Ravi Maths Tuition Centre

Time : 180 Mins **T12 1** **Marks : 737**

1. (A) If a body is taken from earth to moon, its gravitational mass becomes one-sixth on moon.
   (R) Gravitational mass depends upon acceleration due to gravity.
   a)
   If both assertion and reason are true and reason is the correct explanation of assertion.
   b)
   If both assertion and reason are true but reason is not the correct explanation of assertion
   c) If assertion is true but reason is false.
   d) If both assertion and reason are false
   e) If assertion is false but reason is true.

2. A man squatting on the ground gets straight up and stands. The force of reaction of ground on the man during the process is
   a) constant and equal to mg in magnitude.
   b) constant and greater than mg in magnitude.
   c) variable but always greater than mg
   d) at first greater than mg, and later becomes equal to mg.
   Solution : -
   In the process of getting straight up and standing from squatting position, the man exerts a variable force (F) on the ground to set his body in motion. This force is in addition to the force required to support his weight (mg). Once the man is in standing position, F becomes zero.

3. A particle is executing a simple of harmonic motion amplitude a. Its potential energy is maximum when the displacement from the position of the maximum kinetic energy is:
   a) 0 **b) +a** c) $\pm a/2$ d) $-a/2$
   Solution : -

P.E. of particle executing S.H.M. $= \frac{1}{2}m\omega^2x^2$

At x = a, P . E . is maximum i.e. $= \frac{1}{2}m\omega^2a^2$

$\text{K.E.} = \frac{1}{2}m\omega^2\left(a^2 - x^2\right)$

At x = 0, K.E. is maximum. Hence, displacement from position of maximum Kinetic energy = +a.

4. Which of the following statements is correct regarding the gravitational force?

a) The gravitational force is dependent on the intervening medium

b) The gravitational force is a non-conservative force

c) The gravitational force forms action-reaction pair

d) The gravitational force is a non-central force

Solution : -

The gravitational force is independent of the intervening medium. In other words, the force between two masses remains the same whether they are in air, vacuum, water or separated by a brick wall.

Hence, (a) is an incorrect statement.

The gravitational force is a conservative force.

Hence, (b) is an incorrect statement.

The gravitational force obeys Newton's third law of motion. Thus, it form action-reaction pair.

Hence, (c) is a correct statement.

The gravitational force is a central force. Hence, (d) is an incorrect statement.

5. A block of mass m is attached to a spring of spring constant k is free to oscillate with angular velocity ω in a horizontal plane without friction or clamping. It is pulled to a distance X_o and pushed towards the centre with a velocity v_0 at time t = O.The amplitude of oscillations in terms of ω , X_o and v_0 is:

a) $\sqrt{\frac{v_0^2}{\omega^2} - x_0^2}$ b) $\sqrt{\omega^2v_0^2 + x_0^2}$ c) $\sqrt{\frac{x_0^2}{\omega^2} - v_0^2}$ **d)** $\sqrt{\frac{v_0^2}{\omega^2} - x_0^2}$

Solution : -

Let the displacement of the block at instant of time t be, $x = A\cos\left(\omega t + \phi\right)$

At t = 0, x = X_o

$\therefore x_0 = A\cos\phi$... (i)

Velocity, $v = \frac{dx}{dt} - A\omega\sin\left(\omega t + \phi\right)$

At t = 0, v = $-v_0$

$\therefore -v_0 = -A\omega\sin\phi$

or $A\sin\phi = \frac{v_0}{\omega}$ ...(ii)

Squaring and adding (i) and (ii), we get

$A^2\left(sin^2\phi + cos^2\phi\right) = \frac{v_0^2}{\omega^2} + x_0^2$

$A = \sqrt{\frac{v_0^2}{\omega^2} + x_0^2}$

6. The constituents of atomic nuclei are believed to be:
   a) neutrons and protons b) protons only c) electrons and protons
   d) electrons, protons and neutrons

   Solution : -

   According to proton-neutron hypothesis, a nucleus of mass number A and atomic number Z contains Z protons and (A-Z) neutrons.
   Constituents of atomic nucleus are Nucleons i.e., neutron and proton.
7. Two thin lenses of power P_1 and P_2 are placed and a distance d apart.The power of the combination is:
   a) $P_1 + P_2$ b) $P_1 - P_2$ **c) $P_1 + P_2 - dP_1 P_2$** d) $d(P_1 + P_2)-P_1P_2$
8. The SI unit of pressure gradient is
   a) N m^{-2} b) N m c) N m^{-1} **d) N m^{-3}**

   Solution : -

   Pressure gradient = $\frac{Pressure}{Distance}$

   ∵ The SI unit of pressure is N m^{-2} and distance is m.

   ∴ The SI unit of pressure gradient is N m^{-3}.
9. Following sets of three forces act on a body. Whose resultant cannot be zero?
   a) 10,10,10 b) 10,10,20 c) 10,20,23 **d) 10,20,40**

   Solution : -

   Consider triangle of sides a, band c
   If a + b > c, then a >(c - b)
   If b + c > a, then b > (a - c)
   If c + a > b, then c >(b - a)
   As three forces are in equilibrium and are represented as three sides of triangle where each side, so the force is numerically greater (representing a force) than difference of other two forces hence, for equilibrium, each force should be more than or equal to difference of other two. It can be satisfied by options (a), (b) and (c) and not by option (d).
10. Assertion: On reflection from a rigid boundary there takes place a complete reversal of phase.
    Reason: On reflection from a denser medium, both the particle velocity and wave velocity are reversed in sign.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

Solution : -
Reflection from a rigid boundary is a case of reflection from a denser medium. In that case the particle velocity and wave velocity are reversed in sign.

11. The ideal gas equation for an adiabatic process is
a) PV^{γ} = constant b) $TV^{\gamma+1}$ = constant c) $P^{(\gamma-1)}T$= constant
d) $P^{\gamma+1}T$= constant

12. A force of 2 kg is applied at one end of a spring balance kept horizontally and an equal force of 2 kg is applied at the other end in the opposite direction, simultaneously. Then the reading on the spring balance is:
a) 2 kgf b) 4 kgf c) 0 kgt d) 1 kgt

Solution : -
Reading of spring balance = tension
Tension, $T = \frac{2m_1m_2g}{m1+m_2} = \frac{2\times2\times2\times9.8}{2+2}$
= 19.6 N = $\frac{19.6}{9.8}$kgf = 2kgf

13. A conducting circular loop of radius r carries a constant current i. It is placed in a uniform magnetic field B, such that B is perpendicular to the plane of the loop. The magnetic force acting on the loop is
a) irB b) 2πriB **c) zero** d) πrib

14. Assertion: No real body is truly rigid
Reason : A rigid body is a body with a perfectly definite and unchanging shape. The distances between different pairs of particles of such a body do not change.
a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

Solution : -

It is evident from the second statement that no real body is truly rigid, since real bodies deform under the influence of forces. But in many situations the deformations are negligible.

15. The focal length of objective lens is increased then magnifying power of

a) Microscope will increase but that of telescope decreases

b) Microscope and telescope both will increase

c) Microscope and telescope both will decrease

d) Microscope will decrease but that of telescope will increase

16. A thin glass prism (μ = 1.5) is immersed in water (μ = 1.3). if the angle of deviation in air for a particular ray be D, then in water will be

a) 0.2 D **b) 0.3 D** c) 0.5 D d) 0.6 D

17. A vessel of water is placed on the floor of an elevator. How does the pressure at the bottom of the vessel change if the elevator moves up with uniform acceleration a?

a) Increases by hpa b) Decreases by hpa c) No change in pressure

d) None of these

Solution : -

Considering the upward motion of a column of liquid of depth h,

PA - P_oA - Ahpg = Ahpa

$\therefore$ P = Po + hp(g + a)

When the elevator is at rest,

PR = P_o+ hpg

$\therefore \triangle P$ = P - P_R = hpa

Thus, the pressure at the bottom increases.

18. The photoelectric cut off voltage in a certain experiment is I.5 V. The maximum kinetic energy of photoelectrons emitted is

a) 2.4 eV **b) 1.5 eV** c) 3.1 eV d) 4.5 eV

Solution : -

Here, Vo = 1.5 V,

Maximum kinetic energy = eV_0 = 1.5 eV

19. Two discs of moments of inertia I_1 and I_2 about their respective axes, rotating with angular frequencies ω_1 and ω_2 respectively, are brought into contact face to face with their axes of rotation coincident. The angular frequency of the

composite disc will be :

a) $\frac{I_1\omega_1+I_2\omega_2}{I_1+I_2}$ b) $\frac{I_2\omega_1+I_1\omega_2}{I_1+I_2}$ c) $\frac{I_1\omega_1-I_2\omega_2}{I_1-I_2}$ d) $\frac{I_2\omega_1-I_1\omega_2}{I_1-I_2}$

Solution : -

Total initial angular momentum of the two discs is

$L_i = I_1\omega_1 + I_2\omega_2$

When two discs are brought into contact face to face (one on top of the other) and their axes of rotation coincide, the moment of inertia I of the system is equal to the sum of their individual moments of inertia i.e., $I = I_1 + I_2$

Let ω be the final angular speed of the system

The final angular momentum of the system is

$L_f = I\omega = (I_1 + I_2)\omega$

As no external torque acts on the system, therefore according to law of conservation of angular momentum, we get

$L_i = L_f$

$I_1\omega_1 + I_2\omega_2 = (I_1 + I_2)\omega$

$\therefore \omega = \frac{I_1\omega_1+I_2\omega_2}{I_1+I_2}$

20. One gm mole of an ideal gas expands adiabatically from an initial temperature T_I to a final temperature T_F ($T_I > T_F$); then the work done is:

a) $C_v(T_I-T_F)$ b) $C_p(T_I-T_F)$ c) $R(T_I-T_F)$ d) zero

21. A box of mass 50 kg is pulled up on an inclined plane of 12 m long and 2 m high by a constant force of 100 N from rest. It acquires a velocity of2 mls when it reaches the top of the plane. The work done against friction (in joule) is: (g = 10m/s^2)

a) 50 **b) 100** c) 150 d) 200

Solution : -

$\mu = \tan\theta = \frac{1}{6}$

$\cos\theta = \frac{6}{\sqrt{37}}$; $\sin\theta = \frac{1}{\sqrt{37}}$

$a = g(\sin\theta + \mu = \cos\theta)$

$= 10\left[\frac{1}{\sqrt{37}} + \frac{1}{6} \times \frac{1}{\sqrt{37}}\right] = \frac{20}{\sqrt{37}}$

$v^2 = u^2 + 2as$

or $4 - 0 = 2 \times \frac{20}{\sqrt{37}} \times S$

or $s = \frac{4\sqrt{37}}{40} = \frac{\sqrt{37}}{10}$

$W = FS = mas$

$= 50 \times \frac{20}{\sqrt{37}} \times \frac{\sqrt{37}}{10} = 100$ J

22. A particle in a certain conservative force field has a potential energy given by $V = \frac{20xy}{z}$. The force exerted on it is :

a) $\left(\frac{20y}{z}\right)\hat{i}+\left(\frac{20x}{z}\right)\hat{j}+\left(\frac{20xy}{z^2}\right)\hat{K}$ **b)** $-\left(\frac{20y}{z}\right)\hat{i}-\left(\frac{20x}{z}\right)\hat{j}+\left(\frac{20xy}{z^2}\right)\hat{K}$

c) $-\left(\frac{20y}{z}\right)\hat{i}-\left(\frac{20x}{z}\right)\hat{j}-\left(\frac{20xy}{z^2}\right)\hat{K}$ d) $\left(\frac{20y}{z}\right)\hat{i}+\left(\frac{20x}{z}\right)\hat{j}-\left(\frac{20xy}{z^2}\right)\hat{K}$

Solution : -

Given: V = $\frac{20xy}{z}$

$\vec{F}=-\vec{\nabla}$; Where, $\vec{\nabla}=\hat{i}\frac{\partial}{\partial x}+\hat{j}\frac{\partial}{\partial y}+\hat{K}\frac{\partial}{\partial K}$

$\therefore \hat{F}=-\left[\hat{i}\frac{\partial V}{\partial x}+\hat{j}\frac{\partial V}{\partial y}+\hat{K}\frac{\partial V}{\partial z}\right]$

$=-\left[\hat{i}\frac{\partial}{\partial x}\left(\frac{20xy}{z}\right)+\hat{j}\frac{\partial}{\partial y}\left(\frac{20xy}{z}\right)+\hat{K}\frac{\partial}{\partial K}\left(\frac{20xy}{z}\right)\right]$

$=-\left(\frac{20y}{z}\right)\hat{i}-\left(\frac{20x}{z}\right)\hat{j}+\left(\frac{20xy}{z}\right)\hat{K}$

23. Magnetic intensity for an axial point due to a short bar magnet of magnetic moment M is given by :

a) $(\mu_0/4\pi) \times M/d^3$ b) $(\mu_0/4\pi) \times M/d^2$ **c) $(\mu_0/2\pi) \times M/d^3$** d) $(\mu_0/2\pi) \times M/d^2$

Solution : -

Magnetic intensity for axial point due to short bar magnet will be

Ba =$(\mu_0/4\pi) \times 2M/d^3$

=$(\mu_0/4\pi) \times 2M/d^3$

24. (A) When a particle is thrown obliquely from the surface of the earth, it always moves in a parabolic path, provided the air drag is negligible.

