RAVI MATHS TUITION CENTRE , WHATSAPP - 8056206308

Time : 300 Mins **NOVEMBER PORTION COMBINED TEST 4 1** **Marks : 1029**

1. Solar constant may be defined as the amount of solar energy received per em 2 per minute. The dimensions of solar constant is:
   a) [ML ^{2}T^{-3}] b) [ML^{0}T^{-1}] c) [ML^{0}T^{-2}] **d) [M^{1}L^{0}T^{-3}]**

   Solution : -

   $$Solar\ constant,\ S = \frac{sloar\ energy}{area \times time} = \frac{[ML^2T^{-2}]}{[L^2][T]} = \left[M^1L^0T^{-3}\right].$$

2. Assertion: The number 1.202 has four significant figures and the number 0.0024 has two significant figures.
   Reason: All the non zero digits are significant.
   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

3. The dimensional formula of Young's modulus is:
   a) [ML^{2}T^{-2}] **b) [ML^{-1}T^{-2}]** c) [MLT^{-3}] d) none of these

4. The least count of a stop watch is 0.1 sec. The time of 20 oscillations of the pendulum is found to be 20 sec. The percentage error in the time period is:
   a) 0.25% **b) 0.5%** c) 0.75% d) 1.0%

   Solution : -

   $\gamma = \frac{20 \quad sec}{20} = 1 \quad sec$
   $\Delta T = \frac{0.1}{20} = 0.005 \quad sec$
   $\frac{\Delta T}{T} = \frac{0.005}{1} = 0.005 \times 100\%$=0.5%.

5. Macroscopic forces are:
   a) surface tension of a liquid b) viscous force c) contact force between bodies **d) all of the above**

   Solution : -
   In the macroscopic world, besides the gravitational force, we come across various other types of forces, e.g., contact force between bodies, frictional force, the forces exerted by compressed or elongated spring, the buoyant force and viscous force (when solids are in contact with fluids).

6. Classical physics is applicable to
   a) microscopic world **b) macroscopic world** c) both microscopic and macroscopic world d) cannot say

   Solution : -
   Classical physics is applicable to macroscopic world.

7. The respective number of significant figures for the numbers 6.320, 6.032, 0.0006032 are
   a) 3,4,8 b) 4,4,8 **c) 4,4,4** d) 4,3,4

   Solution : -
   According to the rules of significant figures 6.320 has four significant figures.

8. The mass and volume of a body are 4.237 g and 2.5 cm, respectively. The density of the material of the body in correct significant figures is
   a) 1.6948g cm^{-3} b) 1.69g cm^{-3} **c) 1.7 g cm^{-3}** d) 1.695 g cm^{-3}

   Solution : -

Here, mass, m = 4.237 g
Volume, V = 2.5 cm^3
Density, p= $\frac{Mass}{Volume} = \frac{4.237g}{2.5cm^3} = 1.6948gcm^{-3}$
As mass has 4 significant figures and volume has 2 significant figures, therefore, as per rule, density will have only two significant figures. Rounding off to two significant figures, we get, p = 1.7 g cm^{-3}

9. If air resistance is not considered in projectiles, the horizontal motion takes place with:
a) constant velocity b) constant acceleration c) constant retardation d) variable velocity

Solution : -
In the absence of air resistance, the projectile moves with constant horizontal velocity because acceleration due to gravity is totally vertical.

10. Which of the following is a one dimensional motion?
a) Landing of an aircraft b) Earth revolving around the sun c) Motion of wheels of a moving train
d) Train running on a straight track

Solution : -
From the above options :
Landing of an aircrafts $\rightarrow$ 3 dimensional motion
Earth revolving around sun $\rightarrow$ 2 dimensional motion
Motion of wheels $\rightarrow$ 2 dimensional motion
Train running an straight track $\rightarrow$ 1 dimensional motion

11. A stone is thrown at an angle θ to the horizontal reaches a maximum height H. Then the time of flight of stone will be:
a) $\sqrt{\frac{2H}{g}}$ **b) 2** $\sqrt{\frac{2H}{g}}$ c) $\frac{2\sqrt{2Hsin\theta}}{g}$ d) $\frac{\sqrt{2Hsin\theta}}{g}$

Solution : -
$H = \frac{u^2 sin^2\theta}{g}$ and $T = \frac{2usin\theta}{g}$ or $T^2 = \frac{4u^2 sin^2\theta}{g^2}$
$\therefore \frac{T^2}{g} = \left(\frac{2usin\theta}{g}\right)^2 \times \frac{2g}{u^2 sin^2\theta} = \frac{8}{g}$
or $T^2 = \frac{8H}{g}$
$\therefore$ T = $2\sqrt{\frac{2H}{g}}$

12. If $Z = \frac{A^4 B^{1/3}}{CD^{3/2}}$ and ΔA, ΔB, ΔC, and ΔD are their absolute errors in A, B, C and D respectively. The relative error in Z is :
a) $\frac{\Delta Z}{Z} = 4\frac{\Delta A}{A} + \frac{1}{3}\frac{\Delta B}{B} + \frac{\Delta C}{C} + \frac{3}{2}\frac{\Delta D}{D}$ b) $\frac{\Delta Z}{Z} = 4\frac{\Delta A}{A} + \frac{1}{3}\frac{\Delta B}{B} - \frac{\Delta C}{C} - \frac{3}{2}\frac{\Delta D}{D}$
c) $\frac{\Delta Z}{Z} = 4\frac{\Delta A}{A} + \frac{1}{3}\frac{\Delta B}{B} + \frac{\Delta C}{C} - \frac{3}{2}\frac{\Delta D}{D}$ d) $\frac{\Delta Z}{Z} = 4\frac{\Delta A}{A} + \frac{1}{3}\frac{\Delta B}{B} - \frac{\Delta C}{C} + \frac{3}{2}\frac{\Delta D}{D}$

13. A ball thrown by one player reaches the other in 2 sec. The maximum height attained by the ball above the point of projection will be about:
a) 2.5 m **b) 5 m** c) 7.5 m d) 10 m

Solution : -
$= \frac{2usin2\theta}{g} or \quad 2 = \frac{2u \quad sin2\theta}{g}$
$\therefore \quad u \quad sin\theta = g$
$\therefore \quad h_m = \frac{u^2 sin^2\theta}{2g} = \frac{g^2}{2g} = \frac{g}{2} = 5m.$

14. The unit vector along $\hat{i} + j$ is:
a) $\hat{k}$ b) $\hat{i} + j$ **c)** $\frac{\hat{i}+j}{\sqrt{2}}$ d) $\frac{\hat{i}+j}{2}$

Solution : -
$\hat{A} = \frac{\vec{A}}{|\vec{A}} = \frac{\hat{i}+\hat{j}}{\sqrt{1+1}} = \frac{\hat{i}+j}{\sqrt{2}}$

15. A particle moves rectilinearly. Its displacement x at time t is given by $x^2 = at^2 + b$ where a and b are constants. Its acceleration at time t is proportional to

a) $\frac{1}{x^3}$ b) $\frac{1}{x} - \frac{1}{x^2}$ c) $-\frac{1}{x^2}$ d) $\frac{1}{x} - \frac{t^2}{x^3}$

16. A new system of units is proposed in which unit of mass is α kg, unit of length is β m and unit of time is γ s. What will be value of 5 J in this new system?

a) $5\alpha\beta^2\gamma^{-2}$ **b)** $\mathbf{5\alpha^{-1}\beta^{-2}\gamma^2}$ c) $5\alpha^{-2}\beta^{-1}\gamma^{-2}$ d) $5\alpha^{-1}\beta^2\gamma^2$

17. The moment of inertia of a body about a given axis is 1.2 kg x m^2. Initially, the body is at rest. In order to produce a rotational KE of 1500 joule, an angular acceleration of 25 rad/sec^2 must be applied about that axis for a duration of:

a) 4 s **b) 2 s** c) 8 s d) 10 s

Solution : -

$$K_R = \frac{1}{2}I\omega^2 = \frac{1}{2}I(\alpha t)^2 = \frac{1}{2}L\alpha^2 t^2$$

$$1500 = \frac{1}{2} \times 1.2 \times (25)^2 t^2$$

or $t^2 = 4$ or t = 2s.

18. A block of mass 1 kg lies on a horizontal surface in a truck. The coefficient of static friction between the block and the surface is 0.6. If the acceleration of the truck is 5 m S^{-2}. The frictional force acting on the block is

a) 10 N **b) 5 N** c) 2.5 N d) 20 N

Solution : -

Limiting friction f = μmg = 0.6 x 1 x 9.8

= 5.88 N

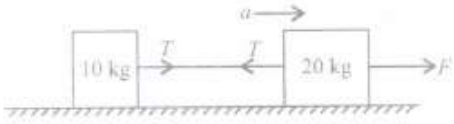
Applied force, F = ma = 1 x 5 = 5 N

As F

19. In the question number 91, if a force F is applied to 20 kg block, then the tension in the string is

a) 100 N **b) 200 N** c) 300 N d) 400 N

Solution : -

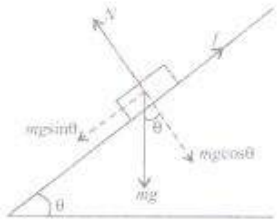


When a force F is applied on 20 kg block, then the tension in string is $T = m_1 a$ = (10 kg) (20 m s^{-1}) = 200 N

20. A block of mass m rests on a rough inclined plane. The coefficient of friction between the surface and the block is μ. At what angle of inclination θ of the plane to the horizontal will the block just start to slide down the plane?

a) $\mathbf{\theta = \tan^{-1}\mu}$ b) $\theta = \cos^{-1}\mu$ c) $\theta = \sin^{-1}\mu$ d) $\theta = \sec^{-1}\mu$

Solution : -



The various forces acting on the block are as shown in the figure.

From figure

mg sinθ = f .....(i)

mg cosθ = N .....(ii)

Divide (i) by (ii), we get

$\tan\theta = \frac{f}{N} = \frac{\mu N}{N}$ or θ =tan-1(μ)

21. For the same total mass which of the following will have the largest moment of inertia about an axis passing through the centre of gravity and perpendicular to the plane of the body?

a) A disc of radius a b) A ring of radius a c) A square lamina of side 2a

d) Four rods forming square of side 2a

Solution : -

$I_{disc} = \frac{Ma^2}{2}$

$I_{ring} = Ma^2$

$I_{square\ lamina} = M\left[\frac{l^2+b^2}{12}\right] = \frac{M(a^2+a^2)}{12} = \frac{Ma^2}{6}$

$I_{fourrods} = M\left[\frac{a^2}{12} + M\left(\frac{a}{2}\right)^2\right] \times 4 = 4\left(\frac{Ma^2}{3}\right)$

Thus, $I_{fourrods}$ is the largest.

22. A grindstone has a moment of inertia of 6 kg m2. A constant torque is applied and the grindstone is found to have a speed of 150 rpm, 10 seconds after starting from rest. The torque is :

a) 3π N m b) 3 N m c) $\frac{\pi}{3}$ N m d) 4π N m

Solution : -

Here, 1= 6 kg m^2, t = 10 s, ω_0= 0

$\upsilon = 150\ \text{rpm} = \frac{150}{60}\ \text{rps} = \frac{5}{2}\ \text{rps}$

$\omega = 2\pi\upsilon = 2\pi \times \frac{5}{2} = 5\pi\ \text{rad s}^{-1}$

$\alpha = \frac{\omega-\omega_0}{t} = \frac{5\pi-0}{10} = \frac{\pi}{2}\ \text{rad s}^{-2}$

$\therefore\ \text{Torque}, \tau = I\alpha = 6 \times \frac{\pi}{2} = 3\pi\ \text{N m}$

23. Two racing cars of masses $m_1$and m_2 are moving in circles of radii r_1 and r_2 respectively. Their speeds are such thateach makes complete circles of radii r_1 and r_2 respectively. Their speeds are such that each makes a complete circle in the same time t. The ratio of the angular speeds of the first to the second car is:

a) 1 : 1 b) $m_1 : m_2$ c) $r_1 : r_2$ d) $m_1 m_2 : r_1 r_2$

24. An aircraft executes a horizontal loop at a speed of 720 km h^{-i} with its wings banked at 15°. What is the radius of the loop?

(Take g = 10 m S^{-2}, tan 15° = 0.27)

a) 14.8 km b) 14.8 m c) 29.6 km d) 29.6 m

Solution : -

Here,

v = 720 km h^{-1} = 720 x $\frac{5}{18}$ms-2 = 200 ms^{-1}

θ= 15°, g = 10 m S^{-2} As tan$\theta\frac{v^2}{rg}$

$\therefore r = \frac{v^2}{tan\theta g} = \frac{(200ms^{-1})^2}{tan15^0 \times 10ms^{-2}}$ = 14815 m = 14.8 km

25. A body is initially at rest. It undergoes one dimensional motion with constant acceleration. The power delivered to it at time *t* is proportional to

a) $t^{1/2}$ **b) *t*** c) $t^{3/2}$ d) t^2

Solution : -

Using v = U + at

$\therefore$ v = at ($\because$ *u* = 0)

As power, P = F x v $\therefore$ P= (ma) x *at*= ma^2t

As m and a are constants, $\therefore$ p $\propto$ t

26. The potential difference that must be applied to stop the fastest photoelectrons emitted by a nickel surface, having work function 5.01 eV, when ultraviolet light of 200 nm falls on it, must be_____

a) 24V b) -1.2V c) -2.4V **d) 1.2V**

Solution : -

$K_{\max} = \frac{hc}{\lambda} - W = \frac{hc}{\lambda} - 5.01$

$= \frac{12375}{\lambda(\text{ in })} - 5.01$

$= \frac{12375}{2000} - 5.01 = 6.1875 - 05.01$

$= 1.17775$

$= 1.2\ \text{V}$

27. Two men with weights in the ratio 4 : 3 run up a staircase in time in the ratio 12 : 11. The ratio of power of the first to that of second is

a) $\frac{4}{3}$ b) $\frac{12}{11}$ c) $\frac{48}{33}$ **d)** $\frac{11}{9}$

Solution : -

$\frac{Work}{time} = \frac{energy}{time} = \frac{mgh}{t} = \frac{Wh}{t}$

(W = weight)

$\therefore \frac{P_1}{P_2} = \frac{W_1}{W_2}\frac{t_2}{t_1} = \frac{4}{3} \times \frac{11}{12} = \frac{11}{9}$

28. 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.

29. A ball loses 15.0% of its kinetic energy when it bounces back from a concrete wall. With what speed you must throw it vertically down from a height of 12.4 m to have it bounce back to the same height? (ignore air resistance)

a) 6.55 m/s b) 12.0 m/s c) 8.6 m/s d) 4.55 m/s

Solution : -

Given: h = 12.4, V = ?

$v^2 = u^2 + 2gh$

$v^2 = u^2 + 2 \times 9 . 8 \times 12 . 4$

$= u^2 + 243.04$

Kinetic energy of the ball when it just hits the wall

$= \frac{1}{2}mv^2 = \frac{1}{2}m\left(u^2 + 243.04\right)$

The KE of ball after the impact

$= \frac{(100 - 15)}{100} \times \frac{1}{2}m\left(u^2 + 243.04\right)$

$= \frac{85}{100} \times \frac{1}{2}m\left(u^2 + 243.04\right)$

Let v_2 be the upward velocity just after the collision with the ground.

So, $\frac{1}{2}mv_2^2 = \frac{85}{100} \times \frac{1}{2}m\left(u^2 + 243.04\right)$

$v_2^2 = \frac{85}{100}\left(u^2 + 243.04\right)$

Now, taking upward motion

$v = 0, u = v_2$

$v^2 = u^2 - 2gh$

$= \frac{85}{100}\left(u^2 + 243.04\right) - 2 \times 9.8 \times 12.4$

or $\frac{85}{100}u^2 = 36.46$ or $u^2 = 12.89$

$\therefore$ u = 6.55 m/s

30. 1 kilowatt hour (kWh) is equal to :

a) 2.25×10^{23}eV **b) 2.25×10^{25}eV** c) 2.25×10^{27}eV d) 2.25×10^{22}eV

Solution : -

1 kilowatt hour (kWh) = (10^3 W) x (3600 s)

= 3.6 x 10^6 J = $\frac{3.6\times10^6}{1.6\times10^{-19}}$ eV ($\because$ 1 eV = 1.6 x 10^{-19} J)

= 2.25 x 10^{25}eV

31. Electrons of mass m with de-Broglie wavelength 1fall on the target in an X-ray tube. The cut-off wavelength (I_o) of the emitted X-ray is _____

a) $\lambda_0 = \frac{2mc\lambda^2}{h}$ b) $\lambda_0 = \frac{2h}{md}$ c) $\lambda_0 = \frac{2m^2c^2\lambda^2}{h^2}$ d) $\lambda_0 = \lambda$

Solution : -

When in collision the incoming electron losses its entire energy the cut-off wavelength takes place. This energy wave find in the form of x-axis.

Mass of electrons = m

de-Broglie wavelength = 1

Thus, kinetic energy of electron

$= \frac{\rho 2}{2\,\mathrm{m}}$

$= \frac{\left(\frac{h}{\lambda}\right)^2}{2m} = \frac{h^2}{2m\lambda^2}$

Now maximum energy of photon can be given by

$E = \frac{hc}{\lambda_0} = \frac{h^2}{2m\lambda^2}$

$\Rightarrow \lambda_0 = \frac{hc\times2\lambda^2\cdot m}{h^2}$

$= \frac{2mc\lambda^2}{h}$

32. In a shotput event an athlete throws the shotput of mass 20 kg with an initial speed of 2 m S^{-1}at 45° from a height 3 m above ground. Assuming air resistance to be negligible and acceleration due to gravity to be 10 m S^{-2}, the kinetic energy of the shotput when it just reaches the ground will be :

a) 2.5 J b) 5 J c) 525 J **d) 640 J**

Solution : -

Using law of energy conservation,

$(TME)_i = (TME)_f \Rightarrow U_i + Ki = U_f + K_f$

$\Rightarrow$ 20 x 10 x 3 + $\frac{1}{2}$ x 20 x 2^2 = 0 + $K_f \Rightarrow K_f$ = 640 J

33. Two solids A and B float in water. It is observed that A floats with half its volume immersed and B floats with 2/3 of its volume immersed. Compare the densities of A and B:

a) 4 : 3 b) 2 : 3 **c) 3 : 4** d) 1 : 3

34. A solid body floating on water has one-fifth of its volume above the surface. It is allowed to float in a liquid of specific gravity 1.25; the fraction of the volume that will project will be:

a) $\frac{16}{25}$ **b)** $\frac{9}{25}$ c) $\frac{4}{5}$ d) $\frac{5}{4}$

35. The total area of cross-section is 0.25 m^2. If the blood is flowing at the rate of 100 cm^3/sec, then the average velocity of flow of blood through the capillaries is:

a) 0.4 mm/sec b) 4 mm/sec c) 25 mm/sec d) 400 mm/sec

36. A large open tank has two holes in its wall. One is a square hole of side a at a depth of x from the top and the other is a circular hole of radius r at depth 4x from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then r is equal to:

a) aπa b) a c) $\frac{a}{2\pi}$ d) $\frac{a}{\pi}$ **e)** $\frac{a}{\sqrt{2\pi}}$

Solution : -

Speed of the water coming out from the hole,

v=$\sqrt{2gh}$

where h denotes depth of the hole from the free surface of the water in a tank.

The quantities of water flowing out per second from both holes are given to be same, therefore

$A_1v_1 = A_2v_2$

where A_1, and A_2 be the area of cross-sections of hole 1 (i.e., square hole) and hole 2 (i.e., circular hole) and v_1 and v_2 be the speeds of water coming out from these holes.

$\therefore a^2\sqrt{2gx} = \pi r^2\sqrt{2g4x}$

$a^2=2\pi r^2$

$r^2=\frac{a^2}{2\pi}$

$r=\frac{a}{\sqrt{2\pi}}$.

37. The ratio of inertial force to viscous force represents:

a) Magnus effect **b) Reynold's number** c) Torricells's law d) Relative density

Solution : -

Reynold's number represents the ratio of inertial force to viscous force.

38. In case of a hollow body, if ρ_B and ρ_s represent the densities of body and substance respectively, then:

a) $p_B=p_s$ **b) $p_B<p_s$** c) $p_B>p_s$ d) none of these

Solution : -

For a hollow body, as $V_{body} > V_{sub.}$, hence density of body is less than that of substance.

39. The following four wires are made of same material. Which of these will have the largest extension when the same tension is applied?

a) Length = 50 em, diameter = 0.5 mm b) Length= 100 em, diameter= 1mm

c) Length = 200 em, diameter = 2 mm d) Length= 300 em, diameter= 3 mm

Solution : -

To find the largest extension in the wires, we use Young's Modulus

$Y = Fl/A\Delta l$ or $\Delta l = Fl/AY \propto l/A$

Among the following wires, wire of least length and least diameter will have largest extension.

