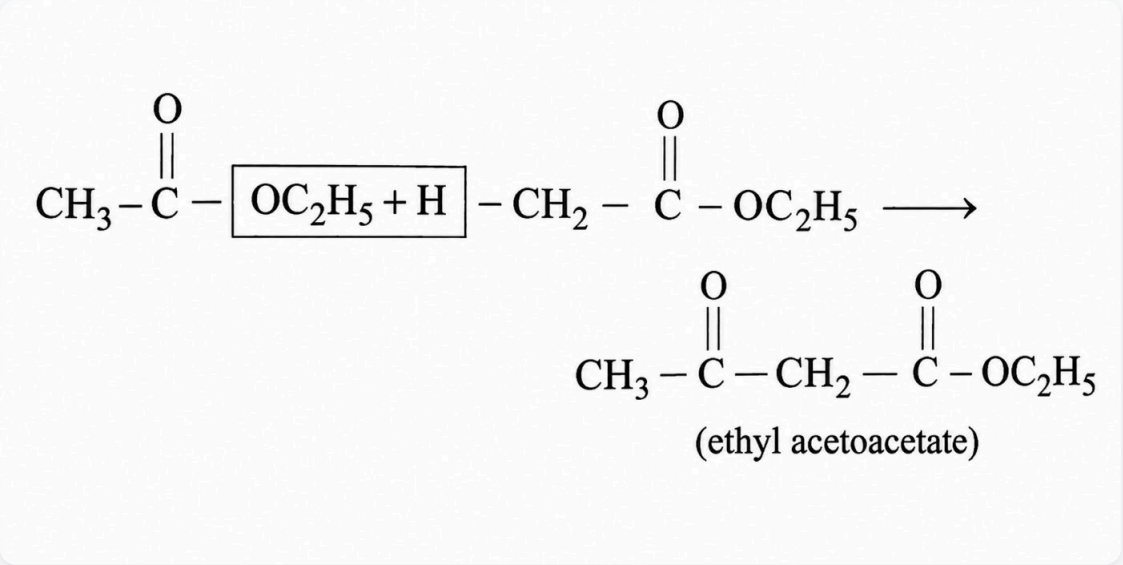
(B) methyl acetoacetate

(C) ethyl propionate

(D) ethyl butyrate

**Explanation:**

It is an example of Claisen condensation. The product is acetoacetic ester.

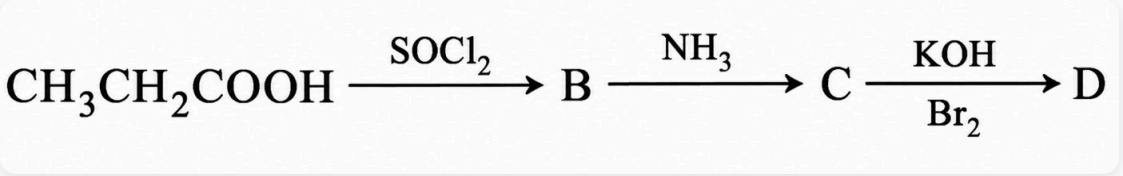



**Question 194.**

In a set of reactions propionic acid yielded a compound D.

The structure of D would b

[4 Marks]