(R) A projectile motion is a three dimensional motion.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

25. The average kinetic energy of a gas molecule at 27^0C is 6.2×10^{-21}J. Its average kinetic energy at 127^0C will be

a) 12.2×10^{-21}J **b) 8.28×10^{-21}J** c) 10.35×10^{-21}J d) 11.35×10^{-21}J

Solution : -

As, KE$\propto$ T$\Rightarrow \frac{E_{127}}{E_{27}}=\frac{(127+273)}{(27+273)}$

$E_{127}=6.21\times10^{-21}\times\frac{400}{300}$

$=8.28\times10^{-21}$J

26. The root mean square velocity of the gas molecules is 300 m/s. What will be the root mean square speed of the molecules if the atomic weight is doubled and absolute temperature is halved?

a) 300 m/s **b) 150 m/s** c) 600 m/s d) 75 m/s

Solution : -

$v_{rms} = \sqrt{\frac{3RT}{M}} 300 = \sqrt{\frac{3RT}{M}}$

and v'rms = $\sqrt{\frac{3R(T/2)}{2m}} = \frac{1}{2} \times 300 = 150 m/s$

27. What is the maximum number of components into which a vector can be split?

a) 2 b) 3 c) 4 **d) Infinite**

Solution : -

A vector can be split into any number of components, i.e, the number of components into which a vector can be split is infinite.

28. A ball of mass 150 g moving with an acceleration 20 m/s^2 is hit by a force, which acts on it for 0.1 s. The impulsive force is _____

a) 0.5N-s b) 0.1N-s **c) 0.3N-s** d) 1.2N-s

Solution : -

Impulse of a force, which is the product of average force during impact and the time for, which the impact lasts is measured by the total change in linear momentum produced during the impact

$Impulse\ I = F_{av} \times \mathrm{t} = \mathbf{p}_2 - \mathbf{p}_1$

$Here, Mass = 150\ \mathrm{g} = \frac{150}{1000}\ \mathrm{kg}$

$\therefore\ F = \frac{150}{1000} \times 20 = 3\ \mathrm{N}$

$\therefore\ I = F.\mathrm{D}t = 3 \times 0.1 = 0.3\ \mathrm{N} - \mathrm{s}$

29. A ball is projected from the ground at a speed of 10 ms-I making an angle of 30° with the horizontal. Another ball is simultaneously released from a point on the vertical line along the maximum height of the projectile. The initial height of the second ball is: (Take g = 10ms^{-2})

a) 6.25 m **b) 2.50 m** c) 3.75 m d) 5 m

Solution : -

Maximum height of projectile, ho = $\frac{u^2 sin^2\theta}{2g}$

$\therefore h_0 = \frac{(10)^2 \times sin^2 30^o}{2 \times 10} = \frac{5}{4}$ = 1.25 m

T·ime for attai.mn.g maximum herght, t =

$\therefore$ t = $\frac{10 \times sin 30^o}{10} = 0.5\ \sec$

$\therefore$ Distance of vertical fall in 0.5 see, S = $\frac{1}{2} gt^2$

or 10 x $(0.5)^2$ = 1.25 m

$\therefore$ Height of second ball = 1.25 + 1.25 = 2.50 m.

30. (A) Comets move around the sun in eJliptical orbits. The gravitational force on the comet due to the sun is not normal to the comet's velocity but the work done by the gravitational force over every complete orbit of the comet is zero.
(R) Gravitational force is a non-conservative force.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false.
d) If both assertion and reason are false.
e) If assertion is false but reason is true.

Solution : -
Assertion is true but reason is false.
The gravitational force on the comet due to the sun. is a conservative force. Since, the work done by a conservative force over a closed path is always zero (irrespective of the nature of path). The work done by the gravitational forces over every complete orbit of the comet is zero.

31. If a gas is heated at constant pressure, its isothermal compressibility:
a) remains constant b) increases linearly with temperature
c) decreases linearly with temperature
d) decreases inversely with temperature

32. A trolley T of mass 5 kg on a horizontal smooth surface is pulled by a load of 2 kg through a uniform rope ABC of length 2 m and mass 1 kg. As the load falls from BC = 0 to BC = 2m, its acceleration (in m/s^2) changes from:
a) $\frac{20}{6}$ to $\frac{30}{5}$ b) $\frac{20}{8}$ to $\frac{30}{8}$ **c) $\frac{20}{5}$ to $\frac{30}{6}$** d) None of these

Solution : -
initial force = load x g = 2 x 10 = 20 N
Initial acceleration = $\frac{force}{mass} = \frac{20}{5+1} = \frac{20}{6}$ m/s^2
Final force = (load + mass of the thread) x g
= (2 + l) x 10 = 30 N
Final acceleration = $\frac{30}{5}$ m/s^2

33. A particle moves with uniform velocity. Which of the following statements about the motion of the particle is true?
a) Its speed is zero. **b) Its acceleration is zero.**
c) Its acceleration is opposite to the velocity. d) Its speed may be variable.

34. In the case of stationary waves all the particles of the medium between two nodes vibrate:

a) in phase but with different amplitudes and time periods

b) in phase and with same amplitude and time period

c) in phase with the same time period but different amplitudes

d)

with the same time period but in different phases and with different amplitudes

35. A sample of metal weighs 210 g in air, 180 g in water and 120 g in an unknown liquid. Then:

a) the density of metal is 3 g/cm^3 **b) the density of the metal is 7 g/cm^3**

c) the density of metal is 4 times the density of unknown liquid

d) the metal will float on water

36. The focal length of a lens depends on

a) The radii of curvature of its surfaces b) The refractive index of its material

c) The refractive index of the medium surrounding the lens

d) All the above facors

37. A capacitor C_1 is charged to a potential difference V. The charging battery is then removed and the capacitor is connected to an uncharged capacitor C_2. The potential difference across the combination is _____.

a) $\frac{VC_1}{(C_1+C_2)}$ b) $V\left(1+\frac{C_2}{C_1}\right)$ c) $V\left(1+\frac{C_1}{C_2}\right)$ d) $\frac{VC_2}{(C_1+C_2)}$

Solution : -

Charge Q = C_1V

For parallel combination

C = C1 + C_2

$\text{P.D.} = \frac{Q}{C_n} = \frac{C_1V}{C_1+C_2}$

38. A ball of mass m moves with speed v and strikes a wall having infinite mass and it returns with same speed, then the work done by the ball on the wall is:

a) zero b) mυJ c) (m/υ)J d) (υ/m)J

39. In Carnot engine efficiency is 40% at hot reservoir temperature T. For efficiency to be 50%, what will be the temperature of hot reservoir?

a) $\frac{T}{5}$ b) $\frac{2T}{5}$ c) 6T **d)** $\frac{6T}{5}$

40. A flywheel of radius 2 m and mass 8 kg rotates at an angular speed of 4 rad/s about an axis perpendicular to it through its centre. The kinetic energy of rotation is:

a) 128 J b) 196 J c) 256 J d) 392 J

Solution : -

M = 8kg, R = 2m, ω = 4 red/sec.

$(KE)_{Rotation} = \frac{1}{2}I\omega^2$

or $K_R = \frac{1}{2} \times \frac{1}{2}MR^2 \times \omega^2 = \frac{1}{4} \times 8 \times 4 \times 16 = 128J.$

41. Which dimensions will be the same as that of time?

a) LC b) $\frac{R}{L}$ **c)** $\frac{L}{R}$ d) $\frac{C}{L}$

Solution : -

$[L] = \left[M^1L^2T^{-2}A^{-2}\right]$ *and* $[R] = \left[M^1L^2T^{-3}A^{-2}\right]$

$\therefore \left[\frac{L}{R}\right] = \frac{\left[M^1L^2T^{-2}A^{-2}\right]}{\left[M^1L^2T^{-3}A^{-2}\right]} = [T]\,.$

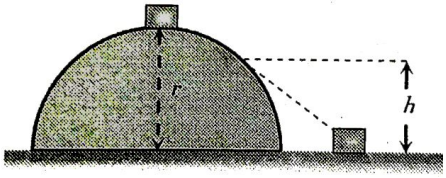
42. Two wires are in unison. If the tension in one of the wires is increased by 2%, 5 beats are produced per second. The initial frequency of each wire is:

a) 200 Hz b) 400 Hz **c) 500 Hz** d) 1000 Hz

43. A small block slides down from the top of a hemisphere of radius r. It is assumed that there is no friction between the block and the hemisphere. At what height, h will the block lose contact with the surface of sphere?

a) $\frac{r}{3}$ **b)** $\frac{2r}{3}$ c) $\frac{r}{2}$ d) $\frac{r}{4}$

Solution : -



The block will lose contact with the surface of hemisphere when the centripetal acceleration becomes equal to the component of acceleration due to gravity along the radius. Suppose it happens at the point S as shown in the adjoining figure. The velocity at the

point S is given by: $v = [2g(r- h)]^{1/2}$

The centripetal acceleration should be equal to the component of g along So.

i.e., $\frac{v^2}{r}$ = gcosθ

or $\frac{2g(r-h)}{r} = g \times \frac{h}{r}$

or $2(r-h) = h$ or $h = \frac{2r}{3}$

44. (A) A piece of cork embedded inside an ice block, floats in water. If ice melts completely, the water level remains unchanged.

(R) Ice and water have same density.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

e) If assertion is false but reason is true.

45. Two circular coils 1 and 2 are made from the same wire but the radius of the Ist coil twice that of the 2nd coil. What potential difference ratio should be applied across them so that the magnetic field at their centres is the same?
a) 2 b) 3 **c) 4** d) 6

46. Mark the correct statement.
a) In case of stationary waves maximum pressure change occurs at antinode.
b)
Velocity of longitudinal waves in a medium is its physical characteristic.
c)
Due to propagation of longitudinal wave in air, maximum pressure change is equal to $2\pi na/\rho v$
d) None of the above

Solution : -

When a stationary wave is established in a medium then maximum deformation of the medium is produced at nodes. Hence, maximum pressure change takes place at nodes and at antinodes, no pressure change takes place. Therefore, option (a) is wrong. Velocity of a longitudinal wave in a medium is, $v = \sqrt{\frac{Elasticity}{Density}}$ Since, elasticity and density both are the characteristic property of the medium, therefore, velocity of a longitudinal wave in a medium is its physical characteristic. So, option (b) is correct. Due to propagation of longitudinal wave in a medium, pressure change $\Delta P = \frac{\gamma P u}{v}$ where u is the velocity of medium particles.