40. A concrete sphere of radius R has a cavity of radius r which is packed with sawdust. The specific gravities of concrete and sawdust are respectively 2.4 and 0.3 for this sphere to flow with its entire volume submerged under water. Ratio of mass of concrete to mass of sawdust will be:

a) 8 **b) 4** c) 3 d) zero

Solution : -

According to principle of floatation, Weight of whole sphere = upthrust

$\frac{4}{3}\pi(R^3-r^3)\rho_1 + \frac{4}{3}\pi r^3\rho_2 = \frac{4}{3}\pi R^3 \times 1$

where P_1 and P_2 are the specific gravities of concrete and sawdust respectively.

$\therefore R^3\rho_1 - r^3\rho_2 = R^3$

or $R^3(\rho_1 - 1) - r^3(\rho_1 - \rho_2)$

or $\frac{R^3}{r^3} = \frac{(\rho_1-\rho_2)}{(\rho_1-1)}$

or $\frac{R^3-r^3}{r^3} = \frac{\rho_1-\rho_2-\rho_1+1}{\rho_1-1}$

or $\frac{(R^3-r^3)\rho_1}{r^3\rho_2} = (\frac{1-\rho_2}{\rho_1-1}) \times \frac{\rho_1}{\rho_2}$

or $\frac{Mass\ of\ concrete}{Mass\ of\ sawdust} = (\frac{1-3.0}{2.4-1}) \times \frac{2.4}{0.3} = 4.$

41. If g_o, g_h and g_d be the acceleration due to gravity at the earth's surface, at height h and at a depth d respectively, then:

a) $g_o > g_h$ and $g_o > g_d$ b) $g_o < g_h$ and $g_o < d$ c) $g_o > g_h$ and $g_o < g_d$ d) $g_o < g_h$ and $g_o > g_d$

42. If the change in the value of gat a height h above the surface of the earth is the same as at a depth x below it when both x and h are much smaller than the radius of the earth, then:

a) x = h **b) x = 2h** c) $x = \frac{h}{2}$ d) $x = \frac{h}{3}$

43. Assertion: The total energy of a satellite is negative.

Reason: Gravitational potential energy of an object is negative.

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 : -

Total mechanical energy of the satellite is the sum of kinetic energy which is always positive and the gravitational potential energy which is negative and in magnitude the K.E. is half the P.E. So the total energy of the satellite is negative. The total energy is negative for any bound system, that is one in which the object is closed.

44. Suppose radius of the moon's orbit around the earth is doubled. Then its period around the earth will become:
a) 1/2 times b) $\sqrt{2}$ times c) $2^{2/3}$ times **d) $2^{3/2}$ times**

45. An artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of escape velocity from the earth. The height of the satellite above the earth's surface will be:
a) 6000 Km b) 5800 Km c) 7500 Km **d) 6400 Km**

Solution : -

Given that; the orbital velocity of the satellite = $\frac{escape\ velocity}{2}$

$v_0 = \frac{v_e}{2}$ ...(I)

But we know that,

$v_0 = \sqrt{\frac{gR^2}{R+h}}$

and $v_e = \sqrt{2gR}$

On putting these values in eqn.(i)

$\sqrt{\frac{9R^2}{R+h}} = \frac{\sqrt{2gR}}{2}$

On squaring both sides:

$\frac{gR^2}{R+h} = \frac{2gR}{4}$

or $2gR^2 = gR\ (R + h)$

or $2R = R+ h$ [$\because$ the radius ofthe earth is 6400 Km]

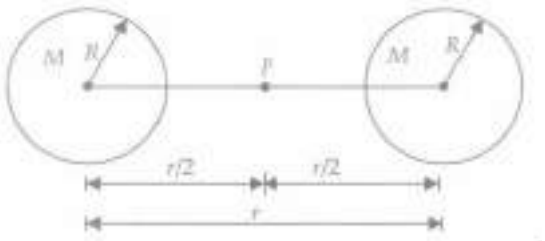
or $R = h$

or $h = R = 6400$ Km.

46. What is the ratio of gravitational mass and inertial mass?
a) 1 : g b) g : 1 **c) 1 : 1** d) g : D

47. Two spheres each of mass M and radius R are separated by a distance of r. The gravitational potential at the midpoint of the line joining the centres of the spheres is
a) $-\frac{GM}{r}$ b) $-\frac{2GM}{r}$ c) $-\frac{GM}{2r}$ **d)** $-\frac{4GM}{r}$

Solution : -



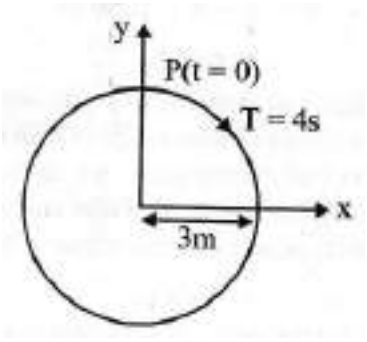
Let P be the midpoint of the line joining the centres of the spheres.

The gravitational potential at point P is

$$V_P = -\frac{GM}{r/2} - \frac{GM}{r/2} = -\frac{2GM}{r} - \frac{2GM}{r} = -\frac{4GM}{r}$$

48. A body is thrown upward from the earth surface with velocity 5 m/s and from a planet surface with velocity 3 m/s. Both follow the same path. What is the projectile acceleration due to gravity on the planet?
a) 2 m/s^2 b) 3.5 m/s^2 c) 4 m/s^2 d) 5 m/s^2

49. The radius of circle, the period of revolution, initial position and sense of revolution are indicated in the fig.



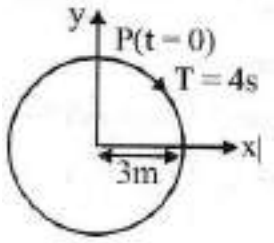
y- projection of the radius vector of rotating particle p is____

a) $y(t) = 4\sin\left(\frac{\pi t}{2}\right)$, where y in m b) $y(t) = 3\cos\left(\frac{3\pi t}{2}\right)$, where y in m

c) $y(t) = 3\cos\left(\frac{\pi t}{2}\right)$, where y in m d) $y(t) = -3\cos 2\mathrm{pt}$, where y in m

Solution : -

At t = 0, y displacement is maximum, so equation will be cosine function



$\mathrm{T} = 4\ \mathrm{s}$

$\omega = \frac{2\pi}{T} = \frac{2\pi}{4} = \frac{\pi}{2}\mathrm{rad/s}$

$y = \mathrm{a}\cos\mathrm{wt}$

$y = 3\cos\frac{\pi}{2}t$

50. The radius of gyration of an uniform rod of length *l* about an axis passing through one of its ends and perpendicular to its length is

a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{3}$ **c) $\frac{1}{\sqrt{3}}$** d) $\frac{1}{2}$

Solution : -

Moment of inertia of rod of mass *M* and length *l* about its axis passing through one of its ends and perpendicular to it is

$I = \frac{1}{3}MI^2$

As $I = Mk^2$ where k is the radius of the gyration

$\therefore Mk^2 = \frac{1}{3}MI^2 \text{ or } k = \frac{1}{\sqrt{3}}$

51. The moments of inertia of two rotating bodies A and B are I_A and I_B ($I_A > I_B$). If their angular momenta are equal, then

a) Kinetic energy of A = Kinetic energy of B b) Kinetic energy of A > Kinetic energy of B

c) Kinetic energy of A < Kinetic energy of B

d) Kinetic energy of the two bodies cannot be compared with the given data

Solution : -

$I_A w_A = I_B w_B$ (Given)

$\therefore \frac{w_A}{w_B} = \frac{I_B}{I_A}$ ....(i)

Kinetic energy$= \frac{1}{2}Iw^2$

$\therefore \frac{(K.E)_A}{(K.E)_B} = \frac{\frac{1}{2}I_A w_A^2}{\frac{1}{2}I_B w_B^2} = \frac{I_A}{I_B} \times \left(\frac{I_B}{I_A}\right)^2$ (Using (i))

$= \frac{I_B}{I_A}$

As $I_A > I_B$ (Given)

$\therefore (K.E.)_A < (K{\cdot}E.)_B$

52. A composite disc is to be made using cqual masses of aluminium and iron so that it has as high a moment of inertia as possible. This is possible when_____

a) the surfaces of the discs are made of iron with aluminium inside

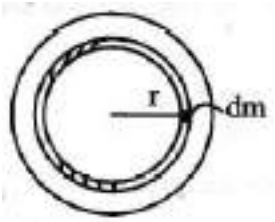
b) the whole of aluminium is kept in the core and the iron at the outer rim of the dise

c) the whole of the iron is kept in the core and the aluminium at the outer rim of the dise

d) the whole disc is made with thin alternate sheets of iron and aluminium

Solution : -

Density of iron > density of aluminium



$\therefore$ Moment of inertia $= \int r^2 dm$

$\therefore$ Since, $\rho_{\text{iron}} > \rho_{\text{aluminium}}$

Therefore, whole of aluminium is kept in the core and the iron at the outer rim of the disc.

53. Analogue of mass in rotational motion is

a) moment of inertia b) torque c) radius of gyration d) angular momentum

Solution : -

Analogue of mass in rotational motion is moment of inertia.

54. Match Column I with Column II

Column I		Column II	
(A)	\(\frac { Mg }{ 4 }	(P)	cube will move up.
(B)	$F > \frac{Mg}{2}$	(q)	cube will not exhibit motion.
(C)	F>Mg	(r)	cube will begin to rotate and slip at A.
(D)	$F = \frac{Mg}{4}$	(s)	Normal reaction effectively at a/3 from A, no motion.

a) A - P. B - q, C - r, D - s b) A - q, B - r, C - s, D - P c) A - r, B - q, C - P. D - s **d) A - r, B - s, C - p, D - q**

Solution : -

For translational equilibrium, $\sum \vec{F} = 0$;A-r

For rotational equilibrium, $\sum \vec{\tau} = 0$; B-s

Moment of inertia of a body = Mk^2; C-p

Torque is required to produce angular acceleration; D - q

55. A dancer on ice spins faster when she folds her hand. This is due to :

a) increase in energy and increase in angular momentum b) decrease in friction at the skates

c) constant angular momentum and increase in kinetic energy

d) increase in energy and decrease in angular momentum

Solution : -

For ease-L when she has expended her hands

$L_1 = I_1\omega_1$, Here, $I_1 = mr_1^2$

For case-2, when she has folded her hand

$L_2 = I_2\omega_2$, Here, $I_2 = mr_2^2$

Since, no additional torque is acting on her, so angular momentum will be constant.

Here, $L_1 = L2$

$I_1\omega_1 = I_2\omega_2$

as $r_1 > r_2 \Rightarrow I_1 > I_2 \Rightarrow \omega_1 < \omega_2$

Since, angular velocity increases. So, kinetic energy will also increase.

56. A child is standing with folded hands at the centre of a platform rotating about its central axis. The kinetic energy of the system is K. Now, the child stretches his arms so that moment of inertia of the system doubled. Now, the kinetic energy of the system is

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

Solution : -

Initial kinetic energy, $K = \frac{1}{2}Iw^2$ ... (i)

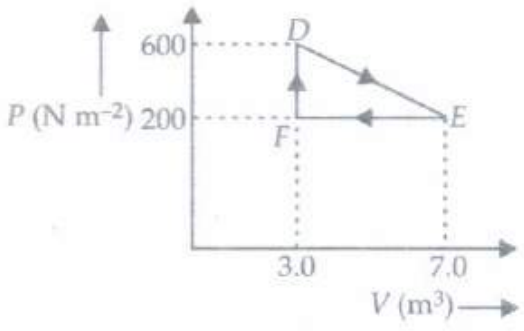
According to the principle of conservation of angular momentum, I*w* = constant

As I is doubled, *w* becomes half.

So final kinetic energy,

$K' = \frac{1}{2}(2I)\left(\frac{w}{2}\right)^2 = \frac{1}{4}Iw^2 = \frac{K}{2} \qquad (using(i))$

57. A thermodynamic process is carried out from an original state D to an intermediate state E by the linear process shown in figure. The total work is done by the gas from D to E to F is total work is done by the gas from D to E to F is:



a) 100 J **b) 800 J** c) 300 J d) 250 J

Solution : -

Total work done by the gas from D to E to F is equal to the area of ΔDEF.

The area of ΔDEF = .!.. DF x EF Here, DF change in pressure = 600 - 200 = 400 N m^{-2} ? Also, EF = change in volume = 7 m^3- 3 m^3= 4 m^3 Area of ΔDEF =1/2 x 400 x 4 = 800 J

Thus, the total work done by the gas from D to E to F is 800 J.

58. (A) The efficiency of a carnot cycle depends on the nature of the gas used.
(R) Adiabatic is a part of carnot cycle and work done in adiabatic process does not depend on nature of gas.

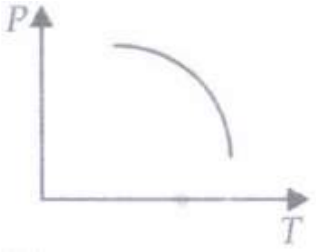
a) If both assertion and reason are true and reason is the correct explanation of assertion

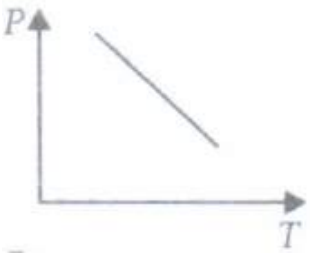
b) If both assertion and reason are true but reason is not the correct explanation of assertion

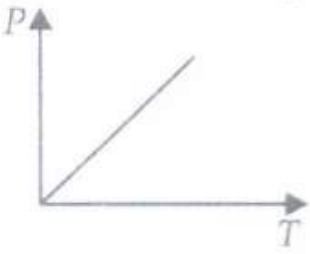
c) If assertion is true but reason is false **d) If both assertion and reason are false**

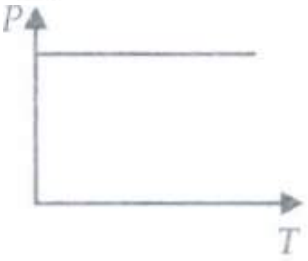
e) If assertion is false but reason is true

59. Which of the following P- Y diagram represent the graph of isometric process?

a) 

b) 

c) 

d) 

Solution : -

In isometric process volume is constant P&T

60. (A) In isothermal process whole of the heat energy supplied to a system is converted into work.
(R) According to first law of thermodynamics Q=W+ΔU

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

61. 70 calories of heat are required to raise the temperature of 2 moles of an ideal gas at constant pressure from 30°C to 35°C. The amount of heat required to raise the temperature of the same gas through same range (30°C to 35°C) at constant volume is:

a) 30 cal **b) 50 cal** c) 70 cal d) 90 cal

Solution : -

Heat absorbed at constant pressure to increase the temperature by

dT is $\mu C_p dT$.

$Q_1=\mu C_p dT=70$ cal

Heat required to raise the temperature of same gas by dT at constant volume is,

$Q2=\mu C_p dT$

$\therefore \frac{Q_2}{Q_1} = \frac{C_v}{C_p}$ or $Q_2=Q_1 \times \frac{C_v}{C_p}$

or $Q_2=70 \times \frac{1}{\gamma} = 70 \times \frac{1}{7/5} = 70 \times \frac{5}{7}$=50 cal

62. Which of the following parameters does not characterise the thermodynamic state of matter?

a) Temperature b) Pressure **c) Work** d) Volume

Solution : -

No change in the internal energy of ideal gas but for real gas internal energy increases because work is done against intermolecular forces.

63. Match the column I with column II

Type of processes	**Feature**
(A) Isothermal	(p) $\triangle Q = 0$
(B) Isobaric	(q) Volume constant
(C) Isochoric	(r) Pressure constant
(D) Adiabatic	(s) Temperature constant

a) (A) - (s), (B) - (r), (C) - (q), (D) - (p) b) (A) - (p), (B) - (s), (C) - (r), (D) - (q)

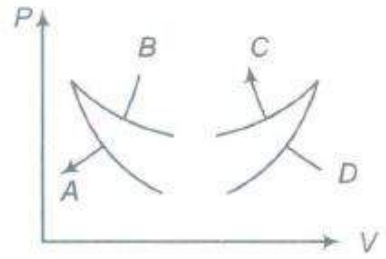
c) (A) - (q), (B) - (r), (C) - (p), (D) - (s) d) (A) - (r), (B) - (p), (C) - (q), (D) - (s)

Solution : -

Type of processes	**feature**

Isothermal	Temperature constant
Isobaric	Pressure constant
Isochoric	Volume constant
Adiabatic	△Q = 0

64. Four curves A, B, C and D are drawn in the adjoining figure for a given amount of gas. The curves which represent adiabatic and isothermal changes are:



a) C and D respectively b) D and C respectively **c) A and B respectively** d) B and A respectively

Solution : -

As we know that slope of isothermal and adiabatic curves are always negative and slope of adiabatic curve is always greater than that of isothermal curve Hence in the given graph curve A and B represents adiabatic and isothermal changes respectively.

65. The temperature of an ideal gas is increased from 120 K to 480 K. If at 120 K, the rms velocity of the gas molecules is v_{rms}, then at 480 K, it becomes

a) $4v_{rms}$ **b) 2 v_{rms}** c) $\frac{v_{rms}}{2}$ d) $\frac{v_{rms}}{4}$

Solution : -

$$\frac{v_{rms_2}}{v_{rms_1}} = \sqrt{\frac{T_2}{T_1}} = \sqrt{\frac{480}{120}} = 2$$

$$V_{rms_2} = 2\,(v_{rms})$$

66. Temperature of an ideal gas is T K and average kinetic energy is E = 2.07 x 10^{-23} T Joule/molecule. Number of molecules in 1 litre gas at S.T.P. will be:

a) 2.68 x 10^{22} b) 2.68 x 10^{25} c) 2.68 x 10^{28} d) 1.68 x 10^{22}

Solution : -

At S.T.P. 22.4 litre of gas contains 6.023 x 10^{23} molecules

∴ 1 litre of gas contain $\frac{6.023\times10^{23}}{22.4}$

=2.68 x 10^{22} molecules.

67. A cylinder containing an ideal gas is in vertical position and has a piston of mass M that is able to move up or down without friction. If the temperature is increased,

a) both P and V of the gas will change b) only P will increase according to Charle's law.

c) V will change but not P d) V will change but not P

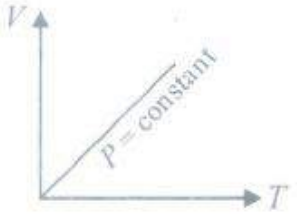
Solution : -

Pressure = force/area = Mg/area of the piston = constant.

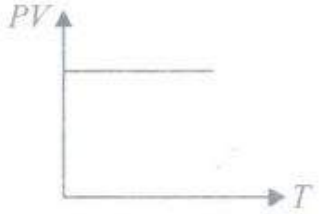
If the temperature is increased, only the volume increases as the piston moves up without friction. Recall $V \propto T$ at constant pressure.

68. Which of the following graphs represent the behaviour of an ideal gas?

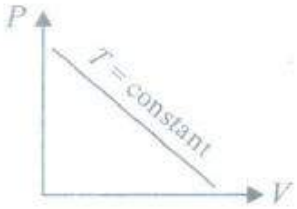
a)



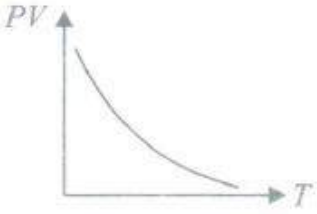
b)



c)



d)



Solution : -

According to Charles law, $V \propto T$

Therefore, graph is a straight line, Hence (a) is correct option.

69. Ten small planes are flying at a speed of 150 km h^{-1} in total darkness in an air space that is 20 x 20 x 1.5 km^3, in volume. You are in one of the planes, flying at random within this space with no way of knowing where the other planes are. On the average about how long a time will elapse between near collision with your plane. Assume for this rough computation that a safety region around the plane can be approximated by a sphere of radius 10m.

a) 125h b) 220h c) 432h **d) 225h**

Solution : -

Here, v = 150 km h^{-1}

N = 10

V = 20 x 20 x 1.5 km^3.

Diameter of plane, d = 2 R = 2 x 10

= 20 m = 20 x 10-3 km

$$n = \frac{N}{V} = \frac{10}{20 \times 20 \times 1.5} 0.0167 km^{-3}$$

Mean free path of a plane

$$\lambda = \frac{1}{\sqrt{2}\pi d^2 n}$$

Time elapse before collision of two planes randomly

$$t = \frac{\lambda}{v} = \frac{1}{\sqrt{2}\pi d^2 n v}$$

$$= \frac{1}{1.414 \times 3.14 \times (20)^2 \times 10^{-6} \times (0.0167) \times (150)}$$

$$= \frac{10^6}{449.5} = 224.74h \approx 225h$$

70. The temperature of a gas is raised from 27^0C to 927^0C. The root mean square speed:

a) $\left(\sqrt{927/27}\right)$ times the earlier value b) Gets halved c) Remains the same **d) Gets doubled**

Solution : -

v_{rms} is equal to $\sqrt{3RT/M}$

Here T_l = 27 + 273 = 300 and T_2 = 927 + 273

= 1200

So, as temperature increases from 300 K to 1200 K which is four times, the v_{rms} will be doubled.