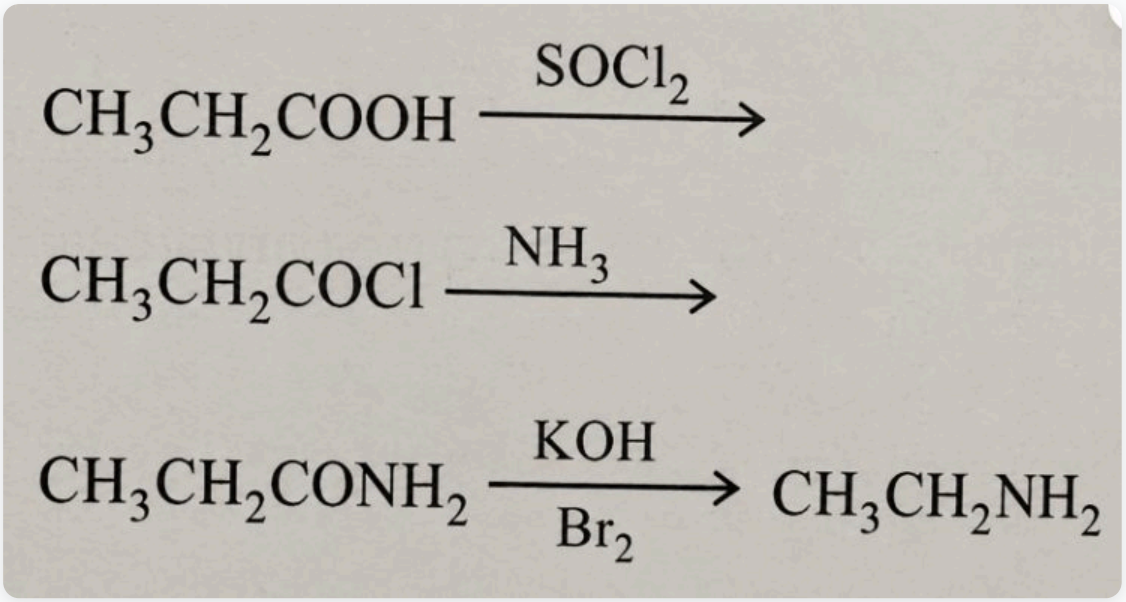

(A) $CH_3CH_2NHCH_3$

**(B) $CH_3CH_2NH_2$**

(C) $CH_3CH_2CONH_2$

(D) $CH_3CH_2CH_2NH_2$

**Explanation:**




**Question 195.**

Which of the following is more basic than aniline?

[4 Marks]

(A) Triphenylamine

(B) p-Nitroaniline

**(C) Benzylamine**

(D) Diphenylamine

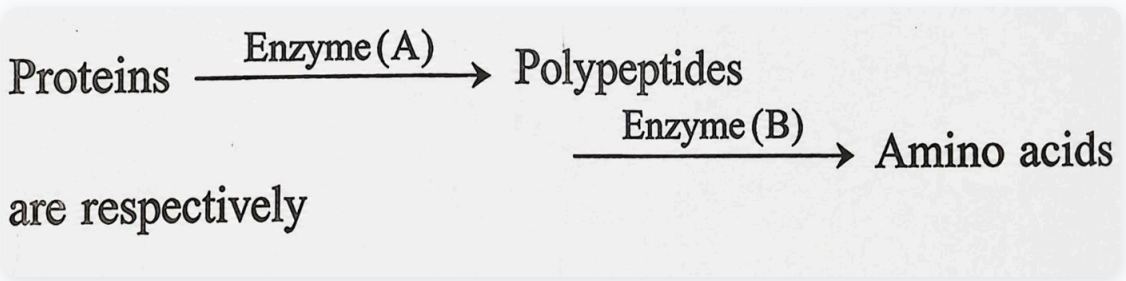
**Explanation:**

Benzylamine is more basic than aniline. The reason is that in aniline, the lone pair of nitrogen is in conjugation with benzene ring so it is not available readily. On the other hand in Benzylamine, nitrogen is not directly attached with ring so lone pair is not in conjugation with ring.

**Question 196.**

During the process of digestion, the proteins present in food materials are hydrolysed to amino acids. The two enzymes involved in the process

[4 Marks]