Pressure change will be maximum possible when medium particles have maximum possible velocity, which is equal to $a\omega = 2\pi na$

Hence, $\Delta P = \gamma P \frac{2\pi na}{v}$

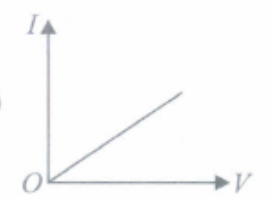
But $\gamma P = \rho v^2$

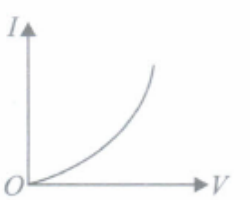
$\therefore \quad \Delta P = 2\pi na\rho v$

So, option (c) and therefore (d) is also wrong.

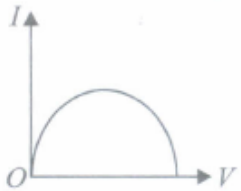
47. A satellite is placed in a circular orbit around the earth at such a height that it always remains stationary with respect to the earth's surface. In such a case, its height (in km) from the earth's surface is:
a) 32000 **b) 36000** c) 6400 d) 4800

48. Which of the following I- V graph represents ohmic conductors?

a) 

b) 

c) 

d) 

Solution : -
Ohm's law V = IR is an equation of straight line. Hence I - V characteristics for ohmic conductors is also a straight line and its slope gives resistance of the conductor.

49. A child is standing with his two arms outstretched at the centre of a turntable that is rotating about its central axis with an angular speed ω_0 Now, the child folds his hands back so that moment of inertia becomes 3 times the initial value. The new angular speed is
a) $3\omega_0$ **b)** $\frac{\omega_0}{3}$ c) $6\omega_0$ d) $\frac{\omega_0}{6}$

Solution : -
Here,
Initial angular speed, $\omega_i = \omega_0$
Initial moment of inertia = I_i
Final moment of inertia $I_f = 3I_i$
According to the law of conservation of angular momentum, we get
$L_i = L_f$ or $I_i\omega_i = I_f\omega_f$
$\omega_f = \frac{I_i\omega_i}{I_f} = \left(\frac{I_i}{I_f}\right)\omega_i = \left(\frac{I_i}{3I_i}\right)\omega_0 = \frac{\omega_0}{3}$

50. The upper end of a wire of radius 4 mm and length 100 cm is clamped and its other end is twisted through an angle of 30°.Then, angle of shear is
a) 12° **b) 0.12°** c) 1.2° d) 0.012°

51. Standard electron potential of three metals X, Y and Z are -1.2 V + 0.5 V and -3.0 V respectively. The reducing power of these metals will be :
a) Y > X > Z **b) Z > X > Y** c) X > Y > Z d) Y > Z > X

Solution : -
E^0_x= -1.2 V, E^0_y = 0.5 V, E^0_z= -3.0 V
∴ Z > X > Y (As higher the reduction potential, lesser the reducing power)

52. Which of the following alcohols will yield the corresponding alkyl chloride on reaction with concentrated HCl at room temperature?

a) CH_3CH_2-CH_2-OH b) $CH_3CH_2-\underset{CH_3}{\underset{|}{CH}}-OH$ c) $CH_3CH_2-\underset{CH_3}{\underset{|}{CH}}-CH_2OH$

d) $CH_3CH_2-\overset{CH_3}{\underset{CH_3}{\overset{|}{\underset{|}{C}}}}-OH$

Solution : -

3° alcohols being most reactive, react with cone. HCl at room.temperature.

53. Complete the following reactions:

(i) SiO_2 + 2NaOH ⟶ X + H_2O

(ii) SiO_2 + 4HF ⟶ Y + $2H_2O$

(iii) Si + $2CH_3Cl \xrightarrow[570\ K]{Cu\ powder}$ Z

a)

X	**Y**	**Z**
Na_2SiO_3	**SiF_4**	**$(CH_3)_2SiCl_2$**

b)

X	**Y**	**Z**
H_2SiO_3	SiF_2	CH_3SiCl_3

c)

X	**Y**	**Z**
Na_2SiO_3	H_2SiO_3	$(CH_3)_3SiCl$

d)

X	**Y**	**Z**
Na_2SiO_3	H_2SiF_4	$(CH_3)_2SiCl_2$

Solution : -

$SiO_2 + 2NaOH \rightarrow \underset{(X)}{Na_2SiO_3} + H_20$

$SiO_2 + 4HF \rightarrow \underset{(Y)}{SiF_4} + 2H_20$

$Si + 2CH_3CI \xrightarrow[570K]{Cu\ powder} \underset{(Z)}{(CH_3)_2SiCl_2}$

54. **Assertion:** Octet rule is based upon the chemical inertness of noble gases.

Reason: Octet rule can explain the shape and relative stability of the molecule.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

Solution : -

Octet rule does not account for the shape of molecules and does not explain the relative stability of the molecules being totally silent about the energy of a molecule.

55. An element, X has the following isotopic composition ^{200}X : 90%, ^{199}X: 8.0%, ^{202}X: 2.0%. The weighted average atomic mass of the naturally occurring element X is closest to :

a) 201 amu b) 202 amu c) 199 amu **d) 200 amu**

Solution : -

Contribution of ^{200}X in average atomic weight

= 0.90 x 200

= 180.00 amu

Contribution of ^{199}X in average atomic weight

= 0.08 x 199

= 15.92amu

Contribution of ^{202}X in average atomic weight

= 0.02 x 202

= 4.04 amu

Thus, weighted average atomic mass of X

= (180.00 + 15.92 + 4.04) amu

= 199.96 amu

≈ 200 amu

56. For a given reaction ΔH = 35.5 kJ mol^{-l} and ΔS= 83.6 JK-1 mol^{-1}. The reaction is spontaneous at: (Assume that ΔH and ΔS do not vary with temperature)

a) T < 425 K **b) T > 425 K** c) all temperature d) T > 298K

Solution : -

According to Gibbs-Helmholtz equation, Gibbs energy,

$\Delta G = \Delta H - T\Delta S$

Where, ΔH = Enthalpy change

ΔS = Entropy change

T = Temperature

For a reaction to be spontaneous,

$\Delta G < 0$

i.e., $\Delta G = \Delta H - T\Delta S < 0$

or, $\Delta H < T\Delta S$

or, $T > \frac{\Delta H}{\Delta S}$

T > $\frac{35.5 kmol^{-1}}{83.6 Jk^{-1}mol^{-1}}$

T > $\frac{35.5 \times 1000 \ J \ mol^{-1}}{83.6 Jk^{-1}mol^{-1}}$

T> 425K

57. Cerium (Z = 58) is an important member of the lanthanoids. Which of the following statements about cerium is incorrect?

a) The common oxidation states of cerium are +3 and +4.

b) The +3 oxidation state of cerium is more stable than +4 oxidation state.

c) The +4 oxidation state of cerium is not known in solutions.

d) Cerium (IV) acts as an oxidising agent.

Solution : -

+4 oxidation state of cerium is also known in solutions.

58. In the redox reaction,

$Pb_3O_4 + 8HCl \rightarrow 3PbCl_2 + Cl_2 + 4H_2O$

a) three numbers of Pb^{2+} ions get oxidised to Pb^{4+} state

b)

one number Pb^{4+} ion gets reduced to Pb^{2+} and two numbers of Pb^{2+} ions remain unchanged in their oxidation state

c)

one number Pb^{2+} ion gets oxidised to Pb^{4+} and two numbers of Pb^{4+} ions remain unchanged in their oxidation states

d) three numbers of Pb^{4+} ions get reduced to Pb^{2+} state.

Solution : -

Reaction given:

$Pb_3O_4 + 8HCl \rightarrow 3PbCl_2 + Cl_2 + 4H_2O$

Pb_3O_4 is a mixture of two PbO and one PbO_2 and is written as:

$Pb_3O_4 = 2PbO \ . \ PbO_2$

Therefore the reaction becomes:

$2PbO.PbO_2 + 8HCl \rightarrow 3PbCl_2 + Cl_2 + 4H_2O$

In the reaction, oxidation state of Pb in P bO is +2 and +4 in PbO_2.

thus, there are two Pb^{2+} ions in the product from PbO that remain unchanged and one Pb^{4+} from PbO_2 that gets reduced to Pb^{2+}, resulting in total three Pb^{2+} ions.

Hence in the reaction,

$Pb_3O_4 + 8HCl \rightarrow 3PbCl_2 + Cl_2 + 4H_2O$

One number Pb^{4+} ion get reduced to Pb^{2+} and two numbers of Pb^{2+} ions remain unchanged in their oxidation states.

59. Select the correct statement(s).

a)

On the basic of Lewis acidity , an oxygen atom is more effective than an fluorine atom as a π -donor towards boron

b)

1,2-diols have a strong tendency to form borate esters on account of chelate effect

c) Borate esters are stable due to chelate effect

d) All of the above are correct statement

60. What mass of sodium chloride would be decomposed by 9.8 g of sulphuric acid if 12 g of sodium bisulphate and 2.75 g of hydrogen chloride were produced in a reaction?

a) 14.75 g b) 3.8 g **c) 4.95 g** d) 2.2 g

Solution : -

According to the law of conservation of mass, the mass of the products in a chemical reaction must equal the mass of the reactants

For the chemical reaction: $NaCl+H_2SO_4 \rightarrow NaHSO_4+HCl$

$m_{reactant}=m_{products}$

$m_{NaCl}+m_{H_2SO_4}=m_{NaHSO_4}+m_{HCl}$

$\therefore x + 9.8 = 12 + 2.75$

$\therefore x = 4.95$ g

61. In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as :

Assertion: The ability of oxygen to stabilize high oxidation states exceeds that of fluorine.

Reason: The highest oxidation number in the oxides coincides with the group number.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

Solution : -

Oxygen can stabilize high oxidation states because of its ability to form multiple bonds to metals.

62. In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

Assertion: Chemicals added to foods for increasing their shelf life are called preservatives.

Reason : Natural sweeteners like sucrose and artificial sweeteners like saccharin are commonly used as food preservatives.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

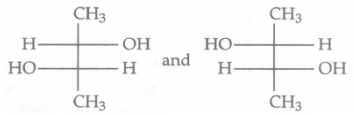
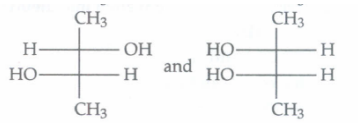
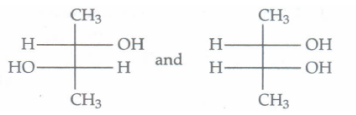
c) If assertion is true but reason is false.

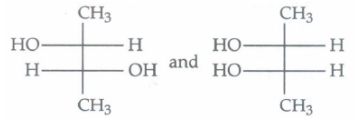
d) If both assertion and reason are false

Solution : -

Sweeteners are added to impart sweetness to the food. Sodium benzoate, table salt, vegetable oils etc. are some commonly used preservatives.

63. Which of the following pairs of compounds are enantiomers ?

a)  b)  c) 

d) 

Solution : -

Option (a) are the two non-superimposable mirror images of each other so they are enantiomers.

64. On reaction with Cl_2, phosphorus forms two types of halides 'A' and 'B'. Halide 'A' is yellowish-white powder but halide 'B' is colourless oily liquid. What would be the hydrolysis products of if and 'B' respectively?

a) H_3PO_4, H_3PO_3 b) $HOPO_3$, H_2PO_2 c) H_3PO_3, H_3PO_4 d) HPO_3, H_3PO_3

Solution : -

A is PCl_5 (yellowish white powder).