71. The temperature of an ideal gas is increased from 27°C to 127°C, then percentage increase in v_{rms} is

a) 37% b) 11% c) 33% **d) 15.5%**

Solution : -

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

$$\%increase \quad in \quad v_{rms} = \frac{\sqrt{\frac{3RT_2}{M}} - \sqrt{\frac{3RT_1}{M}}}{\sqrt{\frac{3RT_1}{M}}} \times 100$$

$$= \frac{\sqrt{T_2} - \sqrt{T_1}}{\sqrt{T_1}} \times 100 = \frac{\sqrt{400} - \sqrt{300}}{\sqrt{300}} \times 100$$

$$= \frac{20 - 17.32}{17.32} \times 100 = 15.5\%$$

72. The volume of vessel A is twice the volume of another vessel B, and both of them are filled with the same gas. If the gas in A is at twice the temperature and twice the pressure in comparison to the gas in B, then the ratio of the gas molecules in A to that of B is

a) $\frac{1}{2}$ **b)** $\frac{2}{1}$ c) $\frac{3}{2}$ d) $\frac{2}{3}$

Solution : -

$PV = nRT$

$\therefore n_B = \frac{PV}{RT}$ and $n_A = \frac{2P \times 2V}{R \times 2T}$

or $n_A = \frac{2PV}{RT}$

$\frac{n_A}{n_B} = \frac{2}{1}$

73. The stationary wave y = 2a sinkx cosωt in a stretched string is the result of superposition of Y_1 = a sin(kx - ωt) and

a) Y_2 = a cos(kx + ωt) **b) Y_2 = a sin(kx + ωt)** c) Y_2 = a cos(kx - ωt) d) Y_2 = asin(kx - ωt)

Solution : -

Y1 = a sin(kx - ωt)

Y2 = a sin(kx + ωt)

According to the principle of superposition, the resultant wave is

Y = Y_1 + Y_2 = a sin(kx - ωt) + a sin(kx + ωt)

Using trigonometric identity

sin(A + B) + sin(A - B) = 2 sin A cos B

we get, Y = 2a sin kx cos ωt

74. Two sources of sound placed close to each other, are emitting progressive waves given by $y_1 = 4\sin 600\pi t$ and $y_2 = 5\sin 608\pi t$. An observer located near these two sources of sound will hear:

a) 8 beats per second with intensity ratio 81: 1 between waxing and waning.

b) 4 beats per second with intensity ratio 81: 1 between waxing and waning.

c) 4 beats per second with intensity ratio 25: 16 between waxing and waning.

d) 8 beats per second with intensity ratio 25: 16 between waxing and waning.

Solution : -

$\omega_1 = 600\pi \quad or \quad n_1 = \frac{600\pi}{2\pi} = 300s^{-1}$.

$\omega_2 = 608\pi \quad or \quad n_2 = \frac{608\pi}{2\pi} = 304s^{-1}$

$\therefore \quad Number \quad of \quad beats = n_2 - n_1 = 304 - 300 = 4s^{-1}$

$Intensity \quad ratio = \frac{I_{mzx.}}{I_{min.}} = \left(\frac{a_2+a_1}{a_2-a_1}\right)^2 = \left(\frac{5+4}{5-4}\right)^2 = \frac{81}{1}.$

75. Velocity of sound is measured in hydrogen and oxygen gases at a given temperature. The ratio of the two velocities will be:
a) 1:4 **b) 4:1** c) 1:1 d) 32:1

76. A man is watching two trains, one leaving and the other coming in with equal speed of 4 m/s. If they sound their whistles, each of frequency 240 Hz, the number of beats heard by the man (velocity of sound in air = 320 m/s) will be equal to :
a) 6 b) 3 c) 0 d) 12

Solution : -
Now app. frequency due to train approaching:
$n_1 = [v/(v-v_s)] \times n$
ow app. frequency due to train leaving:
$n_2 = [v/(v+v_s)] \times n$
Hence number of beats $n_1 - n_2$:
$= (1/316 - 1/324) \times 320 \times 240$
$n_1 - n_2 = 6$

77. $y = a\cos(kx + \omega t)$superposes on another wave giving a stationary wave having node at x = 0.What is the equation of the other wave?
a) $a\cos(kx + \omega t)$ b) $a\cos(kx - \omega t)$ **c)** $-a\cos(kx + \omega t)$ d) $-a\sin(kx + \omega t)$

Solution : -
Stationary wave is formed by superposition of two identical waves travelling in opposite directions. Given, wave is $y = a \cos(kx - \omega t)$. The other wave can't be $y = -a \cos(kx - \omega t)$ as their directions are not opposite. The other possible cosine function can be: $y = -a \cos(kx + \omega t)$.
Their directions are opposite to each other
$\therefore \quad y_s = a \cos(kx - \omega t) - a \cos(kx + \omega t) = 2a \sin kx \sin \omega t$
At x = 0, $y_s = 0$
Hence, a node is formed at x = 0
∴.The equation of other wave $= -a \cos(kx + \omega t)$.

78. The phase difference between the instantaneous velocity and acceleration of a particle executing simple harmonic motion is:
a) p b) 0707p c) zero **d) 0.5p**

Solution : -
Let $y = \mathrm{A}\sin \mathrm{w}t$
Differentiating w.r.t. t,
$v_{inst} = \frac{dy}{dt} = A\omega \cos \omega t$
$= A\omega \sin(\omega t + \pi/2)$
$\therefore \text{ Acceleration } = \frac{dv}{dt} = -A\omega^2 \sin \omega t$
$= A\omega^2 \sin(\pi + \omega t)$
$\therefore \phi = \frac{\pi}{2} = 0.5\pi$

79. A sound wave travels with a velocity of 300 m s^{-1} through a gas. 9 beats are produced in 3 s when two waves pass through it simultaneously. If one of the waves has 2 m wavelength, the wavelength of the other wave is:
a) 1.98 m **b) 2.04 m** c) 2.06 m d) 1.99 m

Solution : -
No. of beats per second = $\frac{9}{3} = -3s^{-1}$
No. of beats per second $d = v_1 - v_2$
$3 = \frac{v}{\lambda_1} - \frac{v}{\lambda_2} = v\left[\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right]$

$$\frac{3}{300} = \frac{1}{2} - \frac{1}{\lambda_2}$$
$$\frac{1}{\lambda_2} = \frac{1}{2} - \frac{1}{100} = \frac{50-1}{100} = \frac{49}{100}$$
$$\lambda_2 = \frac{100}{49} = 2.04m$$

80. The time period of simple harmonic motion depends upon
a) amplitude b) energy c) phase constant **d) mass**

Solution : -
The time period of simple harmonic motion does not depend on amplitude, energy or the phase constant.

81. Molarity equation of a mixture of solutions of same substance is given by
a) $M_1 + V_1 \times M_2 + V_2 \times M_3 + V_3 + ... = M_1 + M_2 + M_3$ **b) $M_1V_1 + M_2V_2 + M_3V_3 + ...= M(V_1+V_2+V_3)$**
c) $\frac{M_1}{V_1} + \frac{M_2}{V_2} + \frac{M_3}{V_3} + \ldots = M\left(\frac{1}{V_1} + \frac{1}{V_2} + \frac{1}{V_3}\right)$
d) $\frac{M_1}{V_1} + \frac{M_2}{V_2} + \frac{M_3}{V_3} + \ldots = M_1\left(\frac{1}{V_1} + \frac{1}{V_2} + \frac{1}{V_3}\right)$

Solution : -
Molarity, M=number of moles/volume of solution
$M = \frac{n}{V}$
for mixture of solutions
$n_1+n_2+n_3+...=M_1V_1+M_2V_2+M_3V_3+ ...$
$(n_1+n_2+n_3+ ...) \times \frac{(V_1+V_2+V_3+\ldots)}{(V_1+V_2+V_3+\ldots)} = M_1V_1+M_2V_2+M_3V_3+...$
total number of moles in the mixture = n_T, total volume = V_T
final molarity = M_T = M
$\frac{n_T}{V_T} \times (V_1 + V_2 + V_3 + \ldots) = M_1\ V_1 + M_2\ V_2 + M_3\ V_3 + \ldots$
$M_T \times (V_1 + V_2 + V_3 + ...) = M_1V_1+M_2V_2+M_3V_3+...$
or $M \times (V_1+V_2+V_3+...) = M_1V_1+M_2V_2+M_3V_3+...$

82. Mark the conversion factor which is not correct.
a) 1 atm = 1.01325 x 10^5 Pa b) 1 metre = 39.37 inches c) 1 litre = 10^{-3} m^3 **d) 1 inch = 3.33 cm**

83. 0.48 g of a sample of a compound containing boron and oxygen contains 0.192 g of boron and 0.288 g of oxygen. What will be the percentage composition of the compound?
a) 60% and 40% B and O respectively **b) 40% and 60% B and O respectively**
c) 30% and 70% B and O respectively d) 70% and 30% B and O respectively

Solution : -
Mass of compound taken = 0.48 g
Mass of boron in sample = 0.192 g
Mass of oxygen in sample = 0.288 g
Percentage of B = $\frac{0.192}{0.48} \times 100 = 40\%$
Percentage of O = $\frac{0.288}{0.48} \times 100 = 60\%$

84. What will be the standard molar volume of He, if its density is 0.1784 g/L at STP?
a) 11.2 L **b) 22.4 L** c) 5.6 L d) 2.8 L

Solution : -
Standard molar volume is the volume occupied by 1 mole of a gas at STP.
0.1784 g of He occupies volume = 1 L
4 g (1 mole) of He occupies $\frac{4}{0.1784} = 22.4L$

85. 6.02 X 10^{20} molecules of urea are present in 100 mL of its solution. The concentration of solution is :
a) 0.02 M **b) 0.01 M.** c) 0.001 M d) 0.1 M

Solution : -

6.023×10^{23} molecules of urea are present in 1 mole.
6.023×10^{20} molecules of urea are present in
(1 mole / 6.023) x 10^{23} x $6.023 \times 10^{20} = 10^{-3}$ moles
Volume of solution = 100 mL = 0.1 L
Molarity of urea solution = No. of moles of urea/Volume of solution
$=10^{-3}$ moles/0.1 L
$= 10^{-2}$ or 0.01 mol L^{-1} or 0.01 M

86. An organic compound contains carbon, hydrogen and oxygen. Its elemental analysis gave C 38.71% and H9.67%. The empirical formula of the compound would be:
a) CH_3O b) CH_2O c) CHO d) CH_4O

Solution : -
Given analysis;

Element	%	Atomic weight	Atomic ratio	Simple ratio
C	38.71	12	$\frac{38.71}{12} = 3.23$	$\frac{3.23}{3.23} = 1$
H	9.67	1	$\frac{9.67}{1} = 9.67$	$\frac{9.67}{3.23} = 3$
O	100 − (38.71 + 9.67) = 51.62	16	$\frac{51.62}{16} = 3.23$	$\frac{3.23}{3.23} = 1$

Thus, empirical formula generated CH_3O.

87. Which of the following options is not correct?
a) 2.300 + 0.02017 + 0.02015 = 2.340 b) 126, 000 has 3 Significant figures c) 15.15 μs = 1.515 x 10^{-5} s
d) 0.0048 = 48 x 10^{-3}

Solution : -
2.300+0.02017+0.02015=2.3432
Rule: The result of an addition or subtraction is reported to the same number of decimal places as present in number with the least decimal places.
Since the least precise number is 2.300 and that has three digits after the decimal, therefore the result of the above addition is rounded off to three decimal figures as 2.340.
126,000 has 3 significant figures as zeros are not counted
$15.15\mu s = 15.15 \times 10^{-6} s = 1.515 \times 10^{-5} s$
$0.0048 = 4.8 \times 10^{-3}$

88. What is the mass of precipitate formed when 50 mL of 16.9% (w/v) solution of $AgNO_3$ is mixed with 50 mL of 5.8% NaCl solution? (Ag = 107.8, N = 14, O= 16, Na = 23, Cl = 35.5) :
a) 3.5 g **b) 7.16 g** c) 14 g d) 28 g

Solution : -
$$\text{Moles of } AgNO_3 = \frac{50 \times 16.9}{100 \times 169.8} = 0.05 \text{ mole}$$
$$\text{Moles of } NaCl = \frac{50 \times 5.8}{100 \times 58.5} = 0.05 \text{ mole}$$
$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$
Mass of AgCl precipitate= Mole $\times$ Molar mass
$=0.05 \times 143.5$
$=7.16$ g
Hence, 7.16 g AgCl will be precipitated out.

89. The probability of finding an electron in p_y orbital along the x-axis is:
a) Maximum **b) Zero** c) Not determined d) Infinite

90. The quantum numbers of four electrons (e_1 to e_4) are given below

n	l	m	s
e_1	3	0	0 $\pm$1/2
e_2	4	0	0 1/2
e_3	3	2	2 -1/2
e_4	3	1	-1 1/2

The correct order of decreasing energy of these electrons is:

a) $e_4 > e_3 > e_2 > e_l$ b) $e_2 > e_3 > e_4 > e_1$ **c) $e_3 > e_2 > e_4 > e_l$** d) $e_1 > e_3 > e_4 > e_2$

Solution : -

Energy $\propto$ (n+1) value

e_1=3+0=3

e_2=4+0=4

e_3=3+2=5

e_4=3+1=4

When (n+1) value is same, larger n value, has more energy.

hence order is : $e_3 > e_2 > e_4 > e_1$

91. The number of elements in the third period of the periodic table is:

a) 2 **b) 8** c) 18 d) 32

Solution : -

The third period starts from Na (atomic number 11) and it ends at Ar (atomic number 18). So this period has 8 elements.

92. What is the velocity of electron present in first Bohr orbit of hydrogen atom?

a) 2.18 x 10^5 m/s b) 2.18 x 10^5 m/s **c) 2.18 x 10^6 m/s** d) 2.18 x 10^{-9} m/s

Solution : -

The velocity of electron of the n^{th} stationary state for a hydrogen-like specie is expressed as :

$$v_n = 2.18 \times 10^6 \times \frac{Z}{n} m/s$$

where Z = atomic number and n = orbit.

For First Bohr orbit of hydrogen atom, n=1 and Z=1

thus for Hydrogen $v_1(H) = 2.18 \times 10^6 \times \frac{1}{1}$ m/s

or the velocity of electron present in first Bohr orbit of hydrogen atom = $v_1(H) = 2.18 \times 10^6$ m/s

93. Read the following statements and mark the incorrect statement.

a) No two electrons in an atom can have all the four quantum numbers same

b) All the orbitals in a subshell are first occupied singly with parallel spins

c) The outer electronic configuration of chromium atom is $3d^4\ 4s^2$

d) Lyman series of hydrogen spectrum lies in ultraviolet region

Solution : -

A. No two electrons in an atom can have all the four quantum numbers same- Pauli's exclusion principle.

B. All the orbitals in a subshell are first occupied singly with parallel spins- Hund's rule of maximum multiplicity.

C. The outer electronic configuration of chromium atom is $3d^5\ 4s^1$ due to the extra stability of half-filled configuration.

D. Lyman series of hydrogen spectrum is from higher energy orbit to first orbit and it lies in ultraviolet region.

94. For an e^- in a hydrogen atom, the wave function Ψ.If is proportional to $e^{-(r/a_0)}$ where a_0 as Bohrs radius; what is the ratio of probability of finding the e^- at the nucleus to the probability of finding it at a_0 the wave function is $\Psi = \frac{1}{\sqrt{\pi}} \left(\frac{1}{a_0}\right)^{3/2} e^{-(r/a_0)}$

a) e **b) e^2** c) $1/e^2$ d) Zero

Solution : -

Hints: $\Psi^2 = \frac{1}{\pi}\left(\frac{1}{a_0}\right)^3 e^{-2r/a_0}$

At nucleus r = 0 and in 1st orbit r = a_0

$\Psi^2 = \frac{1}{\pi}\left(\frac{1}{a_0}\right)^3 e^0 \Rightarrow \left(\frac{1}{a_0}\right)^3$ at $a=a_0$

$\Psi^2{}_n = \frac{1}{\pi}\left(\frac{1}{a_0}\right)^3 e^{-2}; \left(\frac{\Psi_n^2}{\Psi_0^2}\right) = e^2$

95. An atom differs from its ion in
a) Nuclear charge b) Mass number **c) Number of electrons** d) Number of neutrons

Solution : -

An atom differs from its ion in number of electrons. For example, H atom has 1 electron. Whereas H^+ ion has O electrons. On the other hand, H^- ion has 2 electrons.

96. In an hydrogen atom which of the following transition should be associated with highest absorption of energy
a) n = 1 to n = 4 b) n = 2 to n = 3 c) n = 4 to n = 1 d) n = 3 to n = 2

Solution : -

Energy is absorbed when the transitions is from lower level to upper level

97. Which of the following is not an actinoid?
a) Curium (Z = 96) b) Californium (Z = 98) c) Uranium (Z = 92) **d) Terbium (Z = 65)**

98. Which one of the following arrangements represents the correct order of least negative to most negative electron gain enthalpy for C, Ca, Al, F and O?
a) Ca b) Al c) Al d) C

Solution : -

As the nuclear charge increases, the force of attraction between the nucleus and the new electron increases and hence the electron gain enthalpy becomes more negative, therefore the correct order is
Ca<A1 <C<O<F

99. Assertion: Oxidation state of oxygen in OF_2 and Na_2O is +2 and -2 respectively.
Reason: Oxygen is an electronegative element
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 electronegativity order of three elements involved in these compounds is F > O > Na. Hence in OF_2 molecule, F being the most electronegative element. F is given oxidation state −1 and thus, O shows +2 oxidation state.
On the other hand, in Na_2O, O is more electronegative hence, shows oxidation state is −2 and Na has +1 oxidation state.

100. Which one of the above elements is most reactive metal?
a) P **b) Q** c) U d) S

Solution : -

The element having less I.E is less stable and hence readily form compounds to get stability. Hence most reactive.

101. The first ionisation enthalpy of the elements C, N, P, Si are in the order of
a) C<N<Si<P b) N<Si<C<P **c) Si < P < C < N** d) P < Si < N < C

102. The period to which an element belongs to in the long form of periodic table represents
a) atomic mass b) atomic number **c) principal quantum number** d) azimuthal quantum number

Solution : -

n is the principal quantum number or number of shells. It represents the number of periods to which an element belongs to. Thus, n=1 represents first period, n=2 represents second period and n=3 represents third period. Hence periodic table is arranged on the basis of the electronic configuration of elements.

103. Which one of the following arrangements is the incorrect representation of the property indicated with it?
a) Br < Cl < F : Electro negativity **b) F < Br < Cl : Electron - affinity** c) $F_2 < Br_2 < Cl_2$: Bond energy
d) $Br_2 < Cl_2 < F_2$: Oxidising strength

Solution : -
EA values; Cl (-349 kJ/mol); F (-328 kJ/mol); Br(-324.6 kJ/mol).

104. Beryllium has higher ionisation enthalpy than boron. This can be explained as,
a) ionisation energy increases in a period.
b) beryllium has higher size than boron hence its ionisation enthalpy is higher
c) penetration of 2p-electrons to the nucleus is more than the 2s-electrons
d)
it is easier to remove electron from 2porbital as compared to 2s-orbital due to more penetration of s-electrons

105. Identify the correct order of solubility in aqueous medium.
a) CuS > ZnS > Na_2S b) ZnS > Na_2S > CuS c) Na_2S > CuS > ZnS **d) Na_2S > ZnS > CuS**

Solution : -
Water is a polar compound so the salt which is more polar or having more ionic character will be more soluble in it. According to Fajans' rule, ionic character of compound increases with increase in the size of cation. Now, among the given compounds, the size of cations are in the order as follows:
$Na^+ > Zn^{2+} > Cu^{2+}$
Thus, the order of ionic character and the solubility order in aqueous medium is as follows :
Na_2S > ZnS > CuS

106. Which of the following is isoelectronic?
a) CO_2, NO_2 b) NO_2^-, CO_2 **c) CN^-, CO** d) SO_2, CO_2

Solution : -
Number of electrons in CO_2 =6 + 2(8) = 22
Number of electrons in NO_2 = 7 + 2(8) = 23
Number of electrons in NO_2^- = 7 + 2(8) + 1 = 24
Number of electrons in CN^- = 6 + 7 + 1 = 14
Number of electrons in CO = 6 + 8 = 14
Number of electrons in SO_2 = 16 + 2(8) = 32
Thus, species which are isoelectronic are CN^- and CO.