(A) Invertase and Zymase

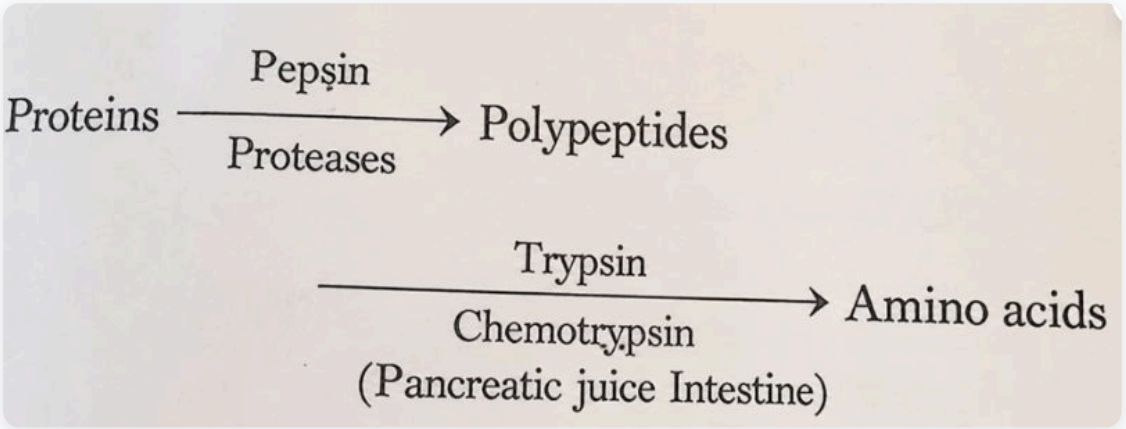
(B) Amylase and Maltase

**(C) Pepsin and Trypsin**

(D) Diastase and Lipase

**Explanation:**

Pepsin and Trypsin are two enzymes involved in the process (hydrolysis of proteins).




**Question 197.**

Which one of the following is a peptide hormone ?

[4 Marks]

**(A) Glucagon**

(B) Adrenaline

(C) Testosterone

(D) Thyroxin

**Explanation:**

Testosterone and Adrenaline are steroid hormone, Thyroxin is a non-steroid hormone and glucagon is a peptide hormone.

**Question 198.**

The human body does not produce

[4 Marks]

(A) DNA

(B) Enzymes

(C) Hormones

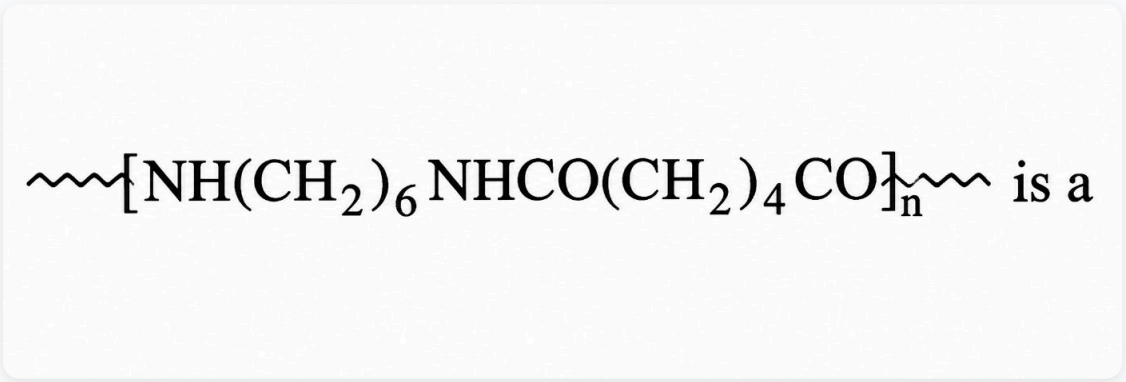
**(D) Vitamins**

**Explanation:**

Vitamins are organic substances which does not provide energy but are essential for healthy growth and proper functioning of body. Synthetically vitamins are not synthesized inside human body but they are essential part of our diet.

**Question 199.**

[4 Marks]




(A) thermosetting polymer

(B) addition polymer

**(C) copolymer**

(D) homopolymer

**Explanation:**

The given compound is a copolymer of hexamethylene diamine and adipic acid. It is actually Nylon-6,6.

**Question 200.**

Antibodies in our body are complex

[4 Marks]

**(A) glycoproteins**

(B) lipoproteins

(C) prostaglandins

(D) steroids

**Explanation:**

Whenever our body gets attacked by some foreign invadors, our body's immune system produces some chemicals to kill or to react against the invader. These chemicals are actually made up of carbohydrates and proteins i.e. glycoproteins called antibody