$P_4 + 10Cl_2 \rightarrow 4PCl_5$

B is PCl_3 (colourless oily liquid).

$P_4 + 6Cl_2 \rightarrow 4PCl_3$

The products of hydrolysis of PCl, and PCl_5 are:

$$\underset{(B)}{PCl_3} + 3H_2O \rightarrow H_3PO_3 + 3HCl$$

$$\underset{(A)}{PCl_5} + 4H_2O \rightarrow H_3PO_3 + 5HCl$$

65. The values of van't Hoff factors for KCl, NaCl and K_2SO_4, respectively, are:
a) 2, 2 and 2 **b) 2, and 3** c) 1, 1 and 2 d) 1, 1 and 1

Solution : -

KCl $\longrightarrow$ K^+ + Cl^-, thus, i = 2

NaCl $\longrightarrow$$Na^+$ + Cl^-, thus, i = 2

K_2SO_4 $\longrightarrow$2K^+ + SO_4^{2-} - thus, i = 3

66. An element X occurs in short period having configuration ns^2np^1. The formula and nature of its oxide is
a) X_2O_3 amphoteric b) XO_3, basic c) XO_3, acidic **d) X_2O_3, basic**

Solution : -

Explanation: We are given an element having electronic configuration as ns2np1, which means that the valency of element X is 3.

We know that the valency of Oxide ion is 2.

Hence, the formula becomes X2O3

From the electronic configuration, it is visible that the element belongs to the 3rd group of periodic table and is a metal.

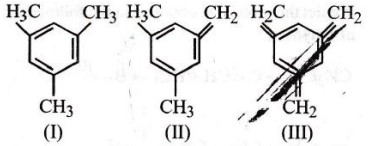
The oxide formed from a metal is a basic oxide.

67. Green house effect is due to :
a) disturbance of the earth's delicate thermal balance.
b)
absorption of heat radiation by atmospheric gases particulary water vapours.
c) Both (a) and (b) d) None of the above

Solution : -

The greenhouse effect is a natural process that warms the earth's surface. When the Sun's energy reaches the earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. Greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide, ozone and some artificial chemicals such as chlorofluorocarbons (CFCs).

68. Given:



The enthalpy of the hydrogenation of these compounds will be in the order as:

a) III>II>I b) II>III>I c) II>I>III d) I>II>III

Solution : -

We know that: Enthalpy of hydrogenation

$\alpha \frac{1}{\text{stability of alkene}}$

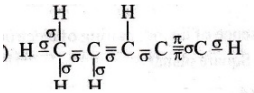
$\therefore$ III $>$ II $>$ I

69. The number of sigma (σ) and pi (π) bonds in pent-2-en-4- yne is:

a) 8σ bonds and 5 π bonds b) 11σ bonds and 2π bonds

c) 13σ bonds and no π bonds **d) 10σ bonds and 3π bonds**

Solution : -



The structure of pent- 2-en-4-yne is as below: Here

No of σ bonds are 10 and No of π bond are 3

70. Which of the following options will be correct for the stage of half completion of the reaction: A $\rightleftharpoons$ B?

a) $\Delta G^0=0$ b) $\Delta G^0>0$ c) $\Delta G^0<0$ d) ΔG^0=-RT ln 2

Solution : -

When the reaction is half completed, [A] = [B].

Thus, $K=\frac{[B]}{[A]}=1$

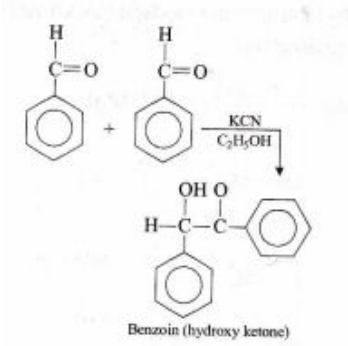
$\therefore \Delta G^0$=-RT lnK =- RT ln (1)=0

71. Benzaldehyde reacts rvith ethanolic KCN to give _____.

a) $C_6H_5CHOHCN$ **b) $C_6H_5CHOHCOC_6H_5$** c) $C_6H_5CHOHCOOH$

d) $C_6H_5CHOHCHOHC_6H_5$

Solution : -



This reaction is also called benzoin condensation. Benzoin is chiral and it exists as a pair of enantiomers, i.e., R-benzoin and S-benzion.

72. When $(NH_4)_2Cr_2O_7$ is heated, the gas evolved is :

a) N_2 b) NO_2 c) O_2 d) N_2O

Solution : -

When $(NH_4)2Cr_2O_7$ is heated then N_2 gas is evolved.

$(NH_4)Cr_2O_7 \longrightarrow Cr_2O_3 + 4H_2O + N2 \uparrow$

73. NaCl, $MgCl_2$ and $CaSO_4$ are known as

The variation in A_m with concentration for a strong electrolyte can be represented by the equation,

$$A_m = A_m^0 - AC^{1/2}$$

The value of constant A for a given solvent and temperature depends upon the type of electrolyte i.e., cations and anions produced on dissociation of electrolyte in the solution.

a) 1 - 1, 2 - 1, and 2 - 2 type electrolytes respectively

b) strong, weak and strong electrolytes respectively

c) electrolytes with different value of A

d) electrolytes with same molar conductivity.

74. Match the column I with column II and mark the appropriate choice

Column I		**Column II**	
(A)	Coal gas	(i)	$CO+H_2$
(B)	Synthesis gas	(ii)	CH_4
(C)	Producer gas	(iii)	$H_2 + CH_4 + CO$
(D)	Natural gas	(iv)	$CO+N_2$

a) (A) ⟶ (i), (B) ⟶ (ii), (C) ⟶ (iii), (D) ⟶ (iv)

b) (A) ⟶ (iii), (B) ⟶ (i), (C) ⟶ (iv), (D) ⟶ (ii)

c) (A) ⟶ (iv), (B) ⟶ (iii), (C) ⟶ (ii), (D) ⟶ (i)

d) (A) ⟶ (i), (B) ⟶ (iii), (C) ⟶ (ii), (D) ⟶ (iv)

75. An ion of a d-block elements has magnetic moment 5.92 B.M. Select the Ion among the following.

a) Zn^{+2} b) Sc^{+2} **c) Mn^{+2}** d) Cr^{3+}

Solution : -

Magnetic moment $\mu = \sqrt{n(n+2)}$ B.M

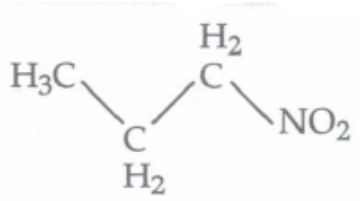
76. Glass having higher refractive index is prepared using:

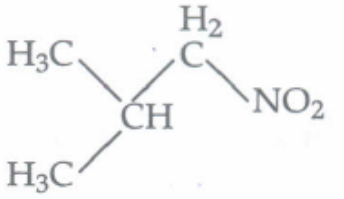
a) NiO b) CoO **c) PbO** d) CaO

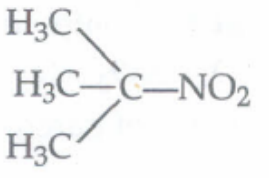
Solution : -

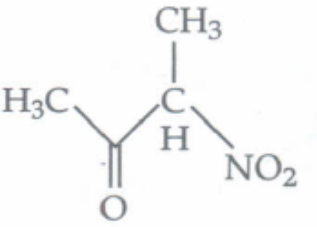
Glass having higher refractive index is prepared using PbO and these are used in Thailand for centuries.

77. Which of the following nitro compounds does not react with nitrous acid?

a) 

b) 

c) 

d) 

Solution : -

Tertiary nitroalkanes do not react with nitrous acid as they do not contain α-hydrogen atom.

78. The correct configuration off-block elements is:

a) $(n - 2)f^{1-14}\ (n - l)d^{0-1}\ ns^2$ b) $(n - 1)f^{1-14}\ (n - 1)d^{0-1}\ ns^2$

c) $(n - 3)f^{1-14}\ (n - 1)d^{0-1}\ (n-1)s^2$ **d) $(n - 2)f^{1-14}(n - 1)d^{0-1}\ ns^2$**

79. Which of the following statements is not true about classical smog?

a)

Its main components are produced by the action of sunlight on emissions of automobiles and factories.

b) Produced in cold and humid climate

c) It contains compounds of reducing nature.

d) It contains smoke, fog and sulphur dioxide

Solution : -

The main components of photochemical smog are produced by the action of sunlight on emissions of automobiles and factories

80. Which one of the following statements is not true?

a) Buna-S is a copolymer of butadiene and styrene

b) Natural rubber is a 1, 4-polymer of isoprene

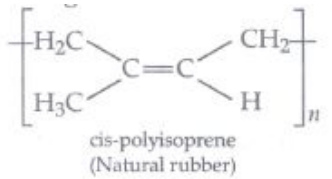
c)

In vulcanization, the formation of sulphur bridges between different chains make rubber harder and stronger.

d) Natural rubber has the trans-configuration at every double bond.

Solution : -

Natural rubber is cis-1, 3 polyisoprene and has only cis-configuration about the double bond.



cis-polyisoprene
(Natural rubber)

81. In which of the following compounds manganese has oxidation number equal to that of iodine in KIO_4?

a) Potassium manganate **b) Potassium permanganate**

c) Dimanganese decacarbonyl d) Manganese chloride

Solution : -

Oxidation number of I in KIO_4 = +7

Oxidation number of Mn in potassium permanganate $KMnO_4$= +7

82. Which of the following has the lowest boiling point?

a) 2-Methylbutane **b) 2-Methylpropane** c) 2,2-Dimethylpropane

d) n-Pentane

Solution : -

Boiling point increases with increase in molecular mass. For the compounds with the same molecular mass, boiling point decreases with an increase in branching.

The molecular mass of 2-Methylbutane: $72 gmol^{-1}$

The molecular mass of 2-Methylpropane: $58 gmol^{-1}$

The molecular mass of 2,2-Dimethylpropane: $72 gmol^{-1}$

The molecular mass of 2-Methylbutane: $72 gmol^{-1}$

2-Methylpropane has the lowest molecular mass among all of the given compounds.

Thus, 2-Methylpropane has the lowest boiling point among the given options.

83. Percentage of free space in a body centred cubic unit cell is

a) 30% **b) 32%** c) 34% d) 28%

Solution : -

Proof that percentage of occupied space in a bcc is 68%.

84. Glycerol is added to soap. It functions_____

a) as a filler b) to increase lathering **c) to prevent rapid drying**
d) to make soap granules

Solution : -

Shaving soaps contain glycerol to prevent rapid drying.

85. Global warming is called:

a) photochemical smog **b) green-house effect** c) acid rain d) respiration

Solution : -

Global Warming is the increase of Earth's average surface temperature due to effect of greenhouse gases, such as carbon dioxide emissions from burning fossil fuels or from deforestation, which trap heat that would otherwise escape from Earth. This is a type of greenhouse effect.

86. Fill in the blanks with appropriate words.

The electrolytic solution is always neutral because the total charge on (i) is equal to (ii) on (iii).Unlike the metallic conductor, the electrolyte conducts the electric current by virtue of movement of its (iv). The property due to which a metal tends to go into solution in term of positive ions is known as (v).

(ii), (iii), (iv) and (v) respectively are

a) (a) cations, partial charge, anions, electrons, reduction

b) cations, total charge, anions, ions, oxidation

c) cations, ionic charge, anions, atoms, dissolution

d) cations, partial charge, anions, molecules, electrolysis.

87. Which of the following statements is/are correct?

(i) In octahedral complexes, t_{2g} orbitals possess low energy as compared to e_g orbitals.

(ii) In tetrahedral complexes, t_{2g} orbitals possess high energy as compared to e_g orbitals.