107. A pair of electrons present between two identical non-metals
a) is shifted to one of the atoms **b) is shared equally between them** c) undergoes addition reactions
d) have same spin.

Solution : -
According to the Gallis scale
The non-polar covalent bond forms when the electronegativity difference between two atoms is zero. it means that both atoms will be identical and the electron pairs will equally share between both atoms.
Gallis scale is given below: where column-1 shows a difference in electronegativity and column-2 shows the consequence of it.

0	Non polar covalent bond
0-1.6	Polar covalent bond
1.7	50 percent covalent, 50 percent ionic
1.7 - 3.3	Mainly Ionic

108. CO^{2-}_3-, NO^-_3, BO^{3-}_3'- The correct increasing order of extent of p-bonding in above molecules are I II III
a) I < II < III b) III < II < I **c) III < I < II** d) II < III < I

Solution : -

In $C0_3^{-2}$ Bond order = 1.33
In NO_3^- Bond order = 1.33
In BO_3^{-3} Bond order = 1.00
In NO_3^-. due to more electronegativity of N, extent or p-bonding is more favoured

109. **Assertion**
In the formation of a molecule, only the outer shell electrons take part in chemical combination and they are known as valence electrons.
Reason
Atoms achieve the stable octet when they are linked by chemical bonds.
In the formation of a molecule, only the outer shell electrons take part in chemical combination and they are known as valence electrons.
a) Both Assertion and Reason are correct and Reason is the correct explanation for assertion
b) Both Assertion and Reason are correct but Reason is not the correct explanation for assertion
c) Assertion is correct but reason is incorrect d) Both Assertion and Reason are incorrect

Solution : -
As atoms unite together they gain, lose or share electrons in such a way that the outer shells become chemically complete. Electrons in the outermost shell are called valence electron.
An atom is said to be stable when it has eight valence electrons (two in the case of hydrogen). This configuration is known as an octet. Hence atoms without octet configuration share their valence electrons with other atoms so that they each will have an octet (or duet in the case of hydrogen) and become stable. This apportions of valence electrons is known as covalent bonding. The valence electrons are in the outermost energy shell.

110. Ethyl alcohol (C_2H_5OH) has higher boiling point than dimethyl ether (CH_3 - O-CH_3) although the molecular weight of both are same due to
a) intramolecular H-bonding **b) intermolecular H-bonding** c) dipole moment d) lattice enthalpy

Solution : -
Though ethyl alcohol and dimethyl ether have the same molecular weight but in ethyl alcohol the hydrogen of the O−H group forms intermolecular hydrogen bonding with the OH group in another molecule. But in case of ether the hydrogen is linked to C and it is not so electronegative to encourage the hydrogen to form hydrogen bonding. Due to intermolecular H−bonding, ethyl alcohol remains in the associated form and therefore, boils at a higher temperature compared to dimethyl ether.

111. Paramagnetism is shown by the molecules which have
a) paired electrons **b) unpaired electrons** c) lone pair of electrons d) bond order more than one

Solution : -
Presence of unpaired electrons makes a molecule paramagnetic. More the number of unpaired electrons, higher is the paramagnetism.

112. O_2^2 is isoelectronic with:
a) H_2 b) N_2 **c) F_2** d) S

Solution : -
O_2^{2-} (8 + 8 + 2 = 18e^-) ; F2 (9 + 9 = 18 e^-).

113. The beans are cooked earlier in pressure cooker, because:
a) B.P. increase with increasing pressure b) B.P. decrase with increasing pressure
c) Extra pressure of pressure cooker, softens the beans
d) Internal energy is not lost while cooking is pressure cooker

Solution : -
The beans are cooked earlier in a pressure cooker because the boiling point increases with increasing pressure. As the pressure increases the particles come closer and due to their Kinetic energy and temperature inside the container increases and thus the boiling point increases which leads to faster cooking.

114. 0.5 mole each of H_2, SO_2 and CH_4 are kept in a container. A hole was made in the container. After 3 hours the order of partial pressures in the container will be
a) $P_{SO_2} > P_{CH_4} > P_{H_2}$ b) $P_{CH_4} > P_{SO_2} > P_{H_2}$ c) $P_{H_2} > P_{SO_2} > P_{CH_4}$
d) $P_{H_2} > P_{CH_4} > P_{SO_2}$

Solution : -

SO_2 Molar mass = 32 + 32 = 64g/mol

CH_4 Molar mass = 12 + 4 = 16g/mol

H_2 Molar mass = 2 $\times$1 = 2g/mol

Rate of diffusion is inversely related to molecular weight. Lighter the gas, more is the diffusion. The rate of diffusion is given by,

$r_{H_2} > r_{CH_4} > r_{SO_2}$

Hence the order of partial pressure will be

$P_{SO_2} > P_{CH_4} > P_{H_2}$

115. A gaseous mixture containing 0.35g of N_2 and 5600 ml of O_2 at STP is kept in a 5 litres flask at 300K. The total pressure of the gaseous mixture is:

a) 1.293 atm b) 1.2315 atm c) 12.315 atm d) 0.616 atm

Solution : -

Moles of O_2 = $\frac{5600}{22400} = 0.25 = n_{O_2}$

Moles of N_2 = $\frac{0.35}{28} = 0.0125 = n_{N_2}$

Initial pressure of N_2 = $\frac{n_{N_2}RT}{V} = \frac{0.0125\times0.0821\times300}{5} = 0.061$ atm

Potential pressure of O_2= $\frac{n_{O_2}RT}{V} = \frac{0.25\times0.0821\times300}{5} = 1.231atm$

$\therefore$ Total pressure = 1.231 + 0.061 = 1.292 atm

116. Equal moles of hydrogen and oxygen gases are placed in a container with a pin-hole through which both can escape. What fraction of the oxygen escapes' in the time required for one-half of the hydrogen to escape?

a) $\frac{3}{8}$ b) $\frac{1}{2}$ **c)** $\frac{1}{8}$ d) $\frac{1}{4}$

Solution : -

Let the number of moles of each gas be x moles. Then, the fraction of hydrogen gas escaped = $\frac{x}{2}$moles.

Then, according to the following relation

$\frac{n_{O_2}}{n_{H_2}} = \sqrt{\frac{M_{H_2}}{M_{O_2}}} = \sqrt{\frac{2}{32}}$

$\frac{n_{O_2}}{n_{H_2}} = \frac{1}{4}$

$\frac{n_{O_2}}{x/2} = \frac{1}{4}$

$n_{O_2} = \frac{x}{8}$

117. If the assumption that there is no force of attraction between the molecules of a gas is correct, what will be the consequences?

a) All gases will be ideal gases **b) The gases will never liquefy when cooled and compressed.**

c) Gases will have definite volume. d) Gases will occupy a definite space.

Solution : -

It means the gas molecules will never come closer under any conditions. Thus they will never liquefy when cooled and compressed.

118. Equal volumes of two jars contain HCl,NH_3, gases respectively at constant temperature and pressure P. When one of the jars is inverted over another jar so that they mix up, the pressure in either of the jars is

a) 1 atm b) Equal to P **c) Becomes Zero** d) P+P=2P

Solution : -

$NH_3(g)$ + HCl(g) $\rightarrow$ $NH_4Cl(s)$

Since they combine to form solid NH_3Cl, the pressure becomes zero.

119. The values of critical volumes of four gases A, B, C and D are 0.025 L, 0.312L, 0.245L and 0.432 L respectively. The gas with larger molecular diameter will be

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

Solution : -

$V_c = 3b = 3 \times 4N \times \frac{4}{3}\pi r^3$

More the critical volume, more is the radius as other are constants.

120. Boyle's temperature of various gases are given below.

Gas	A_1	A_2	A_3	A_4
T_B(K)	117	23	498	406

a) A b) A_2 **c) A_3** d) A_4

Solution : -

Tb α a α liquifiability

121. For the reaction:

$H_{2(g)}+Cl_{2(g)} \longrightarrow 2HCl$; $\triangle H$=-44 kcal

What is the enthalpy of decomposition of HCl?

a) + 44 kcal/mol b) - 44 kcal/mol c) - 22 kcal/mol **d) + 22 kcal/mol**

Solution : -

$H_2(g) + Cl_2(g) \rightarrow 2HCl$; $\triangle H$ = - 44kcal

$\therefore 2HCl \rightarrow H_2(g) + Cl_2(g)$; $\triangle H$ = 44kcal

Therefore, enthalpy of decomposition of 2 moles of HCl =44 kcal

Therefore, enthalpy of decomposition of HCl= $\frac{44}{2}$kcal/mole = +22kcal/mol

122. For the reaction,

$\mathrm{N_2 + 3H_2 \rightleftharpoons 2NH_3}, \quad \Delta \mathrm{H} = ?$

a) $\Delta E + 2RT$ **b) $\Delta E - 2RT$** c) $\Delta H = RT$ d) $\Delta E - RT$

Solution : -

According to enthalpy equation

$$\underset{\text{change}}{\overset{\text{Enthalpy}}{\Delta H}} = \underset{\text{energy}}{\overset{\text{Internal}}{\Delta E}} + \Delta n_g RT$$

$\Delta n = 2 - (1 + 3)$

$[\Delta n = n_P - n_R]$

$\underset{\text{mole}}{\overset{\text{Product}}{}} \quad \underset{\text{mole}}{\overset{\text{Reactant}}{}}$

= 2 - 4 = -2

$\Delta H = \Delta E + (-2)RT$

$\Delta H = \Delta E - 2RT$

123. Enthalpy of the reaction, $CH_4 + \frac{1}{2} O_2 \longrightarrow CH_3OH$, is negative. If enthalpy of combustion of CH_4 and CH_3OH are X and Y respectively, then which relation is correct?

a) x> y **b) x < y** c) x = y d) x ≥ y

Solution : -

$CH_4 + \frac{1}{2}O_2 \longrightarrow CH_3OH$

ΔH_r = -ve

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$ ΔH = x ....(1)

$CH_3OH + \frac{3}{2} O_2 \longrightarrow CO_2 + 2H_2O$ Δx = y ....(2)

Eqn. (1) - Eqn. (2)

$CH4 + \frac{1}{2}O_2 \longrightarrow CH_3OH$ ΔH_r = x - y = -ve

Thus, x < y

124. Enthalpy change for the reaction, $4H_{(g)} \longrightarrow 2H_{2(g)}$ is - 869.6 kJ This dissociation energy of H-H bond is :

a) - 869.6 kJ **b) + 434.8 kJ** c) + 217.4 kJ d) - 434.8 kJ

Solution : -

$4H_{(g)} \longrightarrow 2H_{2(g)}$ ΔH = - 869.6 kJ

Reverse the above equation

$2H_{2(g)} \longrightarrow 4H_{(g)}$, ΔH = + 869.6 kJ

Divide the above equation by 2

$H_{2(g)} \longrightarrow 2H_{(g)}$, $\Delta H = \frac{869.6}{2}$ kJ = 434.8 kJ

125. The statement" The change of enthalpy of a chemical reaction is same whether the reaction takes place in one or several steps" is

a) Le Chatelier's law b) van't Hoff's law c) first law of thermodynamics **d) Hess's law.**

Solution : -

The statement "The change of enthalpy of a chemical reaction is same whether the reaction takes place in one or several steps" is Hess's law of constant heat summation.

126. **Assertion:** The enthalpy change for the reaction

$CaO_{(s)} + CO_{2(g)} \longrightarrow CaCO_{3(s)}$ is called enthalpy of formation of calcium carbonate.

Reason: The reaction involves formation of 1 mole of $CaCO_3$ from its constituent elements.

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 enthalpy change for the given reaction is not an enthalpy of formation of calcium carbonate, since $CaCO_3$ has been formed from other compounds, and not from its constituent elements.

127. From the following bond energies

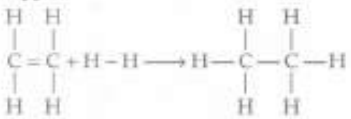
H-H bond energy: 431.37 kJ mol^{-1}

C=C bond energy: 606.10 kJ mol^{-1}

C-C bond energy: 336.49 kJ mol^{-1}

C-H bond energy: 410.50 kJ mol^{-1}

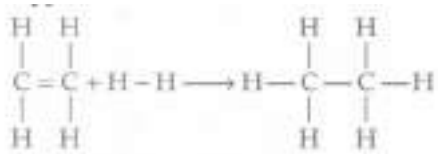
Enthalpy for the reaction,



will be :

a) 1523.6 kJ mol^{-1} b) - 243.6 kJ mol^{-1} **c) -120.0 kJ mol^{-1}** d) 553.0 kJ mol^{-1}

Solution : -



$\Delta H_{reaction} = \Sigma(\text{Bond enthalpy})_{reactants} - \Sigma(\text{Bond enthalpY})_{product}$

$= [(B.E.)_{C=C} + 4(B.E.)_{C-H} + (B.E\cdot)_{H\_H}] - [(B.E.)_{C-C} + 6(B\cdot E.)_{C-H}]$

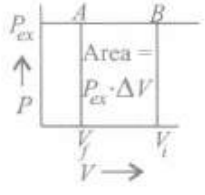
$= [606.10 + 4(410.50) + 431.37] - [336.49 + 6(410.50)]$

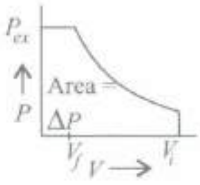
$= 2679.47 - 2799.49$

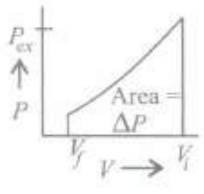
$= -120.02$ kJ mol^{-1}

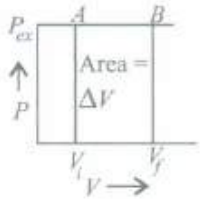
128. Work done on an ideal gas in a cylinder when it is compressed by an external pressure in a single step is shown below:

Which of the following graphs will show the work done on the gas?

a) 

b) 

c) 

d) 

Solution : -

The pressure is constant and equal to P_{ex}.
Also, the process is a single step.
Therefore, it is a straight line parallel to volume axis and has a value of P_{ex}.
Also, work done=P_{ex}. ΔV=Area under the P−V curve.

129. For the reaction, $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$. What is K_c when the equilibrium concentration of $[SO_2]$ = 0.60 M, $[O_2]$ = 0.82 M and $[SO_3]$ = 1.90 M?
a) 12.229 L mol^{-1} b) 24.5 L mol^{-1} c) 36.0 L mol^{-1} d) 2.67 x 10^3 L mol^{-1}

Solution : -

The formula for calculating equilibrium constant $K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$

$$K_c = \frac{(1.9^2)}{[(0.6)^2]\times[0.82]}$$
$$K_c = \frac{3.61}{0.36\times0.82}$$
$$K_c = \frac{3.61}{0.2952}$$
$\therefore$ K_c = 12.229L/mol

130. Solubility of MX2- type electrolytes is 0.5 x 10^{-4} mole/lit, then find out K_{sp} of electrolytes
a) 5 x 10^{-12} b) 25 x 10^{-10} c) 5 x 10^{-13} **d) 5 x 10^{-13}**

Solution : -
Given s = 0.5 x 10^{-4} moles/lit
$$\left[\mathrm{MX_2} \rightleftharpoons \mathrm{M^{2+}} + 2\mathrm{X}\right]$$
$$\because \text{ For } \mathrm{MX_2},\ \mathrm{K_{sp}} = \mathrm{s} \times (2\ \mathrm{s})^2 = 4\ \mathrm{s}^3$$
$$\mathrm{K_{sp}} = 4 \times \left(0.5 \times 10^{-4}\right)^3 = 4 \times 0.125 \times 10^{-12}$$
$$= 0.5 \times 10^{-12} = 5 \times 10^{-13}$$

131. Buffer solutions have constant acidity and alkalinity because:
a) These give unionized acid or base on reaction with added acid or alkali
b) Acids and alkalies in these solutions are shielded from attack by other ions
c) They have large excess of H^+ or OH^- ions d) They have fixed value of pH

Solution : -
When acid or alkali is added to a buffer solution then this added amount of acid or alkali is consumed by the solution according to following equations.
When acid is added $A^- + H_3O^+ \rightleftharpoons H_2O + HA$
Ion in buffer solution added acid undissociated acid
When alkali is added $HA + OH^- \rightleftharpoons H_2O + A$Undissociated
acid and added alkali ion transform
the base (OH-) into water (H_2O) and the conjugate base.

132. In which of the following equilibrium K_c and K_p are not equal?
a) $2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$ b) $SO_{2(g)} + NO_{2(g)} \rightleftharpoons S0_{3(g)} + NO_{(g)}$ c) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$ **d) $2C_{(s)} + O_{2(g)} \rightleftharpoons 2CO_{2(g)}$**

Solution : -
As we know, $K_p = K_c \text{ X } (RT)^{\Delta ng}$
So, for reaction having same number of gaseous moles on reactants and products side will have same value of K_c and K_p otherwise their values are
different.
For reaction, $2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$
$\Delta n_g = 2 - 2 = 0 \Rightarrow K_p = K_c \text{ x } (RT)^o$
$K_p = K_c$
For reaction, $SO_{2(g)} + NO_{2(g)} \sim SO_{3(g)} + NO_{(g)}$
$\Delta n_g = 2 - 2 = 0 \Rightarrow K_p = K_c$
For reaction, $SO_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$
$\Delta ng = 2 - 2 = 0 \Rightarrow K_p = K_c$

For reaction, $2C_{(s)} + 02_{(g)} \sim 2CO_{2(g)}$

$\Delta ng = 2 - 3 = -1 \Rightarrow K_p = K_c \times (RT)^{-1}$

Thus, in this reaction $K_p \neq K_c$

133. The following equilibrium constant are given

$N_2 + 3H_2 \rightleftharpoons 2NH_3; K_1$

$N_2 + O_2 \rightleftharpoons 2NO; K_2$

$H_2 + \frac{1}{2}O_2 \rightleftharpoons H_2O; K_2$

The equilibrium constant for the oxidation of NH_3 by oxygen to given NO is

a) $\frac{K_2 K_3^2}{K_1}$ b) $\frac{K_2^3 K_3}{K_1}$ c) $\frac{K_1 K_2}{K_3}$ **d)** $\frac{K_2 K_3^3}{K_1}$

Solution : -

According to given cquation.

$N_2 + 3H_2 \rightleftharpoons 2NH_3; K_1$ .....(i)

$N_2 + O_2 \rightleftharpoons 2NO; K_2$ .....(ii)

$H_2 + \frac{1}{2}O_2 \rightleftharpoons H_2O; K_3$ .....(iii)

Determine,

$4NH_3 + 5O_2 \rightleftharpoons 4NO + 6H_2O; K = ?$

$\text{or } 2NH_3 + \frac{5}{2}O_2 \rightleftharpoons 2NO + 3H_2O$ .....(iv)

From (iv) $K = \frac{[NO]^2[H_2O]^3}{[NH_3]^2[O_2]^{5/2}}$

$\text{but } K_1 = \frac{[NH_3]^2}{[N_2][H_2]^3},\ K_2 = \frac{[NO]^2}{[N_2][O_2]}$

$\text{and } K_3 = \frac{[H_2O]}{[H_2][O_2]^{1/2}} \text{ or}$

$K_3 = \frac{[H_2O]^3}{[H_2]^3[O_2]^{3/2}}$

Then putting the value K_1, K_2, K_3

$\frac{K_2 \cdot K_3^3}{K_1}$

$= \frac{[NO]^2}{[N_2][O_2]} \times \frac{[H_2O]^3}{[H_2]^3[O_2]^{3/2}}$

$\frac{[N_2][H_2]^3}{[NH_3]^2}$

$= \frac{[NO]^2[H_2O]^3}{[NH_3]^2[O_2]^{5/2}} = K$

$\therefore K = \frac{K_2 \cdot K_3^3}{K_1}$

134. Given the reaction between 2 gases represented by A_2 and B_2 to give the compound AB(g).

$A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$

At equilibrium, the concentration

of $A_2 = 3.0 \times 10^{-3}$ M

of $B_2 = 4.2 \times 10^{-3}$M

of AB = 2.8×10^{-3}M

If the reaction takes place in a sealed vessel at 527°C, then the value of K. will be:

a) 2.0 b) 1.9 **c) 0.62** d) 4.5

Solution : -

$A_2 + B_2 \rightleftharpoons 2AB; \quad K_c = \frac{[AB]^2}{[A_2][B_2]}$

$K_c = \frac{(2.8 \times 10^{-3})^2}{3 \times 10^{-3} \times 4.2 \times 10^{-3}}$

$= \frac{(2.8)^2}{3 \times 4.2} = 0.62$

135. Calculate the pOH of a solution at 25°C that contains 1×10^{-10} M of hydronium ions,i.e.,H_3O^+.

a) 4.000 b) 9.0000 c) 1.000 d) 7.000

Solution : -

Given $[H_3O]^+ = 1 \times 10^{-10}M$

$[H_3O^+][OH^-] = 10^{-14}, at T = 25^\circ C$

$\therefore [OH^-] = \frac{10^{-14}}{10^{-10}} = 10^{-4}$

$Now, [OH^-] = 10^{-pOH} = 10^{-4}$

Hence, pOH = 4

136. pH of a saturated solution of $Ba(OH)_2$ is 12. The value of solubility product K_{sp} of $Ba(OH)_2$ is :

a) 3.3×10^{-7} **b) 5.0×10^{-7}** c) 4.0×10^{-6} d) 5.0×10^{-6}

Solution : -

$Ba(OH)_2 \rightleftharpoons Ba^{2+} + 2OH$

At equilibrium x 2x

$12 = -\log [H^+] \Rightarrow [H^+] = 10^{-12}$

As, $[H^+][OH^-] - K_w = 10^{-14}$

$10^{-12}[OH^-] = 10^{-14} \Rightarrow [OH^-] = 10^{-2}$

If $[OH^-] = 2x = 10^{-2}$ then $x = 5.0 \times 10^{-3}$

Now, $K_{sp} = [Ba^{2+}][OH^-]2$

$K_{sp} = (5 \times 10^{-3})(10^{-2})^2 = 5.0 \times 10^{-7}$

137. Oxidation number of carbon in C_3O_2, Mg_2C_3 are respectively:

a) $-\frac{4}{3}, +\frac{4}{3}$ **b)** $+\frac{4}{3}, -\frac{4}{3}$ c) $-\frac{2}{3}, +\frac{2}{3}$ d) $-\frac{2}{3}, +\frac{4}{3}$

Solution : -

Let oxidation state of C in C_3O_2 be x.

Since the compound is neutral, sum of oxidation states of all elements = 0

$3x + 2(-2) = 0$

or, $x = \frac{4}{3}$

Oxidation state of C in Mg_2C_3 is y.

Since the compound is netural, sum of oxidation states of all elements = 0

$2 \times 2 + 3 \times y = 0$

or, $y = -\frac{4}{3}$

138. Which change occurs when lead monoxide is converted into lead nitrate?

a) Oxidation b) Reduction **c) Neither oxidation nor reduction** d) Both oxidation and reduction

Solution : -

$\overset{+2}{PbO} \rightarrow \overset{+2}{Pb}(NO_3)_2$

Neither oxidation nor reduction

139. Which of the following statements is not correct about the given reaction?

$K_4[Fe(CN)_6] \xrightarrow{Oxidation} Fe^{3+} + CO_2 + NO_3^-$

a) Fe is oxidised from Fe^{2+} to Fe^{3+}. b) Carbon is oxidised from C^{2+} to C^{4+}. c) N is oxidised from N^{3-} to N^{5+}.

d) Carbon is not oxidised.

Solution : -

In the reaction:

$K_4[Fe(CN)_6] \xrightarrow{Oxidation} Fe^{3+} + CO_2 + NO_3^-$

The oxidation of the elements are:

+1 +2 +2-3 Oxidation +3 +4 -2 +5 -2^-

$K_4[Fe(CN)_6] \rightarrow Fe^{+3} + CO_2 + NO_3$

Therefore Fe is oxidised from Fe^{2+} to Fe^{3+}.

Carbon is oxidised from C^{2+} to C^{4+}. thus Carbon gets oxidised.

N is oxidised from N^{3-} to N^{5+}.

140. For the redox reaction $MnO_4^- + C_2O_4^{2-} + H^+ \rightarrow Mn^{2+} + CO_2 + H_2O$. The correct coefficients of the reactants for the balanced equation are:

a)

MnO_4^-	$C_2O_4^{2-}$	H^+
2	**5**	**16**

b)

MnO_4^-	$C_2O_4^{2-}$	H+
16	5	2

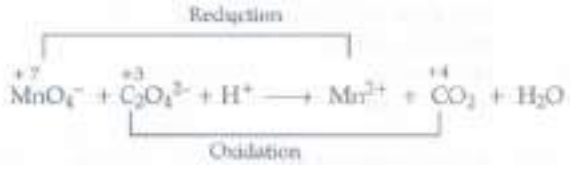
c)

MnO_4^-	$C_2O_4^{2-}$	H+
5	16	5

d)

MnO_4^-	$C_2O_4^{2-}$	H+
2	15	5

Solution : -



n-factor of MnO_4^- ⇒ 5

n-factor of $C_2O_4^-$ ⇒ 2

Since, ratio of n-factors of MnO_4^- and $C_2O_4^{2-}$ is 5 : 2

So, molar ratio in the balanced reaction is 2 : 5

∴ The balanced equation is

$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

141. In the reaction; $As_2S_3 + HNO_3 \rightarrow H_3AsO_4 + H_2SO_4 + NO$, the element oxidised is/are:

a) As only b) S only c) N only **d) As and S both**

Solution : -

$$As_2S_3 + HNO_3 \rightarrow H_3AsO_4 + H_2SO_4 + NO$$

+3 -2 +5 +5 +6 +2

(oxidation) (oxidation) (reduction)

Hence, the elements oxidised are both As and S.

142. The mass of 50% (mass/mass) solution of HCl required to react with 100g of $CaCO_3$ would be

a) 73 g b) 100 g **c) 146 g** d) 200 g

Solution : -

eq of HCl = eq of $CaCO_3$

$\frac{W}{36.5} = \frac{100}{50}; W_{HCI} = 73gm$

50g of HCl is present in 100gm of HCl solution

73g of HCl $\rightarrow$? =146gm of HCl

143. Which species is acting as a reducing agent in the following reaction?

$14H^+ + Cr_2O_7^{2-} + 3Ni \longrightarrow 2Cr^{3+} + 7H_2O + 3Ni^{2+}$

a) $Cr_2O_7^{2-}$ **b) Ni** c) H^+ d) H_2O

Solution : -

Reducing agent is defined as the species which carries out the reduction of other species and itself gets oxidized. In the reaction given in option B, the charge on nickel atom is changed from 0 to +2. Thus Nickel atom is oxidized and it carries out the reduction of Chromium atom.

$14H^+ + Cr_2O_7^{2-} + 3Ni \rightarrow 2Cr^{3+} + 7H_2O + 3Ni^{2+}$

Oxidation: $Ni \rightarrow Ni^{2+}$

Reduction: $Cr^{6+} \rightarrow Cr^{3+}$

144. The oxidation number of phosphorus in $Ba(H_2PO_2)_2$ is:

a) +3 b) +2 **c) +1** d) -1

Solution : -

Let the oxidation state of phosphorus in $Ba(H_2P\ O_2)_2$ be x.

then, the sum of all oxidation states should be 0, since, overall charge on the compound is 0.

therefore, +2 +4 + 2x - 8 = 0

or, x = +1

Hence, the oxidation number of phosphorus = +1.

145. Heavy water is used as

a) drinking water b) detergent c) washing water **d) a moderator.**

Solution : -

In nuclear reactors, heavy water is used as moderator for neutrons.

146. In what respect electronic configuration of hydrogen and halogens are similar?

a) Hydrogen and halogens have one electron in their outermost shell.

b) Hydrogen and halogens have one electron less than the noble gas configuration.

c) Hydrogen and halogens can lose one electron to form positive ions.

d) Hydrogen and halogens show noble gas configuration.

Solution : -

H - $1s^1$; He - $1s^2$

Halogen, X - $ns^2\ np^5$; Inert gas - ns^2np^6

Both have one electron less than the nearest noble gas configuration.

147. Non-stoichiometric hydrides are produced by

a) palladium, vanadium b) manganese, lithium c) nitrogen, fluorine d) carbon, nickel

Solution : -

The hydrogen deficient compounds formed by the reaction of d−block and f−block elements with dihydrogen are called Non-stoichiometric compounds.

The d-block and f-block element form non-stoichiometric hydride because of the vacant d- and f-orbitals along with the small size.

Their elemental composition proportions cannot be represented in integers. They disobey the law of constant composition. Among the elements given, only vanadium and palladium form non-stoichiometric hydrides.

148. Choose the correct option as directed.

a) CsH > KH > NaH < LiH (Order of stability) b) $H_2O < NH_3 < CH_4$ (Order of dipole moment)

c) $PH_3 < AsH_3 < NH_3 < SbH_3$ (Order of boiling point)

d) X ..... H - X,X = O > F > N > S > Cl (Order of strength of H-bonding)

Solution : -

CsH < KH < NaH < LiH

The stability of the hydrides of the elements from a particular group decreases with increasing atomic number (going down the group).

$CH_4 < NH_3 < H_2O$

Dipole moment depends upon the difference between the electronegativities of the bonded atoms, and the internuclear separation.

$PH_3 < AsH_3 < NH_3 < SbH_3$

Boiling point increases with an increase in molecular mass, NH_3 being an exception because of strong hydrogen bonding.

Cl< S The strength of hydrogen bonding depends upon the electronegativity and the size. Higher electronegativity and smaller size increases the strength of hydrogen bonding.

149. Which of the following easily catalys the decomposition of H_2O_2 when stored?

(i) Rough surface, (ii) Sunlight, (iii) Dust particles, (iv) Metals

a) (i) and (ii) b) (i), (ii) and (iii) c) (ii) and (iv) **d) All of these.**

Solution : -

Decomposition of H_2O_2 is catalysed by metals, rough surfaces, sunlight, dust particles, glass and alkalies.

150. Match the reactions of column I with their types given in column II and mark the appropriate choice.

Column - I		**Column -II**	
(A)	$H_2O+NH_3 \rightleftharpoons NH_4^+ + OH$	(i)	Self ionisation of H_2O
(B)	$FeCl_3 + 3H_2O \rightarrow Fe(OH)_3 + 3HCl$	(ii)	Decomposition
(C)	$H_2O + H_2O \rightleftharpoons H_3O^+ + OH$	(iii)	Acidic nature of H_2O
(D)	$2H_2O \rightarrow 2H_2 + O_2$	(iv)	Hydrolysis

a) (A) $\rightarrow$(ii), (B) $\rightarrow$ (i), (C) $\rightarrow$ (iii), (D) $\rightarrow$ (iv) b) (A) $\rightarrow$(iii), (B) $\rightarrow$ (ii), (C) $\rightarrow$ (iv), (D) $\rightarrow$ (i)

c) (A) $\rightarrow$ (i), (B) $\rightarrow$ (ii), (C) $\rightarrow$ (iv), (D) $\rightarrow$ (iii) **d) (A) $\rightarrow$ (iii), (B) $\rightarrow$ (iv), (C) $\rightarrow$ (i), (D) $\rightarrow$ (ii)**

Solution : -

(a) $H_2O + NH_3 \rightleftharpoons NH_4 + OH^-$

Here NH_3 is Lewis base and H_2O

acid as acid to it represents

acidic nature of H_2O

(b) $F_eCl_3 + H_2O \rightarrow F_e(OH)_3 + 3HCl$

it is are example of hydrolysis reaction which produces acid and base

(C) $H_2O + H_2o \rightarrow H_3O + OH^-$

self ionisation of water

(D) $2H_2O \rightarrow 2H_2 + O_2$

Decomposition of water in their corresponding molecule

151. The isotopes of hydrogen have different physical properties due to difference in mass. They have almost same chemical properties with a difference in their rates of reactions which is mainly due to

a) their different enthalpy of bond dissociation b) different electronic configurations

c) different atomic masses d) different physical properties

Solution : -

Enthalpy of bond dissociation of deuterium is higher (443.35 kl mol^{-1}) than hydrogen (435.88 kl mol^{-1}).

152. The density of water is less in its solid state because:

a) in solid state (ice), water molecules are arranged in highly ordered open cage like structure

b) more extensive hydrogen bonding is present in solid state ice

c) the water molecules are closest in solid state of water

d) water is a rigid crystalline, closely packed structure in its solid state.

Solution : -

The water has maximum density at 4 deg C. When liquid water is converted to ice, an open cage three dimensional structure is formed. Almost half the space is unoccupied. In liquid state, molecules are more closely packed.

153. An organic compound contains C = 40%, O = 53 .34% O and H = 6.60%. The empirical formula of the compound is:

a) CH_2O b) CHO c) CH_4O_2 d) C_2H_2O

Solution : -

Element	%	At,Wt	Molar ratio	Simple ratio
C	40	12	$\frac{40}{12} = 3.33$	$\frac{3.33}{3.33} = 1$
H	6.60	1	$\frac{6.60}{1} = 6.60$	$\frac{6.60}{3.33} = 2$
O	53.34	16	$\frac{53.34}{16} = 3.33$	$\frac{3.33}{3.33} = 1$

Hence, empirical formula is

$$C : H : O = 1 : 2 : 1 = CH_2O$$

154. A solution containing components A and B follow Raoult's law when

a) A - B attraction force is greater than A - Aand B - B b) A-B attraction force is less than A - A and B - B

c) A- B attraction force remains same as A.-A and B- B

d) Volume of solution is different from sum of volume of solute and solvent

Solution : -

Given components A and B follow the condition of Raoult's law if the force of attraction between A and A or B and B.

155. **Assertion:** Decrease in the vapour pressure of water by adding 1 mol of sucrose to one kg of water is higher to that produced by adding 1 mol of urea to the same quantity of water at the same temperature.

Reason: Molecular mass of sugar is less than that of urea.

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 : -

Decrease in the vapour pressure of solvent depends on the quantity of non-volatile solute irrespective of its nature. Hence, decrease will besame in both the cases.

156. A 5% solution (w/W) of cane sugar (molar mass = 342 g mol^{-1}) has freezing point 271 K. What will be the freezing point of 5% glucose (molar mass = 18 g mol^{-1}) in water if freezing point of pure water is 273.15 K?

a) 273.07 K **b) 269.07 K** c) 273.15 K d) 260.09 K

Solution : -

$\triangle T_f = \frac{K_f \times W_B}{M_b \times W_A}$

For cane sugar solution, 2.15 K = $\frac{K_f \times 5}{342 \times 0.095}$

($\therefore$ 95 g of water = 0.095 kg)

For glucose solution, $\triangle T_f = \frac{K_f \times 5}{180 \times 0.095}$

$\frac{\triangle T_f}{2.15} = \frac{K_f \times 5}{180 \times 0.095} \times \frac{342 \times 0.095}{k_f} \times 5$

$\triangle T_f = \frac{342}{180} \times 2.15$=4.085 K

Freezing point of glucose solution = 273.15 - 4.085 = 269.07 K

157. Concentrated aqueous sulphuric acid is 98% H_2SO_4 by mass and has a density of 1.80 gmL^{-1} Volume of acid required to make one liter of 0.1M H_2SO_4 solution is :

a) 11.10 mL b) 16.65 mL c) 22.20 mL **d) 5.55 mL**

Solution : -

98% by weight H_2SO_4 = $\frac{98\ g\ H_2SO_4}{100\ g\ solution}$

Volume of 100 g solution = $\frac{mass}{density} = \frac{100}{1.8} = 55.55\ mL$

For, 0.1 M, we need 9.8 g H_2SO_4

55.55 mL acid = 98 g

5.55 ml acid = 9.8 g = 0.1 Molar acid

158. 25.3 g of sodium carbonate, Na_2CO_3 is dissolved in enough water to make 250 mL of solution . If sodium carbonate dissociates completely, molar concentration of sodium ions, Na^+ and carbonate ions, CO_3^{2-} are respectively. (Molar mass of Na_2CO_3 = 106 g mol^{-l})

a) 0.955 M and L.910 M b) 0.910 M and 0.955 M c) 1.90 M and 1.910 M d) 0.477 M and 0.477 M

Solution : -

Concentration of:

$\mathrm{Na_2CO_3} = \frac{25.3}{106} \times \frac{1000}{250} = 0.955\mathrm{M}$

$\text{Where } \mathrm{Na_2CO_3} = 25.3\ \mathrm{g}$

$\left[\mathrm{Na^+}\right] = 2 \times 0.95 = 1.91\mathrm{M}$

$\left[\mathrm{CO_3^{2-}}\right] = 0 \mid 955\mathrm{M}$

159. **Assertion:** Molecular mass of KCl calculated on the basis of colligative properties will be lower than the normal molecular mass.

Reason: Experimentally determined molar mass is always lower than the true value.

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 : -

KCl undergoes dissociation in solution, hence observed molar mass will be lower. Experimentally determined molar mass can be higher or lower depending upon whether solute undergoes dissociation or association.

160. Low concentration of oxygen in the blood and tissues of people living at high altitude is due to_____.

a) low temperature **b) low atmospheric pressure** c) high atmospheric pressure

d) both low temperature and high atmospheric pressure

Solution : -

At high altitudes, the partial pressure of oxygen is less than that at the ground level. This leads to low concentrations of oxygen in the blood and tissues of people living at high altitudes or climbers. Low blood oxygen causes climbers to become weak and unable to think clearly, symptoms of a condition known as anoxia.

161. Iron exhibits bee structure at room temperature. Above 900°C, it transforms to fcc structure. The ratio of density of iron at room temperature to that at 900°C(assuming molar mass and atomic radii of iron remains constant with temperature) is :

a) $\frac{3\sqrt{3}}{4\sqrt{2}}$ b) $\frac{4\sqrt{3}}{3\sqrt{2}}$ c) $\frac{\sqrt{3}}{\sqrt{2}}$ d) $\frac{1}{2}$

Solution : -

BCC FCC

4r=$\sqrt{3a}$ 4r=$\sqrt{3a}$

a=$\frac{4r}{\sqrt{3}}$ a=$\frac{4r}{\sqrt{2}}$

$$\frac{d_{BCC}}{d_{FCC}} = \frac{\frac{Z_{BCC}\times M}{N_A a^3}}{\frac{Z_{FCC}\times M}{N_A a^3}} = \frac{\frac{2\times M}{N_A\left(\frac{4r}{\sqrt{3}}\right)^3}}{\frac{4\times M}{N_A\times\left(\frac{4r}{\sqrt{2}}\right)^3}} = \frac{3}{4}\sqrt{\frac{3}{2}}$$

So, the correct answer is (a).

162. A metal crystallises into two cubic phases, face centred cubic (fcc) and body centred cubic (bcc), whose unit cell lengths are 3.5 Å and 3.0 Å, respectively. The ratio of densities of fee and bee is:

a) 1.259: 1 b) 1: 1.259 c) 3: 2 d) 1.142: 1

Solution : -

Unit cell length for fee = 3.5 Å

Unit cell length for bee = 3.0 Å

∴ Density in fcc = $\frac{n_1\times at.wt}{V_1\times N_A}$

∴ Density in bcc = $\frac{n_2\times at.wt}{V_2\times N_A}$

or $\frac{Density(fcc)}{Density(bcc)} = \frac{n_1}{n_2}\times\frac{V_2}{V_1} = \frac{4}{2}\times\frac{V_2}{V_1}$ $[\because for fcc, n_1 = 4$ $\therefore for bee, n_2 = 2]$

Volume for fee = $V_1 = a^3 = (3.5 \times 10^{-8})^3$ cm^3

and volume for bee = $V_2 = a^3 = (3.0 \times 10^{-8})^3$ cm^3

$$\frac{Density(fcc)}{Density(bcc)} = \frac{4\times(3.0\times10^{-8})^3}{2\times(3.5\times10^{-8})^3}$$

= 1.259 or 1.259:1

163. Which of the following is true about the charge acquired by p-type semiconductors?

a) positive **b) neutral** c) negative d) depends on concentration of p impurity

Solution : -

p−type semiconductors have a larger hole concentration than electron concentration. In p-type semiconductors, holes are the majority carriers and electrons are the minority carriers. p−type semiconductors are created by doping an intrinsic semiconductor with acceptor impurities. A common p−type dopant for silicon is boron or gallium. There will be no charge on the semiconductor.

164. Which type of semiconductor is formed when germanium is doped in the gallium as indicated in the figure?

a)

p-type semiconductor	**Ge**	**Ge**	**Ge**	**Ge**

b)

n-type semiconductor	Ge	Ge	Ga	Ge

c)

No change in conductivity	Ge	Ge	Ge	Ge

d)

It becomes superconductor	Ge	Ge	Ge	Ge

Solution : -

In the given figure, the base element is Ge and it is doped with Ga. Here the impurity is a trivalent element. It creates deficiencies of valence electrons, called "holes". This makes the material a p-type semiconductor.

165. Which among the following will show anisotropy?

a) Glass **b) NaBr** c) Plastic d) Rubber

Solution : -

When the properties of material vary with different crystallographic orientations, the material is said to be anisotropic. This is only possible with crystalline solids.

In the given options, only NaBr is crystalline solid.