(iii) In octahedral complexes, eg orbitals possess low energy as compared to t_{2g} orbitals.

a) (ii) only b) (iii) only **c) (i) and (ii)** d) (i) and (iii)

88. How many electrons are transferred from reductant to oxidant in the following redox process?

$As_2S_3 + HNO_3 \rightarrow H_3ASO_4 + H_2SO_4 + NO$

a) 2 b) 4 c) 24 **d) 84**

Solution : -

Oxidant $[3e^- + \overset{5+}{N} \rightarrow \overset{2+}{N}] \times 28$

Reductant $\overset{3+}{A}s_2 \rightarrow 2As^{5+} + 4e^-$

$S_3^{2-} \rightarrow 3s^{6+} + 24e^-$

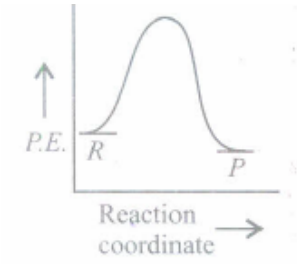
$(As_2S_3 \rightarrow 2A_s^5 + 3s^{6+} + 28) \times 3$

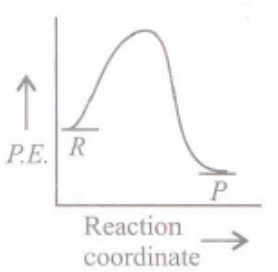
89. Benzoquinone is prepared by reaction of phenol with

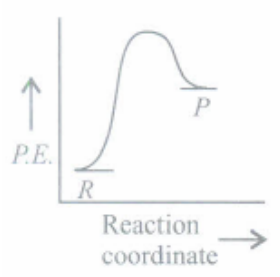
a) $Na_2Cr_2O_7$, H_2SO_4 b) $KMnO_4$, H_2SO_4 c) Na_2CrO_4, HCl

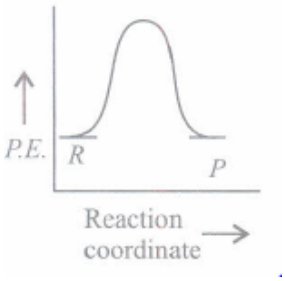
d) K_2MnO_4, H_2SO_4

90. An endothermic reaction with high activation energy for the forward reaction can be shown by th figure

a) 

b) 

c) 

d) 

Solution : -

Graph (c) represents a large gap between energy of products and reactants.

91. Select the correct relation:

a) $\mu_{NH3} = \mu_{NF3}$ b) $\mu_{NH3} > \mu_{NF3}$ c) $\mu_{NH3} < \mu_{NF3}$ d) can't compared

Solution : -

Dipole moment of NF_3 is less than that of Nli, Because in NF_3 the dipole moment of lonepair and N--F bonds are acting in opposite, directions where as in NH_3 dipole moment bonds and ·lonepairs acting in same direction.

92. Which of the following ions will cause hardness in water sample?

a) Ca^{2+} b) Na^+ c) Cl^- d) K^+

Solution : -

Presence of calcium and magnesium salts in the form of hydrogen carbonate, chloride and sulphate in water makes water 'hard'

93. A five litre flask contains 3.5 gm of N_2, 3g of H_2 and 8g of H_2 at 27°C. The total pressure exerted by the mixture of these gases is:

a) 92.4 atm b) 0.924 atm **c) 9.24 atm** d) 924 atm

Solution : -

Total moles = $\frac{3.5}{28} + \frac{3}{2} + \frac{8}{32} = 1.875$

$\Rightarrow P = \frac{nRT}{V} = \frac{1.875 \times 0.0821 \times 300}{5} = 9.24\ atm$

94. Consider the following SN2 reactions

I. $RX+Y^- \rightarrow R\text{-}Y+X^-$

II. $RX + Y \rightarrow R\text{-}Y^+ + X$

III. $RX^+ + Y^- \rightarrow R - Y + X$

IV. $RX^+ + Y \rightarrow R\text{-}Y^+ + X$

In which reactions there is large increase and large decrease in rate of reaction respectively with increase in polarity of the solvent.

a) II and III b) II and IV c) I and IV d) IV and I

Solution : -

For II: Transition state is more stabilised than reactant.

For III: Reactants are more stabilised than transition state. Hence, rate of reaction is affected accordingly.

95. The police are monitoring an automobile of mass 2.0 tons speeding along a high way. They are certain about location of the vehicle only to with in 1m; what is the minimum uncertainty in the speed of the vehicle?

a) 3.9 x 10^{-38} ms-1 b) 12.4 x 10^{-38} ms^{-1} **c) 2.63 x 10^{-38} ms^{-1}**

d) 0.62 x 10^{-38} ms^{-1}

Solution : -

$\Delta v = \frac{h}{4\pi . m\Delta x} = \frac{6.625 \times 10^{-34}}{4 \times 3.143 \times 2000 \times 1}$ = 2.63 x 10^{-38} ms^{-1}

96. How many number of electrons are involved in the formation of a nitrogen molecule?

a) Three b) Four c) Eight **d) Six**

Solution : -

The electronic configuration of N atom is $1s^2 2s^2 2p^3$

Hence, 3 electrons are required to complete the electronic configuration.

So, each N atom share three electrons.

From here we can conclude that total six electrons are involved in the formation of N_2

molecule.

This type of chemical combination is known as the covalent combination.

The structure of the nitrogen molecule is: N≡N

97. Sulphides ores are converted to oxides before reduction. This is explained on the basis of which of the following?

a) Sulphides cannot be reduced easily while oxides can be reduced easily

b) Sulphides decompose on reduction hence they are first converted to oxides.

c) Sulphide ores have higher melting points than oxides

d) Oxides are more stable than sulphides hence easy to reduce

Solution : -

Thermodynamically based on Ellingham diagram it is observed that sulphides cannot be reduced easily as compared to oxides

98. Which of the following compounds will have highest melting point?

a) Chlorobenzene b) a-Dichlorobenzene c) m- Dichlorobenzene

d) p- Dichlorobenzene

Solution : -

p-isomer is symmetrical hence closely packed due to which it shows higher melting point than o- and m- isomers.

99. The expression to calculate time required for: completion of zero order reaction is

a) t=$\frac{[R_0]}{k}$ b) t=[R]-[R_0] c) t=$\frac{k}{[R_0]}$ **d) t=**$\frac{[R_0]-[R]}{[R_0]}$

Solution : -

[R] = [R_o] - kt

For completion of reaction, [R] = 0

or t=$\frac{[R_0]}{k}$.

100. A solute X when dissolved in a solvent associates to form a pentamer. The value of van't Hoff factor (i) for the solute will be

a) 0.5 b) 5 **c) 0.2** d) 0.1

Solution : -

5X⟶ X_5

i=1-$\left(1-\frac{1}{n}\right)=1-\left(1-\frac{1}{5}\right)$=0.2

101. Haplontic life cycle generally occurs in

a) most algae b) bryophytes c) pteridophytes d) gymnosperms.

Solution : -

Haplontic life cycle, generally occurs in most algae such as Volvox, Spirogyra and some species of Chlamydomonas.

102. Kingdom Plantae includes

a) algae and bryophytes b) pteridophytes and gymnosperms

c) angiosperms **d) all of these.**

103. Nitrogenous waste products are eliminated mainly as___

a) urea in tadpole and ammonia in adult frog

b) ammonia in tadpole and urea in adult frog

c) urea in both tadpole and adult frog

d) urea in tadpole and uric acid in adult frog

Solution : -

Ammonia is the main nitrogenous waste. It is soluble in water and highly toxic. A large amount of water is required for its excretion. Tadpole is aquatic and lives in plenty of water so, nitrogenous wastes in tadpole are eliminated as ammonia. Frog being amphibious, excretes its nitrogenous wastes as urea.

104. Domestic waste constitutes _____.

a) non-biodegradable pollution **b) biodegradable pollution** c) effluents

d) air pollution

Solution : -

Domestic waste constitutes biodegradable pollutants, such pollutants are naturally present organic compounds which can be broken down by microorganisms and can be recycled, e.g. sewage.

105. The development of Periplaneta americana is

a) holornetabolous **b) paurometabolous** c) ametabolous

d) hemimetabolous.

Solution : -

The development of **Periplaneta americana** is paurometabolous, i.e., there is development through nymphal stage.

106. Water conduction in stem of tree takes place made by

a) Duramen **b) Sapwood** c) Primary xylem d) All of these

107. In meiosis, how many cycles of chrmosome division occurs?

a) One b) Four c) Two d) Three

108. **Assertion:** Phenotypic superiority of hybrid over either of its parents in one or more traits is termed hybrid vigour.

Reason: Suppression of expression of recessive harmful genes occurs in heterozygotes.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

Solution : -
Plant breeding exploits the phenomenon of hybrid vigour or heterosis. It is the phenotypic superiority of the hybrid over either of its parents in one or more traits. These hybrids generally have greater strength and resistance to disease and larger life span than either parents. This may be due to suppression of expression of harmful recessive genes that are expressed only in homozygous conditions.

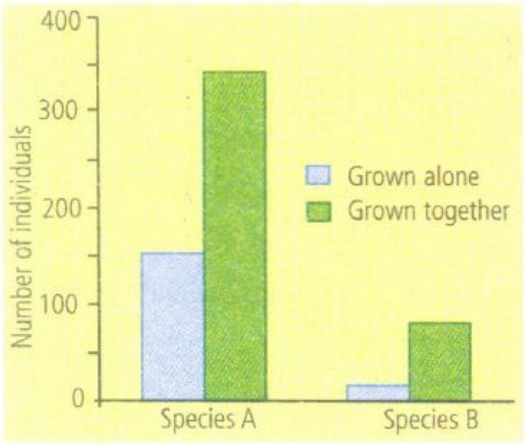
109. All eukaryotic unicellular organisms belong to
a) Monera **b) Protista** c) Fungi d) Bacteria.

Solution : -
All single-celled eukaryotes are placed in Kingdom Protista. Phylogenetically the Kingdom Protista acts as a connecting link between the prokaryotic Kingdom - Monera on one hand and the complex multicellular kingdoms - Fungi, Plantae and Animalia on the other hand.

110. In a flower, if the megaspore mother cell forms megaspores without undergoing meiosis and if one of the megaspores develops into an embryo sac, its nuclei would be
a) haploid **b) diploid** c) a few haploid and a few diploid
d) with varying ploidy

111. Two insect species were used in a laboratory experiment. For one treatment, both species were grown by themselves (in separate chambers) on a suitable food source. For the second treatment, the two species were grown together (in the same chamber) on the same type and amount of food as in the first treatment. The given figure shows the ' results (the number of individuals of each

species in the two treatments) at the end of the experiment. Based on these results the two species should be classified as



a) competitors **b) rnutualists** c) predators or pathogens d) commensalists

Solution : -

The given data shows that the insect species A and B are mutualists. Mutualism is an interaction between two organisms of different species where both the partners are benefitted from each other. Species A when grown alone showed less number of individuals, however, its population increased when grown along with species B. Similar observations were made for species B. Hence, it can be concluded that they exhibit mutualism.

112. Incorrect statement in relation to chemiosmotic hypothesis is

a) Primary electron acceptor is located towards outer side of membrane

b) NADP reductase is located on lumen side of thylakoid membrane

c) Splitting of water releases protons in the lumen of thylakoid membrane

d) Decrease in pH of thylakoid lumen due to proton accumulation

113. The reasons behind conserving biodiversity have been grouped into which of the following categories?

a) Narrowly utilitarian b) Broadly utilitarian c) Ethical **d) All of these**

Solution : -

We should conserve biodiversity. The reason for this can be broadly divided into three categories.

(i) Narrowly utilitarian (Humans derive a major part of their requirement from organisms).