166. Crystalline CsCl has density 3.988 g cm^{-3}. The volume occupied by single CsCl ion pair in the crystal will be:

a) 7.014 x 10^{-3} cm^3 **b) 7.014 x 10^{-23} cm^3** c) 1.014 x 10^{-3} cm^3 d) 1.542 x 10^{-5} cm^3

Solution : -

For bee structure of ionic compounds like CsCl, Z = 1

$d = \frac{Z \times M}{N_A \times a^3}$

$a^3 = \frac{Z \times M}{d \times N_A} = \frac{1 \times 168.4}{3.988 \times 6.023 \times 10^{23}} = 7.014 \times 10^{-23} cm^3$

167. A ferromagnetic substance becomes a permanent magnet when it is placed in a magnetic field because:

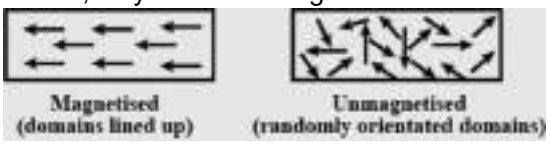
a) all the domains get oriented in the direction of magnetic field

b) all the domains get oriented in the direction opposite to the direction of magnetic field

c) domains get oriented randomly d) domains are not affected by magnetic field

Solution : -

A ferromagnetic substance is a substance in which the magnetic moments of the individual atoms are aligned and point in the same direction. These substances are strongly magnetized when placed in an external magnetic field. Hence, only hard ferromagnets can be used to make permanent magnets.



168. Which of the following solids is the structure of CsCl crystal?

a) Body centred cubic b) Simple cubic c) Face centred cubic d) Edge centred cubic

Solution : -

In CsCl, each Cs atom is surrounded by 8 Cl atoms and each Cl atom is surrounded by 8 Cs atoms making coordination number to 8 with body centerd structure.

169. In electrolysis of NaCl when Pt electrode is taken then H_2 is liberated at cathode while with Hg cathode it forms sodium amalgam because :

a) Hg is more inert than Pt **b) more voltage is required to reduce H^+ at Hg than at Pt**

c) Na is dissolved in Hg while it does not dissolve in Pt

d) concentration of H^+ ions is larger when Pt electrode is taken

Solution : -

Sodium chloride dissociates in water as follows

$NaCl \rightleftharpoons Na^+ + Cl^-$

$H_2O \rightleftharpoons H^+ + OH^-$

When electric currents is passed through this solution using platinum electrodes, Na^+ and H^+ move towards cathode whereas Cl^- and OH^- ions move towards anode.

At cathode : $H^+ + e^- \longrightarrow H$

$H + H \longrightarrow H_2$

At anode : $Cl^- \longrightarrow Cl + e^-$

$Cl + Cl \longrightarrow Cl_2$

If mercury is used as cathode, H^+ ions are not discharged at mercury cathode because mercury has a high hydrogen over voltage. Thus, Na^+ ions are discharged at cathode in preference of H^+ ions yielding sodium which dissolves in mercury to form sodium amalgam.

170. While charging the lead storage battery_____.

a) $PbSO_4$ anode is reduced to Pb b) $PbSO_4$ cathode is reduced to Pb

c) $PbSO_4$ cathode is oxidised to Pb d) $PbSO_4$ anode is oxidised to PbO_2

Solution : -

On charging the battery the reaction is reversed and $PbSO_{4(s)}$ is converted into Pb at anode and PbO_2 at cathode.

171. If the E^0_{cell} for a given reaction has a negative value, which of the following gives the correct relationships for the values of ΔG^0 and K_{eq}?

a) $\Delta G^0 > 0, K_{eq} < 1$ b) $\Delta G^0 > 0, K_{eq} > 1$ c) $\Delta G^0 < 0, K_{eq} > 1$ d) $\Delta G^0 < 0, K_{eq} < 1$

Solution : -

We know that

$\Delta G^0 = -nFE^0$ cell

If E^0_{cell} = -ve then ΔG^0 = +ve i.e. ; $\Delta G^0 > 0$

$\Delta G^0 = -nRT \log K_{eq}$

For ΔG^0 = +ve, K_{eq} = -ve i.e., $K_{eq} < 1$

172. The efficiency of a fuel cell is given by :

a) ΔG/ΔS **b) ΔG/ΔH** c) ΔS/ΔG d) ΔH/ΔG

Solution : -

Efficiency of a fuel cell (ϕ) = $\frac{\Delta G}{\Delta H}$ x 100

Generally, fuel cells are expected to have an efficiency of 100 percent.

173. Specific conductance of 0.1 M NaCl solution is 1.01 x 10^{-2} ohm^{-1} cm^{-1} Its molar conductance in ohm^{-1} cm^{-2} mol^{-1} is

a) 1.01 x 10^2 b) 1.01 x 10^3 **c) 1.01 x 10^4** d) 1.01

Solution : -

$A_m = \frac{k \times 1000}{M}$

$\frac{1.01 \times 10^{-2} \times 1000}{0.1}$ = 1.01 x 10^2 ohm^{-1} cm^2 mol^{-1}

174. Standard electrode potentials are : $\mathrm{Fe}^{+2}/\mathrm{Fe}$

$[\mathrm{E}^\circ = -0.44]; \mathrm{Fe}^{+3}/\mathrm{Fe}^{+2} \mathrm{E}^\circ = +0.77;$ if $\mathrm{Fe}^{2+}, \mathrm{Fe}^{3+}$ and Fe blocks are kept together, then:

a) Fe^{2+} increases **b) Fe^{3+} decreases** c) $\frac{\mathrm{Fe}^{+2}}{\mathrm{Fe}^{+3}}$ remains unchanged d) Fe^{+2} decreases

Solution : -

$\mathrm{Fe}^{+2}/\mathrm{Fe}; \mathrm{E}^\circ = -0.44$

$\mathrm{Fe}^{2+}/\mathrm{Fe}^{+2}; \mathrm{E}^\circ = 0.44$

The metals of higher negative electrode potential values can displace metals of lower values of negative electrode potential from their salt solutions.

175. A weak monobasic acid is 5% dissociated in 0.01 mol dm^{-3} solution. Limiting molar conductivity of acid at infinite dilution is 4 x 10^{-2} ohm $^{-l}$ m 2mol $^{-1}$. What will be the conductivity of 0.05 mol dm-3 solution of the acid?

a) 8.94 x 10^{-6} ohm^{-1} cm^2 mol^{-1} **b) 8.92 x 10^{-4} ohm^{-1} cm^2 mol^{-1}** c) 4.46 x 10^{-6} ohm^{-1} cm^2 mol^{-1}

d) 2.23 x 10^{-5} ohm^{-1} cm^2 mol^{-1}

Solution : -

$K_a = Ca^2$ = 0.01 x $(0.05)^2$ = 2.5 x 10^{-5}

$K_a = Ca^2$

2.5 x 10^{-5} = 0.05 x $a^2 \Rightarrow$ a = 0.0223

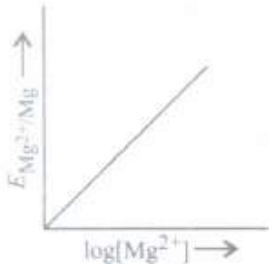
$a = \frac{\Lambda_m^c}{\Lambda_m^\infty}$

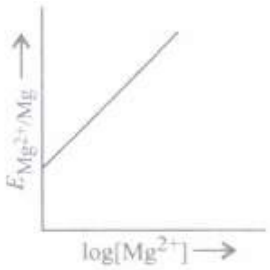
Λ_m^c = 0.0223 x 4 x 10^{-2} = 8.92 X 10-4 ohm^{-1} cm^2 mol^{-1}

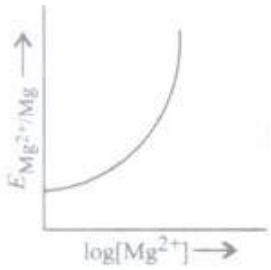
176. Electrode potential for Mg electrode varies according to the equation

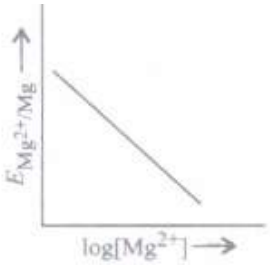
$E_{Mg^{2+}|Mg} = E^o_{Mg^{2+}|Mg} - \frac{0.059}{2} \log \frac{1}{[Mg^{2+}]}$

The graph of $E_{Mg^{2+}|Mg} vs \log [Mg^{2+}] is$

a) 

b) 

c) 

d) 

Solution : -

$E = E^o + \frac{0.059}{2}\log\left[Mg^{2+}\right]$

Hence, plot of E vs log[Mg^{2+}] will be linear with positive slope and intercept = E^o

177. Oxygen will directly react with each of the following elements except

a) P **b) Cl** c) Na d) S

Solution : -

Chlorine does not react directly with oxygen.

178. Aluminium oxide is not reduced by chemical reactions due to

a) its highly stable nature b) its highly unstable nature c) its amphoteric nature

d) its highly explosive nature.

Solution : -

Al_2O_3 is highly stable and passive to chemical reactions.

179. Which one of the following arrangement does not give the correct picture of trends indicated against it?

a) $\mathrm{F_2 > Cl_2 > Br_2 > I_2}$: Oxidizing power **b)** $\mathrm{F_2 > Cl_2 > Br_2 > I_2}$ **: Electron gain enthalpy**

c) $\mathrm{F_2 > Cl_2 > Br_2 > I_2}$: Bond dissociation energy d) $\mathrm{F_2 > Cl_2 > Br_2 > I_2}$: Electronegativity.

Solution : -

(b) and (c), explain below:

(a) The oxidising power of halogen follow the order $\mathrm{F_2 > Cl_2 > Br_2 > I_2}$

(b) The correct order of electron gain enthalpy of halogens is $\mathrm{Cl_2 > F_2 < Br_2 > I_2}$. The low value of $\mathrm{F_2}$ than $\mathrm{Cl_2}$ is because of its small size.

(c) The correct order of bond dissociation energies of halogens is $\mathrm{Cl_2 < Br_2 < F_2 < I_2}$

It is the correct order of electrone-gativity values of halogens.

$\mathrm{F_2 > Cl_2 > Br_2 > I_2}$

180. In the structure of diborane

a) all hydrogen atoms lie in one plane and boron atoms lie in a plane perpendicular to this plane

b)

2 boron atoms and 4 terminal hydrogen atoms lie in the same plane and 2 bridging hydrogen atoms lie in the perpendicular plane

c)

4 bridging hydrogen atoms and boron atoms lie in one plane and two terminal hydrogen atoms lie in a plane perpendicular to this plane

d) all the atoms are in the same plane

181. Which would quickly absorb oxygen?

a) Alkaline solution of pyrogallol b) Cone. H_2SO_4 c) Lime water d) Alkaline solution of $CuSO_4$

Solution : -

Oxygen is quickly absorbed by alkaline solution of pyrogallol.

182. Match the uses of the metal aluminium given in column I with its properties given in column II and mark the appropriate choice

Column I		Column II	
(A)	Transmission cables	(i)	High malleability
(B)	Aircraft body	(ii)	High electrical conductivity
(C)	Packing industry	(iii)	industry conductivity
(D)	Utensils	(iv)	Light and tough alloys

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

183. Ammonia is used in detection of Cu^{2+} ion because
a) aqueous solution of NH_3 reacts with Cu^{2+} ion to form deep blue coloured complex
b) NH_3 reacts with Cu^{2+} ion to give blue precipitate of CuO
c) aqueous solution of NH_3 reacts with Cu^{2+} ion to form white coloured complex
d) NH_3 reacts with Cu^{2+} ion to give green precipitate

Solution : -

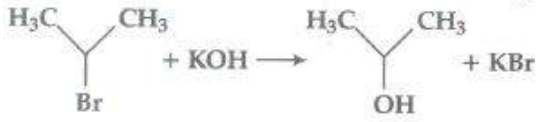
$$Cu^{2+}_{(aq)} + 4NH_{3(aq)} \rightarrow \underset{Deep\quad blue}{[Cu(NH_3)_4]^{2+}_{(aq)}}$$

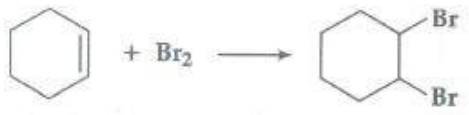
184. Maximum ability of catenation is shown by
a) silicon b) lead c) germanium **d) carbon**

185. Some meta-directing substituents in aromatic substitution are given. Which one is most deactivating?
a) $-SO_3H$ b) -COOH **c) $-NO_2$** d) $-C \equiv N$

Solution : -
Decreasing order of deactivating effect of the given $> NO_2 > -CN > -SO_3H > -COOH$
Hence, $-NO_2$ group is most deactivating group due to strong -E, -I and -M effects

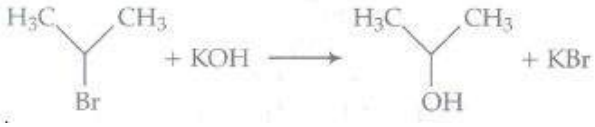
186. Which of the following is a characteristic feature of a free radical?
a) It has a positive charge b) It has a negative charge c) It has all paired electrons
d) It has an unpaired electron

187. For the following reactions:
(A) $CH_3CH_2CH_2Br + KOH \longrightarrow CH_3CH = CH_2 + KBr + H_2O$
(B) 

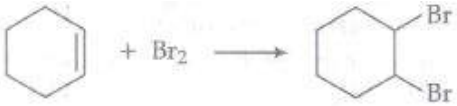
(C) 

a) (A) is elimination, (B) and (C) are substitution reactions.
b) (A) is substitution, (B) and (C) are addition reactions.
c) (A) and (B) are elimination reactions and (c) is addition reaction
d) (A) is elimination, (B) is the substitution and (C) is the addition reaction.

Solution : -
$CH_3CH_2CH_2Br + KOH \longrightarrow CH_3CH = CH_2 + KBr + H_2O$
Saturated compound is converted into unsaturated compound by removal of group of atoms hence, it is an elimination reaction



—Br group is replaced by —OH group hence, it is a substitution reaction



188. The correct statement regarding the comparision of staggered and eclipsed conformation of ethane, is

a)

The staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain

b)

The eclipsed conformation of ethane is more stable than staggered conformation, because eclipised conformation has no torsional strain

c)

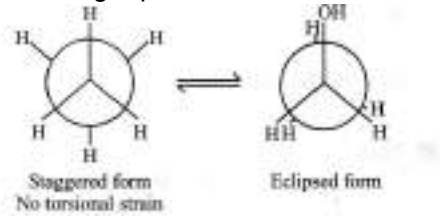
The eclipsed conformation of ethane is more stable than staggered conformation, even through the eclipsed conformation has torsional strain

d)

The staggered conformation of ethane is not.- stable then eclipsed conformation, because staggered conformation has no torsional strain.

Solution : -

In staggered conformation any two hydrogen atoms an adjacent carbon atoms are independent possible there by minimising repulsion between the electron clouds of σ-bonds of two non-bonded H-atomic (torsional strain).



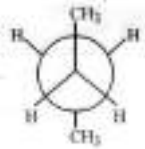
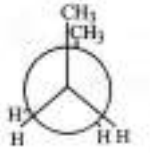
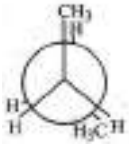
189. Which of the following will exhibit chirality?

a) 2-methyl hexane **b) 3-methyl hexane** c) Neopentane d) Isopentane

Solution : -

3-methyl hexane contains chiral carbon atom. Here it exhibits chirality.

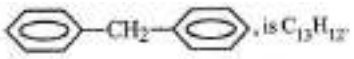
190. In the following the most stable conformation of n-butane is:

a)  **b)**  c)  d) 

Solution : -

The bulky methyl groups are the most stable conformation of n-butane

191. The molecular formula of diphenylmethane,

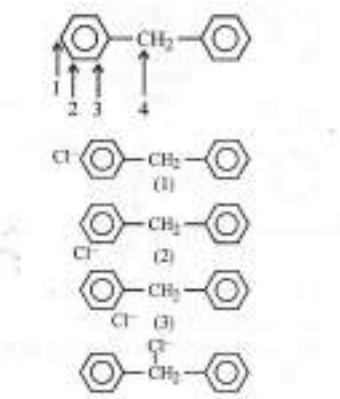


is $C_{13}H_{12}$. How many structural isomers are possible when one of the hydrogens is replaced by a chlorine atom?

a) 6 **b) 4** c) 8 d) 7

Solution : -

According to given compound in diphenylmethane monochlorination at below position will product structured isomers.



Hence, four structural isomers

192. Which of the following compounds is not chiral?

a) $DCH_2CH_2CH_2C$ b) CH_3CH_2CHOCl c) CH_3CHDCH_2Cl d) $CH_3CHCTCH_2D$

Solution : -

Chiral carbon is that carbon whose all the four valencies are satisfied by four different groups

Due to absence of asymmetric (chual) C-atom

$D - CH_2 - CH_2 - CH_2Cl$

molecule is not a chiral molecule.

193. In a taxonomic hierarchy, family is interpolated between

a) kingdom and class b) class and order **c) order and genus** d) class and genus

194. Which term can be used for any taxonomic rank?

a) Class b) Taxon c) Family d) Cohort

195. Nomenclature is governed by certain universal rules. Which of the following is contrary to the rules of nomenclature?

a) The first word in a biological name represents the genus name and the second is a specific epithet.

b) The names are written in Latin and are italicized.

c) When written by hand, the names are to be underlined.

d) Biologicalnames can be written in any language.

Solution : -

Rules for Nomenclature:

(a) Latinised names are used.

(b) First word represents the genus, while the second word is species name.

(c) Printed in italics; if handwritten then underlined separately.

(d) First word starts with a capital letter while species name is written in small letters.

196. Carolus Linnaeus belonged to

a) France b) Germany c) Sweden d) Holland.

Solution : -

Carolus Linnaeus (1707-1778) was a Swedish naturalist, who is known as the Father of taxonomy.

197. Two animals belong to the same kingdom but different classes. They may belong to the same

a) phylum b) order c) division d) species

Solution : -

Animals belonging to the same kingdom but different classes may belong to the same phylum.

198. Mango belongs to this order

a) Anacardiales b) Poales **c) Sapindales** d) Polymoniales

199. Which one of the following statements is incorrect?

a) indica, tuberosum and lea represent the specific epithets.

b) Physalia, Apis and Helianthus represent the generic epithets

c) Monocotyledonae and Dicotyledonae are the two classes of division Angiospermae.

d) Phylum Chordata is the largest phylum of Kingdom Animalia.

Solution : -

Phylum Arthropoda is the largest phylum of Kingdom Animalia. It includes the largest number of animals with about 900,000 species

200. Which of the following options represents the correct classification for the given animal?

a)

Phylum	Class	Order	Family	Genus	Species
Chordata	Vertebrata	Chiroptera	Felidae	Canis	tigris

b)

Phylum	Class	Order	Family	Genus	Species
Chordata	Mammalia	Carnivora	Felidae	Panthera	tigris

c)

Phylum	Class	Order	Family	Genus	Species
Vertebrata	Mammalia	Carnivora	Felidae	Panthera	tigris

d)

Phylum	Class	Order	Family	Genus	Species
Mammalia	**Felidae**	**Carnivora**	**Feliaeeae**	**Panthera**	**leo**

201. Which of the following statements is incorrect regarding the structure of a typical bacterial cell?

a) Cells possess naked circular DNA which is folded to form nucleoid.

b) Cells are surrounded by a peptidoglycan cell wall and a mucilaginous sheath.

c) Cells possess well developed membrane bound cell organelles.

d) Ribosomes in these cells are 70S in nature.

202. Which of the following statements is wrong for viroids?

a) They lack a protein coat. b) They are smaller than viruses. c) They cause infections.

d) Their RNA is of high molecular weight

Solution : -

Viroids, the smallest known pathogens, are naked, circular single-stranded RNA molecules that do not encode protein but autonomously replicate when introduced into host plants. Viroids only infect plants; some cause economically important diseases of crop plants, while others appear to be benign.

203. Mycoplasmas are classified under which of the following kingdoms?

a) Monera b) Protista c) Fungi d) Plantae

204. The chief advantage of encystment to an Amoeba is _____ .

a) The chance to get rid of accumulated waste products.

b) The ability to survive during adverse physical conditions.

c) The ability to live for sometime without ingesting food. d) Protection from parasites and predators.

Solution : -

During adverse environmental periods, Amoeba survive by encystment. The Amoeba becomes circular, loses most of its water, and secretes a cyst membrane that serves as a protective covering. When the environment is again suitable, the envelope ruptures and the Amoeba emerges.

205. Which of these is a defining character of plants?

a) Autotrophic nature b) Eukaryotic cell structure c) Cellulosic cell wall **d) Aerobic respiration**

206. In Penicillium, the asexual reproduction takes place by

a) ascosporesc b) aplanospores c) sporangiospores **d) conidiospores.**

Solution : -

In **Penicillium**, the asexual reproduction takes place by conidiospores.