(ii) Broadly utilitarian (Biodiversity is fundamental to ecosystem services of nature).

(iii) Ethical (Every living species has an intrinsic value, it is our moral duty not to destroy them).

114. Gene which is responsible for the synthesis of a polypeptide chain is called:

a) Promotor gene **b) Structural gene** c) Regulator gene d) Operator gene

115. Identify the correct statement from the following.

a) High levels of estrogen triggers the ovulatory surge.

b)

Oogonial cells start to proliferate and give rise to functional ova in regular cycles from puberty onwards.

c) Sperms released from seminiferous tubules are highly motile.

d)

Progesterone level is high during the post-ovulatory phase of menstrual cycle

116. Which of the following options is incorrect about the larynx (sound box)?

a) It is a bony box b) Glottis is the opening into the larynx.

c)

During swallowing of food glottis is covered by epiglottis to prevent food entry into the larynx.

d) All of these

Solution : -

Larynx is a cartilaginous box containing nine pieces of cartilages.

117. Competition for light, nutrients and space is most severe between _____ .

a) closely related organisms growing in different niches

b) closely related organisms growing in the same area/ niche

c) distantly related organisms growing in the same habitat

d) distantly related organisms growing in different niches

Solution : -

Niche word was used for the first time by Joseph Grinnel (1917). Niche means functional role of an organism in an ecosystem. Competition becomes most severe between the closely related organisms which share same niche.

118. **Assertion:** Fascicular vascular cambium, interfascicular cambium and cork-cambium are examples of lateral meristems.

Reason : These are responsible for producing the secondary tissues.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

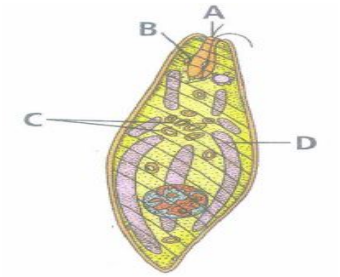
b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

119. Study the given figure showing structure of Euglena and select the option that correctly identifies A, B, C and D.



a)

A	B	C	D
Cytostome	Photoreceptor	Paramylum bodies	Myonemes

b)

A	B	C	D
Contractile vacuole	Photoreceptor	Paramylum bodies	Chloroplast

c)

A	**B**	**C**	**D**
Cytostome	**Stigma**	**Paramylum bodies**	**Chloroplast**

d)

A	B	C	D
Cytostome	Stigma	Myonemes	Chloroplast

Solution : -

The body of Euglena is covered by a plasma membrane followed by periplast or pellicle. At the place of union of the two branches, the flagellum bears a swelling called paraflagellar body (photoreceptor). The posterior end is pointed. The anterior end of the cell is blunt and bears an eccentric cytostome (mouth). At one end of the reservoir, the cytoplasm contains an orange red stigma (eye spot). Pyrenoids (proteinaceous bodies) may be present in the chloroplasts. The endoplasm contains several paramylum bodies.

120. Haploid plant body produces gametes by

a) Mitosis b) Meiosis c) Bothe mitosis and meiosis

d) Usually mitosis but sometimes meisis

121. Which one from those given below is the period for Mendel's hybridisation experiments?

a) 1856-1863 b) 1840-1850 c) 1857-1869 d) 1870-1877

Solution : -

Mendel conducted hybridisation experiments on pea plant for 7 years between 1856 to 1863 and his research data was published in 1865.

22. To which one of the following categories does adipose tissue belong?

a) Epithelial **b) Connective** c) Muscular d) Neural

Solution : -

Adipose tissue is a fat-storing loose connective tissue found subcutaneously, around the heart, kidney, eyeballs, mesenteries, etc.

23. What will happen if ligaments are cut or broken?

a) Bones will move freely at joints b) No movement at joints

c) Bones will become unfix d) Bones will become fixed

Solution : -

Ligaments are fibrous connective tissue that connect one bones to other, hence if they are cut or broken the bone will be come unfixed.

24. **Assertion:** A drop in temperature does not affect spermatogenesis.

Reason: During temperature drop the smooth muscle contracts and bring the testes closer to the pelvic cavity.

a)

If both assertion and reason are true and reason is the correct explanation of assertion.

b)

If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

Solution : -

The normal temperature of the testes in the scrotum is about 2°-2.5°C lower than the internal body temperature. When the body is chilled, the smooth muscle contracts and brings the testes closer to the pelvic cavity. This movement towards the pelvic cavity allows the testes to absorb heat from the rest of the body so that the sperm cells do not become chilled and get optimum temperature for spermatogenesis.

25. Gastric juice of infants contains_____

a) nuclease, pepsinogen, lipase **b) pepsinogen, lipase, rennin**

c) amylase, rennin, pepsinogen d) maltase, pepsinogen, rennin

Solution : -

Pepsinogen, lipase and rennin are found in the gastric juice of infants. pH of gastric juice is ranges from 7.5 to 8.5. Rennin is synthesized by stomach and is a proteolytic enzyme. It is helps in curdling of milk. So, it is secreted in infants because they feed on milk but is absent in adults.

126. Histogens are components of

a) Apical meristem b) Intercalary meristem c) Lateral meristem d) Secondary meristem

127. What is the correct sequence of sperm formation?

a) Spermatogonia, spermatozoa, spermatocyte, spermatid

b) Spermatogonia, spermatocyte, spermatid, spermatozoa

c) Spermatid, spermatocyte, spermatogonia, spermatozoa

d) Spermatogonia, spermatocyte, spermatozoa, spermatid

Solution : -

Fact.

128. RQ of proteins, carbohydrates, fats and organic acids are in order

a) <1,1,<1,>1 b) >1,<1,1,1 c) 1,1,0,-1 d) 0,<1,1,>1.

129. In a healthy adult man, the smallest type of leucocytes are

a) basophils b) monocytes c) eosinophils **d) lymphocytes**

Solution : -

Lymphocytes are the smallest (6-10 nm) leucocytes

130. At which of the given stages of mitosis, chromosomes appear in V. L, J and I shapes.

a) A b) B c) C d) D

Solution : -

In ana phasic movement of chromosomes, the centromeres lead the path while the arms trail behind. As a result the anaphasic chromosomes appear V-, L-, J- and I-shaped. The shapes are formed respectively in metacentric, submetacentric, acrocentric and telocentric chromosomes.

131. DNA ligase is involved in

a) Formation of RNA primer b) Filling of gaps

c) Joining of Okazaki fragments d) Both (1) & (2)

132. Which of the following statements is correct?

a) There are working 'Ecosan' toilets in many areas of Kerala and Sri Lanka.

b)

Municipal solid wastes are wastes from homes, offices, stores, schools, hospitals, etc., that are collected and disposed by the municipality.

c)

In a sanitary landfill, wastes are dumped in a depression or trench after compaction and covered with dirt everyday.

d) All of these

133. Major percentage of India's Gross Domestic Product is constituted by

a) industry **b) agriculture** c) export d) small-scale cottage industry.

134. Leguminous plants are able to fix atmospheric nitrogen through the process of symbiotic nitrogen fixation. Which one of the following statement is not correct during this process of nitrogen fixation?

a) Nodules act as sites for nitrogen fixation

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

c) Nitrogenase is insensitive to oxygen

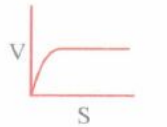
d) Leghaemoglobin scavenges oxygen and pinkish in colour

135. Which of the following graphs shows the relationship between the rate of an enzymatic activity (V) and substrate concentration (S)?

a) 

b) 

c) 

d) 

Solution : -

Increase in substrate concentration increases the rate of reaction due to two factors: (i) occupation of more and more active sites by the substrate molecules; (ii) higher number of collisions between substrate molecules. The rise in velocity is quite high in the beginning but it decreases progressively with the increase in substrate concentration. If a graph is plotted for substrate concentration versus reaction velocity, it appears as a hyperbolic curve. A stage is reached where velocity is maximum. It does not increase further by increasing the substrate concentration. At this stage the enzyme molecule becomes fully saturated and no active site is left free to bind additional substrate molecules.

136. Which of the following are not membrane -bouns :

a) Mesosomes b) Vacuoles **c) Ribosomes** d) Lysosomes

37. _____bacteria oxidise various inorganic substances such as nitrates, nitrites and ammonia and use the released energy for ATP production. They play an important role in recycling of nutrients (N, P, Fe, S etc.).
a) Photosynthetic autotrophic **b) Chemosynthetic autotrophic** c) Parasitic
d) Saprophytic

Solution : -
Chemoautotrophic bacteria or chemosynthetic autotrophic bacteria are able to manufacture their organic food from inorganic raw materials with the help of energy derived from exergonic chemical reactions involving oxidation of an inorganic substance present in the external medium.

38. Which one of the following is the correct matched-pair of an endangered animal and National park?
a) Rhinoceros - Kaziranga National park
b) Wild ass - Dudhwa National park
c) Great Indian - Keoladeo National park bustard
d) Lion - Corbett National park

Solution : -
Kaziranga National Park is situated in Assam. It is famous for protection environmental parks for rhinoceros.

39. Bacillus anthracis causes
a) Rhinderpest b) Tick fever **c) Anthrax** d) Diarrhoea

40. Which of the following diseases is due to an allergic reaction?
a) Goitre **b) Hay fever** c) Skin cancer d) Enteric fever

Solution : -
Allergy also known as hypersensitivity, is an inappropriate over-reaction of the immune system. Hay fever is an allergic reaction, antigens for such response are pollens grains, dust and SPM in the polluted air.
Symptoms of hay fever includes closure of bronchial tubes that results in difficulty in normal breathing, skin rashes and eosinophilia.

41. Presence of E.coli in water indicates
a) Water is clear b) Water is fully polluted c) Inorganic pollution
d) Faecal pollution

42. Purine bases of DNA are-
a) U & G **b) A & G** c) A % C d) None

43. Which of the following are homologous organs?

a) Wings of birds and locust

b) Wings of birds (sparrow) and pectoral fins of fish

c) Wings of bat and butterfly d) Legs of frog and cockroach

Solution : -

Homologous organs are same in basic structure and origin but they differ in their external appearance and function.

144. Which one of the following is not a characteristic of phylum Annehda ?

a) Ventral nerve cord b) Closed circulatory system c) Segmentation

d) Pseudocoelome

Solution : -

Fact.

145. A moss sperm moves by means of

a) pseudopodia b) cilia **c) flagella** d) any of these

146. The carbon dioxide acceptor in Calvin cyble/C_3 - plants is _____ .

a) Phosphoenoi Pyruvare (PEP) **b) Ribulose 1, 5-Diphosphate (RuDP)**

c) Phosphoglyceric Acid (PGA) d) Ribulose Monophosphate (RMP)

Solution : -

In C_3 - plants, CO_2 combines with ribulose biphosphate (acceptor molecule) in the presence of RuBisCO (RuBP carboxylase) and form two molecules of 3-Phosphoglyceric acid or PGA (first stable product).

147. In the human-induced process called acid precipitation, the main biogeochemical cycles that are altered are the _____ cycles and one effect in lakes is to _____ population of nitrifying bacteria.

a) phosphorus and nitrogen, decrease **b) nitrogen and sulphur, decrease**

c) nitrogen and sulphur, increase d) phosphorus and sulphur, decrease

Solution : -

Acid rain or acid precipitation is rainfall and other forms of precipitation with a pH of less than 5. Acid rain is caused by large scale emission of acidic gases into the atmosphere from thermal power plants, industries and automobiles. The common ones are sulphur dioxide, nitrogen oxides (NO_x), volatile organic carbons (VOCs) and hydrogen chloride. Sulphur dioxide and nitrogen oxides are changed in the atmosphere into sulphuric acid and nitric acid by combining with oxygen and water. When such rain falls on land, it acidifies the soil and water. Nitrifying bacterial populations and thereby densities decrease in acid stressed water and soil.

148. Which of the following statements is incorrect?

a)
Endodermis is impervious to water due to the presence of suberised Casparian strips.

b) Xylem vessels and tracheids, being non-living, are parts of the apoplast

c) Ascent of sap is best explained by root pressure theory.

d) None of these

Solution : -
Cohesion tension theory (Cohesion-tension and transpiration pull theory) explains the ascent of sap best. It was put forward by Dixon and Jolly in 1894. It was further improved by Dixon in 1914. Therefore, the theory is also named after him as Dixon's theory of ascent of sap. Today most of the workers believe in this theory.

49. When we homogenise any tissue in an acid the acid soluble pool represents
a) cytoplasm b) cell membrane c) nucleus d) mitochondria

Solution : -
The acid soluble pool has roughly similar composition as of cytoplasm. Biomolecules with molecular weights in the range of 18 - 800 Daltons come in acid-soluble fraction (with the exception of lipids). Though, the macromolecules from cytoplasm and organelles represent the acid-insoluble fraction.

50. Fetal haemoglobin has X affinity for oxygen than that of mother's haemoglobin during gestation. X is
a) same **b) higher** c) lower d) lower affinity earlier but higher later

Solution : -
Fetal haemoglobin is the main oxygen transport carrier in human fetus during the last seven months of development in the uterus and persists in the newborn until it is about 6 months old. Functionally, fetal haemoglobin has a higher affinity to bind with oxygen molecules than the adult (or maternal) haemoglobin, giving the developing fetus better access to oxygen from the mother's bloodstream.

51. A timber merchant told his customer that log of wood which he was purchasing comes from a 20 years old tree, he told so by inspecting the
a) Diameter of log b) Thickness of the heart wood c) Number of cork layers
d) Annual rings

52. Assertion: Complementary pairing between nucleotides is used to diagnose presence of a specific DNA segment in a mixture.
Reason: DNA probes having radioactive isotopes help to detect DNA by autoradiography.

a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false

d) If both assertion and reason are false

53. **Assertion**: Insulin stimulates glycogenolysis and gluconeogenesis resulting in hyperglycemia.
Reason: Prolonged hyperglycemia leads to complex disorder called diabetes insipidus.
a)
If both assertion and reason are true and reason is the correct explanation of assertion

b)
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false

d) If both assertion and reason are false.

Solution : -
Insulin stimulates conversion of glucose to glycogen (glycogenesis) in the target cells. Prolonged hyperglycemia leads to a complex disorder called diabetes mellitus.

54. Fattyness is due to the excess of:-
a) Connective tissue b) Blood c) Muscular tissue **d) Adipose tissue**

55. Which of the following statements is incorrect about the Class Deuteromycetes?
a) They reproduce only by asexual spores (conidia).
b) Mycelium in these fungi is branched and septate.
c) They have only parasitic forms
d) Examples of these fungi are Alternaria, Colletotrichum, and Trichoderma.

Solution : -
Some members of Class Deuteromycetes are saprophytes or parasites while a larger number of them are decomposers of litter and help in mineral cycling. Some examples are **Colletotrichum** and **Trichoderma**.

156. Montreal protocol which calls for appropriate action to protect the ozone layer from human activities was passed in the year _____.

a) 1987 b) 1988 c) 1985 d) 1986

Solution : -

Montreal protocol which calls for appropriate action (like less production of ozone-depleting substances called ODS such as CFCs) to protect the ozone layer was passed by a forum of 27 industrialized countries on 16 September 1987. Till now 175 countries have joined this.

157. Methanogens, growing anaerobically on cellulosic material produce

a) methane b) methane and carbon dioxide c) methane and hydrogen

d) methane, carbon dioxide and hydrogen

158. Diphtheria is caused by _____

a) poisons released by living bacterial cells into the host tissue

b) poisons released from dead bacterial cells into the host tissue

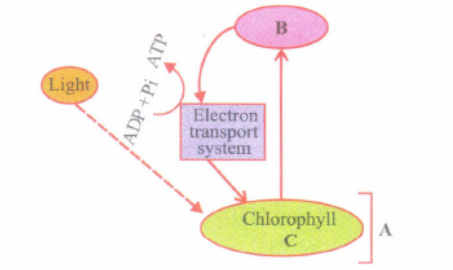
c) poisons released by virus into the host tissues

d) excessive immune response by the host's body

Solution : -

Toxins released from Corynebacterium diphtheriae cause diphtheria, Actually, bacterial cells do not contain gene for toxin production, i.e, a phage carries the gene for it. Only those lysogenised cell of C. diphtheriae which carry 3-phage, can produce the toxin and cause diphtheria.

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



a)

A	B	C
PS II	Cytochrome	P 680

b)

A	B	C
PS I	e- acceptor	P 680

c)

A	**B**	**C**
PS I	**e- acceptor**	**P 700**

d)

A	B	C
PS II	Cytochrome	P 700

160. Anoxygenic photosynthesis is characteristic of____

a) Rhodospirillum b) Spirogyra c) Chlamydomonas d) Ulva

Solution : -

Anoxygenic photosynthesis is characteristic of Rhodospirillum. It is a purple non-sulphur bacteria. In this type of photosynthesis O_2 is not released

161. In Chlorophyceae, sexual reproduction occurs by _____ .

a) isogamy and anisogamy **b) isogamy, anisogamy and oogamy**

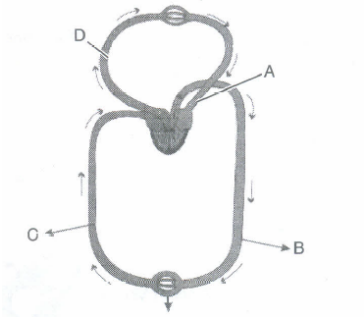
c) oogamy only d) anisogamy and oogamy

Solution : -

(i) In Chlorophyceae, three types of sexual reproduction occurs, i.e. isogamy, anisogamy and oogamy. Isogamy involves the fusion of those gametes which are similar in size, shape and structure, e.g. Chktmydomonos debaryana.

(ii) In anisogamy gametes differ morphologically and also behave differently, e.g. Chlamydomonas braunii. In oogamy, fusion between motile and non-motile gametes takes place, e.g. Chlamydomonas coccifera.

162. The figure shows the schematic plan of blood circulation in humans with labels A, B, C and D. Choose the correct option labelled with its functions.



a) A - pulmonary vein - takes impure blood from body parts, pO_2 = 60 mm Hg

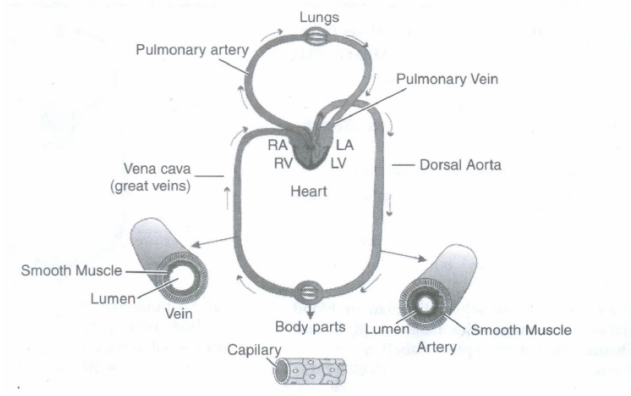
b) B- pulmonary artery - takes blood from heart to lungs, pO_2 = 90 mm Hg

c)

C - vena cava - takes blood from body parts to right auride, pCO_2 = 45 mm Hg

d) D - dorsal aorta - takes blood from heart to body parts, pO_2 = 95 mm Hg

Solution : -



63. In biolistic method of gene transfer, the microparticles coated with foreign DNA are bombarded into target cells at a very high velocity. These microparticies are made up of:

a) silver or tungsten b) arsenic or silver **c) gold or tungsten**

d) none of these

Solution : -

Biolistic method or gene gun method is a direct or vectorless method of introducing DNA into cells that involves bombardment of cells with high-velocity microprojectiles coated with DNA. In biolistic method, tungsten or gold particles, coated with foreign DNA are bombarded into target at a very high velocity.

64. Life span could be 60 years in all of the following, except

a) Dog b) Horse c) Elephant d) Crocodile

65. Specialised epidermal cells surrounding the guard cells are called:

a) Lenticels b) Complimentary cells **c) Subsidiary cells** d) Bulliform cells

Solution : -

The guard cells are surrounded by some cells that are quite distinct from other epidermal cells. These are called subsidiary or accessory cells.

66. How do you differentiate a butterfly from a moth?

a) Moth has feathery antennae but butterfly has club shaped antennae

b) Moth has one pair of wings but butterfly has two pairs of wings.

c) Moth is diurnal but butterfly is nocturnal.

d) Moth has simple eyes but butterfly has compound eyes.

Solution : -

Moth has short and feather like antennae while butterfly has long, filamentous and club-shaped antennae.

67. Development of male gametophyte is

a) Both b) In-vitro c) Invivo d) Insitu

68. The factors which include the form, surface and behaviour of the earth with special reference to slopes, mountains, valleys etc. are called

a) Edaphic factor b) Biotic factors c) Climatic factors

d) Topographic factors

69. Read the given statements and select the correct option.

Statement 1: The process of diffusion does not require any input of energy.

Statement 2: Diffusion involves movement of particles from a region of higher concentration to a region of lower concentration.

a) Both statements 1 and 2 are correct

b) Statement 1 is correct but statement 2 is incorrect

c) Statement 1 is incorrect but statement 2 is correct.

d) Both statements 1 and 2 are incorrect

170. Which one of the following is not a micronutrient?

a) Molybdenum **b) Magnesium** c) Zinc d) Boron

Solution : -

Magnesium is not a micronutrient. The elements which are required in less quantity by plants are called micronutrients e.g. Zn, Mn, B, Cu etc. The elements which are required in large amount by plants for growth and development is called macro-nutrients e.g. C, H, O, N, P, K etc.

171. Biogas consists of :

a) Carbon monoxide, methane and hydrogen

b) Carbon dioxide, methane and hydrogen

c) Carbon monoxide, ethane and hydrogen

d) Carbon dioxide, ethane and hydrogen

172. Which of the following statements are true for the phylum - chordata?

(a) In urochordata notochord extends from head to tail and it is present throughout their life.

(b) In Vertebrata notochord is present during the embryonic period only.

(c) Central nervous system is dorsal and hollow.

(d) Chordata is divided into 3 subphyla: Hemichordata, Tunicata and Cephalochordata.

a) (a) and (b) **b) (b) and (c)** c) (d) and (c) d) (c) and (a)

Solution : -

(a) In Urochordata, notochord is present only in larval tail, while in Cephalochordata, it extends from head to tail region and is persistent throughout their life.

(b) Vertebrata possess notochord during the embryonic period. The notochord is replaced by a cartilaginous or bony vertebral column in the adult.

(C)S.No	**Chordates**	**Non-chordates**
1.	Notochord present	Notochord absent.
2.	Central nervous system is dorsal, hollow and single	Central nervous system is ventral, solid land double.

3.	Pharynx perforated by gill slits.	Gill slits are absent
4.	Heart is ventral.	Heart is dorsal (if present)
5.	A post-anal part (tail) is present.	Post-anal tail is absent

(d) Phylum Chordata is divided into three subphyla: Urochordata or Tunicata, Cephalochordata and Vertebrata.

173. A child of blood group O cannot have parents of blood groups _____ .

a) AB and AB/O b) A and B c) B and B d) O and O

Solution : -

Blood group of the child is determined by allelic genes, i.e. I^AI^B and I^O in which I^A and I^B are dominant over I^O, so if one of the parent either mother or father is of blood group AB, then she or he will have both genes, i.e, I^A and I^B and child of such parent cannot have blood group O.