207. In Amoeba and Paramecium osmoregulation occurs through _____ .

a) Pseudopodia b) Nucleus c) Contractile vacuole **d) General surface**

Solution : -

Contractile vacuole in Amoeba and paramecium maintain the water balance of the cell. This is known as osmoregulation.

208. Pick up the wrong statement.

a) Nuclear numbrane is present is Monera b) Cell wall is absent in Animalia

c) Protista have photosynthetic and heterotrophic modes of nutrition d) Some fungi are edible.

Solution : -

All monerans are unicellular; They lack true nuclei and generally lack membrane-bound organelles.

209. Match Column-I with Column-II

Column-I	**Column-II**
(A) Saprophyte	(i) Symbiotic association of fungi with plant roots of fungi with plant roots
(B) Parasite	(ii) Decomposition of dead organic materials
(C) Lichens	(iii) Living on living plants or animals
(D) Mycorrhiza	(iv) Symbiotic association of algae and fungi

Choose the correct answer from the option given below:

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

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

Solution : -

(A) Saprophyte	Decomposition of dead organic materials
(B) Parasite	Grow on/in living plants and animals
(C) Lichens	Symbiotic association of algae and fungi
(D) Mycorrhiza	Symbiotic association of fungi with plant roots

210. Resin and terpentine are obtained from _____ .

a) Cycas **b) Pinus** c) Cedrus d) Abies

Solution : -

Pinus roxburghi is a source of resin and terpentine, obtained after distillation. Terpentine is utilised in varnishes and paints.

211. Which of the following statements is correct?

a) Horsetails are gymnosperms b) Selaginella is heterosporous, while Salvinia is homosporous

c) Ovules are not enclosed by ovary wall in gymnosperms

d) Stems are usually unbranced in both Cycas and Cedrus

Solution : -

Gymnosperms are plants in which ovules are not enclosed by any ovary wall and remain exposed, both before and after fertilisation.

(i) Horsetails are Pteridophytes.

(ii) Stems are branched in Cycas and unbranched in Cedrus.

212. Flagellated cells are ansent in:-

a) Red algae b) Blue green algae c) Higher seed plants **d) All the above**

213. The antherozoids of Funaria are _____ .

a) Aciliated **b) Biflagellated** c) Multiciliated d) Monociliated

Solution : -

The antherozoids of Funaria are spirally coiled and bear two equal flagella at anterior end.

214. Haplo-diplontic life cycle is found in

a) bryophytes b) pteridophytes c) fungi **d) both (a) and (b).**

Solution : -

Haplo-diplontic type of life cycle involves the clear alternation of generations between a haploid gamete producing gametophyte and a diploid spore producing sporophyte. Both bryophytes and pteridophytes exhibit this kind of life cycle pattern.

215. Aquatic fern which supports the grouth of blue green algae, Anabaena, and used to increase the yield of paddy crop is:-

a) Salvinia b) Marsilea c) Isoetes **d) Azolla**

216. Match column I with column II and select the correct option from the codes given below.

Column I	Column II
A. Non-vascular cryptogams	(i) Gymnosperms, angiosperms
B. Vascular cryptogams	(ii) Pteridophytes
C. Phanerogams	(iii) Algae, bryophytes

a) A-(iii), B-(ii), C-(i) b) A-(ii), B-(i), C-(iii) c) A-(i), B-(ii), C-(iii) d) A-(ii), B-(iii), C-(i)

217. What is true about all sponges without exception?

a) They are all marine **b) They have flagellated collar cells**

c) They have a mixed skeleton consisting of spicules and spongin fibres

d) They reproduce only asexually by budding

Solution : -

(i) Sponges are all aquatic, mostly marine but few fresh water forms also exist. Choanocytes or collar cells are only present in sponges.

(ii) Sponges usually have a skeleton consisting of spicules or spongin fibres.

(iii) Sponges reproduce asexually by budding, gemmules and reproduce sexually too.

218. Which one of the following pairs of animals comprises jawless fishes?

a) Mackerals and Rohu **b) Lampreys and hagfishes** c) Guppies and hagfishes d) Lampreys and eels.

Solution : -

Lamprey and Hagfish are Cyclostomes which are jawless fishes

219. Which of the following statements are incorrect?

(i) Parapodia are lateral appendages in arthropods used for swimming.

(iI) Radula in molluscs are structures involved in excretion.

(iii) Aschelminthes are dioecious.

(iv) Echinoderm adults show radial symmetry.

(v) Ctenophorans are diploblastic.

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

Solution : -

Parapodia are present in some annelid worms. These are a pair of flattened flesh lobes bearing numerous bristles. Radula (rasping organ) in molluscs is a structure involved in feeding.

220. In which one of the following, the genus name, its two characters and its class/phylum are correctly matched?

a)

Genus name	**Two characters**	**ClassrPhylum**
Ascaris	(i) Body segmented (ii) Males and females distinct	Annelida

b)

Genus name	**Two characters**	**ClassrPhylum**
Salamandra	**(i) A tympanum cover middle ear, (ii) Fertilisation is internal**	**Amphibia**

c)

Genus name	Two characters	ClassrPhylum
Pteropus	(i) Skin possesses hair (ii) Oviparous	Mammalia

d)

Genus name	Two characters	ClassrPhylum
Aurelia	(i) Cnidoblast (ii) Organ level of organisation	Coelenterata

Solution : -

Salamandra belonging to the Class Amphibia has a tympanum that covers middle ear and in it fertilisation is internal. Ascaris has unsegmented body and it belongs to the Phylum Aschelminthes. Pteropus is viviparous. Aurelia has tissue level of organisation.

221. In some chordates, the notochord is modified as the vertebral column. Such animals are called vertebrates. Which one of the following statements makes sense?

a) All chordates are vertebrates but all vertebrates are not chordates

b) All vertebrates are chordates and all chordates are vertebrates

c) All vertebrates are chordates but all chordates are not vertebrates

d) Chordates are not vertebrates and vertebrates are not chordates.

Solution : -

Chordates are those animals that have rod-like notochord. Notochord is also present in vertebrates but in most adult vertebrates, the notochord is replaced by vertebral column, which is the peculiar feature of vertebrates. Thus, we can say that all vertebrates are chordates but all chordates are not vertebrates.

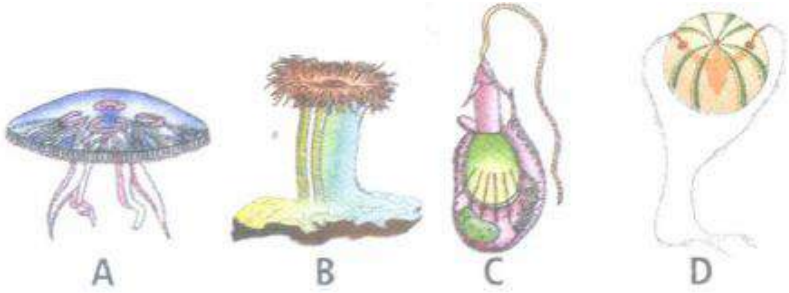
222. Which one of the following has the highest number of species in nature?

a) Fungi **b) Insects** c) Birds d) Angiosperms

Solution : -

The largest phylum in animal kingdom is Arthropoda and the largest class is Insecta

223. Identify the figures A, B, C and D and select the correct option.



a)

A	B	C	D
Pleurobrachia	Cnidoblast	Aurelia	Adamsia

b)

A	**B**	**C**	**D**
Aureliaa	**Adamsia**	**Cnidoblast**	**Pleurobrachia**

c)

A	B	C	D
Cnidoblast	Pleurobrachia	Adamsia	Aurelia

d)

A	B	C	D
Adamsia	Aurelia	Pleurobrachia	Cnidoblast

224. Ascaris larva is called _____ .

a) cysticercus **b) rhabditiform** c) hexacanth d) onchosphere

Solution : -

Ascaris larva is called rhabditoid or rhabditiform due to its close resemblance with Rhabditis

225. The kind of epithelium which forms the inner walls of blood vessels is :

a) Cuboidal epithelium b) Columnar epithelium c) Ciliated epithelium **d) Squamous epithelium**

Solution : -

The squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries. They are found in the walls of blood vessels and air sacs of lungs and are involved in a function like forming a diffusion boundary.

226. In the mouth parts of a cockroach, the labium forms (i) while (ii) acts as a tongue.
a) (i) - upper lip; (ii) - maxilla b) (i) - upper lip; (ii) - hypopharynx c) (i) - lower lip; (ii) - maxilla
d) (i) - lower lip; (ii) - hypopharynx

Solution : -
The mouth parts of cockroach are of biting and chewing type consisting of labrum (upper lip), a pair of mandibles, a pair of maxillae and a labium (lower lip). Within the oral cavity enclosed by the mouthparts, lies a median flexible lobe called hypopharynx (tongue).

227. In male cockroaches, sperms are stored in which part of the reproductive system?
a) Seminal vesicles b) Mushroom glands c) Testes d) Vas deferens

Solution : -
The sperms are stored in the seminal vesicles and are glued together in the form of bundles called spermatophores which are discharged during copulation

228. Mast cells secrete _____ .
a) Myoglobin **b) Histamine** c) Haemoglobin d) Hippurin

Solution : -
At the site of infection, the infectious organisms release some chemical to increase the flow of mast cells towards the inflammation site. Mast cell release histamine which increase permeability of blood vessels at the site of inflammation so that more blood supply takes place. The site gets warm and red due to this.

229. The function of the gap junction is to :
a) Perform cementing to keep neighbouring cells together
b)
Facilitate communication between adjoining cells by connecting the cytoplasm for rapid transfer of ions, small molecules and some large molecules
c) Separate two cells from each other d) Stop substance from leaking across a tissue

Solution : -
Gap junctions facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small molecules and sometimes big molecules.

230. Choose the correctly matched pair:
a) Tendon-Specialised connective tissue b) Adipose tissue- Dense connective tissue
c) Areolar tissue - Loose connective tissue d) Cartilage-Loose connective tissue

Solution : -
Areolar tissue is a loose connective tissue which provide flexibility and cushioning. Adipose tissue is not dense connective tissue, it is also loose connective tissue. Tendon is a type of dense connective tissue which connect the muscles with the bone. Cartilage is a type of specialised connective tissue called chondrocytes which produce a large amount of extracellular matrix made up of collagen fibre.

231. Which of the following is a transparent tissue?
a) Tendon b) Fibrous cartilage c) Hyaline cartilage **d) All of these**

232. Haversian canal occurs in _____ .
a) Humerus b) Pubis c) Scapula d) Clavicle

Solution : -
Haversian canal, named after 'Clopton Havers' are fine channels parallel to the long axis of mammalian bone containing blood vessels, nerve fibres, connective tissue and occasionally lymphatic vessels. Haversian system is found in long bones of mammals (humerus among given options) and absent in spongy bones of mammals.

233. Which of the following tissues has dead cells with thick and lignified cell walls, having a few or numerous pits?
a) Sclerenchyma b) Collenchyma c) Collenchyma d) None of these

Solution : -
Sclerenchyma is a simple supportive tissue of highly thick-walled cells with little or no protoplasm. Sclerenchyma cells are generally dead, these cells are empty. Wall thickening is uniform which can be made up of cellulose, lignin or both. Pits are usually simple and oblique, they may be branched,

234. Centripetal and centrifugal xylem are the important feature of

a) Root and stem xylem respectively b) Exarch and endarch xylem respectively
c) Endarch and exarch xylem respectively **d) Both (1) & (2)**

235. Bark formed early in the season is called as _____ bark and bark formed towards the end of the season is called _____bark.
a) hard, soft b) soft, hard c) scaly, ring d) ring, scaly

Solution : -
Bark that is formed early in the season is called as early or soft bark and the bark formed towards the end of season is called as late or hard bark.

236. Tissue is the group of cells which are
a) Similar in origin, but dissimilar in form and function b) Similar in origin and form, but dissimilar in function
c) Similar in origin, form and function d) Dissimilar in origin, but similar in form and function

237. In dicot root
a) Vascular bundles are scattered with cambium b) Vascular bundles are open and arranged in a ring
c) Xylem and ppholem are radial d) Xylem is always endarch

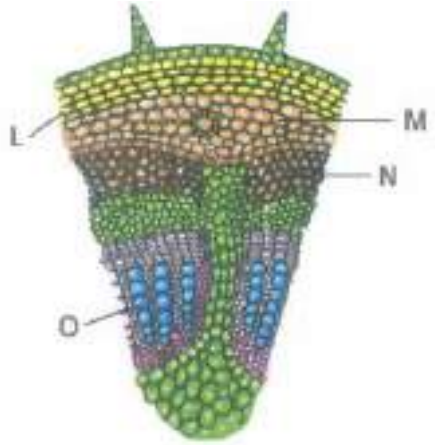
238. A flower represents a complex array of functionally specialised structures that differ substantially from vegetative plant body in form and cell types. Select the statement that is not true with regard to floral meristems.
a) Floral meristems are larger in sizethan the vegetative meristems.
b)
Increase in size of the floral meristem is due to larger size of the cells, which in turn results from rapid cell expansion only.
c) Increase in size of the floral meristem is largely a result of increased rate of cell division in central cells.
d) A floral morphogenesis is controlled by a network of genes in plants.

Solution : -
During reproductive phase of a shoot apex, the floral meristem broadens, becomes less conical and increases In size. This increase in size is due to an increase in rate of cell division in the central cells. In plants, floral morphogenesis is controlled by a network of genes.

239. Idioblasts are
a) sclerenchymatous fibres found in the leaf of Yucca
b) specialised parenchymatous cells which contain ergastic substances
c) collenchymatouscells possessingangular thickenings d) crystals of calcium oxalate found in hard fruits.

Solution : -
Idioblasts are specialised non-green large-sized parenchyma cells which possess inclusions or ingredients like tannins, oils, crystals, etc.

240. Consider the following statements regarding the given figure and select the correct one.



a) 'L' is the collenchymatous hypodermis that provides mechanical strength and flexibility to young dicot stems.
b) 'M' is the innermost layer of cortex which usually possessesCasparian strips.
c) 'N' is the parenchymatouspericyclethat synthesises food.
d) 'O' is xylem which is exarch with respect to the positions of protoxylem and metaxylem

Solution : -

During reproductive phase of a shoot apex, the floral meristem broadens, becomes less conical and increases In size. This increase in size is due to an increase in rate of cell division in the central cells. In plants, floral morphogenesis is controlled by a network of genes.

241. New banana plants develop from _____ .
a) Rhizome **b) Sucker** c) Stolon d) Seed

Solution : -
Sucker is the subaerial modification of stem, which originates from the basal and underground portion of the main stem but it grows obliquely upwards and give rise to leafy shoot or a new plant, e.g. Musa (banana) Chrysanthemum, mint.

242. Unbranched, erect, cylindrical stout axis with distinct nodes and internodes and with jointed appearance is called as
a) runner b) Zygomorphic, hypogynous with imbricate aestivation **c) culm** d) caudex.

Solution : -
Erect, unbranched stems with distinct nodes and internodes are called culms, nodes are swollen giving a jointed appearance, e.g., bamboo.

243. A small rootless aquatic herb in which a portion of leaf forms a tiny sack or bladder which traps water insects is
a) Dionaea **b) Utricularia** c) Sarracenia d) Drosera.

Solution : -
Leafbladders occur in the aquatic carnivorous plants of Utricularia (Bladderwort). Some of the leaf segments are modified to form small bladders. A bladder has sensitive hair, branched trigger bristles, a trap valve, internal and external glands for trapping and digesting small animals (e.g., water fleas)

244. Which of the following represents the edible part of the fruit Litchi
a) Endocarp b) Pericarp **c) Juicy aril** d) Mesocarp

245. Read the following statements and select the correct option.
Statement 1: The stem tubers are the swollen ends of specialised underground stem branches, which help in vegetative propagation of the plant
Statement 2: Solanum tuberosum is an example of a stem tuber which stores inulin as the main reserve food material.
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)
Ficus benghalensis, Pisstem tuber is an oval or spherical underground swollen stem structure which does not bear adventitious roots, e.g., potato (Solanum tuberosum), Jerusalem artichoke (Helianthus tuberosus). Food reserve is starch in potato and inulin in artichokeum sativum

246. Study carefully the given floral diagram and select the option which correctly represents the related floral formula.

(A)
a) $\%\,\varnothing\,\mathrm{K}_{(5)}\mathrm{C}_{1+2+(2)}\mathrm{A}_5\overline{\mathrm{G}}_{(2)}$

(B)
b) $\oplus\,\varnothing\,\mathrm{K}_{(5)}\overset{\frown}{\mathrm{C}_5\ \ \mathrm{A}_5}\,\underline{\mathrm{G}}_{(2)}$

(C)
c) $|\oplus\,\varnothing\,\mathrm{P}_{5+5}\mathrm{A}_{(5)}\underline{\mathrm{G}}_{(2)}$

(D)
d) $\oplus\,\varnothing\,\mathrm{K}_{(5)}\overset{\frown}{\mathrm{C}_{(5)}\ \ \mathrm{A}_5}\,\underline{\mathrm{G}}_{(2)}$

Solution : -

The given floral diagram is of Family Solanaceae (potato family). Its flower is bisexual and actinomorphic ebracteate or bracteate, pentamerous, cyclic. Calyx 5, gamosepalous, persistent. Corolla 5, gamopetalous, often plicate in bud. Androecium 5, polyandrous and epipetalous. Gynoecium bicarpellary and syncarpous. Ovary superior placed obliquely, placentation axile with swollen-placenta. Fruit is berry or capsule.

247. The edible part of turnip is

a) Modified Adventitious roots **b) Modified tap root** c) Stem d) Underground stem

248. The Earth Summit held in Rio de Janeiro in 1992 was called _____.

a) for conservation of biodiversity and sustainable utilisation of its benefits.

b) to assess threat posed to native species by invasive weed species.

c) for immediate steps to discontinue use of CFCs that were damaging the ozone layer.

d) to reduce CO_2 emissions and global warming.

Solution : -

Earth Summit (Rio Summit)-1992, called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits.

249. Which one of the following shows maximum genetic diversity in India?

a) Groundnut **b) Rice** c) Maize d) Mango

Solution : -

Rice shows maximum diversity in India. There are about 2,00,000 varieties of rice are cultivated in India. Among them, there are 27 documented varieties of Basmati rice are grown in India. Thus, we can say that India is rich in diversity of rice.

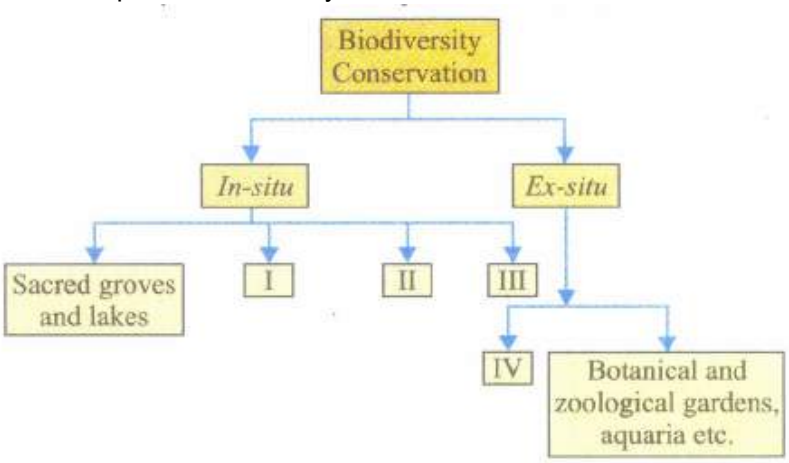
250. According to Robert May, the global species diversity is about _____.

a) 50 million **b) 7 million** c) 1.5 million d) 20 million

Solution : -

Robert May was a theoretical ecologist the established, who field of theoretical ecology and population biology. According to him the global species diversity is about 7 million.

251. Select the option that correctly identifies I, II, III and IV.



a)

I - Biosphere reserves; II - National parks, wildlife sanctuaries, III - Sacred groves; IV - Gene banks, cryopreservation

b)

I - Sacred plants, home gardens; II - National parks, wildlife sanctuaries; III - Arboreta; IV - Gene banks, cryopreservation

c)

I - Biosphere reserves; II - Gene banks, cryopreservation; III - Sacred plants, home gardens; IV - National parks, wildlife sanctuaries

d)

I - Biosphere reserves; II - Aroboreta; III - Gene banks, cryopreservation; IV - National parks, wildlife sanctuaries

252. Introduction of alien species into new area poses a threat to extinction of indigenous species due to

a) their high nutrient requirement b) their symbiotic relationship **c) absence of their natural predators**

d) more intraspecific competition.

Solution : -

In the absence of their natural predators, exotic speciesflourish better and pose a threat to indigenous species.

253. An area is declared as 'hot spot' when:

a) It has 1500 or more endemic species and 75% of its original habitat is lost

b) It has 1500 or more vertebral species and 75% of its original habitat is lost

c) It has more than 2000 species of plants d) Most of the species inhabiting the area are facing

Solution : -

According to conservationists, 'biodiversity hotspots' regions with very high levels of species richness and high degree of endemism.