174. Kyoto Protocol was endorsed at _____.

a) Cop-5 b) Cop-6 c) Cop-4 **d) Cop-3**

Solution : -

Kyoto protocol was endorsed at Cop-3. It was held at Kyoto, Japan in 1997. The developed nations agreed to specific targets to decrease the emissions of green house gases. This is known as Kyoto-protocol.

175. Acsute vision is present in _____

a) vulture b) shark c) bat d) frog

Solution : -

Acute vision is found in birds like vulture.

176. Osteoporosis is an age-related disease of skeletal system may occur due to the:

a) Immune disorder affecting neuromuscular junction leading to fatigue

b) High concentration of Ca++ and Na + **c) Decreased level of oestrogen**

d) Accumulation of uric acid leading to inflammation of joints

Solution : -

Age-related disorder characterised by decreased bone mass and increased chances of fractures. The decrease in the levels of estrogen is a common cause

177. Double fertilization involves

a) Fertilization of the egg by two male gametes

b)

Fertilization of two eggs in the same embryosac by two sperms brought by one pollen tube

c)

Fertilization of the egg and the central cell by two sperms brought by different pollen tubes

d)

Fertilization of the egg and the central cell by two sperms brought by the same pollen tube

178. Study the following statements regarding lactic acid bacteria (LAB) which are used to convert milk into curd

(i) They produce acids that coagulate and partially digest the milk proteins.

(ii) A small amount of curd added to the fresh milk as an inoculum contains millions of LAB, which at suitable temperature, multiply and convert milk into curd.

(iii) Conversion of milk into curd improves its nutritional quality by increasing vitamin B12.

(iv) LAB may result in acidity in the stomach of human beings.

Which of the given statements are correct?

a) (i) and (ii) b) (ii) and (iii) **c) (i), (ii) and (iii)** d) (i), (ii), (iii) and (iv)

Solution : -

Microbes such as Lactobacillus and others commonly called lactic acid bacteria (LAB) grow in milk and convert it into curd. During growth, such bacteria produce acids (mainly lactic acid) that coagulate and partially digest the milk proteins. A small amount of curd, known as starter, is added to the milk and kept at suitable temperature, where lactic acid bacteria multiply in millions and converts milk into curd that also improves its nutritional quality by increasing vitamin B_{12} . It also check growth of disease causing microbes in the stomach.

179. High milk yielding varieties of cows are obtained by _____.

a) superovulation b) artificial insemination c) use of surrogate mother

d) All of the above

Solution : -

In superovulation, a high milk yielding cow is induced to shed 4-6 eggs every 6-8 weeks (instead of 20-21 days). The superovulated donor is artificially inseminated with semen from a quality bull, the embryos developing from the

eggs so fertilised are flushed out. These good quality embryos are now transferred to surrogate mother for delivery.

180. Alfred Wallace worked in

a) Galapagos Island b) Australian Island Continent **c) Malay Archipelago**

d) none of these

Solution : -

Alfred Wallace worked in Malay Archipelago. He came to similar conclusions around the same time as Darwin.

181. Consider the following three statements and select the correct option stating which ones are true (T) and which ones are false (F).

(i) Hybridisation is crossing of two or more types of plants for bringing their traits together in progeny.

(ii) Semi-dwarf rice varieties were derived from IR-8 and Taichung Native -1.

(iii) Hybrid breeding have led to the development of several high yielding varieties resistant to water stress.

a)

(i)	(ii)	(iii)
F	T	T

b)

(i)	(ii)	(iii)
T	T	F

c)

(i)	(ii)	(iii)
F	T	F

d)

(i)	**(ii)**	**(iii)**
T	**T**	**T**

182. Viruses are non-cellular organisms but replicate themselves once they infect the host cell. To which of the following kingdom do viruses belong to?

a) Monera b) Protista c) Fungi **d) None of these**

Solution : -

Virus is a group of ultramicroscopic, non-cellular, highly infectious agents that multiply only intracellularly inside living host cells without involving growth and division. Viruses are regarded as intermediate between non-living entities and living organisms. It is very difficult to ascertain whether they are living or non-living. They do not belong to any kingdom.

183. Fruit shape in shephered's purse (Capsella bursa) is of two types-triangular and top-shaped. Triangular fruit shape (T) is dominant over top-shape (t). Following table summarises the results of several crosses.

Cross	**Result**
Strain 1 $\times$ tt	All triangular
Strain 2 $\times$ tt	1 triangular: 1 top-shaped
Strain 3 $\times$ tt	All top-shaped
Strain 4 $\times$ Tt	3 triangular: 1 top-shaped

Which pair of strains possess the genotype Tt?

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

184. At what phase of meiosis there are two cells, each with separated sister chromatids that have been moved to opposite spindle poles?
a) Anaphase II b) Anaphase I c) Telophase II d) Telophase I

Solution : -

Anaphase II, where the centromeres are cleaved, allows the kinetochores to pull the sister chromatids apart. The sister chromatids by convention are now called sister chromosomes and they are pulled towards opposite poles.

185. In Anaphase - I each chromosome composed of
a) One chromatid **b) Two chromatid** c) Four chromatid d) Many chromatid

186. Which of the following factors is not favourable for the formation of oxyhaemoglobin?
a) High PO_2 b) Low temperature c) Less H^+ concentration **d) High PCO_2**

Solution : -

Low PCO_2 favours the formation of oxyhaemoglobin.

187. **Assertion :** The sugar phosphate backbone of two chains in DNA double helix show anti-parallel polarity.
Reason: The phosphodiester bonds in one strand go from a 3' carbon of one nucleotide to a 5' carbon of adjacent nucleotide, whereas those in complementary strand go vice versa.
a)
If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and reasonare true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false.
d) If both assertion and reasonare false

Solution : -

The backbone of a DNA chain or strand is built up of alternate deoxyribose sugar and phosphate groups. The phosphate group is connected to carbon 5' of the sugar residue of its own nucleotide and carbon 3' of the sugar residue of the next nucleotide by (3' $\longrightarrow$ 5') phosphodiester bonds. The two DNA chains are antiparallel, that is, they run parallel but in opposite directions. In one chain the direction is 5' $\longrightarrow$ 3', while in the opposite one, it is 3' $\longrightarrow$ 5'.

88. The possibility of a female becoming haemophilic is extremely rare because mother of such a female has to be at least _(i)_and father should be _(ii)_.
a) (i) haemophilic, (ii) carrier **b) (i) carrier, (ii) haemophilic**
c) (i) haemophilic, (ii) normal d) (i) haemophilic, (ii) haemophilic

Solution : -
Haemophilia is genetically due to the presence of a recessive sex linked gene h. carried by X-chromosome. A female becomes haemophilic only when both its X-chromosomes carry the gene (X^hX^h). However, such females generally die before birth because the combination of these two recessive alleles is lethal. A female having only one allele for haemophilia (XX^h) appears normal because the allele for normal blood clotting present on the other X-chromosome is dominant. Such females are known as carriers. In case of males, a single gene for the defect is able to express itself as the V-chromosome is devoid of any corresponding allele (X^hY). The possibility of human female becoming haemophilic is extremely rare because she has to be homozygous recessive for the trait, i.e., her father must be a haemophilic and mother must be atleast a carrier.

89. The members of a homologous pair of chromosomes
a) are identical in size and appearance
b) contain identical genetic information
c) separate and move to opposite poles of the cell during mitosis
d) are found only in haploid cells

Solution : -
Homologous chromosomes are chromosomes having same structural features. In diploid nuclei, pairs of homologous chromosomes can be identified at the start of meiosis. One member of each pair comes from the female parent and other from the male parent. Homologous chromosomes have the same pattern of genes along the chromosome but the nature of the genes may differ

90. **Assertion:** The Henle's loop and vasa recta play a significant role in producing a concentrated urine.
Reason: The counter current arrangement of Henle's loop and vasa recta helps in this.

a)
If both assertion and reason are true and reason is the correct explanation of assertion.

b)
If both assertion and reason are true but reason is not the correct explanation of assertion

c) If assertion is true but reason is false.

d) If both assertion and reason are false.

Solution : -
Mammals have the ability to produce concentrated urine. The Henle's loop and vasa recta play a significant role in this. The flow of filtrate in the two limbs of Henle's loop is in opposite directions and thus forms a counter current. The flow of blood through the two limbs of vasa recta is also in a counter current pattern. The proximity between the Henle's loop and vas recta, as well as the counter current in them help in maintaining an increasing osmolarity towards the inner medullary interstitium. Presence of such interstitial gradient helps in an easy passage of water from the collecting tubule thereby concentrating the filtrate (urine). Human kidneys can produce urine nearly four times concentrated than the initial filtrate formed.

91. Which one of the following does not differ in E.coli and Chlamydomonas?
a) Cell wall **b) Cella membrane** c) Ribosomes
d) Chromosomal organization

92. Double helix model of DNA
a) Was given by Watson and Crick b) Suggests '3D' structure
c) Was given for B-DNA **d) All of these**

93. In Arthropoda, head and thorax are often fused to form cephalothorax, but in which one of the following classes, is the body divided into head, thorax and abdomen?
a) Insecta b) Myriapoda c) Crustacea d) Arachnida and Crustacea

Solution : -
In arachnids body is divided into prothorax, mesothorax and metathorax. In insects, there is a distinct division into head, thorax and abdomen. In crustaceans and myriapods head and thorax are fused.

94. Rate of polyrnerlsatlon by DNA polymerase III per second is
a) 1000 bp b) 200 bp **c) 2000 bp** d) 4000 bp

95. One of the possible early sources of energy was/were

a) CO_2 b) chlorophyll **c) green plants** **d) UV rays and lightning.**

Solution : -

The energy requiring synthetic processes, that occurred on primitive earth obtained energy from the sun, violent electric discharges like lightning, heat produced from volcanic eruptions and ionizing radiations like X-rays, etc.

196. Polyribosomes are aggregation of:

a) ribosomes and rRNA b) peroxisomes

c) several ribosomes held together by a string of mRNA d) rRNA

Solution : -

Ribosomes may occur singly as monosomes or in rosettes and helical groups called polyribosomes. The different ribosomes are connected with a 10- 20A thick strand of mRNA. They are formed during periods of active protein synthesis when a number of copies of the same polypeptide are required.

197. Annual rings are the bands of

a) Secondary cortex and cork b) All secondary xylem is located

c) Secondary xylem and xylem rays

d) Secondary phloem and medullary rays

198. Death of protoplasm is a prerequisite for a vital function like _____ .

a) Transport of sap b) Transport of food c) Absorption of water

d) Gaseous exchange

Solution : -

Certain cells get lignified, leading to death of protoplasm such as xylem cells. Xylem cells are dead, i.e. devoid of protoplasm, and performs the function of conducting water or sap inside the plant.

199. Which of the following is true for nucleolus?

a) It takes part in spindle formation. b) It is a membrane-bound structure.

c) Larger nucleoli are present in dividing cells.

d) It is a site for active ribosomal RNA synthesis.

Solution : -

Nucleolus is a site for active Ribosomal RNA (rRNA) synthesis. Located within the nucleus, it is not surrounded by any membrane and its content are in direct contact with the nucleoplasm. Microtubules take parts in spindle formation. Mitochondria, vacuoles and plastids etc, are membrane bound structures. Dividing cells posses a large number of mitochondria and large nucleus.

200. In the zoological name of fish Catla catla, the specific name is identical with the generic name, thus it is an example of

a) antonym **b) tautonym** c) synonym d) homonym

Solution : -

Tautonyms are the scientific names in which both generic and specific epithets are same. Tautonyms are used in zoological nomenclature. However, in the current rules for nomenclature of living organisms, tautonyms are explicitly prohibited. Examples of tautonyms are Rattus rattus (Rat), Catla catla (Catla), Gorilla gorilla (Western gorilla), etc.