254. Fill up the blanks in the following paragraph by selecting the correct option.

Human beings have a significant ability to maintain and moderate the respiratory rhythm to suit the demands of the body tissues. This is done by the neural system. A specialised centre present in the medulla region of the brain called ____(i)____is primarily responsible for this regulation. Another centre present in the pons region of the brain called ___(ii)____can moderate the functions of the respiratory rhythm centre. Neural signal from this centre can reduce the duration of ___(iii)____and thereby alter the respiratory rate. A____(iv)____is situated adjacent to the rhythm centre which is highly sensitive to CO_2 and hydrogen ions.

a)

(i)	(ii)	(iii)	(iv)
Chemosensitive area	Respiratory rhythm centre	Expiration	Pneumotaxic centre

b)

(i)	**(ii)**	**(iii)**	**(iv)**
Respiratory rhythm centre	**Pneumotaxic cxentre**	**Inspiration**	**Chemosensitive**

c)

(i)	(ii)	(iii)	(iv)
Respiratory rhythm centre	Chemosensitive area	Expiration	Pneumotaxic centre

d)

(i)	(ii)	(iii)	(iv)
Pneumotaxic centre	Chemosensitive area	Inspiration	Respiratory rhythm centre

255. Consider the following statements each with two blanks.

(i) Actually, only about___(1)___mL of air enters the lung alveoli for the exchange of gases. The remaining fills the respiratory passage and is termed___(2)____.

(ii) The amount of air which one can inhale with maximum effort and also exhale with maximum effort is termed as____(3)____. It is about___(4)___in normal adult person.

(iii) During normal quiet breathing, on an average, approximately___(5)___mL of air is inspired or expired by adult human male in each breath. It is termed as___(6)____volume.

Which of the following options gives the correct fill-ups for the respective blank numbers from (1) to (6) in the above statements?

a) (3)-vital capacity, (4)-4000 mL, (5)-500, (6)-tidal

b) (1)-1 00, (2)-residual volume, (3)-functional residual capacity, (4)-3000 mL

c) (1)-350, (2)-dead space air, (5)-1000, (6)-inspiratory reserve

d) (1)-350, (2)-residual volume, (3)-vital capacity, (4)-4000 mL

Solution : -

Actually, only about 350 mL of air (out of total 500 mL tidal volume) enters the lung alveoli for the exchange of gases. The remaining 150 mL fills the respiratory passage and is termed as dead air space because no exchange of gases takes place here.

256. In alveoli of the lungs, the air at the site of gas exchange, is separated from the blood by_____ .

a) alveolar epithelium only **b) alveolar epithelium and capillary endothelium**

c) alveolar epithelium, capillary endothelium and tunica adventitia

d) alveolar epithelium, capillary endothelium, a thin layer of tunica media and tunica adventitia

Solution : -

The wall of the capillaries consists of only tunica intemae which is made up of simple squamous endothelium. The wall of alveoli is also very thin, consisting of squamous epithelium.

257. Consider the following statements each with one or two blanks.

(i) Left lung has___(1)___lobes and right lung has___(2)____lobes.

(ii) Prawn respires with___(3)_____and insects with____(4)____.

(iii) Amount of air inhaled and exhaled with maximum effort is referred to as the___(5)____of the lungs.

Fill up the above blanks by selecting the correct option.

a) (1) - three, (2) - two, (3) - gills (4)-tracheae **b) (1) - two, (2) - three, (5) - vital capacity**

c) (3) - gills, (4) - tracheae, (5) - tidal volume d) (3) - tracheae, (4) - gills, (5) - tidal volume

Solution : -

Prawn respires with gills (Branchial respiration) and insects respire by tracheae (Tracheal respiration).

258. **Assertion:** Asthma is a difficulty in breathing causing wheezing.

Reason: Asthma occurs due to inflammation of bronchi and bronchioles.

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.

259. When temperature decreases, oxy-Hb curve becomes:

a) more steep b) straight c) parabola d) none of these.

Solution : -

When temperature decreases, oxy-Hb curve will become more steep. The steep rise of the curve indicates high affinity of Hb for O_2.

260. Which of the following statements is incorrect regarding lysozyme present in saliva?

a) It acts as an antibacterial agent b) It prevents infections. **c) It acts as an enzyme** d) All of these

Solution : -

Lysozyme present in saliva acts as an antibacterial agent that prevents infections.

261. Read the following four statements (i) to (iv) with certain mistakes in two of them.

(i) Fructose is generally absorbed by simple diffusion.

(ii) The digestive wastes, solidified into coherent faeces in the rectum initiate an endocrinal action causing an urge or desire for its removal.

(iii) The food mixes thoroughly with the acidic gastric juice of the stomach by the churning movements of its muscular wall and is called the chyme.

(iv) The secretions of the brush border cells of the mucosa along with the secretions of the goblet cells constitute the succus entericus.

Which of the above two statements have mistakes

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

Solution : -

Fructose is generally absorbed by facilitated transport. The digestive wastes, solidified into coherent faeces in the rectum initiate a neural reflex causing an urge or desire for its removal.

262. Match column I with column II and select the correct option from the given codes

Column I	**Column II**
A. Goblet cells	(i) Antibacterial agent
B. Lysozyme	(ii) Mucus
C. Saliva	(iii) HCl
D. Oxyntic cells	(iv) Sublingual gland

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

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

263. A gland not associated with the alimentary canal is
a) pancreas **b) adrenal** c) liver d) salivary glands.

Solution : -
Adrenal glands are located on the top of kidneys. Adrenal glands are hormone secreting glands and do not take part in digestion.

264. During absorption of carbohydrates in the blood the most rapidly transported monosaccharide is
a) glucose **b) galactose** c) fructose d) sucrose

265. Identify the correct statement with reference to human digestive system_____
a) Ileum is a highly coiled part b) Vermiform appendix arises from duodenum
c) Ileum opens into small intestine d) Serosa is the innermost layer of the alimentary canal.

Solution : -
(a) Small intestine is distinguishable into three regions, a 'C' shaped duodenum, a long coiled middle portion jejunum and a highly coiled ileum.
(b) Anarrow finger-like tubular projection, the vermiform appendix which is a vestigial organ, arises from the caecum.
(c) Ileum opens into the large intestine.
(d) The wall of alimentary canal possesses four layers from outer to inner namely serosa, muscularis, submucosa and mucosa. Serosa is the outermost layer and mucosa is the innermost layer

266. An enzyme that can stimulate germination of barley seeds is_____
a) lipase b) protease c) invertase **d) cc-amylase**

Solution : -
Germination of barley seed is stimulated by alpha amylase enzyme.

267. Which of the following is both a growth promoter as well as a growth inhibitor?
a) Auxin b) Gibberellic acid c) ABA **d) Ethylene**

268. Read the given statements to identify the phytohormone that performs these functions.
(i) Horizontal growth of seedlings, swelling of the axis and apical hook formation in dicot seedlings.
(ii) Promoting senescence and abscission of leaves and flowers.
(iii) Breaking seed and bud dormancy.
(iv) Initiating germination in peanut seeds.
(v) Sprouting of potato tubers.
a) ABA **b) Ethylene** c) GA d) Cytokinins

269. Phylochrome is involved in_____
a) phototropism b) photorespiration **c) photoperiodism** d) geotropism

Solution : -
Phytochrome is a chromoprotein (photosensitive pigment) that exists in two states P_r (red) or P_{660} and P_{fr} (far red) or P_{730}.
Phytochrome is involved in photomorphogenetic responses, seed germination, bud dormancy synthesis of gibberellin and ethylene and Photoperiodism.

270. The exponential growth can be mathematically expressed as
a) $L_t=L_0+rt$ b) $W_1=W_0+e^{rt}$ **c) $W_1=W_0e^{rt}$** d) $L_t=L_0-rt$

271. Senescence as an active developmental cellular process in the growth and functioning of a flowering plant, is indicated in___
a) vessels and tracheid differentiation **b) leaf abscission** c) annual plants d) floral parts

Solution : -
Senescence is the gradual deterioration of functional life of an organisms. It can be limted to particular plant organ like leaf, flower or cells such as phloem and xylem or whole plant. Abscission is natural shedding of leaves, fruits floral parts, foliage branches, etc. Whole plant senescence occurs in annuais like rice, wheat, gram and biennials like henbane or perennials.

272. What would be the heart rate of a person if the cardiac output is 5 L, blood volume in the ventricles at the end of diastole is 100 ml- and at the end of ventricular systole is 50 ml _____ .

a) 75 beats per minute b) 100 beats per minute c) 125 beats per minute **d) 50 beats per minute**

Solution : -

Cardiac output = stroke volume x Heart rate
Cardiac output = 5L or 5000 ml
Blood volume in ventricles at the end of diastole = 100 ml
Blood volume in ventricles at the end of systole = 50 ml
Stroke volume = 100 - 50 = 50 ml.
So, 5000 ml = 50 ml x Heart rate
So, Heart rate = 100 beats Per minute

273. Which one engulfs pathogens rapidly_____
a) Acidophils b) Monocytes c) Basophils **d) Neutrophils**

Solution : -

Neutrophiis are granulocytes, i.e., cytoplasm is filled with fine granules. These granules are actually lysosorne and Golgi bodies. These are the chief phagocytic cells of the body and engulf the microbes by phagocytosis so neutrophils are also called soldiers of the body.

274. Which of the following statements is true for lymph?
a) WBCs + serum **b) Blood - RBCs and some proteins** c) RBCs + WBCs + plasma
d) RBCs + proteins + platelets

Solution : -

Lymph differs from blood in lacking RBCs, platelets and some plasma proteins and in having less calcium and phosphorus than the blood.

275. The most popularly known blood grouping is the ABO grouping. It is named ABO and not ABC, because "O" in it refers to having _____ .
a) overdominance of this type on the genes for A and B types
b) one antibody only - either anti -A or and - B on the RBC **c) no antigens A and B on RBCs**
d) other antigens besides A and B on RBCs

Solution : -

The most popular blood grouping is the ABO grouping. It is named ABO and not ABC because 'O' in it refers to having no antigens A and B on RBCs. It was Landsteiner who grouped human blood groups in four categories on the presence or absence of antigens on RBCs membrane. These blood groups are A, B, AB and O. Blood groups 'O' does not contain any antigens on RBCs, hence can be given to any person. That is why 'O' is called universal donar.

276. Given below are four statements (i-iv) regarding human blood circulatory system
(i) Arteries are thick-walled and have narrow lumen as compared to veins.
(ii) Angina is acute chest pain when the blood circulation to the brain is reduced.
(iii) Persons with blood group AB can donate blood to any person with any blood group under ABO system.
(iv) Calcium ions play a very important role in blood clotting.
Which two of the above statements are correct?
a) (i) and (iv) b) (i) and (ii) c) (ii) and (iii) d) (iii) and (iv)

Solution : -

Angina is acute chest pain when the blood circulation to the heart is reduced. Persons with blood group AB can receive blood from any person with any blood group under ABO system.

277. Crossing over occurs during
a) Pachytene b) Diplotene c) Diakinesis d) Zygotene

278. Which one of the following structures will not be common to mitotic cells of higher plants?
a) Cell plate **b) Centriole** c) Centromere d) Spindle fibres

Solution : -

(i) Centrosome is found in animals, Euglena, Nitella, some fungi and members of dinoflagellate. It is found near the nucleus.
(ii) Centriole is not common to mitotic cell of higher plants. Main function of centrosome is at the time of cell division when the two centrioles separate and move on two poles.

(iii) Aster and spindle are formed from it which help in the movement of chromatids. They form basal body, cilia, flagella, etc. Centriole is rich in tubulin and ATPase.

(iv) Centrioles replicate in G_2-phase of interphase of cell cycle but do not initiate cell division.

279. Select the incorrect match regarding mitotic cell division.

(i) Prophase	Chromosomes begin to uncoil
(ii) Metaphase	Chromatids move apart
(iii) Telophase	The nuclear membrane reappears
(iv) Late	Each chromosome consists of two anaphase chromatids
(v) Interphase	Chromosomes are not distinct

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

Solution : -

Chromatids move apart in anaphase stage of cell division. In late anaphase, splitting of centromere occurs so chromatids of a chromosome separate apart.

280. In meiosis , division of centromere occurs during ;

a) Interphase b) Anaphase - I **c) Anaphase - II** d) Metaphase - I

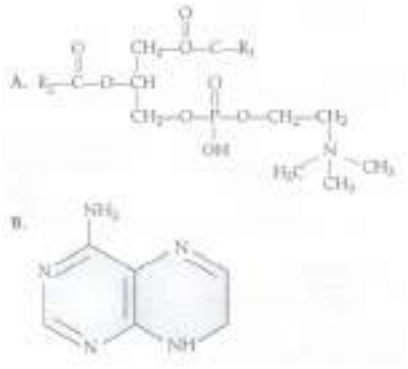
281. Which of the following not occurs in Anaphase -I but occurs in Anaphase - II

a) condensation of chrmosomes b) poleward movement of chromosome c) contraction of splindle fibers **d) splitting of centromere**

282. Slipping of chiasmata towards the ends bivalent is called ;

a) Terminalisation b) Diakinesis c) Interkinesis d) Heterpycnosis

283. Which one of the following structural formulae of two organic compound is correctly identified along with the related function.



a) A: Lecithin: a component of cell membrane b) B: Adenine: a nucleotide that makes up nucleic acids

c) A: Triglyceride: major source of energy d) B: Uracil: a component of DNA

Solution : -

Lecithin is a lipid with phosphorous and a phosphorylated organic compound. Adenine is a purine with 9-membered double ring structure. Triglyceride refers to the number of three molecules of fatty acids esterified to a molecule of alcohol. Uracil is a 6-membered pyrimidine.

284. **Assertion:** A protein is a heteropolymer.

Reason: Dietary proteins are the source of non-essential amino acids.

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 : -

Each protein is a polymer of amino acids. As there are 20 types of amino acid, a protein is a heteropolymer and not a homopolymer. Amino acids can be essential or nonessential. Certain amino acids are essential for our health and they have to be supplied through our diet. Hence, dietary proteins are the source of essential amino acids. Non-essential amino acids are those amino acids which are synthesised in our body.

285. DNA is not present in -

a) Mitochondria b) Chloroplast c) Bacteriophage **d) TMV**

286. Chemically enzymes are:-

a) Fats b) Carbohydrates c) Hydrocarbons **d) Proteins**

287. Proteins perform many physiological functions. For example, some proteins function as enzymes. One of the following represents an additional function that some proteins perform
a) antibiotics b) pigment conferring colour to skin c) pigment making colours of flowers **d) hormones**

Solution : -
Most of the body functions are regulated by hormones like growth, vegetative and sexual development, thermal regulation, cellular oxidation, metabolism of carbohydrates, proteins, fats, etc. Hormones are needed in very small quantity to carry out these functions. Some hormones are proteinaceous, e.g., insulin (regulates sugar metabolism), growth hormone of pituitary, parathyroid hormone parathormone (regulates calcium and phosphate transport).

288. Essential amino acids include
a) leucine b) valine c) tryptophan **d) all of these**

Solution : -
Essential amino acids are those which cannot be synthesised by organisms in the body and are obtained from plants, e.g., valine, leucine, isoleucine, phenylalanine, threonine, lysine, tryptophan, methionine.
Non-essential amino acids can be synthesised by the organism and may not be the requisite components of diet, e.g., serine, cysteine, proline, glycine, alanine, asparagine, glutamine and tyrosine.

289. Plasmodesmata are:
a) Locomotary structures b) Membranes connecting the nucleus with plasmalemma
c) Connections between adjacent cells d) Lignified cemented layers between cells

Solution : -
Plasmodesmata are connections between adjacent cells through which cells communicate to each other. This connection allows circulation of fluids and passage of solutes from one cell to other.

290. Which of these statements is/are true?
(i) The surface area available for cellular functions in a prokaryotic cell is less than that in a eukaryotic cell.
(ii) The total genome size of a prokaryotic cell is always less than that of a eukaryotic cell.
(iii) Unlike eukaryotes, no special respiratory organelles are found in prokaryotes. Hence they respire at a much lesser rate than eukaryotes.
(iv) Eukaryotic cells show various membrane bound organelles such as chloroplasts and nucleus while ribosomes are the only membrane bound organelles found in prokaryotes.
a) (i) and (ii) b) (iv) only c) (iii) only d) (i), (ii) and (iv)

Solution : -
Unlike eukaryotes, prokaryotes do not have membrane bound organelle for respiration but many enzymes needed for cellular respiration are attached to the plasma membrane, which may fold and extend into cell. Ribosomes are the only cytoplasmic organelles in prokaryotes and they are not membrane bound.

291. Cytoskeleton is made up of:
a) Callose deposits b) Cellulosic microfibrils **c) Proteinaceous filaments** d) Calcium carbonate granules

Solution : -
Cytoskeleton is made up of proteinaceous filaments. These filaments are of three types namely - actin filaments, microtubules and intermediate filaments. In all eukaryotic cells, a network of protein fibres present which maintains the shape of the cell and also help to anchor the organelles to fixed locations.

292. Ribosomes are composed of
a) RNA only b) Proteins only **c) RNA and proteins** d) RNA, proteins and DNA

Solution : -
Chemically, ribosomes co~sist of two parts, proteins and rRNA. Proteins are both structural and enzymatic

293. Stroma in the chloroplasts of higher plant contains:
a) Light-dependent reaction enzymes b) Ribosomes c) Chlorophyll
d) Light- independent reaction enzymes

Solution : -

Stroma in the chloroplasts of higher plants contains light-independent reaction enzymes. Dark reactions occurs in stroma in which product of light reactions (ATP and NADPH) are used to produce food. Light dependent reaction or Light reaction occurs in grana of chloroplast. Ribosome are factory of protein synthesis. Chlorophyll is photosynthetic pigment which are green and present in chloroplast.

294. Prokaryotic cells are generally __ and multiply __ than the eukaryotic cells.
a) smaller, slower b) larger, slower **c) smaller, faster** d) larger, faster

Solution : -
Prokaryotic cell is usually small (0.1 - 5.0 μrn) in size whereas eukaryotic cell size is comparatively larger (5-100 μrn). Prokaryotic cells multiply very rapidly by asexual means like binary fission, sporulation etc.

295. Smaller, lipid soluble molecules diffuse faster through cell membrane, but the movement of hydrophilic substances is facilitated by certain transporters which are chemically
a) proteins b) carbohydrates c) lipids d) phospholipids

Solution : -
Particles which are lipid soluble (i.e., lipophilic or hydrophobic) can easily diffuse through the cell membrane as the lipid is a major constituent of the membrane. Where as hydrophilic substances (i.e., the substances which are soluble in water, e.g., glucose) do not pass through a biological membrane by simple diffusion. They are, therefore, transported across a cell membrane by facilitated diffusion (i.e., carrier mediated diffusion), which takes place with the help of certain transport proteins.

296. Water moves up against gravity and even for a tree of 20 m height, the tip receives water within two hours. The most important physiological phenomenon which is responsible for the upward movement of water is _____.
a) guttation b) evaporation **c) transpiration** d) none of these

Solution : -
According to transpiration pull theory, due to transpiration, the water column inside the plant comes under tension. This is called 'transpiration pull'. On account of this tension, the water column is pulled up passively from below to top of the plant (almost like a rope). A tension of one atmosphere is sufficient to pull water to a height of about 20 meters.

297. Read the given statements and select the correct option.
Statement 1: Xylem transport is unidirectional.
Statement 2: Phloem transport is bi-directional.
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.

Solution : -
Water passage from root hair to xylem and then to other parts is unidirectional (unidirectional upwards in xylem). The direction of movement of organic solutes in phloem can be upwards or downwards i.e., bi-directional.

298. Stomata cf a plant open due to_____
a) influx ofcalcium ions **b) influx of potassium ions** c) efflux of potassium ions
d) influx of hydrogen ions

Solution : -
In sun, due to photosynthesis, malic acid forms, which breaks into H^+ and malate. H^+ ions move out of guard ells and K^+ ions enter forming potassium malate which makes guard cells turgid and stomata opens.

299. Movement of solvent molecule from a region of its higher concentration to a region of its lower concentration through a semi-permeable membrane, is referred to as
a) simple diffusion b) facilitated diffusion **c) osmosis** d) active transport.

Solution : -
When the two solutions having different osmotic concentrations are separated by means of a semipermeable membrane, the molecules of solvent or water move from the region of their higher diffusion pressure (or free energy) to the region of their lower diffusion pressure (or free energy). This movement of water or solvent is called osmosis.

300. Less negative T.P. and first sign of shrinkage of protoplasm of cell is detectable at

a) Limiting plasmolysis **b) Incipient plasmolysis** c) Evident plasmolysis d) Permanent plasmolysis